Greater Sudbury Hydro Inc

Interrogatory Submission

January 28, 2025

Coalition of Concerned Manufacturers and Businesses of Canada

EB-2024-0026

Table Of Contents

Table Of Contents

1-CCMBC-1 Organizational Structure

Question:

Reference: Exhibit 1, Tab 3, Schedule 11, page 2, *Figure 2 Organizational Structure Chart – Executive & Senior Management*

Question:

Of the positions shown in Figure 2, are the VP Engineering & Operations, Manager Engineering, and Operations Superintendent the only employees of Greater Sudbury Hydro Inc. (GSHi), and all other positions shown are employees of Greater Sudbury Plus Inc. (GSHPi)?

Response:

GSHi confirms that in the Organization Structure Chart (Figure 2 of Exhibit 1, Tab 3, Schedule 11, page 2), the only employees of GSHi are the VP Engineering & Operations, Manager of Engineering, and Operations Superintendent. The remaining positions shown in the chart are employees of Greater Sudbury Hydro Plus Inc., except for the VP Strategy & Growth, who is employed by one of GSU's other affiliate companies.

2-CCMBC-2 Vehicle Disposals

Question:

Reference: Exhibit 2, Tab 2, Schedule 1, page 3

Preamble: **"**The net impact of disposals remains consistent year over year, typically not resulting in significant variances—except in 2022. During that year, GSHi recorded a net impact of disposals amounting to $720,442, compared to the usual figure of approximately $530,000. The increase was primarily due to the sale of vehicles with a net book value of $195,651, which were sold at the same value, in addition to regular disposals."

Questions:

a) Did GSHi seek bids for the sale of vehicles? If the answer is no, please explain why?
b) Please file a table listing vehicles sold showing the net book value and the sale price for each vehicle.
c) Were any vehicles sold to an affiliate of GSHi or to the municipality or to any municipal councillor, or to a director of GSHi, or to an employee of the municipality or of GSHi.?
d) If the answer is yes, did those sales take place at net book value or at market price?

Response:

a) Beginning in 2022, it has been GSHi's practice to bring any retired vehicles to auction, with the proceeds of those sales included in the gain on disposal. Prior to that it was a mix of bringing them to auction and selling them for bids internally. However, in the case of the vehicles described in the preamble, those vehicles were being used by affiliate companies and were sold to those affiliates at their net book value. GSHi did not seek bids for these sales because the vehicles had already been in use by the affiliates as part of their operations, and transferring ownership at net book value was considered an equitable and practical approach to regularizing the ownership structure.

b)

Vehicle Number	Make/Model	Net Book Value	Sale Price
944	2017 Chev K1500 Silverado WT	12,230	12,230
988	2013 Ford Explorer	-	-
951	2008 Ford Escape	-	-
952	2018 Toyota Corrola	11,560	11,560
953	2018 Chevy Silverado	16,154	16,154
956	2021 Dodge 1500	35,747	35,747
991	2012 Dodge Ram	-	-
993	2020 Ford Transit	74,222	74,222
965	2017 Chevy K1500 Silverado WT	12,230	12,230
907	Trailer	33,508	33,508
	Total	**195,651**	**195,651**

c) The vehicles discussed in the preamble with a net book value of $195,651 and illustrated in the table in part b) above were sold to affiliates, as discussed in part a).

d) The sales took place at net book value. Since this transaction, GSHi no longer owns any vehicles that are used by an affiliate.

2-CCMBC-3 Commercial Economic Evaluations

Question:

Reference: Exhibit 2, Tab 2, Schedule 1, page 4

Preamble: "GSHi addressed outstanding liabilities by compensating developers for amounts owed, including interest. Contributions from these projects were recalculated, and refunds were issued where necessary. The net impact on rate base was $349,753. As a result, GSHi is now fully caught up and reconciled with developers."

Question:

Were any of the developers mentioned in the quoted text in the preamble, members of the Board of Directors of GSHI or Sudbury municipal councillors?

Response:

GSHi is not aware of any members of its Board of Directors or Sudbury municipal councillors being associated with the developers mentioned in the preamble.

2-CCMBC-4 Gemmell MS11

Question:

Reference: Exhibit 2, Tab 2, Schedule 1, Page 6

Preamble: "As part of its system renewal 1 planning in 2020, GSHI intended on incurring capital expenditures related to the renewal of the 11T1 side of municipal substation Gemmell MS11 at a cost of $2,333,387. The project was completed at a cost of $3,300,293 for a net increase of $966,906."

Questions:

a) Please explain the meaning of the term "intended on incurring".
b) Was the $2,333,387 a budget amount supported by an itemized cost estimate that included allocated overheads, contingency, and interest during construction? If the answer is yes, please file the cost estimate. If the answer is no, please explain why not.
c) Please file an itemized actual cost showing company labour, contractor labour, overheads, contingency used and interest during construction.
d) Please explain the reasons for the $966,906 increase.

Response:

a) "Intended on incurring" means that GSHi planned to spend funds on the project.
b) The budget of $2,333,387 allocated for 2020 was based on a high-level scope of work, which included evaluating the repurposing of existing walls and replacing equipment on a like-for-like basis. The budget also considered the costs of existing equipment and GSHi labour based on previous projects. A conceptual estimate was provided as a guideline for the project.

In early March 2020, a more detailed cost estimate was prepared by GSHi's engineering consultant (See Attachment #1 to this interrogatory response). The consultant's estimate calculated the project costs at $2,327,623, with an additional 10% contingency of $232,762, bringing the total estimated cost to $2,560,384.

c) Please see the table below for an itemized actual cost listing company labour, contractor labour, overheads, contingency used and interest during construction:

	Total
Contract Labour	$1,326,118
Company Labour	$286,206
Overhead	$14,663
Materials	$1,563,226
Vehicle	$ 29,414
CWIP Interest	$80,666
	$3,300,293

d) The table below lists the items within the substation construction project which contributed to the $966,906 variance:

ITEMS THAT CONTRIBUTED TO PROJECT VARIANCE	ESTIMATE	ACTUAL	VARIANCE
MAJOR EQUIPMENT	1,154,000	1,265,575	111,575
PRE CAST WALL	105,000	254,177	149,177
SECOND EGRESS	0	20,862	20,862
DECOMMISSIONING	0	71,994	71,994
CONSTRUCTION COSTS	752,785	1,181,027	428,242
CWIP INTEREST	0	80,666	80,666
2019 Work In Progress	0	104,390	104,390
TOTAL			966,906

Described below are the key factors which contributed to the $966,906 budget variance:

a. Major Equipment

Equipment Type	Original Estimated Cost	Actual Cost	Date Awarded
44kV Switchgear	$114,000	$114,500	Feb 3, 2020
Power Transformer	$320,000	$391,075	Feb 3, 2020
E-House and Switchgear	720,000	$760,000	April 9, 2020
TOTAL	$1,154,000	$1,265,575	

The initial estimated costs for major electrical equipment were $1,269,400, including contingency, while the actual costs totaled $1,265,575. However, due to the decision to reduce the original project contingency, these actual costs fully depleted the remaining contingency funds, contributing $111,575 to the overall project cost variance.

b. PRE-CAST concrete wall

In the conceptual estimate prepared by GSHi for this project, it was assumed that the existing concrete wall at Gemmell MS11 could be repurposed. However, during the detailed design phase, it was determined that the existing walls could not be reused. A preliminary budget variance for Q1 2020 estimated an additional $105,000.

Further analysis revealed that the overall footprint of the wall needed to be expanded to meet modern construction standards and design clearances. With a final cost of $254,177, the cost variance specific to the substation wall and its construction requirements amounted to $149,177. Additionally, GSHi determined the need to add a second method of egress to ensure safe worker evacuation in the event of an emergency. This work led to an additional variance of $20,862.

c. Decommissioning

Decommissioning costs of $71,994 involving internal GSHi labour were incorrectly budgeted as an OM&A expense, whereas they should have been included in the capital budget.

d. Construction RFQ – Cost increase

The proponent bid costs significantly exceeded GSHi's expected construction costs of $752,785, with evaluated bids ranging from $1.18M to $1.80M. These bids were assessed by the GSHi project team in May 2020, during the early months of the COVID-19 pandemic.

Additionally, GSHi opted to use contract labor to assemble the high-voltage equipment (e.g., 15kV switchgear, 44kV switchgear, etc.) associated with this project, while leveraging internal resources to handle the low-voltage electrical construction work. This decision was made with a focus on the health and safety of our employees and to address the operational uncertainties introduced by the COVID-19 pandemic, particularly in terms of job planning.

As a result of this approach, the project experienced a budget variance of $428,242.

e. CWIP Interest

CWIP Interest costs were not factored into the initial capital budget, resulting in an additional expense of $80,666.

f. 2019 Work In progress

Work in progress costs of $104,390 for 2019 relating to items such as preliminary studies and engineering were carried over to 2020 and were not included in the 2020 expense budget.

Attachment 1 (of 1):

2-CCMBC-4 Attachment 1: Gemmell T1 MS11 - Capital Cost Estimate

GREATER SUDBURY HYDRO INC.

GEMMELL T1 MS11

Engineering – Electrical Power Specialists

A CORMORANT UTILITY SERVICES COMPANY

OneLine Engineering,
Engineering Branch of EPTCON Ltd.
63 Church Street, Suite 201
St. Catharines, ON L2R 3C4
Phone: 905-688-6857
Fax: 905-688-6926
www.onelineeng.com

CAPITAL COST ESTIMATE

REPORT NO. 1795-38015-03

Revisions

Revision	Date	Description
A	2020-03-11	Issued for Review and Comment

Prepared By: N. Hewitt
Reviewed By: R. Cressman
Approved By: T. Litt

Table of Contents

Appendices

1.0 Introduction

1.1 General

Greater Sudbury Hydro Inc. (GSHI) owns, maintains and operates Gemmell T1 MS11, a medium voltage transmission station located on Gemmell Street, in Sudbury, Ontario. Much of the equipment in this station is nearing end of life and the decision has been made to move forward with a project to refurbish the station. The intent is to demolish the existing station including all equipment and foundations as well as the existing precast concrete wall surrounding the station and replace with all new equipment, foundations and a new precast concrete wall. The refurbished station will comply with modern standards and provide another approximately 45-year lifespan.

1.2 Scope of Work

This report provides a capital cost estimate (+/- 20%) for the completion of the project. It includes cost of the major equipment, main power cables, and concrete work as well as the installation and demolition work and has been based on the electrical single line diagram, 1795-GSH-D1-001 (Rev. C) and preliminary Chimax station layout drawings.

2.0 Summary of Work by Phase

The capital cost estimate for the project has been broken up into five items which together comprise the full scope of work. The following will provide a short description of the work included in each section and the total anticipated cost as provided by the capital cost estimate in Appendix A. The items included in each table have been labeled according to the section where they can be found in Appendix A.

2.1 Engineering Phase

Includes labour for the creation of a detailed electrical design for this project. This shall include all power components, bonding and grounding, instrumentation, metering, protection equipment and equipment specification or review. The electrical design shall be comprised of drawings, documents, specifications and calculations.

Description	Total Estimated Amount with Tax	GSHI Overhead	Total Cost
AA - Engineering – OneLine Contract T1912	$117,960.70*		

* The total listed above is taken from Appendix A.

2.2 Equipment Purchasing Phase

Includes cost of the major project equipment being free issued by GSHI to the Contractor. Specifically, this includes the new precast sound wall, the 44-12.47kV power transformer, the 15kV switchgear installed in a prefabricated e-house and the 44kV switchgear and associated bus connection duct.

Task	Total Estimated Amount with Tax	GSHI Overhead	Total Cost
M – Equipment Free Issued by GSHI	$1,162,575.00*		

* The total listed above is taken from Appendix A.

2.3 Demolition Phase

Includes labour and equipment rentals for the demolition of the existing substation and preparing the property for the installation of the new substation. The removal of all existing electrical equipment will be completed by GSHI, while the removal of the existing foundations, the sound wall, and any trees and foliage that would impede the installation of the new equipment will be completed by the selected Contractor.

Task	Estimated Amount with Tax by Task	GSHI Overhead	Total Cost
A – Removal of Existing Major Equipment	$0.00 *		
B – Site Work & Tree Removal	$30,768.25 **		
C – Existing Sound Wall & Foundations Removal	$111,367.92 **		

* Removal of existing major electrical equipment to be performed by GSHI.
** The totals listed above are taken from Appendix A with a 15% Contractor markup applied.

2.4 Equipment Receiving and Construction Phase

Includes labour and equipment rentals for the construction of the new substation. Specifically, this will include construction of the new foundations and ductbanks, installation of a ground grid, installation of the new precast soundwall, receiving and placing of the control building, transformer and switchgear, and routing/termination of all cables.

Task	Breakdown Total Amount with Tax*	OPG Overhead	Total Cost
D – Foundations & Soundwall Installation	$274,421.69		
E- Ductbank & Grounding Installation	$80,793.48		
F – Switchgear Building, Transformer & 44kV Switch Installation	$51,635.00		
G – 44kV & 15kV Feeder Cables & Terminations Installation	$125,888.60		
H – Protection & Control Cables	$16,432.01		

* The totals listed above are taken from Appendix A with a 15% Contractor markup applied.

2.5 Miscellaneous

Includes labour and equipment rentals for all remaining project activities not specifically required during the demolition and construction phase. For further details and a breakdown of what is covered by each of these totals, refer to Appendix A.

Task	Breakdown Total Amount with Tax*	OPG Overhead	Total Cost
I – Preservice Testing & Commissioning	$59,972.50		
J – Civil and Landscape Restoration	$35,304.77		
K – Mobilization & Site Facilities Setup	$5,175.00		
L - Demobilization	$9,545.00		
AB – Site Surveying	$5,444.10		
AC – ESA & Building Permits	$46,000.00		
AD – Civil Site Testing 3rd Party	$9,200.00		
AE – Construction Management & Facilities	$93,138.50		
AF – Head Office Costs	$92,000.00		

* The totals listed above are taken from Appendix A with a 15% Contractor markup applied.

3.0 Conclusion

3.1 Summary of Results

The capital cost estimate, included in Appendix A, indicates that the estimated total cost to carry this project through to completion with taxes would be approximately $2,560,384.76. This figure includes a 10% contingency factor as well as the cost of engineering, the demolition of the existing equipment, and the purchasing and installation of the new equipment.

WM GARRY YOUNG SENIOR ESTIMATOR
ESTIMATE FOR
ONE LINE ENGINEERING
NATHAN HEWITT, P. Eng.

OPTION 1
3-Mar-20

WGY

WM GARRY YOUNG - March 3, 2020
BASE ON UNIT COST DATA 2018/19 REFERENCE AND HISTORICAL

JOB NAME GEMMELL MS11 T1 SUBSTATION UPGRADE
OWNER GREATER SUDBURY HYDRO INC.
WORK 44kV - 12.47 / 7.2kV SUBSTATION REPALCEMENT

BUDGET EST PLUS / MINUS 20%

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	UNIT TOTAL	SUB TOTAL	SUB TOTAL
A	**EXISITNG STATION REMOVALS EQUIPMENT, FEEDERS, SWITCHGEAR BLDG, 44 KV LOAD BREAK & TRANSFORMER**					$ -	$ -
1	GSHI - DISCONNECT & REMOVE 44 KV INCOMMING FEEDER	LOT	1	$ -	$ -		
2	GSHI - DISCONNECT & REMOVE 12.47 KV EGRESSING FEEDERS	LOT	1	$ -	$ -		
3	GSHI - DISCONNECT & REMOVE 44 KV MAIN SWITCHING DEVICE AND HV BUS TO XFMR AND MOVE OFF SITE.	LOT	1	$ -	$ -		
4	GSHI - DISCONNECT & REMOVE POWER TRANSFORMER AND MOVE OFF SITE.	LOT	1	$ -	$ -		
5	GSHI - DISCONNECT & REMOVE EXISTNG E HOUSE, SWITCH GEAR AND MAIN 12.47 KV INTERCONNECT FEEDER	LOT	1	$ -	$ -		
6					$ -		
7					$ -		
8					$ -		
9					$ -		
10					$ -		
B	**SITE WORK & TREE REMOVAL**					**$ 26,755.00**	**$ 26,755.00**
1	SET UP TEMPORARY FENCING 4 X 4 FRAME 8 FT HIGH PAINTED	FT	380	$ 28.50	$ 10,830.00		
2	NORTHSIDE & EAST SIDE OF STATION REMOVE TREES & LANDSCAPING UP TO 12 " DIAMETER	EST	20	$ 620.00	$ 12,400.00		
3	ALLOWANCE ROUGH GRADING SITE APP 7800 SQ FT	EA	1	$ 3,525.00	$ 3,525.00		
4				$ -	$ -		
5				$ -	$ -		
6				$ -	$ -		
7				$ -	$ -		
8				$ -	$ -		
9				$ -	$ -		
10				$ -	$ -		
C	**CIVIL REMOVALS EXISTING SOUND WALL & FOUNDATIONS**					**$ 96,841.67**	**$ 96,841.67**
1	EXISTING PRECAST SOUND WALL REMOVAL & DISPOSAL16 FT HIGH X 190 FT LENGTH ESTIMATED	SQ FT	3040	$ 3.50	$ 10,640.00		
2	REMOVAL OFF SITE & DISPOSAL	CU YDS	115	$ 50.00	$ 5,750.00		
3	DUMPSTERS 20 CU YDS	EA	6	$ 625.00	$ 3,750.00		
4	WALL FOUNDATION REMOVAL 6 FT DEEP WITH 2.5 X 1 FT FOOTING	CU YDS	59.81	$ 163.00	$ 9,749.81		
5	TRANSFORMER & 44 KV MAIN TRANSRUPTER PAD ESTIMATED 24 FT X 16 FT X 5 FT	CU YDS	71.11	$ 163.00	$ 11,591.11		
6	SWITCHGEAR BUILDING FOUNDATION 24 X 16 X 6	CU YDS	25.19	$ 163.00	$ 4,105.19		
7	REMOVAL & DISPOSAL OFF SITE	CU YDS	156.11	$ 50.00	$ 7,805.56		
8	DUMPSTERS 20 CU YDS	EA	10	$ 625.00	$ 6,250.00		
9	ALLOWANCE FOR HYDROVAC EXPOSURE OF FOUNDATIONS & DUCTBANKS	DAYS	5	$ 3,600.00	$ 18,000.00		
10	ALLOWANCE FOR EXCAVATION & DISPOSAL FOR FOUNDATION & DUCTBANK REMOVAL	CU YDS	640	$ 30.00	$ 19,200.00		
11				$ -	$ -		
12				$ -	$ -		
13				$ -	$ -		
14				$ -	$ -		
15				$ -	$ -		
D	**NEW FOUNDATIONS & SOUNDWALL INSTALLATION**					**$ 238,627.56**	**$ 238,627.56**
1	NEW TILT UP PRECAST SOUNDWALL INSTALLATION MATERIAL OWNER SUPPLIED 72' X 40' X 16'	SF	3584	$ 8.00	$ 28,672.00		
2	PRECAST SOUND WALL FOUNDATION 70 X 46 X 5	CU YDS	64.44	$ 1,200.00	$ 77,333.33		
3	TRANSFORMER & TRANSRUPTER FOUNDATION 24 X 16 X 5.5	CU YDS	78.22	$ 1,200.00	$ 93,866.67		
4	E- HOUSE FOUNDATION 24 X 16 + 10 X 18 X 5	CU YDS	22.96	$ 1,200.00	$ 27,555.56		
5	STEEL SUPPORT BEAM 20 FT X 16"	LBS	1200	$ 4.00	$ 4,800.00		
6	PRECAST COVER FOR CABLE PIT 18 X 5 C/W 2 MH ACCESS	CU YDS	3.33	$ 1,200.00	$ 4,000.00		
7	MANHOLE ACCESS ASSEMBLIES 3 X 3	EA	2	$ 1,200.00	$ 2,400.00		
8				$ -	$ -		
9				$ -	$ -		
10				$ -	$ -		
E	**REVISE EXISTING & NEW DUCTBANKS & GROUNDING**					**$ 70,255.20**	**$ 70,255.20**
1	FDR #2 & SPARE FDR - SW GEAR TO NP#1 8 X 4" DUCTS CONCRETE ENCASED	FT	65	$ 150.00	$ 9,750.00		

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BASE ON UNIT COST DATA 2018/19 REFERENCE AND HISTORICAL

JOB NAME GEMMELL MS11 T1 SUBSTATION UPGRADE
OWNER GREATER SUDBURY HYDRO INC.
WORK 44kV - 12.47 / 7.2kV SUBSTATION REPALCEMENT

BUDGET EST PLUS / MINUS 20%

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	UNIT TOTAL	SUB TOTAL	SUB TOTAL
2	SPARE FDR - NP#1 TO NP#2 CONTINUATION 4 X 4" DUCTS CONCRETE ENCASED	FT	90	$ 100.00	$ 9,000.00		
3	FDR #1 & FDR #3 SW GEAR TO MH AT GEMMEL NORTH SIDE 8 X 4" DUCTS CONCRETE ENCASED	FT	40	$ 150.00	$ 6,000.00		
4	FDR #1 & FDR #3 NEW MH TO EXISTING DIP POLE @ CORNER BD & GEM NS 8 X 4" DUCTS CE	FT	80	$ 150.00	$ 12,000.00		
5	FDR #1 ENDS AT DIP POLE 4 X 4" DUCTS	FT	10	$ 100.00	$ 1,000.00		
6	FDR #3 CONNECTS TO EXISTING DUCT STRUCTURE GOING NORTH ACROSS GEMMELL ST TO EXISITNG DIP POLE 4 X 4" DUCTS	FT	166	$ 20.00	$ 3,320.00		
7	44 KV PRIMARY TRANSFORMER FEEDER DUCT BANK EXTENSION 4 X 4" DUCT CONCRETE ENCASED	FT	60	$ 100.00	$ 6,000.00		
8	12.47 KV SECONDARY DUCTBANK FROM TRANSFORMER TO SWITCHGEAR 8 X 4" DUCTS CONCRETE ENCASED	FT	30	$ 150.00	$ 4,500.00		
9	2 X 4" CONDUITS TO TRANSFORMER & 44 KV TRANSRUPTER SCHEDULE 40 FOR PROTECTION & CONTROL	FT	100	$ 37.50	$ 3,750.00		
10	NEW STATION GROUNDING , BELLOW GRADE & ABOVE GRADE	FT	840	$ 17.78	$ 14,935.20		
11					$ -		
12					$ -		
13					$ -		
14					$ -		
15					$ -		
F	**INSTALLATION OF NEW SWITCHGEAR BUILDING, TRANSFORMER & 44 KV LOADBREAK SWITCH**					**$ 44,900.00**	**$ 44,900.00**
1	10/13.3 MVA POWER TRANSFORMER 44 KV PRIMARY / 12.47 SECONDARY OWNER SUPPLIED / OFFLOAD/ PLACE/ ASSEMBLE / OIL FILL & TEST	EA FREE ISSUE	1.00	$ 15,000.00	$ 15,000.00		
2	S&C ELECTRIC 44 KV FUSIBLE MOTORIZED SWITCH ASSEMBLEY COMPLETE ALSO INCLUDES 44 KV BUS CONNECTION ASSEMBLT TO CONNECT TO TRANSFORMER PRIMAMRY	EA FREE ISSUE	1.00	$ 8,500.00	$ 8,500.00		
3	PREFABRICATED E-HOUSE COMPLETE APPROXIAMTELY 16' X 24 FT OFFLOAD & PLACE ON FOUNDATION	EA FREE ISSUE	1.00	$ 18,000.00	$ 18,000.00		
4	FREE STANDING RTU SCADA PANEL OFFLOAD INSTALL & CONNECT	EA FREE ISSUE	1.00	$ 3,400.00	$ 3,400.00		
5					$ -		
6					$ -		
7					$ -		
8					$ -		
9					$ -		
10					$ -		
G	**NEW 44 KV & 15 KV FEEDER CABLES & TERMINATIONS**					**$ 109,468.35**	**$ 109,468.35**
1	44 KV PRIMARY FEEDER 3 X 1C 46 KV 350 MCM CABLES PULLED IN TO DUCTBANK	FT	115	$ 86.25	$ 9,918.75		
2	44 KV TERMINATIONS SUPPLY & INSTALL	EA	6	$ 1,875.00	$ 11,250.00		
3	15 KV FEEDER CABLES 6 X 15 KV 350 MCM FROM TRANSFORMER SECONDARY TO MAIN BREAKER IN E HOUSE	FT	60	$ 133.32	$ 7,999.20		
4	FDR #1 3 X 1C 350 MCM 15 KV CABLES FROM SWITCHGEAR FEEDER BREAKER TO DIP POLE	FT	195	$ 66.66	$ 12,998.70		
5	FDR #2 3 X 1C 350 MCM 15 KV CABLES FROM SWITCHGEAR FEEDER BREAKER TO DIP POLE	FT	160	$ 66.66	$ 10,665.60		
6	FDR #3 3 X 1C 350 MCM 15 KV CABLES FROM SWITCHGEAR FEEDER BREAKER TO DIP POLE	FT	360	$ 66.66	$ 23,997.60		
7	SPARE FDR 3 X 1C 350 MCM 15 KV CABLES FROM SWITCHGEAR FEEDER BREAKER TO DIP POLE (FUTURE COST)	FT	225	$ 66.66	$ 14,998.50		
8	NEUTRAL CONDUCTOR FOR FEEDERS 1/2/3/4/ 1C # 2/0 1000V	FT	1000	$ 5.58	$ 5,580.00		
9	15 KV TERMINATIONS SUPPLY & INSTALL	EA	36	$ 335.00	$ 12,060.00		
10				$ -	$ -		
H	**PROTECTION & CONTROL CABLES**					**$ 14,288.70**	**$ 14,288.70**
1	POWER TRANSFORMER FANS & SCADA CABLING (3 X 70)	FT	210	$ 10.51	$ 2,207.10		
2	44 KV MORORIZED LOAD BREAK SWITCH AC FEEDERS & SCADA CABLING (2 X 80)	FT	160	$ 10.51	$ 1,681.60		
3	FIBER SCADA FROM E HOUSE TO F2 FEEDER POLE WITH TERMINATIONS	FT	160	$ 15.00	$ 2,400.00		
4	UTILITY AC FEEDER 1 X 3C # 3/0 TECK CABLE FROM SWITCHGEARD BUILDING TO F2 TERMINAL POLE	FT	160	$ 50.00	$ 8,000.00		
5					$ -		
6					$ -		

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				WGY		**OPTION 1** 3-Mar-20	
WM GARRY YOUNG - March 3, 2020		JOB NAME	GEMMELL MS11 T1 SUBSTATION UPGRADE				**BUDGET EST**
BASE ON UNIT COST DATA 2018/19 REFERENCE AND HISTORICAL		OWNER	GREATER SUDBURY HYDRO INC.				**PLUS / MINUS**
		WORK	44kV - 12.47 / 7.2kV SUBSTATION REPALCEMENT				**20%**

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	UNIT TOTAL	SUB TOTAL	SUB TOTAL
7					$ -		
8					$ -		
9					$ -		
10					$ -		
I	**PRESERVICE TESTING & COMMISSIONING**					**$ 52,150.00**	$ 52,150.00
1	44 KV CABLE HIGH POT TESTS	EA	3	$ 150.00	$ 450.00		
2	15 KV CABLE HIGH POT TESTS	EA	18	$ 150.00	$ 2,700.00		
3	10/13.3 MVA POWER TRANSFORMER	EA	1	$ 15,000.00	$ 15,000.00		
4	44 KV MOTORIZED LOAD BREAK SWITCH	EA	1	$ 5,000.00	$ 5,000.00		
5	6 CELL 15 KV SWITCHGEAR PROTECTION & CONTROLS	CELLS	6	$ 2,500.00	$ 15,000.00		
6	AC POWER SYSTEM	LOT	1	$ 1,000.00	$ 1,000.00		
7	DC POWER SYSTEM	LOT	1	$ 1,500.00	$ 1,500.00		
8	SCADA POINTS	LOT	1	$ 1,500.00	$ 1,500.00		
9	FUNCTIONAL TESTING WITH OWNER	HRS	20	$ 150.00	$ 3,000.00		
10	REPORTS & DOCUMENTATION	HRS	32	$ 125.00	$ 4,000.00		
11	TEST EQUIPMENT	LOT	1	$ 3,000.00	$ 3,000.00		
J	**CIVIL AND LANDSCAPE RESTORATIONS**					**$ 30,699.80**	**$ 30,699.80**
1	ASPHALT REPLACEMENT & REPAIR	SQ YDS	360	$ 36.63	$ 13,186.80		
2	YARD AREA INSULATING STONESTONE	CU YDS	30	$ 62.00	$ 1,860.00		
3	GRASS AREA RESTORATION & SODDING	SQ FT	2025	$ 0.52	$ 1,053.00		
4	NEW TREES MAPLE 8 TO 10 FT TALL	EA	20	$ 505.00	$ 10,100.00		
5	WATERING & CARE 30 DAYS	EA	30	$ 150.00	$ 4,500.00		
6					$ -		
7					$ -		
8					$ -		
9					$ -		
10					$ -		
K	**MOBILIZATION & SITE FACILITIES SET UP**					**$ 4,500.00**	**$ 4,500.00**
1	MOBILIZATION	EA	**10**	**$ 200.00**	$ 2,000.00		
2	SET UP SITE FACILITIES	LOT	**1**	**$ 2,500.00**	$ 2,500.00		
3					$ -		
4					$ -		
5					$ -		
L	**DEMOBILIZATION**					**$ 8,300.00**	**$ 8,300.00**
1	DEMOBILIZATION	EA	10	**$ 200.00**	$ 2,000.00		
2	REMOVE SITE FACILITIES	LOT	1	**$ 2,500.00**	$ 2,500.00		
3	REMOVE TEMPORARY FENCING	FT	380	**$ 10.00**	$ 3,800.00		
4					$ -		
5					$ -		
M	**EQUIPMENT FREE ISSUED BY GSHI**					**$ 1,162,575.00**	**$ 1,162,575.00**
1	PRECAST SOUND WALL	EA	1	**$ 112,000.00**	$ 112,000.00		
2	44-12.47kV POWER TRANSFORMER	EA	1	**$ 391,075.00**	$ 391,075.00		
3	PREFABRICATED E-HOUSE	EA	1	**$ 545,000.00**	$ 545,000.00		
4	44kV SWITCHGEAR & BUS CONNECTION DUCT	EA	1	**$ 114,500.00**	$ 114,500.00		
5					$ -		
N	**NOT USED**					**$ -**	$ -
0	**NOT USED**					**$ -**	$ -
P	**NOT USED**					**$ -**	$ -
Q	**NOT USED**					**$ -**	**$ -**
R	**NOT USED**					**$ -**	**$ -**
S	**NOT USED**					**$ -**	**$ -**
T	**NOT USED**					**$ -**	$ -
U	**NOT USED**					**$ -**	**$ -**
V	**NOT USED**					**$ -**	**$ -**
W	**NOT USED**					**$ -**	**$ -**
X	**NOT USED**					**$ -**	**$ -**
Z	**NOT USED**					**$ -**	**$ -**
AA	**ENGINEERING - ONE LINE**					**$ 117,960.70**	**$ 117,960.70**
1	CONTRACT T1912	N/A	**N/A**		$ 117,960.70		
2					$ -		
3					$ -		
AB	**SITE SURVEYING**					**$ 4,734.00**	**$ 4,734.00**
1	TOPOGRAPHICAL SURVEY	ACRE	**0**	**$ 2,150.00**	$ -		

WM GARRY YOUNG SENIOR ESTIMATOR
ESTIMATE FOR
ONE LINE ENGINEERING
NATHAN HEWITT, P. Eng.

OPTION 1

		WGY

3-Mar-20

WM GARRY YOUNG - March 3, 2020
BASE ON UNIT COST DATA 2018/19 REFERENCE AND HISTORICAL

JOB NAME GEMMELL MS11 T1 SUBSTATION UPGRADE
OWNER GREATER SUDBURY HYDRO INC.
WORK 44kV - 12.47 / 7.2kV SUBSTATION REPALCEMENT

BUDGET EST PLUS / MINUS 20%

ITEM	DESCRIPTION	UNIT	QTY	UNIT COST	UNIT TOTAL	SUB TOTAL	SUB TOTAL
2	LOCATION LINES	ACRE	**1**	**$ 1,650.00**	$ 1,650.00		
3	MONUMENTS	EA	**6**	**$ 242.00**	$ 1,452.00		
4	PROPERTY LINES	LF	**800**	**$ 2.04**	$ 1,632.00		
5					$ -		
AC	**ESA & BUILDING PERMITS**					**$ 40,000.00**	**$ 40,000.00**
1	BUILDING PERMIT - ESTIMATE	ALLOWANCE	**1**	**$ 30,000.00**	$ 30,000.00		
2	ESA INSPECTION PERMIT	LOT	**1**	**$ 10,000.00**	$ 10,000.00		
3		LOT		**$ -**	$ -		
4					$ -		
5					$ -		
AD	**CIVIL SITE TESTING 3RD PARTY**	NA				**$ 8,000.00**	**$ 8,000.00**
1	CIVIL TESTING ALLOWANCE	**LOT**	**1**	**$ 5,000.00**	$ 5,000.00		
2	ALLOWANCE FOR OIL & SOIL TESTING	**LOT**	**1**	**$ 3,000.00**	$ 3,000.00		
3					$ -		
4					$ -		
5					$ -		
AE	**CONSTRUCTION MANAGEMENT & FACILITIES**					**$ 80,990.00**	**$ 80,990.00**
1	**PROJECT MANAGER BASED ON 16 HRS PER WEEK**	**MTH**	**4**	**$ 5,480.00**	$ 21,920.00		
2	**SUPERINTENDENT**	**MTH**	**4**	**$ 11,600.00**	$ 46,400.00		
3	**FIELD ENGINEER**	**MTH**	**0**	**$ -**	$ -		
4	**CLERK**	**MTH**	**0**	**$ 2,700.00**	$ -		
5	**TRAVEL & ALLOWANCE**	**MTH**	**0**	**$ 3,000.00**	$ -		
6	**TRAILERS**				$ -		
6.1	12 X 56 FT OFFICE TRAILER MAIN OFFICE	MTH	4	$ 1,000.00	$ 4,000.00		
6.2	12 X 56 FT LUNCHROOM TRAILER EMPLOYEES	MTH	0	$ 1,000.00	$ -		
6.3	12 X 56 FT OFFICE TRAILER OWNER OFFICE	MTH	**0**	$ 1,000.00	$ -		
6.4	1 QTY STORAGE CONTAINERS 8 FT X 40 FT	MTH	4	$ 500.00	$ 2,000.00		
6.5	WASHROOM TRAILER 2 STATION MODEL	MTH	4	$ 517.50	$ 2,070.00		
6.6	2 QTY OSHA STAIRS & PLATFORMS, WITH RAILINGS	MTH	2	$ 300.00	$ 600.00		
6.7	TRAILER DELIVERY & SET UP MOBOLIZATION	EA	2	$ 1,000.00	$ 2,000.00		
6.8	TRAILER PICKUP & RETURN DEMOBOLIZATION	EA	2	$ 1,000.00	$ 2,000.00		
AF	**HEAD OFFICE COSTS**					**$ 80,000.00**	**$ 80,000.00**
	HEAD OFFICE COSTS BASED ON 3 MONTHS	**MTH**	**4**	**$ 20,000.00**	$ 80,000.00		
SUB TOTAL							**$ 910,510.27**
CONTRACTOR MARK UP		**15%**					$ 136,576.54
TOTAL PROJECT							**$ 2,327,622.51**
PROJECT CONTINGENCY		**10.00%**					**$ 232,762.25**
TOTAL PROJECT BUDGET							**$ 2,560,384.76**

Wm. Garry Young
Senior T&D Estimator

REVISION O

2-CCMBC-5 Gross Fixed Assets

Question:

Reference: Exhibit 2, Tab 2, Schedule 1, page 7, Table 4 *GSHi Gross Fixed Assets 2021 vs 2020 Actuals,* and page 8.

Preamble: **"**These investments were partially offset by contributions of $1,119,716, primarily related to System Access projects aimed at providing new customer connections."

Questions:

a) Please explain the reason for the $1,119,716 variance in Account 2440 Deferred Revenue.

b) Why is the entire amount shown as variance in Table 4? Were there no contributions in 2020?

Response:

a) In 2021, GSHi collected contributions totaling $1.1 million. This amount is consistent with contributions collected in previous years, such as $1.25 million in 2020 and $1.1 million in 2022. These contributions are recorded as deferred revenue and subsequently amortized in alignment with the capitalization of the related assets, ensuring an accurate match between revenue and asset utilization.

b) The variance shown in Table 4 represents the difference between the closing cost balance of Account 2440 Deferred Revenue for 2020 and 2021. This variance reflects the net impact of contributions collected during 2021, less any disposals that occurred within the year. As noted in part (a), GSHi collected $1.1 million in contributions in 2021, which contributed to the variance observed in the table.

2-CCMBC-6 Account 1820 Variance

Question:

Reference: Exhibit 2, Tab 2, Schedule 1, Page 9

Preamble: "Gross assets increased by $2,992,436 from 2021 to 2022, primarily driven by a $3,901,627 increase in Distribution Plant. Contributing to this increase were relay upgrades at the MS15 Robinson station and station service transformer upgrades at four other stations, accounting for a $470,000 variance in account 1820."

Question:

Please provide more detail that would explain the $470,000 variance in Account 1820, including how much of the variance was attributed to each of the five stations.

Response:

The table below outlines the costs associated with several substations that account for the $470,156 variance. Construction work included items such as relay upgrades, recloser replacement and station battery replacement.

STATION	COST ($)
MS15	249,235.93
MS24	64,275.58
MS30	95,133.83
MS6	18,485.00
MS11	22,297.00
MS21	20,728.89

2-CCMBC-7 Inventory Adjustment

Question:

Reference: Exhibit 2, Tab 2, Schedule 1, page 9

Preamble: "A decrease of $639,282 in 'Line Transformers' was largely due to the accounting reversal of $1.1 million in capital costs related to assets classified as 'major spare parts' or 'standby equipment' held in general inventory and included as fixed assets. As discussed above, GSHi reversed the amount that had been historically included in fixed assets as major spares and standby equipment in 2022 as it worked to refine its process to determine an appropriate balance. GSHi booked another adjustment to reinstate the balance to fixed assets in 2024."

Question:

The text quoted in the preamble seems to indicate that equipment held in general inventory had been recorded as being in service. Please explain.

Response:

The OEB's *Accounting Procedures Handbook*, Article 410, page 21, under the subsection titled "Major Spare Parts and Stand-by Equipment," outlines the conditions under which major spare parts and standby equipment can be accounted for as property, plant, and equipment (PPE) for rate-making and reporting purposes. GSHi has adhered to these established practices in its treatment of major spare parts and standby equipment.

The adjustment referenced in the preamble reflects GSHi's efforts to refine its processes to ensure appropriate classification and balances. While these assets were historically included in fixed assets as major spares and standby equipment, the accounting reversal in 2022 was made to align with the refined process. The subsequent adjustment in 2024 reinstated the balance to fixed assets, consistent with the guidance provided in the *Accounting Procedures Handbook*.

2-CCMBC-8 Supply Chain Disruptions - Ukraine

Question:

Reference: Exhibit 2, Tab 9, Schedule 1, Attachment 1, Distribution System Plan, Page 18

Preamble: "After GSHI filed its inaugural DSP in 2019, capital expenditures and planning for the upcoming period were almost immediately under threat due to the global COVID-19 pandemic. Shortly thereafter, the (ongoing) conflict in Ukraine further disrupted supply chains that had yet to recover from the shocks caused by the pandemic."

Questions:

a) Please explain how the conflict in Ukraine disrupted supply chains of GSHi.
b) Please provide a list of GSHi supply chains that were disrupted by the conflict in Ukraine.

Response:

a) During the historical period 2020-2024, the dual effect of both the ongoing pandemic and the conflict in Ukraine contributed towards manufacturers struggling to keep up with demand from customers. As a result, lead times for critical electrical components, and the costs of these components, were trending upward. In addition to difficulty securing new orders for many padmounted electrical components, such as distribution transformers and switchgear at the 4/12kV level, supply chains for larger electrical components found in substations became increasingly difficult to source.

As a result of these supply chain challenges, GSHI was required to adjust the quantum and/or timing for several prospective investments during this period.

b) In addition to difficulty securing new orders for many padmounted electrical components, such as distribution transformers and switchgear at the 4/12kV level, supply chains for larger electrical components found in substations became increasingly difficult to source.

The table below shows a list of critical substation components and the change in lead time for these components between 2021/2022 and 2024:

Product Category	Pandemic (2021/2022) Lead Time	Current Lead Time (2024)
Power Transformers	1 – 2 years	3+ Years
Dead Tank Circuit Breaker	MV: 20-30 weeks HV: 30-50 weeks	MV: 30-50 Weeks HV: 3 – 4 years
Circuit Switcher	20 weeks	60 weeks
Instrument Transformers	LV: 8-12 weeks MV: 12-16 weeks	LV: 22+ weeks MV: 25+ weeks
Disconnect Switches	20+ weeks	40+ Weeks
Connectors	8-12 weeks	12-20+ weeks
Panels & Relays	Chip shortage	20+ weeks
Substation Trenches	16-20 weeks	30+ weeks

2-CCMBC-9 DSP Environmental Impacts

Question:

Reference: Exhibit 2, Tab 9, Schedule 1, Attachment 1, Distribution System Plan, Page 20

Preamble: "GSHI's distribution system is already experiencing a range of impacts from climate change, which are likely to increase. Climate adaptation considerations must therefore become a component of any prospective infrastructure renewal investment."

Questions:

a) Please list the impacts from climate change that GSHi has experienced over the last 10 years. For each impact, please provide the date of each event.

b) Does GSHi have any statistical data of the frequency of climate change impacts in its service territory that would indicate that such impacts are likely to increase?

c) How does GSHi differentiate between weather impacts and climate change impacts?

Response:

a) As climate change is recognized as a long-term pattern, rather than a short-term event, exact dates for the impacts of climate change experienced by GSHi are not possible. However, generally, Sudbury, like many other regions, is experiencing the impacts of climate change. Sudbury's climate has been warming over the past few decades, with noticeable changes in temperature, precipitation patterns and weather extremes. GSHI's incorporation of climate adaptation practices includes ensuring that it continues to build and design infrastructure to meet or exceed the latest revision of CSA C22.3 No.1 Overhead Systems which ensures that new distribution system expansions, extensions and replacements are storm-hardened to a level appropriate with the regional climate.

b) GSHi currently does not have statistical data on the frequency of climate change impacts within its service territory.

c) Weather impact is short-term and localized, while climate change impact involves long-term shifts and broader, global consequences.

2-CCMBC-10 DSP System Access Expenditures

Question:

Reference: Exhibit 2, Tab 9, Schedule 1, Attachment 1, Distribution System Plan, Page 206

Preamble:

"In 2024, GSHI is projected to experience an increase in System Access expenditures of $733,000 as compared with the Board-approved amount for that year. Several projects have contributed to this projected increase:

a. Most of the projected increase is attributed to actual contributions of $691,993 as compared with the planned amount of $225,000 for Subdivision work. The expected number of phases (3-4) are being developed in 2024, however, they are tending to be larger and more expensive than the original planned amount.
b. Projected 'Overhead Services' costs of $191,473 are $40,973 more than were planned."

Questions:

a) Why would higher contributions result in an increase in System Access Expenditures?

b) Did the OEB approve System Access expenditures for 2024? If the answer is yes, please provide reference for the approval.

c) What costs are included in Overhead Services costs?

d) Please file a table that shows the Board-approved vs Actual 2024 expenditures, contributions and overhead services costs

Response:

a) The statement regarding higher contributions leading to an increase in System Access Expenditures was inaccurately phrased. The intended message is that expenses were higher due to higher-than-expected costs associated with the installation of the distribution system in the residential subdivision phases completed in 2024. These costs were offset by contributions totaling $691,993.

b) No, the OEB has not approved System Access expenditures for 2024.

c) GSHi records “Overhead Service” costs in accordance with the OEB’s ‘Accounting Procedures Handbook for Electricity Distributors’ (1855 Services). This account includes the installation cost of overhead and underground conductors leading from a point where wires leave the last pole of the overhead system or the transformers or manhole, or the top of the pole of the distribution line, to the point of connection with the customer's electrical panel. Conduit used for underground service conductors is also included.

Example items:

1) Brackets
2) Cables and wires
3) Conduit
4) Insulators
5) Municipal inspection

6) Overhead to underground, including conduit or standpipe and conductor from last splice on pole to connection with customer's wiring
7) Pavement disturbed, including cutting and replacing pavement, pavement base, and sidewalks
8) Permits
9) Protection of street openings
10) Service switch
11) Suspension wire

d) GSHi cannot provide the requested table because the OEB has not approved System Access expenditures for 2024.

2-CCMBC-11 GSU Routing Study - Siemens Smart Grid Compass

Question:

Reference: Exhibit 2, Tab 9, Appendix H, *GSU Routing Study – Siemens Smart Grid Compass®*

Questions:

a) Why was this draft document from November 2016 included in evidence?
b) Is there a final version of this document? If the answer is no, please explain why not. If the answer is yes, please file it.
c) What is GSHi's definition of "smart grid"?

Response:

a) The document was included because it is referenced in Section 5.4.2.1 Material Investments, specifically 5.4.2.1.1.5 General Plant – Utility Network Migration/GIS Modernization and 5.4.2.1.3.5 General Plant – Asset Management Software.
b) The final version is provided as Tab 5, Interrogatory 11, Attachment 1.
c) GSHi does not have an official definition for the term 'smart grid' and relies on the definition in the Electricity Act, 1998 Section 2(1.3).

Attachment 1 (of 1):

2-CCMBC-11 Attachment 1: GSU Routing Study - Final

SIEMENS

siemens.com/smartgrid/compass

Smart Grid Compass®

Routing Study – Greater Sudbury Utilities

Answers for Energy Management.

Smart Grid Compass®

Routing Study

Greater Sudbury Utilities

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29 July 2016

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Version History

Version	Date	Status	Changes from Previous Version
0.9	10 June 2016	Draft	Initial draft
1.0	29 July 2016	Release	· Initiative "Introduce energy efficiency programs with regional scope": · Moved from VP.9 to VP.1 · Value Added Services Revenue target removed · Resulting program net benefit reduced from \$67.7M NPV to \$53.6M NPV · Value Pack Impact on KPIs changed from tables to charts (e.g. Fig. 8.1) · KPI impact chains added to Appendix A

Contents

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Executive Summary

1. Introduction

Recognizing and supporting GSU's vision and strategy, Siemens is pleased to have been provided the opportunity to prepare and present the final results of the Smart Grid Compass® Routing Phase.

GSU and Siemens have been working closely together to develop the grid modernization program using the Siemens Smart Grid Compass® as a guiding tool. The Smart Grid Compass® framework is implemented sequentially in three phases called Orientation, Destination and Routing, followed by the Navigation Phase for deployment and execution. Each phase delivers, at its completion, a comprehensive study documenting the input from GSU, the results of the joint workshops and Siemens's recommended actions. The current document is the final result of the Compass Routing work and is predicated on the results of the Destination Phase.

The grid modernization program described by the Routing Study is the step-by-step execution of Scenario 3 as defined in the Destination Study. This scenario supports the jointly developed vision originating from the Destination workshops:

GSU empowers people and communities
to connect and prosper
through innovation and infrastructure.

In order to achieve this vision, a set of objectives to guide the execution of the grid modernization program is required. The joint Siemens / GSU workshop participants drafted a proposed set of objectives during the Routing phase as a guide to organization throughout the program. These objectives are consistent with those of similar utilities across North America and together represent the key aspirations of a modern electric utility.

No.	Strategic Objective
1	Maintain top safety performance
2	Ensure operational excellence in the distribution system
3	Improve environmental performance
4	Improve financial performance
5	Enhance customer value

Each of the initiatives proposed within the program will advance the organization towards its vision by focusing on one or more of these strategic objectives. The impact diagrams included in the Initiative descriptions in Chapter 8 show which strategic objective will be impacted through the execution of the initiative.

The program is measured through a set of Key Performance Indicators. Table 1.2 shows how each strategic objective maps to the program KPIs.

While the Siemens Smart Grid Compass® provides a strategic framework for capturing GSU's vision through identifying the company's objectives and recommending concrete actions to fulfill them, the implementation of these concrete actions takes place guided through the Value Improvement Program embedded within GSU's grid modernization program.

For GSU, 12 Value Packs have been created, each with a distinct theme and each structured to optimize its internal synergy. (Value Packs are logical groupings of process initiatives and technology deployments, designed to provide the greatest benefit for the fewest technologies implemented.)

The Foundational Value Pack (VPi) has been designed to help GSU mobilize the organization around the shared vision of the future. This *'hit the ground running'* approach will help GSU marshal its technical and organizational resources and be prepared for subsequent Value Packs.

Initiatives are the most granular building blocks of the grid modernization program. They link business capabilities, objectives and technologies together and are a core component of the Smart Grid Compass® method. Each initiative has the target to change the level of sophistication of a business capability within a Compass domain, which results in impacts to the strategic objectives described in Section 1.3.

Many of the impacts are measured by effects on parameters proposed and discussed with GSU during the Routing workshops, wherein each proposed initiative was reviewed and its corresponding impact on the suite of parameters was discussed. In some cases the impacts of the proposed initiatives could not be quantified, but the initiative contributes strategic value to GSU. To clarify the way in which each initiative contributes value, they are grouped into three Contribution Categories:

1. **Strategic Initiatives** - Initiatives in this category are those that enable GSU to progress towards its vision despite being non-quantifiable and non-monetizable. These initiatives enable GSU to at least 'stay in the game'.

2. **Cost Savings and Capacity Creation** - Initiatives in this category are quantifiable and monetizable, and result either in direct cost savings or capacity creation within the organization. These initiatives enable GSU to 'win the game', which is useful and practicable as long as the rules of the game stay the same.

3. **Profit Contributions** - Initiatives in this category are intended to provide material contributions to the overall financial profitability of GSU. These initiatives enable GSU to 'change the rules'; as regulations, technologies and business models continue to evolve, GSU through its non-regulated affiliates will have the required capabilities to capitalize on new opportunities.

Technology deployments are the execution of projects intended to establish or extend the technology features as described in the Siemens Reference Architecture presented in Figure 1.2. Similar to initiatives, technology deployments form another of the building blocks of the grid modernization program.

2. Business Case

The creation of a quantitative business case is one of the core steps on the path to create an executable grid modernization program and the logical extension of the qualitative business case created during the Destination phase.

Creating the business case depends on combining aggregated cost streams with detailed value streams and adjusting for risk, transformation support and overhead.

For the creation of the cost view, individual estimations have been made for each initiative and each technology function that needs to be implemented.

The set of 107 parameters is the basis for the creation of the business value view. Using a subset of parameters, a total of 29 KPIs were derived, in order to make the approach manageable. For 6 out of the 29 KPIs it was possible to identify calculation formulas that enabled converting the KPI impact into monetary values.

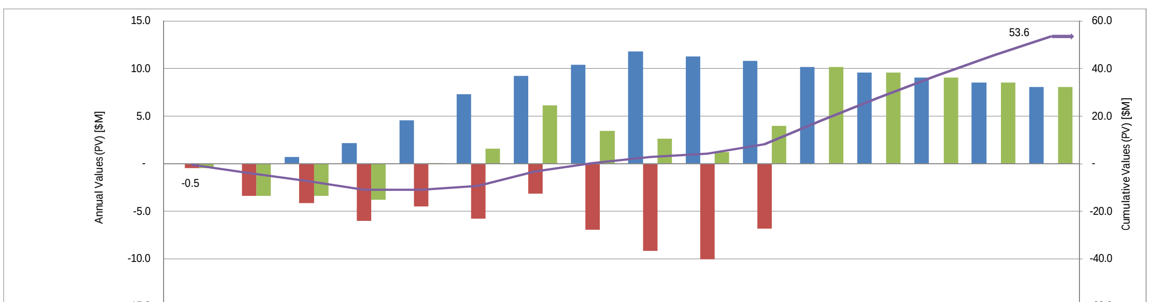
For the overall business case creation, a net present value (NPV) calculation was used with a discount rate of 5.99% as discussed with GSU. A 15 year timeframe for the business case was used, allowing sufficient run time to accrue value from the program.

The final numbers calculated for the business case of the grid modernization program are:

	Nominal	**Discounted**
Cost	\$ 82.7	\$ 60.2
Value	\$ 190.0	\$ 113.8
Net Benefit	**\$ 107.3**	**\$ 53.6**

The present value of **\$53.6M** is 89% of the discounted program cost. This value is significantly higher than typical minimum investment requirements. A clear justification for the grid modernization exists.

Figure 1 shows the overall program cost, business value and net benefit by year, showing a breakeven in year 7.



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Value - Annual	-	-	0.7	2.2	4.6	7.3	9.2	10.4	11.8	11.3	10.8	10.2	9.6	9.1	8.5	8.1
Cost - Annual	-0.5	-3.4	-4.1	-6.0	-4.5	-5.7	-3.1	-7.0	-9.1	-10.0	-6.8	-	-	-	-	-
Net Benefit - Annual	-0.5	-3.4	-3.4	-3.8	0.1	1.6	6.1	3.5	2.7	1.3	4.0	10.2	9.6	9.1	8.5	8.1
Net Benefit - Cumulative	-0.5	-3.8	-7.2	-11.0	-10.9	-9.3	-3.2	0.3	2.9	4.2	8.2	18.3	27.9	37.0	45.6	53.6

Figure 1.: Business Case Summary (PV)

3. Program Description

The grid modernization program is targeted to occur over a 10 year timeframe, deploying 12 Value Packs including a total of 103 initiatives and the implementation or extension of 62 technology functions.

Figure 1.3 shows a simplified Gantt Chart for the program implementation over the next 10 years, starting with the end of VPi.

4. Program Management

The GSU grid modernization program is comprised of 12 Value Packs that are to be executed within 10 years. These Value Packs are built from 103 initiatives addressing 40 business capabilities in six business domains, requiring the deployment of 62 technology features. This means that GSU will execute up to 103 initiatives plus 62 technology deployments resulting in 165 projects to implement its grid modernization program.

To ensure the synchronization of these 165 projects and their interdependencies, the Smart Grid Compass® methodology proposes an initial value pack (VPi) that establishes a Program Management Office (PMO) for coordinating and managing the grid modernization program guided by the Executive Oversight Committee.

The principles of Program Management are normally reasonably well understood but often confused with Project Management. Given the complexity of the entire grid modernization program, superior program management is required to ensure successful achievement of all targets within budget constraints and on time. The Program Management Office structure designed by Siemens is therefore expected to serve as GSU's mission control for the entire grid modernization program.

5. Conclusion

Siemens and GSU have completed the Smart Grid Compass® Routing Phase and jointly developed a comprehensive long-term plan to achieve a range of strategic business objectives and position GSU as a leader in terms of grid modernization.

This leadership position means that GSU will not only be able to better cope with its changing business environment, but can be positioned to define and shape its environment in the years to come. The ambitious 10 year plan set out in this report includes a range of initiatives including those which are foundational and which will develop fundamental business processes needed to support growth and increased complexity, and those which will redefine the nature of the services offered by GSU and the markets in which it participates.

The Siemens team believes that this plan and the Smart Grid Compass® methodology which underpins it will maximize the chance of success for GSU in achieving Smart Grid aspirations while supporting core business objectives.

Part I.

Introduction

Chapter 1. Introduction

Recognizing and supporting Greater Sudbury Utilities's (GSU's) vision and strategy, Siemens is pleased to have been provided the opportunity to prepare and present the final results of the Smart Grid Compass® Routing Phase.

This comprehensive Routing Study has been prepared with intense participation of the GSU project team and with the full support of executive management. The Study is comprised of 12 chapters and 3 appendices and describes GSU's grid modernization program. The program described in the Study is designed in a way that all activities become foundation blocks for future value creation. The strength of the proposed program lies in its completely modular but consecutive nature. This facilitates assignment of specific fine-resolution tasks to skilled subject matter experts.

All individual results/deliverables are aggregated to provide the value generation identified in the program business case. As the program is an end-to-end scenario covering all aspects of GSU's grid modernization aspiration, we believe that GSU is well on its way to becoming an Ontario and global benchmark and reference.

1.1. Background

GSU and Siemens have been working closely together to develop the grid modernization program using the Siemens Smart Grid Compass® as a guiding tool. The Smart Grid Compass® framework is implemented sequentially in three phases called Orientation, Destination and Routing, followed by the Navigation Phase for deployment and execution. Each phase delivers, at its completion, a comprehensive study documenting the input from GSU, the results of the joint workshops and Siemens's recommended actions. The current document is the final result of the Compass Routing work and is predicated on the results of the Destination Phase.

In the Destination Phase the project team defined three different scenarios differentiated by required investments, scope of aspiration and modulated roll-outs for a Roadmap of the 'Utility of the Future'. The vision of the three scenarios was:

- Scenario 1: GSU will sustain its viability by improving reliability and customer service through enhanced information and grid technologies.
- Scenario 2: Make GSU the best performing diversified utility in Ontario, providing energy, connections and related services by leveraging proven advanced networks and infrastructure technologies.
- Scenario 3: GSU empowers people and communities to connect, prosper and grow through innovation and proven leading edge infrastructure.

In discussions during the Destination workshop, GSU determined that it would aspire to Scenario 3. The grid modernization program described by the Routing Study is the step-by-step execution of Scenario 3 as defined in the Destination Study.

Figure 1.1 shows the Siemens Business Capability Model consisting of 40 business capabilities, with the capability evaluation and aspiration as determined during the Orientation phase. The figure indicates the baseline capability level, the original aspiration and the resulting capability realization of the program based on an evaluation of the practicality of executing initiatives to bring GSU to the indicated level.

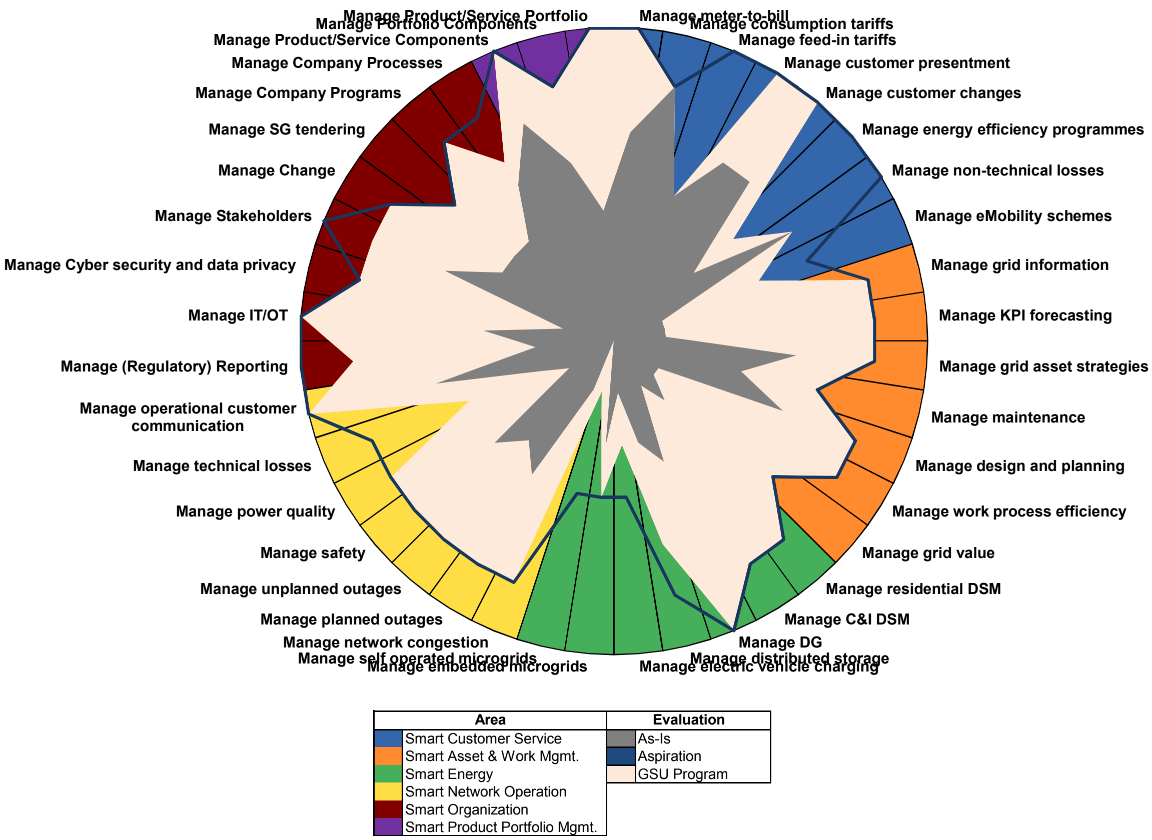


Figure 1.1.: GSU's Capability Aspirations

The Siemens Functional Reference Architecture for a ‘Utility of the Future’ is shown in Figure 1.2, with its 25 sub-classes and 80 technology functions. The technology capabilities that the workshop team established as existing and required are shown. During the course of the program, all technology features indicated as ‘Implementation Required’ or ‘Extension Required’ will be established through the Technology Deployments detailed in Chapter 8 - Value Packs (VPs).

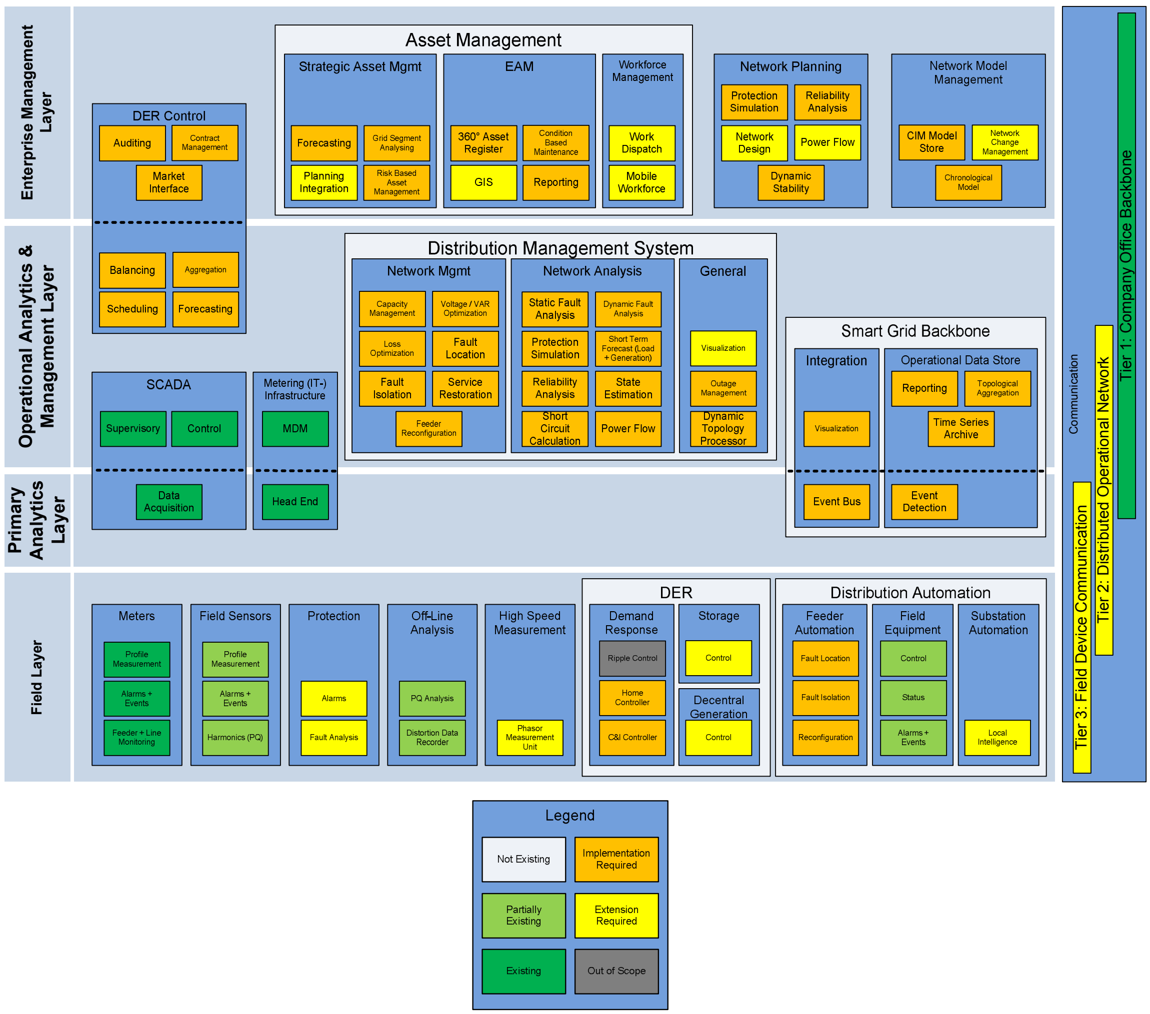


Figure 1.2.: Siemens Functional Reference Architecture - GSU Grid Modernization Program

1.2. Vision

The grid modernization program described by the Routing Study is the step-by-step execution of Scenario 3 as defined in the Destination Study. This scenario supports the jointly developed vision originating from the Destination workshops:

GSU empowers people and communities
to connect and prosper
through innovation and infrastructure.

Empowering people and communities is a key theme of the work that GSU is doing in the community, not limited to the grid modernization program but extending to its participation in the Community Energy Planning project with a broader stakeholder group.

Connection and prosperity are the central aspirations for the theme; the central purpose of a utility has been to enable these aspirations since the earliest days of electric distribution systems.

Innovation is a required capability in the emerging digital grid space, since there are multiple emerging business models for the 'utility of the future' and the ones that will be most successful over the long term have yet to be determined. Counterbalancing the innovation imperative is the prudence imperative, wherein the utility is required to make effective use of proven infrastructure to drive value and cost savings for both customers and the utility shareholders.

The grid modernization program proposed in this study will enable GSU to take great strides towards its vision, while enabling it to adapt to changes in the regulatory, technical and market landscapes as they continue to evolve and emerge.

1.3. Strategic Objectives

In order to achieve the vision described in the previous section, a set of objectives to guide the execution of the grid modernization program is required. The joint Siemens / GSU workshop participants drafted a proposed set of objectives during the Routing phase as a guide to organization throughout the program. These objectives are consistent with those of similar utilities across North America and together represent the key aspirations of a modern electric utility.

Table 1.1.: GSU's Proposed Strategic Objectives

No.	Strategic Objective
1	Maintain top safety performance
2	Ensure operational excellence in the distribution system
3	Improve environmental performance
4	Improve financial performance
5	Enhance customer value

Each of the initiatives proposed within the program will advance the organization towards its vision by focusing on one or more of these strategic objectives. The impact diagrams included in the Initiative descriptions in Chapter 8 show which strategic objective will be most impacted through the execution of the initiative.

The program is measured through a set of Key Performance Indicators, discussed in the next section. Table 1.2 shows how each strategic objective from Table 1.1 maps to the program KPIs.

Although these strategic objectives enable the organization to focus its efforts over the course of the program, they are not official statements of strategy vetted and ratified by the organization. Siemens recommends the development of a sanctioned set of strategic objectives as early as possible in the grid modernization program.

1.4. Value Management

While the Siemens Smart Grid Compass® provides a strategic framework for capturing GSU's vision through identifying the company's objectives and recommending concrete actions to fulfill them, the implementation of these concrete actions takes place guided through the Value Improvement Program embedded within GSU's grid modernization program.

Embedding Value Management into program deployment is a unique Siemens approach that provides a holistic, systematic and structured framework for the management of the program execution. The aim is to achieve the best value for every process required to achieve the objectives of GSU. This is accomplished by delivering the deployment program steps with the least cost in a way that is consistent with the required levels of quality and performance.

The GSU Routing Study proposes a Value Improvement Program that focuses on the program as a whole rather than its modular components. It is crucial to explore opportunities for innovation at every stage to find the most cost-effective means of implementation. The Value Improvement Program described herein is a valuable tool in implementing a complex and multifaceted activity such as GSU's grid modernization program. The feedback mechanisms proposed in this closed-loop implementation approach ensure that potential business improvements are recognized in an iterative process that sets clear goals, drives the implementation of well-defined actions and evaluates the impact of each action through a defined set of KPIs, defined in the next section.

1.4.1. KPIs

The project team identified a set of 29 KPIs to set the targets for the Smart Grid Implementation Program, presented in Table 1.2 below.

The '**Current**' column indicates self-reported baseline values of the KPIs, based on input directly from GSU either in the Routing workshops or through follow-up correspondence.

The '**Forecast**' column indicates the forecast values for each KPI based on the discussions of the initiatives during the Routing workshops. For each initiative, an impact value on the parameters that constitute the KPI was discussed; the values given for each KPI in the Forecast column constitute the forecast value of the KPI at the end of the program if each initiative affects its respective parameters in the way the Routing workshop participants anticipate.

The '**Target**' column represents the aspired level of the KPI as determined in the early

Routing workshops. These target aspirations formed the guidelines of the workshop discussions, but ultimately the Forecast values will be used as metrics against which program progress will be measured. (N/A indicates that no specific target was aspired to in the workshop.)

A detailed description of the KPI, along with its calculation method and impact chain showing its effect on the associated Strategic Objective(s), is given in Appendix A.

These KPIs form the basis of the value contributions in the business case, discussed in detail in Part II - Business Case.

Table 1.2.: KPI Overview

ID	KPI	Current	Forecast	Target	Unit	Strategic Objectives				
						1	**2**	**3**	**4**	**5**
1	SAIDI	97.8	27.1	N/A	min/cust/y		•			•
2	SAIFI (planned and unplanned)	1.78	0.89	N/A	outages/cust/y		•			•
3	Customers experiencing multiple interruptions (CEMI4)	3.00	2.70	0.0	cust/y		•			•
4	Load Factor	66	66	95	%		•			
5	Technical Losses	3.00	2.25	N/A	%		•	•		
6	Non-Technical Losses	2.4	1.74	N/A	%				•	
7	Energy Savings from Efficiency and Conservation	6.90	39.17	34.74	GWh/y			•		
8	Peak Power Demand	184	184	145	MW		•			
9	Accident Frequency	0.24	0.00	0.00	inc/200,000h	•				
10	Accident Severity	0.30	0.23	0.00	lostdays/200,000h	•				
11	Near Miss Frequency	0.78	0.00	0.00	inc/200,000h	•				
12	Billing Efficiency Index - Customers	46.51	45.58	N/A	/cust				•	
13	Billing Efficiency Index - Energy	68.31	66.94	N/A	/kWh				•	
14	OPEX (Maintenance)	2.15	1.49	1.65	$M/y				•	
15	OPEX (Maintenance) per Customer	45.74	31.79	35.10	$/cust				•	
16	OPEX (Maintenance) per Energy Delivered	67.19	46.70	51.56	$/MWh				•	
17	OPEX / CAPEX	27	19	N/A	%				•	
18	Efficiency of Dispatch Process	60	65	75	%		•		•	•
19	Effort for Regulatory Reporting	3.00	1.50	2.0	FTE				•	
20	Time to Change	180	90	90	days		•		•	
21	Av. Size of Projects	1200	800	700	hours		•		•	
22	Interaction Cost per Customer	9.57	5.11	7.44	$/cust				•	
23	Customer Satisfaction Index	95	97	100	%					•
24	Value Added Services Revenue / Total Revenue	7.2	45.6	30	%				•	•
25	Value Added Services Gross Margin	1.00	20.65	15.00	$M/y				•	
26	Market Share (per product / service)	15	65	70	%				•	
27	GSU Renewable Generation - Power	1.63	1.70	180	MW			•		
28	Maximum DG Power / Line Capacity	19	19	40	%		•			
29	GSU Renewable Generation - Energy	5,643	5,869	56,430	GWh/y			•		

1.5. Value Packs

The GSU grid modernization program has been developed on the principle of creating Value Packs built from initiatives that share similar technological requirements to ensure investment synergy. The overall program design and sequence of Value Packs is further enhanced to ensure that early investments in the program facilitate capabilities for later investments, allowing strategic deployment of capabilities and positive business case results that ultimately result in cumulative value creation.

For GSU, 12 Value Packs have been created, each with a distinct theme and each structured to optimize its internal synergy. The Foundational Value Pack (VPi) has been designed to help GSU mobilize the organization around the shared vision of the future. This *'hit the ground running'* approach will help GSU marshal its technical and organizational resources and be prepared for subsequent Value Packs.

The theme of the value pack, along with detailed descriptions of the constituent initiatives and technology deployments, are given in the sections referenced in Table 1.3 below.

Table 1.3.: Value Packs

Chapter	Value Pack Title
7	Foundation Value Pack (VPi)
8.1	VP.1: Enhanced Asset & Work Information
8.2	VP.2: Basic Performance Monitoring
8.3	VP.3: Grid Value Maximization Leveraging Grid Information
8.4	VP.4: Leveraging Grid Information for Enhanced Performance Monitoring
8.5	VP.5: Introducing Business Value and Risk as Parameters for Asset Management
8.6	VP.6: Extending Network Planning through Lean Design Techniques
8.7	VP.7: Utilize Reliability and Communication Improvements to Improve Customer Satisfaction
8.8	VP.8: Basic Demand-Side Management
8.9	VP.9: Balance Load & Generation Based on Network Condition
8.10	VP.10: Advanced Demand Side Management
8.11	VP.11: Advanced Grid Management Based on Substation Automation
8.11	VP.12: Introduction of Self-Healing Network Characteristics

This level of fine-grained planning facilitates the ability to manage a high resolution deployment as described elsewhere in the Routing Study.

1.6. Initiatives and Technology Deployments

Initiatives are the most granular building blocks of the grid modernization program. They link business capabilities, objectives and technologies together and are a core component of the Smart Grid Compass® method. Each initiative has the target to change the level of sophistication of a business capability within a Compass domain, which results in impacts to the strategic objectives described in Section 1.3. Many of the impacts are measured by effects on parameters proposed and discussed with GSU during the Routing workshops, wherein each proposed initiative was reviewed and its corresponding impact on the suite of parameters was discussed. The next section discusses the category of contribution of each initiative to the overall justification of the grid modernization program.

Technology deployments are the execution of projects intended to establish or extend the technology features as described in the Siemens Reference Architecture presented in Figure 1.2. Similar to initiatives, technology deployments form another of the building blocks of the grid modernization program.

The general principle is that initiatives create capabilities which in turn create value for the organization; technologies themselves do not create value until their functionality is utilized by a business capability through an initiative.

Detailed descriptions of initiatives along with required technology deployments are given in Chapter 8. For details of the technology functions, please refer to the GSU Destination Study.

1.7. Business Case

The creation of a quantitative business case is one of the core steps on the path to create an executable grid modernization program and the logical extension of the qualitative business case created during the Destination phase.

Creating the business case depends on combining aggregated cost streams with detailed value streams and adjusting for risk, transformation support and overhead. Siemens adheres to the following general principles when creating a business case:

1.7.1. Cost

For the creation of the cost view, individual estimations (required person-hours per role and device/service costs) have been made for each initiative and each technology function that needs to be implemented. Those estimations have been assembled and combined with jointly-defined hourly rates. Finally, the necessary costs for program management, value management and to cover adjustments and potential risks have been added.

For details regarding the cost estimates see Chapter 3 - Program Cost. Details of the estimation methods for each initaitive and technology project are given in 12 - Estimates.

1.7.2. Value

The set of 107 parameters is the basis for the creation of the business value view. Each parameter is related to one of the Smart Grid Compass™objectives, and through the KPIs impacts GSU's strategic objectives. Using a subset of parameters, a total of 29 KPIs (strategic, tactical and operational) were derived, in order to make the approach manageable. Finally for 6 out of the 29 KPIs it was possible to identify calculation formulas that enabled converting the KPI impact into monetary values.

An explanation of program value can be found in Chapter 4 - Business Value. For details regarding the parameters, KPIs and the calculation formulas refer to Appendices A - Key Performance Indicators (KPIs) and B - Performance Parameters.

Not all initiatives lead to quantifiable changes in parameters that lead to monetizable changes in KPIs. However each of the initiatives discussed in the Routing workshops was considered to be of value to the organization. The ways in which each initiative contributes to the grid modernization program are explained in the next section.

1.8. Contribution Categories

Each initiative, described in detail in Chapter 8, is intended to drive GSU towards the achievement of its strategic objectives as described in Section 1.3.

Some initiatives can be measured in quantifiable ways, and the forecasting of the effects of initiatives on parameters and KPIs was a central focus of the Routing workshops. Some of these quantifiable effects manifest themselves in monetizable contributions that are reflected in the Business Case presented in Part II - Business Case. Others are able to be quantified but not monetized. Still other initiatives are not quantifiable or monetizable but are key capabilities that enable GSU to advance towards its vision.

Each of the ways the initiatives contribute to the overall vision are presented in the categories described below, and these contribution categories are reflected in the Value Packs discussed further in Chapter 8.

1.8.1. Category 1 - Strategic Initiatives

Initiatives in this category are those that enable GSU to progress towards its vision despite being non-quantifiable and non-monetizable.

Capabilities developed through these initiatives can improve reliability, lower greenhouse gas emissions, enable energy efficiency programs, renewable generation and electric vehicles, or simply facilitate the adherence to evolving regulations and standards. These are examples of capabilities that are difficult if not impossible to monetize, but form the core of the strategic capabilities of a modern utility.

In the context of grid modernization, there are risks associated with action and risks associated with inaction. Although initiatives in this category do not provide bottom-line contributions to the organization, they are justified on the basis that the risks of not doing them is greater than the risks of doing them.

These initiatives enable GSU to at least 'stay in the game'.

1.8.2. Category 2 - Cost Savings and Capacity Creation

Initiatives in this category are quantifiable and monetizable, and result either in direct cost savings or capacity creation within the organization.

Reduced operational expenses are an example of a hard cost savings generated by initiatives in this category. Soft cost savings or capacity creation examples include deferred capital expenditures as well as reductions in customer service interaction time and associated costs, enabling the organization to spend resources proactively interacting with customers.

Initiatives in this category are characteristic of traditional business case contributions executed by utilities that perceive themselves as infrastructure providers. However, lowering operating costs and extracting greater value from distribution assets are necessary but not sufficient drivers of a modern grid. Decreasing demand and the move to distributed generation can reduce the role of the utility in the future energy system unless resources are applied to new and innovative business models.

These initiatives enable GSU to 'win the game', which is useful and practicable as long as the rules of the game stay the same.

1.8.3. Category 3 - Profit Contributions

Initiatives in this category are intended to provide material contributions to the overall financial profitability of GSU.

Initiatives primarily in the Smart Product Portfolio domain are intended to leverage capabilities developed early in the grid modernization program, enabling the utility to act as an energy service provider (ESP) rather than just an infrastructure provider.

Initiatives in this category are monetizable and form the vast majority of value contributions to the overall business case. Since they involve creating products and services that have not yet been developed in many cases, there is a high degree of risk. However, as with the strategic initiatives described above, the risk of not doing these initiatives exceeds the risk of doing them.

These initiatives enable GSU to 'change the rules'; as regulations, technologies and business models continue to evolve, GSU through its non-regulated affiliates will have the required capabilities to capitalize on new opportunities.

1.9. Grid Modernization Program

The grid modernization program is targeted to occur over a 10 year timeframe, deploying 12 Value Packs including a total of 103 initiatives and the implementation or extension of 62 technology functions.

The execution philosophy behind the entire grid modernization program rests on two main planks:

- Exploit technological synergies as soon as they arise with the goal to generate business value as early as possible
- Budgetary requirements, and especially human resources, are to be smooth to ensure program continuity

Figure 1.3 shows a simplified Gantt Chart for the program implementation over the next 10 years, starting with the end of VPi. Please note:

- VPi (Value Pack - Initial) is the Foundational Value Pack for the program that helps GSU prepare for the launch of the program
- VPi starts before the planned 10 year run-time of the program
- Activities planned for VPi (described in more detail in Chapter 7) refer to internal preparation and ramp-up required by GSU to define and establish the program organization
- Execution of Value Packs 1 to 12 are scheduled to start in Year 1 and conclude in Year 10.
  - Each Value Pack has a capability enhancement component that contains key process change initiatives in selected areas, indicated by blank boxes in the Gantt Chart. Capability enhancement components conclude in year 8.
  - For Value Packs that require technology roll outs, the capability enhancement phase is followed by a 'Roll Out' component indicated by blue boxes in the Gantt Chart. 'Roll Out' components of the last value packs conclude in Year 10.

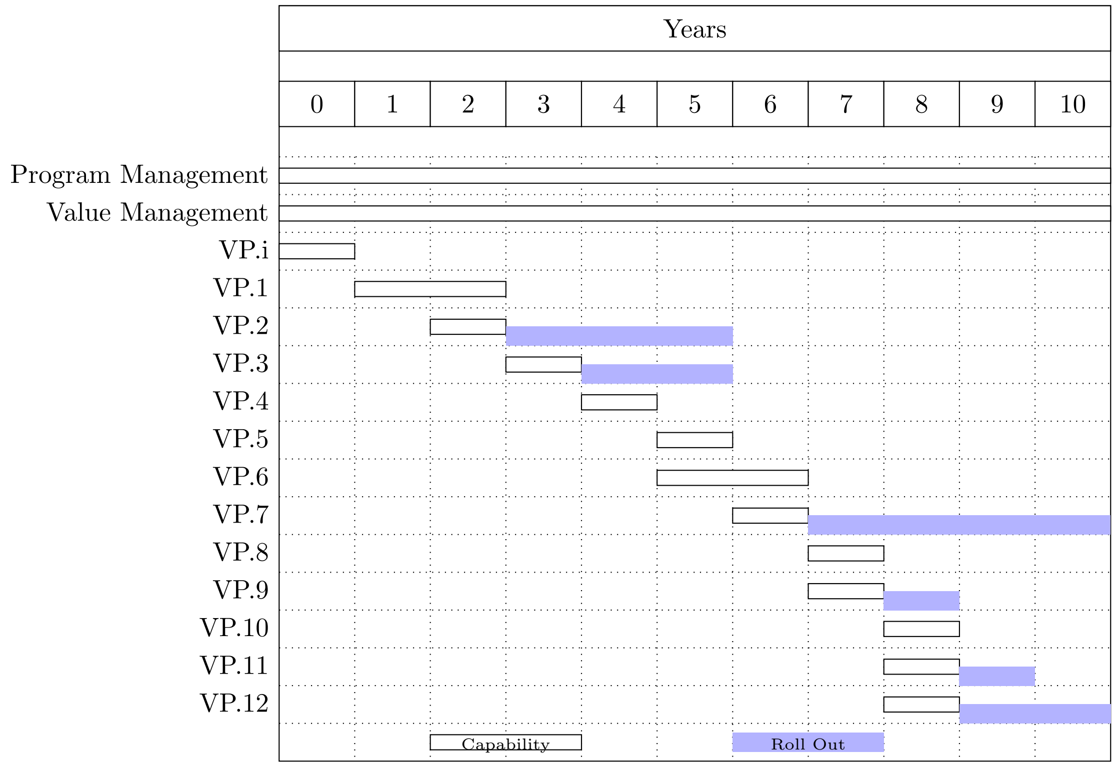


Figure 1.3.: Program Overview

Part II.

Business Case

Chapter 2.

Business Case Overview

As mentioned in Section 1.7 - Business Case, the creation of a quantitative business case is one of the core steps on the path to create an executable grid modernization program and the logical extension of the qualitative business case created during the Destination phase.

Creating the business case depends on combining aggregated cost streams with detailed value streams and adjusting for risk, transformation support and overhead. Program cost is described in more detail in Chapter 3 and Business Value in Chapter 4.

For the overall business case creation, a present value (PV) calculation was used with a discount rate of 5.99% as discussed with GSU. A 15 year timeframe for the business case was used, allowing sufficient run time to accrue value from the program especially for later-stage initiatives.

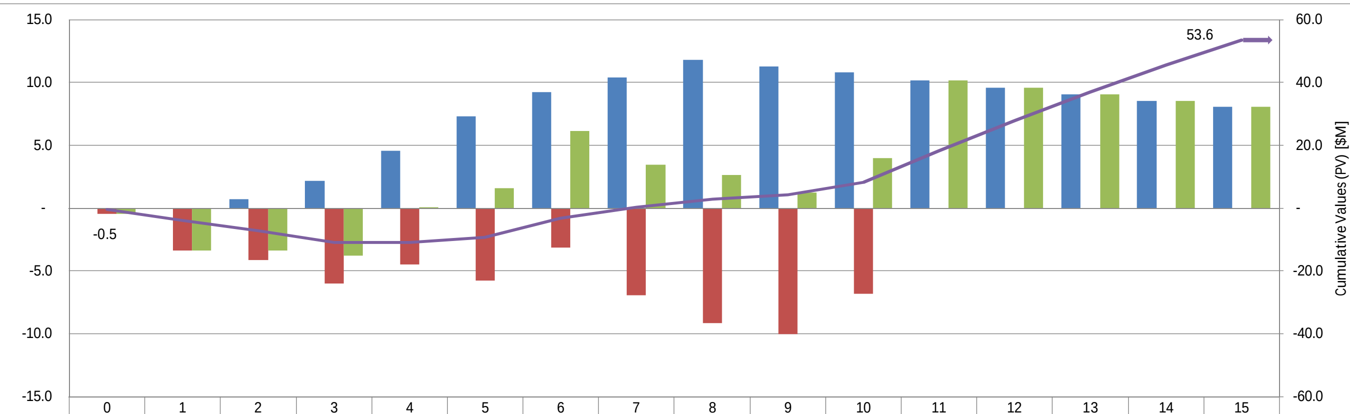
The final numbers calculated for the business case of the grid modernization program are:

Table 2.1.: Business Case Overview

	Nominal	**Present Value**
Cost	$ 82.7	$ 60.2
Value	$ 190.0	$ 113.8
Net Benefit	**$ 107.3**	**$ 53.6**

As Table 2.1 shows, the present value of **$53.6M** is 89% of the discounted program cost. This value is significantly higher than typical minimum investment requirements. A clear justification for the grid modernization exists.

Figure 2.1 on page 22 gives the cost and value streams until 2031.



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Value - Annual	-	-	0.7	2.2	4.6	7.3	9.2	10.4	11.8	11.3	10.8	10.2	9.6	9.1	8.5	8.1
Cost - Annual	-0.5	-3.4	-4.1	-6.0	-4.5	-5.7	-3.1	-7.0	-9.1	-10.0	-6.8	-	-	-	-	-
Net Benefit - Annual	-0.5	-3.4	-3.4	-3.8	0.1	1.6	6.1	3.5	2.7	1.3	4.0	10.2	9.6	9.1	8.5	8.1
Net Benefit - Cumulative	-0.5	-3.8	-7.2	-11.0	-10.9	-9.3	-3.2	0.3	2.9	4.2	8.2	18.3	27.9	37.0	45.6	53.6

Figure 2.1.: Business Case Summary (PV)

Business value is shown in blue bars. No monetizable value is created year 0 (VPi) since the program management office is only being set up at this stage. Initiatives in year 1 begin to produce value, but for conservatism value is not recognized until the following year, which is true throughout the program. Value accumulates in an essentially linear fashion due to the assumptions made around product portfolio gross margin contributions, described further in Section 4 - Business Value.

Program cost is shown in red bars as negative numbers. Costs for VPi are shown in year 0 and are included in total program cost. Costs vary throughout the program since they are comprised of labour and materials, which are affected by technology rollouts. Program costs peak at $10M in year 9 but are offset by significant value in that year. Costs are zero after year 10 when the program ramps down, but value is accrued for a further 5 years to account for the run-rate benefits of the later technologies and initiatives.

Net benefit on an annual basis is shown in green bars. In the early years with program costs but low business value, the net benefit is negative. However the offsetting effects of the value contributions means that net outlays for the program do not exceed $3.8M (year 3).

As the revenue-producing (Category 3 - Profit Contributions) initiatives continue to produce value, the business case returns a positive net benefit in year 7 as indicated by the purple line. Value contributions peak in year 8 and counteract the high cash outflows in the later years. These costs are offset by significant value contributions and the program returns a positive cash flow in all years after year 5.

Chapter 3.

Program Cost

The calculation of the cost to implement GSU's grid modernization program is based on a set of specific effort estimations, albour rates and technology costs. For each initiative in scope, as well as for each technology function that needs to be implemented or extended, a unique effort estimation was created, utilizing a common estimation framework. The estimation sheets were provided to GSU prior to the submission of this Study.

The result of those estimations is a clear view on the required person-hours for the initiative or technology in total as well as per required role. The estimations include the costs for devices, IT hardware and software as well as for additional services (e.g. marketing, expert support, etc.). For more details on the estimation method please see Chapter 12 - Estimates.

To ensure a smooth implementation of the program, besides the already explained efforts for technology and initiatives implementation, additional efforts are required for:

- Program Management
- Value Management
- Adjustments / Risk

The efforts for the Program Management are required to ensure that all activities are coordinated and aligned. The effort for Value Management are required to ensure that the program achieves the business value targets that have been defined. In essence, program management is about 'doing things right', while value management is about 'doing the right things'. Adjustments / Risk is required to ensure that potential problems like delays or errors in an estimation, increases in prices, emergence of new technologies, or other unforeseeable material program changes can be handled in a flexible way without endangering the program execution or the overall program success.

Table 3.1 summarizes the total program cost per value pack and year. The total nominal costs required are about \$82.7M.

Table 3.2 gives the overall program costs by Contribution Categories, as explained in Section 1.8.

Table 3.3 gives the overall program costs by Value Pack, with Contribution Categories broken out.

Table 3.1.: Cost Overview by Value Pack

Year	**0** **2016**	**1** **2017**	**2** **2018**	**3** **2019**	**4** **2020**	**5** **2021**	**6** **2022**	**7** **2023**	**8** **2024**	**9** **2025**	**10** **2026**	**Grand Total**
PMO	109,738	327,958	378,239	446,346	416,674	508,977	400,479	748,495	848,493	544,781	458,592	5,188,772
VMO	109,738	427,958	478,239	546,346	516,674	608,977	500,479	848,495	948,493	544,781	458,592	5,988,772
VP. 0	232,060											232,060
VP. 1		2,681,980										2,681,980
VP. 2			3,494,266	1,693,547	1,673,952	1,701,291						8,563,056
VP. 3				4,023,833	182,246	202,703						4,408,782
VP. 4					2,580,125							2,580,125
VP. 5						2,762,530						2,762,530
VP. 6						1,467,429						1,467,429
VP. 7							3,259,148	3,122,796	3,051,207	3,051,207	3,136,639	15,620,997
VP. 8								2,535,104				2,535,104
VP. 9								2,521,862	122,100			2,643,962
VP.10									2,337,528			2,337,528
VP.11									2,564,748	4,428,749		6,993,497
VP.12									3,861,734	7,408,318	7,442,360	18,712,412
Grand Total	**451,537**	**3,437,896**	**4,350,743**	**6,710,071**	**5,369,672**	**7,251,905**	**4,160,107**	**9,776,753**	**13,734,303**	**15,977,837**	**11,496,181**	**82,717,006**

Table 3.2.: Program Cost by Project Type

Year	0 2016	1 2017	2 2018	3 2019	4 2020	5 2021	6 2022	7 2023	8 2024	9 2025	10 2026	Grand Total
PMO	**109,738**	**327,958**	**378,239**	**446,346**	**416,674**	**508,977**	**400,479**	**748,495**	**848,493**	**544,781**	**458,592**	**5,188,772**
VMO	**109,738**	**427,958**	**478,239**	**546,346**	**516,674**	**608,977**	**500,479**	**848,495**	**948,493**	**544,781**	**458,592**	**5,988,772**
Contribution Category 1	**232,060**	**481,270**	**724,738**	**478,614**	**664,716**	**1,686,037**	**558,959**	**2,764,725**	**1,896,608**			**9,487,728**
Material		30,000				275,000						**305,000**
Personnel	193,384	376,058	520,615	357,178	553,930	1,134,198	382,466	2,220,604	1,463,840			**7,202,273**
Service			100,000	50,000		50,000	100,000	100,000	140,000			**540,000**
Risk	38,677	75,212	104,123	71,436	110,786	226,840	76,493	444,121	292,768			**1,440,455**
Contribution Category 2		**519,603**	**602,709**	**880,060**	**740,368**	**807,022**	**892,757**	**468,240**	**976,589**			**5,887,348**
Material						50,000		50,000				**100,000**
Personnel		433,003	481,424	683,383	596,140	443,352	673,131	348,534	813,824			**4,472,790**
Service			25,000	60,000	25,000	225,000	85,000					**420,000**
Risk		86,601	96,285	136,677	119,228	88,670	134,626	69,707	162,765			**894,558**
Contribution Category 3		**274,591**	**207,078**	**569,839**	**182,921**	**496,526**	**201,722**	**374,515**				**2,307,191**
Personnel		228,826	130,899	308,199	110,768	413,771	168,102	228,762				**1,589,326**
Service			50,000	200,000	50,000			100,000				**400,000**
Risk		45,765	26,180	61,640	22,154	82,754	33,620	45,752				**317,865**
Infrastructure		**1,195,436**	**1,959,741**	**3,788,868**	**2,848,317**	**3,144,367**	**1,605,711**	**4,783,363**	**9,064,120**	**14,888,274**	**10,578,998**	**53,857,195**
Material		675,000	950,000	2,220,833	1,530,833	1,595,833	438,000	1,328,500	3,785,000	10,520,500	7,245,500	**30,290,000**
Personnel		433,696	841,451	1,306,695	1,097,903	1,290,445	973,093	2,879,052	4,399,267	3,639,812	2,777,915	**19,639,329**
Risk		86,739	168,290	261,339	219,581	258,089	194,619	575,810	879,853	727,962	555,583	**3,927,866**
Grand Total	**451,537**	**3,226,817**	**4,350,743**	**6,710,071**	**5,369,672**	**7,251,905**	**4,160,107**	**9,987,833**	**13,734,303**	**15,977,837**	**11,496,181**	**82,717,006**

Table 3.3.: Program Cost by Value Pack and Contribution Category

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**Grand Total**
PMO	**109,738**	**327,958**	**378,239**	**446,346**	**416,674**	**508,977**	**400,479**	**748,495**	**848,493**	**544,781**	**458,592**	**5,188,772**
VMO	**109,738**	**427,958**	**478,239**	**546,346**	**516,674**	**608,977**	**500,479**	**848,495**	**948,493**	**544,781**	**458,592**	**5,988,772**
VPi	**232,060**											**232,060**
CC.1	232,060											232,060
VP. 1		**2,470,900**										**2,470,900**
CC.1		481,270										481,270
CC.2		519,603										519,603
CC.3		274,591										274,591
Tech.		1,195,436										1,195,436
VP. 2			**3,494,266**	**1,693,547**	**1,673,952**	**1,701,291**						**8,563,056**
CC.1			724,738									724,738
CC.2			602,709									602,709
CC.3			207,078									207,078
Tech.			1,959,741	1,693,547	1,673,952	1,701,291						7,028,531
VP. 3				**4,023,833**	**182,246**	**202,703**						**4,408,782**
CC.1				478,614								478,614
CC.2				880,060								880,060
CC.3				569,839								569,839
Tech.				2,095,321	182,246	202,703						2,480,270
VP. 4					**2,580,125**							**2,580,125**
CC.1					664,716							664,716
CC.2					740,368							740,368
CC.3					182,921							182,921
Tech.					992,119							992,119
VP. 5						**2,762,530**						**2,762,530**
CC.1						1,241,562						1,241,562
CC.2						588,321						588,321
CC.3						110,190						110,190
Tech.						822,457						822,457
VP. 6						**1,467,429**						**1,467,429**
CC.1						444,475						444,475
CC.2						218,701						218,701
CC.3						386,336						386,336
Tech.						417,917						417,917
VP. 7							**3,259,148**	**3,122,796**	**3,051,207**	**3,051,207**	**3,136,639**	**15,620,997**
CC.1							558,959					558,959
CC.2							892,757					892,757
CC.3							201,722					201,722
Tech.							1,605,711	3,122,796	3,051,207	3,051,207	3,136,639	13,967,560
VP. 8								**2,535,104**				**2,535,104**
CC.1								1,823,526				1,823,526
CC.3								194,690				194,690
Tech.								516,888				516,888
VP. 9								**2,732,942**	**122,100**			**2,855,042**
CC.1								941,198				941,198
CC.2								468,240				468,240
CC.3								179,824				179,824
Tech.								1,143,679	122,100			1,265,779
VP.10									**2,337,528**			**2,337,528**
CC.1									1,374,803			1,374,803
CC.2									254,497			254,497
Tech.									708,228			708,228
VP.11									**2,564,748**	**4,428,749**		**6,993,497**
CC.1									521,805			521,805
CC.2									254,000			254,000
Tech.									1,788,943	4,428,749		6,217,692
VP.12									**3,861,734**	**7,408,318**	**7,442,360**	**18,712,412**
CC.2									468,093			468,093
Tech.									3,393,641	7,408,318	7,442,360	18,244,319
Grand Total	**451,537**	**3,226,817**	**4,350,743**	**6,710,071**	**5,369,672**	**7,251,905**	**4,160,107**	**9,987,833**	**13,734,303**	**15,977,837**	**11,496,181**	**82,717,006**

3.1. Program Budget

Figure 3.1 gives the annual budget requirements for the 10-year program. They are shown summarized in the following categories:

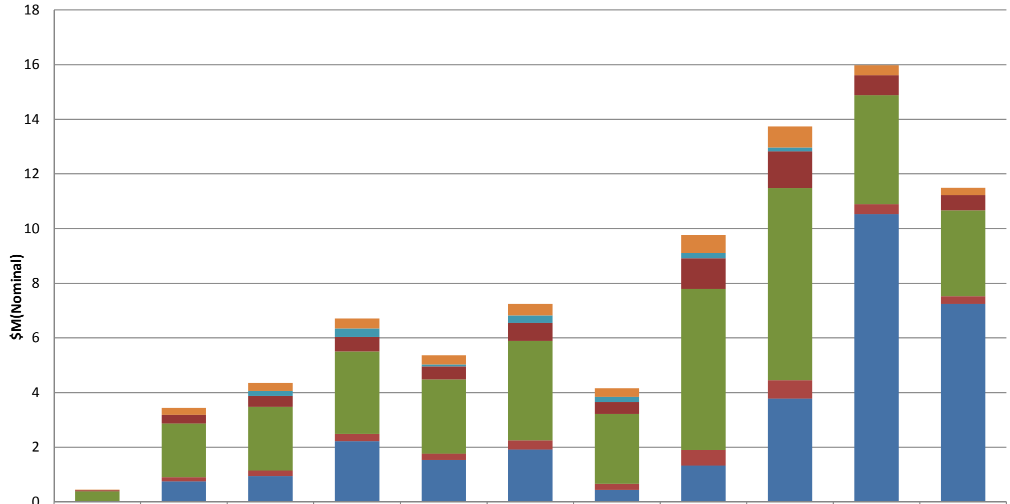
- Material
  Materials are things like software and hardware or devices that are needed to execute the initiatives or technology deployments
- Overhead
  Overhead is time budgeted for meetings, planning, administration, communication and so on in the program layer not related directly to individual Value Pack deployment
- Personnel
  Personnel is denoting all productive effort (total resource requirements) to execute the initiatives and the technology deployments
- Risk
  Risk is a contingency to cover inaccuracy issues with estimations prior to finalization
- Service
  Service covers efforts that are envisioned to be executed by third parties (subcontracted labour like e.g. design of marketing campaigns, etc.)
- Value Management
  Value Management includes the activities required to ensure the value generation of the entire program

Material, Personnel and Service are derived out of the estimations described in Chapter 12 - Estimates; costs for Overhead (program management), Value Management and Risk comprise the PMO and VMO lines in Table 3.1.

Budgetary requirements increase from a figure of roughly \$3M in Year 1 to a peak of roughly \$16M in year 9.

Taken in isolation the budget requirements appear formidable, but it is important to note that the program will also be producing revenues from its non-regulated affiliates that will, according to current estimates, provide more than sufficient cash flow to fund the program.

It is also important to note that the program budget is based on both internal and external labour resources; much of the program cost is allocated to personnel who will also be acting as non-program employees of GSU.



	0	1	2	3	4	5	6	7	8	9	10
Value Management	19,338	247,158	297,439	365,546	335,874	428,177	319,679	667,695	767,693	363,981	277,792
Service			175,000	310,000	75,000	275,000	185,000	200,000	140,000		
Risk	38,677	321,163	394,878	531,091	471,748	656,353	439,358	1,108,544	1,335,386	727,962	555,583
Personnel	374,184	1,967,416	2,335,988	3,017,056	2,720,342	3,643,366	2,558,390	5,904,319	7,038,531	4,001,412	3,139,515
Overhead	19,338	147,158	197,439	265,546	235,874	328,177	219,679	567,695	667,693	363,981	277,792
Material		755,000	950,000	2,220,833	1,530,833	1,920,833	438,000	1,328,500	3,785,000	10,520,500	7,245,500

Figure 3.1.: Annual Budgets

3.2. Labour Requirements

Table 3.4 gives the total hours required by role for the overall program. These total hours estimates combined with the labour rates in the following section produce the overall labour component of program cost.

A breakdown of the required personnel by role can be found in Section 11.3 - Staffing Requirements.

Table 3.4.: Labour Requirements [hours]

Role	0 2016	1 2017	2 2018	3 2019	4 2020	5 2021	6 2022	7 2023	8 2024	9 2025	10 2026	Grand Total
Business Architect		432	942	829	907	1,177	1,512	2,623	4,798	1,363	837	15,422
Communication Specialist		192	259	171	231	67	177	617	275			1,990
Consultant	621	3,975	3,505	4,438	3,858	6,550	3,349	7,603	6,582			40,480
Field Engineer		302	790	995	837	989	1,123	1,480	3,771	2,907	1,913	15,107
Field Technician			711	2,509	2,713	2,801	1,236	8,365	10,495	12,754	10,444	52,028
Legal Counsel		38			40		137	495				710
Managing Consultant	601	1,908	1,847	2,032	1,956	2,736	1,810	2,983	2,797	800	800	20,270
Program Manager	1,349	2,699	2,699	2,699	2,699	2,699	2,699	2,699	2,699	2,699	2,699	28,334
Project Manager		194	276	327	238	345	355	604	1,102	631	394	4,467
Purchasing Specialist		294	378	461	295	482	546	814	1,188	134		4,592
Software Engineer		416	577	585	360	429	328	899	897			4,491
System (IT/OT) Architect	190	1,755	2,089	2,496	1,773	2,432	1,770	3,476	3,586			19,568
Team Assistant		127	66	97	28	191	147	143	135			934
Trainer	68	394	399	397	385	827	374	850	792			4,486
Grand Total	**2,829**	**12,726**	**14,538**	**18,036**	**16,320**	**21,724**	**15,564**	**33,651**	**39,117**	**21,288**	**17,086**	**212,879**

3.3. Labour Rates

Table 3.5 provides an overview of the hourly rates used to calculate the labour cost required for the implementation of the grid modernization program.

There are three different prices per role. The first price is an internal price provided by GSU. Since the rates provided were unburdened, a burden rate of 40% was applied. The second price is a local market price for roles to be hired from within Ontario. The third price is an 'out-of-province' price for external expertise. Roles that can be filled from within GSU naturally create the lowest hourly prices, followed by local market prices, with most expensive being out of province experts.

Table 3.5.: Hourly rates by Role

	Balance of Resources			Rates [$/hr]				
Role	**GSU Internal**	**External (Local)**	**External (Out of Province)**	**GSU Internal**	**GSU Internal (40% Burdened)**	**External (Local)**	**External (Out of Province)**	**Blended Hourly Rate**
Project Manager	50%	50%	0%	$ 48	$ 67	$ 185	$ 230	$ 126
Managing Consultant	30%	50%	20%	$ 49	$ 69	$ 280	$ 325	$ 226
Consultant	40%	50%	10%	$ 49	$ 69	$ 230	$ 275	$ 170
Business Architect	40%	40%	20%	$ 49	$ 69	$ 230	$ 275	$ 174
System (IT/OT) Architect	25%	50%	25%	$ 44	$ 62	$ 230	$ 275	$ 199
Software Engineer	50%	25%	25%	$ 135	**$ 135**	$ 175	$ 220	$ 166
Field Engineer	50%	50%	0%	$ 47	**$ 240**	$ 320	$ -	$ 280
Field Technician	10%	90%	0%	$ 42	**$ 160**	$ 200	$ -	$ 196
Team Assistant	100%	0%	0%	$ 33	$ 46	$ 90	$ 135	$ 46
Communication Specialist	100%	0%	0%	$ 42	$ 59	$ 130	$ 175	$ 59
Legal Counsel	100%	0%	0%	$ 350	**$ 350**	$ 225	$ 270	$ 350
Purchasing Specialist	100%	0%	0%	$ 49	$ 69	$ 130	$ 175	$ 69
Trainer	100%	0%	0%	$ 48	$ 67	$ 120	$ 165	$ 67
Program Manager	100%	0%	0%	$ 48	$ 67	$ 280	$ 325	$ 67

The final rate used for calculating program costs are a blend of the three price categories depending on anticipated share of FTE going to each price category for each role. The defined shares per role can also be found in Table 3.5.

Chapter 4.

Business Value

In order to assemble the value creation side of the business case, a set of 107 performance parameters has been assessed. For many of the parameters, baseline figures have been gathered by GSU, and target figures describing the aspired improvement have been defined.

Out of the set of 107 performance parameters a total of 29 KPIs were derived in order to improve manageability. For each KPI, an analysis was undertaken to investigate whether a valid and justifiable formula could be identified to convert the KPI value into a monetary value. In the end, the calculation of the business value was based on 6 KPIs for which it was possible to derive monetized values. They are given in Figure 4.1. Table 4.1 shows the values in both nominal and present value dollars.

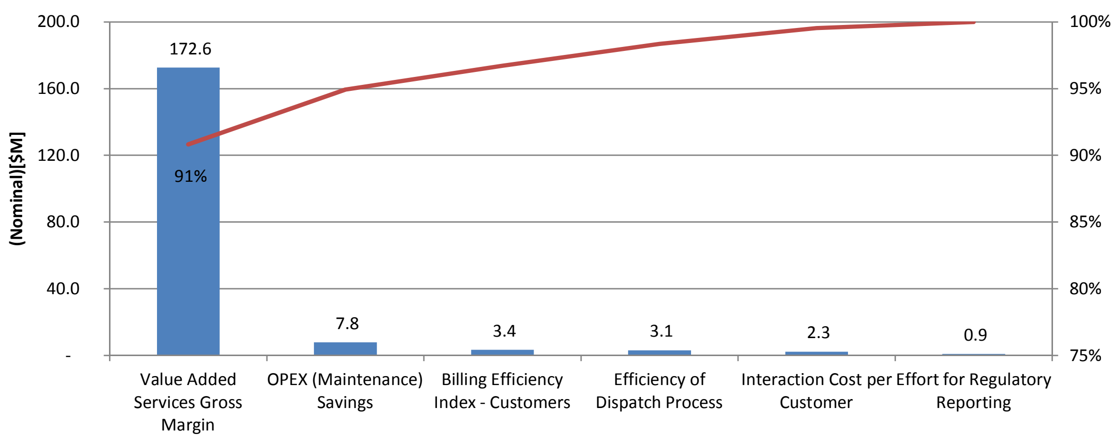


Figure 4.1.: Monetized KPI Pareto

As Table 4.1 shows, value generation is currently calculated for only 6 KPIs out of a total of 29. It is reasonable to assume that actual value generated during the course of the program will also cover KPIs that have not been monetized, in addition to other indirect benefits with non-monetizable benefits for GSU. Taken together, the value estimations carried out

Table 4.1.: Monetized KPI Values [$M]

KPI	**Nominal**	**PV**
Value Added Services Gross Margin	$ 172.6	$ 103.4
OPEX (Maintenance) Savings	$ 7.8	$ 4.9
Billing Efficiency Index - Customers	$ 3.4	$ 2.0
Efficiency of Dispatch Process	$ 3.1	$ 1.6
Interaction Cost per Customer	$ 2.3	$ 1.4
Effort for Regulatory Reporting	$ 0.9	$ 0.5
Grand Total	**$ 190.0**	**$ 113.9**

jointly by Siemens and GSU for most of the KPI monetization have been very conservative.

However, in the case of Value Added Services, which provides the vast majority of program monetary benefits, the estimate is somewhat ambitious and aspirational. The value contribution of this KPI was determined based on anticipated and aspired growth in the non-regulated affiliates of GSU. As the utility landscape changes and new products, services and business models emerge, the real value of these contributions will come into better focus. At the present time, not only do they represent the largest value contributor to the business case, they also represent the most uncertainty. Section 5.2 gives an explanation of the effects of changes to business value assumptions on overall program value.

4.1. Approach

The calculation approach for the business value is a multi-step approach deeply woven into the Smart Grid Compass® framework. During the Orientation phase, GSU and Siemens jointly evaluated a set of business objectives within 6 Compass® domains. During the Destination phase, the strength of the impact of an initiative onto relevant business objectives was assessed. Finally, in the Routing phase the business value was assessed from a quantitative perspective.

In order to get a clear view onto the business value, Siemens proposed a set of 'performance parameters' (see also Appendix B - Performance Parameters) as a basis for evaluation and discussion. During the workshops, parameters were modified, added or removed to arrive at a set that would adequately measure the effects of the grid modernization program.

In the end, a set of 107 performance parameters was finalized. For each parameter it was necessary to collect a baseline value that reflects its current state or the starting point for measuring the program success. Where values were not available or relevant, parameters were retained in order to drive future discussions around meaningful metrics.

Next, the joint Siemens / GSU workshop participants assigned Target values for each parameter wherever possible (to be achieved at the end of the program implementation). The Target proposals were discussed and matched with Siemens's project experience in order to arrive at a reasonable value and to find the right distribution of the impact across the relevant initiatives.

The next step was mainly about reducing complexity. Instead of directly handling 107 performance parameters, a smaller set of KPIs was defined that could be used for impact calculation and for program progress monitoring. Siemens proposed a set of roughly 50 KPIs, of which a total of 29 KPIs were jointly defined. Each KPI is either calculated out of a set of the parameters or is directly assigned to a single parameter.

Finally monetization approaches were discussed for all KPIs. It was not possible to define valid and justifiable monetization approaches for all KPIs. In the end, monetization formulas were aligned for a total of 6 KPIs.

4.2. Details of Value Contributions

Table 4.2 summarizes the annual contribution of each monetized KPI. The table contains two lines for each monetized KPI. The first line shows the change in the monetized KPI for the given year as a result of the initiative implementations, reflected by change in one or more of the KPI constituent parameters. When more than one of the parameters changes during the year, the value shows the sum of the effects of the individual parameter changes.

The cumulative effect is shown in the second line where each impact change is carried forward the following year for the remainder of the program.

For conservatism, the value generated by any initiative is recognized only in the year following the initiative. Hence no value is recognized in year 1, despite there being Contribution Category 3 (revenue-generating) initiatives in VP.1.

Table 4.2.: Business Value Generation by Year [$]

	Program Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**		
	Calendar Year	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**Grand Total**	**PV**
Efficiency of Dispatch Process	One time	-	-	-	-	-	-	-	-	239,389	239,389	-	-	-	-	-	**478,777**	**292,123**
	Recurring	-	-	-	-	-	-	-	-	-	239,389	478,777	478,777	478,777	478,777	478,777	**2,633,275**	**1,336,884**
Effort for Regulatory Reporting	One time	-	7,500	12,500	20,000	15,000	15,000	-	5,000	-	-	-	-	-	-	-	**75,000**	**61,852**
	Recurring	-	-	7,500	20,000	40,000	55,000	70,000	70,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	**787,500**	**470,976**
OPEX (Maintenance) Savings	One time	-	75,250	150,500	150,500	215,000	64,500	-	-	-	-	-	-	-	-	-	**655,750**	**554,204**
	Recurring	-	-	75,250	225,750	376,250	591,250	655,750	655,750	655,750	655,750	655,750	655,750	655,750	655,750	655,750	**7,170,250**	**4,332,698**
Interaction Cost per Customer	One time	-	-	50,000	22,500	37,500	45,000	55,000	-	-	-	-	-	-	-	-	**210,000**	**165,557**
	Recurring	-	-	-	50,000	72,500	110,000	155,000	210,000	210,000	210,000	210,000	210,000	210,000	210,000	210,000	**2,067,500**	**1,211,202**
Value Added Services Gross Margin	One time	-	700,000	1,400,000	2,800,000	3,500,000	2,900,000	2,210,400	2,950,000	-	-	-	-	-	-	-	**16,460,400**	**12,761,617**
	Recurring	-	-	700,000	2,100,000	4,900,000	8,400,000	11,300,000	13,510,400	16,460,400	16,460,400	16,460,400	16,460,400	16,460,400	16,460,400	16,460,400	**156,133,200**	**90,684,192**
Billing Efficiency Index - Customers	One time	-	-	34,997	24,884	24,884	99,537	149,305	-	-	-	-	-	-	-	-	**333,607**	**251,498**
	Recurring	-	-	-	34,997	59,881	84,765	184,302	333,607	333,607	333,607	333,607	333,607	333,607	333,607	333,607	**3,032,798**	**1,732,034**
Grand Total		**-**	**782,750**	**2,430,747**	**5,448,631**	**9,241,015**	**12,365,052**	**14,779,757**	**17,734,757**	**17,974,145**	**18,213,534**	**18,213,534**	**18,213,534**	**18,213,534**	**18,213,534**	**18,213,534**	**190,038,057**	
Present Value		**-**	**738,513**	**2,163,764**	**4,576,071**	**7,322,512**	**9,244,246**	**10,425,045**	**11,802,418**	**11,285,716**	**10,789,720**	**10,179,942**	**9,604,625**	**9,061,822**	**8,549,695**	**8,066,511**	**113,810,599**	**113,854,836**

Appendix A - Key Performance Indicators (KPIs) gives the details of the calculation method for each KPI, and Section 5.2 - Business Value Sensitivity Analysis gives an explanation of the effects that changes in the KPIs have on the overall program value.

Chapter 5.

Sensitivity Analysis

The business case for the grid modernization program is based on a set of assumptions that were valid at the time of creating the business case. In order to determine the effect that any variance in the calculated amount of any of the contributors to the business case, both cost and value, a sensitivity analysis has been undertaken. The intent is to show the effect on the overall business case that a percentage variation in any of the inputs would have on the overall monetary net benefit of the program.

The analysis shows that with a 50% reduction in total program business value contribution (holding cost constant), the business case almost breaks even, and with a 50% increase in program cost (holding business value constant) the program value is still almost $25M.

5.1. Program Cost Sensitivity Analysis

A series of calculations were carried out for evaluating the sensitivity of the net benefit generated by the program with respect to changes in the cost parameters.

The sensitivity of Total Program NPV was calculated for all key cost contributor categories of Labour, Hardware / Software costs, External Services, and PMO / VMO / Adjustments. Sensitivity slopes for different cost variations are plotted in Figure 5.1.

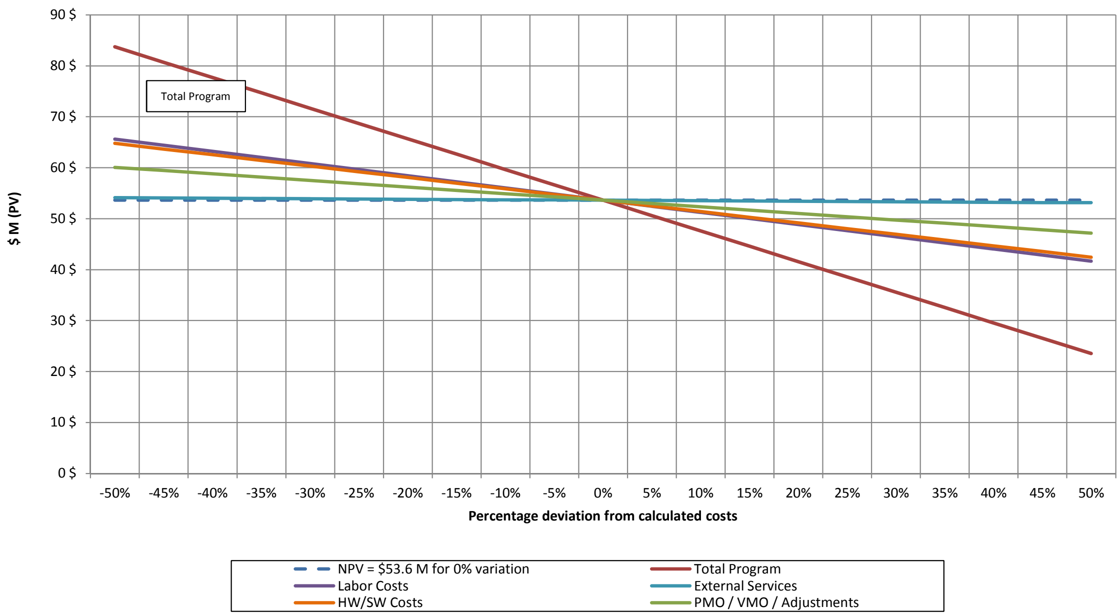


Figure 5.1.: Sensitivity of Program Value to Changes in Cost Estimates

The cost sensitivity analysis shows that if the costs have been underestimated by 20%, the program PV of $53.6M will decline by 22% to $41.6M.

The single most influential cost on total program value is Labour, since it is the largest contributor to cost. A 50% underestimation in labour cost would also result in a 22% drop in total program PV from $53.6M to $41.6M.

Hardware and Software costs are almost equally influential on total program value, so a similar 50% variation would result in a similarly reduced overall program PV.

It is important to remember here that the overall cost already includes significant margin for risk/adjustments. This means the total program PV is robust and can withstand variations in cost estimations.

5.2. Business Value Sensitivity Analysis

Figure 5.2 shows the sensitivity of the total program PV with respect to changes in the value generated by the total program, as well as to changes in total program PV as a result of variations in the 6 monetized KPIs.

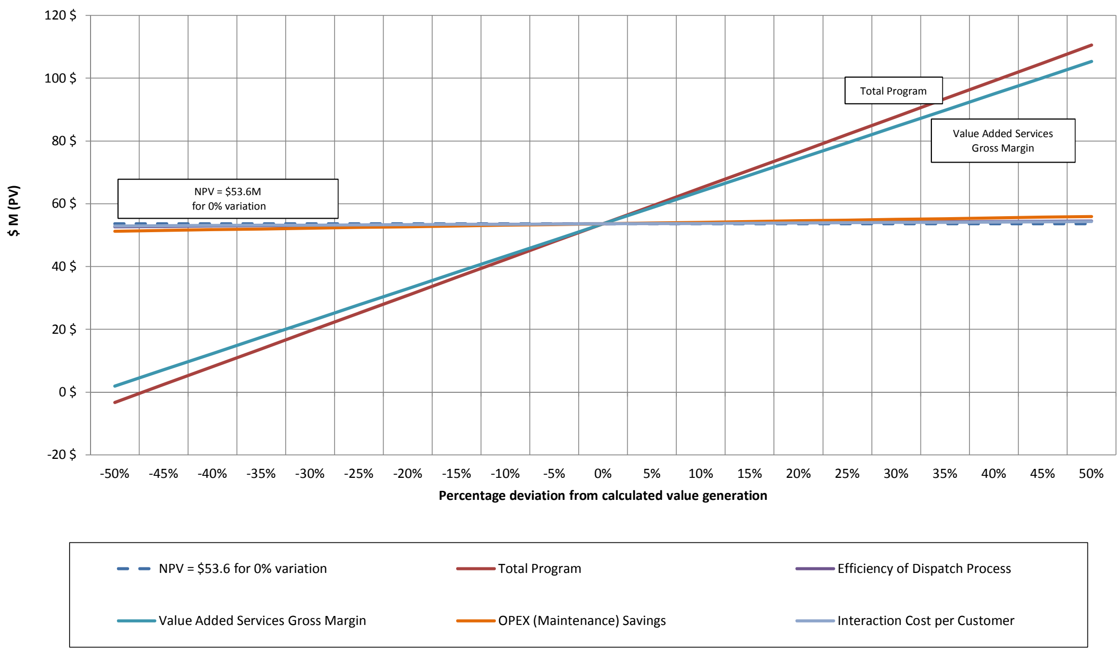


Figure 5.2.: Sensitivity of Program Value to changes in Monetized KPIs

The red line indicates the sensitivity of the total program present value to changes in the sum of the monetized KPIs. Since Value Added Services forms over 90% of the program value contribution it is clear that the program is highly sensitive to changes in the value of this KPI.

Significantly, if the value of Value Added Services Gross Margin has been overestimated by a factor of 2, i.e. if the actual amount of realized value from Value Added Services is 50% of what GSU has anticipated, the overall program PV remains only slightly negative. At the current values of estimates of the program costs, the program could be completely funded through just over half of the Value Added Services contribution originally assumed.

Part III.

Program Description

Chapter 6.

Grid Modernization Program

GSU's vision is to empower people and communities to connect, prosper and grow through innovation and proven leading edge infrastructure. It must do so in an environment of uncertainty around the future of Ontario's electricity distribution market, an abundance of generation capacity and in an era of intense focus on the environmental impacts of power generation.

In order to achieve this, GSU must ensure that it is able to operate effectively in the environment of change, able to reduce operating costs of current activities, and to leverage its capability development through support of new products and services created by its non-regulated affiliates.

The Grid Modernization Program consists of 165 projects in total, comprised of 103 initiatives and 62 technology projects. As discussed in Section 1.8 - Contribution Categories, the initiatives are categorized according to their value contribution to the overall program.

Table 6.1 gives the breakdown of the grid modernization program by Contribution Category and Technology. Budgets for each Value Pack, comprised of initiatives and technology projects, are given in the corresponding Section in Chapter 8.

Table 6.1.: Program by Project Type

	Initiatives				Tech.	Grand Total
	CC.1	**CC.2**	**CC.3**	**Subtotal**	**Projs**	
VPi	3	-	-	**3**	-	**3**
VP.1	5	4	2	**11**	3	**14**
VP.2	6	4	1	**11**	6	**17**
VP.3	4	5	3	**12**	5	**17**
VP.4	6	6	1	**13**	4	**17**
VP.5	8	2	1	**11**	3	**14**
VP.6	3	1	2	**6**	5	**11**
VP.7	3	4	1	**8**	5	**13**
VP.8	9	-	1	**10**	4	**14**
VP.9	4	1	1	**6**	7	**13**
VP.10	6	1	-	**7**	5	**12**
VP.11	2	1	-	**3**	10	**13**
VP.12	-	2	-	**2**	5	**7**
Grand Total	**59**	**31**	**13**	**103**	**62**	**165**

6.1. Technology Implementation

All together, 37,000 of GSU's customers with residential load control devices, representing approximately 70% of residential customers. In total 500 large C&I customers will also be equipped with C&I controllers, representing essentially all of of the total large C&I customers.

The number of storage and DG controllers was estimated based on a likely scenario and will be revised as the planning for the associated value pack takes place.

Approximately 75% of feeders will be equipped with state-of-the-art advanced automation to enable self-healing capabilities. Monitoring protective devices will be deployed at a rate of 1 for every 5 automated feeders. About 10% of distribution substations will be automated.

Communication for field devices will be deployed at a rate of roughly 1 for every 5 smart devices. In order to support this rollout, distributed operational network devices will be deployed at a rate of about 1 for every 100 field communication devices.

Table 6.2 gives an overview of the planned device rollout.

Table 6.2.: Grid Modernization Plan - Device Rollout

Technology	Capability Enablement	Rollout	Total	Coverage	
Home Controllers	1,000	36,000	37,000	≈ 70%	of residential customers
C&I Controllers	50	450	500	≈ 100%	of large C&I customers
Storage Controllers	1	9	10		
DG Controllers	1	9	10		
Feeder Automation	10	65	75	≈ 75%	of feeders
Monitoring Protective Devices	5	10	15	≈ 1	for every 5 automated feeders
Substation Automation	2	18	20	≈ 65%	of distribution stations
Field Device Communication*	500	7,000	7,500	100%	of corresponding devices
Distributed Operational Network**	5	70	75	100%	of corresponding devices

- *For complete infrastructure enablement, average unit device numbers & per unit costs are calculated as a rough 1:5 proportion of total number of smart devices.
- **Similarly, average unit devices numbers are estimated as a 1:100 proportion of total number of Field Device Communication assets.

6.2. Program Timeline

Execution of the grid modernization program enables GSU to leverage and extend its existing capabilities into the previously defined aspirations for a ten year plan while maintaining alignment with currently planned budgets, supporting the achievement of the vision. Execution of this comprehensive scenario will realize step-by-step all 12 identified value packs that now contain a total of 103 initiatives and require the implementation or extension of 62 technology functions.

The primary benefit derived from the creation of Value Packs is that associated initiatives share related content and similar technological requirements establishing investment synergy. The achieved synergy designed into the planning is a significant contributor to realizing overall program results. Figure 1.2 shows how the 12 value packs will create or leverage existing and partially existing technology while also systematically expanding these capabilities through the deployment of the aspired smart grid program. Figure 6.1 shows the sequence of the Value Pack executions and accompanying technology rollouts.

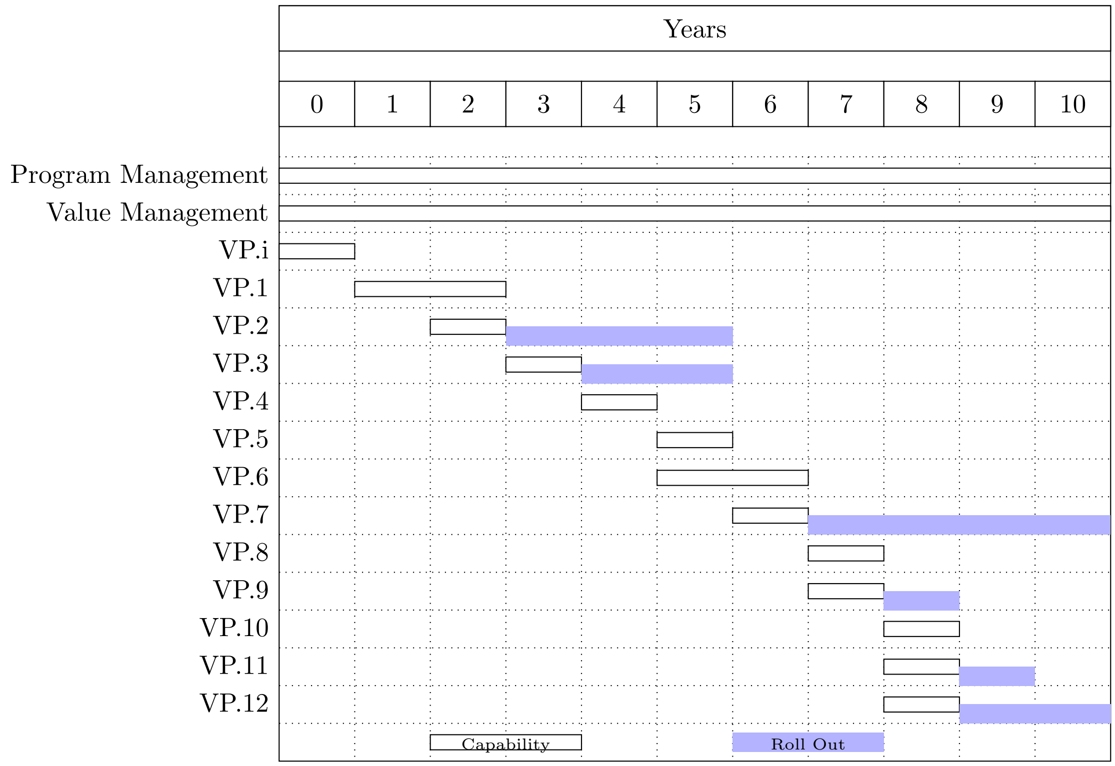


Figure 6.1.: Value Pack Timeline

Subsequent sections of this document summarize the initiatives that constitute each value pack in Chapter 8, along with a description of the impact mechanism and the necessary/required technologies as identified in the Functional Reference Architecture. In this way each Value Pack chapter is designed to become a reference handbook with all core concepts in one place to guide both the executive and deployment team through the program implementation across a ten year planning horizon.

Program deployment will be focused on management of the respective impact mechanisms defined such that a particular action or measure impacts some simple commonly understood parameters of GSU's business.

Chapter 7.

Foundation Value Pack (VPi)

GSU's grid modernization program is comprised of 12 Value Packs that are executed over 10 years. These Value Packs are built from 103 initiatives belonging to 40 business capabilities. These initiatives cover all six business domains and require the deployment of 62 technology features. Taken together, GSU plans to execute 165 projects in order to realize its Smart Grid vision. Given the scale and complexity of the business transformation program, Siemens proposes a foundational Value Pack to initiate the program and create the basic structure on which the subsequent grid modernization program will be built.

A ten year grid modernization program can only be effectively managed by providing representation, engagement and support to all internal stakeholders. Decisions based on ad hoc policies, provisional guidelines and without cross-enterprise acceptability are likely to encounter unforeseen hurdles and institutional resistance. This is especially pertinent given the often competing demands between organizational silos such as customer service, grid operations, maintenance services, IT, logistics and supply etc.

In Siemens's experience with grid modernization programs, the right governance structure is the key to a successful long-term business transformation program. A robust governance structure helps utilities manage significant program complexity by institutionalizing tools, standards, strategic policies, operational procedures and functional guidelines.

Governance and oversight should be delivered by an Executive Oversight Committee (EOC) comprised of senior management including the CEO, described in Section 7.2. This committee will provide advice and guidance to the Program Management Office (PMO), described in Section 7.3, and ensure that the grid modernization program is sufficiently planned, resourced and funded. Creation of this oversight body should be established as a first step in VPi.

Successful execution of VPi depends on strong integration with GSU's resource pool: corporate and HR policies, project management frameworks, IT standards as well as company procurement procedures. Integration with and support from service providers will create necessary traction for the grid modernization program and enable it to start without unnecessary delays.

7.1. Scope of VPi

The general idea of VPi is a soft launch of the program by:

- Staffing the core roles including the PMO
- Setting up the governance structure
- Setting up the infrastructure of the office
- Preparing GSU's organization to effectively deal with process changes
- Executing one or more initiatives and technology deployments from the program to fine-tune the method understanding

Including the points above, VPi will cover activities in the following five areas:

1. **Governance** - Establishing program oversight, internal implementation & communication plans, resourcing & funding, reporting, limits of authority, as well as identifying and providing guidance on project risks
2. **Program Management** (from VP.1) - Ensuring the organization has the required capability to plan, resource, execute and manage the program and its component projects, including establishing appropriate Project Management standards and practices
3. **Process Management**(from VP.1) - Building upon the process management work that has been done in the recent past at GSU, ensuring that applicable techniques, methods and the supporting information systems are in place, and to establish process design for continuous improvement
4. **Change Management** (from VP.1) - Creating an enabling framework around organizational change, ensuring the desired outcomes of the program are realized through enabling individuals to adopt new values, skills and behaviours
5. **Navigate Program Planning** - Identifying and addressing key program delivery risks, refining high level planning for the Navigate phase, creating a detailed plan for VP.1, and evaluating the technology architecture baseline that will guide the rest of the program

These activities are structured as initiatives to ensure the overall consistency of the program structure.

Three initiatives, included in VP.1 in the Destination Study, to be brought forward and executed as part of VPi are as follows:

- **Manage company programs ($0 \rightarrow 1$): Introduce structured project management execution**

  This initiative will extend the existing program controlling process to utilize a higher level of abstraction in order to manage project tasks instead of project activities. Additionally, a program coordination process will be established to ensure coordination between projects within a program. In order to enable these activities, a structured project management methodology is introduced (based on project management standards).

- **Manage company processes ($1.5 \rightarrow 2$): Introduce process standardization and individual ownership**

  This initiative will further formalize process definitions, including first approaches for performance measurement, and establish the capability to assign process ownership to chosen individuals. These process owners are accountable for the process performance and ensuring that the process is executed in a standardized way. In order to be able to achieve this capability, owners need to be empowered to adjust process as part of continuous improvement efforts.

- **Manage change ($0.5 \rightarrow 1$): Introduce a basic change management process**

  This initiative will introduce a basic change management process that can be adjusted based on the size and type of project. Formalizing the basic elements of the change management process include elements such as roles, responsibilities and keeping the right people informed.

7.1.1. Budget

The budget for VPi is comprised of estimates for the three initiatives brought forward from VP.1, along with costs for items 1 and 5 in the previous section. Presented in this section is the budget for the three initiatives; budget for the remaining work is to be determined during VPi discussions between Siemens and GSU.

- For Yearly Budgets see Figure 7.1
- For a Budget breakdown see Table 7.1

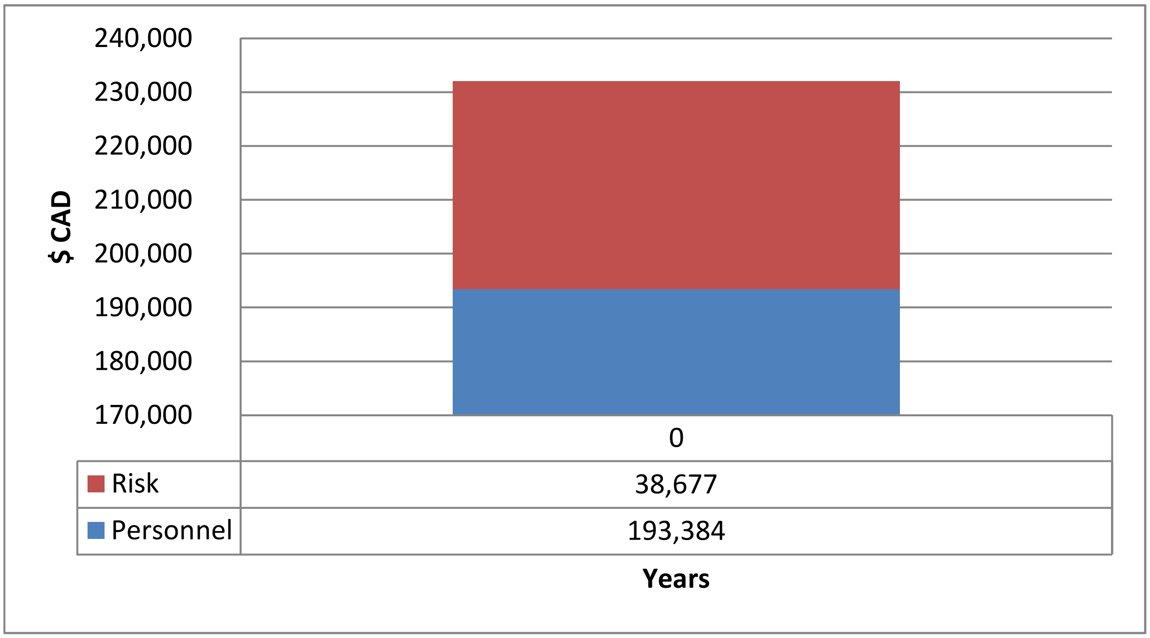


Figure 7.1.: VP_i Budget

Table 7.1.: VPi - Costs per Initiative

Items	Personnel	Risk	Grand Total
Contribution Category 1	**$ 193,383.51**	**$ 38,676.70**	**$ 232,060.21**
Manage change	**$ 67,671.63**	**$ 13,534.33**	**$ 81,205.95**
Introduce a basic change management process	$ 67,671.63	$ 13,534.33	$ 81,205.95
Manage company processes	**$ 74,390.91**	**$ 14,878.18**	**$ 89,269.09**
Introduce process standardization and individual ownership	$ 74,390.91	$ 14,878.18	$ 89,269.09
Manage company programs	**$ 51,320.97**	**$ 10,264.19**	**$ 61,585.16**
Introduce structured project management execution	$ 51,320.97	$ 10,264.19	$ 61,585.16
Grand Total	**$ 193,383.51**	**$ 38,676.70**	**$ 232,060.21**

7.1.2. Further Initiatives

After the preparatory work has been completed, GSU will be better prepared to start the execution of the program initiatives and technology deployments. It is recommended to keep the team together and productive by starting to execute initiatives from the program during VPi. This would allow the team to further learn and streamline the delivery process to ensure a smooth start for the Program Kick Off and to further ramp up the delivery capacity as necessary without significant setbacks in terms of productivity (training on the job).

7.1.3. Technologies

It is also recommended that a technology from the scope of the program is implemented in the context of VPi to allow the team to learn and fine-tune the delivery process for technologies.

7.2. Executive Oversight Committee

Aim

As the core decision-making body of the grid modernization program, the Executive Oversight Committee must ensure strong coordination between, as well as among, all internal and external stakeholders.

Participation
An adequate representation from key business units as well as from external partners is necessary for providing joint leadership to the program and mobilizing it around a shared vision. The Executive Oversight Committee should have the following membership structure:

- Customer Service
- Grid Operations
- Human Resources
- Engineering (Asset Management, Design & Planning)

Responsibility

Key tasks of the Executive Oversight Committee include:

- Ensuring successful program execution, maximization of program benefits and compliance to approved standards and methodologies.
- Providing advice and guidance to the PMO based on Program Manager's reporting.
- Approving the program approach, the business case and the program management methodology.
- Defining limits of authority for the program management office in terms of budget, time, resources, quality and scope of activities.
- Establishing risk profiles, defining acceptable thresholds for the program and carrying out risk assessments based on approved risk management strategies.
- Establishing programs covering the management of program changes and handling change requests originating from the program management office.
- Handling issues arising from program budget, time, resources, quality and scope that are escalated to the oversight committee.

- Coordinating with management personnel and ensuring compliance to management reporting guidelines.

Additional tasks of the Executive Oversight Committee include:

- Providing a forum to bring operational leadership of GSU together with external subject matter experts.
- Resolving coordination issues between different business units that are outside the authority or control of the PMO.
- Monitoring and facilitating the implementation of new technological deployments.
- Monitoring and facilitating the implementation of new processes and initiatives.
- Taking up complex subject matter questions that might arise from technology deployments or process change initiatives and ensuring consensus-based decision-making guided by subject matter expertise.

Reporting

The Program Manager reports to the Executive Oversight Committee.

7.3. Program Management Office (PMO)

While the PMO and relevant roles in the context of executing the work are described in complete detail in Section 11.1, the following administrative roles are specific to operating the PMO and are described below:

- Program Manager
- Financial Controller
- Value Controller
- Quality Management & Assurance Officer

Please note that one person can fulfill more than one role.

7.3.1. Program Manager

The Program Manager leads the PMO and coordinates all activities regarding process change initiatives and technology deployment projects to ensure efficient implementation, effective leveraging of resource synergies, and integration within GSU processes. At the early planning stages of the Program, particularly during VPi activities, the Program Manager will be actively involved with the HR Manager as well as key internal and external stakeholders to define and elaborate program outcomes, roadmap and overall timeline, synchronize resource requirements, available budgets, as well as identify potential risks, their classification regarding severity and proposed mitigation measures.

As GSU's grid modernization program transitions out of VPi and into VP.1, the Program Manager will perform an increasingly consultative and supportive role for project managers while communicating on project progress to the Executive Oversight Committee to resolve conflicting demands or technical hurdles.

7.3.2. Financial Controller

Preparing and delivering timely and accurate monthly or quarterly financial information for the EOC is one of the key tasks of the Financial Controller. He or she has to maintain an organized system of accounting policies, procedures and tools in order to exercise internal control over accounting transactions. The Financial Controller shall ensure legal and regulatory compliance as well as adherence to corporate policies regarding financial functions.

7.3.3. Value Controller

By developing and utilizing Value Management strategies in early planning stages of the Program, the Value Controller shall ensure that value management principles are institutionalized in GSU's Smart Grid Compass Program. In that context, he or she is responsible for introducing and applying the principles of value management consistently across the portfolio of technology and initiative projects, fostering performance-based thinking and providing value-oriented visibility to the management.

Based on VPi requirements, the Value Controller shall designate appropriate value management methodologies and tools to VPi components and track value development through monitoring Key Performance Indicators defined as part of the Smart Grid Compass Program. Besides communicating to the Program Manager when KPI(s) are expected to fall short of expected value targets, the Value Controller also designs and proposes remedial measures.

7.3.4. Quality Management & Assurance Officer

The Quality Management & Assurance Officer is responsible for designing and establishing quality procedures, standards and specifications for GSU's grid modernization program with the goal to increase employee productivity, process and product quality, operational efficiency, and overall customer satisfaction. Besides defining quality standards for processes specific to the VPi portfolio, the QM&A Officer also defines and implements quality standards for routine procurement, health, safety and HR processes. As VPi transitions into the full Smart Grid Compass® – Navigate Program, significant changes in GSU's relationship with customers are anticipated.

To ensure organizational readiness, he or she shall also be responsible for defining quality management standards, procedures and tools for systematically reviewing customer requirements, gauging customer expectations and measuring customer satisfaction. Moreover, the QM&A Officer is also responsible for developing guidelines and procedures for identifying risks to process and product quality, proposing risk mitigation measures and regularly communicating quality issues to the PMO. By developing quality standards for processes and product offerings at the VPi stage, the QM&A Officer shall ensure that these standards and tools are institutionalized in the broader grid modernization program. He or she shall also have demonstrable experience and knowledge in business process analysis, Quality Management standards, procedures and tools.

Chapter 8.

Value Packs (VPs)

In many cases, utility investments for technology are focused only on one problem or specific objective at a time. In the digital grid space with its high complexity and massive inter-dependencies this does not work well. Business cases focused on one problem or objective often become negative and therefore do not justify the required investments. Looking for and leveraging synergies of technology investments has become a key success factor for grid modernization programs.

To accommodate this Siemens has developed the Value Pack approach. Value Packs by design contain a set of initiatives that are related from the content perspective and share similar technological requirements to leverage investment synergy. Overall 12 value packs have been defined for GSU.

Table 8.1.: Value Packs

Chapter	Value Pack Title
7	Foundation Value Pack (VPi)
8.1	VP.1: Enhanced Asset & Work Information
8.2	VP.2: Basic Performance Monitoring
8.3	VP.3: Grid Value Maximization Leveraging Grid Information
8.4	VP.4: Leveraging Grid Information for Enhanced Performance Monitoring
8.5	VP.5: Introducing Business Value and Risk as Parameters for Asset Management
8.6	VP.6: Extending Network Planning through Lean Design Techniques
8.7	VP.7: Utilize Reliability and Communication Improvements to Improve Customer Satisfaction
8.8	VP.8: Basic Demand-Side Management
8.9	VP.9: Balance Load & Generation Based on Network Condition
8.10	VP.10: Advanced Demand Side Management
8.11	VP.11: Advanced Grid Management Based on Substation Automation
8.12	VP.12: Introduction of Self-Healing Network Characteristics

Value Packs are consecutive. It is not possible to skip or remove certain packages without changing the others, because later packages build on the infrastructure provided by the prior packages. Only packages at the end of the sequence can be left out at will. The value packs proposed are to be considered as building blocks.

To emphasize the nature of the building blocks, this section will proceed by breaking each value pack into its unique components as follows:

- 8.X where X represents Value Packs 1 through 12 and its title.
  - Brief Value pack description
  - Summary of Initiatives contained
  - Summary of Technologies deployed, installed or extended
  - Summary of impacts on KPIs
  - Budget overview graphic
  - Detailed list of costs per initiative and technology, broken down by Contribution Category
  - Detailed descriptions of initiatives in the following format: 8.X.Y where Y represents Initiatives contained
    * Visual representation of the Impact Chain of Initiative
    * Initiative impacts quantified and listed next to baseline and target values, where applicable
    * Detailed description of the initiative, including the main drivers and desired outcomes

For some initiatives, the workshop participants identified potential qualitative impacts on a given parameter because a quantified impact was considered likely to be unreliable. Such directional impacts are indicated as ↑ or ↓.

Baseline and target values for some parameters are not available since they are currently not measured. However, they have been included in the program with the view that monitoring shall be initiated as soon as deemed possible/necessary. In such cases, the lack of a baseline or target value is indicated.

The intent of this section is to summarize the core elements of GSU's grid modernization program. To accomplish a high level summary review, the summary of a value pack (8.X level) provides significant insight. For detailed reviews of a value pack the initiative summaries (8.X.Y level) provide more detailed information.

During the Value Pack planning stage and the detailed planning stage of each initiative, the initiatives in this section should be reviewed, specific outcomes determined, and the measures refined for use when tracking the success of the initiative.

8.1. VP.1: Enhanced Asset & Work Information

The first value pack in GSU's grid modernization program advances existing grid information management capabilities by utilizing current and new data sources, and processes this data into Key Performance Indicators (KPIs). The overarching outcome of the first value pack is better decision-making, optimized investments and improved operational efficiencies.

This value pack deals with grid asset data and will be enabled by a 360° asset register, giving the organization the basis for further capture and management of asset data. This functionality will serve as a foundation for later value packs when GSU will work on monitoring network health, detecting undesirable event patterns and carrying out remedial actions.

The asset data will be used to create forecasting capabilities. Key Performance Indicators (KPIs) will be created, and these will be used to predict the behaviour of individual assets and asset classes, their interdependent relationships and the correlating factors that influence asset conditions.

Initiatives in this value pack build and develop the portfolio of components that go into an offering, and the utility at this point will consider ways in which energy can be packaged into a compelling value proposition beyond electricity retailing.

This value pack also implements basic security monitoring, paving the way for further security-related issues in future, an initiative that can be implemented without extensive effort or investment.

Energy efficiency programs are also in scope for this value pack, potentially extending the existing IESO-driven work at GSU.

Finally in this value pack, a grid access policy for electric vehicles, and a charging post register, will be implemented. This initiative will be critical in improving information on electric vehicle charging and use within GSU's territory, and will lay the foundation for further enhancements of driver services and opportunities to manage vehicle charging for the benefit of GSU's distribution system.

Initiatives:

- Introduce basic KPI system for asset class
- Introduce a basic cross silo KPI system for key assets
- Introduce basic extrapolation for forecasting selected KPIs

- Realize automated transfer of work order closure information
- Introduce joint coordination and planning of IT/OT implementation and management
- Introduce a grid access policy for electric vehicles combined with a charging post register
- Introduce manual approaches to security monitoring
- Introduce internal employee briefings
- Streamlining of the component portfolio and cost accounting on component level
- Introduce multiple sales channels and basic usage consideration
- Introduce energy efficiency programs with regional scope

Technology Deployments:

- Asset Management - EAM - 360 degree Asset Register
- Asset Management - Strategic Asset Management - Forecasting
- Asset Management - Work Management - Work Dispatch

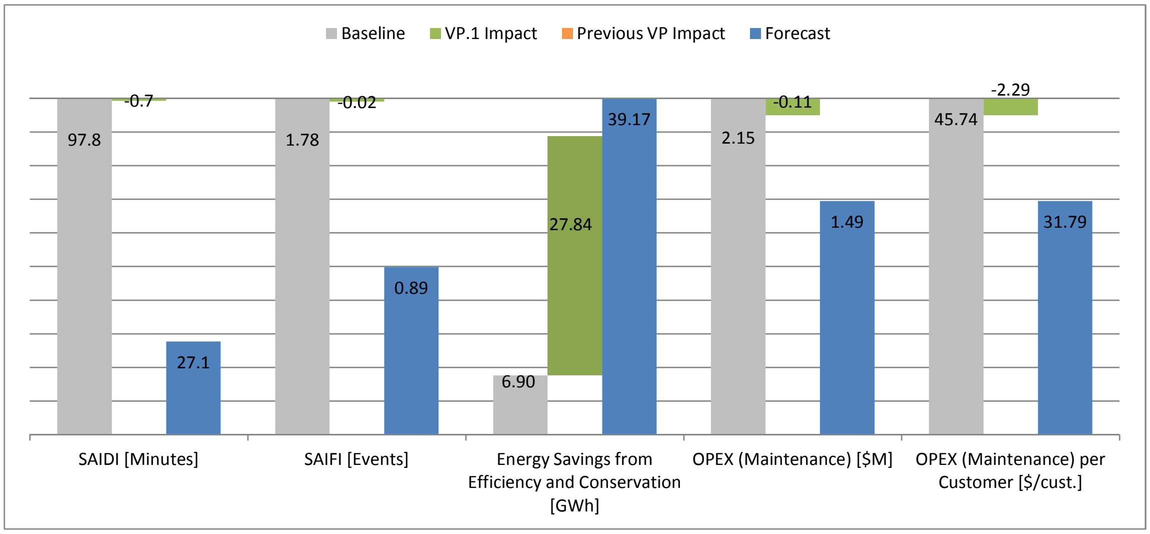


Figure 8.1.: VP.1 - Impact on KPIs (a)

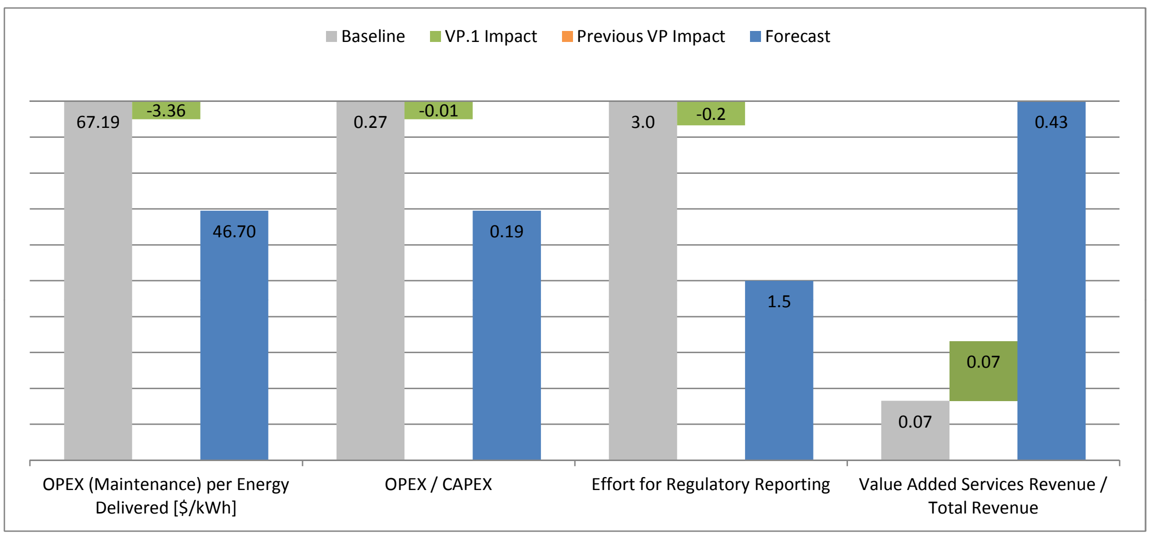


Figure 8.2.: VP.1 - Impact on KPIs (b)

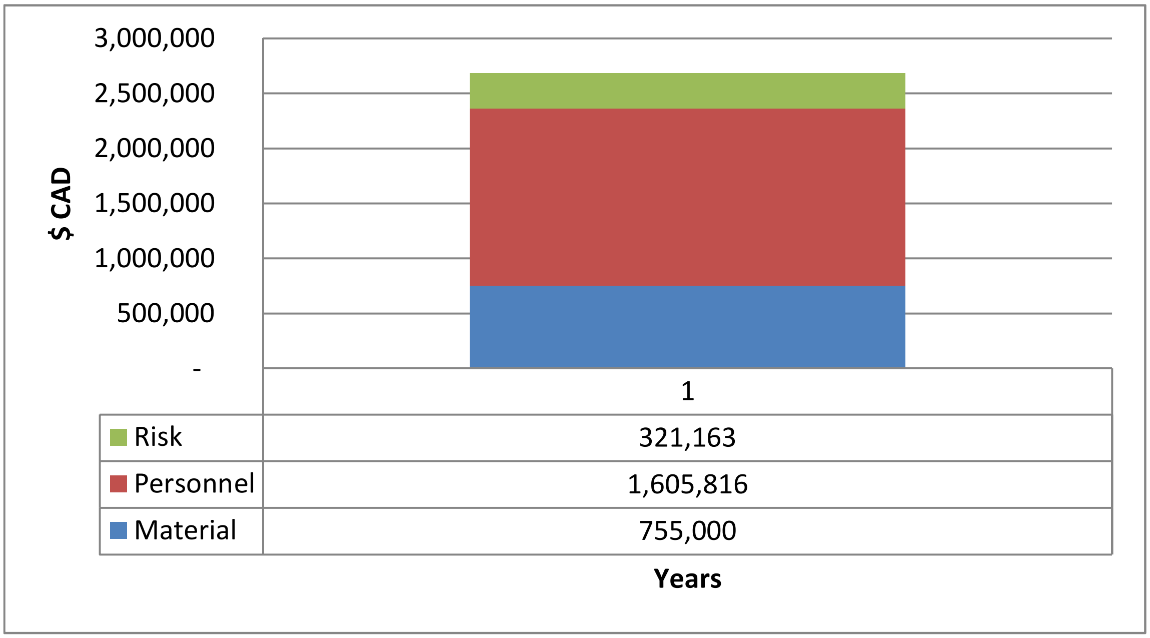


Figure 8.3.: VP.1 Budgets

Table 8.2.: VP. 1 Costs per Initiative & Technology

Items	Material	Personnel	Risk	Grand Total
Contribution Category 1	**$ 30,000**	**$ 376,058**	**$ 75,212**	**$ 481,270**
Manage cyber security and data privacy		**$ 54,835**	**$ 10,967**	**$ 65,801**
Introduce manual approaches to security monitoring		$ 54,835	$ 10,967	$ 65,801
Manage electric vehicle charging		**$ 118,452**	**$ 23,690**	**$ 142,142**
Introduce a grid access policy for electric vehicles combined with a charging post register		$ 118,452	$ 23,690	$ 142,142
Manage IT-OT		**$ 61,372**	**$ 12,274**	**$ 73,646**
Introduce joint coordination and planning of IT/OT implementations and management		$ 61,372	$ 12,274	$ 73,646
Manage stakeholders		**$ 48,054**	**$ 9,611**	**$ 57,665**
Introduce internal employee briefings		$ 48,054	$ 9,611	$ 57,665
Manage work execution	**$ 30,000**	**$ 93,345**	**$ 18,669**	**$ 142,015**
Realize automated transfer of work order closure information	$ 30,000	$ 93,345	$ 18,669	$ 142,015
Contribution Category 2	**$ 50,000**	**$ 567,236**	**$ 113,447**	**$ 730,683**
Manage energy efficiency programs	**$ 50,000**	**$ 134,233**	**$ 26,847**	**$ 211,080**
Introduce energy efficiency programs with regional scope	$ 50,000	$ 134,233	$ 26,847	$ 211,080
Manage grid information		**$ 249,214**	**$ 49,843**	**$ 299,056**
Introduce a basic cross silo KPI system for key assets		$ 125,277	$ 25,055	$ 150,332
Introduce basic KPI system for asset class		$ 123,937	$ 24,787	$ 148,724
Manage KPI forecasting		**$ 183,789**	**$ 36,758**	**$ 220,547**
Introduce basic extrapolation for forecasting selected KPIs		$ 183,789	$ 36,758	$ 220,547
Contribution Category 3		**$ 228,826**	**$ 45,765**	**$ 274,591**
Manage component portfolio		**$ 114,445**	**$ 22,889**	**$ 137,334**
Streamlining of the component portfolio and cost accounting on component level		$ 114,445	$ 22,889	$ 137,334
Manage product-service portfolio		**$ 114,381**	**$ 22,876**	**$ 137,257**
Introduce multiple sales channels and basic usage consideration		$ 114,381	$ 22,876	$ 137,257
Infrastructure	**$ 675,000**	**$ 433,696**	**$ 86,739**	**$ 1,195,436**
Enterprise Asset Management	**$ 325,000**	**$ 188,739**	**$ 37,748**	**$ 551,487**
360Â° Asset Register	$ 300,000	$ 125,612	$ 25,122	$ 450,735
Reporting	$ 25,000	$ 63,127	$ 12,625	$ 100,752
Strategic Asset Management	**$ 200,000**	**$ 125,446**	**$ 25,089**	**$ 350,535**
Forecasting	$ 200,000	$ 125,446	$ 25,089	$ 350,535
Workforce Management	**$ 150,000**	**$ 119,511**	**$ 23,902**	**$ 293,414**
Work Dispatch	$ 150,000	$ 119,511	$ 23,902	$ 293,414
Grand Total	**$ 755,000**	**$ 1,605,816**	**$ 321,163**	**$ 2,681,980**

8.1.1. Introduce basic KPI system for asset classes

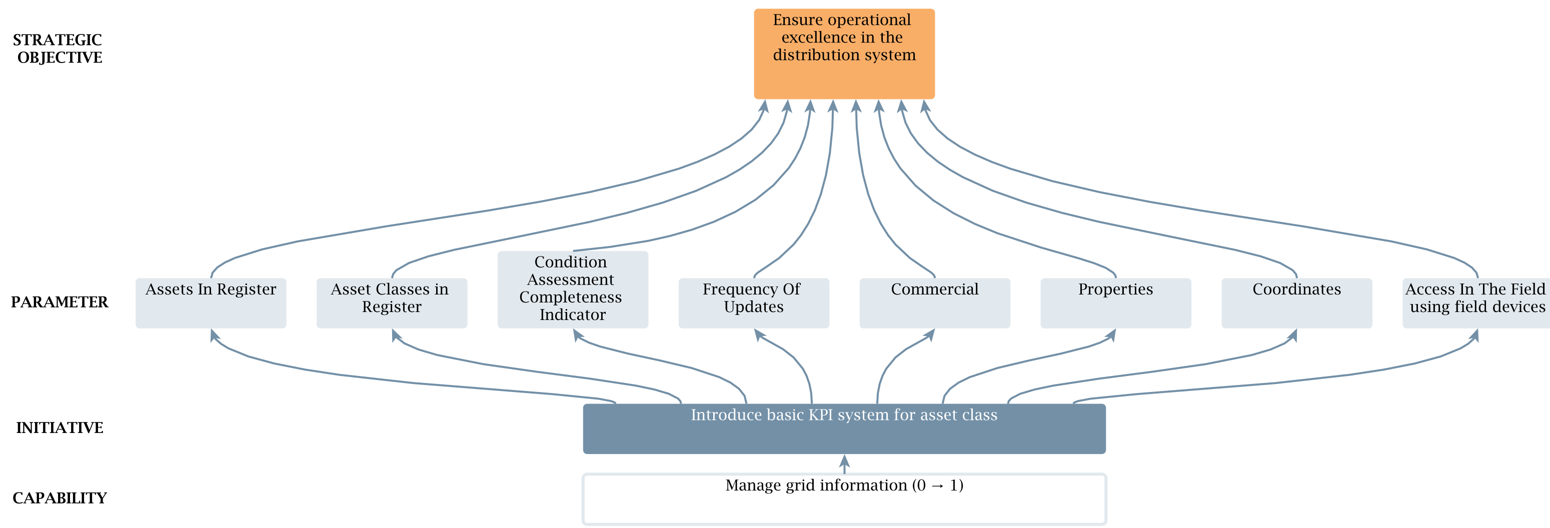


Figure 8.4.: VP.1 - Initiative No.1: Impact Chain (a)

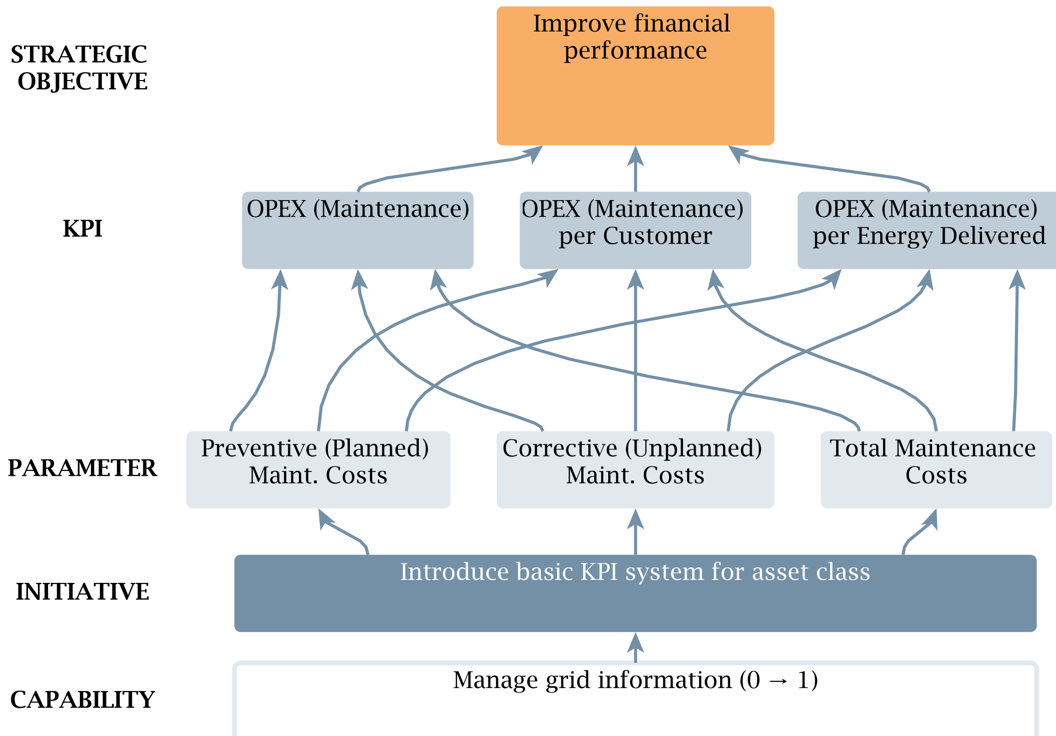


Figure 8.5.: VP.1 - Initiative No.1: Impact Chain (b)

This initiative introduces a basic KPI system by asset class for each individual management process. Although several parameters and KPIs are measured and tracked at GSU, the basis of a sound management system is a set of KPIs that describe a sufficient number of performance areas to be meaningful and to drive corrective and improvement action.

Introducing basic KPIs for asset classes is the first step in determining the performance of asset management processes, asset performance, and in tracking CAPEX budgets and the associated maintenance costs. This will in turn provide benefits in terms of reduced maintenance costs, and reduced outages due to breakdowns, in order to support GSU's strategic objectives to improve financial performance and to ensure operational excellence in the distribution system. The workshop team assessed a 4% reduction of corrective maintenance budget, half of which might be allocated to preventive activities as a result of the transparency provided by this initiative.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An

Table 8.3.: VP.1 - Initiative No.1: Impact

Parameter	Baseline	Impact	Forecast	Target	Unit
Preventive (Planned) Maint. Costs	0.30	0.04	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.04	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-43,000	1,494,250	1,650,000	$
Assets In Register	102,873	↑	↑	↑	Number
Asset Classes in Register	20.00	↑	↑	↑	Number
Condition Assessment Completeness Indicator	0.83	↑	↑	0.90	Ratio
Frequency Of Updates	200.00	↑	↑	↑	Number
Commercial	0.00	↑	↑	1.00	Ratio
Properties	0.00	0.50	1.00	1.00	Ratio
Coordinates	0.00	↑	↑	1.00	Ratio
Access In The Field using field devices	0.50	↑	0.55	0.50	Ratio

in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.1.2. Introduce a basic cross silo KPI system for key assets

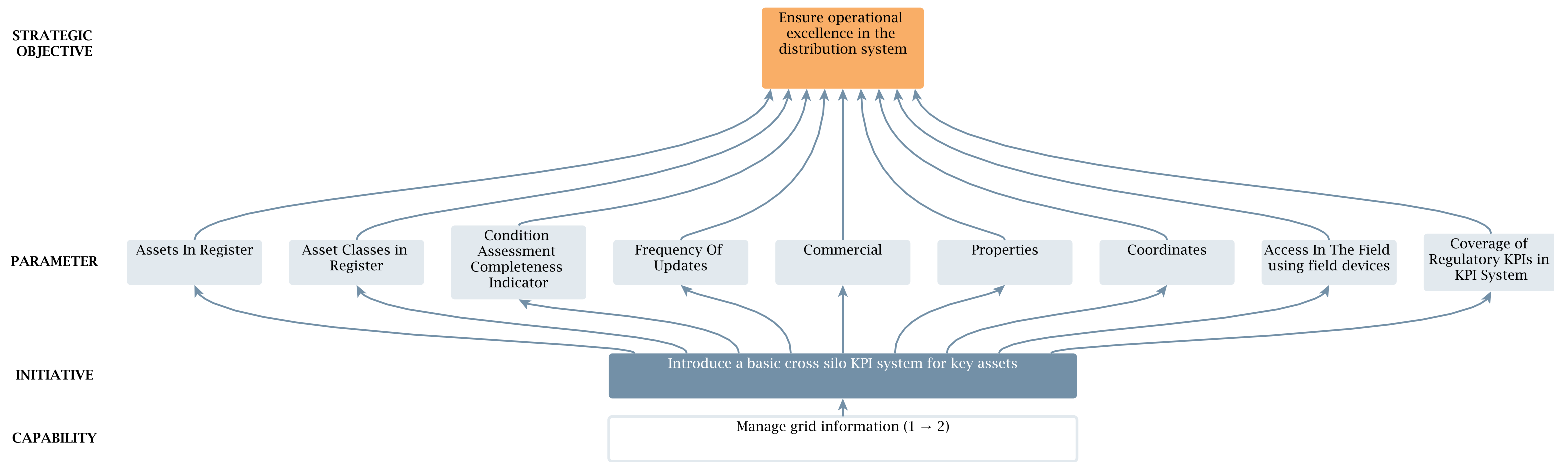


Figure 8.6.: VP.1 - Initiative No.2: Impact Chain (a)

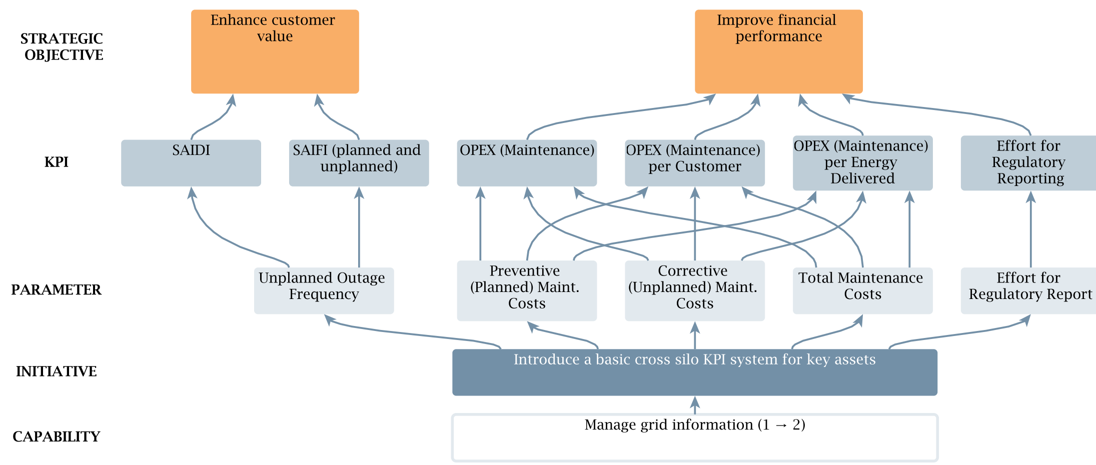


Figure 8.7.: VP.1 - Initiative No.2: Impact Chain (b)

Table 8.4.: VP.1 - Initiative No.2: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Unplanned Outage Frequency	233	-2.33	200	N/A	Number
Preventive (Planned) Maint. Costs	0.30	0.04	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.04	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-43,000	1,494,250	1,650,000	$
Assets In Register	102,873	↑	↑	↑	Number
Asset Classes in Register	20.00	↑	↑	↑	Number
Condition Assessment Completeness Indicator	0.83	↑	↑	0.90	Ratio
Frequency Of Updates	200	↑	↑	↑	Number
Commercial	0.00	↑	↑	1.00	Ratio
Properties	0.00	0.50	1.00	1.00	Ratio
Coordinates	0.00	↑	↑	1.00	Ratio
Access In The Field using field devices	0.50	↑	0.55	0.50	Ratio
Coverage of Regulatory KPIs in KPI System	0.00	0.10	0.80	1.00	Ratio
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

In this initiative, a basic cross-silo KPI system defined and maintained for key assets is introduced, with asset classes being the main aggregation hierarchy. This will enable greater coordination between departments and reduce efforts to compile unified asset data for cross-departmental work. The effect of this initiative will be to further enhance service reliability, reduce maintenance costs, as well as reducing efforts for reporting functions which rely on aggregating information from several departments.

Enhanced awareness of asset health due to this initiative will aid GSU in decision-making. For example, frequent overloading of a distribution transformer can drive replacement activities before the asset fails. Replacement of existing under-stress assets (e.g. overloaded transformer with lower rating) with assets that have the correct rating will lead to reduced unplanned outages. Similarly, due to the transparency provided by this initiative, GSU will be able to shift post-fault high corrective maintenance costs to preventive maintenance budget that avoids the need to carry out expensive corrective maintenance when faults occur. The workshop team assessed a 4% reduction of corrective maintenance budget, half of which might be allocated to preventive activities as a result of the transparency provided by this initiative.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

Reduced unplanned outages, due to improving maintenance practices based on increased information availability was also assessed as a 1% reduction in unplanned outage frequency. Effort for regulatory reporting was also expected to be reduced by 0.1 FTE per year.

8.1.3. Introduce basic extrapolation for forecasting select KPIs

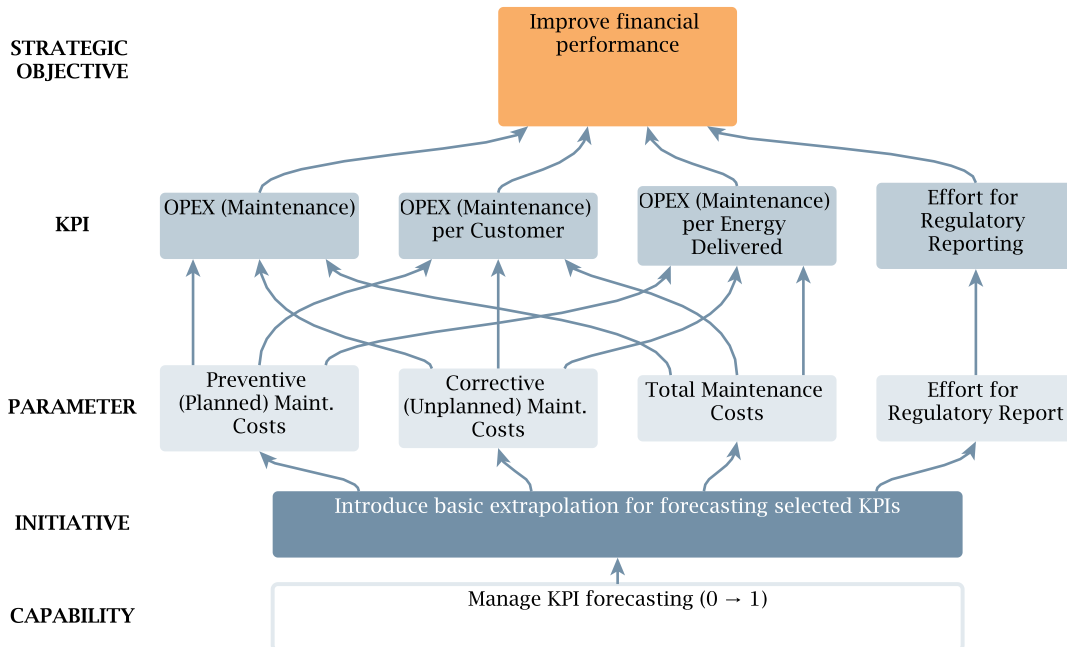


Figure 8.8.: VP.1 - Initiative No.3: Impact Chain

Table 8.5.: VP.1 - Initiative No.3: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Preventive (Planned) Maint. Costs	0.30	0.02	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.02	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-21,500	1,494,250	1,650,000	$
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

This initiative will introduce the capability to manage and utilize historic information to extrapolate selected KPIs in the forecasting process. This information is utilized in the budgeting process however at this stage is limited to where select historic information is available.

The impact of this initiative will be to facilitate the forecasting process, reducing effort, and will enable maintenance cost savings through more thorough planning. The workshop team assessed a 4% reduction of corrective maintenance budget, half of which might be allocated to preventive activities as a result of the transparency provided by this initiative. The team also assessed a reduction in effort for regulatory reporting of 0.1 FTE.

8.1.4. Realize automated transfer of work order closure information

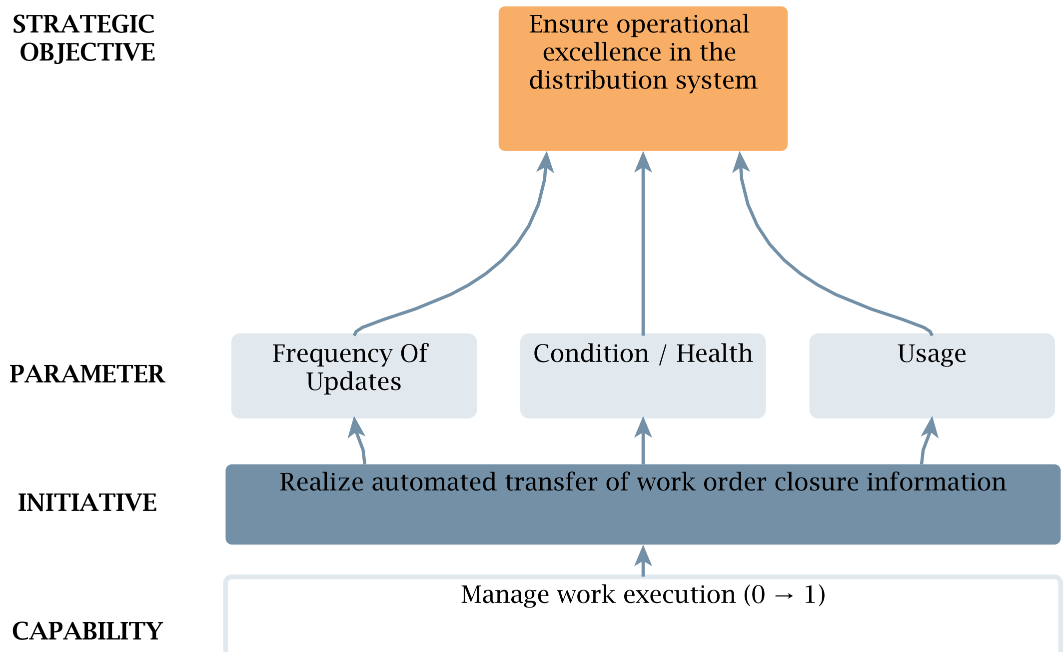


Figure 8.9.: VP.1 - Initiative No.4: Impact Chain

Table 8.6.: VP.1 - Initiative No.4: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Frequency Of Updates	200.00	↑	200.00	Updates in real time	number
Condition / Health	0.00	↑	1.00	1.00	Ratio
Usage	0.00	↑	1.00	1.00	Ratio

This initiative will establish a process to automate work order process using mobile digital devices. As a result of this process paper work order processes will be replaced by electronic forms which will link to field devices and the back-office IT systems. At this stage at a minimum it is expected that digital information will be automatically uploaded when crews return to their base at the end of the day/shift.

Currently at GSU, work order information resides within both ERP and GIS systems. It is an objective of this initiative to automate the updating process for these databases.

This initiative will enable enhanced capture of asset information and lay the foundation for further improvements in work execution. While numerical impacts were not assessed by the workshop team, this initiative was viewed to have positive impacts in the area of asset information, and will support GSU's strategic objective to ensure operational excellence in the distribution system.

8.1.5. Introduce joint coordination and planning of IT/OT implementations and management

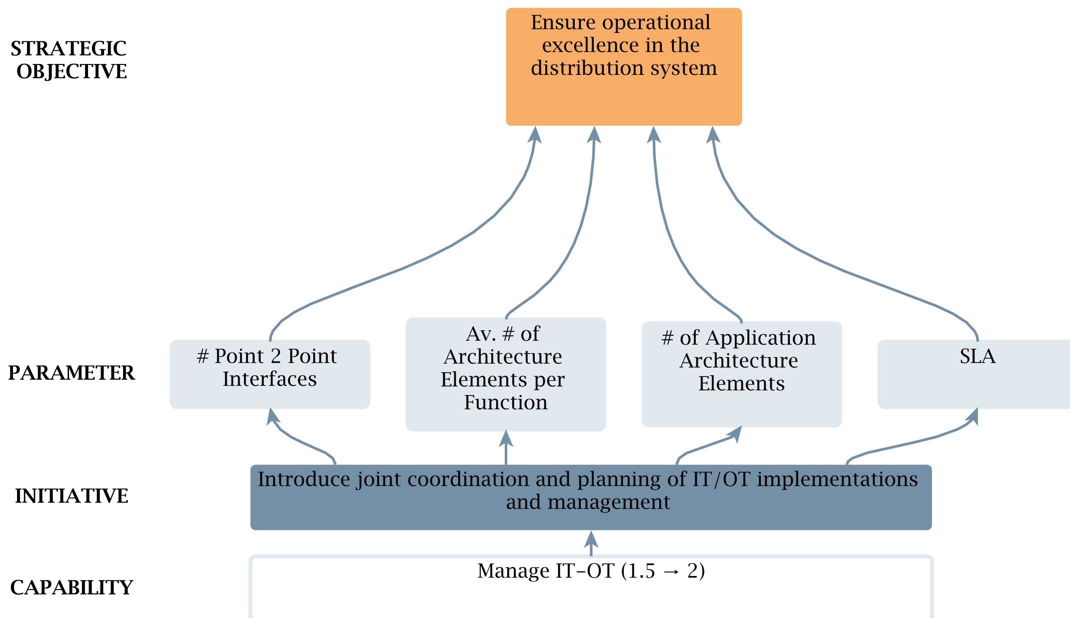


Figure 8.10.: VP.1 - Initiative No.5: Impact Chain

Table 8.7.: VP.1 - Initiative No.5: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
SLA	0.99	0.01	1.00	1.00	Ratio
# of Application Architecture Elements	128	↓	↓	↓	Number
Av. # of Architecture Elements per Function	1.75	↓	↓	1.00	Ratio
# Point 2 Point Interfaces	23	↓	↓	↓	Number

A joint higher-ranking process for management of IT and OT is introduced by this initiative. This ensures a high level coordination and planning between the two domains. In the background of this improvement process, the first integration scenarios should be realized to optimize enterprise architecture management and decrease the number of architecture elements through standardized functional components.

Although the impact on the Number of Application Architecture Elements could not be assessed directly, a decrease in the parameter is expected. This decline also affects the number of Point to Point Interfaces. The harmonization of the IT/OT landscape helps to reduce complexity and decreases licensing and administration costs, thereby supporting GSU's strategic goal to ensure operational excellence in the distribution system.

8.1.6. Introduce a grid access policy for electric vehicles combined with a charging post register

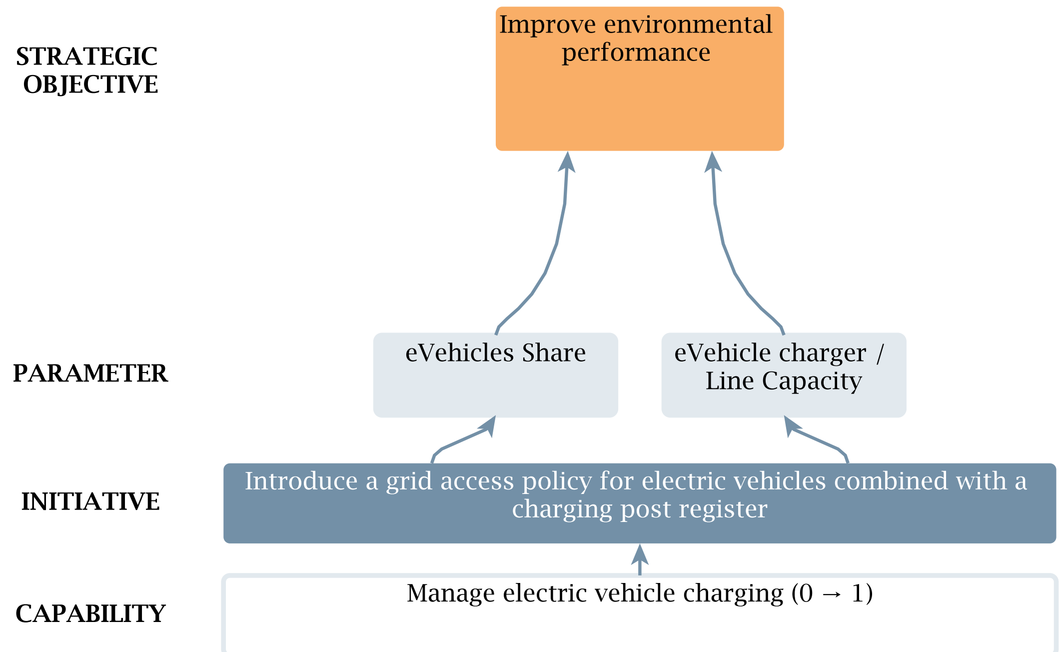


Figure 8.11.: VP.1 - Initiative No.6: Impact Chain

Table 8.8.: VP.1 - Initiative No.6: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
eVehicles Share	0.00	↑	↑	0.15	Ratio
eVehicle charger / Line Capacity	0.18	↑	↑	0.35	Ratio

This initiative is a first step in introducing electric vehicles on a wide scale in GSU's distribution system. A uniform grid access policy is needed to allow non-discriminatory grid access to all electric vehicles. This means the grid interconnection procedure should not be influenced by the type of electric vehicle, its service provider, its geographic location or its manufacturer. In that context, GSU's grid access policy for electric vehicles should define the time to connect an eVehicle, service provider-related connection charges, applicable tariffs and rules for prioritizing access to the charging post. Taken together, the capabilities enabled by this initiative will help GSU earn revenue from new value-added service offerings and improve society's quality of life by encouraging renewable generation and electric vehicles.

The second part of this initiative is the registering of charging posts prior to commissioning. Once the units are registered, GSU will start collecting information about their activities to build an information basis to support network operations in the future and will be able to remotely connect/disconnect selected charging posts if necessary from operational perspective.

8.1.7. Introduce manual approaches to security monitoring

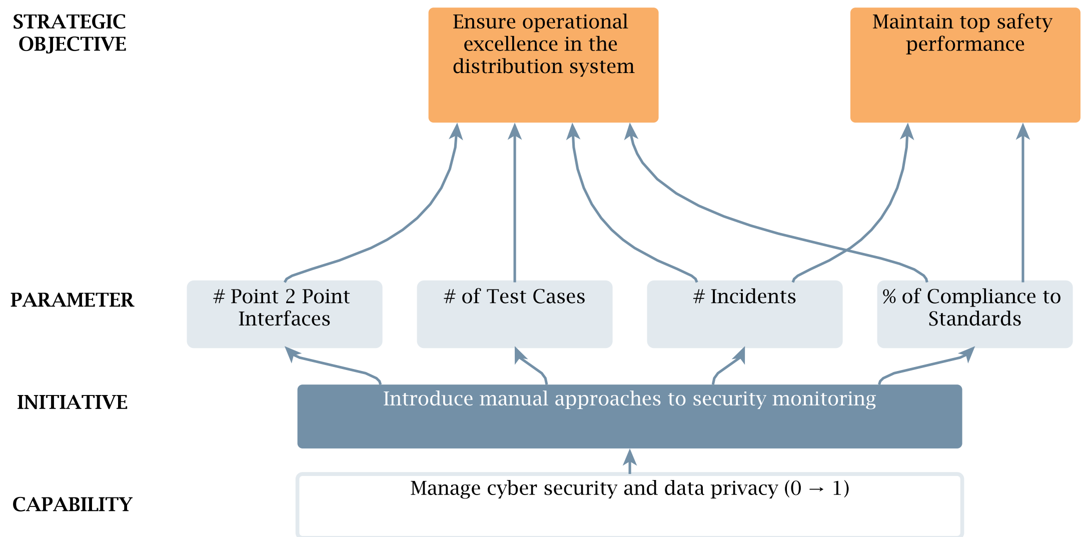


Figure 8.12.: VP.1 - Initiative No.7: Impact Chain

Table 8.9.: VP.1 - Initiative No.7: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
# Point 2 Point Interfaces	23	↓	↓	↓	Number
# of Test Cases	0	↑	0	1	Number
# Incidents	2	↓	2	0	Number
% of Compliance to Standards	Not avail.	↑	↑	N/A	Ratio

This initiative will introduce of scheduled regular processes for security monitoring. While GSU does conduct some security audits and tests ad hoc, this initiative will document a formalized policy for physical and cyber security, as well as a process for implementing, monitoring and auditing security measures.

While numerical impacts for this initiative were not assessed, it will contribute to GSU's strategic objective of maintaining top safety performance.

8.1.8. Introduce internal employee briefings

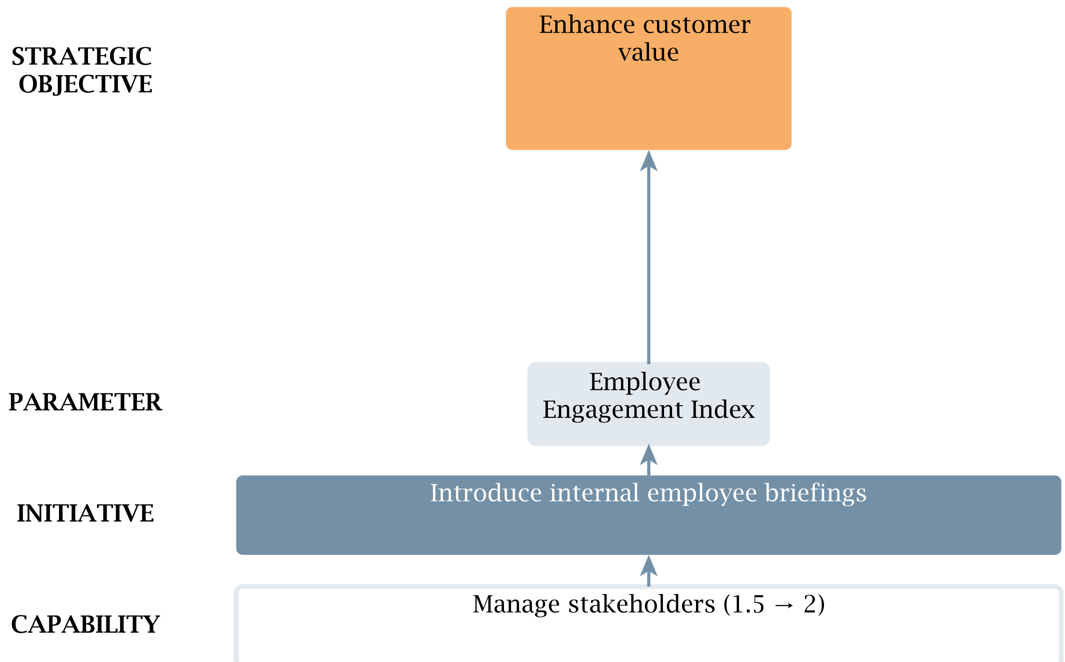


Figure 8.13.: VP.1 - Initiative No.8: Impact Chain

Table 8.10.: VP.1 - Initiative No.8: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Employee Engagement Index	n/a	↑	n/a	0	0

This initiative extends the stakeholder management process by appropriate process steps for internal propagation of the communication plans to all relevant groups. Pro-active and frequent stakeholder interaction to improve stakeholder management will also keep the employees in the loop.

Critical topics and decisions shall be communicated, explained and described to establish a relationship of trust and confidence with the employees.

As a result of this initiative, GSU expects to increase the Employee Engagement Index, which although not tracked as part of a KPI, has a direct impact on GSU's strategic goal to ensure operational excellence in the distribution system.

8.1.9. Streamlining of the component portfolio and cost accounting on component level

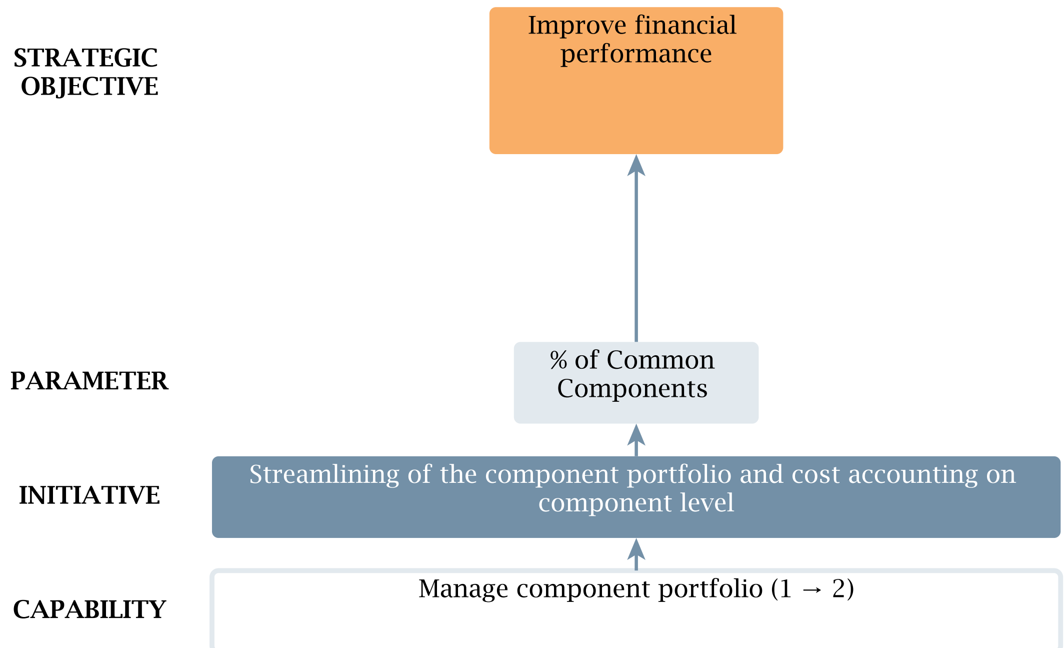


Figure 8.14.: VP.1 - Initiative No.9: Impact Chain

Table 8.11.: VP.1 - Initiative No.9: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
% of Common Components	0.00	↑	↑	0.60	Ratio

Within the Smart Product and Portfolio Management (SPPM) domain, the Component Portfolio consists of individual product/service elements present within the business's offerings, for example marketing, sales, service, financing can all be components of a specific product or service, and may ether be shared, or differentiated between products and services.

This initiative will introduce new steps into the existing process to support a regular structured review of the component portfolio. During this review the gathered information about overlaps will be analyzed in order to derive necessary adjustment measures to remove all overlaps. Additionally new steps will be introduced with the target to run a cost accounting on the component level.

While numerical impacts were not assessed for this initiative it will lay a foundation for managing discrete product/service components and ultimately contribute to GSU's goal of increasing value-added services margins.

8.1.10. Introduce multiple sales channels and basic usage consideration

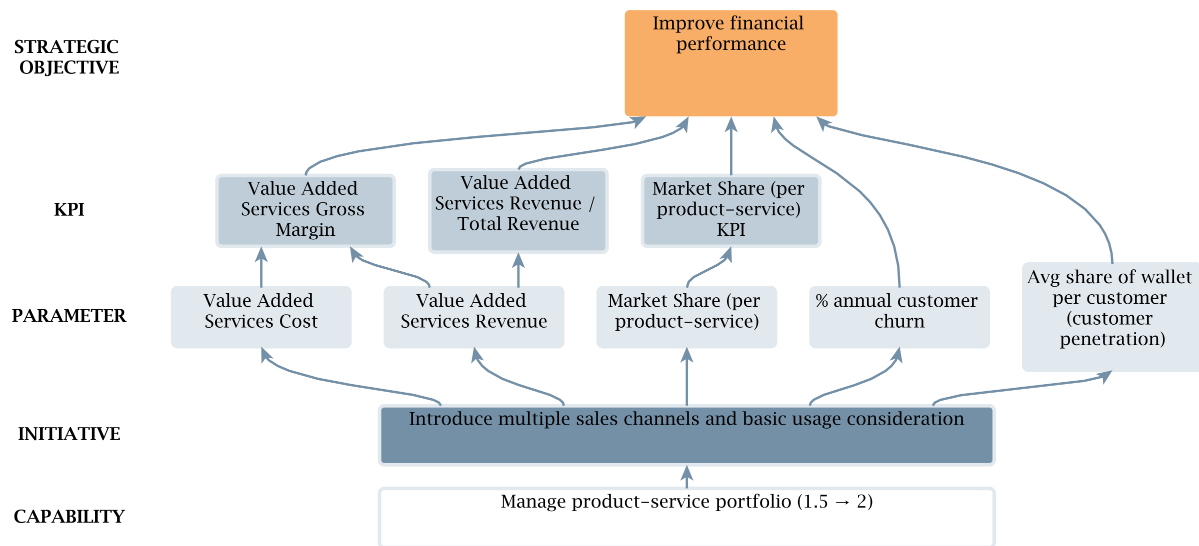


Figure 8.15.: VP.1 - Initiative No.10: Impact Chain (a)

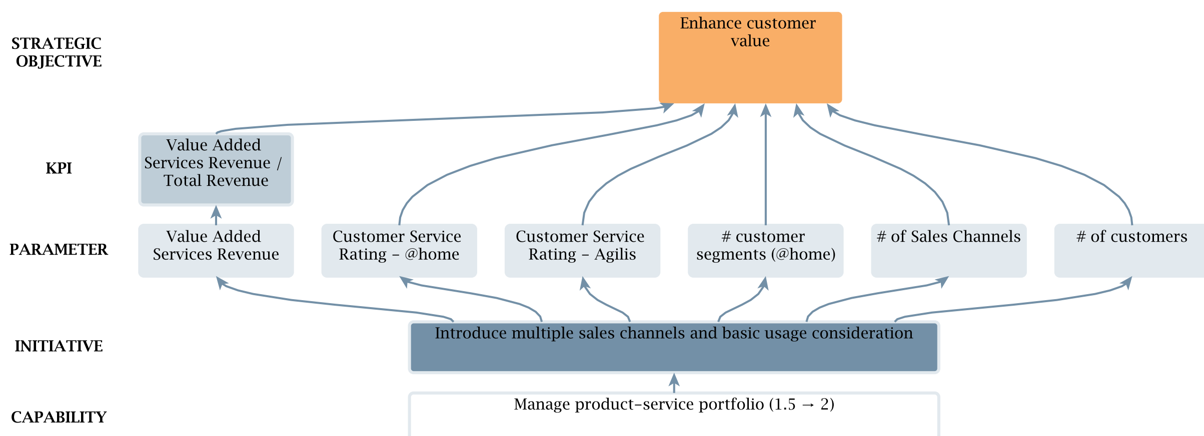


Figure 8.16.: VP.1 - Initiative No.10: Impact Chain (b)

The Product-Service Portfolio consists of the range of product-service types offered by GSU's non-regulated affiliates, e.g. internet and hot water heaters. Product-service strat-

Table 8.12.: VP.1 - Initiative No.10: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Value Added Services Cost	9,000,000	7,200,000	42,850,000	45,000,000	$
Value Added Services Revenue	10,000,000	10,000,000	60,310,400	60,000,000	$
Customer Service Rating - @home	0.94	↑	↑	0.99	Ratio
Customer Service Rating - Agilis	0.85	↑	↑	0.95	Ratio
# customer segments (@home)	2.00	↑	↑	↑	Number
Market Share (per product-service)	0.15	0.10	0.65	0.70	%
# of Sales Channels	2	5	12	10	Number
# of customers	10,400	↑	↑	60,000	Number
% annual customer churn	0.05	↓	↓	0.02	Ratio
Avg share of wallet per customer (customer penetration)	36.11	↑	↑	100.00	$

egy involves determining which markets represent attractive opportunities, and which are best left to others. Identifying these opportunities involves understanding where GSU has a competitive advantage, due to branding, existing customer base and channels, or synergies with other products/services.

This initiative will formalize the strategic business planning steps to first create a general understanding of customer usage patterns in order to adjust the product/service portfolio accordingly. A fundamental concept for this initiative is to motivate a shift away from providing simply energy, and energy using devices, and towards providing a benefit or service that the customers desires (E.g. hot water on demand, home comfort, security and peace of mind). In order to adequately support this and transfer the right messages the number of possible channels utilized for the customer communication will have to be extended.

This initiative will contribute to increasing market share for GSU's value-added services, by increasing the number of customers per product, and increasing the number of products offered, ultimately driving increased revenues and margins.

8.1.11. Introduce energy efficiency programs with regional scope

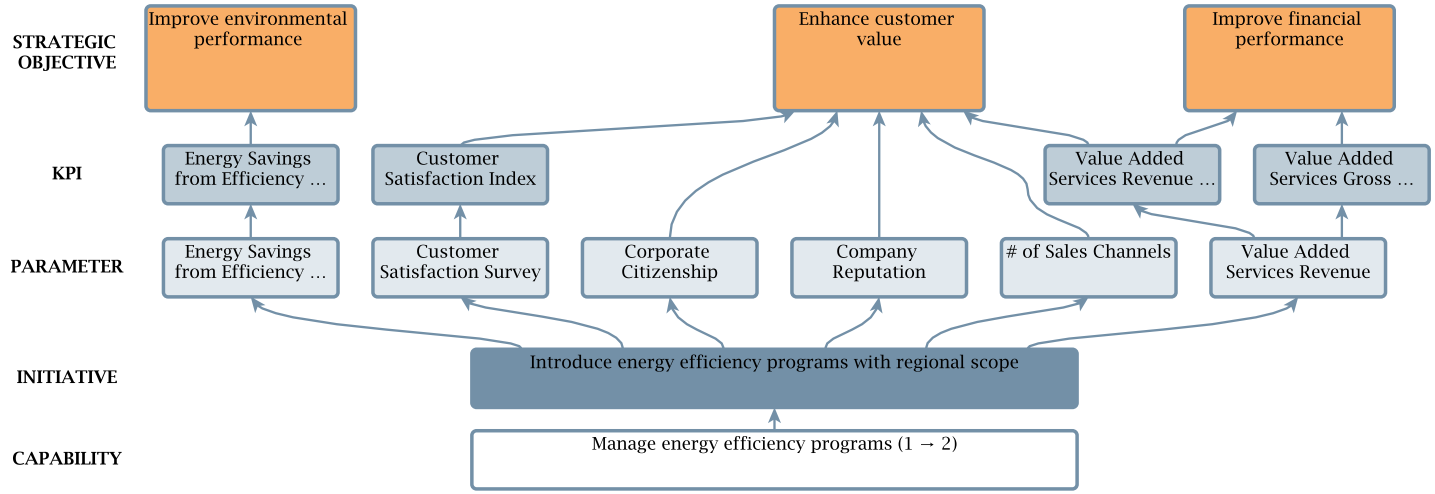


Figure 8.17.: VP.1 - Initiative No.11: Impact Chain

Table 8.13.: VP.1 - Initiative No.11: Impact Table

Parameter	**Baseline**	**Impact Table**	**Forecast**	**Target**	**Unit**
Energy Savings from Efficiency and Conservation	6,900	27,840	39,174	34,740	MWh
Customer Satisfaction Survey	0.95	↑	0.97	1.00	Ratio
Corporate Citizenship	0.54	↑	↑	1.00	Ratio
Company Reputation	0.75	↑	0.90	1.00	Ratio
# of Sales Channels	2	1	12	10	Number

GSU has existing capabilities in managing the Province of Ontario's mandated energy efficiency programs. While these programs are highly standardized across the Province's LDCs, there is some ability to customize programs and program delivery. This initiative will examine the potential for implementing energy efficiency programs with regional scope to target local grid benefits such as reducing congestion or reducing unpaid bills.

Insulation programs or programs promoting device efficiency are a big lever in helping reduce peak power and enabling the offering of new business models as well as Value Added Services (e.g. heating as a service).

As measurement and verification processes are already existing as part of the mandated energy efficiency programs, it was not seen as necessary to pursue an additional initiative to reach capability level 3. Measurement and Verification should be planned and executed at a level appropriate to the savings and based on recognized standards such as the IPMVP.

This initiative will drive both energy savings through efficiency and also provide an opportunity to expand value-added services revenue. By increasing the product/service mix and the levels of service there will be strategic benefits in strengthening the perception of GSU's brands and corporate citizenship.

8.2. VP.2: Basic Performance Monitoring

The asset & work information capabilities developed in the first value pack are utilized in this value pack to extend work management and KPI forecasting capabilities. As a result of introducing condition-based maintenance, GSU will be able to allocate limited maintenance resources to assets that are of strategic importance and have deteriorating condition. By processing raw data from operational awareness applications and converting it into Key Performance Indicators (KPIs), GSU will be able to build a solid foundation for establishing strategic asset management. Working in tandem, organizational initiatives will integrate cyber security approaches across standardized IT and OT domains. The overall impact of this value pack will be to reduce lifecycle cost of assets by furthering the capability of ensuring the right work gets done on the right assets at the right time.

The organizational capabilities are also extended from the first value pack, extending the focus on managing change, program execution and external stakeholder management. The ability of the organization to manage the changes resulting from the grid modernization program will be extended by continuing to standardize and structure the organization's program management capabilities.

System Component elements of GSU's product portfolio are managed at an increased granularity in this value pack, since multiple component elements will need to be managed for each product / service offering. In order to understand the value proposition of products and services created using these component elements, customer segmentation based on behaviour is developed in order to produce offerings that complement customer behaviour. In this value pack, the management of IT-OT will be extended by ensuring that both operational and information technology standards are aligned. The management of cyber security will also be extended, this time by focusing on the separate requirements of information technology vs. operational technology from a security point of view.

Finally, this value pack implements the capability of managing pre-payment schemes for customers, and begins to examine demand-side management (DSM) information to predict future responses, two initiatives that can be implemented without extensive effort or investment.

Initiatives:

- Introduce pre-payment schemes
- Manage asset information consistently across organizational boundaries
- Introduce sophisticated, single KPI forecasting models leveraging historic information
- Introduce strategic prioritization of individual assets

- Introduce DSM response prediction based on historic response information
- Introduce common set of standards covering information and operational technologies
- Introduce separate cyber security approaches for the information and operational technology domains
- Introduce the development and execution of pro-active communication plans
- Introduce a change management approach for selected projects
- Introduce a deliverable based program controlling and defined limits of authority
- Introduce a behaviour-based customer segmentation

Technology Deployments:

- Asset Management - Enterprise Asset Management - Condition Based Maintenance
- Smart Grid Backbone - Integration - Visualisation
- Smart Grid Backbone - Operational Data Store (ODS) - Time Series Archive
- Smart Grid Backbone - Operational Data Store (ODS) - Reporting (ODS)
- Communication Infrastructure - Communication Infrastructure - Field Device Communication

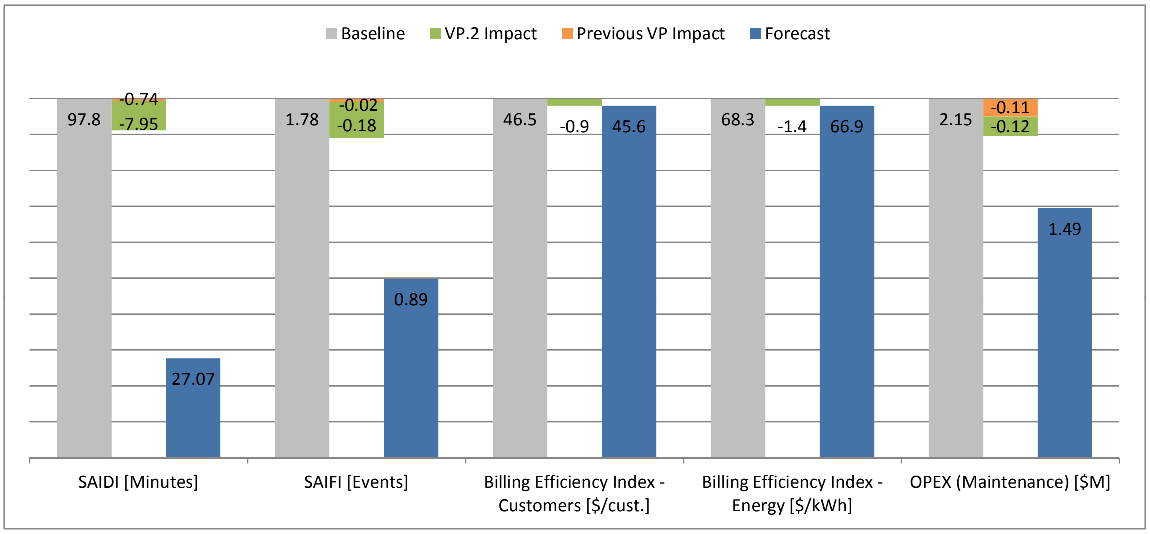


Figure 8.18.: VP.2 - Impact on KPIs (a)

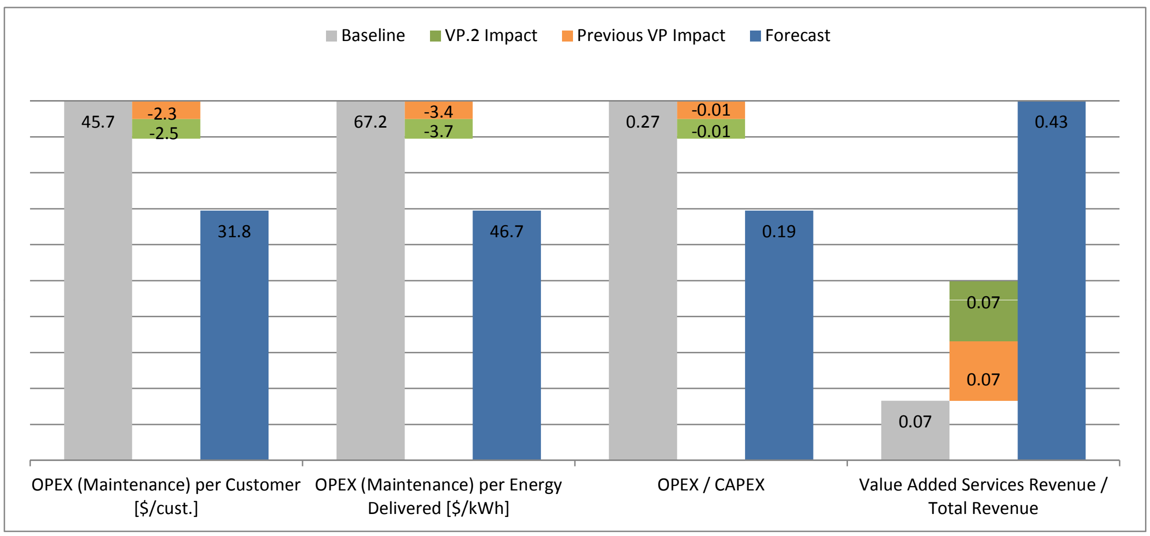
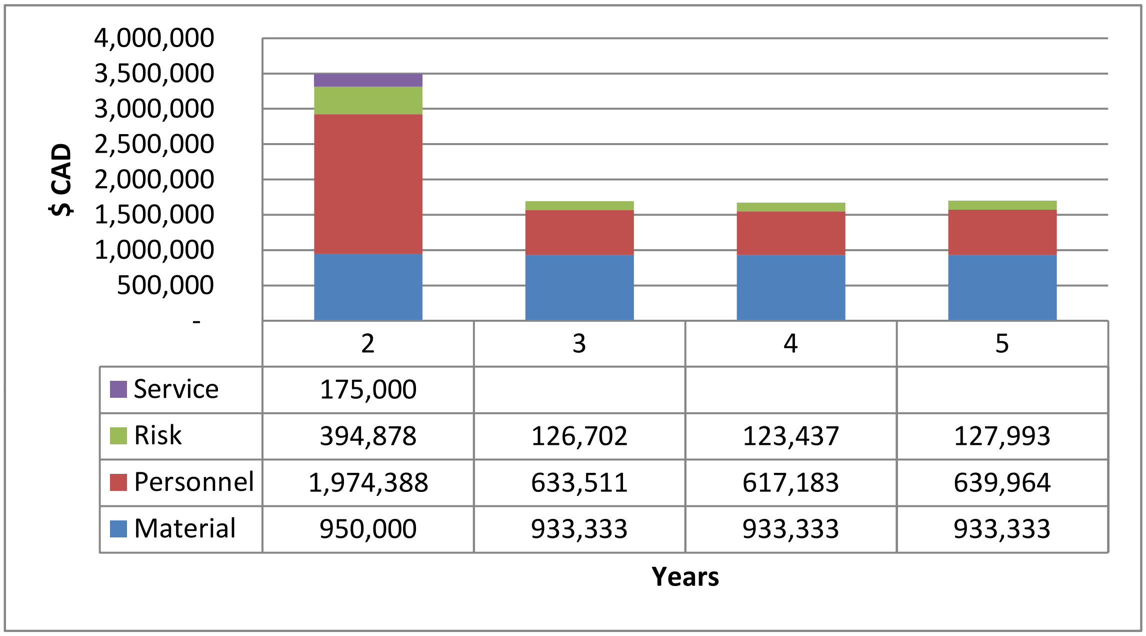


Figure 8.19.: VP.2 - Impact on KPIs (b)



	2	3	4	5
Service	175,000			
Risk	394,878	126,702	123,437	127,993
Personnel	1,974,388	633,511	617,183	639,964
Material	950,000	933,333	933,333	933,333

Figure 8.20.: VP.2 Budgets

Table 8.14.: VP.2 Costs per Initiative & Technology

Items	Material	Personnel	Service	Risk	Grand Total
Contribution Category 1		**$ 520,615.00**	**$ 100,000.00**	**104,123.00**	**724,738.00**
Manage change		**$ 48,221.72**		**9,644.34**	**57,866.06**
Introduce a change management approach for selected projects		$ 48,221.72		9,644.34	57,866.06
Manage cyber security and data privacy		**$ 127,697.17**	**$ 100,000.00**	**25,539.43**	**253,236.60**
Introduce separate cyber security approaches for the information and operational technology domains		$ 127,697.17	$ 100,000.00	25,539.43	253,236.60
Manage residential DSM		**$ 141,828.38**		**28,365.68**	**170,194.05**
Introduce DSM response prediction based on historic response information		$ 141,828.38		28,365.68	170,194.05
Manage stakeholders		**$ 75,354.25**		**15,070.85**	**90,425.10**
Introduce the development and execution of pro-active communication plans		$ 75,354.25		15,070.85	90,425.10
Manage IT-OT		**$ 91,840.52**		**18,368.10**	**110,208.62**
Introduce common set of standards covering information and operational technologies		$ 91,840.52		18,368.10	110,208.62
Manage company programs		**$ 35,672.97**		**7,134.59**	**42,807.56**
Introduce a deliverable based program controlling and defined limits of authority		$ 35,672.97		7,134.59	42,807.56
Contribution Category 2		**$ 481,423.85**	**$ 25,000.00**	**96,284.77**	**602,708.62**
Manage grid information		**$ 70,410.46**		**14,082.09**	**84,492.55**
Manage asset information consistently across organizational boundaries		$ 70,410.46		14,082.09	84,492.55
Manage KPI forecasting		**$ 183,789.32**		**36,757.86**	**220,547.18**
Introduce sophisticated, single KPI forecasting models leveraging historic information		$ 183,789.32		36,757.86	220,547.18
Manage maintenance		**$ 77,979.78**		**15,595.96**	**93,575.73**
Introduce strategic prioritization of individual assets		$ 77,979.78		15,595.96	93,575.73
Manage meter-to-bill		**$ 149,244.30**	**$ 25,000.00**	**29,848.86**	**204,093.16**
Introduce pre-payment schemes		$ 149,244.30	$ 25,000.00	29,848.86	204,093.16
Contribution Category 3		**$ 130,898.66**	**$ 50,000.00**	**26,179.73**	**207,078.39**
Manage product-service portfolio		**$ 130,898.66**	**$ 50,000.00**	**26,179.73**	**207,078.39**
Introduce a behaviour based customer segmentation		$ 130,898.66	$ 50,000.00	26,179.73	207,078.39
Infrastructure	**$ 3,750,000.00**	**$ 2,732,108.98**		**546,421.80**	**7,028,530.78**
Enterprise Asset Management	**$ 125,000.00**	**$ 121,496.83**		**24,299.37**	**270,796.20**
Condition Based Maintenance	$ 125,000.00	$ 121,496.83		24,299.37	270,796.20
Integration	**$ 250,000.00**	**$ 77,471.98**		**15,494.40**	**342,966.38**
Visualization	$ 250,000.00	$ 77,471.98		15,494.40	342,966.38
Communication Infrastructure	**$ 3,000,000.00**	**$ 2,315,039.56**		**463,007.91**	**5,778,047.48**
Field Device Communication	$ 3,000,000.00	$ 2,315,039.56		463,007.91	5,778,047.48
Operational Data Store (ODS)	**$ 375,000.00**	**$ 218,100.60**		**43,620.12**	**636,720.72**
Time Series Archive	$ 350,000.00	$ 146,180.95		29,236.19	525,417.13
Reporting (ODS)	$ 25,000.00	$ 71,919.66		14,383.93	111,303.59
Grand Total	**$ 3,750,000.00**	**$ 3,865,046.49**	**$ 175,000.00**	**773,009.30**	**8,563,055.78**

8.2.1. Introduce pre-payment schemes

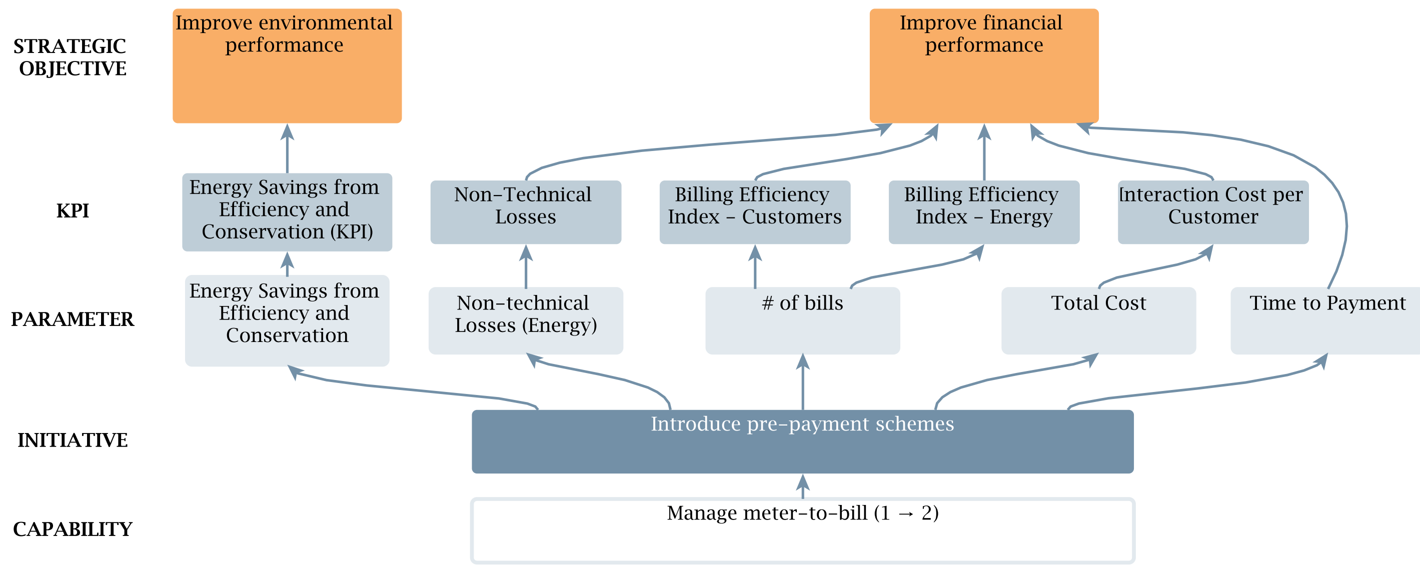


Figure 8.21.: VP.2 - Initiative No.1: Impact Chain

Table 8.15.: VP.2 - Initiative No.1: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
# of bills	552,000	-11040.00	540,960	552,000	Number
Time to Payment	21.00	-0.42	20.58	20.00	Days
Total Cost	450,000	-45,000	240,000	350,000	$
Non-technical Losses (Energy)	0.0240	-0.0024	0.0174	0.0240	Ratio
Energy Savings from Efficiency and Conservation	6,900	308	39,174	34,740	MWh

This initiative will introduce pre-payment schemes, allowing customers to purchase credits to their account enabling the use of energy at full load without the impact or action of 'Load Limiting' being applied.

Appropriate incentives for pre-payment will enable greater uptake and reduction in accounts receivable. GSU indicated interest in investigating a token-based prepayment scheme (e.g. chip card) for certain customer segments (e.g. student housing, short-term rentals and delinquent accounts). This would reduce unpaid bills as well as eliminate the need for billing these accounts (transaction would be limited to charging the token or card). In addition, it is likely that this initiative will drive energy savings.

The workshop team forecast a 2% adoption rate of pre-payment, reducing the overall number of bills and associated expense in proportion. In addition, a 2% decrease in time to payment was assessed. This initiative was also forecast to reduce interaction costs and non-technical losses by 10% each. On average, it is expected that a 4% energy savings across the total 2% of customer base adopting pre-payment could be expected.

8.2.2. Manage asset information consistently across organizational boundaries

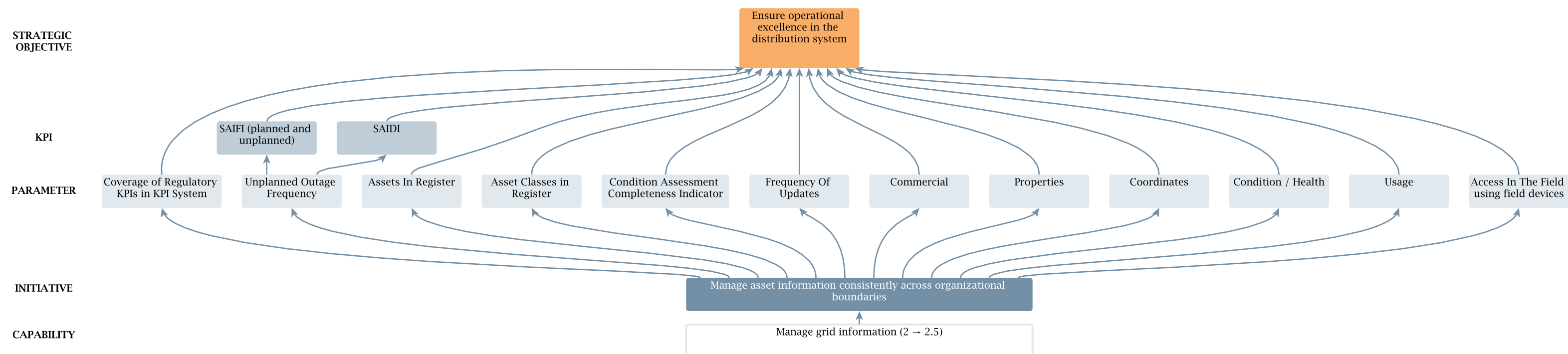


Figure 8.22.: VP.2 - Initiative No.2: Impact Chain (a)

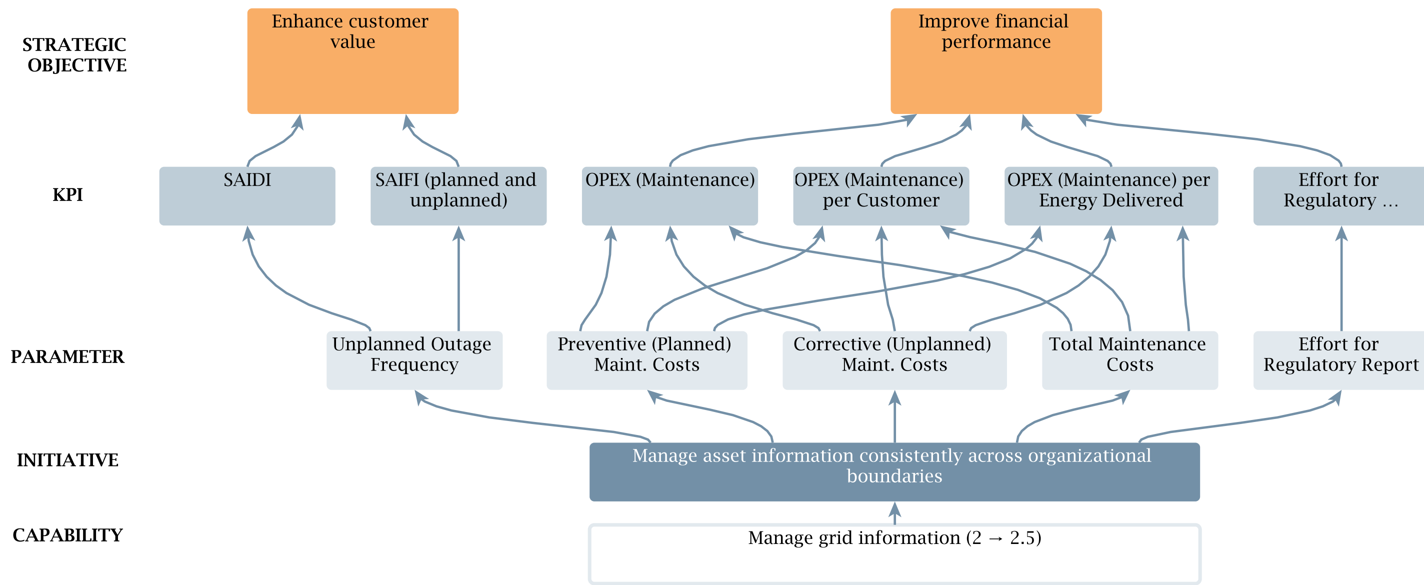


Figure 8.23.: VP.2 - Initiative No.2: Impact Chain (b)

Table 8.16.: VP.2 - Initiative No.2: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Unplanned Outage Frequency	233	-2	200	N/A	Number
Preventive (Planned) Maint. Costs	0.30	0.04	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.04	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-43,000	1,494,250	1,650,000	$
Assets In Register	102,873	↑	↑	↑	Number
Asset Classes in Register	20.00	↑	↑	↑	Number
Condition Assessment Completeness Indicator	0.83	↑	↑	0.90	Ratio
Frequency Of Updates	200	↑	200	↑	Number
Commercial	0.00	↑	↑	1.00	Ratio
Properties	0.00	↑	1.00	1.00	Ratio
Coordinates	0.00	↑	↑	1.00	Ratio
Condition / Health	0.00	0.50	1.00	1.00	Ratio
Usage	0.00	0.50	1.00	1.00	Ratio
Access In The Field using field devices	0.50	↑	0.55	0.50	Ratio
Coverage of Regulatory KPIs in KPI System	0.00	0.10	0.80	1.00	Ratio
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

This initiative introduces a standardized approach for the management (e.g. creation, naming, maintenance, etc.) of asset information for all relevant business areas. This capability enables the harmonized usage of information which helps improve reporting, providing a higher coverage of KPIs with less effort. The data will be more consistent and more assets will be registered on time.

The core of this initiative will be process improvement, in order to build on previous initiatives, and apply the KPI management process developed in the previous initiatives to all departments and functions within GSU.

This initiative will drive further improvements across the previously impacted areas of maintenance costs, reduced outages and more efficient reporting as increased use of cross-silo KPIs enhances business processes throughout GSU.

The workshop team assessed a 1% reduction in unplanned outages due to maintenance activities enabled through improved asset information. The workshop team also assessed a 4% reduction of corrective maintenance budget, half of which might be allocated to preventive activities as a result of the transparency provided by this initiative. Finally, a reduction in effort for regulatory reporting of 0.1 FTE was assessed due to more consistent tracking of asset information across the organization.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.2.3. Introduce sophisticated, single KPI forecasting models leveraging historic information

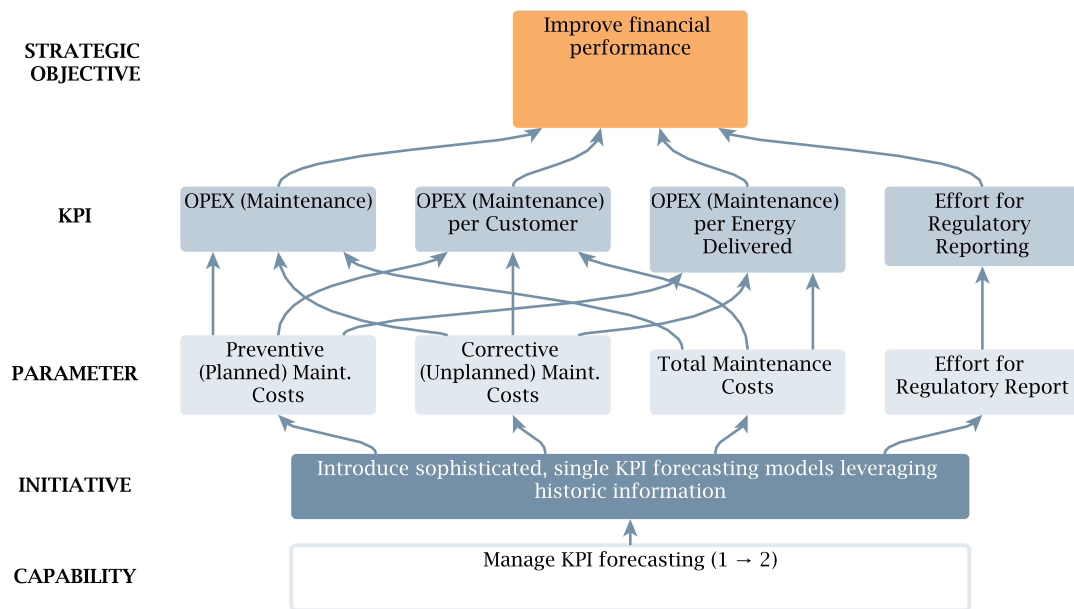


Figure 8.24.: VP.2 - Initiative No.3: Impact Chain

Table 8.17.: VP.2 - Initiative No.3: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Preventive (Planned) Maint. Costs	0.30	0.02	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.02	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-21,500	1,494,250	1,650,000	$
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

This initiative will increase the sophistication of models used within the KPI forecasting process. Forecasts for individual KPIs will leverage historical information but allow normalization and adjustment factors based on identified dependencies.

For example, by leveraging business domain knowledge and historic information, GSU will be able to recognize patterns such as different seasonal peaks in different areas and will therefore be able to forecast more accurate load peaks in the future. As a result of forecasting of individual KPIs, it will be possible for GSU to optimize OPEX (replace aging assets, reduce post-fault corrective maintenance budgets and increase preventive maintenance budget to prevent failures) as well CAPEX (new build costs).

The impact of this initiative will be to facilitate the forecasting process, reducing effort, and will enable maintenance cost savings through more thorough planning.

The workshop team assessed a 2% reduction of corrective maintenance budget, half of which might be allocated to preventive activities as a result of this initiative. In addition, a reduction in effort for regulatory reporting of 0.1 FTE was assessed due to enhanced forecasting information.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.2.4. Introduce strategic prioritization of individual assets

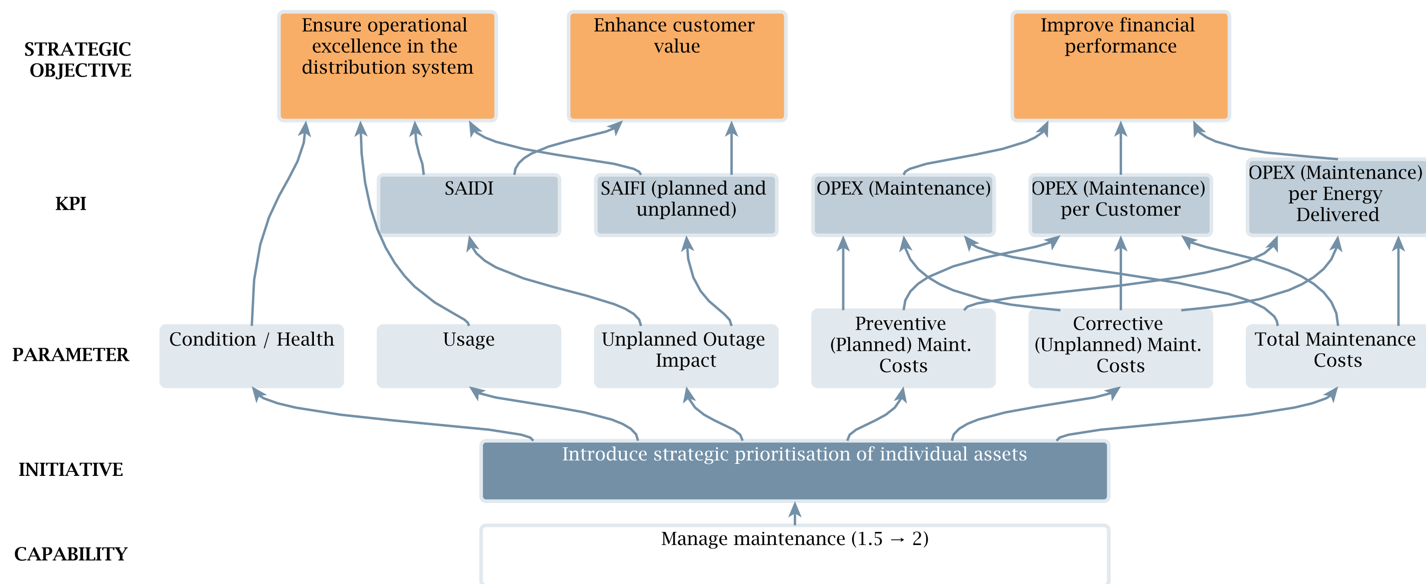


Figure 8.25.: VP.2 - Initiative No.4: Impact Chain

Table 8.18.: VP.2 - Initiative No.4: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Unplanned Outage Impact	335	-34	184	0.00	Customers
Preventive (Planned) Maint. Costs	0.30	0.05	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.05	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-53,750	1,494,250	1,650,000	$
Condition / Health	0.00	↑	1.00	1.00	Ratio
Usage	0.00	↑	1.00	1.00	Ratio

This initiative introduces the capability to prioritize assets strategically using information such as their importance and health derived from inspections. The improvements in operational excellence created by this initiative will influence OPEX and CAPEX related KPIs to help support GSU's strategic objective to improve financial performance.

This initiative will leverage enhanced asset information and extend the maintenance management process by prioritizing assets based on their importance, health and other metrics. Currently at GSU there is ad-hoc deferral of projects which are less critical, however a formalized process has not been defined. This process will ensure that asset management strategies are customized to individual assets, not just asset classes.

This initiative will ensure that maintenance budgets target the right assets, and will provide benefits in reducing maintenance costs by targeting proactive maintenance on high-risk assets, and reduce unplanned outage impacts.

During the Routing workshops the team assessed a 5% decline in the corrective maintenance costs, half of which could be allocated to preventive maintenance activities.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.2.5. Introduce DSM response prediction based on historic response information

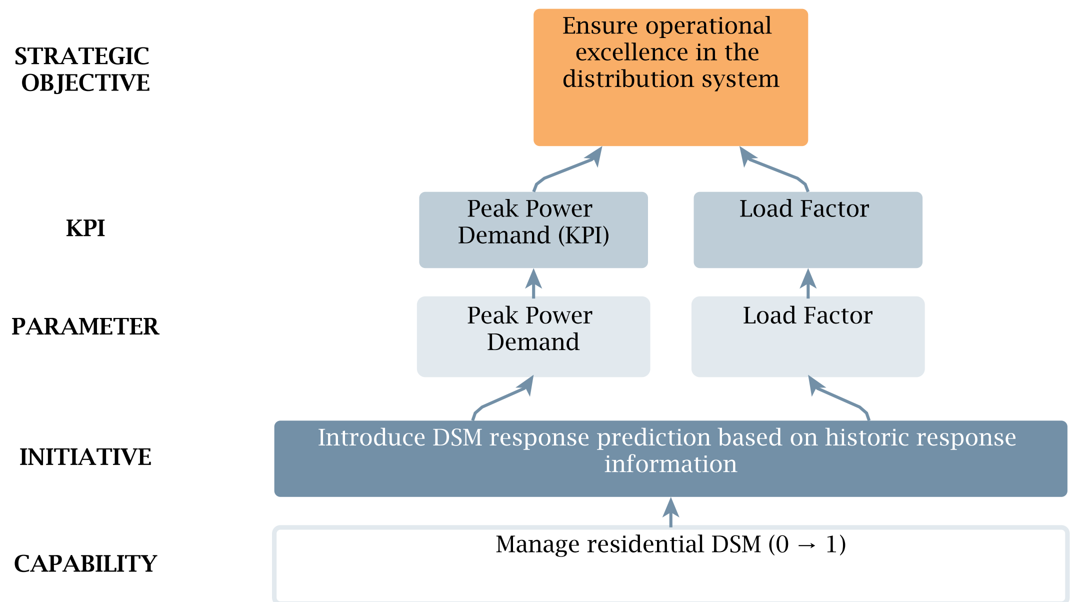


Figure 8.26.: VP.2 - Initiative No. 5: Impact Chain

Table 8.19.: VP.2 - Initiative No. 5: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Peak Power Demand	184	↓	↓	145	MW
Load Factor	0.66	↑	↑	0.95	Ratio

This initiative introduces DSM response prediction based on historic response of individual customers. The historic response is analyzed with the aim of predicting the response to future DSM requests more accurately and help with targeted marketing programs. The introduction of DSM response prediction based on historic response information helps to reduce the deviation of load profile from forecast in order to optimize the generation fleet through a better management of residential DSM.

The workshop team did not identify quantifiable parameter impacts, however activities undertaken during this initiative will provide support for later DSM initiatives, and will support GSU's strategic objective to ensure operational excellence in the distribution system.

8.2.6. Introduce common set of standards covering information and operational technologies

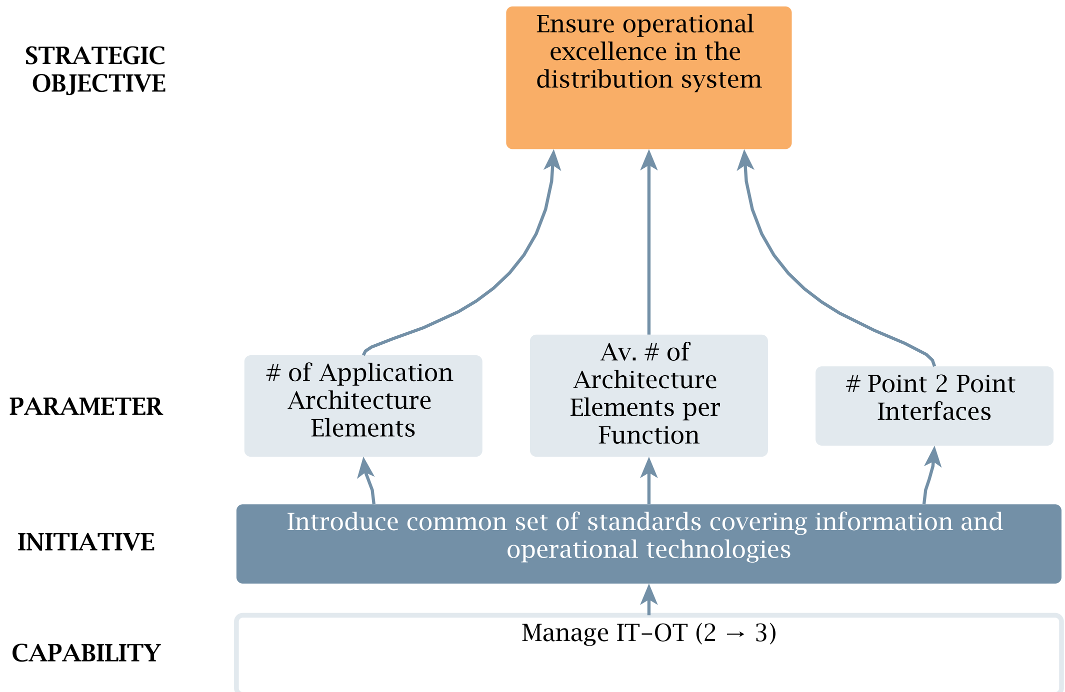


Figure 8.27.: VP.2 - Initiative No.6: Impact Chain

Table 8.20.: VP.2 - Initiative No.6: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
# of Application Architecture Elements	128	↓	↓	↓	Number
Av. # of Architecture Elements per Function	1.75	↓	↓	1.00	Ratio
# Point 2 Point Interfaces	23	↓	↓	↓	Number

This initiative establishes a common set of standards which cover all information and operational technology topics like software engineering, security, training, operation, etc. The further harmonization of the IT and OT landscape and all associated activities help to reduce the number of Architecture Elements and point-2-point interfaces. Many companies use this opportunity to migrate from legacy systems and applications close to end of life time to standardized functional components. This helps to decrease the necessary average number of architecture elements per function.

Since some of the impacted parameters are either not currently measured, or quantified impacts cannot be reliably assessed, the workshop team identified potential reductions in these parameters without explicitly quantifying them. For the same reason, these parameters have not been linked to a KPI but it was concluded that the overall impact delivered by this initiative will help reduce cost-inefficiencies and support GSU's strategic goal to improve financial performance.

8.2.7. Introduce separate cyber security approaches for the information and operational technology domains

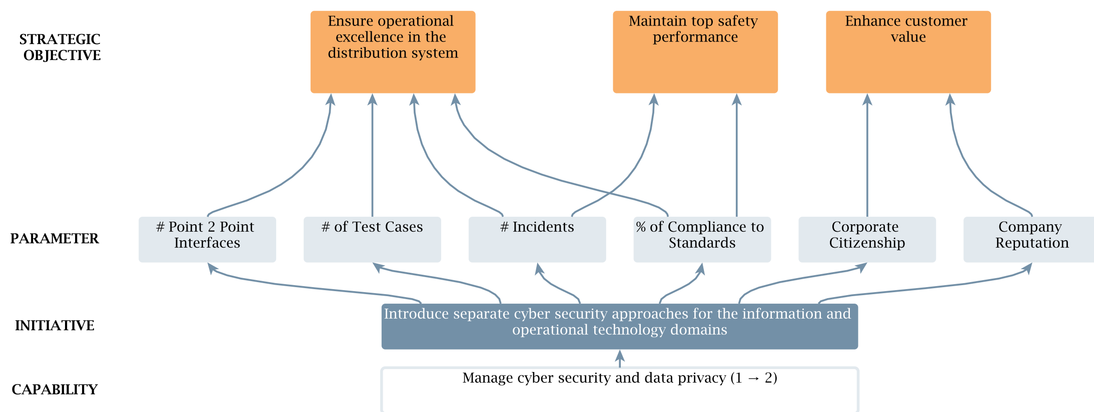


Figure 8.28.: VP.2 - Initiative No.7: Impact Chain

Table 8.21.: VP.2 - Initiative No.7: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
# Point 2 Point Interfaces	23	↓	↓	↓	Number
# of Test Cases	0.00	↑	↑	1.00	Number
# Incidents	2.00	↓	↓	0.00	Number
% of Compliance to Standards	N/A	↑		N/A	Ratio
Corporate Citizenship	0.54	↑	↑	1.00	Ratio
Company Reputation	0.75	↑	0.90	1.00	Ratio

This initiative introduces separate though comprehensive/complete cyber security approaches for both IT and OT domains. Separate cyber security approaches cover the individual requirements of the two domains and realize first steps in cyber security monitoring automation.

The workshop team did not assess numerical impacts, however this initiative is expected to improve standardization, reduce cyber-security incidents, enable further compliance to standards, and increase corporate citizenship and company reputation metrics. This supports GSU's strategic objectives to ensure operational excellence in the distribution system and enhance customer value.

8.2.8. Introduce the development and execution of pro-active communication plans

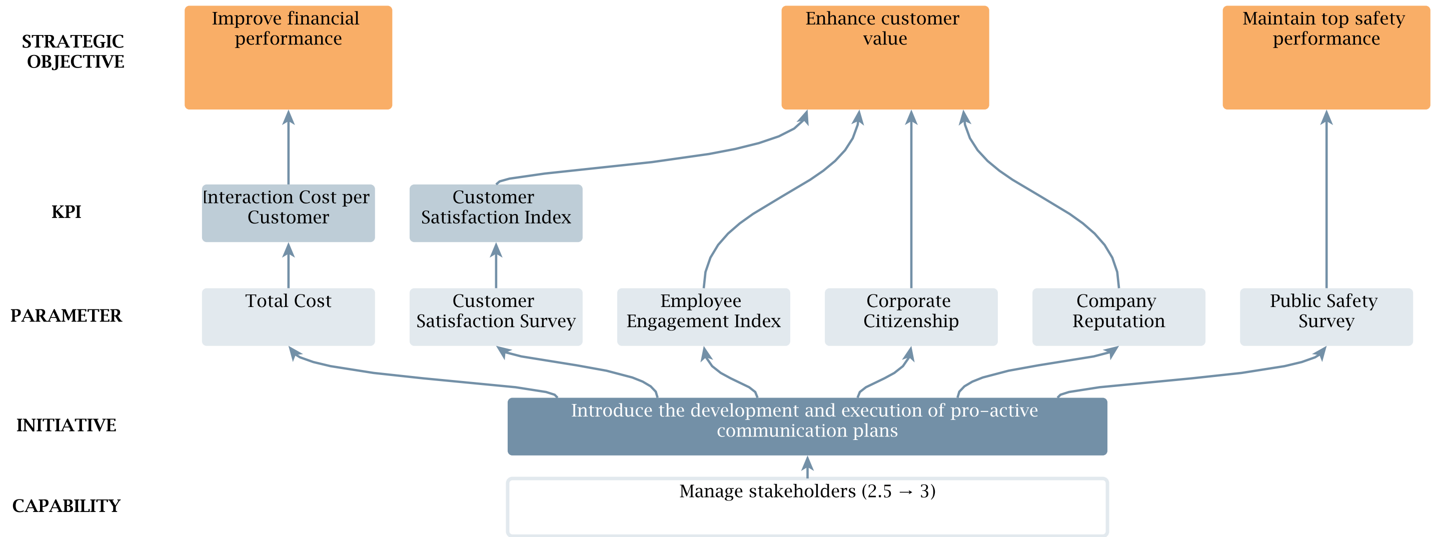


Figure 8.29.: VP.2 - Initiative No.8: Impact Chain

Table 8.22.: VP.2 - Initiative No.8: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Total Cost	450,000	-5,000	240,000	350,000	$
Customer Satisfaction Survey	0.95	↑	0.97	1.00	Ratio
Employee Engagement Index	N/A	↑	↑	N/A	N/A
Corporate Citizenship	0.54	↑	0.54	1.00	Ratio
Company Reputation	0.75	↑	0.90	1.00	Ratio
Public Safety Survey	0.63	↑	↑	1.00	Ratio

This initiative evolves the stakeholder management process from a reactive approach to a proactive approach utilizing surveys to better understand the perspectives of the stakeholders in order to predict their reactions and update communication plans. By proactively influencing communication plans, the provided information can be adapted and stakeholder management improved.

Through a proactive communication strategy, GSU's standing in customer surveys will increase and support the strategic target of providing exceptional customer value and improving its corporate image and brand integrity.

The workshop team identified a decrease in interaction cost of around 1%, through improving information targeted to external stakeholders. In addition, while not quantified, impacts are expected in customer satisfaction, employee engagement, corporate citizenship, company reputation and public safety.

8.2.9. Introduce a change management approach for selected projects

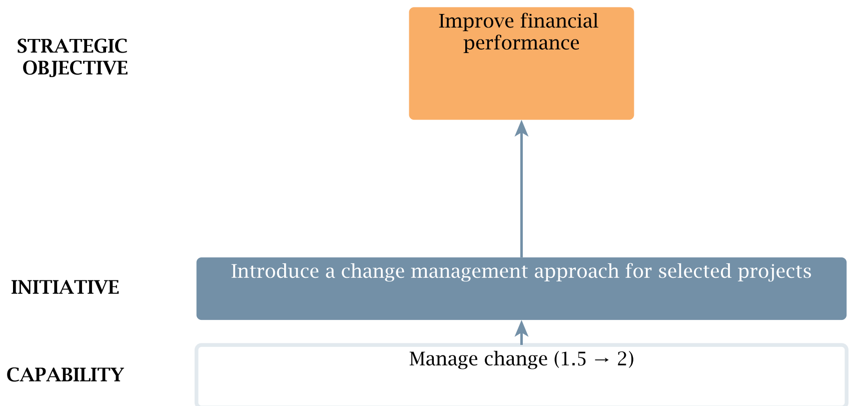


Figure 8.30.: VP.2 - Initiative No.9: Impact Chain

Table 8.23.: VP.2 - Initiative No. 9: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
No parameter effects were assessed for this initiative.					

This initiative will establish of a basic structured change management process for selected projects (typically very large projects) and define formal criteria to identify critical projects and enforce the structured change management process.

While numerical impacts were not assessed for this initiative, it will contribute to GSU's strategic objective to ensure operational excellence in the distribution system by increasing flexibility to adapt to changes in the business environment.

8.2.10. Introduce a deliverable based program controlling and defined limits of authority

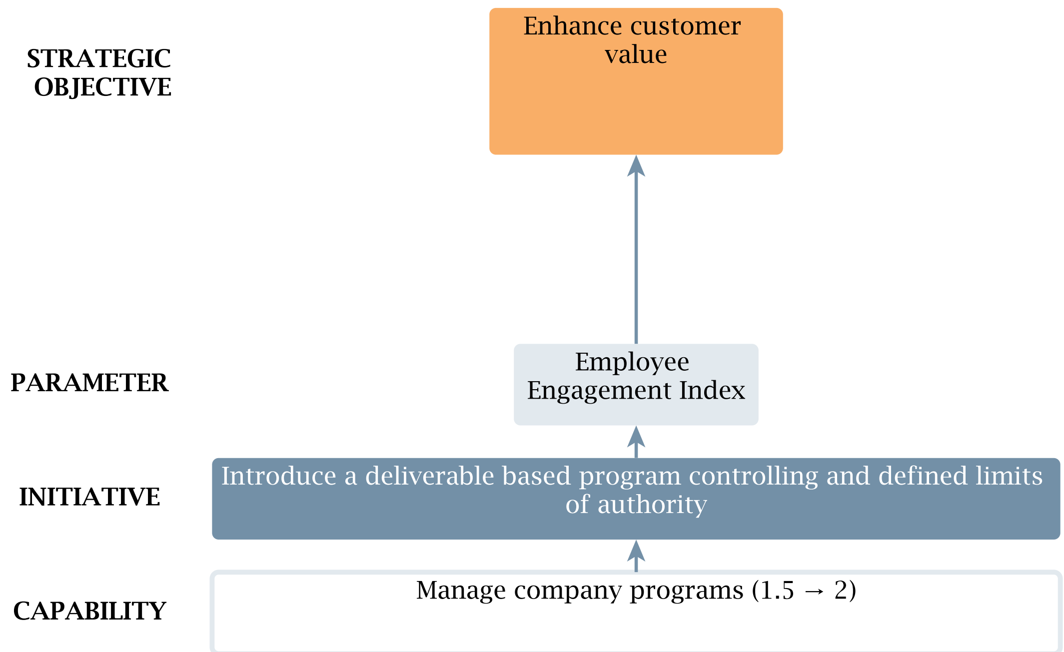


Figure 8.31.: VP.2 - Initiative No.10: Impact Chain

Table 8.24.: VP.2 - Initiative No.10: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Employee Engagement Index	N/A	↑	↑	N/A	Ratio

This initiative will extend the existing program management to replace task-based program control with more robust deliverable-based program control. Additionally it will introduce process steps for the definition and management of an approach and rules for decision making as well as definition, management and assignment of roles with different levels of authority.

While numerical impacts for this initiative were not assessed, it will contribute to GSU's strategic objective to enhance customer value and will facilitate the management and execution of all projects and programs.

8.2.11. Introduce a behaviour based customer segmentation

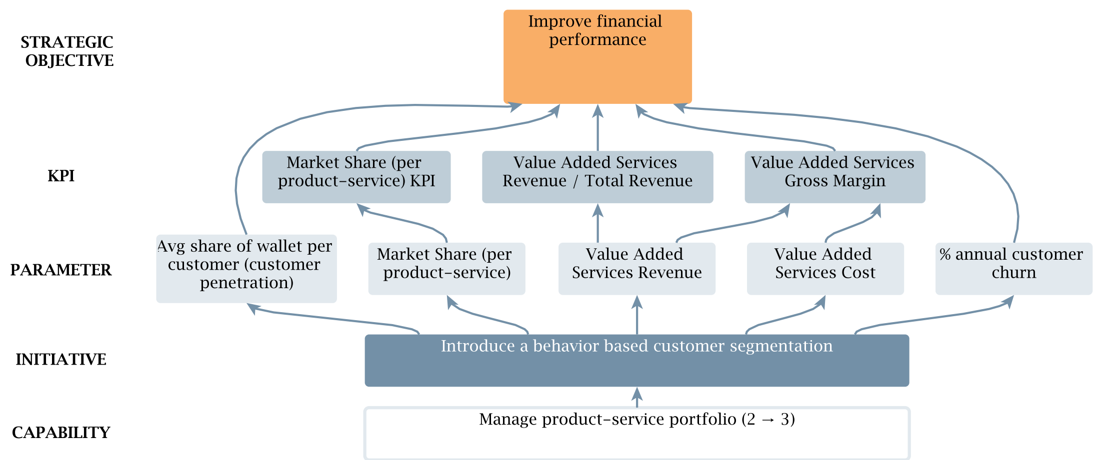


Figure 8.32.: VP.2 - Initiative No.11: Impact Chain (a)

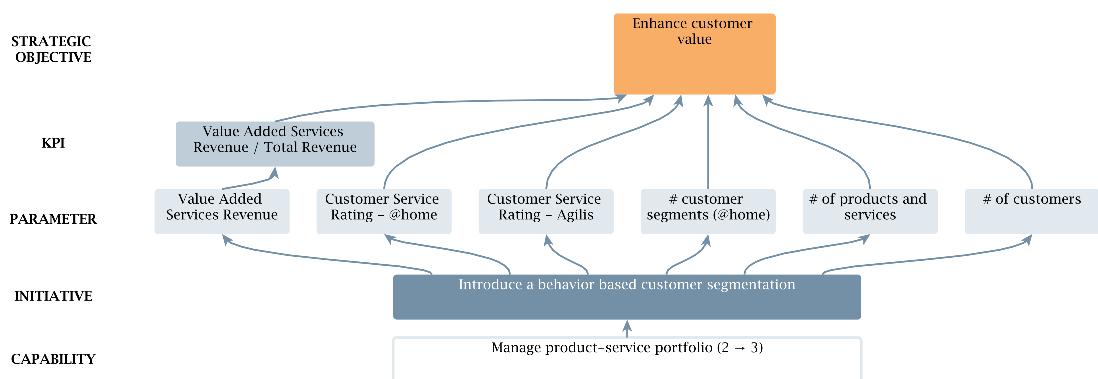


Figure 8.33.: VP.2 - Initiative No.11: Impact Chain (b)

This initiative will establish customer behaviour as new aspect within product/service portfolio management. The goal is to adjust the existing process in order to enable definition and management of customer segments based on behaviour. As a prerequisite to do this it is necessary to extend and evolve the existing capabilities around basic customer usage patterns to fully cover customer behaviour. The target of this change is to create the perception that products/services complement the customer behaviour.

Table 8.25.: VP.2 - Initiative No.11: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Value Added Services Cost	9,000,000	7,200,000	42,850,000	45,000,000	$
Value Added Services Revenue	10,000,000	10,000,000	60,310,400	60,000,000	$
Customer Service Rating - @home	0.94	↑	0.94	0.99	Ratio
Customer Service Rating - Agilis	0.85	↑	0.85	0.95	Ratio
# customer segments (@home)	2.00	↑	↑	↑	Number
Market Share (per product-service)	0.15	0.10	0.65	0.70	Ratio
# of products and services	10	5	25	30	Number
# of customers	10,400	↑	↑	60,000	Number
% annual customer churn	0.05	↓	↓	0.02	Ratio
Avg share of wallet per customer (customer penetration)	36.11	↑	↑	100.00	$

This initiative will contribute to increasing market share for GSU's value-added services, by increasing the number of customers per product, and increasing the number of products offered, ultimately driving increased revenues and margins supporting the strategic objective of improving financial performance.

8.3. VP.3: Grid Value Maximization Leveraging Grid Information

The core objective of this Value Pack is an active exploration of ways of increasing asset utilization efficiency and maximizing value generation from existing assets.

Advances in CIM-compliant network model management will enable aggregating KPIs on a grid-segment level and identifying grid segments where asset performance might be sub-par.

In the control centre, the Smart Grid Backbone event bus function introduced in this value pack will begin to facilitate in the next value pack the identification of event patterns in the data stream to evaluate the consequences of identified events and update the KPI system. Existence of recurrent event patterns that have negative consequences obviously necessitates formalized mitigating measures, or a system of 'management by exception'. Therefore, vital improvements in budget efficiency, risk distribution and complexity reduction are targeted in this value pack.

The themes of VP3 reinforce those of the first two value packs; maximization of grid value is a central area of focus in asset and work management, and processes, programs and change are the areas of focus from an organizational management point of view. The grid modernization program will maximize grid value by leveraging the grid information that has been created and enhanced in the first two VPs and extending it in this one, but the main value drivers of this VP are how to enhance grid value using this information.

Enhancements in distributed operational communications will allow data to be accessed in the field as well as in the control centre. Making this level of asset detail available to the forecasting applications will allow GSU to have an internally consistent basis for asset decision making as well as improved work process efficiency.

By shaping new offerings to customers that go beyond just being a re-seller of electrons, GSU can increase the perceived value of the utility in the community and increase gross margins as a result. By building capabilities that enable GSU to develop product and service offerings and advancing organizational management capabilities, GSU will have significant effect on customer satisfaction, gross margin and market share.

Initiatives in this value pack continue to build and develop the portfolio of components that go into an offering, and the utility at this point can further consider ways in which energy can be packaged into a compelling value proposition beyond electricity retailing.

Initiatives contained in this value pack formalize the informal know-how of GSU's qualified personnel by codifying a set of rules that define certain undesirable patterns which are automatically detected, tracked and notified.

During this initiative, further enhancements will be made to the project and program management functions at GSU along with the management of change capability. These will bring together the organizational elements from previous VPs and provide a more comprehensive approach to their application.

Finally, this VP extends the customer service theme by including an initiative to allow customers to initiate events using self-service.

Initiatives:

- Introduce a comprehensive approach to the management of change
- Introduce KPI based end-2-end performance monitoring for processes
- Introduce program coordination on value pack level and outcome based program controlling
- Vary parameter sets to setup different scenarios
- Introduce customer self service to initiate events
- Introduce historic information access in the field
- Utilization of individualized load profiles in network planning
- Introduce management by exception
- Introduce recommendations for additional value creation
- Introduce management of component elements
- Introduce secondary use of energy into component portfolio and utilize partnerships to enrich it
- Introduce targeted communication and quality of life consideration

Technology Deployments:

- Communication Infrastructure - Communication Infrastructure - Distributed Operational Network
- Asset Management - Workforce Management - Mobile Workforce
- Network Model Management - Network Model Management - CIM Model Store
- Asset Management - Strategic Asset Management - Grid Segment Analysis
- Smart Grid Backbone - Integration - Event Bus

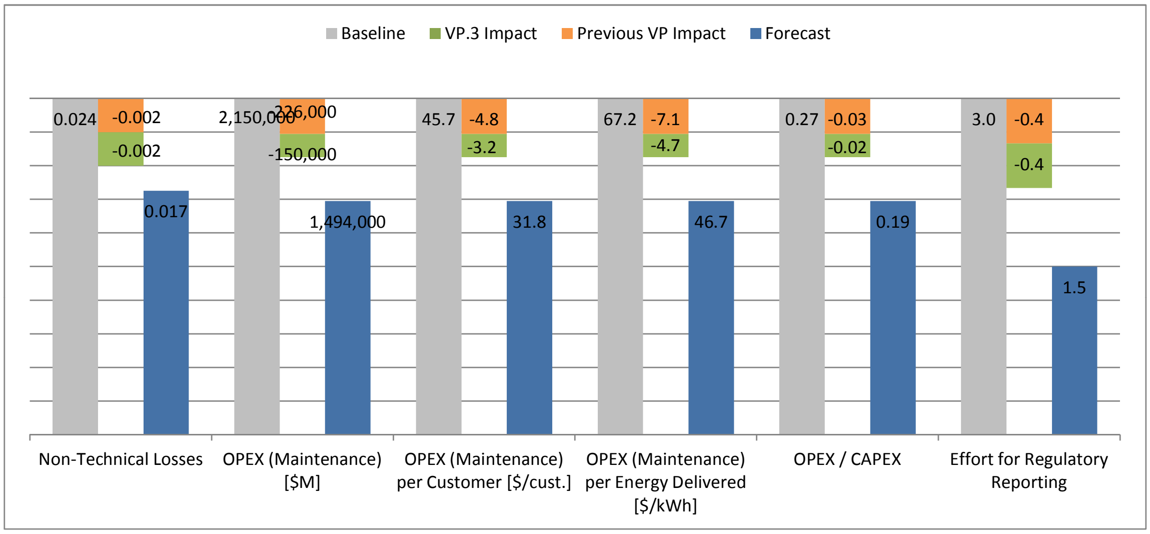


Figure 8.34.: VP.3 - Impact on KPIs (a)

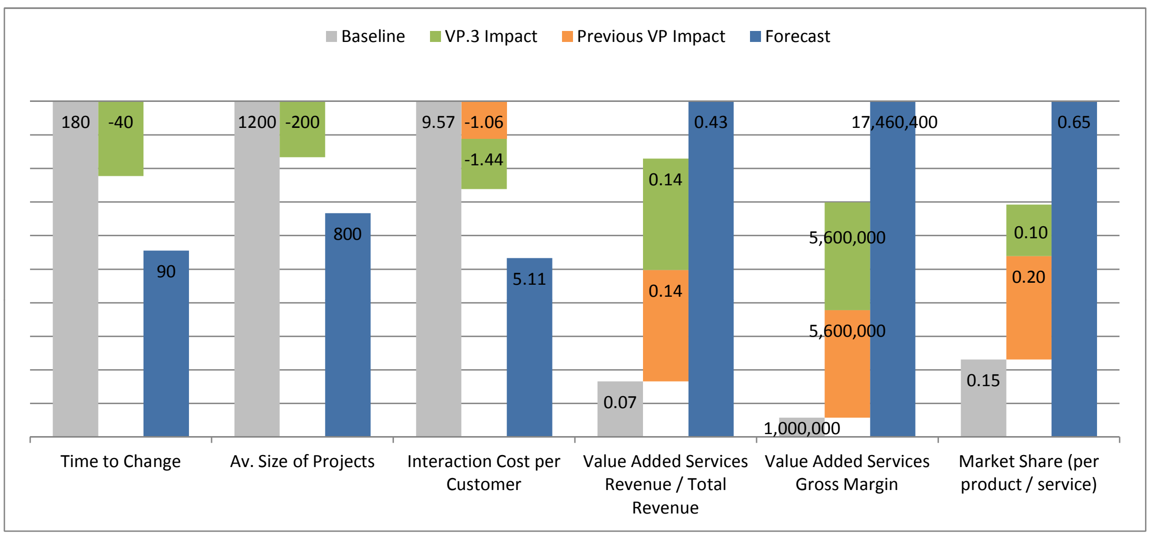
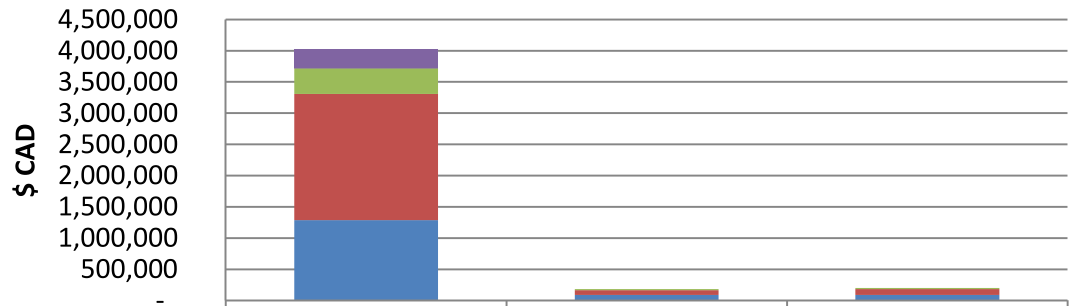


Figure 8.35.: VP.3 - Impact on KPIs (b)



	3	4	5
Service	310,000		
Risk	404,389	15,791	19,200
Personnel	2,021,944	78,955	96,002
Material	1,287,500	87,500	87,500

Years

Figure 8.36.: VP.3 Budgets

Table 8.26.: VP. 3 Costs per Initiative & Technology

Items	Material	Personnel	Service	Risk	Grand Total
Contribution Category 1		**$ 357,178.31**	**$ 50,000.00**	**71,435.66**	**478,613.97**
Manage change		**$ 70,652.20**		**14,130.44**	**84,782.64**
Introduce a comprehensive approach to the management of change		$ 70,652.20		14,130.44	84,782.64
Manage design and planning		**$ 151,720.14**		**30,344.03**	**182,064.16**
Utilization of individualized load profiles in network planning		$ 151,720.14		30,344.03	182,064.16
Manage company processes		**$ 78,909.39**	**$ 50,000.00**	**15,781.88**	**144,691.27**
Introduce KPI based end-to-end performance monitoring for processes		$ 78,909.39	$ 50,000.00	15,781.88	144,691.27
Manage company programs		**$ 55,896.59**		**11,179.32**	**67,075.91**
Introduce program coordination on value pack level and outcome based program controlling		$ 55,896.59		11,179.32	67,075.91
Contribution Category 2		**$ 683,382.95**	**$ 60,000.00**	**136,676.59**	**880,059.54**
Manage customer changes		**$ 139,266.91**	**$ 10,000.00**	**27,853.38**	**177,120.29**
Introduce customer self service to initiate events		$ 139,266.91	$ 10,000.00	27,853.38	177,120.29
Manage grid value		**$ 173,667.29**		**34,733.46**	**208,400.75**
Introduce management by exception		$ 83,541.07		16,708.21	100,249.29
Introduce recommendations for additional value creation		$ 90,126.22		18,025.24	108,151.46
Manage KPI forecasting		**$ 268,752.33**	**$ 50,000.00**	**53,750.47**	**372,502.80**
Vary parameter sets to setup different scenarios		$ 268,752.33	$ 50,000.00	53,750.47	372,502.80
Manage work execution		**$ 101,696.42**		**20,339.28**	**122,035.70**
Introduce historic information access in the field		$ 101,696.42		20,339.28	122,035.70
Contribution Category 3		**$ 308,198.82**	**$ 200,000.00**	**61,639.76**	**569,838.59**
Manage component portfolio		**$ 91,824.81**		**18,364.96**	**110,189.77**
Introduce secondary use of energy into component portfolio and utilize partnerships to enrich it		$ 91,824.81		18,364.96	110,189.77
Manage product-service components		**$ 105,606.14**	**$ 50,000.00**	**21,121.23**	**176,727.36**
Introduce management of component elements		$ 105,606.14	$ 50,000.00	21,121.23	176,727.36
Manage product-service portfolio		**$ 110,767.88**	**$ 150,000.00**	**22,153.58**	**282,921.45**
Introduce targeted communication and quality of life consideration		$ 110,767.88	$ 150,000.00	22,153.58	282,921.45
Infrastructure	**$ 1,462,500.00**	**$ 848,141.47**		**169,628.29**	**2,480,269.77**
Integration	**$ 750,000.00**	**$ 133,074.28**		**26,614.86**	**909,689.14**
Event Bus	$ 750,000.00	$ 133,074.28		26,614.86	909,689.14
Network Model Management	**$ 225,000.00**	**$ 124,249.92**		**24,849.98**	**374,099.91**
CIM Model Store	$ 225,000.00	$ 124,249.92		24,849.98	374,099.91
Strategic Asset Management	**$ 200,000.00**	**$ 127,207.80**		**25,441.56**	**352,649.36**
Grid Segment Analysis	$ 200,000.00	$ 127,207.80		25,441.56	352,649.36
Workforce Management	**$ 100,000.00**	**$ 119,804.73**		**23,960.95**	**243,765.67**
Mobile Workforce	$ 100,000.00	$ 119,804.73		23,960.95	243,765.67
Communication Infrastructure	**$ 187,500.00**	**$ 343,804.75**		**68,760.95**	**600,065.70**
Distributed Operational Network	$ 187,500.00	$ 343,804.75		68,760.95	600,065.70
Grand Total	**$ 1,462,500.00**	**$ 2,196,901.55**	**$ 310,000.00**	**439,380.31**	**4,408,781.86**

8.3.1. Introduce a comprehensive approach to the management of change

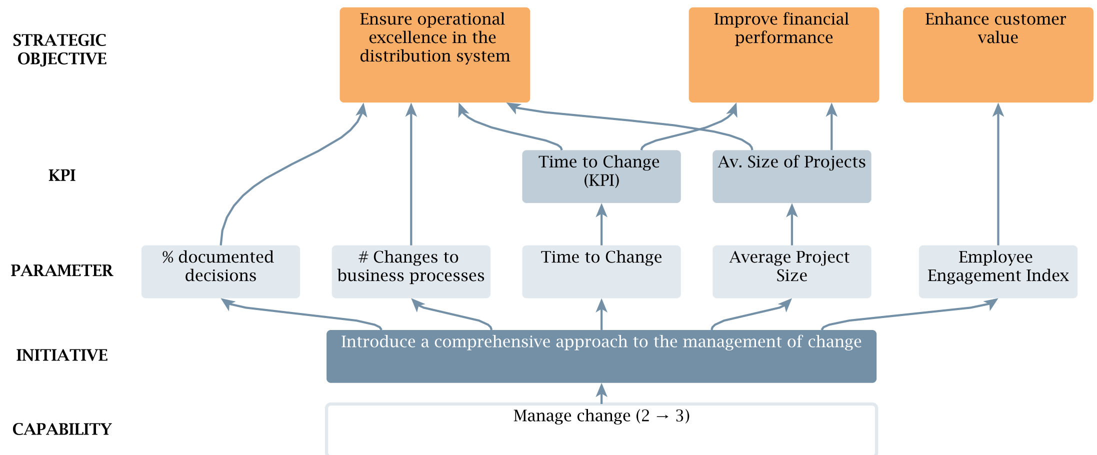


Figure 8.37.: VP.3 - Initiative No.1: Impact Chain

Table 8.27.: VP.3 - Initiative No.1: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
% documented decisions	0.60	↑	0.70	0.80	Ratio
Time to Change	180.00	-30.00	100.00	90.00	days
Average Project Size	1,200	-200.00	800	700	person-hours
# Changes to business processes	10	5	29	15	number
Employee Engagement Index	n/a	↑		0	0

This initiative formalizes and extends the existing process to cover a comprehensive scope of activities, beyond being applied to only special projects. To ensure consistency in change management, a unified methodology needs to be chosen, described and supported by best-practice examples.

The large-scale grid modernization program at GSU will involve new and legacy systems working in parallel for some time with many employees who have spent a considerable part of their careers working on legacy systems. This creates a rather high transition barrier which can only be bridged by a unified change management process that integrates active employee engagement, relevant training and streamlined management and approval processes. This initiative achieves this through comprehensive change management, best practice templates and the implementation of project monitoring and value management.

A formalized change management process will help counter institutional inefficiencies, inertia and resistance to change in order to support GSU's strategic objectives to improve financial performance, and to ensure operational excellence in the distribution system.

The workshop team identified this initiative as decreasing the overall time to execute changes, reducing project size, and making it possible to execute a greater number of changes to business processes within a given year.

8.3.2. Introduce KPI based end-to-end performance monitoring for processes

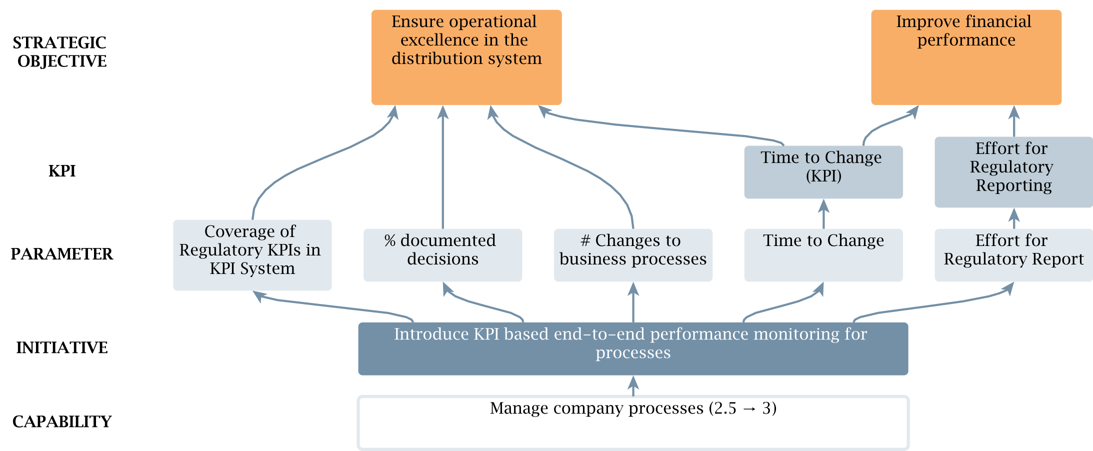


Figure 8.38.: VP.3 - Initiative No.2: Impact Chain

Table 8.28.: VP.3 - Initiative No.2: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Coverage of Regulatory KPIs in KPI System	0.00	0.10	0.80	1.00	Ratio
Effort for Regulatory Report	3.00	-0.30	1.50	2.00	FTE
% documented decisions	0.60	0.10	0.70	0.80	Ratio
Time to Change	180	-10	100	90	days
# Changes to business processes	10	5	29	15	number

This initiative will build on previously standardized process definitions and limited performance measurement to introduce additional steps for process management in order to enable process specific definition and management of performance parameters and Key Performance Indicators (KPIs). Based on the defined parameters and KPIs a continuous measurement program has to be established to allow monitoring of each individual process instance from initialization to process closure.

By formalizing process measurement, the workshop team asserted that this initiative will drive a 10% improvement in decision documentation, will increase visibility of KPIs by 10%, reduce efforts for regulatory reporting, and will reduce time to change and increase the number of process changes.

8.3.3. Introduce program coordination on a value pack level and outcome based program controlling

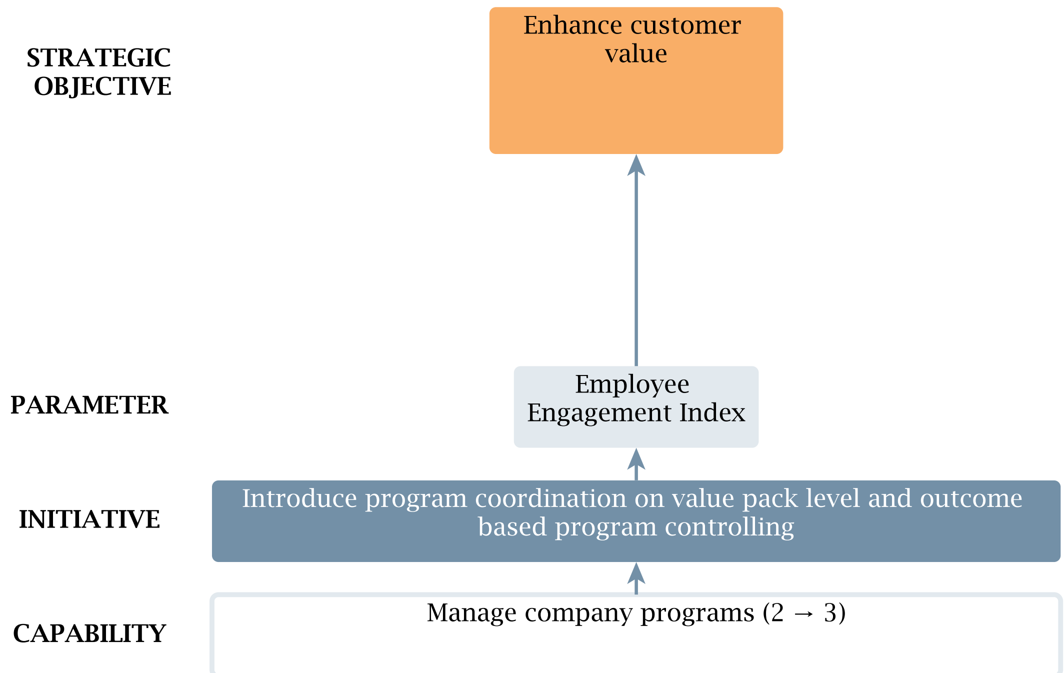


Figure 8.39.: VP.3 - Initiative No.3: Impact Chain

Table 8.29.: VP.3 - Initiative No.3: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Employee Engagement Index	N/A	↑	↑	N/A	Score

Building on previous initiatives which develop deliverable-based program management and defined limits of authority, this initiative will establish the necessary process steps to define and manage value packs that combine multiple projects as new level of abstraction for the coordination of company programs.

Additionally, it will extend the existing deliverable based program controlling to an outcome based program controlling in order to match it to the new level of abstraction on the coordination side. A prerequisite for the changes is a fully standardized approach for project management.

While numerical impacts for this initiative were not assessed, it will contribute to GSU's strategic objective to ensure operational excellence in the distribution system and will facilitate the management and execution of all projects and programs.

8.3.4. Vary parameter sets to setup different scenarios

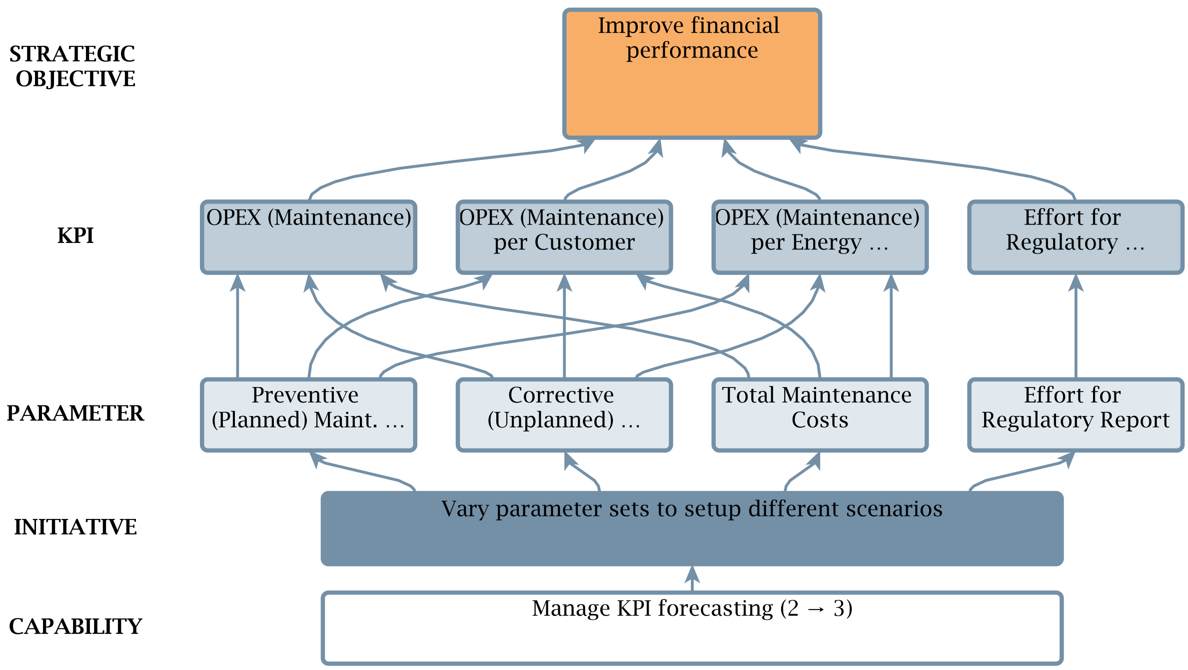


Figure 8.40.: VP.3 - Initiative No.4: Impact Chain

Table 8.30.: VP.3 - Initiative No.4: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Preventive (Planned) Maint. Costs	0.30	0.02	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.02	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-21,500	1,494,250		$
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

The initiative extends the forecasting process with forecasting scenarios based on varying parameter sets which reflect different assumptions, in order to optimize OPEX and CAPEX. By leveraging business domain knowledge and historic information, GSU will be able to recognize patterns in different scenarios such as different seasonal peaks in different areas and will therefore be able to forecast more accurate load peaks in the future by comparing the scenarios.

Forecasting future scenarios also provides crucial transparency on current asset performance which will therefore aid GSU in optimizing various asset-related costs such as new build and replacement costs as well as preventive and corrective maintenance costs. Due to the transparency provided by this initiative, GSU will be able to shift post-fault, high corrective maintenance costs to preventive maintenance budgets, avoid the need to carry out expensive corrective maintenance when faults occur, and thereby support its strategic target of maintaining financial strength.

The workshop team assessed a 2% reduction of corrective maintenance budget, half of which might be allocated to preventive activities. In addition a reduction in efforts for regulatory reporting, by 0.1 FTE, due to more accurate forecasting was assessed.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.3.5. Introduce customer self service to initiate events

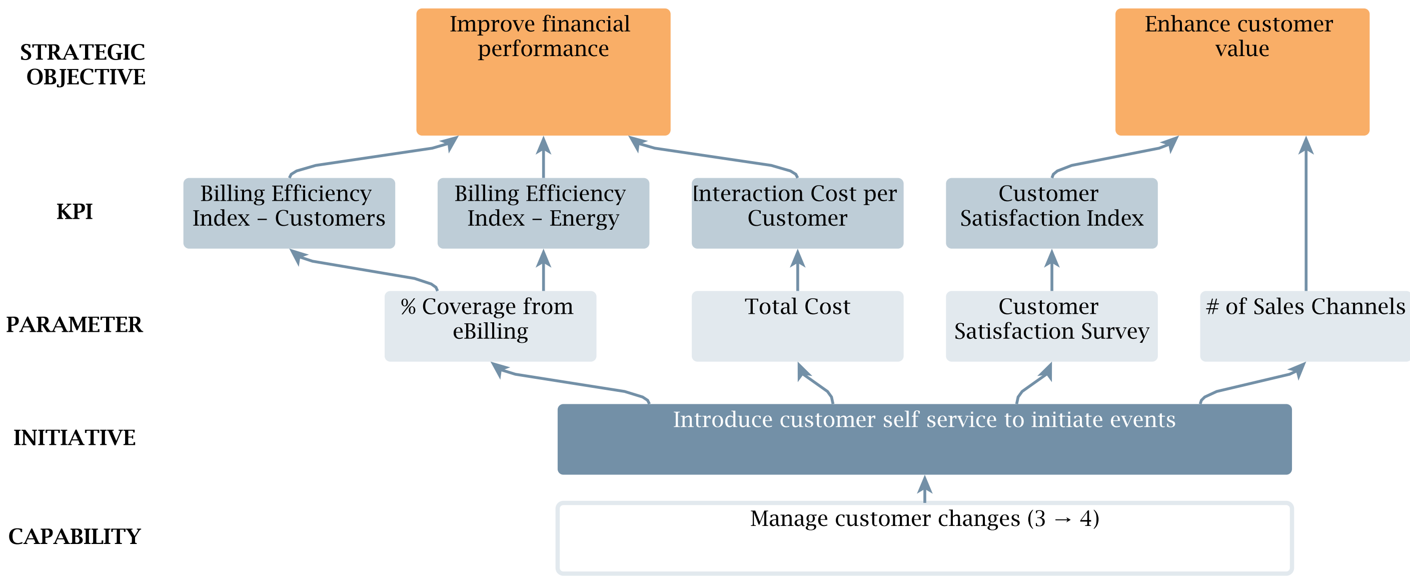


Figure 8.41.: VP.3 - Initiative No.5: Impact Chain

Table 8.31.: VP.3 - Initiative No.5: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
% Coverage from eBilling	0.00	0.10	0.40	0.40	%
Total Cost	450,000	-67,500	240,000		$
Customer Satisfaction Survey	0.95	↑	0.97	1.00	Ratio
# of Sales Channels	2.00	1.00	12.00	10.00	count

This initiative introduces a capability that enables customers to initiate events using a self-service portal and track the process through to billing. The customer self service improves the data quality at the point of customer contact, avoiding misunderstandings, decreasing administrative work and the average time to perform a change.

The workshop team assessed this initiative to have a significant impact in reducing interaction costs through enabling greater online self-service capability. The total interaction costs were forecast to be reduced by 15%, while due to increased portal traffic, an increase in customers signing up for ebilling, on the order of 10% was also seen to be likely. This initiative was also expected to influence positively customer satisfaction, however a numerical forecast was not assessed.

8.3.6. Introduce historic information access in the field

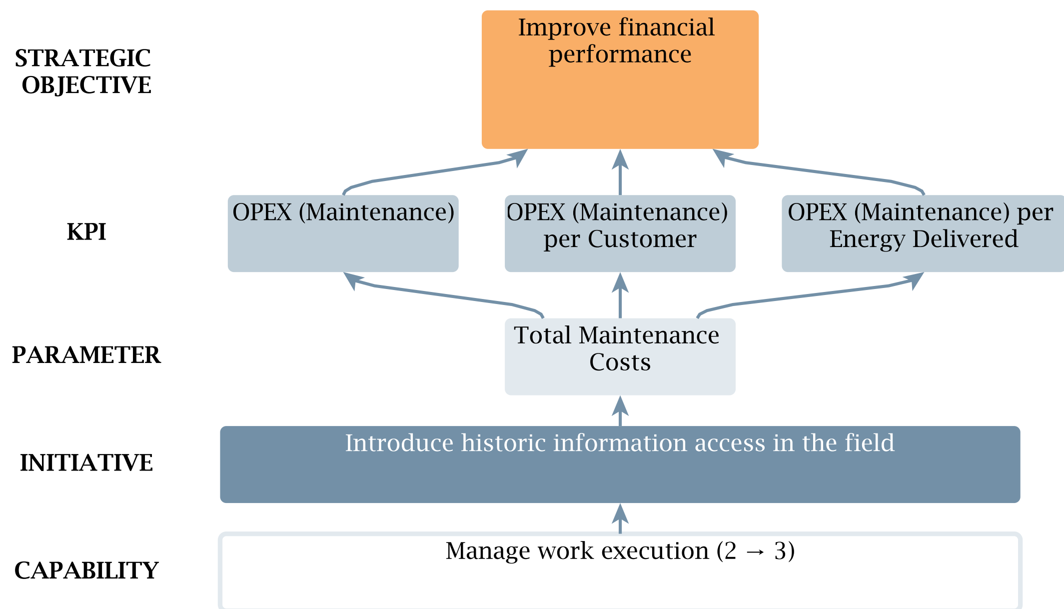


Figure 8.42.: VP.3 - Initiative No.6: Impact Chain

Table 8.32.: VP.3 - Initiative No.6: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Total Maintenance Costs	2,150,000	-21,500	1,494,250	-	$

This initiative provides on-site field crews access to historic information through mobile devices capable of downloading relevant information from central databases. Access to historic information in the field extends the scope of online information exchange / access within the work execution process. Reduction in the duration of unplanned outages positively impacts GSU's strategic objective of enhancing customer value.

The workshop team identified savings in total maintenance costs (OPEX) of 1% due to increased access to historical maintenance data in the field.

8.3.7. Utilization of individualized load profiles in network planning

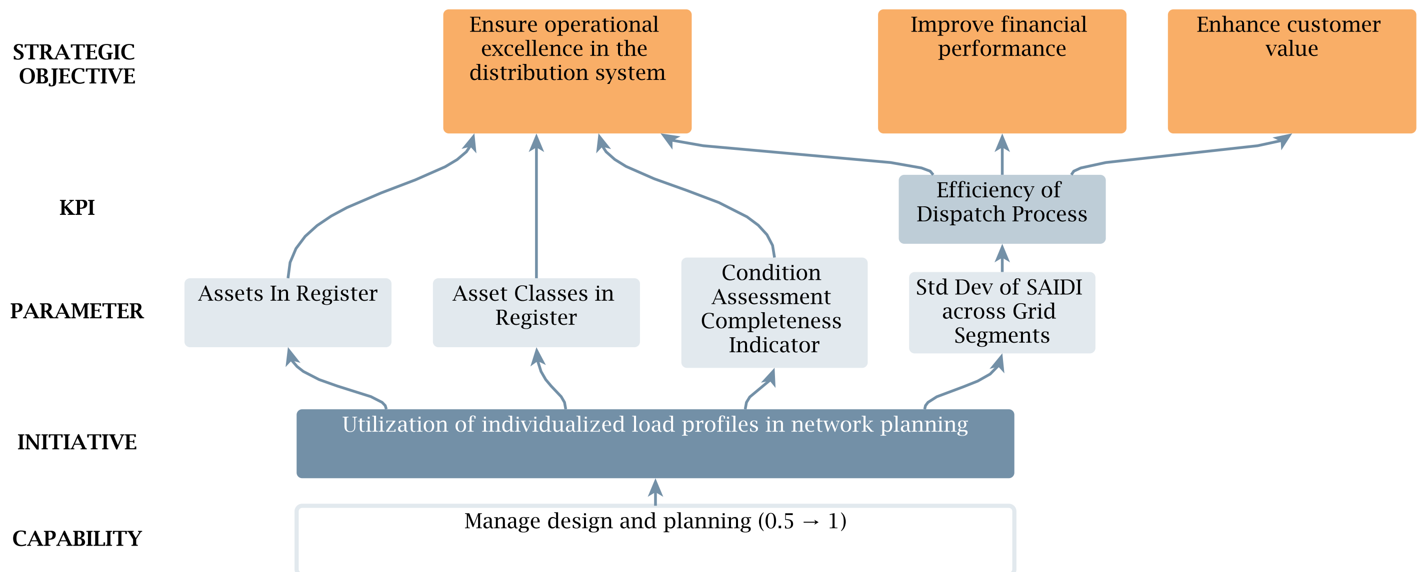


Figure 8.43.: VP.3 - Initiative No.7: Impact Chain

Table 8.33.: VP.3 - Initiative No.7: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Std Dev of SAIDI across Grid Segments	0.40	-0.02	0.28	0.20	Ratio
Assets In Register	102,873	↑	102,873	Increase	number
Asset Classes in Register	20.00	↑	20.00	Increase	number
Condition Assessment Completeness Indicator	83.20	↑	83.20	90.00	Index

This initiative will improve GSU's existing as-built model by integrating historical load and consumption information. GSU's existing smart meter data will be leveraged to provide updated load profiles. These load profiles will enable planning to consider different patterns of consumption on a regional basis when examining design options, including feeder expansion due to load or distributed generation growth.

As a result of improving this capability, GSU will ensure greater consistency in service quality across its system as it is expanded or upgraded. The workshop team agreed that this initiative could result in at least 5% decrease in variance of SAIDI across grid segments. This initiative will also provide a basis for further design and planning process improvements which will enable greater efficiencies and increase capability to integrate dynamic loads and distributed generation.

8.3.8. Introduce management by exception

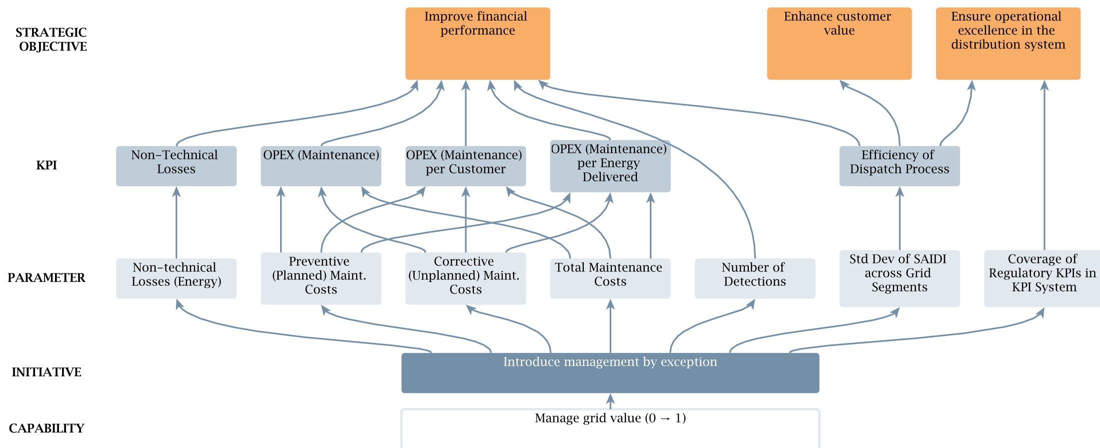


Figure 8.44.: VP.3 - Initiative No.8: Impact Chain

Table 8.34.: VP.3 - Initiative No.8: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Non-technical Losses (Energy)	0.02	0.00	0.02	0.02	ratio
Number of Detections	5.00	↑	5.00	5.00	number
Preventive (Planned) Maint. Costs	0.30	0.05	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.05	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-53,750	1,494,250		$
Std Dev of SAIDI across Grid Segments	0.40	-0.02	0.28	0.20	Ratio
Coverage of Regulatory KPIs in KPI System	0.00	0.10	0.80	1.00	Ratio

As KPI calculation and correlation at GSU is mostly carried out manually, it relies on the know-how of its personnel to identify undesirable pattern developments and to take remedial actions.

Automation of KPI collection and compilation will reduce inherent latency by making information available in real-time which enables the identification of exact chain of events leading to complicated failures. As a result of such automation, the level of consistency in the data of the distribution grid is expected to increase which supports GSU's strategic objectives to improve financial strength and ensure operational excellence in the distribution system.

Increases in data quantity and complexity will require automation of data collection, event detection and complex event processing. This initiative will enable GSU to formalize the informal know-how of its qualified personnel by codifying a set of rules that define certain undesirable patterns which are automatically detected, tracked and notified.

Such exception-handling capabilities can help GSU detect and rectify a range of issues. The workshop team identified the potential for a 5% reduction in non-technical losses and a 2% reduction of corrective maintenance budget, half of which might be allocated to preventive activities The team also anticipated a 5% reduction in the variance of SAIDI across grid segments, through earlier identification of abnormal conditions.

8.3.9. Introduce recommendations for additional value creation

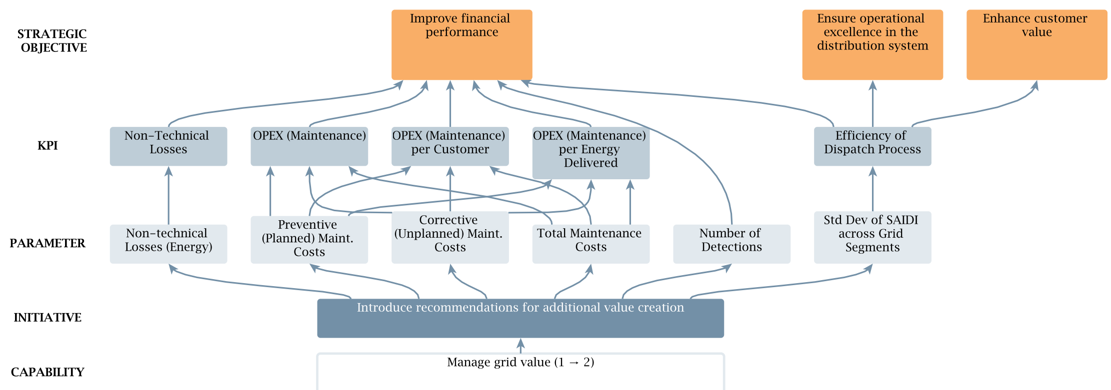


Figure 8.45.: VP.3 - Initiative No.9: Impact Chain

Table 8.35.: VP.3 - Initiative No.9: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Non-technical Losses (Energy)	0.02	0.00	0.02	0.02	ratio
Number of Detections	5.00	↑	5.00	5.00	number
Preventive (Planned) Maint. Costs	0.30	0.05	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.05	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-53,750	1,494,250		$
Std Dev of SAIDI across Grid Segments	0.40	-0.02	0.28	0.20	Ratio

This initiative will build on previously established process of managing grid exceptions to further enhance the management of grid value through developing grid risk and value KPIs (e.g. SAIDI, outage impact, frequency, value of service) and a set of recommendations on how to address exceptions to performance standards.

By enhancing the ability to assess and manage value and risk KPIs, and better prioritize high value or high risk grid segments, the workshop team expects this initiative will further increase reductions in maintenance related OPEX by 5%, half of which might be allocated to preventive activities, provide a 5% reduction in non-technical losses and decrease grid-risk variance by 5%.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.3.10. Introduce management of component elements

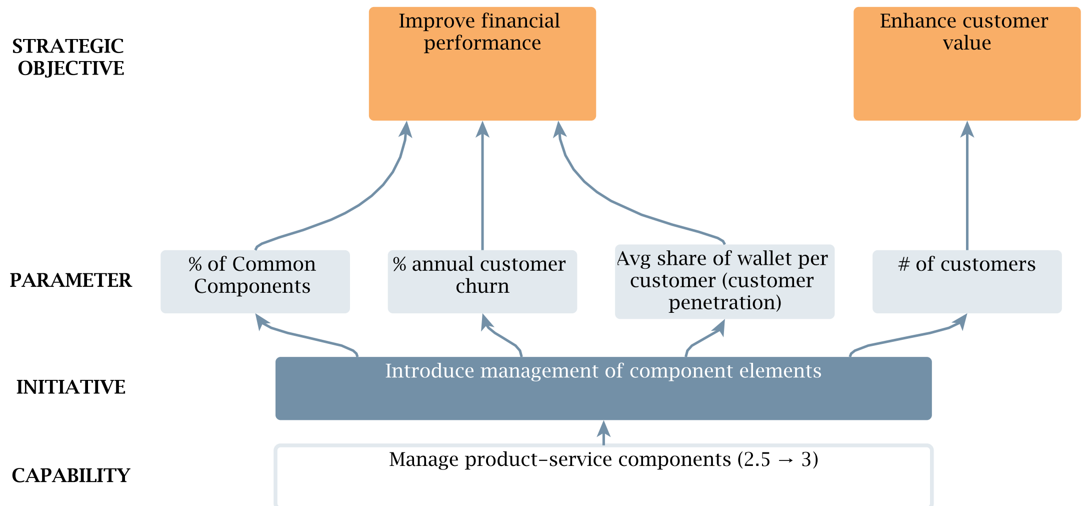


Figure 8.46.: VP.3 - Initiative No.10: Impact Chain

Table 8.36.: VP.3 - Initiative No.10: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
% of Common Components	0.00	↑	↑	0.60	Ratio
# of customers	10,400	↑	↑	60,000	Count
% annual customer churn	0.05	↓	↓	0.02	Ratio
Avg share of wallet per customer (customer penetration)	36.11	↑	↑	100.00	$

This initiative will further develop the capability to create and manage product/service components at an increased granularity. This means the process needs be able to handle more instances, because multiple component elements need to be created / managed per product or service instead of just one component per product/service. The splitting up reduces duplication and increases re-usability, which both lead to reduced overall costs.

This initiative will contribute to increasing market share for GSU's value-added services, by increasing the number of customers per product, and increasing the number of products offered.

8.3.11. Introduce secondary use of energy into component portfolio and utilize partnerships to enrich it

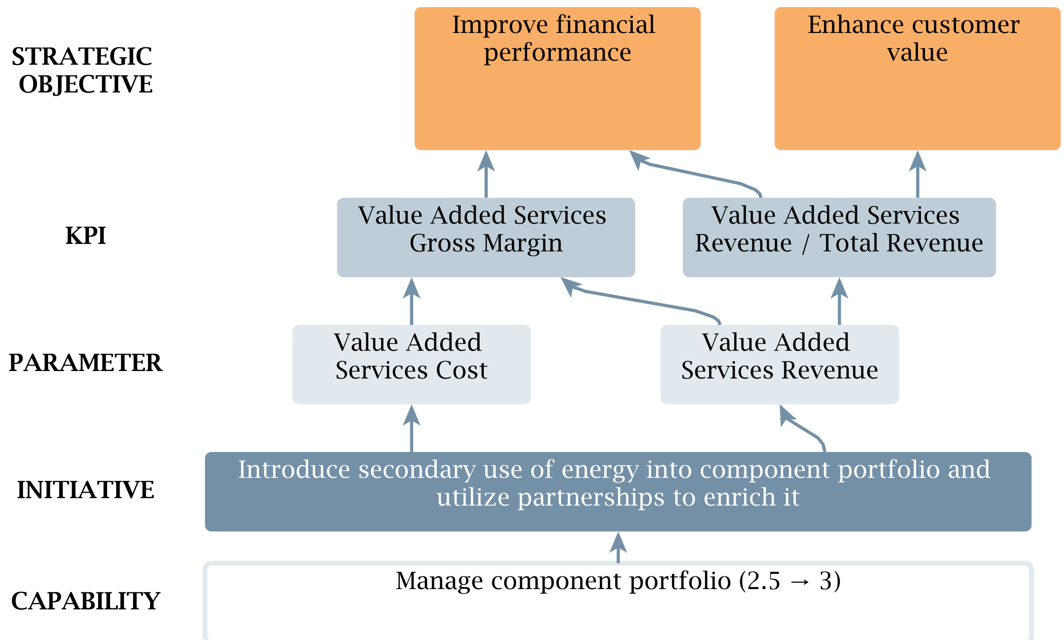


Figure 8.47.: VP.3 - Initiative No.11: Impact Chain

Table 8.37.: VP.3 - Initiative No.11: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Value Added Services Cost	9,000,000	7,200,000	42,850,000	45,000,000	$
Value Added Services Revenue	10,000,000	10,000,000	60,310,400	60,000,000	$

Building on the creation of a process to manage the component portfolio in the previous initiative, this initiative will extend the process steps for partnership management and interaction to enable the expansion of the component portfolio.

This will enable existing processes to be more flexible in order to enable management of a broader variety of topics, like secondary use of energy (e.g. heating/cooling), within the component portfolio.

Taken together, these will enable management and development of the portfolio around value proposition clusters that reflect the company's chosen core value propositions.

This initiative will enable GSU to introduce new products and services and increase value-added services revenues and margins.

8.3.12. Introduce targeted communication and quality of life consideration

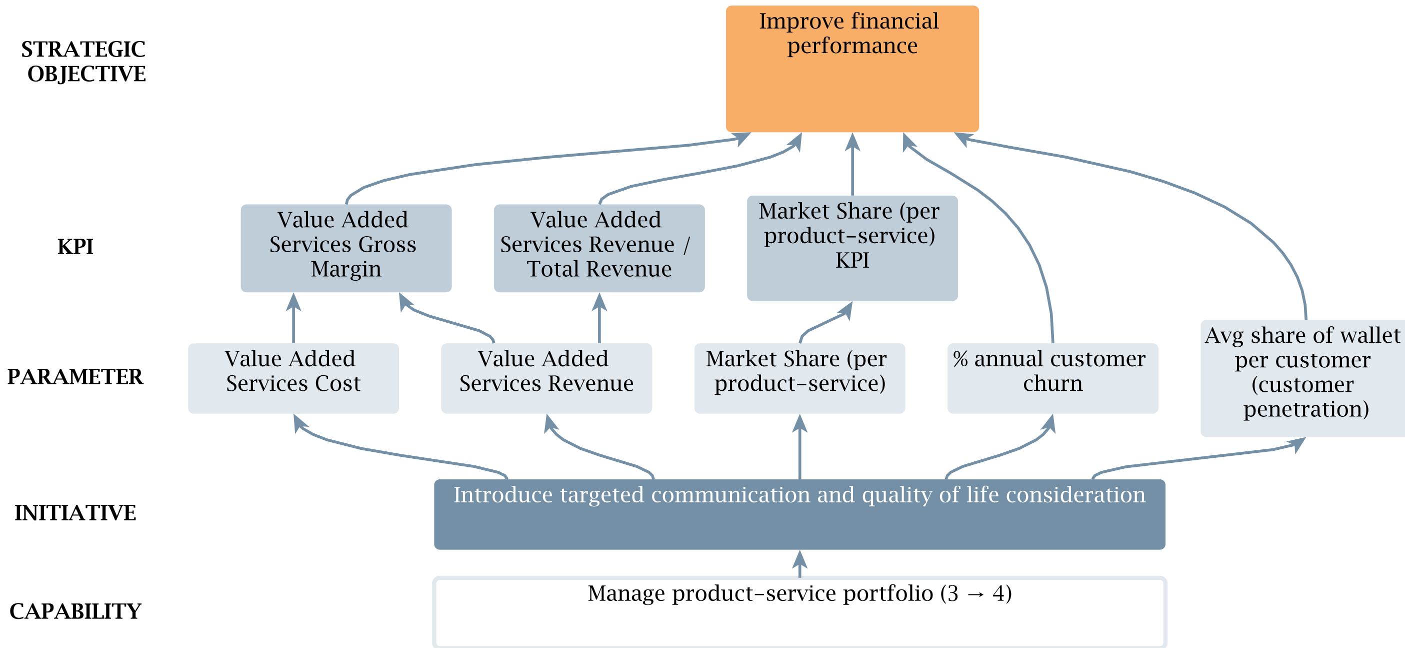


Figure 8.48.: VP.3 - Initiative No.12: Impact Chain (a)

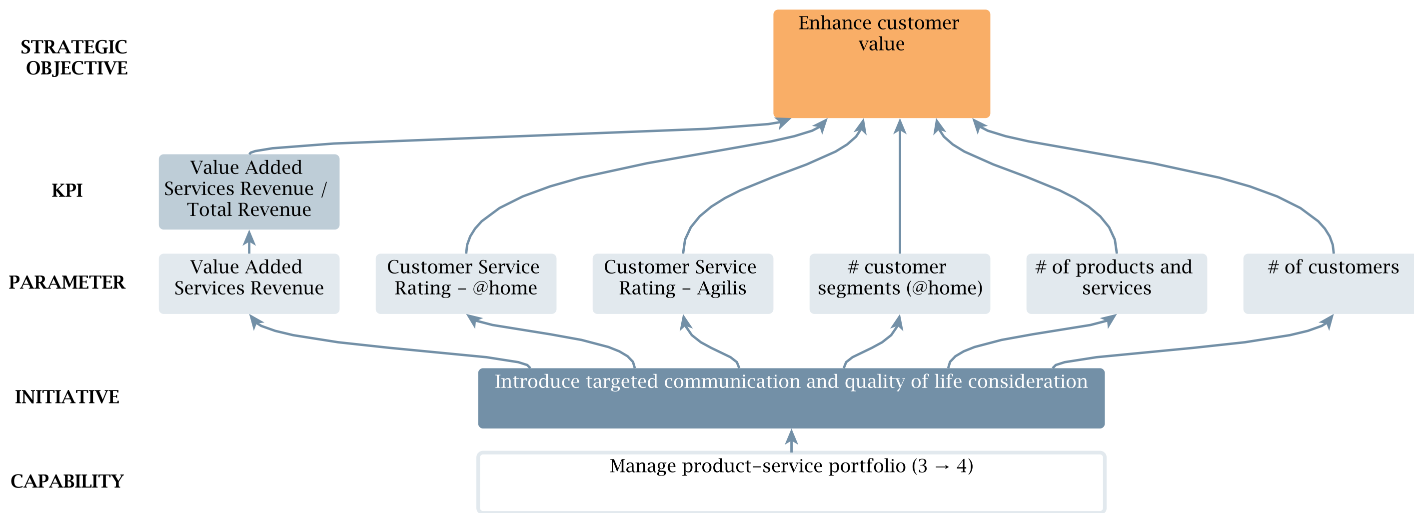


Figure 8.49.: VP.3 - Initiative No.12: Impact Chain (b)

Table 8.38.: VP.3 - Initiative No.12: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Value Added Services Cost	9,000,000	7,200,000	42,850,000	45,000,000	$
Value Added Services Revenue	10,000,000	10,000,000	60,310,400	60,000,000	$
Customer Service Rating - @home	0.94	↑	↑	0.99	Ratio
Customer Service Rating - Agilis	0.85	↑	↑	0.95	Ratio
# customer segments (@home)	2.00	↑	↑	↑	Number
Market Share (per product-service)	0.15	0.10	0.65	0.70	Ratio
# of products and services	10	5	25	30	Number
# of customers	10,400	↑	↑	60,000	Number
% annual customer churn	0.05	↓	↓	0.02	Ratio
Avg share of wallet per customer (customer penetration)	36.11	↑	↑	100.00	$

This initiative will adapt and extend the existing process steps to understand the comfort requirements of customers in order to adjust the product/service portfolio accordingly. The general approach in this initiative is to change the perception of customers to one that emphasizes the quality of life contributions of the products and services offerings rather than a strictly cost-based view. In order to adequately support this and to transfer the right messages to the right customers, the customer communication will have to become more targeted.

This initiative will contribute to increasing market share for GSU's value-added services, by increasing the number of customers per product, and increasing the number of products offered, ultimately driving increased revenues and margins.

8.4. VP.4: Leveraging Grid Information for Enhanced Performance Monitoring

The core theme of this value pack is to create real-time event-detection capabilities by enhancing information gathering, processing and analysis capabilities.

These capabilities will enable GSU to continuously monitor and respond to events on chosen key assets, as well as enhancing employee safety by creating synergies for automatic coordination between control centre and workforce. As program sophistication increases, organizational initiatives are included to carry out coordinated program controlling and enable requirements-based tendering processes.

Overall, process and technology changes contained in this value pack are designed to deliver a broad range of benefits ranging from optimization of CAPEX vs. OPEX, rationalization of risk distribution across the grid and improvements in reducing complexity.

Technologies enhanced or introduced in this value pack focus on the network model, both topologically and geographically. The GIS technology function touches most of the initiatives in this value pack and will be utilized, enhanced and integrated with the CIM model store to provide a model schema for detailed network models and pertinent asset data.

Network change management will allow the update of a representation of the power system, as well as a 'snapshot' of the network for a specific day or time period (point-in-time view). With an adequate network change management process coupled with advanced network planning systems and real-time data, GSU will be able to determine the network configuration that optimized according to its design criteria.

In this value pack the organization-orientated initiatives continue to enhance program capabilities and stakeholder management capabilities.

Initiatives:

- Establish electronic communication between control center and work crews
- Introduce targeted (individuals) communication
- Introduce analysis of consumption using historic
- Introduce a comprehensive KPI system for all assets
- Introduce grid structures as aggregation hierarchies
- Introduce event monitoring on key assets
- Introduce a close, continuous and automated coordination between control centre and workforce

- Introduce KPI Monitoring on Grid Segment Level
- Introduce manual correlation and combination of reports
- Introduce pro-active communication based on anticipated stakeholder reaction to potential events
- Introduce tendering by functional requirements leveraging multiple vendors
- Introduce program level oriented coordination and impact based program controlling
- Introduce an attitude based customer segmentation

Technology Deployments:

- Smart Grid Backbone - Operational Data Store (ODS) - Event Detection
- Asset Management - Enterprise Asset Management - GIS
- Network Model Management - Network Model Management - Chronological Model
- Network Model Management - Network Model Management - Network Change Management

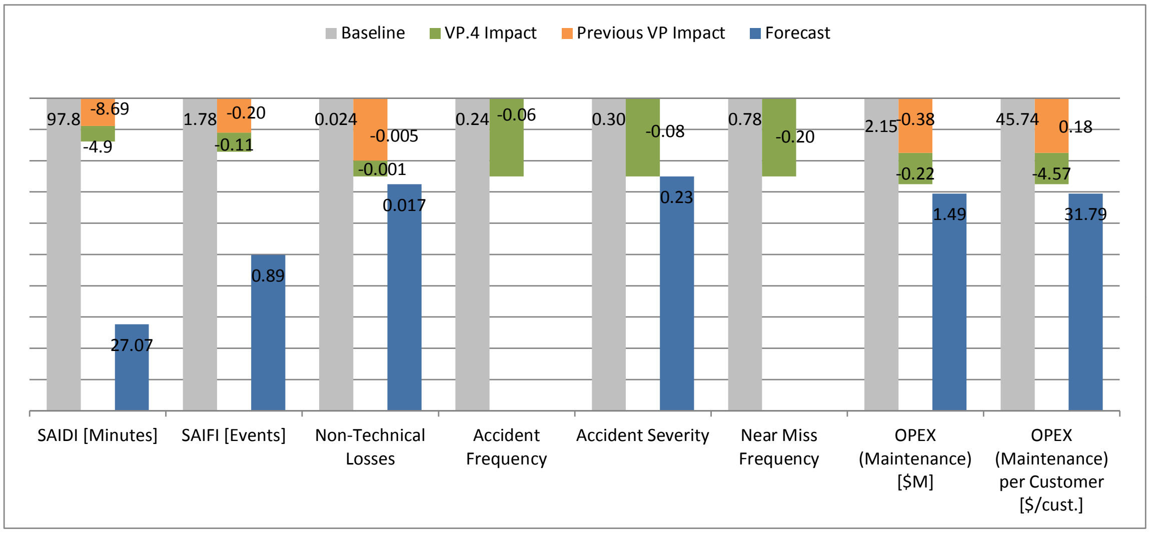


Figure 8.50.: VP.4 - Impact on KPIs (a)

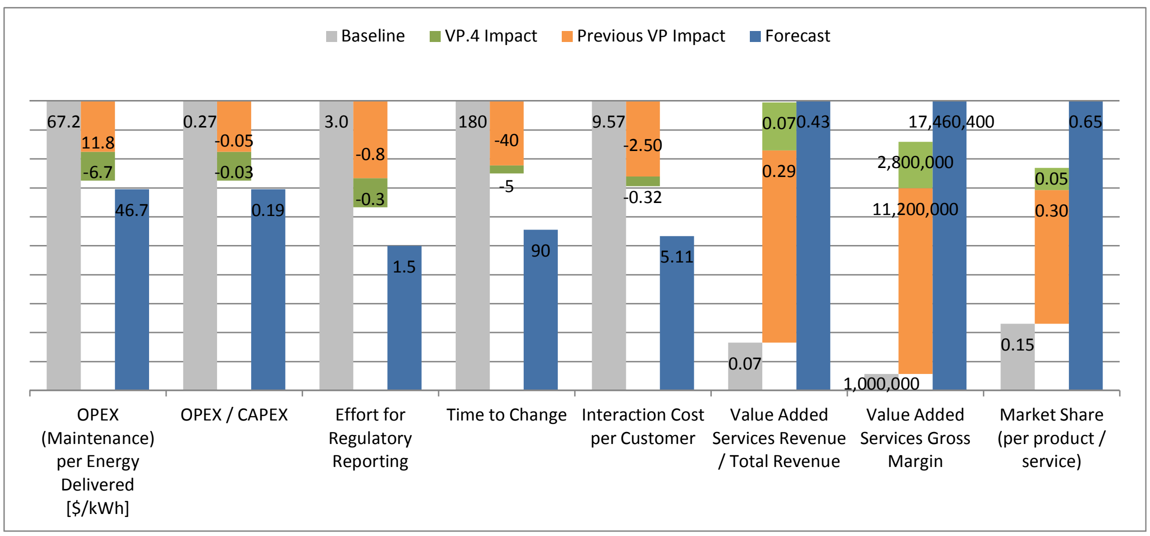


Figure 8.51.: VP.4 - Impact on KPIs (b)

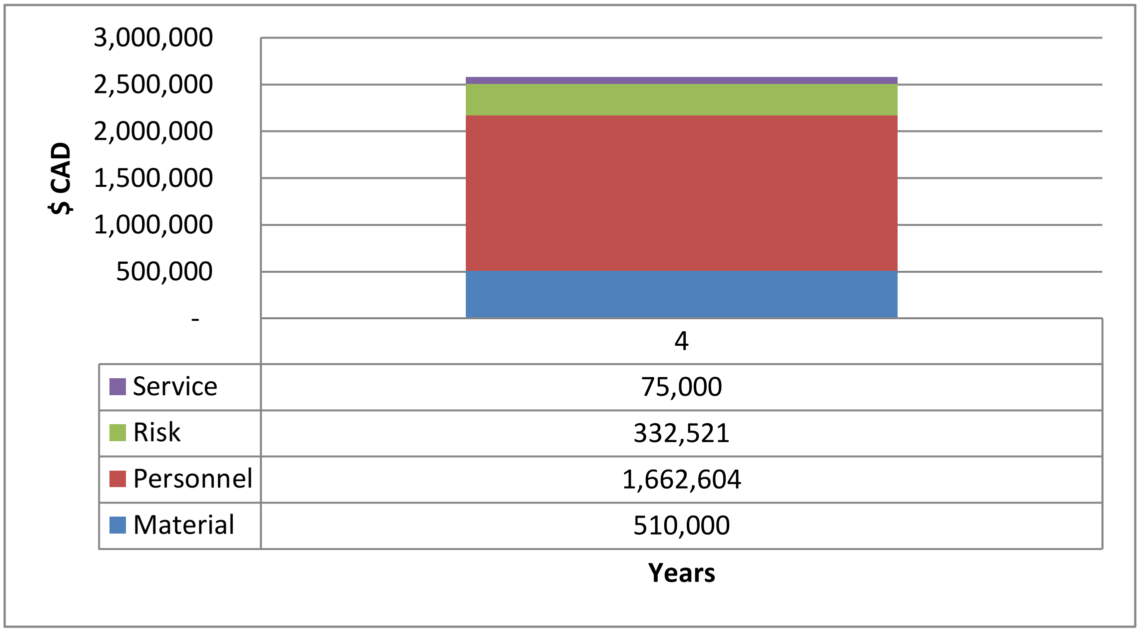


Figure 8.52.: VP.4 Budgets

Table 8.39.: VP. 4 Costs per Initiative & Technology

Items	Material	Personnel	Service	Risk	Grand Total
Contribution Category 1		**$ 553,930.37**		**110,786.07**	**$ 664,716.44**
Manage (regulatory) reporting		**$ 54,115.69**		**10,823.14**	**$ 64,938.83**
Introduce manual correlation and combination of reports		$ 54,115.69		10,823.14	$ 64,938.83
Manage non-technical losses		**$ 90,008.94**		**18,001.79**	**$ 108,010.72**
Introduce analysis of consumption using historic data		$ 90,008.94		18,001.79	$ 108,010.72
Manage safety		**$ 98,755.20**		**19,751.04**	**$ 118,506.24**
Establish electronic communication between control center and work crews		$ 98,755.20		19,751.04	$ 118,506.24
Manage stakeholders		**$ 75,354.25**		**15,070.85**	**$ 90,425.10**
Introduce pro-active communication based on anticipated stakeholder reaction to potential events		$ 75,354.25		15,070.85	$ 90,425.10
Manage company programs		**$ 58,141.54**		**11,628.31**	**$ 69,769.85**
Introduce program level oriented coordination and impact based program controlling		$ 58,141.54		11,628.31	$ 69,769.85
Manage tender		**$ 177,554.75**		**35,510.95**	**$ 213,065.70**
Introduce tendering by functional requirements leveraging multiple vendors		$ 177,554.75		35,510.95	$ 213,065.70
Contribution Category 2		**$ 596,140.28**	**$ 25,000.00**	**119,228.06**	**$ 740,368.34**
Manage grid information		**$ 167,541.46**		**33,508.29**	**$ 201,049.75**
Introduce a comprehensive KPI system for all assets		$ 96,882.54		19,376.51	$ 116,259.05
Introduce grid structures as aggregation hierarchies		$ 70,658.92		14,131.78	$ 84,790.71
Manage grid value		**$ 79,303.00**		**15,860.60**	**$ 95,163.60**
Introduce KPI Monitoring on Grid Segment Level		$ 79,303.00		15,860.60	$ 95,163.60
Manage maintenance		**$ 82,895.23**		**16,579.05**	**$ 99,474.28**
Introduce event monitoring on key assets		$ 82,895.23		16,579.05	$ 99,474.28
Manage operational customer communication		**$ 163,184.93**	**$ 25,000.00**	**32,636.99**	**$ 220,821.91**
Introduce targeted (individuals) communication		$ 163,184.93	$ 25,000.00	32,636.99	$ 220,821.91
Manage work execution		**$ 103,215.66**		**20,643.13**	**$ 123,858.80**
Introduce a close, continuous and automated coordination between control centre and workforce		$ 103,215.66		20,643.13	$ 123,858.80
Contribution Category 3		**$ 110,767.88**	**$ 50,000.00**	**22,153.58**	**$ 182,921.45**
Manage product-service portfolio		**$ 110,767.88**	**$ 50,000.00**	**22,153.58**	**$ 182,921.45**
Introduce an attitude based customer segmentation		$ 110,767.88	$ 50,000.00	22,153.58	$ 182,921.45
Infrastructure	**$ 510,000.00**	**$ 401,765.76**		**80,353.15**	**$ 992,118.91**
Enterprise Asset Management	**$ 150,000.00**	**$ 130,507.33**		**26,101.47**	**$ 306,608.80**
GIS	$ 150,000.00	$ 130,507.33		26,101.47	$ 306,608.80
Network Model Management	**$ 60,000.00**	**$ 186,396.64**		**37,279.33**	**$ 283,675.97**
Chronological Model	$ 20,000.00	$ 111,196.29		22,239.26	$ 153,435.55
Network Change Management	$ 40,000.00	$ 75,200.35		15,040.07	$ 130,240.42
Operational Data Store (ODS)	**$ 300,000.00**	**$ 84,861.78**		**16,972.36**	**$ 401,834.14**
Event Detection	$ 300,000.00	$ 84,861.78		16,972.36	$ 401,834.14
Grand Total	**$ 510,000.00**	**$ 1,662,604.29**	**$ 75,000.00**	**332,520.86**	**$ 2,580,125.15**

8.4.1. Establish electronic communication between control center and work crews

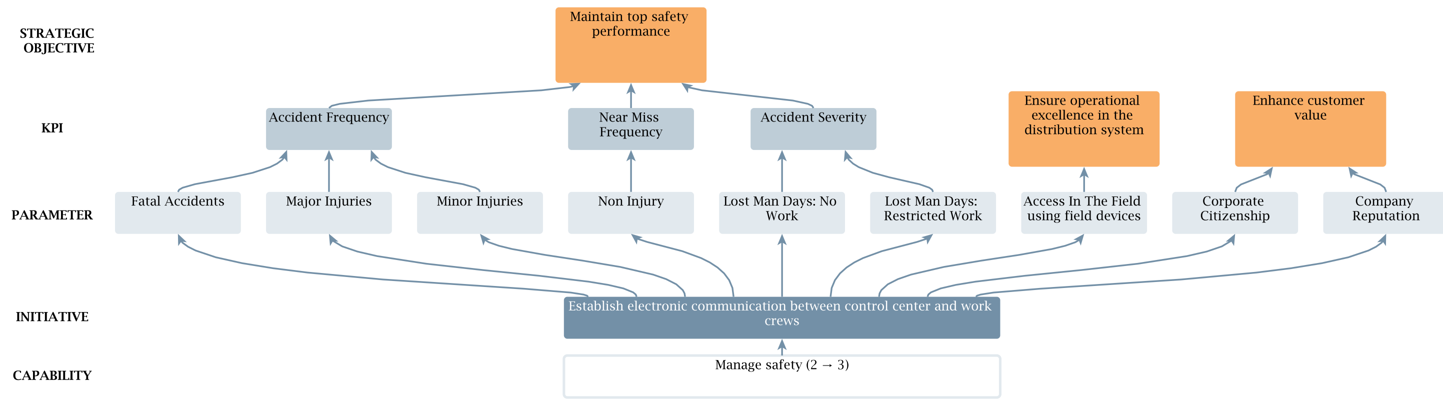


Figure 8.53.: VP.4 - Initiative No.1: Impact Chain

Table 8.40.: VP.4 - Initiative No.1: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Fatal Accidents	0.00	↓	↓	0.00	Number
Major Injuries	0.00	↓	↓	0.00	Number
Minor Injuries	4.00	-1.00	0.00	0.00	Number
Non Injury	13.00	-3.25	0.00	0.00	Number
Lost Man Days: No Work	0.00	↓	↓	0.00	Number
Lost Man Days: Restricted Work	5.00	-1.25	3.75	0.00	Days
Access In The Field using field devices	0.50	0.05	0.55	0.50	Ratio
Corporate Citizenship	0.54	↑	↑	1.00	Ratio
Company Reputation	0.75	↑	0.90	1.00	Ratio

This initiative will enhance overall safety by providing selected real-time feeder information to the field crews through smart devices to reduce the number of accidents, avoid severe injuries and minimize lost productive time. As part of the grid modernization program, real-time data will already be available from feeder-monitoring and advanced metering infrastructure which can then be leveraged for improving safety. The main activity in this initiative will therefore be integrating this real-time feeder information with online communication system between control center and field crew.

Investment in communication equipment in this initiative will enable the crew and control center to exchange information online e.g. new work orders, work order updates and work order closure information are transferred automatically from one to the other. Online communication will increase productivity by reducing the need for field crews to travel frequently, altogether supporting GSU's strategic objectives to maintain top safety performance, and ensure operational excellence in the distribution system.

While accident and injury rates at GSU are already very low, the impact of this initiative was assessed as a reduction in accidents and lost time due to accidents by 25% of current levels.

8.4.2. Introduce targeted (individuals) communication

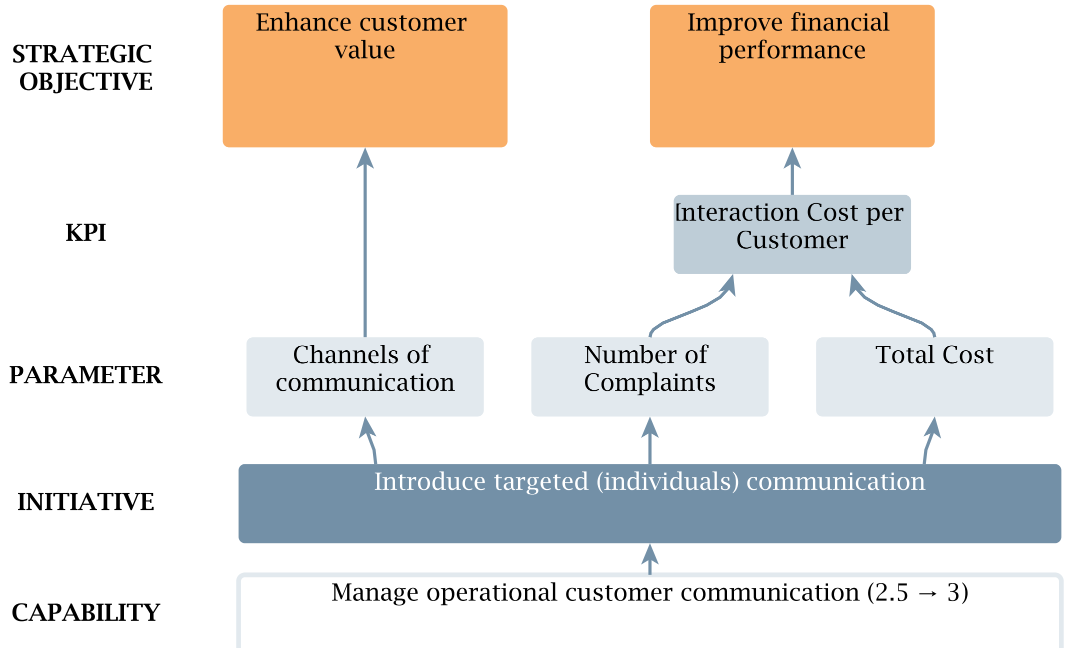


Figure 8.54.: VP.4 - Initiative No.2: Impact Chain

Table 8.41.: VP.4 - Initiative No.2: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Channels of communication	5	↑	6	6	Number
Number of Complaints	292	↓	↓	100	Number
Total Cost	450,000	-10,000	240,000	350,000	$

The existing communication process for operational information will be extended to enable determination of individual customers potentially affected by certain operational issues (e.g. unplanned outages). By implementing this initiative, targeting of individual customers with individual messages will be enabled, which will have a strong impact on GSU's strategic objective to enhance customer value.

This initiative will reduce the burden on customer service staff by increasing push information provided to customers, reducing total interaction costs by about 2%.

8.4.3. Introduce analysis of consumption using historic data

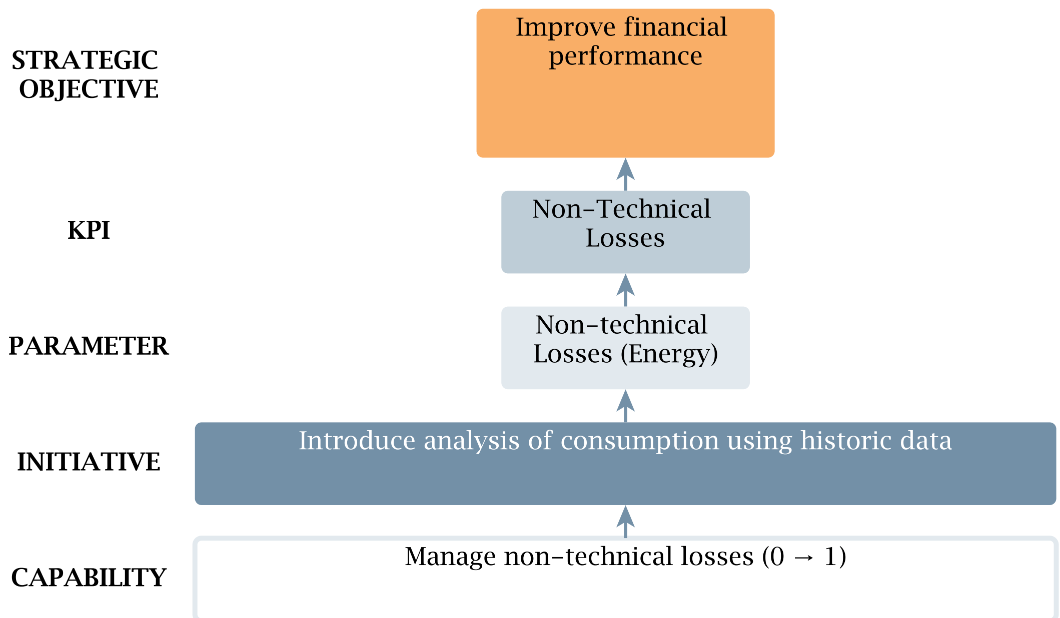


Figure 8.55.: VP.4 - Initiative No.3: Impact Chain

Table 8.42.: VP.4 - Initiative No.3: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Non-technical Losses (Energy)	0.0240	-0.0012	0.0174	0.0240	Ratio

GSU currently does not have a structured program to manage non-technical losses / theft, however smart meter technologies are able to provide tamper alerts, and when accounts transition, meters remain active so consumption can billed to the new account owner.

By leveraging the existing smart meter technology to obtain historical data, abnormal changes in metered consumption patterns can be identified. This initiative will establish a systematic process to analyze historic consumption patterns and compare with current consumption. Within the process, an additional step will combine historic and current consumption, site occupancy, and inspection reports to detect suspicious consumption patterns.

This initiative will aim to reduce non-technical losses through detecting unauthorized connections and meter failures. The workshop team assessed a 5% reduction in non-technical losses as a result of this initiative.

8.4.4. Introduce a comprehensive KPI system for all assets

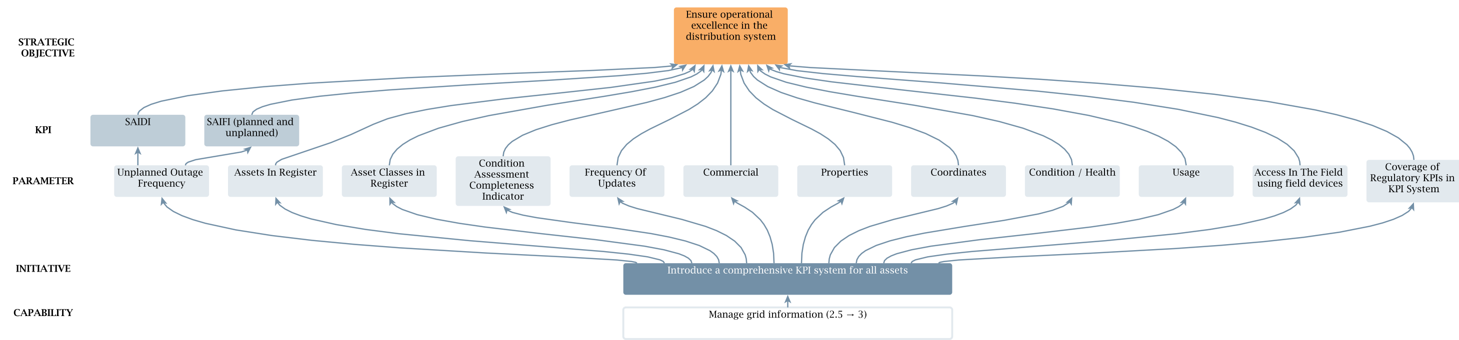


Figure 8.56.: VP.4 - Initiative No.4: Impact Chain (a)

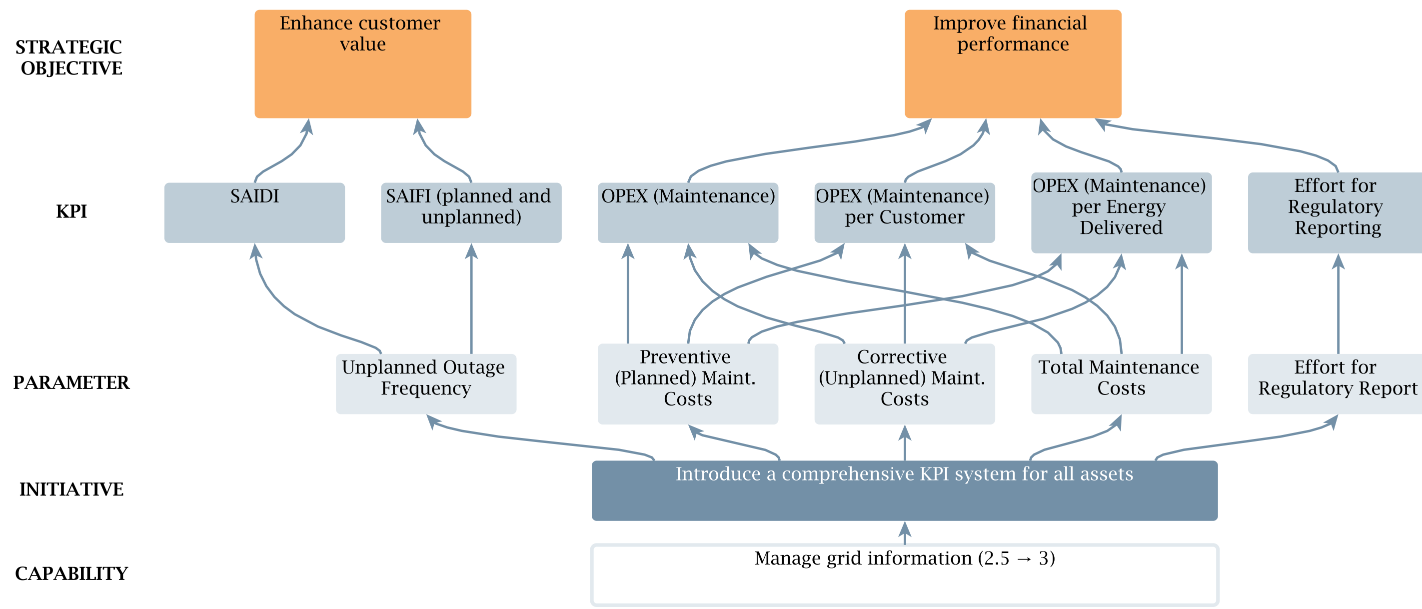


Figure 8.57.: VP.4 - Initiative No.4: Impact Chain (b)

Table 8.43.: VP.4 - Initiative No.4: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Unplanned Outage Frequency	233	-2.33	200	N/A	Number
Preventive (Planned) Maint. Costs	0.30	0.04	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.04	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-43,000	1,494,250	1,650,000	$
Assets In Register	102,873	↑	↑	↑	Number
Asset Classes in Register	20	↑	↑	↑	Number
Condition Assessment Completeness Indicator	0.83	↑	↑	0.90	Ratio
Frequency Of Updates	200	↑	↑	↑	Number
Commercial	0.00	↑	↑	1.00	Ratio
Properties	0.00	↑	1.00	1.00	Ratio
Coordinates	0.00	↑	↑	1.00	Ratio
Condition / Health	0.00	0.50	1.00	1.00	Ratio
Usage	0.00	0.50	1.00	1.00	Ratio
Access In The Field using field devices	0.50	↑	0.55	0.50	Ratio
Coverage of Regulatory KPIs in KPI System	0.00	0.10	0.80	1.00	Ratio
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

In an earlier value pack, a basic cross-silo KPI system was established which is improved in this initiative by extending it to all assets and by tracking additional information classes (financial, technical, geographical).

Considering additional information in an extended KPI system which covers all assets will address GSU's strategic objective to ensure operational excellence in the distribution system and to improve financial performance.

Comprehensive awareness of asset health will aid GSU in deciding whether it makes sense to, for example, increase preventive maintenance on problem components or to replace problem components with more modern solutions to avoid anticipated failures.

The impact of this initiative was assessed by the Workshop team as enabling a reduction in unplanned outage frequency by 1%, and a corrective maintenance costs by 4%, half of which might be allocated to preventive activities.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.4.5. Introduce grid structures as aggregation hierarchies

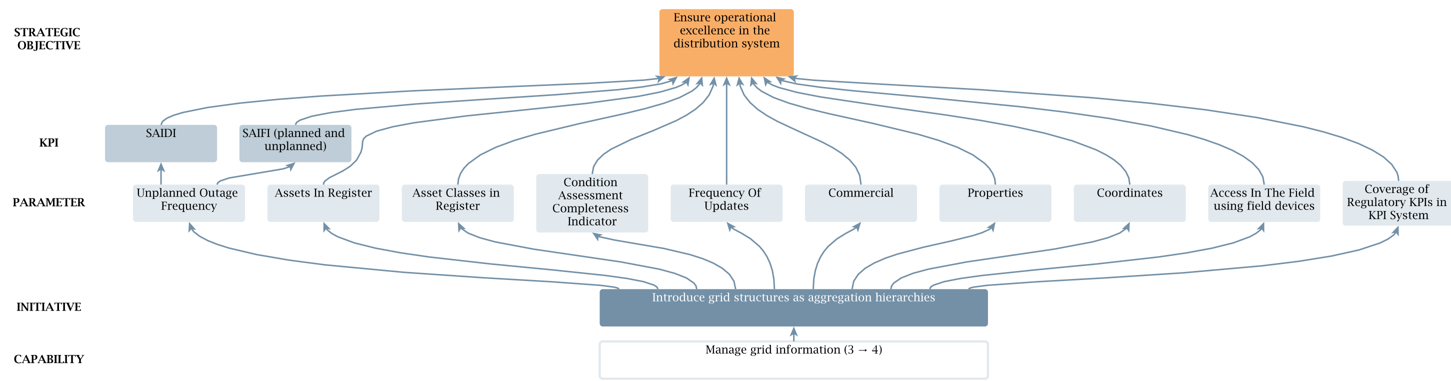


Figure 8.58.: VP.4 - Initiative No.5: Impact Chain (a)

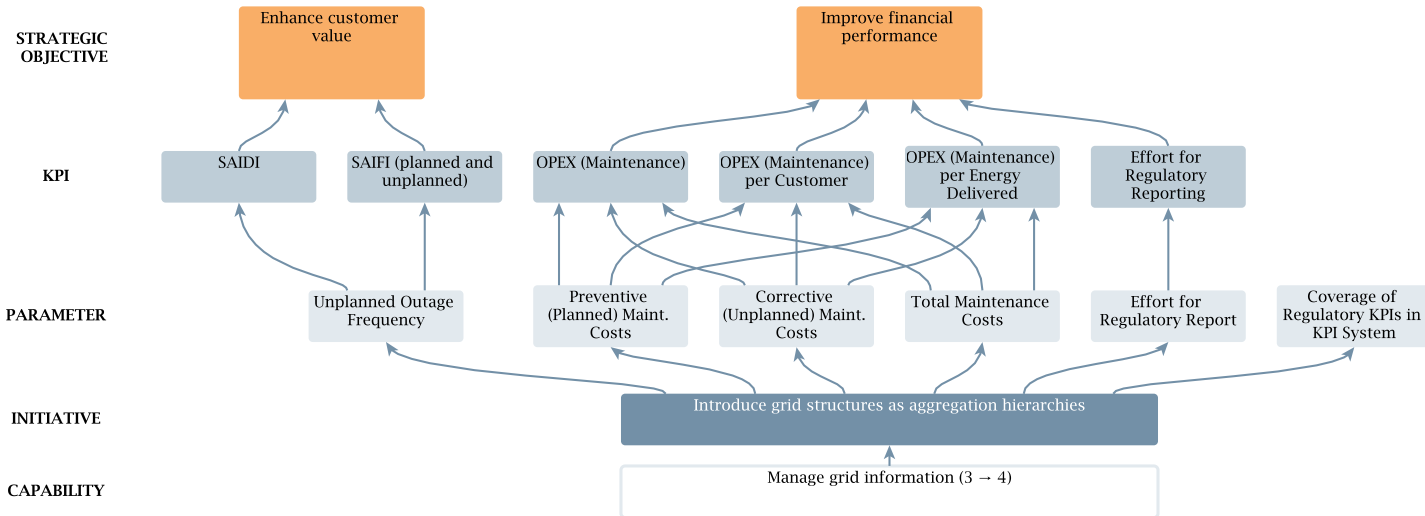


Figure 8.59.: VP.4 - Initiative No.5: Impact Chain (b)

Table 8.44.: VP.4 - Initiative No.5: Impact

Parameter	Baseline	Impact	Forecast	Target	Unit
Unplanned Outage Frequency	233	-2.33	200	N/A	Number
Preventive (Planned) Maint. Costs	0.30	0.04	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.04	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-43,000	1,494,250	1,650,000	$
Assets In Register	102,873	↑	↑	↑	Number
Asset Classes in Register	20.00	↑	↑	↑	Number
Condition Assessment Completeness Indicator	0.83	↑	↑	0.90	Ratio
Frequency Of Updates	200	↑	↑	↑	Number
Commercial	0.00	↑	↑	1.00	Ratio
Properties	0.00	↑	1.00	1.00	Ratio
Coordinates	0.00	↑	↑	1.00	Ratio
Access In The Field using field devices	0.50	↑	0.55	0.50	Ratio
Coverage of Regulatory KPIs in KPI System	0.00	0.10	0.80	1.00	Ratio
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

This initiative will develop a process for assessing asset management information at the grid segment level. This will enable the identification of risks and prioritization of activity based on groups of assets present in specific grid areas.

Placing asset information in its grid context implies a system-oriented view of asset performance which is achieved by, for example, placing sensors on strategic grid segments to identify under-performing segments and mapping the sensor information on grid topology. This will enable GSU to locate under-performing assets/segments, see the remaining book value of assets and decide on whether to replace them.

Therefore, this initiative establishes the capability to manage, access and aggregate asset information in its grid context (topology) as well as extension of the KPI system with KPIs on grid segment level. This will allow GSU to break-down asset maintenance strategies in its grid context and down to grid segment level which helps improve daily operation, maintenance and planning.

The impact of this initiative was assessed by the workshop team as enabling a reduction in unplanned outage frequency by 1%, and a corrective maintenance costs by 4%, half of which might be allocated to preventive activities.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.4.6. Introduce event monitoring on key assets

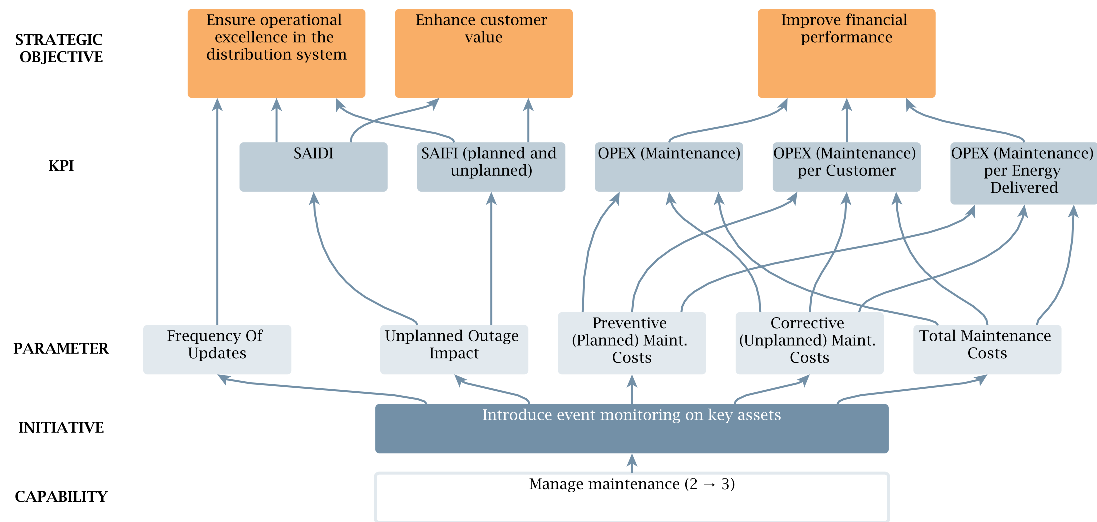


Figure 8.60.: VP.4 - Initiative No.6: Impact Chain

Table 8.45.: VP.4 - Initiative No.6: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Unplanned Outage Impact	335	-17	184	N/A	Customers
Preventive (Planned) Maint. Costs	0.30	0.05	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.05	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-53,750	1,494,250	1,650,000	$
Frequency Of Updates	200	↑	↑	↑	Number

This initiative equips key assets with condition monitoring equipment in order to use condition and event information, such as a higher number of overload events on a critical transformer, for the creation of additional maintenance measures or modification of existing maintenance plans.

This means GSU will be able to alter maintenance plans in case certain pre-defined events are detected on one or more assets. Using this information, new maintenance strategies can be derived and existing maintenance procedures can be optimized. Such enhanced awareness of key asset behaviour will help detect potential issues before they occur through calculating fault probabilities, in order to reduce the unplanned outage impacts, and to enhance customer satisfaction and value.

The impact of this initiative was assessed by the workshop team as enabling a reduction in unplanned outage impact by 5%, and a corrective maintenance costs by 5%, half of which might be allocated to preventive activities.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

This initiative will extend the asset information model to capture event and maintenance history. This information will further improve maintenance planning to enable further cost savings and outage reduction by targeted proactive maintenance.

8.4.7. Introduce a close, continuous and automated coordination between control centre and workforce

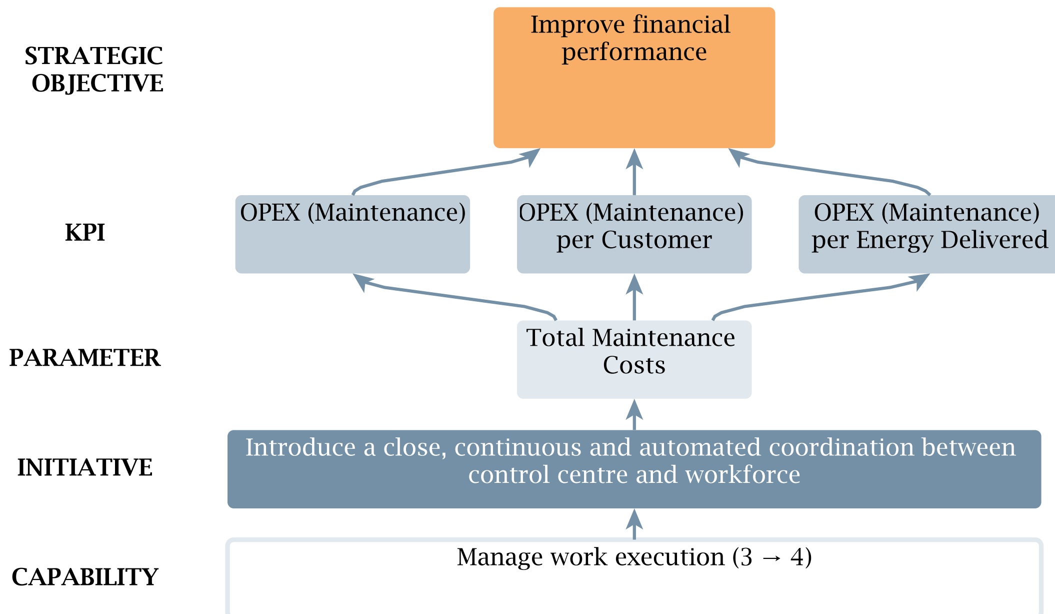


Figure 8.61.: VP.4 - Initiative No.7: Impact Chain

Table 8.46.: VP.4 - Initiative No.7: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Total Maintenance Costs	2,150,000	-21,500	1,494,250	1,650,000	$

Implementation of this initiative will formalize information flow by enabling the field crew to have their tasks organized in sub-steps with estimated completion times for each step. The overall effect of this initiative will be faster repairs, less downtime and improvement in the reliability which addresses GSU's strategic targets of providing exceptional customer value, maintaining financial strength and improving workforce skills to create a sustainable energy system for future generations.

Information about work execution at each step is automatically communicated to the control center as field crews progress down their task lists. Switch status will be continually updated and accessible to field crews for safety purposes which is expected to become even more critically important as increasing numbers of distributed generators are connected to the grid posing the risk of nominally ‘OFF’ lines being ‘LIVE’ due to backfeed from local distributed generation.

Increasing the investment in modern communication equipment will help optimize information flows which will enable GSU to increase the productivity of its crew and reduce the number of unnecessary trips to stock yards, warehouses and incident locations. As accurate details about the incident nature, its location and the tools needed for the job are available to the right work crew at the right time, GSU will be able to support the strategic objectives to improve financial performance, enhance customer value, maintain top safety performance and ensure operational excellence in the distribution system.

This initiative will enable further 1% savings in maintenance costs, by reducing communication-related delays in completing maintenance activities.

8.4.8. Introduce KPI Monitoring on Grid Segment Level

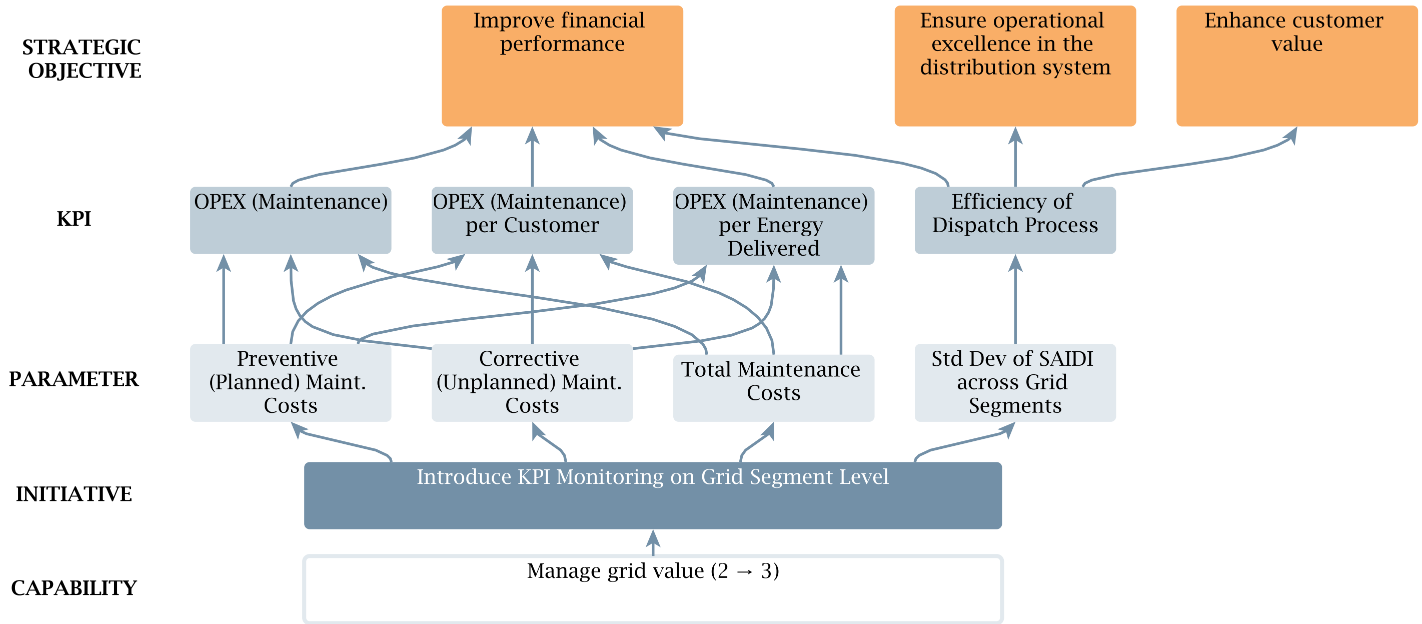


Figure 8.62.: VP.4 - Initiative No.8: Impact Chain

Table 8.47.: VP.4 - Initiative No.8: Impact

Parameter	Baseline	Impact	Forecast	Target	Unit
Preventive (Planned) Maint. Costs	0.30	0.05	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.05	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-53,750	1,494,250	1,650,00	$
Std Dev of SAIDI across Grid Segments	0.40	-0.02	0.28	0.20	Ratio

With this initiative, a process for value oriented grid management will be established. The process will provide transparency to the individual network segments to allow a better understanding of the contribution of each segment to overall business success, what the possible causes are and what needs to be changed in certain segments. This transparency can help identify grid segments that are under-performing, e.g. encounter frequent metering failures and non-technical losses of energy (theft) where grid-level KPI monitoring will increase number of detections and may lead to increased revenue recovery.

Aggregating KPIs and monitoring them on a grid segment level will also provide management insights into the risk variance between different grid segments. For example, a grid segment with relatively new assets but in a dense urban environment might have higher risk than a grid segment serving a suburban community with considerably older assets. Understanding risk value and risk variance and monitoring KPIs on grid segment level support GSU's strategic objective of improving financial performance.

The impact of this initiative was assessed by the Workshop team as enabling a reduction in corrective maintenance costs by 5%, half of which might be allocated to preventive activities. In addition, it will reduce the variance of SAIDI across grid segments by 5%.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.4.9. Introduce manual correlation and combination of reports

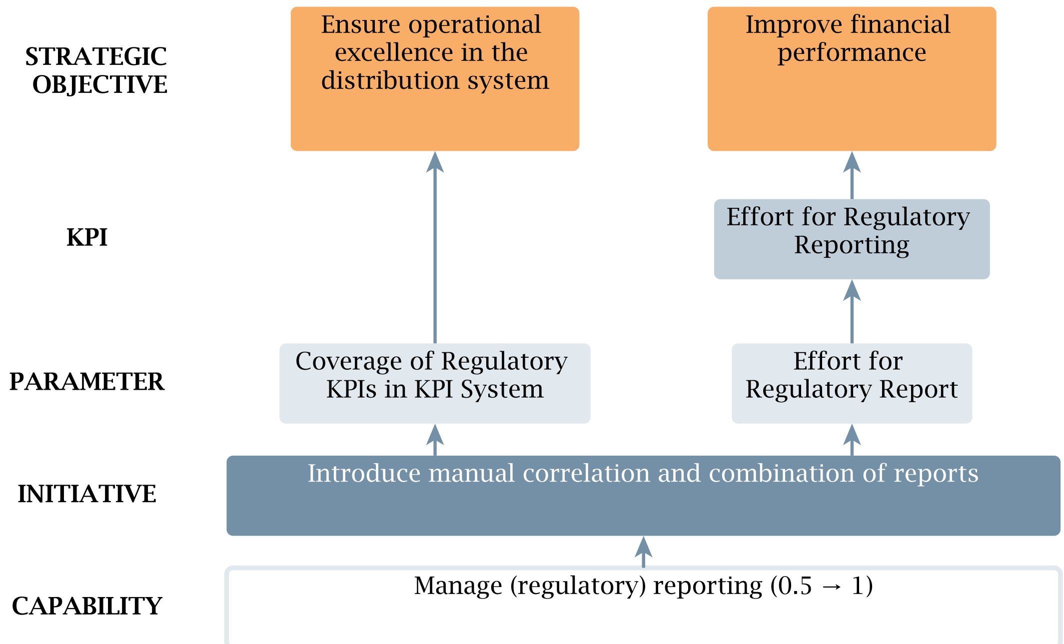


Figure 8.63.: VP.4 - Initiative No.9: Impact Chain

Table 8.48.: VP.4 - Initiative No.9: Impact

Parameter	Baseline	Impact	Forecast	Target	Unit
Coverage of Regulatory KPIs in KPI System	0.00	0.10	0.80	1.00	Ratio
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

This initiative will extend the reporting process to cover manual correlation and combination of reports and sub-reports to produce a comprehensive report covering all required information. This initiative will extend automation for report generation to cover all necessary reports containing the required technical, commercial and geographical data etc.

The workshop team estimated a 0.1 FTE reduction in effort for regulatory reporting as a result of this initiative. More broadly, it will contribute to GSU's strategic objective to improve financial performance through reduced complexity.

8.4.10. Introduce pro-active communication based on anticipated stakeholder reaction to potential events

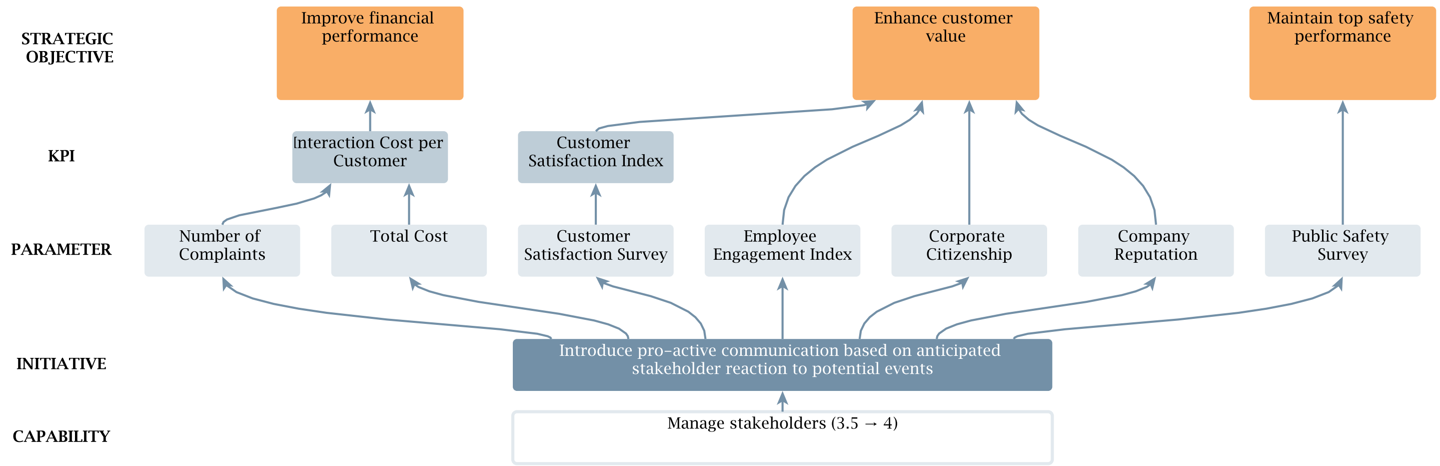


Figure 8.64.: VP.4 - Initiative No.10: Impact Chain

Table 8.49.: VP.4 - Initiative No.10: Impact

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Number of Complaints	292	$\downarrow$	$\downarrow$	100	Number
Total Cost	450,000	-5,000	240,000	350,000	$
Customer Satisfaction Survey	0.95	$\uparrow$	0.97	1.00	Ratio
Employee Engagement Index	N/A	$\uparrow$	$\uparrow$	N/A	Ratio
Corporate Citizenship	0.54	$\uparrow$	$\uparrow$	1.00	Ratio
Company Reputation	0.75	$\uparrow$	0.90	1.00	Ratio
Public Safety Survey	0.63	$\uparrow$	$\uparrow$	1.00	Ratio

Extending the capabilities established in previous initiatives, this initiative takes into account future potential disruptive events and the anticipated reaction of stakeholders. A streamlined process will be established for evaluating anticipated stakeholder reaction to potential events.

As a result of evaluating feedback from stakeholders, a comprehensive and coherent communication strategy can be carried out through customer education campaigns (e.g. through brochures accompanying monthly bills) in parallel with marketing/advertising campaigns in the media.

This initiative will extend pro-active communication that further takes into account future potential events (development of smart grids) and their impact on anticipated stakeholders.

While numerical impacts for this initiative were not assessed, it will contribute to GSU's strategic objective to enhance customer value by optimizing stakeholder relationships.

8.4.11. Introduce tendering by functional requirements leveraging multiple vendors

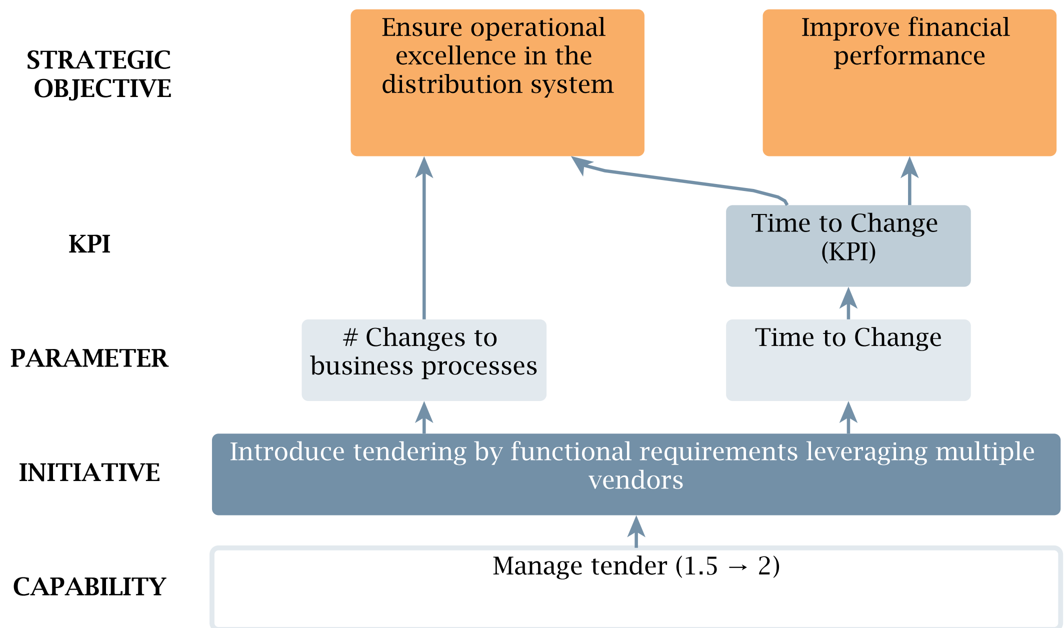


Figure 8.65.: VP.4 - Initiative No.11: Impact Chain

Table 8.50.: VP.4 - Initiative No.11: Impact

Parameter	Baseline	Impact	Forecast	Target	Unit
Time to Change	180	-5	100	90	Days
# Changes to business processes	10	2	29	15	Number

Tendering processes are often designed to ensure transparency and fairness through rigidly structured formats and requirements, often using independent basis of design to develop detailed specifications. The drawbacks to this approach are especially significant in emerging or rapidly changing areas of technology such as digital grid. In this environment, overly rigid specifications can hamper innovative and cost effective solutions that may ultimately lead to achieving the same or better functional requirements.

This initiative will extend the existing tendering process to define component specifications by functional requirements (usage). Establish multiple vendor sourcing to facilitate volume purchases. Standardized T&Cs are defined and managed for key vendors.

By reducing the timeline for procurement while ensuring a competitive and effective tendering framework, this initiative will contribute to the goal of increasing organizational flexibility by reducing time to complete changes and increase the number of changes.

8.4.12. Introduce program level oriented coordination and impact based program controlling

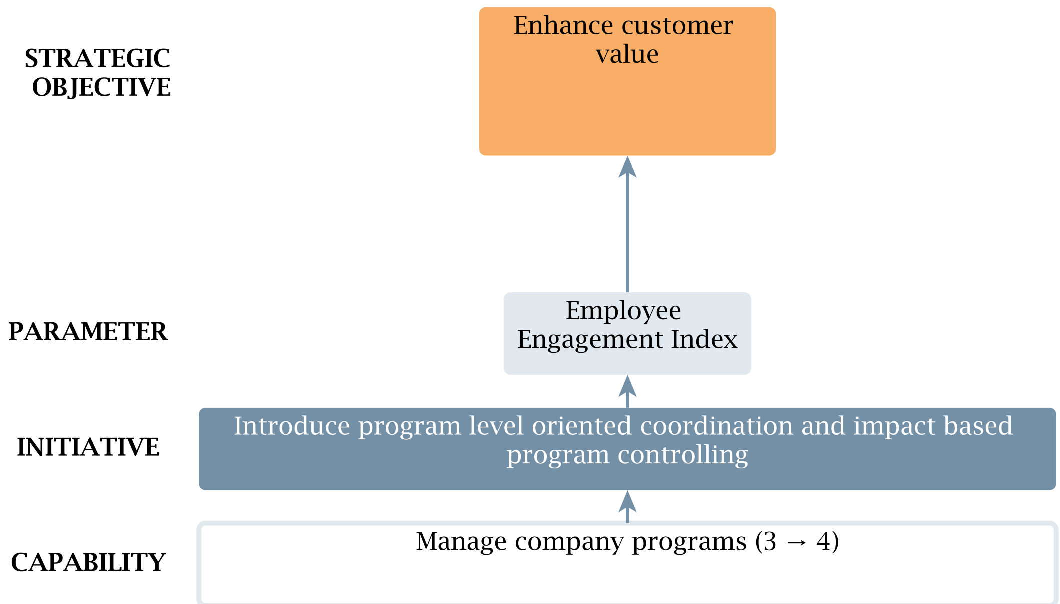


Figure 8.66.: VP.4 - Initiative No.12: Impact Chain

Table 8.51.: VP.4 - Initiative No.12: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Employee Engagement Index	N/A	↑	↑	N/A	Ratio

Through previous initiatives, GSU will have built level 3 capability in managing company programs. This capability includes standardizing project management approaches, and coordinating programs on a value pack level, with controlling based on outcomes.

This initiative will extend the existing outcome based program controlling to an impact based program controlling in order to match it to the coordination on program level. In this context it is required to implement new process steps for the definition, management and monitoring of KPIs that reflect the impact of the program.

While numerical impacts for this initiative were not assessed, it will contribute to GSU's strategic objective to ensure operational excellence in the distribution system, and will facilitate the management and execution of all projects and programs.

8.4.13. Introduce an attitude based customer segmentation

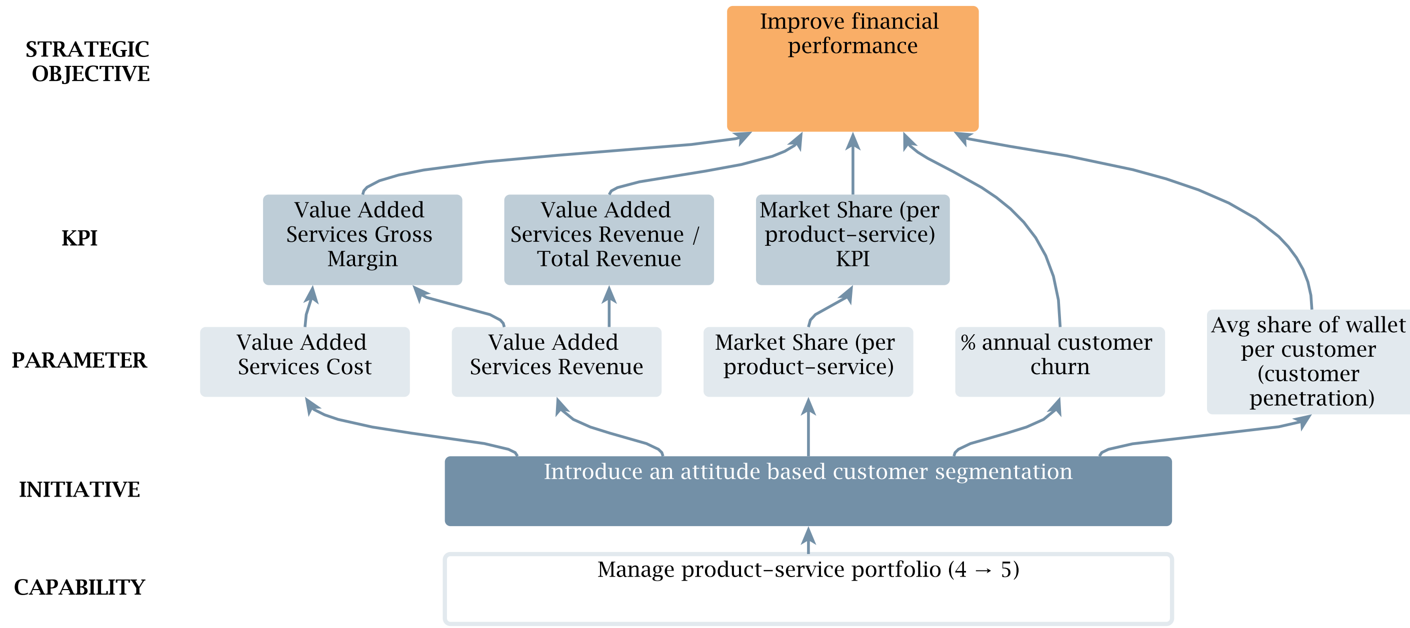


Figure 8.67.: VP.4 - Initiative No.13: Impact Chain (a)

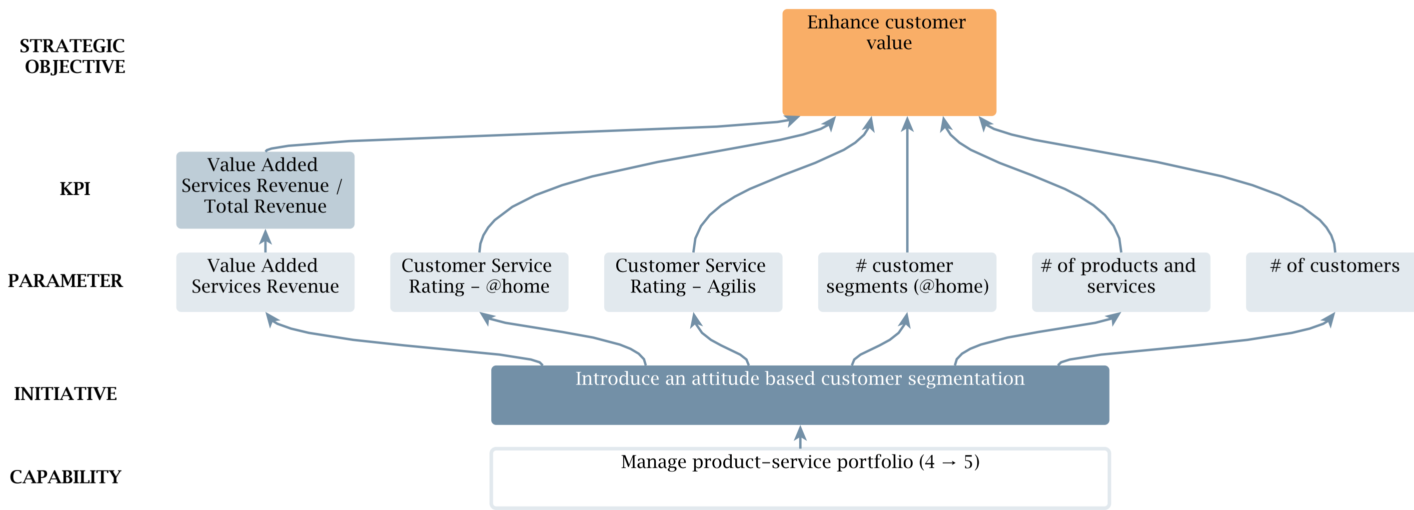


Figure 8.68.: VP.4 - Initiative No.13: Impact Chain (b)

Table 8.52.: VP.4 - Initiative No.13: Impact

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Value Added Services Cost	9,000,000	7,200,000	42,850,000	45,000,000	$
Value Added Services Revenue	10,000,000	10,000,000	60,310,400	60,000,000	$
Customer Service Rating - @home	0.94	↑	↑	0.99	Ratio
Customer Service Rating - Agilis	0.85	↑	↑	0.95	Ratio
# customer segments (@home)	2	↑	↑	↑	Number
Market Share (per product-service)	0.15	0.05	0.65	0.70	Ratio
# of products and services	10	5	25	30	Number
# of customers	10,400	↑	↑	60000	Number
% annual customer churn	0.05	↓	↓	0.02	Ratio
Avg share of wallet per customer (customer penetration)	36.11	↑	↑	100.00	$

This initiative will establish customer attitude as new aspect within product/service portfolio management. Adjust the existing process in order to enable definition and management of customer segments based on attitude. As prerequisite to do this, it is necessary to extend and evolve the existing capabilities around customer behaviour to include the customer attitude as well. The target of this change is to create the perception that products/services match the customer specific life stage and mindset.

This initiative will contribute to increasing market share for GSU's value-added services, by increasing the number of customers per product, and increasing the number of products offered, ultimately driving increased revenues and margins.

8.5. VP.5: Introducing Business Value and Risk as Parameters for Asset Management

Complex and large data sets originating from smart grid devices are only meaningful if understood in their right context. Operational data store functionalities planned in this Value Pack are critical for aggregating and manipulating such data sets according to their topological context.

Together with risk-based asset management, topological aggregation of smart grid data will create the basis for meaningful KPI models, forecasting these models and determining asset risk levels. As a result, GSU will be able to customize asset management strategies for chosen key assets based on business value as well as risk.

Many of the initiatives in this value pack were delayed until this value pack as a result of a value comparison with initiatives from previous value packs. During the workshops, as the importance of the business objectives was discussed and the relative impact of each of the initiatives on those objectives was discussed, the impacts of initiatives in areas other than asset and work management and organizational capabilities was deemed to be low. In this value pack, these initiatives further the groundwork laid by previous initiatives and begin to capitalize upon the capabilities that were introduced alongside the previous initiatives.

Consumption information, both from a company and customer point of view, is a focus of this value pack. The capabilities in this area are built on technologies that were rolled out in previous initiatives, with these initiatives extending the value of these technology investments.

Initiatives:

- Enforce security online
- Consider feeder head monitoring in manual determination of improved network configuration
- Introduce multi-channel access to consumption information
- Introduce analysis of consumption and supply over a period of time
- Consider cross KPI dependencies in systemic forecasting models for selected KPIs
- Introduce Business Value and Risk as additional criteria for strategy definition
- Introduce prediction of C&I DSM request leveraging historic response information
- Introduce reporting on a regular basis

- Introduce organization-wide standards for the management of change
- Introduce system based tendering capability
- Utilize market to obtain commodity components

Technology Deployments:

- Smart Grid Backbone - Operational Data Store (ODS) - Topological Aggregation
- Asset Management - Strategic Asset Management - Planning Integration
- Asset Management - Strategic Asset Management - Risk Based Asset Management

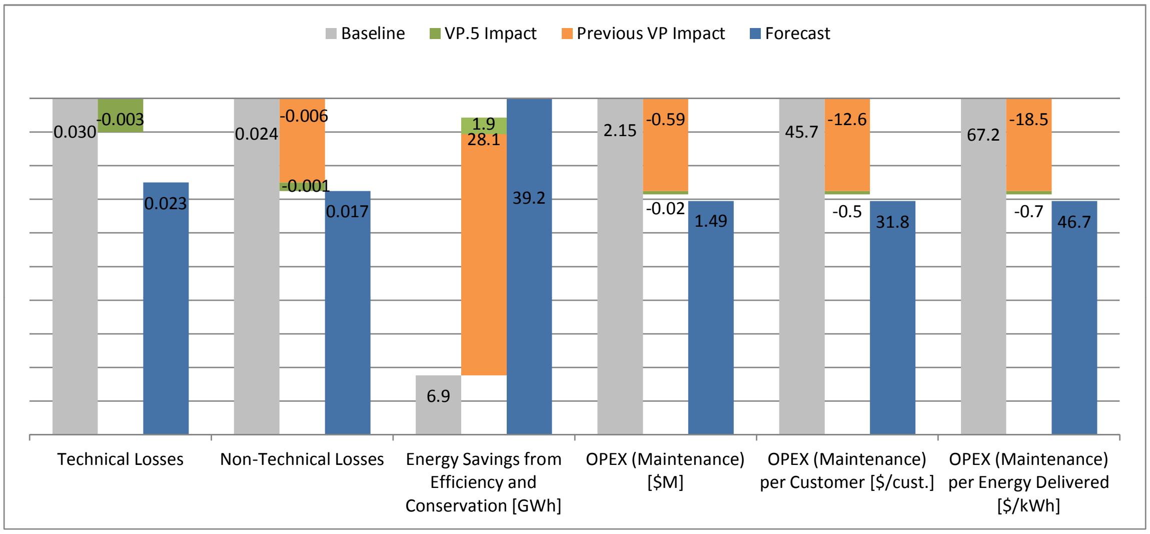


Figure 8.69.: VP.5 - Impact on KPIs (a)

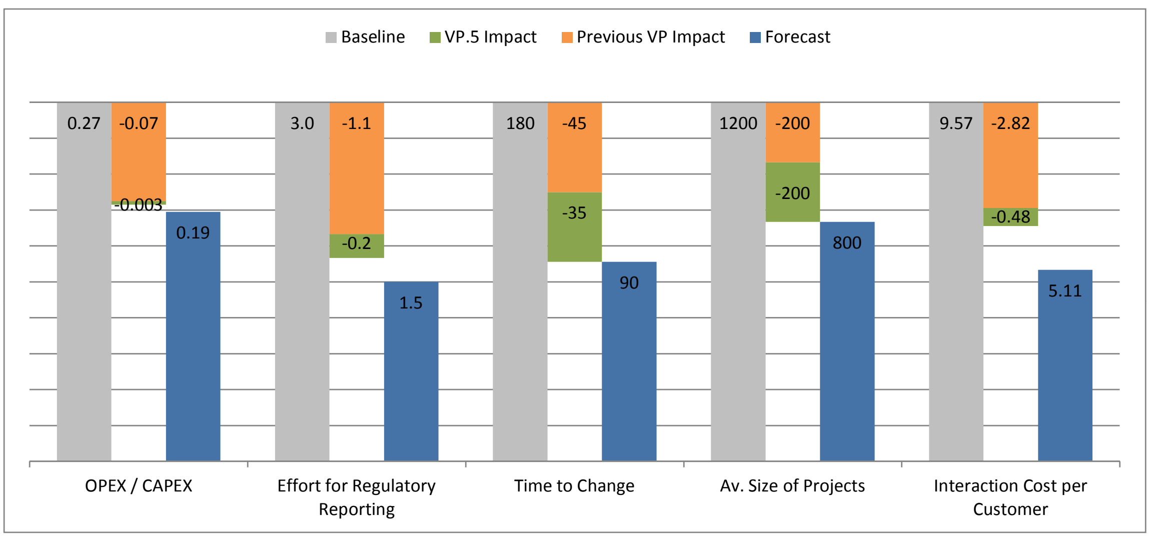


Figure 8.70.: VP.5 - Impact on KPIs (b)

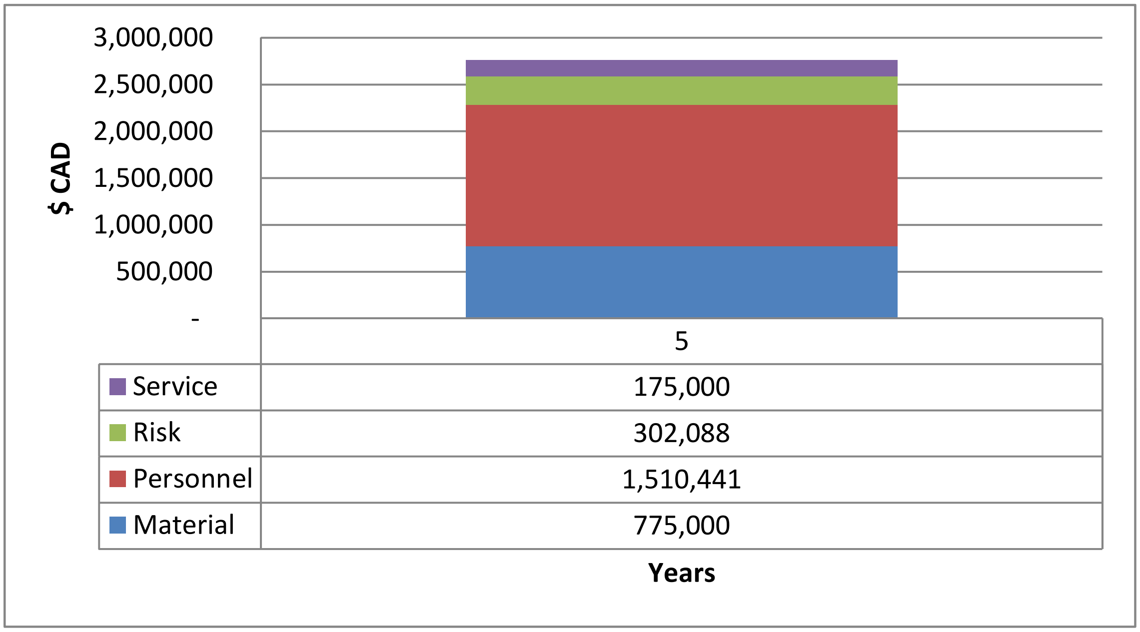


Figure 8.71.: VP.5 Budgets

Table 8.53.: VP. 5 Costs per Initiative & Technology

Items	Material	Personnel	Service	Risk	Grand Total
Contribution Category 1	**$ 250,000.00**	**$ 826,301.73**		**165,260.35**	**$ 1,241,562.08**
Manage (regulatory) reporting		**$ 57,322.94**		**11,464.59**	**$ 68,787.53**
Introduce reporting on a regular basis		$ 57,322.94		11,464.59	$ 68,787.53
Manage C&I DSM		**$ 136,761.36**		**27,352.27**	**$ 164,113.63**
Introduce prediction of C&I DSM requests leveraging historic response information		$ 136,761.36		27,352.27	$ 164,113.63
Manage change		**$ 66,680.73**		**13,336.15**	**$ 80,016.88**
Introduce organization-wide standards for the management of change		$ 66,680.73		13,336.15	$ 80,016.88
Manage grid asset strategies		**$ 85,545.26**		**17,109.05**	**$ 102,654.32**
Introduce Business Value and Risk as additional criteria for strategy definition		$ 85,545.26		17,109.05	$ 102,654.32
Manage non-technical losses		**$ 96,727.69**		**19,345.54**	**$ 116,073.22**
Introduce analysis of consumption and supply over a period of time		$ 96,727.69		19,345.54	$ 116,073.22
Manage safety	**$ 250,000.00**	**$ 117,288.67**		**23,457.73**	**$ 390,746.41**
Enforce security online	$ 250,000.00	$ 117,288.67		23,457.73	$ 390,746.41
Manage technical losses		**$ 177,554.75**		**35,510.95**	**$ 213,065.70**
Consider feeder head monitoring in manual determination of improved network configuration		$ 177,554.75		35,510.95	$ 213,065.70
Manage tender		**$ 88,420.32**		**17,684.06**	**$ 106,104.38**
Introduce system based tendering capability		$ 88,420.32		17,684.06	$ 106,104.38
Contribution Category 2	**$ 50,000.00**	**$ 302,767.24**	**$ 175,000.00**	**60,553.45**	**$ 588,320.69**
Manage customer presentment		**$ 129,775.18**	**$ 125,000.00**	**25,955.04**	**$ 280,730.22**
Introduce multi channel access to consumption information		$ 129,775.18	$ 125,000.00	25,955.04	$ 280,730.22
Manage KPI forecasting	**$ 50,000.00**	**$ 172,992.06**	**$ 50,000.00**	**34,598.41**	**$ 307,590.47**
Consider cross KPI dependencies in systemic forecasting models for selected KPIs	$ 50,000.00	$ 172,992.06	$ 50,000.00	34,598.41	$ 307,590.47
Contribution Category 3		**$ 91,824.81**		**18,364.96**	**$ 110,189.77**
Manage component portfolio		**$ 91,824.81**		**18,364.96**	**$ 110,189.77**
Utilize market to obtain commodity components		$ 91,824.81		18,364.96	$ 110,189.77
Infrastructure	**$ 475,000.00**	**$ 289,547.57**		**57,909.51**	**$ 822,457.08**
Strategic Asset Management	**$ 175,000.00**	**$ 204,271.08**		**40,854.22**	**$ 420,125.30**
Planning Integration	$ 50,000.00	$ 76,247.43		15,249.49	$ 141,496.92
Risk Based Asset Management	$ 125,000.00	$ 128,023.65		25,604.73	$ 278,628.38
Operational Data Store (ODS)	**$ 300,000.00**	**$ 85,276.49**		**17,055.30**	**$ 402,331.79**
Topological Aggregation	$ 300,000.00	$ 85,276.49		17,055.30	$ 402,331.79
Grand Total	**$ 775,000.00**	**$ 1,510,441.35**	**$ 175,000.00**	**302,088.27**	**$ 2,762,529.62**

8.5.1. Enforce security online

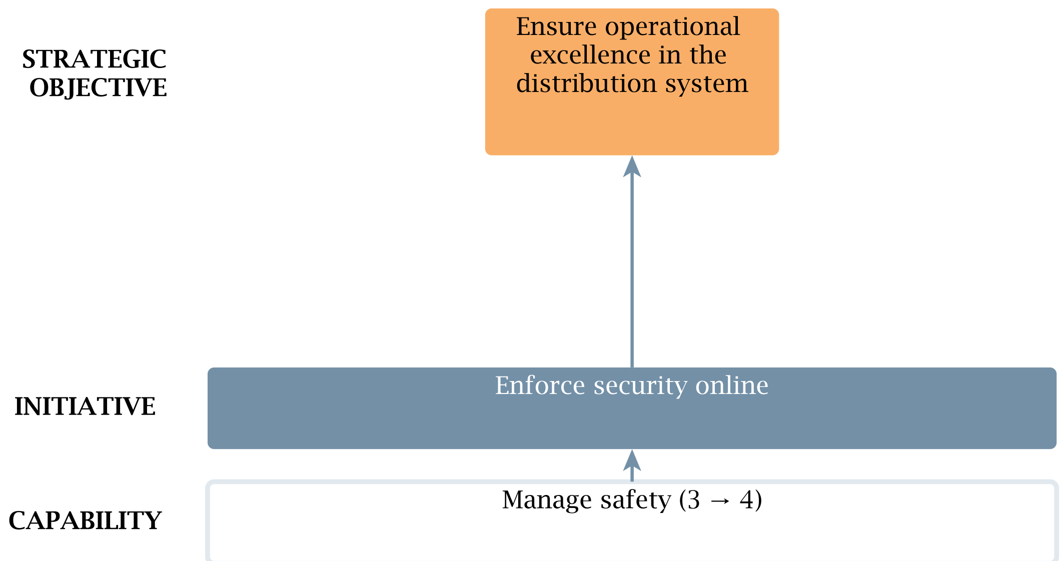


Figure 8.72.: VP.5 - Initiative No. 1: Impact Chain

Table 8.54.: VP.5 - Initiative No. 1: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
No parameter effects were assessed for this initiative.					

This initiative will establish online tracking and access control mechanisms into existing processes and facilities. This is necessary to ensure that only employees with authority, appropriate skills and an adequate reason can enter a facility, location or designated area. This would encompass implementing physical security devices that have online connectivity, for example keycards which can have permissions controlled, as well as validating the reason (enforcement) for someone having access to an area (e.g. work order was issued).

Numerical impacts were not assessed for this initiative however it was determined that this initiative will contribute to GSU's objective to maintain top safety performance through enhanced security.

8.5.2. Consider feeder head monitoring in manual determination of improved network configuration

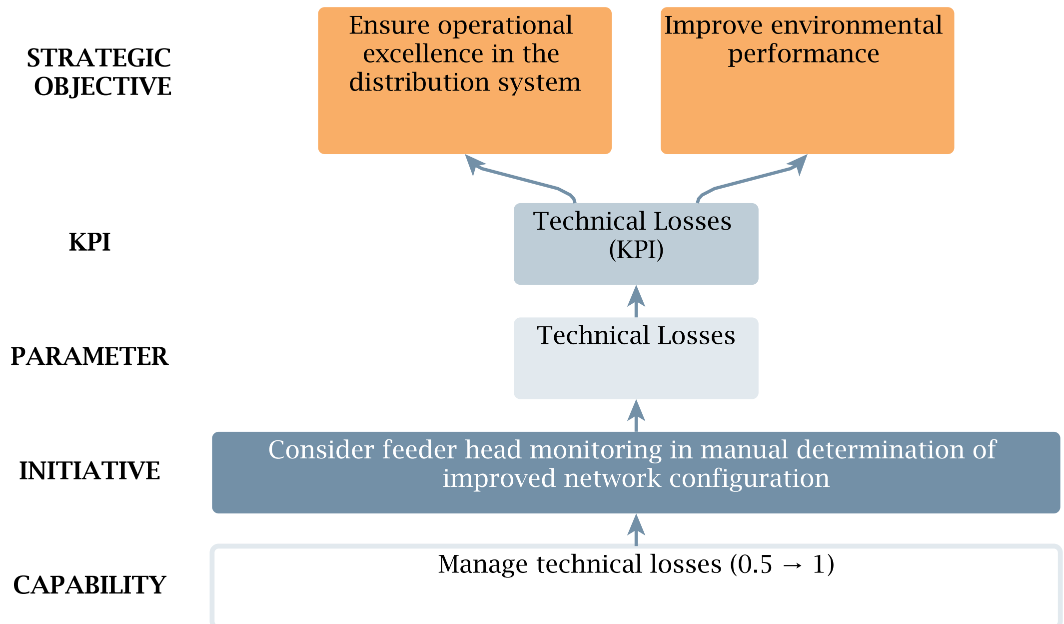


Figure 8.73.: VP.5 - Initiative No.2: Impact Chain

Table 8.55.: VP.5 - Initiative No.2: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Technical Losses	0.0300	-0.0030	0.0225	0.0300	Ratio

GSU currently employs load tap changers (LTCs) to optimize voltage levels and minimize losses, and has currently has a demonstration project underway to use inline power regulators.

This initiative will introduce feeder head monitoring to manually determine improved network configuration. Medium voltage measurements and locally controlled field devices are used to optimize energy delivery (i.e. time/voltage controlled capacitor banks and voltage regulators in addition to existing LTCs.).

The workshop team targeted a 10% reduction in technical losses due to this initiative.

8.5.3. Introduce multi channel access to consumption information

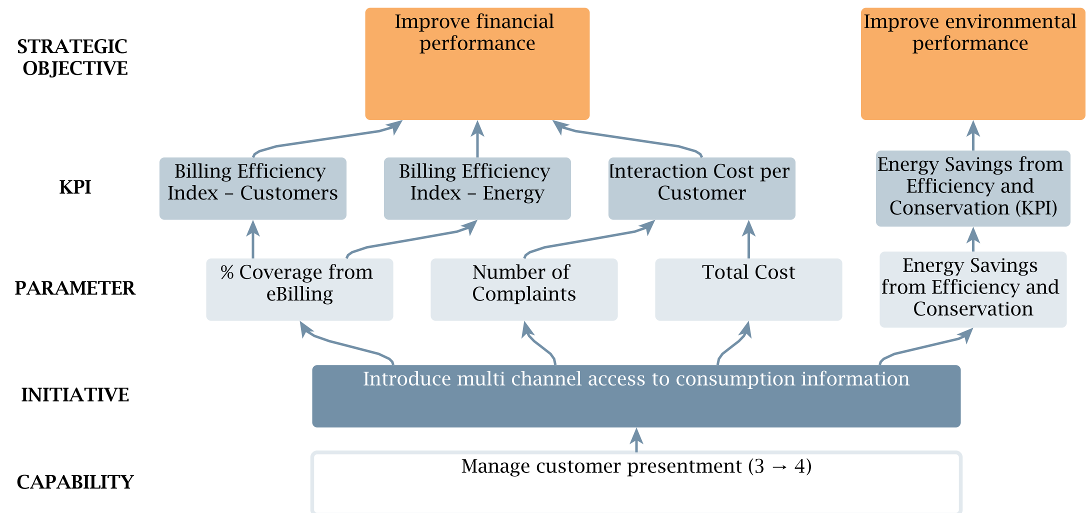


Figure 8.74.: VP.5 - Initiative No.3: Impact Chain (a)

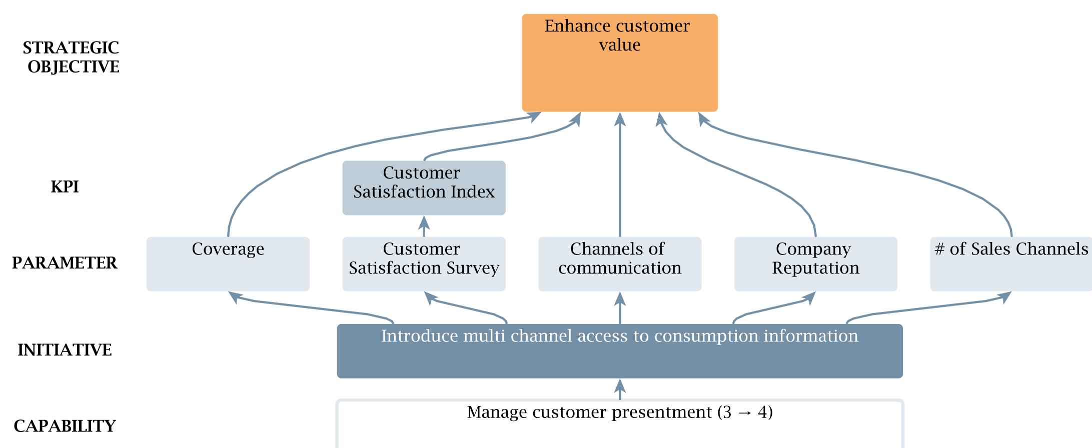


Figure 8.75.: VP.5 - Initiative No.3: Impact Chain (b)

This initiative establishes easy multi-channel access to consumption information that is able to show current and accumulated consumption. The immediate effect of this initiative

Table 8.56.: VP.5 - Initiative No.3: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
% Coverage from eBilling	0.00	0.10	0.40	0.40	Ratio
Coverage	12	↑	↑	N/A	Number
Channels of communication	5	1	6	6	Number
Number of Complaints	292	↓	↓	100	Number
Total Cost	450,000	-22,500	240,000	350,000	$
Energy Savings from Efficiency and Conservation	6,900	1,925	39,174	34,740	MWh
Customer Satisfaction Survey	0.95	↑	0.97	1.00	Ratio
Company Reputation	0.75	↑	0.90	1.00	Ratio
# of Sales Channels	2	1	12	10	Number

will be an increase in precision of targeting and customer base penetration that reduces peak power demand, energy consumed and emails from customers to inquire about billing precision. GSU also expects changes in customer behaviour that reduces consumption as a result of greater visibility about their energy use.

Taking advantage of the multi-channel access, additional value-added services can also be offered to customers thereby creating an additional revenue stream. Taken together, improvements in these parameters will help GSU in efficient use of energy which is supplied at least cost and sold as part of an innovative and diverse product portfolio.

Sharing of information establishes trust and helps the customers perceive and appreciate the received value, enabling GSU to further pursue its strategic objective to enhance customer value. GSU's strategic target will also be positively impacted by timely transmission of service issues (outages, maintenance etc) to customers through the multiple channels.

The workshop team assessed a 10% increase in coverage from ebilling as a result of driving increased portal traffic, and a 5% reduction in interaction costs through providing customers with greater options for accessing consumption information. In addition, a 5% reduction in energy use across a 10% segment of GSU's consumer base was estimated (0.5% overall reduction) based on increasing consumption awareness.

8.5.4. Introduce analysis of consumption and supply over a period of time

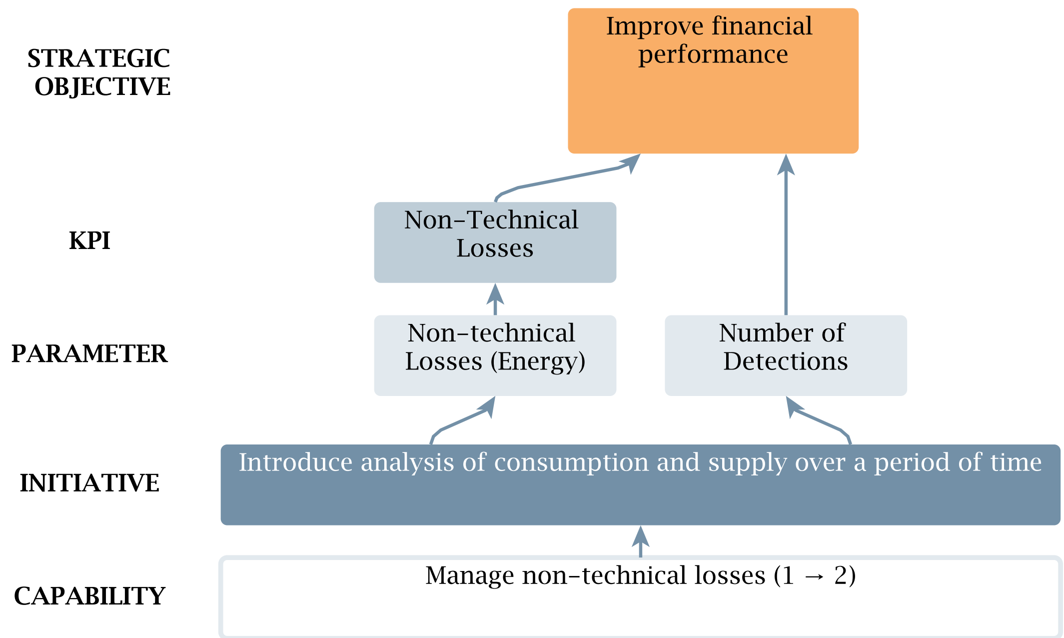


Figure 8.76.: VP.5 - Initiative No.4: Impact Chain

Table 8.57.: VP.5 - Initiative No.4: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Non-technical Losses (Energy)	0.0240	-0.0006	0.0174	0.0240	ratio
Number of Detections	5	↑	↑	N/A	Number

This initiative will build on previous capabilities in identifying sources of non-technical losses, and introduces analysis capabilities that allow identifying grid segments where there is a variance between supply and consumption over a period of time. Using grid metering capabilities, further analysis is possible to allow more transparency and therefore detect metering failures and theft. By identifying certain issues, revenue can be recovered and energy can be saved. This would have a positive impact on GSU's strategic objective to improve financial performance.

The workshop team assessed a target of a 2.5% reduction in non-technical losses as a result of this initiative.

8.5.5. Consider cross KPI dependencies in systemic forecasting models for selected KPIs

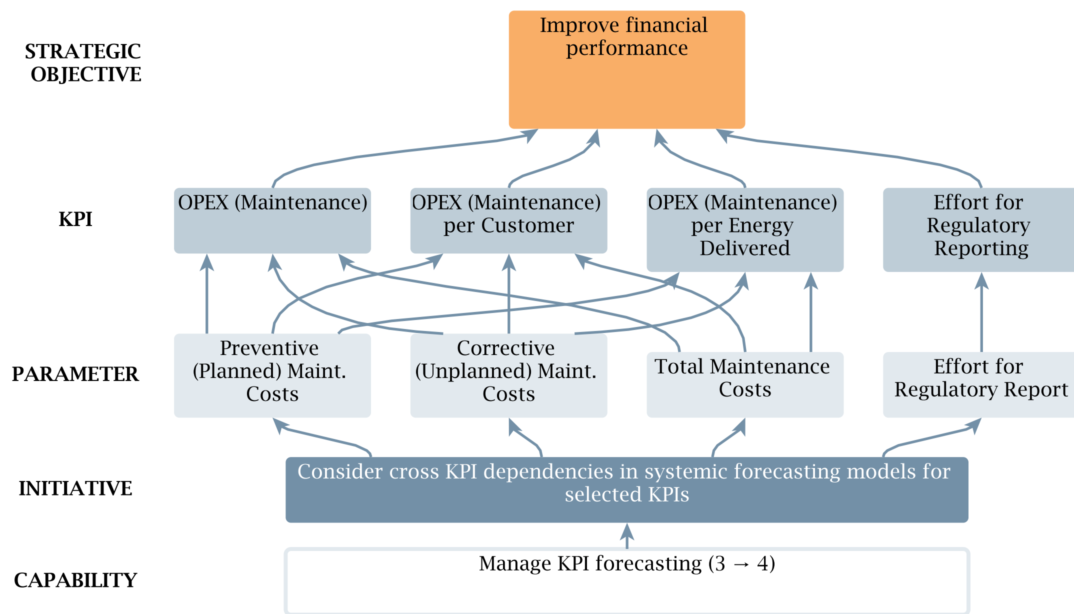


Figure 8.77.: VP.5 - Initiative No.5: Impact Chain

Table 8.58.: VP.5 - Initiative No.5: Impact

Parameter	Baseline	Impact	Forecast	Target	Unit
Preventive (Planned) Maint. Costs	0.30	0.02	0.83	0.70	Ratio
Corrective (Unplanned) Maint. Costs	0.70	-0.02	0.17	0.30	Ratio
Total Maintenance Costs	2,150,000	-21,500	1,494,250	1,650,000	$
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

This initiative builds on KPI forecasting capabilities enabled by previous initiatives and extends it by developing progressive and realistic forecasting models based on scenarios. By investigating cross-dependencies between KPIs in their system context to improve forecasting precision, GSU will be able to avoid new build costs of new assets/new grid segments by instead replacing existing under-stress assets (e.g. overloaded transformer with lower rating) with assets that have the correct rating. Similarly, due to the transparency provided by this initiative, GSU will be able to shift post-fault high corrective maintenance costs to preventive maintenance budget that avoids the need to carry out expensive corrective maintenance when faults occur.

The impact of this initiative will be to facilitate the forecasting process, reducing effort, and will enable maintenance cost savings through more thorough planning.

The workshop team assessed a 2% reduction of corrective maintenance budget, half of which might be allocated to preventive activities as a result of this initiative. A reduction in effort for regulatory reporting of 0.1 FTE was also forecast.

The impacts on preventive maintenance and corrective maintenance costs were assessed based on the assumption that the annual baseline values shall not change drastically. An in-depth analysis of GSU's asset base using probabilistic analysis was carried out on GSU's asset demographic data to determine expected replacement cost curves with respect to time. Based on expected failure rates, and the existing practices of proactive replacement for assets such as poles and pole-mount transformers, cost curves were determined to be in line with these assumptions.

8.5.6. Introduce Business Value and Risk as additional criteria for strategy definition

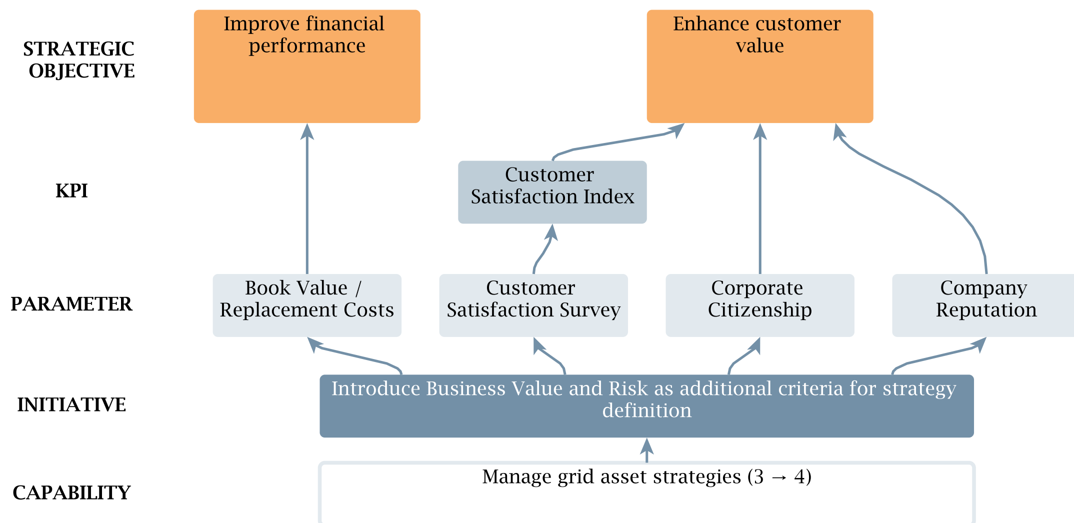


Figure 8.78.: VP.5 - Initiative No.6: Impact Chain

Table 8.59.: VP.5 - Initiative No.6: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Book Value / Replacement Costs	0.50	↑	↑	N/A	Ratio
Customer Satisfaction Survey	0.95	↑	0.97	1.00	Ratio
Corporate Citizenship	0.54	↑	↑	1.00	Ratio
Company Reputation	0.75	↑	0.90	1.00	Ratio

Previous initiatives focused on management of grid asset strategies for key assets. This initiative enhances the existing process by helping GSU define acceptable risk zones for grid segments considering the two dimensions of risk calculation, which are: asset health determined through condition monitoring data, and, importance of the asset (e.g., high importance for an asset whose failure will disconnect large numbers of urban customers, compared with low-to-medium importance for rural assets). This will allow GSU to design customized maintenance strategies for each risk zone in the specific business value and grid structure context(e.g. rural vs. urban).

This initiative will develop a process to evaluate both risk and value metrics for individual grid elements, as the basis for establishing asset and maintenance strategies which take into account critical customers (e.g. hospital) or other high value resources (e.g. distributed generation).

While numerical impacts were not assessed by the workshop team, this initiative will have strategic benefits in terms of enhancing customer service, minimizing economic and societal impacts of outages, and in enhancing a range of planning and monitoring activities.

8.5.7. Introduce prediction of C&I DSM request leveraging historic response information

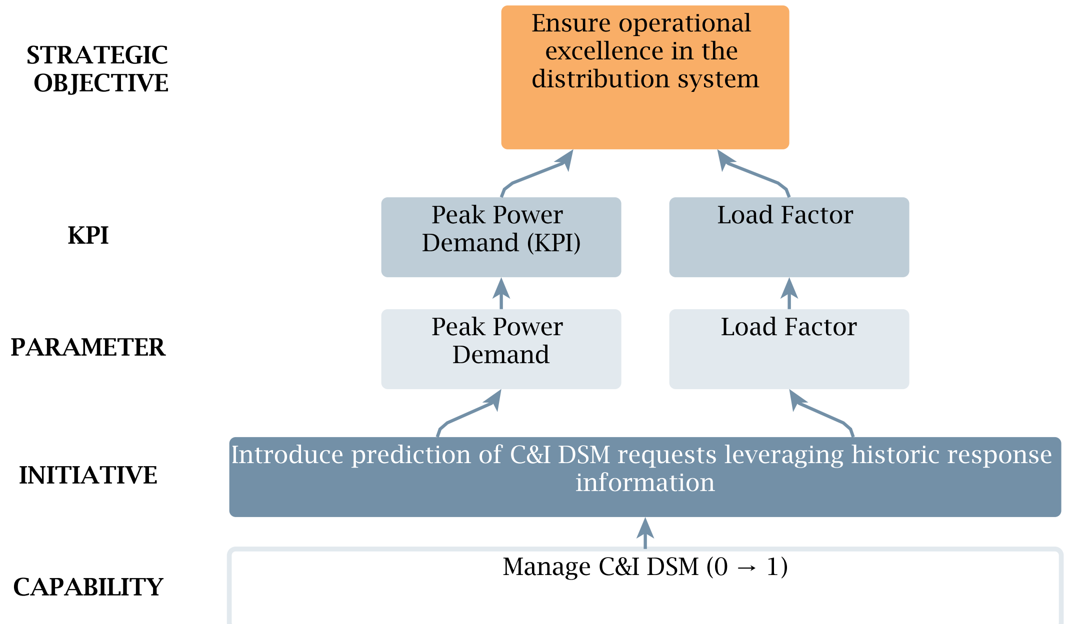


Figure 8.79.: VP.5 - Initiative No.7: Impact Chain

Table 8.60.: VP.5 - Initiative No.7: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Peak Power Demand	184	↓	↓	145	MW
Load Factor	0.66	↑	↑	0.95	Ratio

Similar to the preceding initiative, this initiative introduces C&I DSM response prediction based on historic response of large and small C&I customers. The historic response is analyzed with the aim of predicting the response to future C&I DSM requests more accurately and help with targeted marketing programs. The introduction of DSM response prediction based on historic response information helps to reduce the deviation of load profile from forecast in order to optimize the generation fleet through a better management of C&I DSM.

This initiative will develop a business case for implementing commercial & industrial demand-side management control for the benefit of the grid. In order to do this, a process will be developed for determining the necessary number of commercial and industrial loads to be controlled to achieve desired outcomes utilizing response predictions based on historic information.

The workshop team did not directly identify quantifiable parameter impacts, however activities undertaken during this initiative generally support GSU's strategic objective to ensure operational excellence in the distribution system and to Improve environmental performance through reducing peak demand and improving power factor.

8.5.8. Introduce reporting on a regular basis

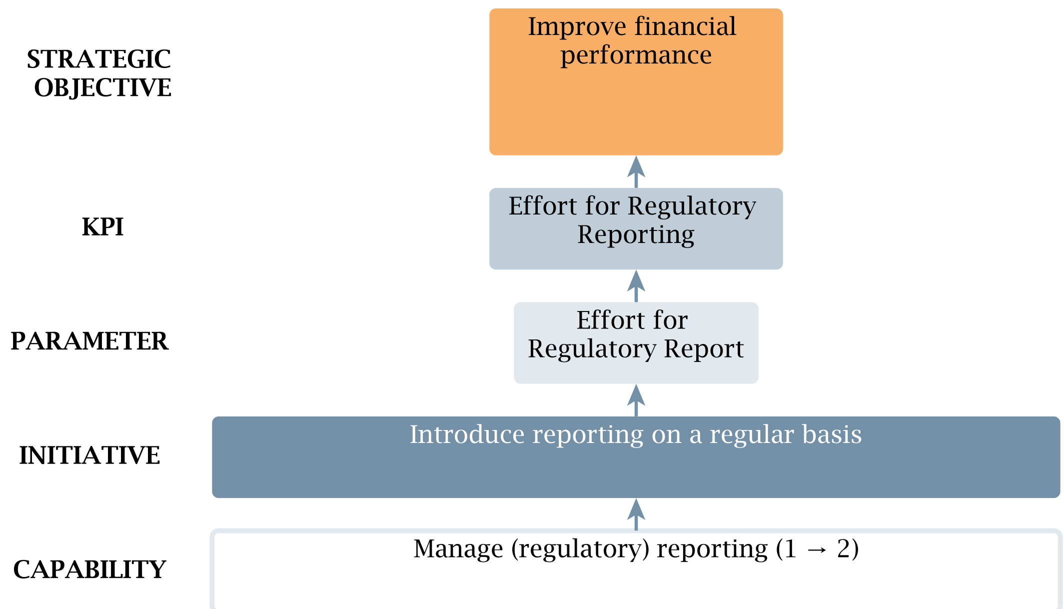


Figure 8.80.: VP.5 - Initiative No.8: Impact Chain

Table 8.61.: VP.5 - Initiative No.8: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

This initiative will extend the reporting process to enable internal reporting on a regular basis to ensure transparency about the development of relevant performance indicators independent from the regulatory reporting schedules. Target of the regular reporting is to improve transparency throughout the year and avoid surprises once the regulator asks for certain reports.

It was assessed that the implementing of this initiative will cause a reduction in the Effort for Regulatory Reporting of 0.1 FTE.

8.5.9. Introduce organization-wide standards for the management of change.

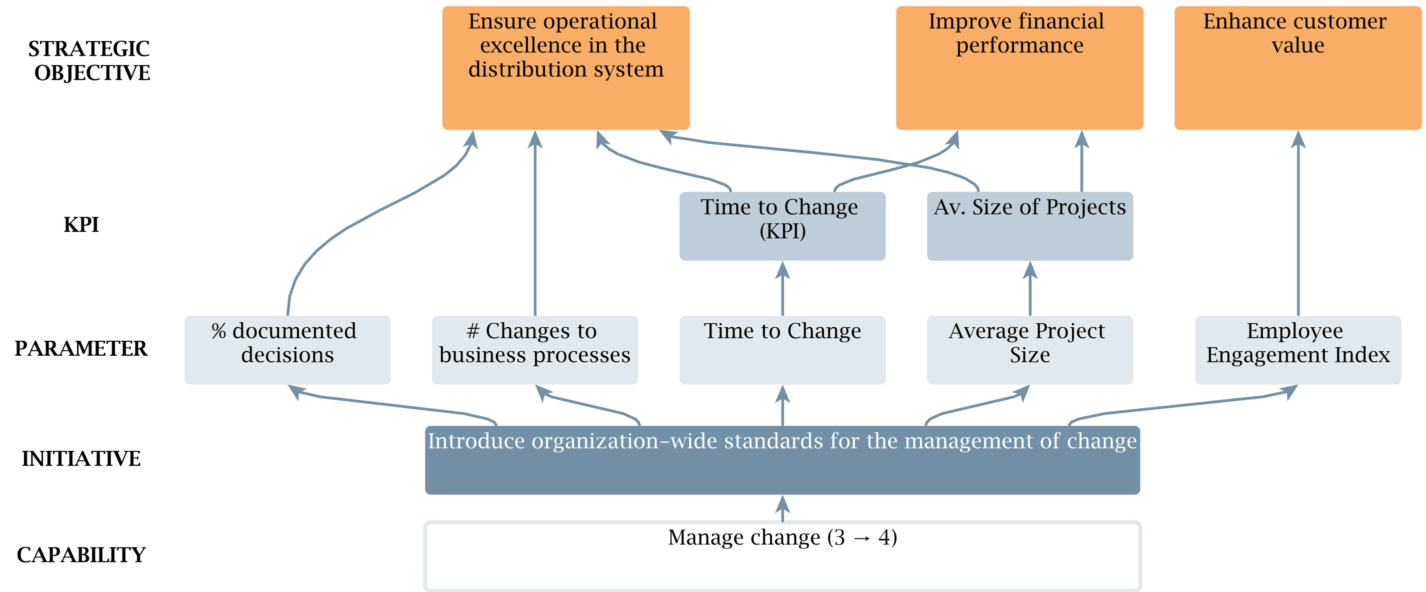


Figure 8.81.: VP.5 - Initiative No.9: Impact Chain

Table 8.62.: VP.5 - Initiative No.9: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
% documented decisions	0.60	↑	0.80	0.80	Ratio
Time to Change	180	-30	90	90	Days
Average Project Size	1,200	-200	800	700	Person-Hours
# Changes to business processes	10	5	34	15	Number
Employee Engagement Index	N/A	↑	↑	N/A	Ratio

This initiative will introduce organization-wide standards for the management of change. Clearly defined change management procedures on an organization-wide level make management decision-making more efficient and decrease time to decisions. Well-prepared project overviews, change requests and the introduction of templates optimize the decision making process and the documentation of actions and decisions until the effective and efficient monitoring of the project results.

This initiative will reduce the average time and size of change management initiatives, enabling an increased number of process changes to be carried out.

8.5.10. Introduce system based tendering capability

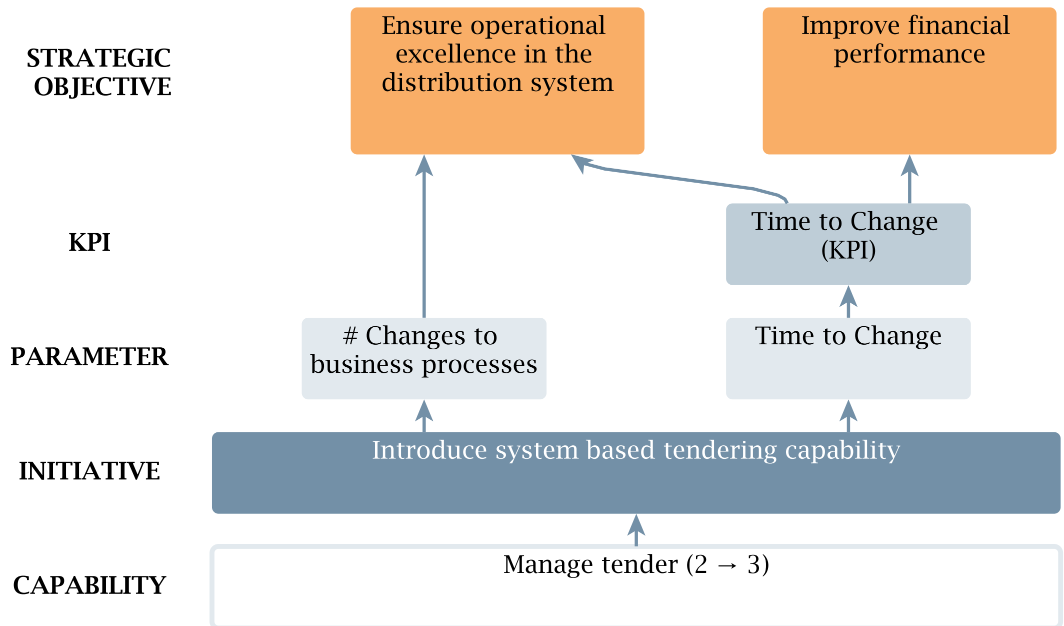


Figure 8.82.: VP.5 - Initiative No.10: Impact Chain

Table 8.63.: VP.5 - Initiative No.10: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Time to Change	180	-5	100	90	Days
# Changes to business processes	10	2	29	15	Number

This initiative will extend the tender specification process to define functional requirements at the system level. Functional requirements will no longer only cover components. To realize this, systems need to be well defined, including boundaries, and their linkages to key business processes are well understood. Basic system performance parameters are established.

By reducing the timeline for procurement while ensuring a competitive and effective tendering framework, this initiative will contribute to the goal of increasing organizational flexibility by reducing time to complete changes and increase the number of changes.

8.5.11. Utilize market to obtain commodity components

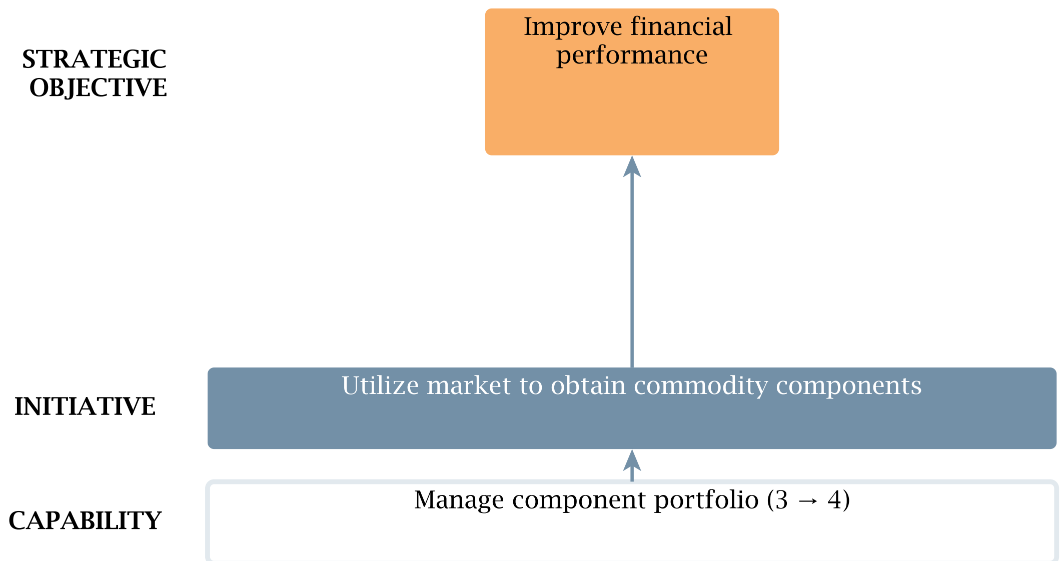


Figure 8.83.: VP.5 - Initiative No.11: Impact Chain

Table 8.64.: VP.5 - Initiative No. 11: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
No parameter effects were assessed for this initiative.					

This initiative will extend the process to manage the component portfolio with analysis steps that enable identification and documentation of commodity components available on the market. In addition necessary steps are established to setup the adequate frame conditions in order to include the identified components into the portfolio and make them available on demand.

While numerical impacts were not assessed for this initiative it will contribute to GSU's goal of increasing value-added services margins by optimizing cost structure.

8.6. VP.6: Extending Network Planning through Lean Design Techniques

The two core themes of this value pack are advances in network planning and enhancements in GSU's product and service portfolio.

Utilizing network modelling and planning software, lean design techniques will be implemented to determine key nodes and configurations where selective automation can further reduce losses. Furthermore, new smart grid technologies will be integrated into design and planning processes with the vision that substation rebuilds, new feeder segments etc. are designed while considering smart grid consumption patterns. On the product-service side, GSU will make key improvements in streamlining its component portfolio, identify multiple sales channels and design value-added services beyond energy alone.

Taken together, this value pack delivers improvements in rationalized CAPEX vs. OPEX expenditure, customer retention, market share and perceived value.

This value pack also strengthens network planning significantly, and as such is the capstone Value Pack for asset and work management capabilities. To advance network design and planning, several technology functions will be deployed or extended to provide this functionality.

In this value pack GSU will create a combined information and operational technology strategic plan, shaping the interplay between these technologies and ensuring GSU is in a stable position to continue to integrate new technologies in a consistent manner.

Also new in this value pack is eMobility. This value pack enhances services for drivers of e-vehicles and introduces agreements between multiple operators, reducing barriers to mobility across charging station operators.

Initiatives:

- Introduce enhanced driver services for individual charging network operator
- Introduce multi-operator agreements
- Introduce active integration of new technologies and information into design and planning
- Introduce leaner design and strategically guided automation
- Utilize regulatory reporting for operational management
- Introduce a combined information and operational technology strategic plan

Technology Deployments:

- Network Planning - Network Planning - Network Design
- Network Planning - Network Planning - Dynamic Stability
- Network Planning - Network Planning - Reliability Analysis
- Network Planning - Network Planning - Protection Simulation
- Network Planning - Network Planning - Power Flow

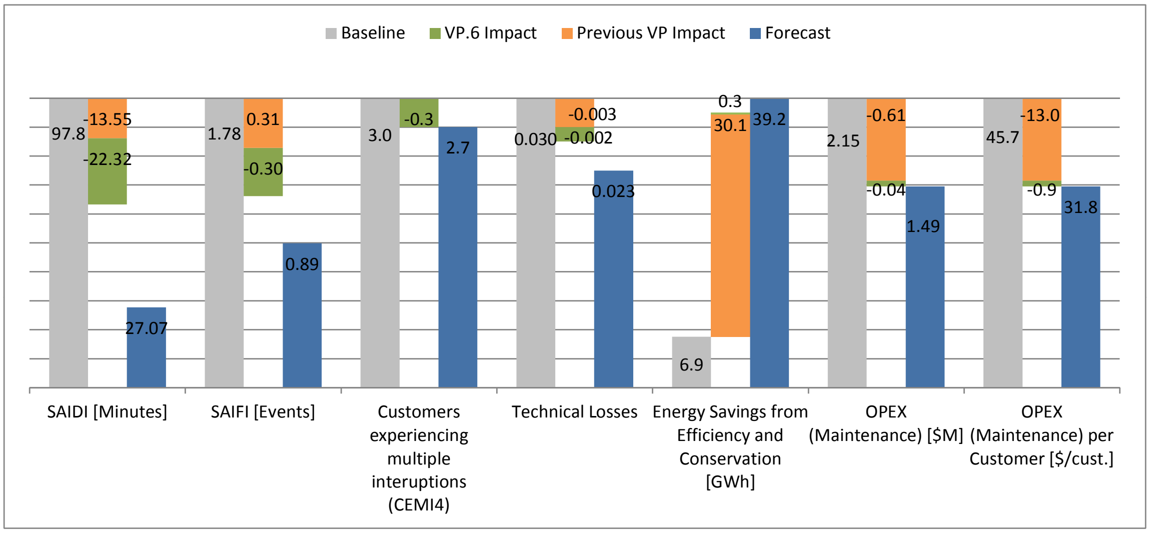


Figure 8.84.: VP.6 - Impact on KPIs (a)

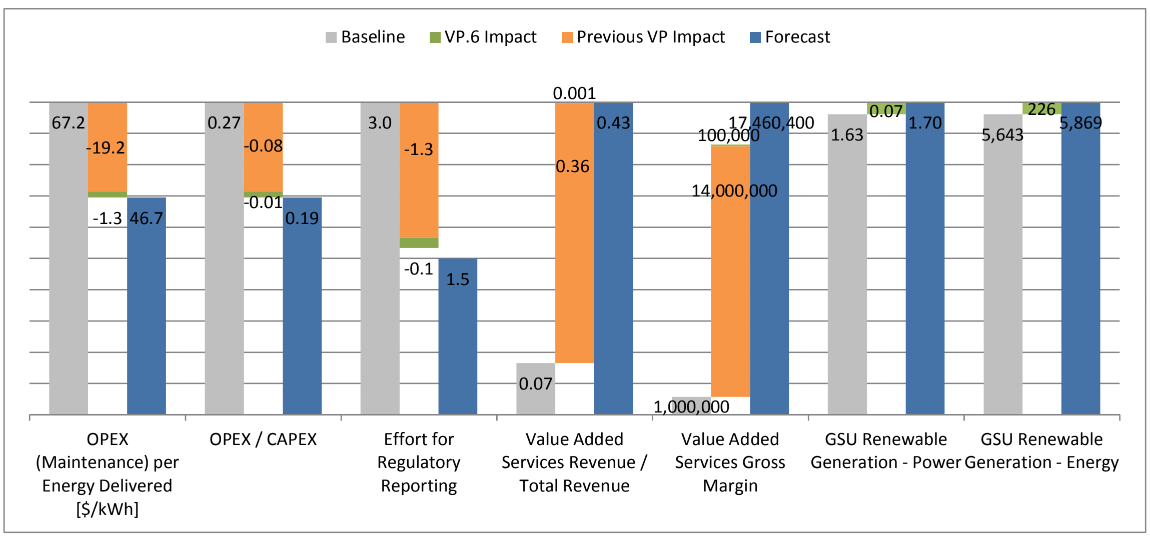


Figure 8.85.: VP.6 - Impact on KPIs (b)

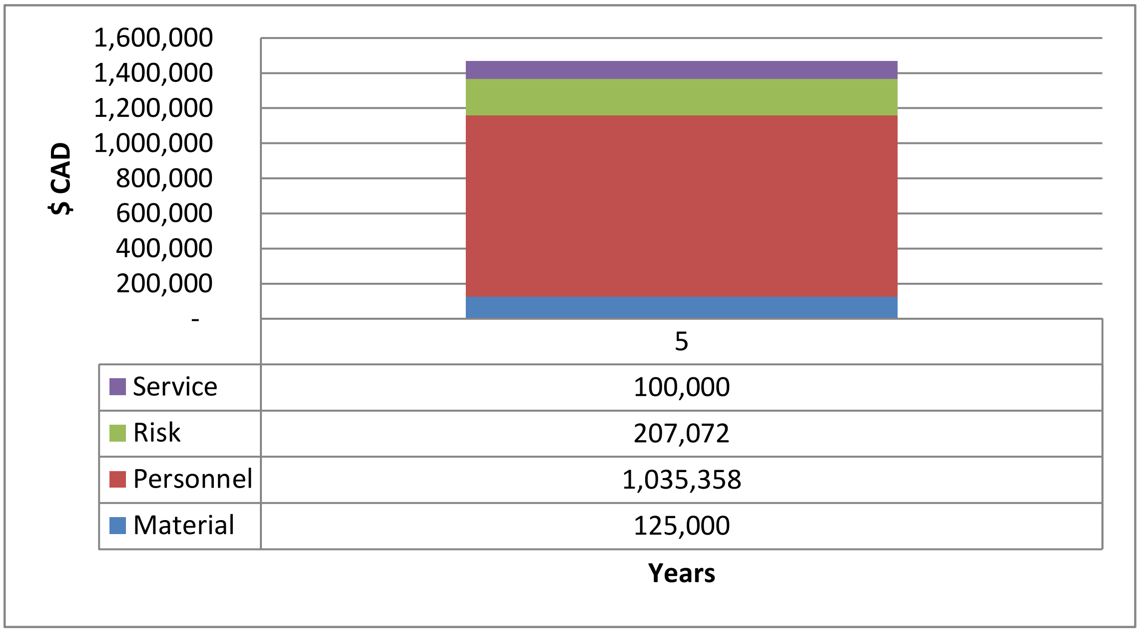


Figure 8.86.: VP.6 Budgets

Table 8.65.: VP. 6 Costs per Initiative & Technology

Items	Material	Personnel	Service	Risk	Grand Total
Contribution Category 1	**$ 25,000.00**	**$ 307,896.04**	**$ 50,000.00**	**61,579.21**	**$ 444,475.25**
Manage (regulatory) reporting		**$ 72,128.27**		**14,425.65**	**$ 86,553.93**
Utilize regulatory reporting for operational management		$ 72,128.27		14,425.65	$ 86,553.93
Manage design and planning	**$ 25,000.00**	**$ 144,357.80**	**$ 50,000.00**	**28,871.56**	**$ 248,229.36**
Introduce active integration of new technologies and information into design and planning	$ 25,000.00	$ 144,357.80	$ 50,000.00	28,871.56	$ 248,229.36
Manage IT-OT		**$ 91,409.96**		**18,281.99**	**$ 109,691.96**
Introduce a combined information and operational technology strategic plan		$ 91,409.96		18,281.99	$ 109,691.96
Contribution Category 2		**$ 140,584.47**	**$ 50,000.00**	**28,116.89**	**$ 218,701.36**
Manage design and planning		**$ 140,584.47**	**$ 50,000.00**	**28,116.89**	**$ 218,701.36**
Introduce leaner design and strategically guided automation		$ 140,584.47	$ 50,000.00	28,116.89	$ 218,701.36
Contribution Category 3		**$ 321,946.58**		**64,389.32**	**$ 386,335.89**
Manage eMobility scheme		**$ 321,946.58**		**64,389.32**	**$ 386,335.89**
Introduce enhanced driver services for individual charging network operator		$ 156,517.29		31,303.46	$ 187,820.75
Introduce multi-operator agreements		$ 165,429.29		33,085.86	$ 198,515.15
Infrastructure	**$ 100,000.00**	**$ 264,930.49**		**52,986.10**	**$ 417,916.58**
Network Planning	**$ 100,000.00**	**$ 264,930.49**		**52,986.10**	**$ 417,916.58**
Dynamic Stability	$ 20,000.00	$ 53,376.69		10,675.34	$ 84,052.02
Power Flow	$ 20,000.00	$ 52,725.70		10,545.14	$ 83,270.85
Reliability Analysis	$ 20,000.00	$ 52,725.70		10,545.14	$ 83,270.85
Protection Simulation	$ 20,000.00	$ 53,523.04		10,704.61	$ 84,227.65
Network Design	$ 20,000.00	$ 52,579.35		10,515.87	$ 83,095.22
Grand Total	**$ 125,000.00**	**$ 1,035,357.57**	**$ 100,000.00**	**207,071.51**	**$ 1,467,429.08**

8.6.1. Introduce enhanced driver services for individual charging network operator

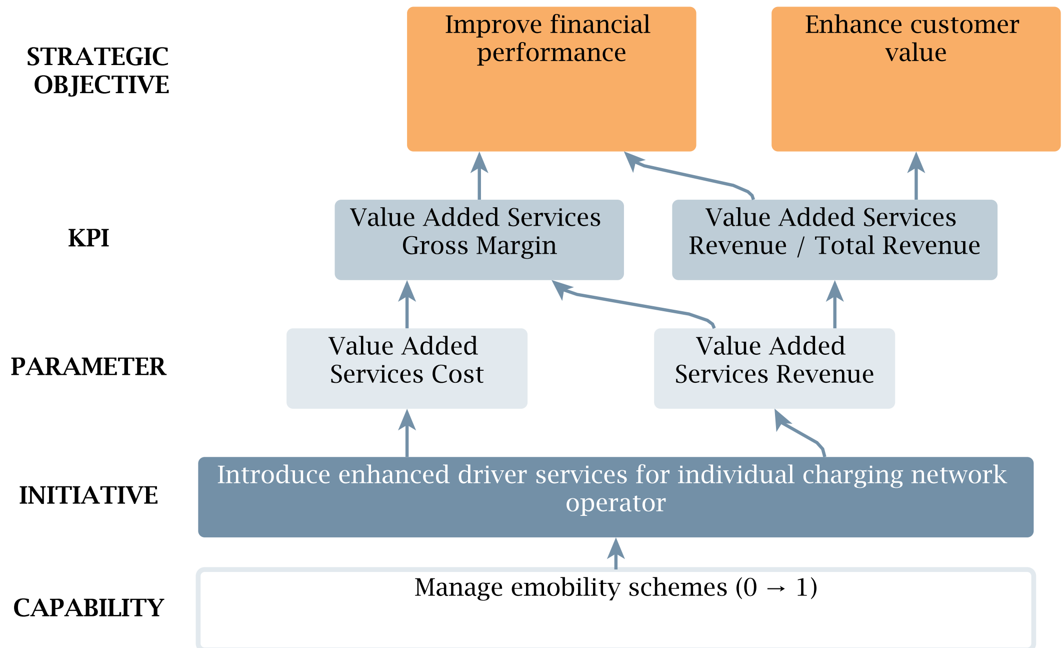


Figure 8.87.: VP.6 - Initiative No.1: Impact Chain

Table 8.66.: VP.6 - Initiative No.1: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Value Added Services Cost	9,000,000	50,000	42,850,000	45,000,000	$
Value Added Services Revenue	10,000,000	100,000	60,310,400	60,000,000	$

Currently there is limited electric vehicle infrastructure in GSU's territory, however electric vehicle technology is currently in a state of rapid development. While plug-in electric vehicles sales in 2015 represented about 0.66% of North American vehicle sales, by 2024 it is expected that plug-in electric vehicle sales will increase tenfold, to make up over 6% of sales.[1]

[1] Navigant Research, 2016. https://www.navigantresearch.com/newsroom/annual-plug-in-electric-vehicle-sales-in-north-america-are-expected-to-exceed-1-1-million-by-2024

As battery technologies and production volumes improve, increased range and affordability are likely to bring electric vehicles into mainstream use, even in less urban areas.

This evolution of the transportation industry provides opportunities for utilities in leveraging electric vehicles as a form of distributed storage, or controllable load, and in marketing new services to drivers within their territory. This initiative will build on the enabling step of developing a charging post register and grid access policy (Implemented in Value Pack 1) and enable GSU to engage their client base, and begin developing a brand around electric vehicle driver services.

This initiative would entail developing and maintaining an online geographic directory of vehicle charging locations, and charging services through GSU's non-regulated affiliates. At this stage it is anticipated that individual charging network operators will be responsible for contracts with users.

This initiative is a foundational initiative to developing a suite of services for the electric vehicle market segment, which will ultimately provide opportunities to grow revenues from value-added services. It will also help increase website traffic, strengthen branding and have secondary effects of increasing awareness of other GSU products and services.

8.6.2. Introduce multi-operator agreements

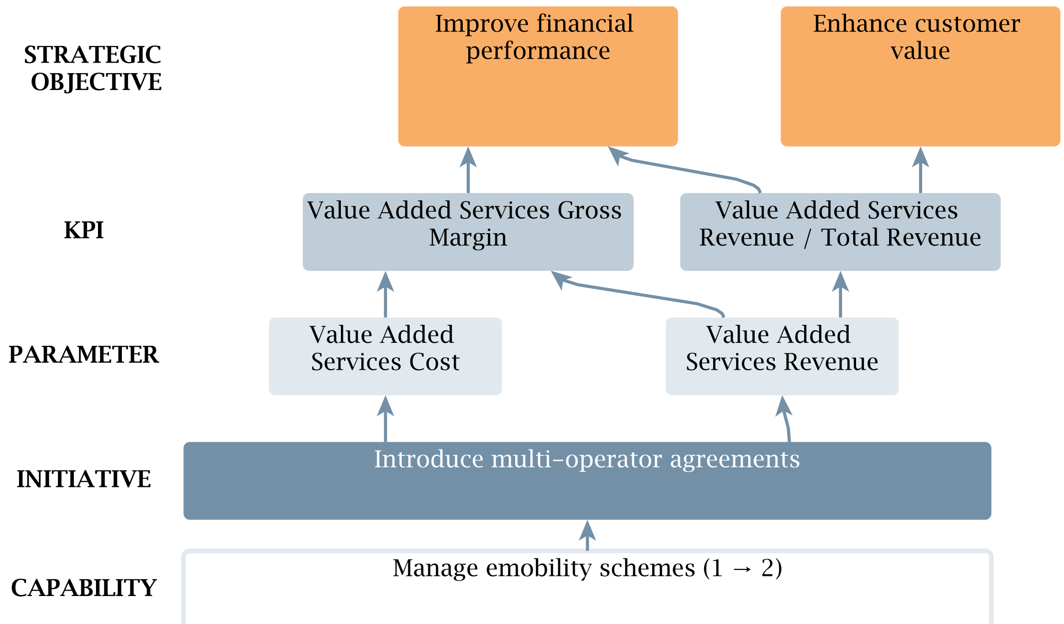


Figure 8.88.: VP.6 - Initiative No.2: Impact Chain

Table 8.67.: VP.6 - Initiative No.2: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Value Added Services Cost	9,000,000	50,000	42,850,000	45,000,000	$
Value Added Services Revenue	10,000,000	100,000	60,310,400	60,000,000	$

This initiative will build on the previous initiative introduced in this value pack to introduce the capability to setup and manage local roaming contracts for electric vehicle charging infrastructure usage. This capability enables drivers to use the infrastructure of other charging infrastructure operators within their home area while only having a single agreement with one of the operators. Enhanced driver services are only available for the infrastructure of the charging operator with whom they have the contract.

The primary impact of this initiative is in increased revenues from value added services. Creating an eMobility driver services offering will supplement the value added services portfolio, drive cross-product sales and strengthen GSU's brands.

8.6.3. Introduce active integration of new technologies and information into design and planning

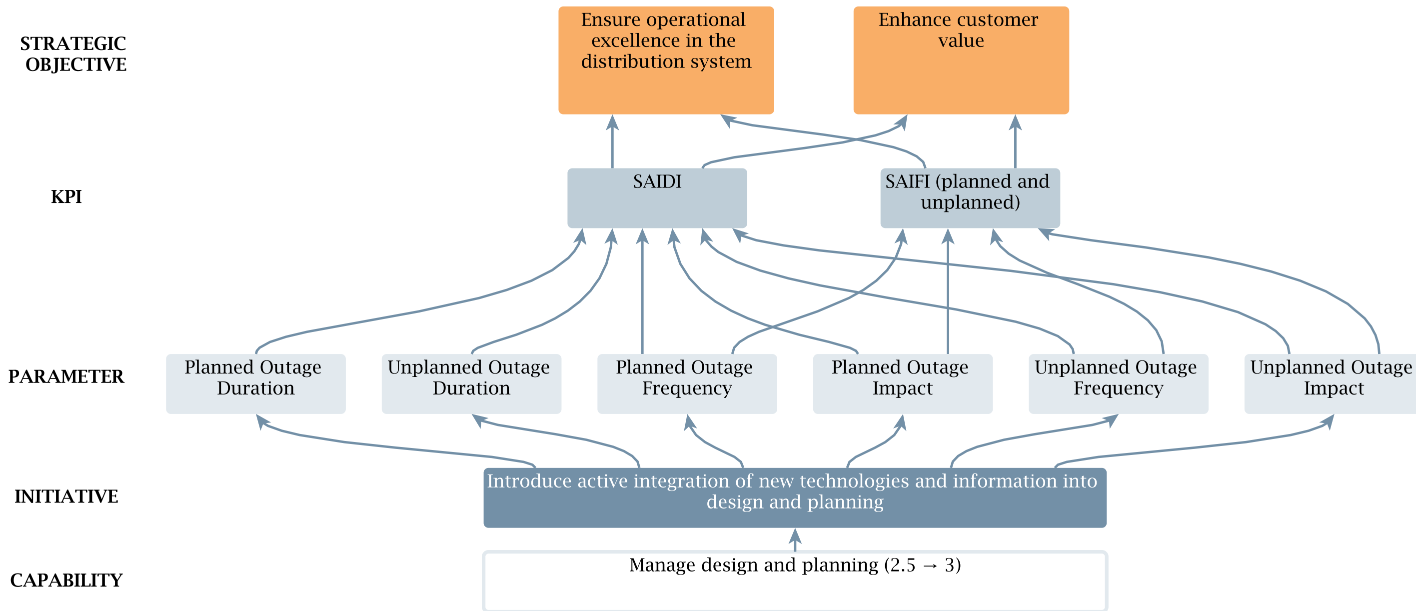


Figure 8.89.: VP.6 - Initiative No.3: Impact Chain (a)

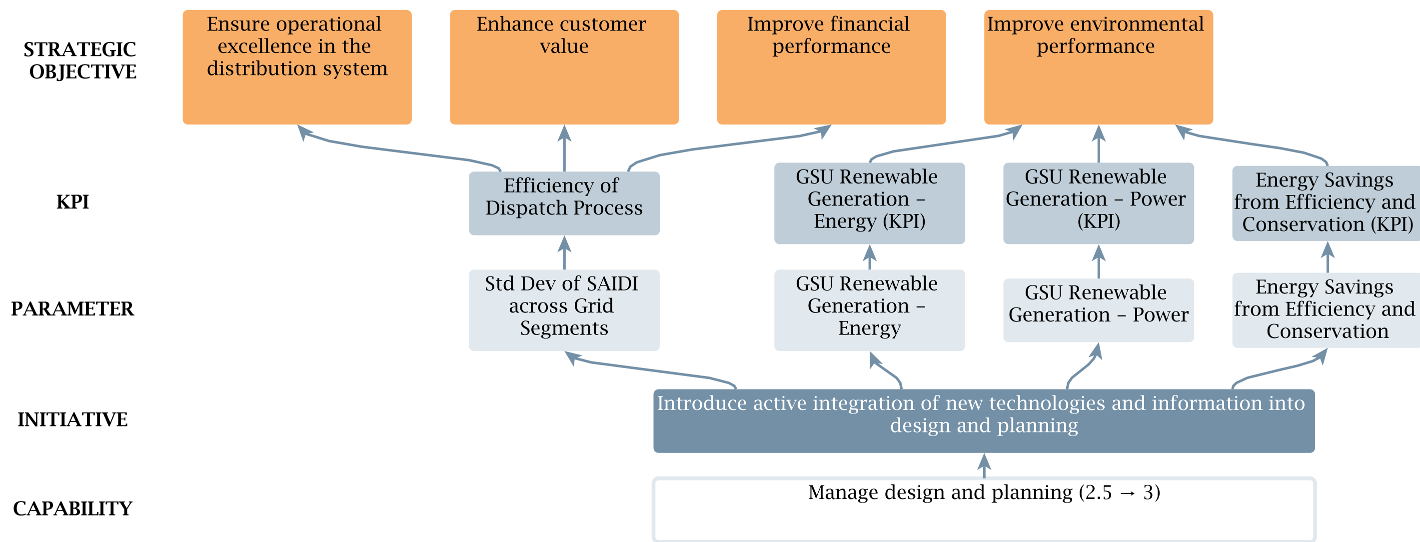


Figure 8.90.: VP.6 - Initiative No.3: Impact Chain (b)

Table 8.68.: VP.6 - Initiative No.3: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Planned Outage Frequency	153	-2	147	N/A	Number
Planned Outage Duration	199	-10	169	N/A	Minutes
Planned Outage Impact	37	-2	33	N/A	Customers
Unplanned Outage Frequency	233	-12	200	N/A	Number
Unplanned Outage Duration	44	-2	12	N/A	Minutes
Unplanned Outage Impact	335	-17	184	N/A	Customers
Std Dev of SAIDI across Grid Segments	0.40	-0.02	0.28	0.20	Ratio
GSU Renewable Generation - Energy	5,643	112.86	5,869	56,430	MWh
GSU Renewable Generation - Power	1.63	0.03	↑	180	MW
Energy Savings from Efficiency and Conservation	6,900	138	39,174	34,740	MWh

This initiative introduces active integration of new technologies and information into the design and planning process to enhance reliability, optimize the network and improve asset utilization. This means, the design and planning process will be extended to actively consider the usage of advanced technology components with higher reliability or improved asset utilization when designing new network segments or planning for critical areas.

Sophisticated design and planning will make GSU's grid robust and future-proof, with the benefits mainly noticeable in fewer network capacity issues and a reduced number of planned maintenance activities that minimize customer impact. The overall effect will support GSU's strategic target of creating exceptional customer value. Additionally, acquisition of new technologies and systems will require enhancing institutional skill availability, i.e., a more skilled work force, that supports the strategic target of a sustainable energy system for future generations.

New technologies such as FLISR which will enhance the detection of faults and allow greater flexibility in reconfiguring feeders for servicing will enable reductions in outage frequency, duration and impact, both during unplanned restoration work and planned servicing or upgrading. Including consideration of customer technologies such as DG or storage at the design and planning stage will also be an important contributor to the goals of increasing the penetration and utilization of these technologies on the grid.

The workshop team assessed a 1% reduction in planned outage frequency and a 5% reduction in planned outage impact as a result of greater flexibility to reconfigure grid segments while performing maintenance, or avoiding outages altogether. For unplanned outages, reductions of 5% in frequency, duration and impact were assessed. In addition, the team identified that this initiative will enable increased penetration of renewable energy (by approximately 2%), and will help reduce the variance of SAIDI across the grid.

8.6.4. Introduce leaner design and strategically guided automation

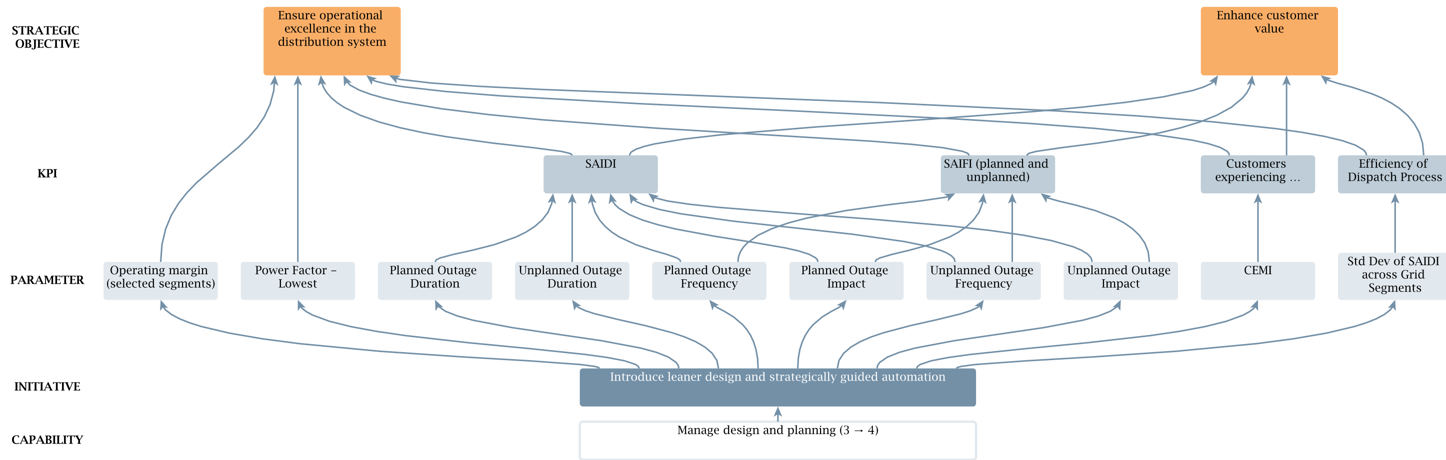


Figure 8.91.: VP.6 - Initiative No.4: Impact Chain (a)

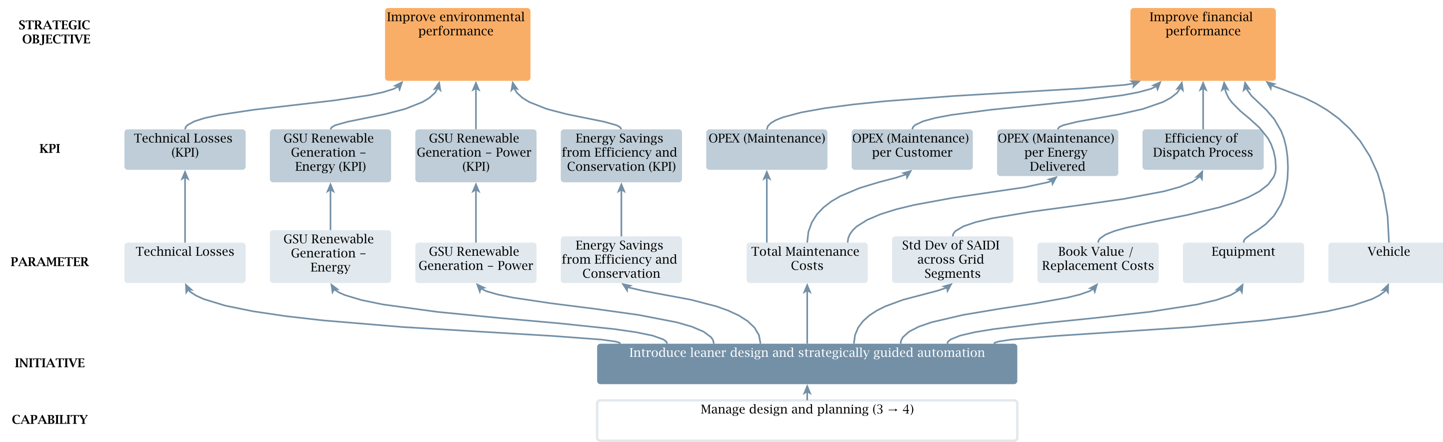


Figure 8.92.: VP.6 - Initiative No.4: Impact Chain (b)

Table 8.69.: VP.6 - Initiative No.4: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Operating margin (selected segments)	0.40	↓	↓	0.20	Ratio
Planned Outage Frequency	153	-2	147	N/A	Number
Planned Outage Duration	199	-10	169	N/A	Minutes
Planned Outage Impact	37	-2	33	N/A	Customers
Unplanned Outage Frequency	233	-12	200	N/A	Number
Unplanned Outage Duration	44	-2	12	N/A	Minutes
Unplanned Outage Impact	335	-17	184	N/A	Customers
CEMI	3.0	-0.3	2.7	0.0	Customers
Technical Losses	0.0300	-0.0015	0.0225	0.0300	Ratio
Power Factor - Lowest	0.90	0.06	0.96	0.96	Ratio
Total Maintenance Costs	2,150,000	-43,000	1,494,250	1,650,000	$
Book Value / Replacement Costs	0.50	↑	↑	N/A	Ratio
Std Dev of SAIDI across Grid Segments	0.40	-0.02	0.28	0.20	Ratio
Equipment	172,000	-3,440	168,560	N/A	$
Vehicle	1,100,000	-22,000	1,078,000	1,000,000	$
GSU Renewable Generation - Energy	5,643	112	↑	56,430	MWh
GSU Renewable Generation - Power	1.63	0.03	↑	180	MW
Energy Savings from Efficiency and Conservation	6,900	138	39,174	34,740	MWh

Utilizing network modelling and planning software, lean design techniques will be implemented to determine the network configuration that has the least losses. Since the 'as-built' model is continually updated, including detailed Smart Grid component models and optimization algorithms, GSU will have better visibility on asset performance which will allow it to shift a part of the corrective maintenance costs to preventive maintenance costs.

For example, executing lean network design routines, it might become evident that a particular grid segment can be optimized for least losses if instead of of upgrading or building new infrastructure, aging assets are replaced and the network configuration is optimized. The OPEX and CAPEX decisions about which assets to replace, which to service and which to upgrade will be assisted by life-time costing. This would reduce the corrective maintenance and new build costs in return for an increase preventive maintenance, but would ultimately reduce technical losses. The overall effect will be a positive impact on GSU's strategic objective to improve financial performance.

Instead of carrying out large scale cost-prohibitive substation or feeder automation, lean network design techniques will also point out the sensitive strategic segments that are frequent sources of grid instability and should be automated. Strategically guided automation on sensitive grid segments will not only save the costs of a wider automation program, it will also help reduce the duration, frequency and impact of outages (planned or unplanned) as the field crews will no longer have to manually reconfigure feeders to restore supply. This will result in improvements in outage duration, frequency and fewer customers being impacted, thus impacting the strategic objective to enhance customer value.

In this initiative, the planning process will be further enhanced through the development of planning scenarios, which enable leaner design through the use of automation. These scenarios will be considered when evaluating options for expansion, renewal or replacement of assets. The impact of this initiative will be to drive even further enhancements in service level, reliability, as well as flexibility for the addition and use of new grid assets including a range of distributed energy resources (DER). Finally, lean network design and automation of strategic grid segments will also lead to workforce skill advancement and encourage an increase in renewable integration to support the development of a sustainable energy system for the future.

The workshop team assessed a 1% reduction in planned outage frequency and a 5% reduction in planned outage impact as a result of greater flexibility to reconfigure grid segments while performing maintenance, or avoiding outages altogether. For unplanned outages, reductions of 5% in frequency, duration and impact were assessed. A reduction in multiple outages of 10% was also assessed. A 5% improvement in technical losses and a 6% improvement in power factor was forecast due to being able to better optimize grid configuration for losses and to deploy distributed resources to provide VAR compensation where needed. In addition, the team identified that this initiative will enable increased penetration of renewable energy (by approximately 2%), and will help reduce the variance of SAIDI across the grid. Increasing the level of automation on the grid will also reduce maintenance costs, and associated vehicle and equipment costs.

8.6.5. Utilize regulatory reporting for operational management

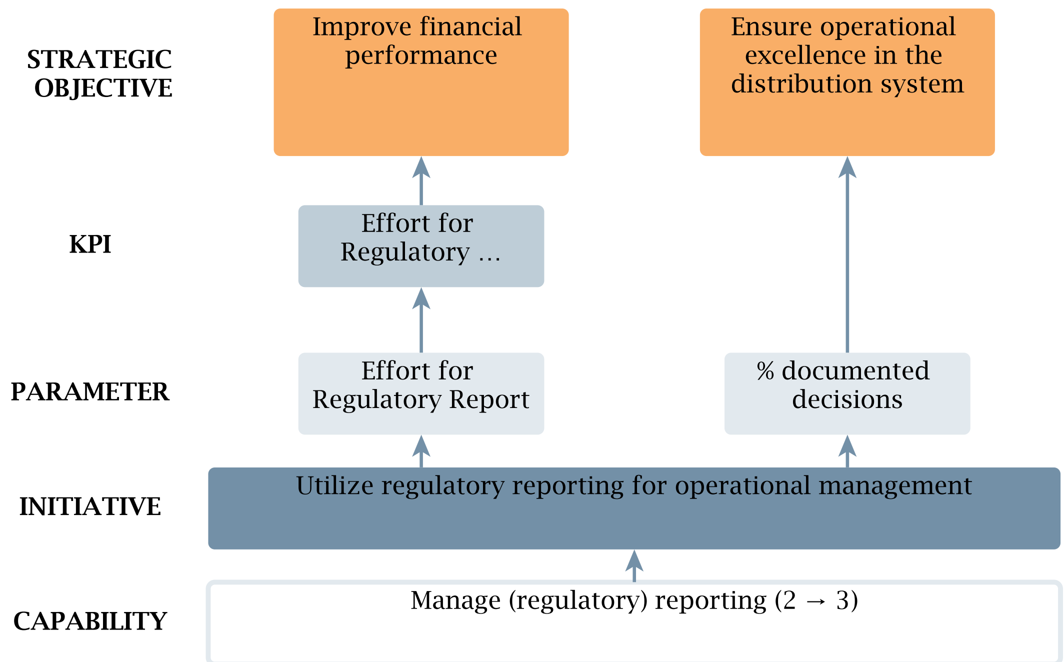


Figure 8.93.: VP.6 - Initiative No.5: Impact Chain

Table 8.70.: VP.6 - Initiative No.5: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE
% documented decisions	0.60	↑	0.70	0.80	Ratio

Previous initiatives have established a process to provide regular internal reports including KPIs used for regulatory reporting. This initiative will extend the reporting process with an additional step for regular management reviews of the intermediary results and latest KPI developments. The additional step would ensure easy incorporation of the available information into operational management e.g. via dashboards.

This initiative was assessed by the workshop team as reducing the effort for regulatory reporting by 0.1 FTE, as regulatory reporting will increasingly become simply a new instance of already existing internal reporting processes.

8.6.6. Introduce a combined information and operational technology strategic plan

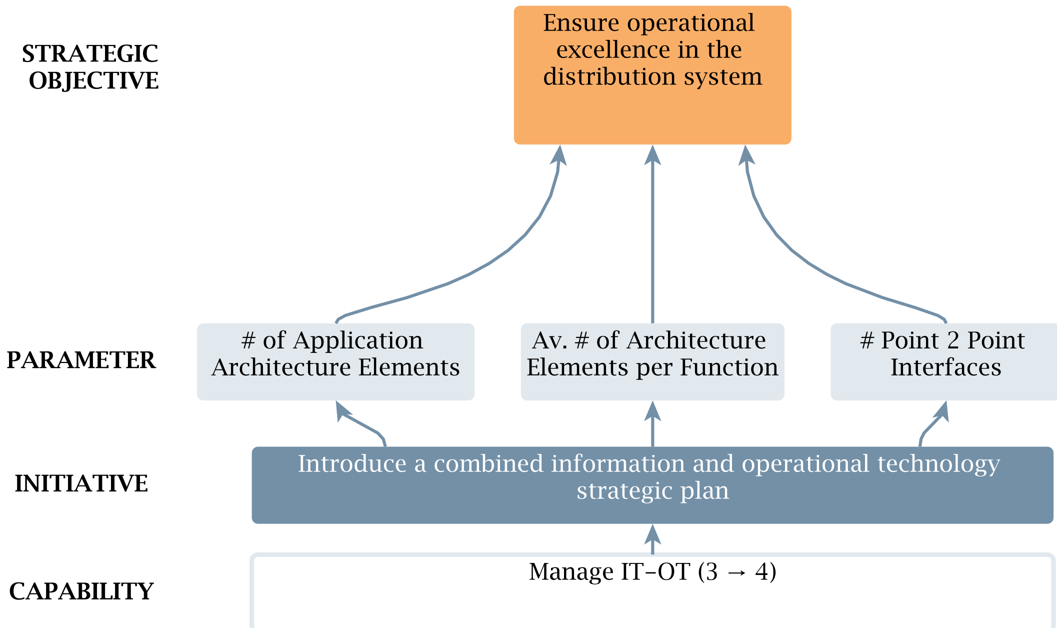


Figure 8.94.: VP.6 - Initiative No.6: Impact Chain

Table 8.71.: VP.6 - Initiative No.6: Impact

Parameter	Baseline	Impact	Forecast	Target	Unit
# of Application Architecture Elements	128	↓	↓	↓	Number
Av. # of Architecture Elements per Function	1.75	↓	↓	1.00	Ratio
# Point 2 Point Interfaces	23	↓	↓	↓	Number

In previous initiatives, IT-OT elements have been progressively standardized and more closely coordinated. This initiative extends the joint higher-ranking process for the management of IT and OT by the creation and maintenance of a combined information and operational technology strategic plan. This combined strategic plan helps coordinate a better implementation strategy for new Architecture elements and the operation and maintenance of existing Architecture elements.

Better coordination helps decrease the number of application architecture elements and all associated costs (licensing) and efforts (updates), thereby supporting GSU's strategic goal to improve financial performance.

While numerical impacts for this initiative were not assessed, it will contribute to increasing standardization of components and reducing the number of architecture elements, ultimately reducing complexity.

8.7. VP.7: Utilize Reliability and Communication Improvements to Improve Customer Satisfaction

This value pack has the customer at its centre and seeks to enhance the customer satisfaction, engagement and retention by enhancing system reliability, creating new product offerings and improving customer relationships.

Information from basic distribution management system (DMS) elements such as an outage management system and its integration with classical customer communication will deliver vital improvements in customer satisfaction. Increasing customer perceived-value through value-added services is further enabled by rolling out load controllers for residential customers as well as for C&I (MUSH - Municipalities, Universities, Schools, Hospitals) customers.

Customer service capabilities that have been established and developed in previous value packs are brought to the highest capability level in this value pack, using customer-specific home area network (HAN) data including appliance data from behind the meter. Customer communication is made more sophisticated by integrating change request status as well as outward communication through multiple advanced channels (mobile devices, in-home display (IHD), etc.).

Customer communication is the focus of the enhancements to network operations capabilities as well. This value pack includes process changes that integrate operational information such as planned outage schedules, critical peak times, seasonal TOU rate changes, requests for conservation and load reduction etc. with classical forms of customer communication (printed bills, email, portal etc.) to deliver vital improvements in customer satisfaction.

These forms of communication will be supported by information derived from customer-centred control devices, including home controllers, C&I controllers and storage controllers to be introduced during this value pack. The distribution management system will be further enhanced with the enhancement of distribution management system elements, specifically in the area of visualization and outage management.

Finally, the management and integration of IT and OT is further addressed in this value pack by integrating a cyber-security approach across IT and OT domains that allows the organization to address NERC-CIP and other standards.

Initiatives:

- Introduce manual group appliance control
- Introduce updates in communication

- Integration of operational and classical customer communication
- Introduce advanced communication and control capabilities based on meter-to-bill management
- Leverage portal as broadcast channel for the utility
- Introduce multi-channel communication for customer change with operational information
- Introduce a close integration of information and operational technologies providing a seamless view
- Introduce an integrated cyber security approach across IT and OT domains which complies with all required standards

Technology Deployments:

- Distributed Energy Resources Demand Response C&I Controller
- Distributed Energy Resources Demand Response Home Controller
- Distribution Management System (DMS) General Visualization (DMS)
- Distribution Management System (DMS) General Outage Management
- Distributed Energy Resources Storage Storage Controller

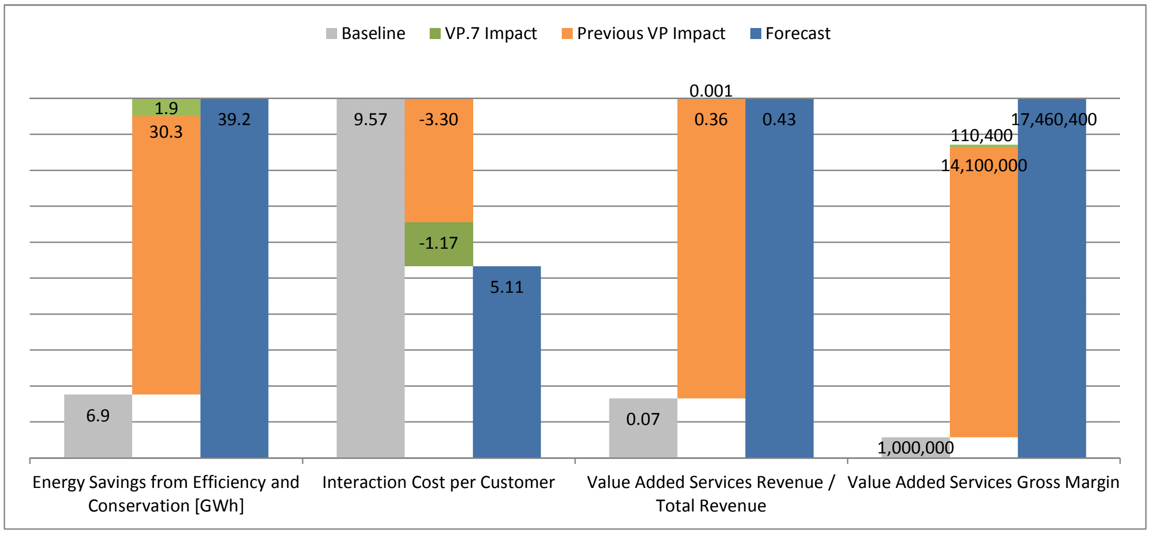
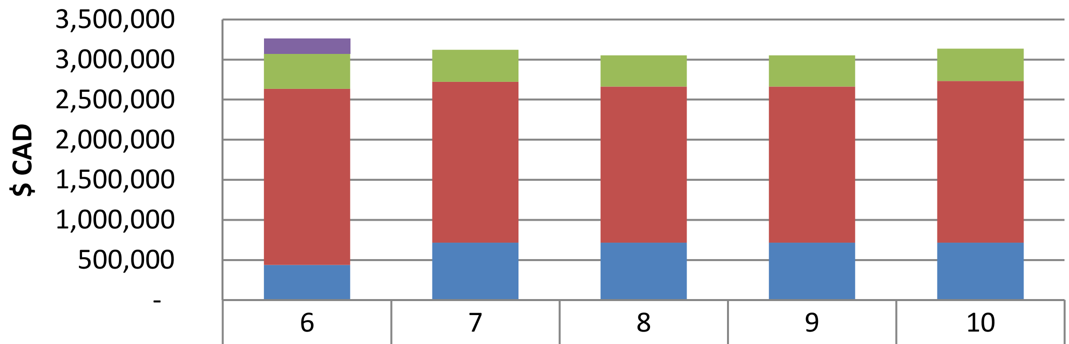


Figure 8.95.: VP.7 - Impact on KPIs



	6	7	8	9	10
Service	185,000				
Risk	439,358	401,216	389,285	389,285	403,523
Personnel	2,196,790	2,006,080	1,946,423	1,946,423	2,017,616
Material	438,000	715,500	715,500	715,500	715,500

Years

Figure 8.96.: VP.7 Budgets

Table 8.72.: VP. 7 Costs per Initiative & Technology

Items	Material	Personnel	Service	Risk	Grand Total
Contribution Category 1		**$ 382,465.54**	**$ 100,000.00**	**76,493.11**	**$ 558,958.64**
Manage cyber security and data privacy		**$ 132,671.05**	**$ 100,000.00**	**26,534.21**	**$ 259,205.26**
Introduce an integrated cyber security approach across IT and OT domains		$ 132,671.05	$ 100,000.00	26,534.21	$ 259,205.26
Manage network congestion		**$ 148,278.55**		**29,655.71**	**$ 177,934.27**
Introduce manual group appliance control		$ 148,278.55		29,655.71	$ 177,934.27
Manage IT-OT		**$ 101,515.93**		**20,303.19**	**$ 121,819.12**
Introduce a close integration of information and operational technologies		$ 101,515.93		20,303.19	$ 121,819.12
Contribution Category 2		**$ 673,130.65**	**$ 85,000.00**	**134,626.13**	**$ 892,756.78**
Manage customer changes		**$ 136,134.69**	**$ 10,000.00**	**27,226.94**	**$ 173,361.62**
Introduce multi-channel communication for customer change		$ 136,134.69	$ 10,000.00	27,226.94	$ 173,361.62
Manage customer presentment		**$ 185,402.60**	**$ 25,000.00**	**37,080.52**	**$ 247,483.11**
Leverage portal as broadcast channel for the utility		$ 185,402.60	$ 25,000.00	37,080.52	$ 247,483.11
Manage operational customer communication		**$ 351,593.37**	**$ 50,000.00**	**70,318.67**	**$ 471,912.04**
Integration of operational and classical customer communication		$ 187,020.44	$ 25,000.00	37,404.09	$ 249,424.53
Introduce updates in communication		$ 164,572.93	$ 25,000.00	32,914.59	$ 222,487.51
Contribution Category 3		**$ 168,101.56**		**33,620.31**	**$ 201,721.88**
Manage meter-to-bill		**$ 168,101.56**		**33,620.31**	**$ 201,721.88**
Introduce advanced communication and control capabilities based on meter-to-bill		$ 168,101.56		33,620.31	$ 201,721.88
Infrastructure	**$ 3,300,000.00**	**$ 8,889,633.25**		**1,777,926.65**	**$13,967,559.90**
Demand Response	**$ 2,970,000.00**	**$ 8,423,974.89**		**1,684,794.98**	**$13,078,769.87**
Home Controller	$ 2,220,000.00	$ 7,899,974.67		1,579,994.93	$11,699,969.60
C&I Controller	$ 750,000.00	$ 524,000.22		104,800.04	$ 1,378,800.26
General	**$ 300,000.00**	**$ 299,416.49**		**59,883.30**	**$ 659,299.78**
Outage Management	$ 150,000.00	$ 144,786.40		28,957.28	$ 323,743.68
Visualisation (DMS)	$ 150,000.00	$ 154,630.08		30,926.02	$ 335,556.10
Storage	**$ 30,000.00**	**$ 166,241.88**		**33,248.38**	**$ 229,490.25**
Storage Controller	$ 30,000.00	$ 166,241.88		33,248.38	$ 229,490.25
Grand Total	**$ 3,300,000.00**	**$ 10,113,331.00**	**$ 185,000.00**	**2,022,666.20**	**$15,620,997.20**

8.7.1. Introduce manual group appliance control

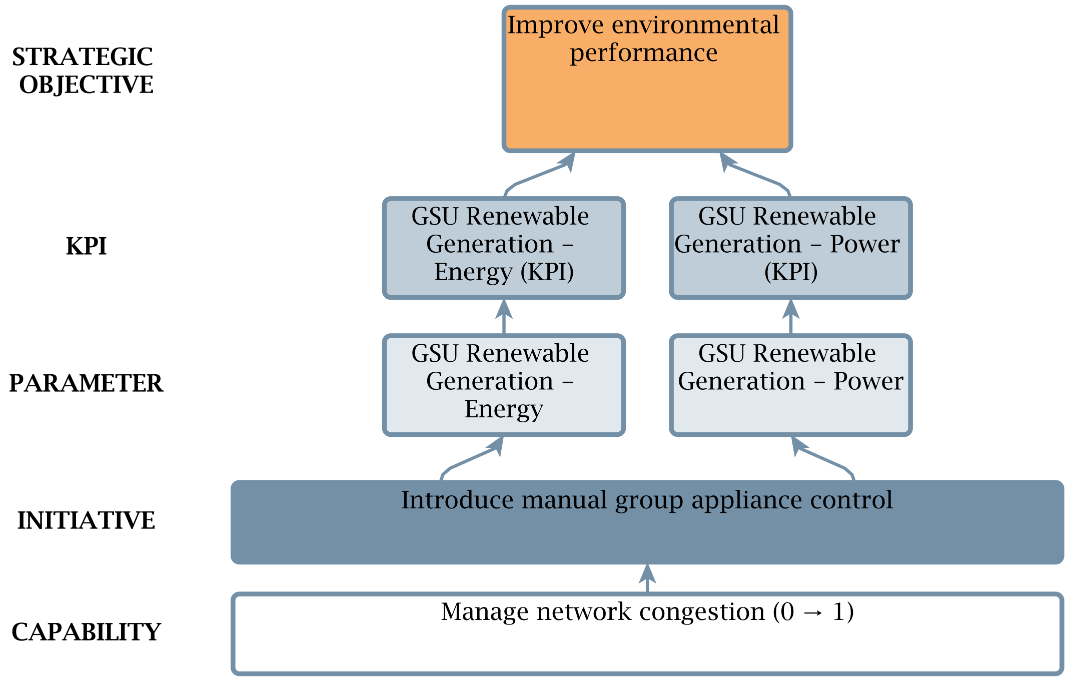


Figure 8.97.: VP.7 - Initiative No.1: Impact Chain

Table 8.73.: VP.7 - Initiative No.1: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
GSU Renewable Generation - Energy	5,643	↑	↑	56,430	MWh
GSU Renewable Generation - Power	1.63	↑	↑	180	MW

During times of high grid stress, device groups need to be disconnected to relieve congestion to avoid unplanned outages. This initiative is the first step towards managing network congestion which will allow GSU to introduce manually initiated group appliance control to relieve network congestion.

Since preceding value packs contain technology deployments that resolve the issue of real-time awareness of loading conditions, this initiative also realizes capabilities for load-shedding at feeder level.

GSU currently has no congestion related constraints on their system, and does not directly manage load shedding programs. The Province-wide Peaksaver program currently provides a load shedding program which is directed by the IESO. However, it is considered likely that in the near future, factors such as an increase in distributed generation on GSU's grid could create constraints and require local balancing to match intermittent or variable sources of generation, such as renewables.

While numerical impacts were not assessed, this initiative will enable GSU to deploy more renewable generation on their system and support the goal of increasing distributed generation.

8.7.2. Introduce updates in communication

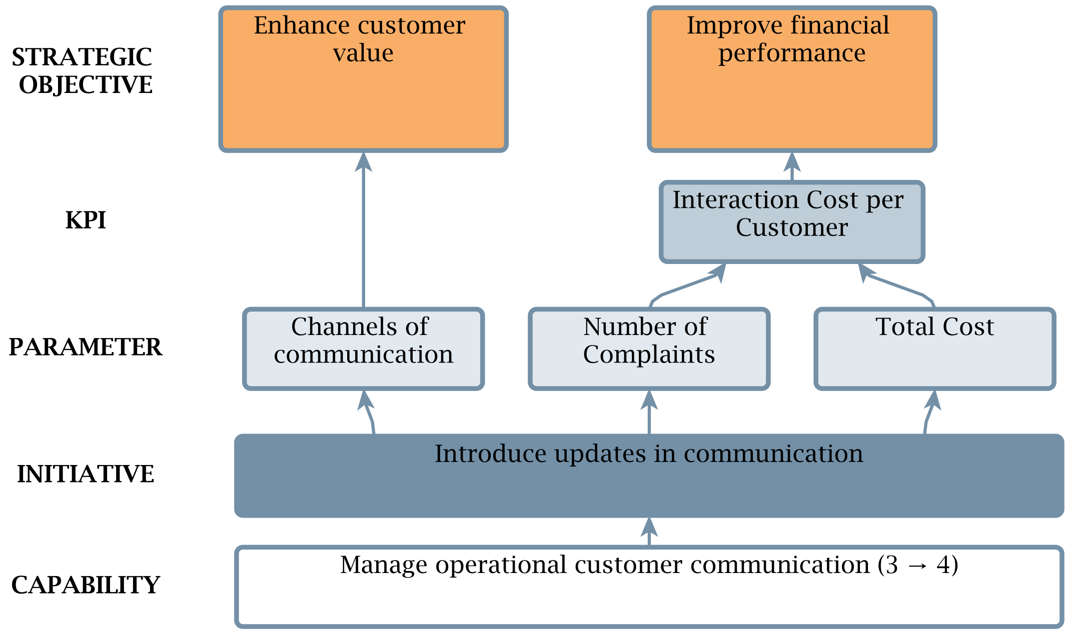


Figure 8.98.: VP.7 - Initiative No.2: Impact Chain

Table 8.74.: VP.7 - Initiative No.2: Impact

Parameter	Baseline	Impact	Forecast	Target	Unit
Channels of communication	5	↑	6	6	Ratio
Number of Complaints	292	↓	↓	100	number
Total Cost	450,000	-5,000	240,000	350,000	$

By implementing this initiative, an integrated and repeated communication to the customer including operational information and relevant updates (e.g. estimated time to restoration) will be established. To enable this, an integration of the customer communication and the operational systems is required. An integrated and repeated communication with additional operational information means customers will receive regular updates through communication channels like web portals, smartphone apps, social media or in-home displays.

This initiative will reduce the burden on customer service staff by increasing push information provided to customers, reducing total interaction costs.

8.7.3. Integration of operational and classical customer communication

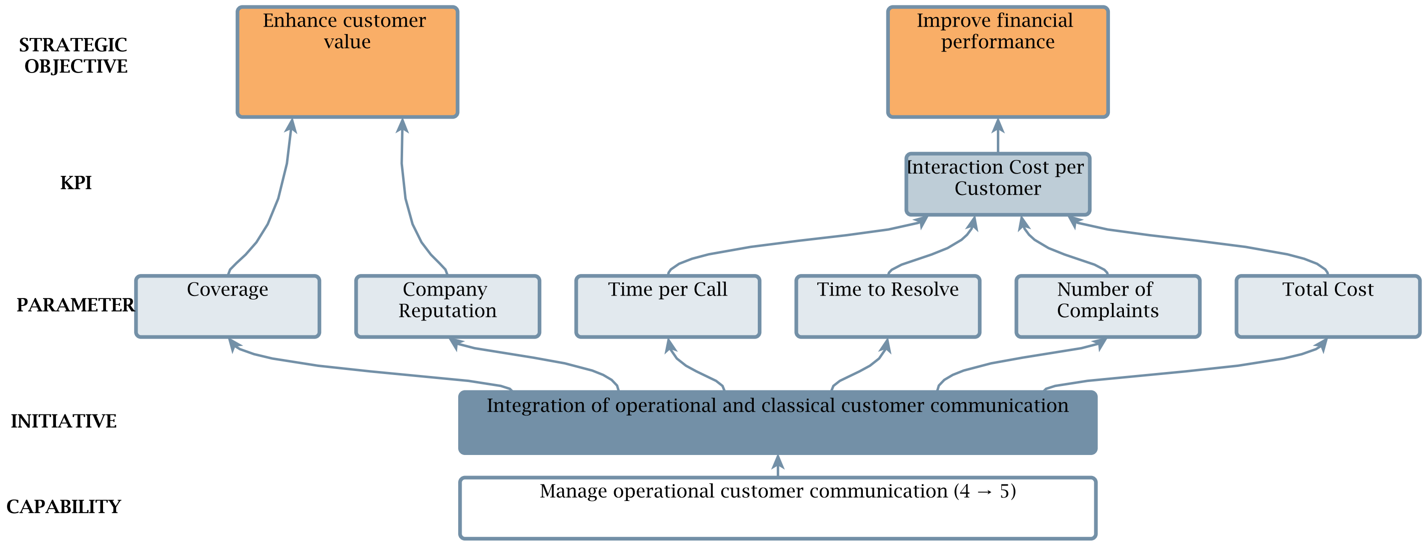


Figure 8.99.: VP.7 - Initiative No.3: Impact Chain

Table 8.75.: VP.7 - Initiative No.3: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Coverage	12	↑	↑	N/A	Number
Time per Call	10	↓	↓	5	Minutes
Time to Resolve	2	↓	↓	1	Hours
Number of Complaints	292	↓	↓	100	Number
Total Cost	450,000	-5,000	240,000	350,000	$
Company Reputation	0.75	↑	0.90	1.00	Ratio

This initiative integrates operational and classical forms of customer communication with the target to realize a unified and comprehensive communication to the customer based one or multiple convenient channels. This means that operational information such as planned outage schedules, critical peak times, seasonal TOU rate changes, requests for conservation and load reduction etc. is integrated with classical forms of communication (printed bills, email, etc.).

This initiative will reduce the burden on customer service staff by increasing push information provided to customers, reducing total interaction costs and enabling further achievement of GSU's strategic objective of improving financial performance.

8.7.4. Introduce advanced communication and control capabilities based on meter-to-bill management

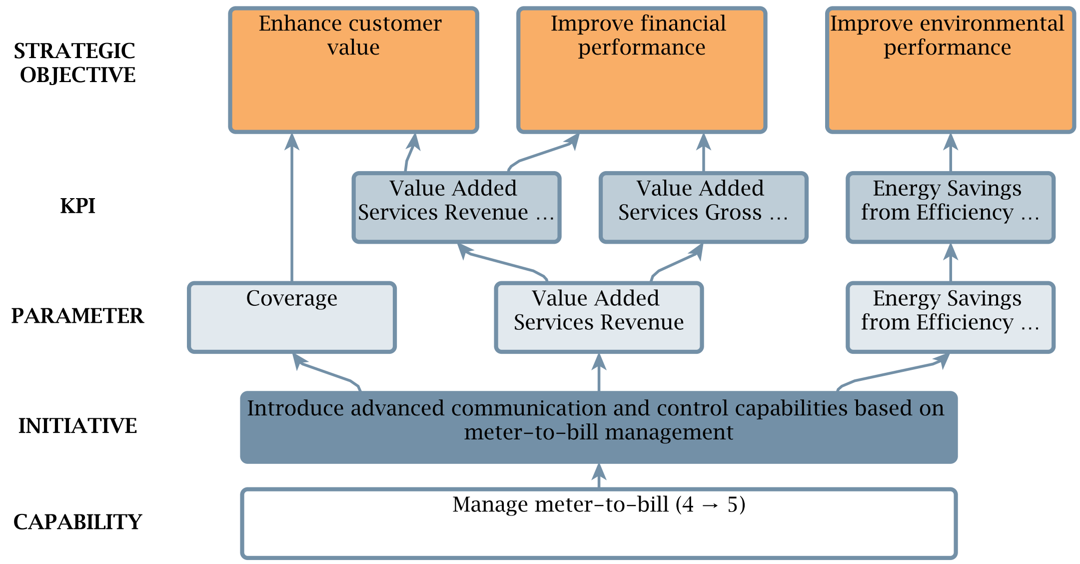


Figure 8.100.: VP.7 - Initiative No.4: Impact Chain

Table 8.76.: VP.7 - Initiative No.4: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Coverage	12	↑	↑	N/A	Number
Energy Savings from Efficiency and Conservation	6,900	1,925	39,174	34,740	MWh
Value Added Services Revenue	10,000,000	110,400	60,310,400	60,000,000	$

This initiative will establish connection between the HAN world and the power grid to enable additional monitoring and control capabilities beyond the meter (e.g. appliances) as well as transformation of the existing communication to a unified approach containing all types of information and utilizing available devices on the customer side (e.g. customer tablets/smart phone, in-home displays).

The outcome of this initiative will be to provide customers with the ability to automatically manage energy costs through closed-loop control of appliances through communication with smart meters. This represents a value-added service which represents an opportunity to market new products and services, and will result in energy savings on the customers side.

8.7.5. Leverage portal as broadcast channel for the utility

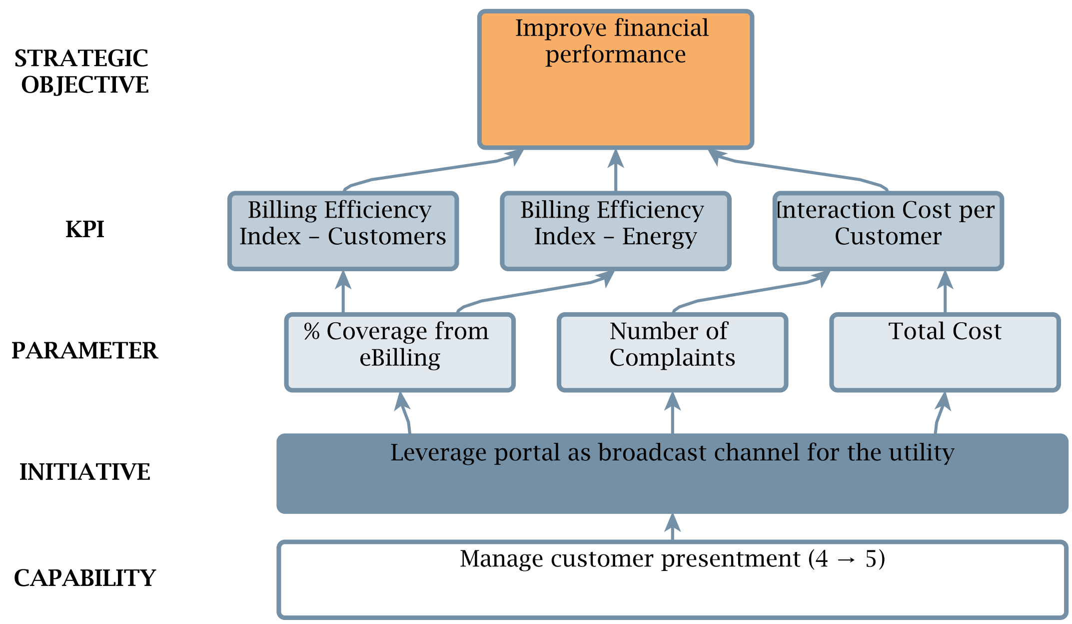


Figure 8.101.: VP.7 - Initiative No.5: Impact Chain (a)

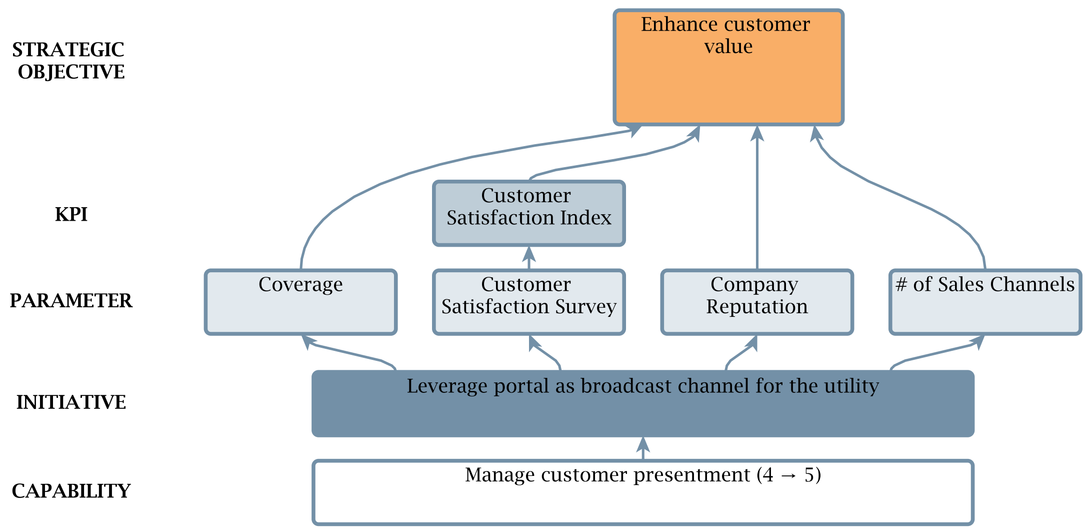


Figure 8.102.: VP.7 - Initiative No.5: Impact Chain (b)

Table 8.77.: VP.7 - Initiative No.5: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
% Coverage from eBilling	0.00	0.10	0.40	0.40	Ratio
Coverage	12	↑	↑	N/A	Number
Number of Complaints	292	↓	↓	100	Number
Total Cost	450,000	-22,500	240,000	350,000	$
Customer Satisfaction Survey	0.95	↑	0.97	1.00	Ratio
Company Reputation	0.75	↑	0.90	1.00	Ratio
# of Sales Channels	2	1	12	10	Number

The scope of GSU's portal is broadened extensively with this initiative to include broadcasting additional information to customers. The range of information covered can include, for example, planned outage schedules, critical peak times, seasonal TOU rate changes, requests for conservation and load reduction, etc. By publishing the information on the portal and 'pushing' it to subscribed customers, GSU will be able to broadcast information about critical peak times and publish load curtailment requests to participating customers.

Using the portal as a primary broadcast channel will also make it possible for GSU to promote innovative value added services designed in previous initiatives. Engaging customers and gaining their confidence will help transition GSU into a trusted energy advisor.

This will create a single interface for a range of client information and has the potential to drive additional revenues in value-added services. In addition, this initiative will enable further reductions in customer interaction cost. This initiative will help GSU meet its strategic objectives of improving financial performance and enhancing customer value.

8.7.6. Introduce multi-channel communication for customer change with operational information

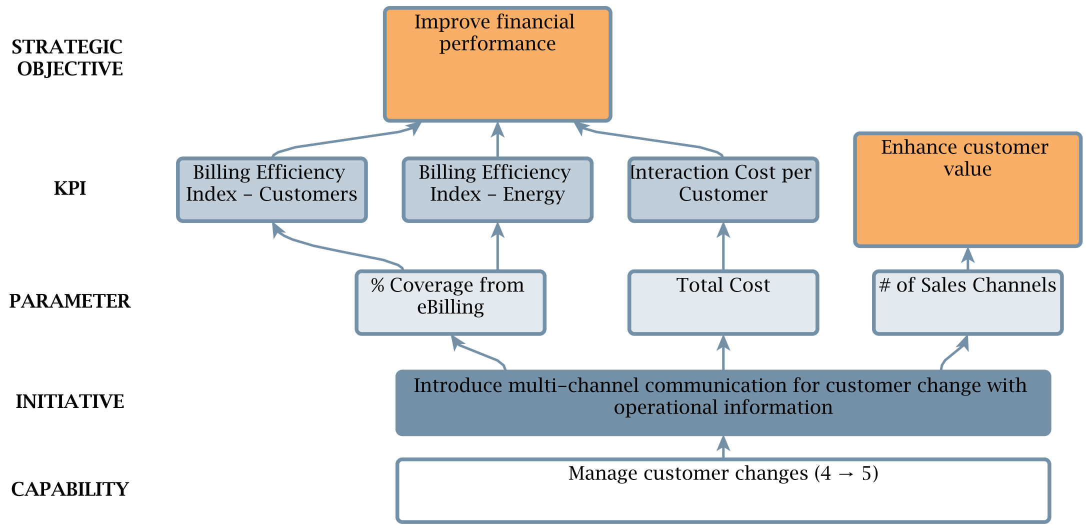


Figure 8.103.: VP.7 - Initiative No.6: Impact Chain

Table 8.78.: VP.7 - Initiative No.6: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
% Coverage from eBilling	0.00	0.10	0.40	0.40	Ratio
Total Cost	450,000	-22,500	240,000	350,000	$
# of Sales Channels	2	1	12	10	Number

This initiative will enable customers to initiate events using a variety of communication channels such as a self-service portal, mobile apps or an in-home display (IHD) and track the process through to billing in a manner similar to package tracking by courier companies. The same channels would also be also used to interact with the customer for operational communication (outage schedules, maintenance work, energy consumption information etc.).

The multi-channel communication with operational information can improve the management of customer changes through better request handling, lower costs per interaction and shorter times in performing a change. The joint Siemens/GSU team concluded that providing the relevant customers with the correct information at the right time will help lower interaction costs incurred when customer queries must be responded to by email or phone. This, in turn, will not only improve customer satisfaction, it will also support the strategic objective of improving financial performance.

8.7.7. Introduce a close integration of information and operational technologies providing a seamless view

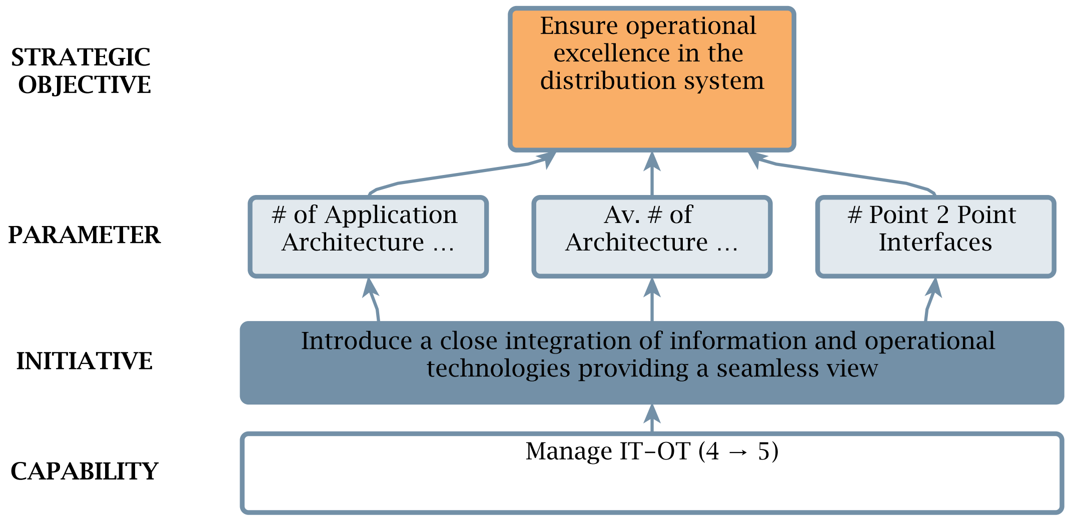


Figure 8.104.: VP.7 - Initiative No.7: Impact Chain

Table 8.79.: VP.7 - Initiative No.7: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
# of Application Architecture Elements	128	↓	↓	↓	Number
Av. # of Architecture Elements per Function	1.75	↓	↓	1.00	Ratio
# Point 2 Point Interfaces	23	↓	↓	↓	Number

By implementing this initiative, GSU will be able to develop common sets of standards, carry out joint planning of operational and information technologies from a strategic perspective and work towards integrating the IT and OT worlds more closely.

FLISR (fault location, isolation, and service restoration) applications are an ideal example of seamless integration of IT and OT. The IT application of FLISR are integrated with sensors and actuators in the grid that relay OT information (voltage levels, fault currents, switch statuses etc.) to the FLISR application suite to optimize fault isolation and service restoration while maintaining grid stability and maximizing the number of restored customers.

While numerical impacts for this initiative were not assessed, it will contribute to increasing standardization of components and reducing the number of architecture elements, ultimately reducing complexity and supporting the strategic objective of ensuring operational excellence in the distribution system.

8.7.8. Introduce an integrated cyber security approach across IT and OT domains which complies with all required standards

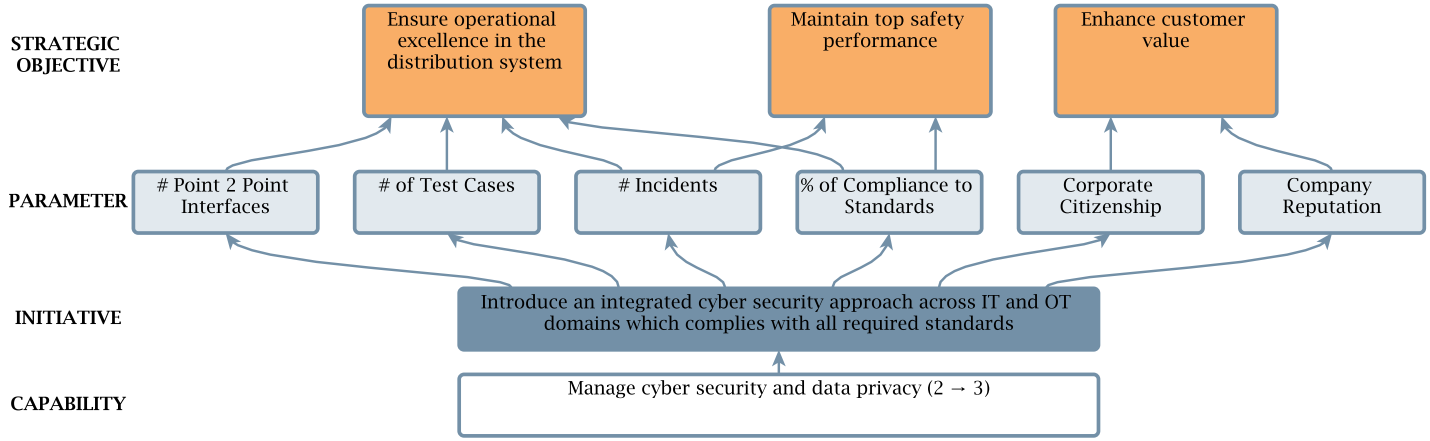


Figure 8.105.: VP.7 - Initiative No.8: Impact Chain

Table 8.80.: VP.7 - Initiative No.8: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
# Point 2 Point Interfaces	23	↓	↓	↓	Number
# of Test Cases	0	↑	↑	1	Number
# Incidents	2	↓	↓	0	Number
% of Compliance to Standards	N/A	↑	↑	N/A	Ratio
Corporate Citizenship	0.54	↑	↑	1.00	Ratio
Company Reputation	0.75	↑	0.90	1.00	Ratio

An integrated cyber security approach across information technology and operational technology domains is implemented in this initiative. Such an integrated cyber security approach across IT and OT domains will decrease complexity in the enterprise architecture and improve cyber security through test cases. Regular checks and the introduction of test cases are necessary to identify security gaps and increase cyber security.

Activities in this initiative will also fully comply with all requirements of IT and OT security, all legal standards as well as full automation of the existing security monitoring procedures.

While numerical impacts for this initiative were not assessed, it will contribute to GSU's strategic objective of maintaining top safety performance and ensuring operational excellence in the distribution system.

8.8. VP.8: Basic Demand-Side Management

This value pack introduces basic demand side management supported by organizational capabilities as well as product and service portfolio offerings introduced in earlier value packs.

Technology improvements such as state estimation and capacity management support network condition-based generation and load management. This value pack also introduces fundamental capabilities in generation and load management, including microgrids and storage.

By introducing network analysis technology, this value pack enables GSU to further enable the integration of renewable generation sources.

Beyond key concepts of demand side management, this value pack also develops capabilities in distributed generation scheduling and dispatch along with the supporting DER Control technologies. With these capabilities in place, and having been able to respond to the increase in distributed generation through both a load and generation management approach, these techniques are then integrated into overall network design and planning.

Microgrids, demand side management (DSM) and storage are introduced in this value pack enabling GSU to ramp up generation management and load management capabilities as further renewables come on stream.

Initiatives:

- Introduce surgical appliance control
- Introduce detection of potential congestion
- Introduce schemes targeting individual customers with near real-time response
- Introduce improved management of C&I DSM resources based on near real time response measurement
- Introduce network condition based distributed storage control
- Introduce network condition based passive microgrid control
- Introduce basic self operated microgrid
- Introduce automatic correlation and combination of reports
- Introduce cyber security as a design paradigm for technology projects
- Introduce continuous improvement / optimization of component quality, cost and value proposition

Technology Deployments:

- Distribution Management System (DMS) - Network Analysis - Short Term Forecast (Load and Generation)
- Distribution Management System (DMS) - Network Analysis - State Estimation
- Distribution Management System (DMS) - Network Analysis - Power Flow (DMS)
- Distribution Management System (DMS) - Network Management - Capacity Management

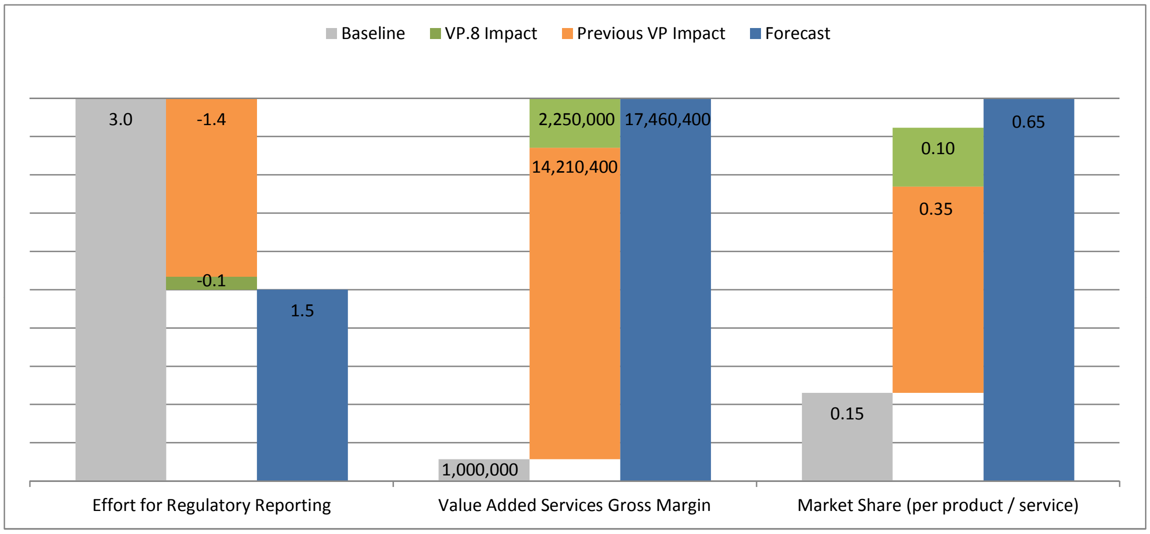


Figure 8.106.: VP.8 - Impact on KPIs

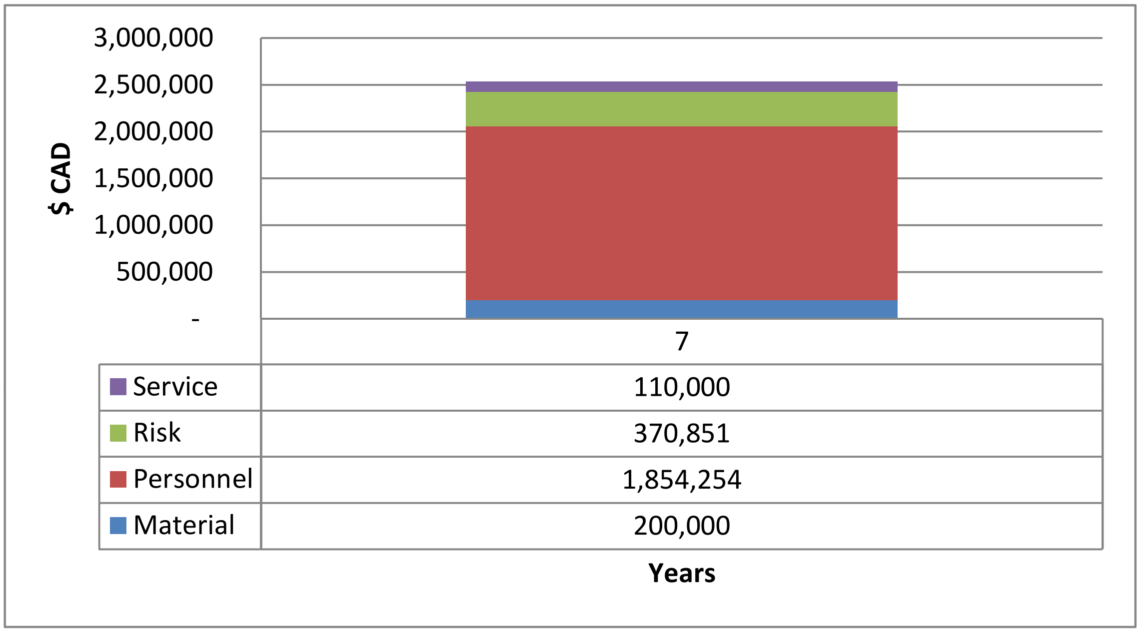


Figure 8.107.: VP.8 Budgets

Table 8.81.: VP. 8 Costs per Initiative & Technology

Items	Material	Personnel	Service	Risk	Grand Total
Contribution Category 1		**$ 1,469,605.20**	**$ 60,000.00**	**293,921.04**	**$ 1,823,526.24**
Manage (regulatory) reporting		**$ 97,543.86**		**19,508.77**	**$ 117,052.63**
Introduce automatic correlation and combination of reports		$ 97,543.86		19,508.77	$ 117,052.63
Manage C&I DSM		**$ 193,787.88**	**$ 10,000.00**	**38,757.58**	**$ 242,545.46**
Introduce improved management of C&I DSM resources based on near real time response measurement		$ 193,787.88	$ 10,000.00	38,757.58	$ 242,545.46
Manage cyber security and data privacy		**$ 121,703.06**		**24,340.61**	**$ 146,043.67**
Introduce cyber security as a design paradigm for technology projects		$ 121,703.06		24,340.61	$ 146,043.67
Manage distributed storage		**$ 194,459.29**		**38,891.86**	**$ 233,351.15**
Introduce network condition based distributed storage control		$ 194,459.29		38,891.86	$ 233,351.15
Manage network congestion		**$ 331,997.68**		**66,399.54**	**$ 398,397.21**
Introduce detection of potential congestion		$ 183,719.12		36,743.82	$ 220,462.95
Introduce surgical appliance control		$ 148,278.55		29,655.71	$ 177,934.27
Manage residential DSM		**$ 194,398.90**	**$ 50,000.00**	**38,879.78**	**$ 283,278.68**
Introduce schemes targeting individual customers with near real-time response		$ 194,398.90	$ 50,000.00	38,879.78	$ 283,278.68
Manage embedded microgrids		**$ 187,600.70**		**37,520.14**	**$ 225,120.84**
Introduce network condition based passive microgrid control		$ 187,600.70		37,520.14	$ 225,120.84
Manage self operated microgrids		**$ 148,113.83**		**29,622.77**	**$ 177,736.60**
Introduce basic self operated microgrid		$ 148,113.83		29,622.77	$ 177,736.60
Contribution Category 3		**$ 120,575.18**	**$ 50,000.00**	**24,115.04**	**$ 194,690.22**
Manage product-service components		**$ 120,575.18**	**$ 50,000.00**	**24,115.04**	**$ 194,690.22**
Introduce continuous improvement / optimization of component quality, cost and value proposition		$ 120,575.18	$ 50,000.00	24,115.04	$ 194,690.22
Infrastructure	**$ 200,000.00**	**$ 264,073.29**		**52,814.66**	**$ 516,887.94**
Network Analysis	**$ 150,000.00**	**$ 199,855.72**		**39,971.14**	**$ 389,826.86**
State Estimation	$ 50,000.00	$ 66,618.57		13,323.71	$ 129,942.29
Power Flow (DMS)	$ 50,000.00	$ 66,618.57		13,323.71	$ 129,942.29
Short Term Forecast (Load and Generation)	$ 50,000.00	$ 66,618.57		13,323.71	$ 129,942.29
Network Management	**$ 50,000.00**	**$ 64,217.57**		**12,843.51**	**$ 127,061.08**
Capacity Management	$ 50,000.00	$ 64,217.57		12,843.51	$ 127,061.08
Grand Total	**$ 200,000.00**	**$ 1,854,253.67**	**$ 110,000.00**	**370,850.73**	**$ 2,535,104.40**

8.8.1. Introduce surgical appliance control

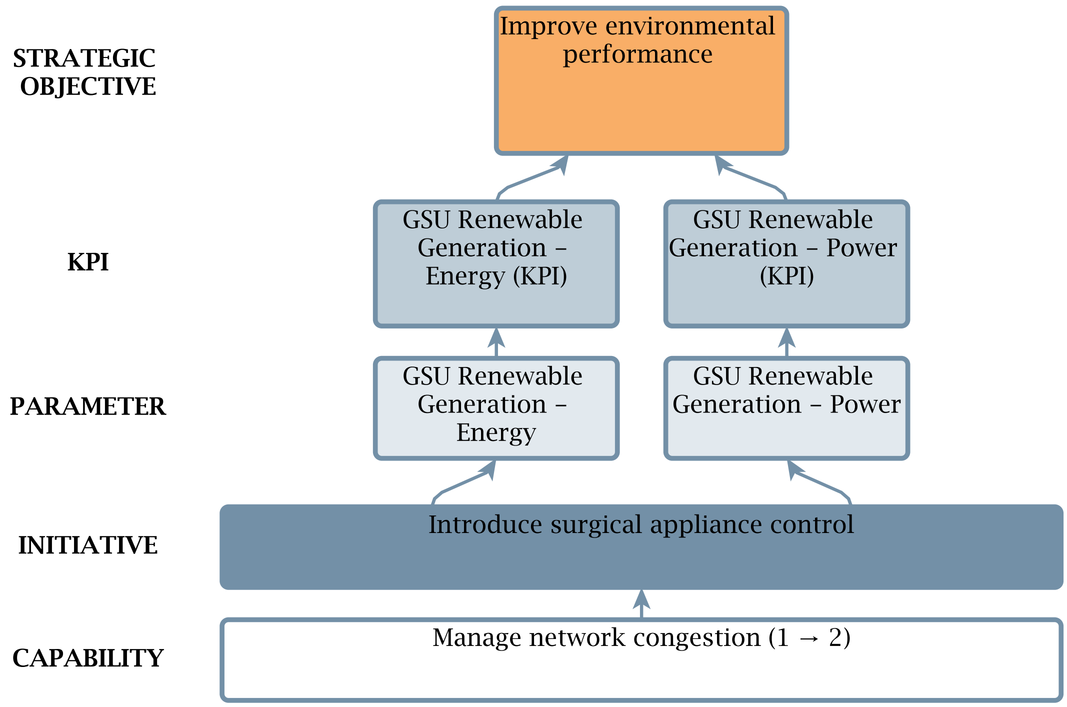


Figure 8.108.: VP.8 - Initiative No.1: Impact Chain

Table 8.82.: VP.8 - Initiative No.1: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
GSU Renewable Generation - Energy	5,643	↑	5,869	56,430	MWh
GSU Renewable Generation - Power	1.63	↑	↑	180	MW

GSU currently has no congestion related constraints on their system, and does not directly manage load shedding programs. The Province-wide Peaksaver program currently provides a load shedding program which is directed by the IESO. However, it is considered likely that in the near future, factors such as an increase in distributed generation on GSU's grid could create constraints and require local balancing to match intermittent or variable sources of generation, such as renewables.

Non-surgical, manual group appliance control capabilities were introduced in VP.7 as shown on page 230. Using GIS, demand response controllers and SCADA telemetry, this initiative will extend the existing process to utilize situational awareness in the control room to leverage surgical appliance control with individual limitations (location, quantity, etc.) and direct load shedding where contracts exist.

While numerical impacts were not assessed, this initiative will enable GSU to deploy more renewable generation on their system and support the goal of increasing distributed generation.

As a result of avoiding outages caused by congestion, GSU will be able to improve its outage duration, outage impact and SAIFI figures and thus meet one of its most important strategic targets of providing exceptional customer value.

8.8.2. Introduce detection of potential congestion

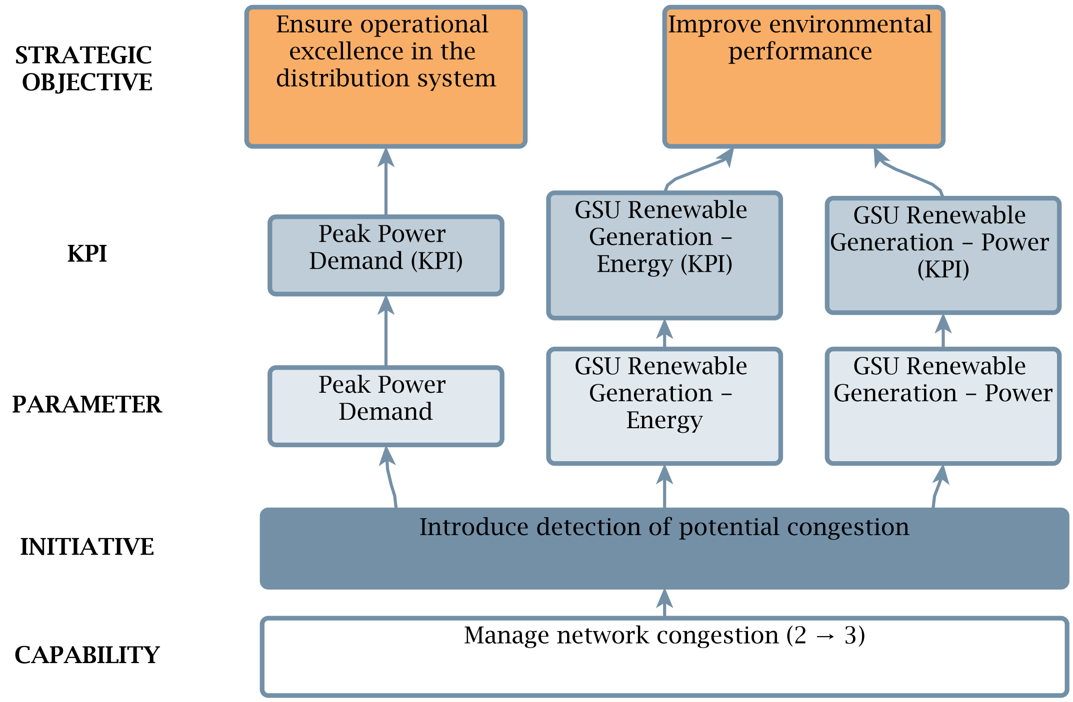


Figure 8.109.: VP.8 - Initiative No.2: Impact Chain

Table 8.83.: VP.8 - Initiative No.2: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Peak Power Demand	184	↓	↓	145	MW
GSU Renewable Generation - Energy	5,643	↑	5,869	56,430	MWh
GSU Renewable Generation - Power	1.63	↑	↑	180	MW

GSU currently has no congestion related constraints on their system, and does not directly manage load shedding programs. The Province-wide Peaksaver program currently provides a load shedding program which is directed by the IESO. However, it is considered likely that in the near future, factors such as an increase in distributed generation on GSU's grid could create constraints and require local balancing to match intermittent or variable sources of generation, such as renewables.

By implementing this initiative, GSU will be able to carry out automated initiation of preconfigured remedial actions to avoid and mitigate network congestion caused by sudden seasonal loads (heating loads during severe winter). Previous initiatives in the larger grid modernization program have established capabilities to detect potential congestion based on real-time connectivity data. Process changes introduced in this initiative will enable GSU to define and automatically execute pre-determined remedial actions unique to the situation in the areas where potential congestion is detected. The verification of the results from executed remedial actions is done via feedback from a sample of loads.

For example, when potential congestion is detected in a grid segment, GSU will execute the pre-determined remedial action list unique for that area and that situation. Such a list could consist of issuing load curtailment commands to clothes dryers, adjust programmable communicating thermostats (PCT) on air-conditioners, optimize feeder and switch configuration and publish critical peak pricing information on an app or the web portal.

This process will ultimately have connections with managing DSM programs, DERs for the purposes of reducing network congestion.

Although the budget for corrective maintenance costs is expected to decline, by the time VP.8 is implemented, GSU will have expanded its operational asset base and extended its data analytics program.

This initiative will establish analysis capabilities in the process to proactively detect potential congestion and automatically initiate pre-configured remedial actions. The verification of the results from executed remedial actions is done via feedback from a sample of loads.

While numerical impacts were not assessed, this initiative will enable GSU to deploy more renewable generation on their system and support the goal of increasing distributed generation, together moving GSU towards its strategic objective of ensuring operational excellence in the distribution system.

8.8.3. Introduce schemes targeting individual customers with near real-time response

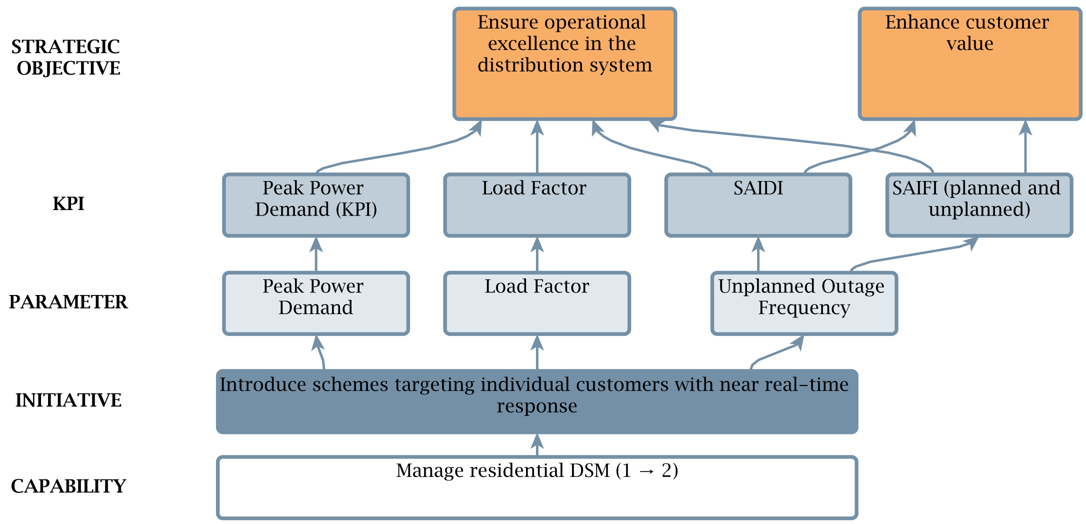


Figure 8.110.: VP.8 - Initiative No.3: Impact Chain

Table 8.84.: VP.8 - Initiative No.3: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	number
Peak Power Demand	184	↓	↓	145	MW
Load Factor	0.66	↑	↑	0.95	Ratio

The existing residential DSM process will be extended through this initiative in order to target individual customers with schemes in order to improve management of residential DSM resources. In chosen localities that are especially prone to network congestion or overloading, individual customers will be offered special tariffs to increase or decrease their consumption dynamically or at specified times.

Utilizing home DR controllers together with smart meters and SCADA telemetry, GSU will then be able to measure their load response to such schemes in near real-time in response to current network conditions.

This initiative will address GSU's strategic objectives of operational excellence in the distribution system by reducing peak demand, improving financial performance by improving load factor and asset utilization, and finally, providing enhanced customer value by reducing the number of unplanned outages.

Although the impact of this initiative on value added services was not assessed by the workshop team, it creates the necessary conditions for generating additional value streams through targeting individual customers with tailored DSM schemes.

8.8.4. Introduce improved management of C&I DSM resources based on near real time response measurement

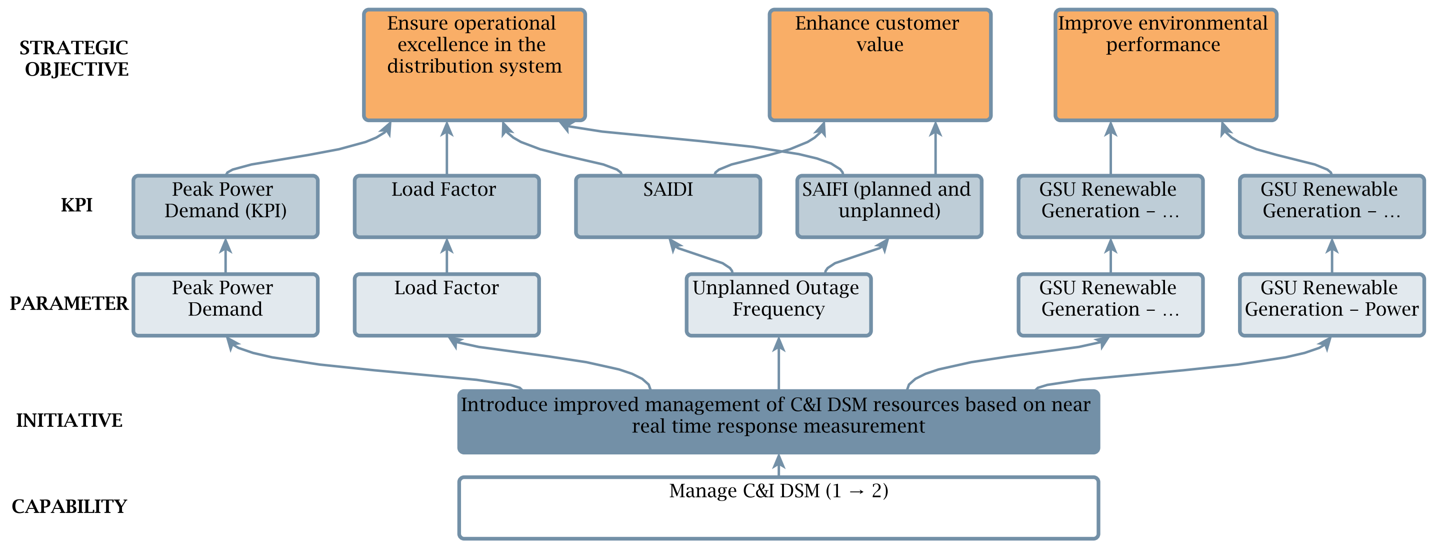


Figure 8.111.: VP.8 - Initiative No.4: Impact Chain

Table 8.85.: VP.8 - Initiative No.4: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	Number
Peak Power Demand	184	↓	↓	145	MW
Load Factor	0.66	↑	↑	0.95	Ratio
GSU Renewable Generation - Energy	5,643	↑	5,869	56,430	MWh
GSU Renewable Generation - Power	1.63	↑	↑	180	MW

This initiative will extend the existing process in order to target individual C&I customers with schemes in order to improve management of C&I DSM resources. In business parks or industrial areas that may become prone to network congestion or overloading, individual C&I customers will be offered special tariffs to increase or decrease their consumption dynamically or at specified times.

Utilizing C&I DR controllers together with smart meters and SCADA telemetry, GSU will then be able to measure their load response to such schemes in near real-time in response to current network conditions.

This initiative will address GSU's strategic targets of operational excellence in the distribution system by shaving peak demand, maintaining financial strength by improving load factor and asset utilization, and finally, providing exceptional customer value by reducing the number of unplanned outages.

Although the impact of this initiative on value added services was not assessed by the workshop team, it creates the necessary conditions for generating additional value streams through targeting individual customers with tailored DSM schemes.

This initiative will enable GSU to reduce peak power demand, increase load factor, and enable increased penetration of renewable generation, thereby ensuring operational excellence in the distribution system.

8.8.5. Introduce network condition based distributed storage control

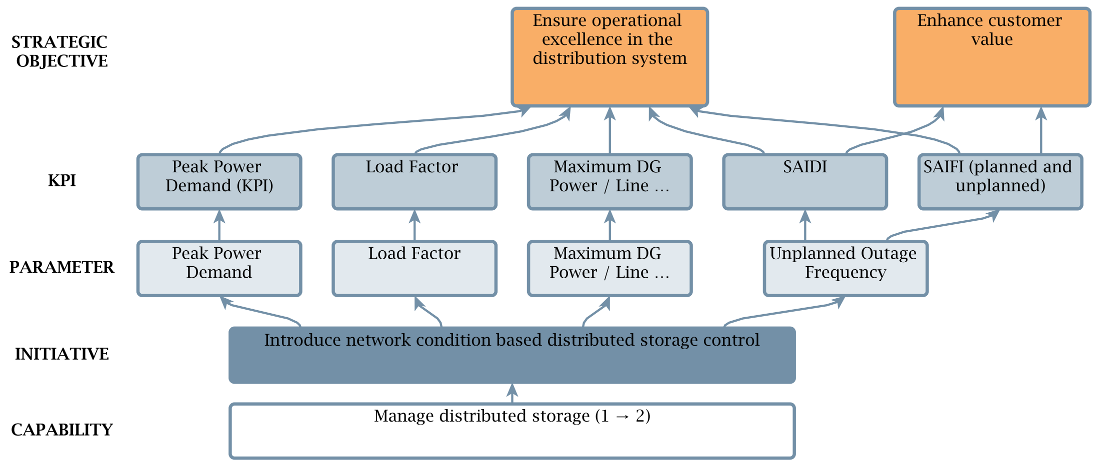


Figure 8.112.: VP.8 - Initiative No.5: Impact Chain (a)

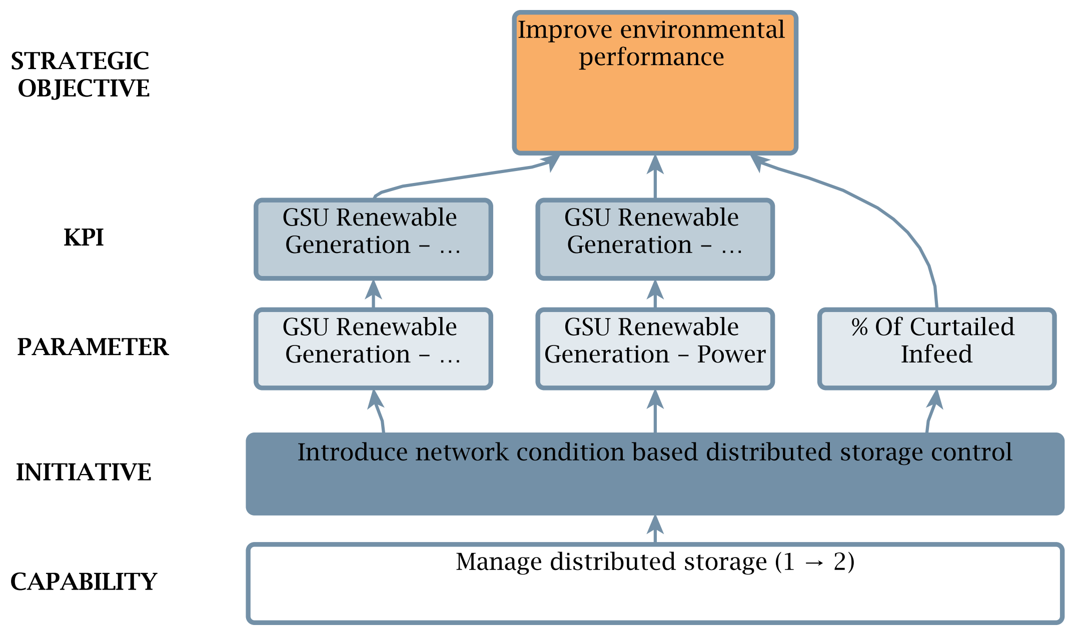


Figure 8.113.: VP.8 - Initiative No.5: Impact Chain (b)

Table 8.86.: VP.8 - Initiative No.5: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	Number
Peak Power Demand	184	↓	↓	145	MW
Load Factor	0.66	↑	↑	0.95	Ratio
GSU Renewable Generation - Energy	5,643	↑	5,869	56,430	MWh
GSU Renewable Generation - Power	1.63	↑	↑	180	MW
% Of Curtailed Infeed	0.00	↓	0.00	N/A	Ratio
Maximum DG Power / Line Capacity	0.19	↑	↑	0.40	Ratio

This initiative will introduce distributed storage control in response to current network conditions. This relies on near real-time visibility of storage resource activity and involves the capability to curtail, disconnect or make resource set-point adjustment suggestions to storage based on grid operating characteristics. Allowing control may be optional, or mandatory if the stability of the grid is in danger.

By leveraging distributed storage, one of several technologies encompassed in the broader scope of distributed energy resources, GSU will be able to reduce outages, reduce peak loads and increase load factor, as well as facilitate the operation of increasing levels of renewable generation.

The initiative impacts the strategic objectives of ensuring operational excellence in the distribution system and enhanced customer value.

8.8.6. Introduce network condition based passive microgrid control

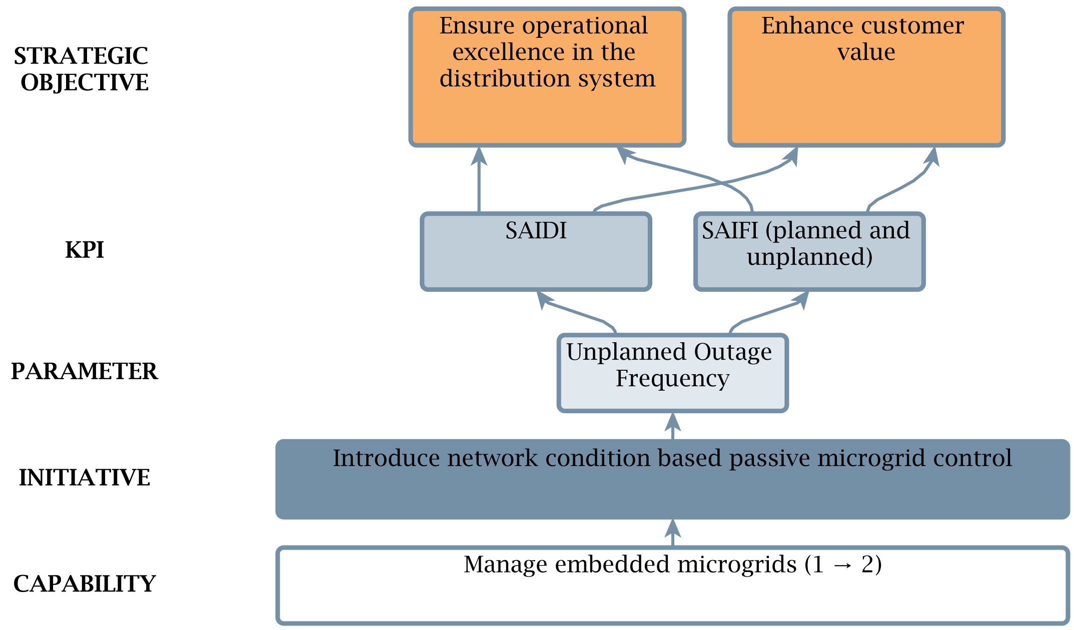


Figure 8.114.: VP.8 - Initiative No.6: Impact Chain

Table 8.87.: VP.8 - Initiative No.6: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	number

This initiative will introduce passive microgrid control in response to current network conditions based on near real-time visibility of the internal microgrid activities. Passive control in this sense means to make resource set-point adjustment suggestions to the microgrid operator, with the option to override operator control in the event of a grid emergency.

By developing the capability to control embedded microgrids, GSU will be able to reduce outages and facilitate the deployment of increasing levels of renewable generation.

8.8.7. Introduce basic self operated microgrid

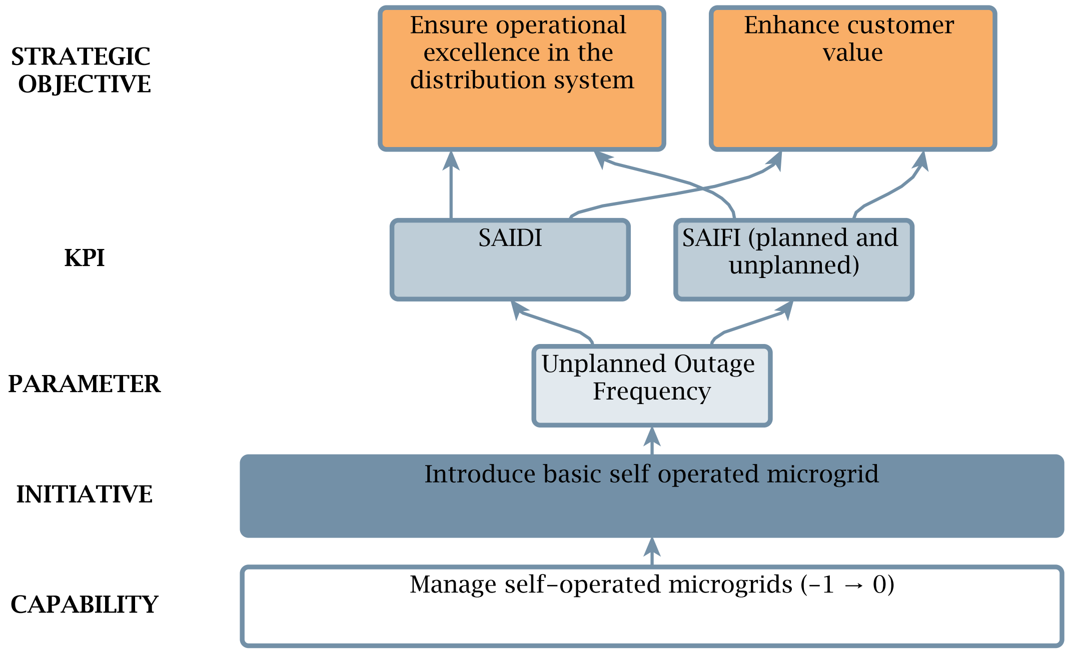


Figure 8.115.: VP.8 - Initiative No.7: Impact Chain (a)

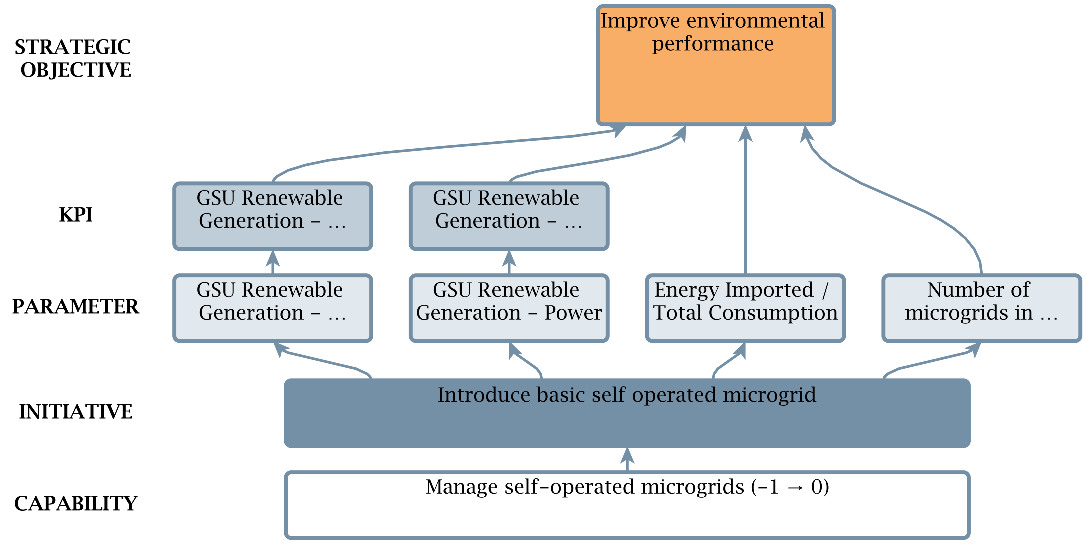


Figure 8.116.: VP.8 - Initiative No.7: Impact Chain (b)

Table 8.88.: VP.8 - Initiative No.7: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	Number
GSU Renewable Generation - Energy	5,643	↑	5,869	56,430	MWh
GSU Renewable Generation - Power	1.63	↑	↑	180	MW
Energy Imported / Total Consumption	1.00	↓	↓	0.40	Ratio
Number of microgrids in operation	1.00	1.00	2.00	4.00	Number

This initiative will identify an opportunity to establish a self-operated microgrid supporting enhanced reliability or energy services to customers or for internal use.

Establishing a GSU-operated microgrid will provide an additional tool which can be used to reduce outages and increase the ability to deploy renewable generation.

The basic self-operated microgrid forms the basis of the development of the microgrid management capability that can be further enhanced as required.

8.8.8. Introduce automatic correlation and combination of reports

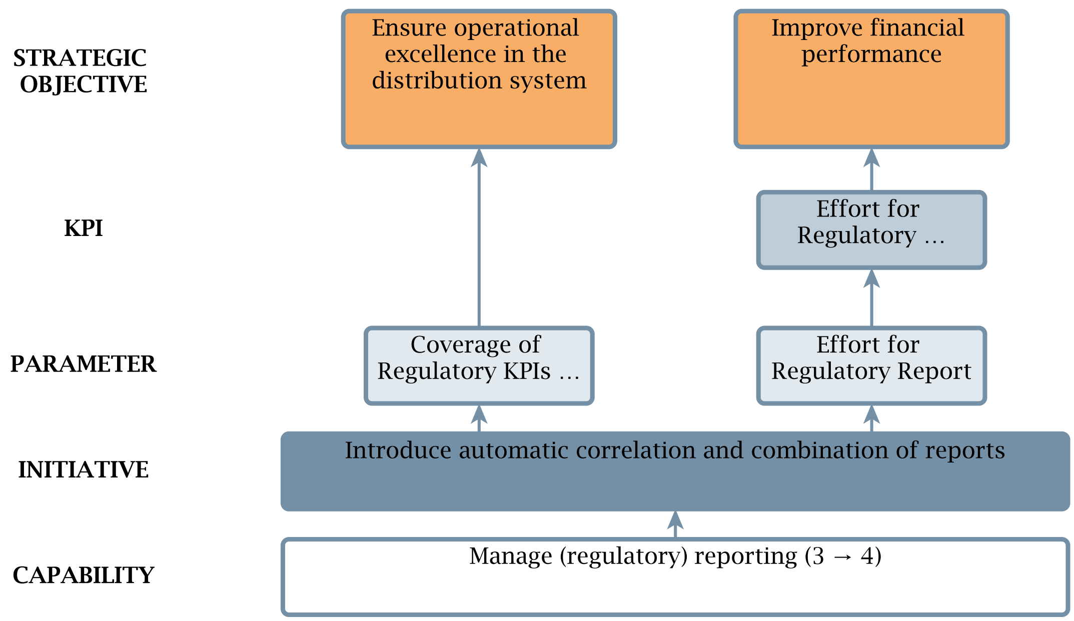


Figure 8.117.: VP.8 - Initiative No.8: Impact Chain

Table 8.89.: VP.8 - Initiative No.8: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Coverage of Regulatory KPIs in KPI System	0.00	0.10	0.80	1.00	Ratio
Effort for Regulatory Report	3.00	-0.10	1.50	2.00	FTE

This initiative extends the reporting process with an additional step for regular management reviews of intermediate results and latest KPI developments. The additional step would ensure easy incorporation of the available information into operational management decision making processes, e.g. via dashboards. Leveraging the synergy to utilize regulatory reporting for operational management will help to accelerate the time to a decision through higher information availability. This synergy will lead to direct decreases in reporting effort and corresponding costs.

This initiative also introduces automation within the reporting process to reduce the effort required for correlation and combination of reports and sub-reports. A prerequisite for this is the integration of different systems to enable automated access to the required information. Through the automation of the reporting procedures the effort for Regulatory Reporting can be decreased. Moreover the correlation and easy access to information decreases the Effort for Regulatory Reports KPI by considering regulatory targets in day to day management.

While numerical impacts for this initiative were not assessed, it will contribute to GSU's goal of reducing complexity.

8.8.9. Introduce cyber security as a design paradigm for technology projects

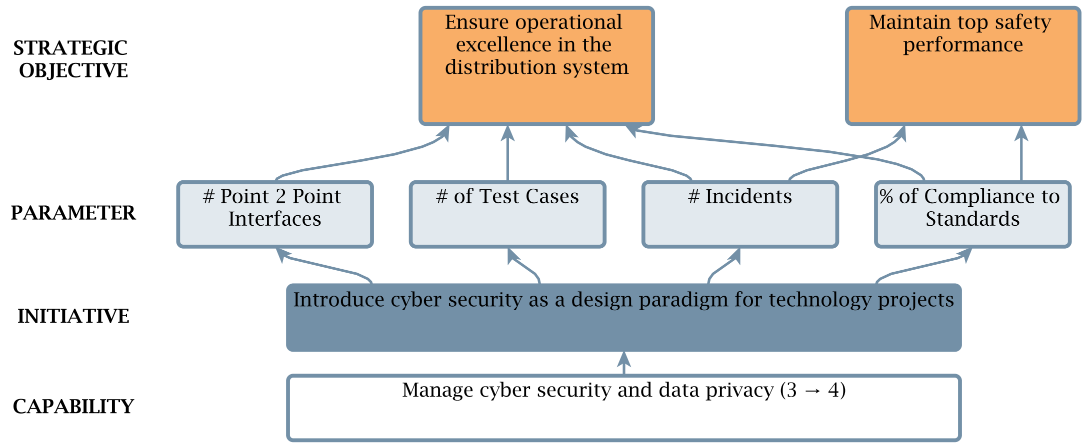


Figure 8.118.: VP.8 - Initiative No.9: Impact Chain

Table 8.90.: VP.8 - Initiative No.9: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
# Point 2 Point Interfaces	23	↓	↓	↓	Number
# of Test Cases	0	↑	↑	1	Number
# Incidents	2	↓	↓	0	Number
% of Compliance to Standards	N/A	↑	↑	N/A	Ratio

Through implementing this initiative, cyber security is introduced as a key component in the design of every technology related project at GSU. This means, for new technology related projects such as field device communication infrastructure, FLISR functions or smart meter rollouts, customized cyber security test-cases will be integrated within the design process. Process changes introduced by this initiative will help further reduce or altogether eliminate cyber security incidents that might negatively impact GSU's corporate image.

The increase in the number of test-cases refers to additional security procedures which have to be implemented and tested for new technology projects with the target to improve overall cyber security, reduce costs arising from breaches of cyber security and thereby supporting the strategic objective of improving financial performance.

8.8.10. Introduce continuous improvement / optimization of component quality, cost and value proposition

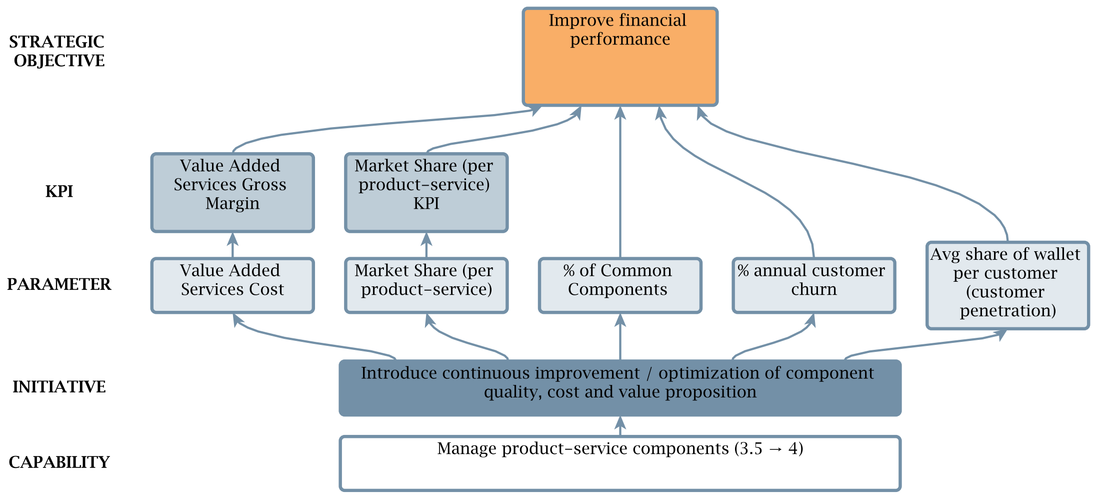


Figure 8.119.: VP.8 - Initiative No.10: Impact Chain (a)

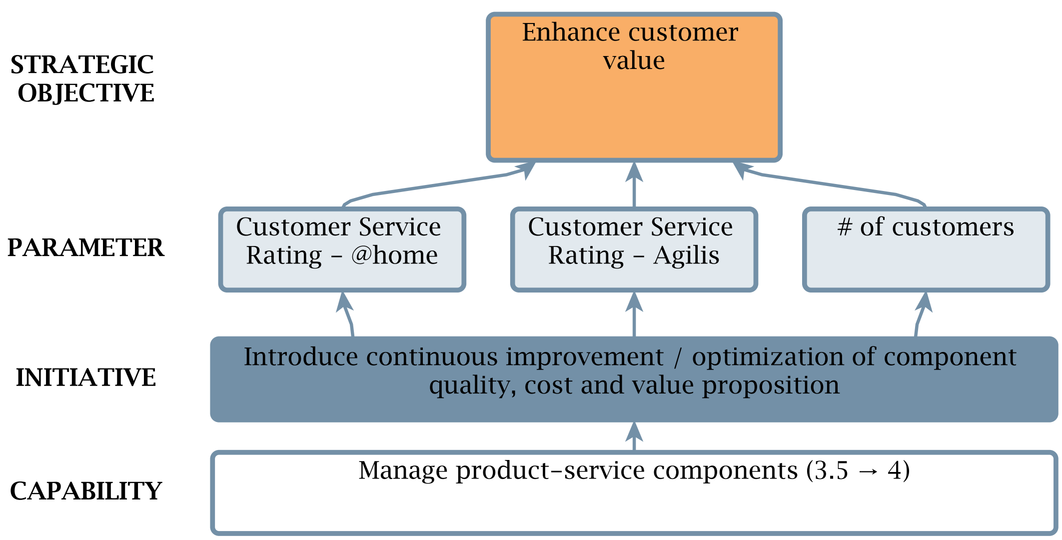


Figure 8.120.: VP.8 - Initiative No.10: Impact Chain (b)

Table 8.91.: VP.8 - Initiative No.10: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Value Added Services Cost	9,000,000	-2,250,000	42,850,000	45,000,000	$
% of Common Components	0.00	↑	↑	0.60	Ratio
Customer Service Rating - @home	0.94	↑	↑	0.99	Ratio
Customer Service Rating - Agilis	0.85	↑	↑	0.95	Ratio
Market Share (per product-service)	0.15	0.10	0.65	0.70	Ratio
# of customers	10,400	↑	10,400	60,000	Number
% annual customer churn	0.05	↓	↓	0.02	Ratio
Avg share of wallet per customer (customer penetration)	36.11	↑	↑	100.00	$

This initiative will introduce additional steps for the optimization of the individual component elements as well as the continuous improvement / optimization of their value propositions. Utilize the results of the existing cost and quality tracking as core input for the optimization approach.

This initiative will contribute to increasing market share for GSU's value-added services, by increasing the number of customers per product, increasing the number of products offered, and reducing cost, thereby supporting the strategic objective of improving financial performance.

8.9. VP.9: Balance Load & Generation Based on Network Condition

As the penetration of renewable energy resources ramps up, control capabilities need to become more sophisticated. This Value Pack introduces technological features that will enable GSU to control, aggregate and schedule renewable sources, both generation and demand, as well as provide them market access through an interface.

Technology synergies that are created in this Value Pack enable increasing process sophistication in other directions as well, such as designing energy efficiency programs and determining automated switching schedules after outages. Benefits of this Value Pack range from managing customer demand for grid benefit, system reliability, customer retention, customer satisfaction and market share.

Demand side management (DSM) is extended from the basic levels introduced in previous value packs. The implementation of distributed energy resource control technology enables the DSM and distributed generation capabilities to be further extended.

Initiatives:

- Introduce system support for automated switching schedule determination
- Introduce network condition based residential DSM scheduling and dispatch
- Introduce network condition based C&I DSM scheduling and dispatch
- Introduce network condition based DG scheduling and dispatch
- Introduce network condition based distributed storage scheduling and dispatch
- Introduce management of components in terms of aspects of product/service elements

Technology Deployments:

- Distribution Management System (DMS) General Dynamic Topology Processor
- DER Control - DER Control Aggregation
- DER Control - DER Control Scheduling
- DER Control - DER Control Market Interface
- DER Control - DER Control Contract Management
- DER Control - DER Control Auditing
- Distributed Energy Resources - Distributed Generation - DG Controller

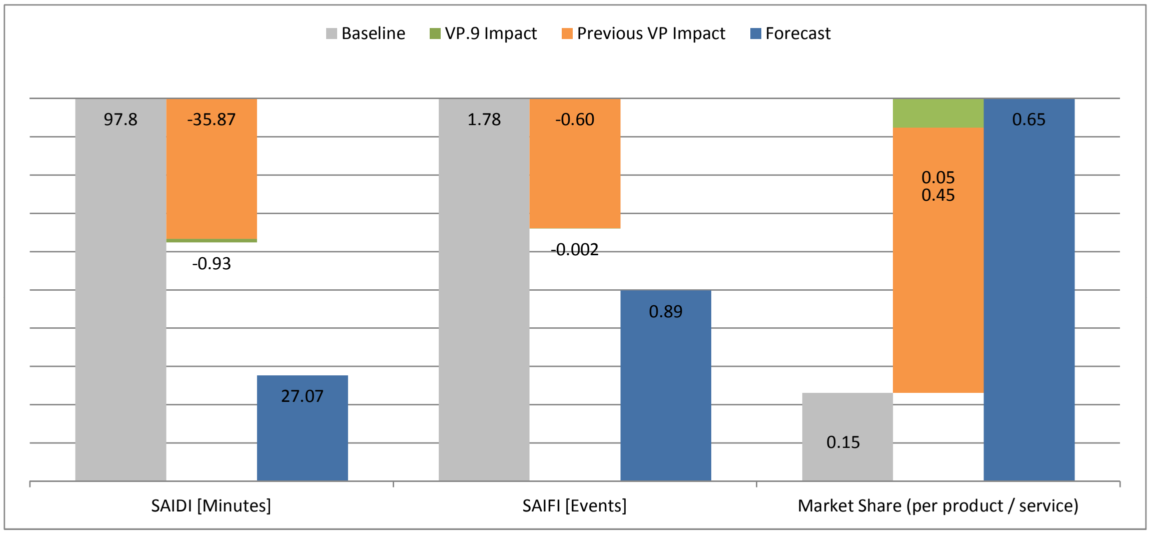


Figure 8.121.: VP.9 - Impact on KPIs

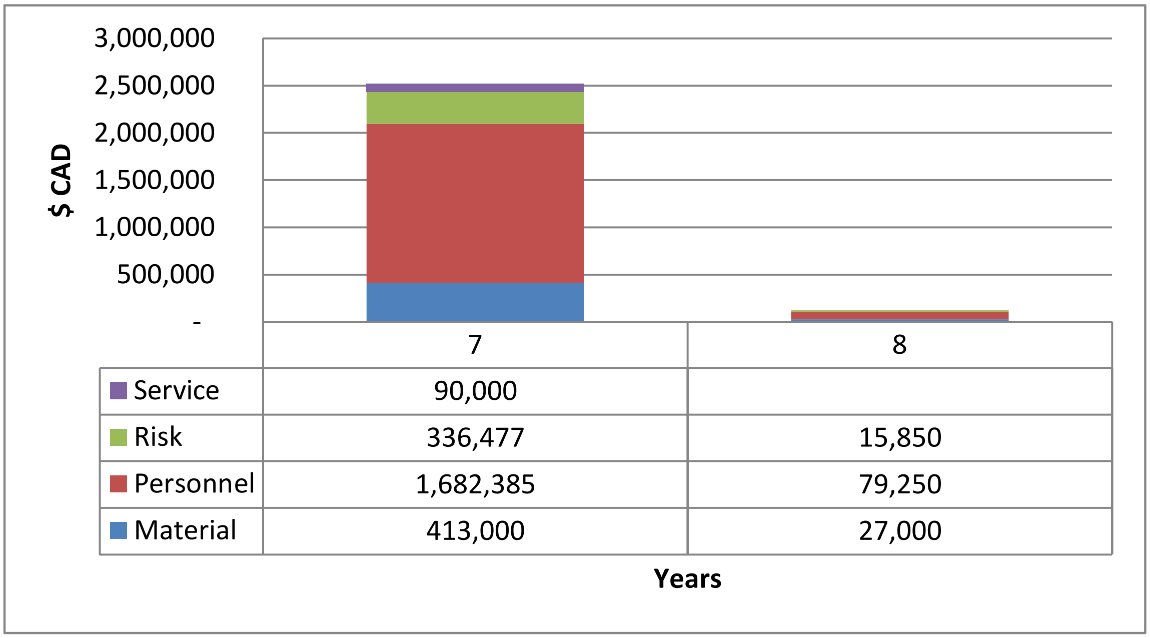


Figure 8.122.: VP.9 Budgets

Table 8.92.: VP. 9 Costs per Initiative & Technology

Items	Material	Personnel	Risk	Service	Grand Total
Contribution Category 1		**$ 750,999**	**$ 150,200**	**$ 40,000**	**941,198**
Manage C&I DSM		**$ 184,808**	**$ 36,962**	**$ 15,000**	**236,769**
Introduce network condition based C&I DSM scheduling and dispatch		$ 184,808	$ 36,962	$ 15,000	236,769
Manage DG		**$ 199,604**	**$ 39,921**		**239,524**
Introduce network condition based DG scheduling and dispatch		$ 199,604	$ 39,921		239,524
Manage distributed storage		**$ 181,780**	**$ 36,356**		**218,136**
Introduce network condition based distributed storage scheduling and dispatch		$ 181,780	$ 36,356		218,136
Manage residential DSM		**$ 184,808**	**$ 36,962**	**$ 25,000**	**246,769**
Introduce network condition based residential DSM scheduling and dispatch		$ 184,808	$ 36,962	$ 25,000	246,769
Contribution Category 2		**$ 214,300**	**$ 42,860**		**257,161**
Manage planned outages		**$ 214,300**	**$ 42,860**		**257,161**
Introduce system support for automated switching schedule determination		$ 214,300	$ 42,860		257,161
Contribution Category 3		**$ 108,187**	**$ 21,637**	**$ 50,000**	**179,824**
Manage product-service components		**$ 108,187**	**$ 21,637**	**$ 50,000**	**179,824**
Introduce management of components in terms of aspects of product/service elements		$ 108,187	$ 21,637	$ 50,000	179,824
Infrastructure	**$ 440,000**	**$ 688,149**	**$ 137,630**		**1,265,779**
DER Control	**$ 310,000**	**$ 413,896**	**$ 82,779**		**806,676**
Aggregation	$ 200,000	$ 141,349	$ 28,270		369,619
Auditing	$ 20,000	$ 56,879	$ 11,376		88,255
Contract Management	$ 20,000	$ 60,580	$ 12,116		92,697
Market Interface	$ 20,000	$ 56,879	$ 11,376		88,255
Scheduling	$ 50,000	$ 98,208	$ 19,642		167,850
Distributed Generation	**$ 30,000**	**$ 166,242**	**$ 33,248**		**229,490**
DG Controller	$ 30,000	$ 166,242	$ 33,248		229,490
General	**$ 100,000**	**$ 108,011**	**$ 21,602**		**229,613**
Dynamic Topology Processor	$ 100,000	$ 108,011	$ 21,602		229,613
Grand Total	**$ 440,000**	**$ 1,761,635**	**$ 352,327**	**$ 90,000**	**2,643,962**

8.9.1. Introduce system support for automated switching schedule determination

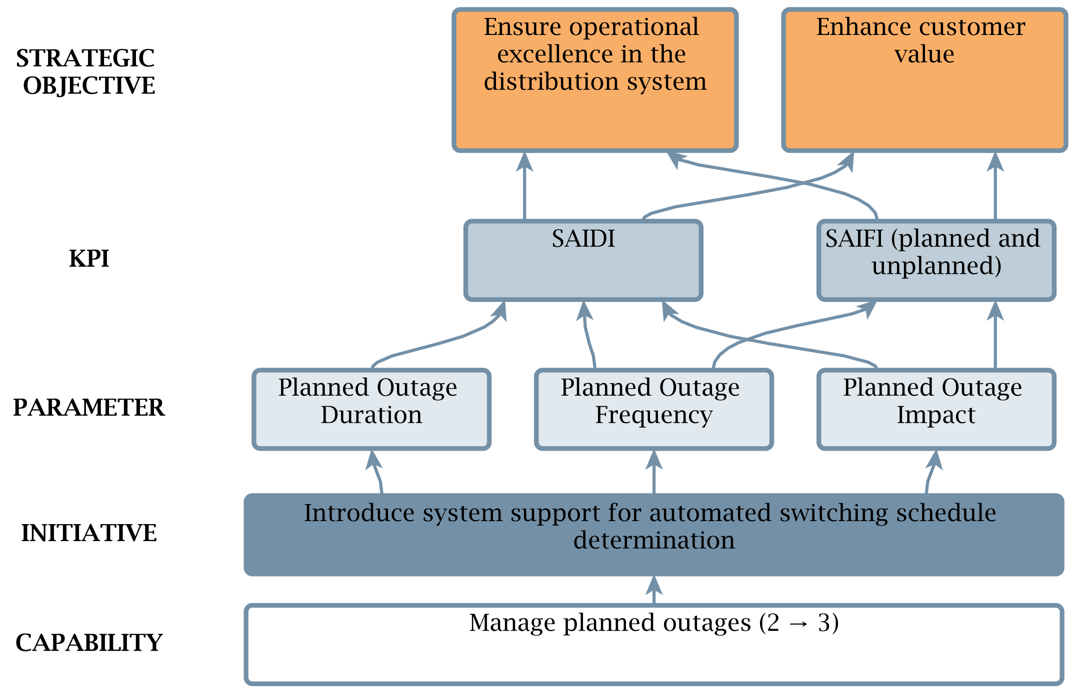


Figure 8.123.: VP.9 - Initiative No.1: Impact Chain

Table 8.93.: VP.9 - Initiative No.1: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Planned Outage Frequency	153	-2	147	N/A	Number
Planned Outage Duration	199	-5	169	N/A	Minutes
Planned Outage Impact Table	37	0	33	N/A	Customers

This initiative will enable GSU to automatically determine switching schedules with the objective of minimizing interruption duration and customer impact.

Since the pre-requisites for this initiative are already in place from previous initiatives, this initiative will enable GSU to use the real-time connectivity data from the grid (feeder monitoring, smart meters, substation monitoring etc.) to automatically determine the switching schedule which results in least customer impact and outage duration. Reduced outage durations and reduced customer impact will help GSU support its strategic target of providing exceptional customer value.

8.9.2. Introduce network condition based residential DSM scheduling and dispatch

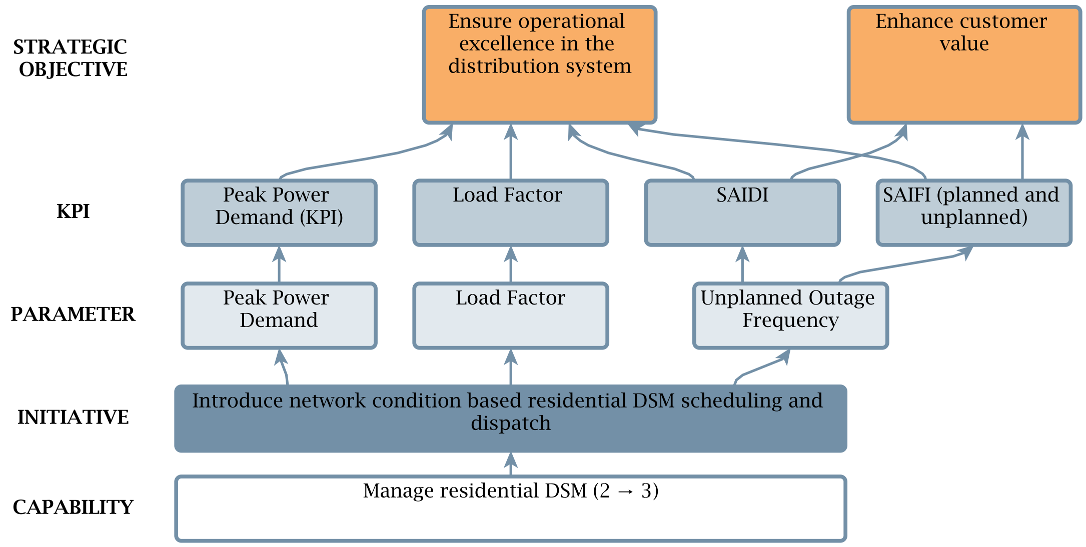


Figure 8.124.: VP.9 - Initiative No.3: Impact Chain

Table 8.94.: VP.9 - Initiative No.3: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	number
Peak Power Demand	184	↓	↓	145	MW
Load Factor	0.66	↑	↑	0.95	Ratio

The implementation of this initiative extends the existing process to enable configuration, scheduling and dispatch of residential DSM depending on the network condition as well as provision of ancillary services to the transmission system operator. This will help GSU reduce peak power demand and improve its load factor considerably, thereby meeting its strategic targets of improving financial performance as well as ensuring operational excellence in the distribution system.

Relying on data from smart meters, home/C&I controllers, DG controllers and feeder monitoring sensors, GSU is also capable of identifying potential congestion and real-time grid stress. Taken together, these capabilities provide the necessary pre-requisite for scheduling and even dispatching DSM resources in response to network situations. As a result of avoiding potential congestion, the number of unplanned outages is expected to decline which addresses the strategic objective of enhancing customer value.

Similarly, providing consumption incentives at times of surplus energy and minimizing consumption at peak times through DSM mechanisms will help reduce peak demand and promote efficient use of energy. Innovative DSM schemes that influence load consumption are essentially designed around increasing customer perception of value. Although scheduling and dispatching of DSM resources is therefore also expected to further strengthen GSU's revenue position with respect to value-added services, the impact was not quantified by the joint Siemens/GSU team at this time.

8.9.3. Introduce network condition based C&I DSM scheduling and dispatch

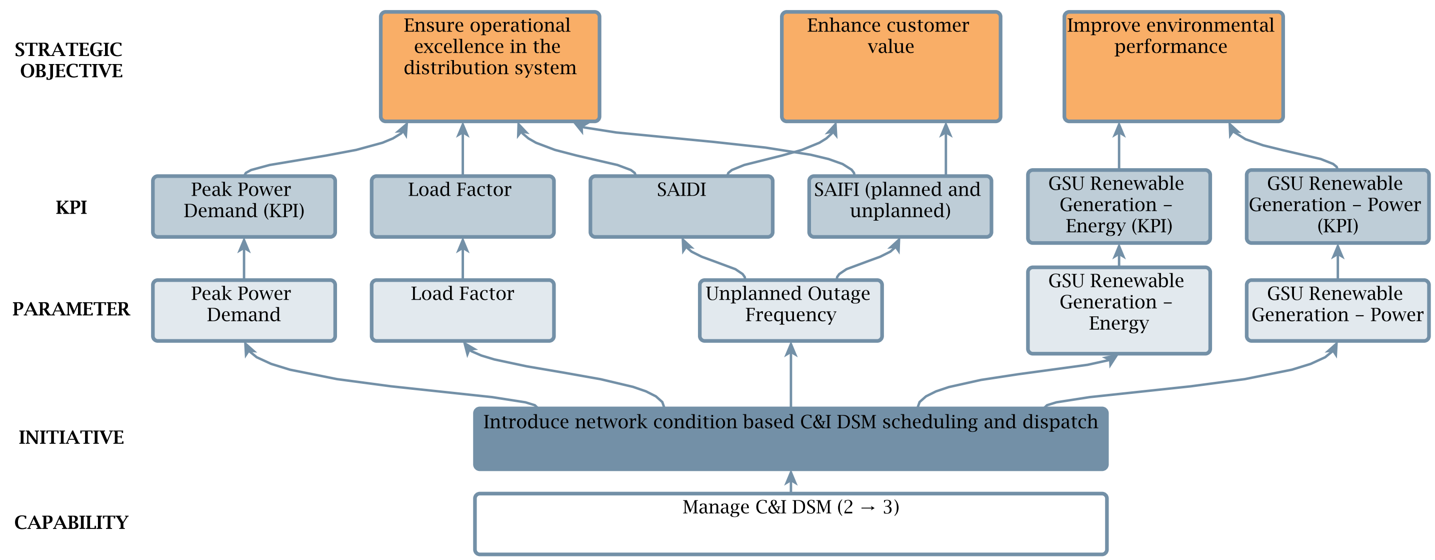


Figure 8.125.: VP.9 - Initiative No.4: Impact Chain

Table 8.95.: VP.9 - Initiative No.4: Impact Table

Parameter	**Baseline**	**Impact Table**	**Forecast**	**Target**	**Unit**
Unplanned Outage Frequency	233	↓	200	N/A	Number
Peak Power Demand	184	↓	↓	145	MW
Load Factor	0.66	↑	↑	0.95	Ratio
GSU Renewable Generation - Energy	5,643	↑	↑	56,430	MWh
GSU Renewable Generation - Power	2	↑	↑	180	MW

This initiative is similar in content to the previous initiative and extends the scheduling and dispatch capabilities for residential DSM to commercial and industrial customers. GSU will be able to configure, schedule and dispatch large C&I DSM resources depending on the network condition as well as to provide ancillary services to the transmission system operator. This will help GSU reduce peak power demand and improve its load factor considerably, thereby meeting its strategic objective of improving financial performance and ensuring operational excellence in the distribution system.

Relying on data from smart meters, home/C&I controllers, DG controllers and feeder monitoring sensors, GSU is also capable of identifying potential congestion and real-time grid stress. Taken together, these capabilities provide the necessary prerequisites for scheduling and even dispatching C&I DSM resources in response to network situations. As a result of avoiding potential congestion, the number of unplanned outages is expected to decline which addresses the strategic objective of enhancing customer value.

Innovative DSM schemes for C&I customers that influence load consumption are essentially designed around increasing customer perception of value. But for C&I customers, the perceived value will naturally be different when compared to residential customers. For C&I customers, this initiative therefore includes designing and offering innovative products and services for C&I customers that take advantage of the specific nature of industrial and commercial load consumption. Businesses and industries with load consumption patterns that are cyclical, periodic and predictable are ideal candidates for DSM schemes. By offering innovative value-added services to C&I customers such as supermarkets, process industries etc., GSU will further strengthen its revenue position with respect to value-added services. Finally, although this initiative is expected to further strengthen GSU's revenue position with respect to value-added services, the impact was not quantified by the joint Siemens/GSU team at this time.

8.9.4. Introduce network condition based DG scheduling and dispatch

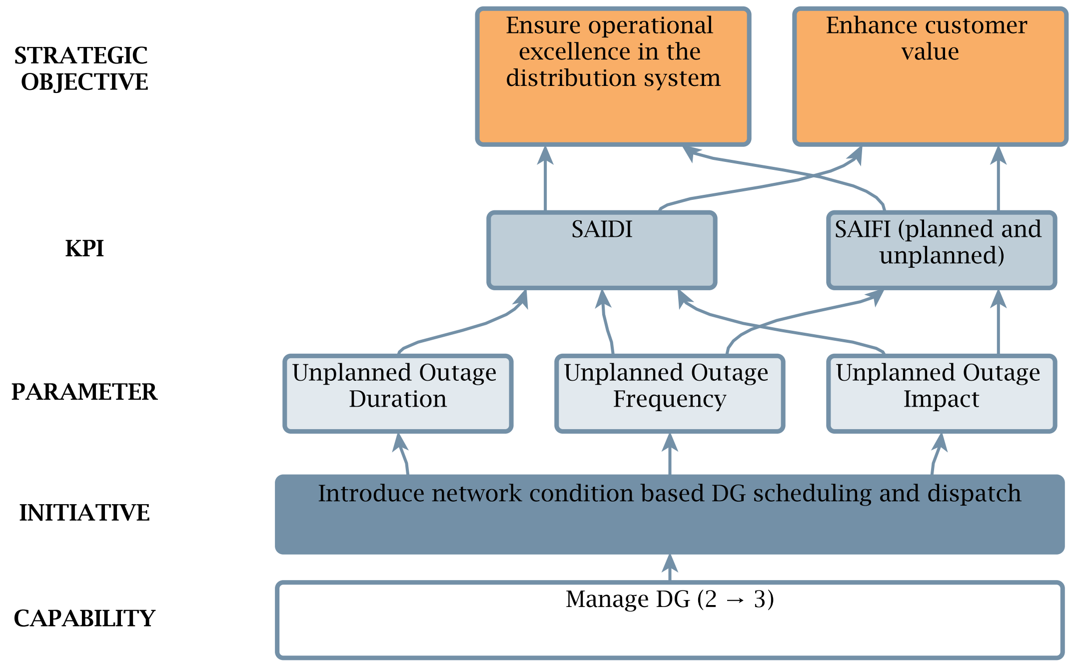


Figure 8.126.: VP.9 - Initiative No.5: Impact Chain

Table 8.96.: VP.9 - Initiative No.5: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	Number
Unplanned Outage Duration	44	↓	12	N/A	Minutes
Unplanned Outage Impact Table	335	↓	184	N/A	Customers

GSU currently conducts CIAs (connection impact assessments) and has the ability to monitor and control generation ¿10kW, however currently there is no ability to dispatch or control output.

This initiative will extend the existing process to enable scheduling and dispatch of DG depending on the network condition as well as to provide ancillary services to the transmission system operator. Integrating DG controllers with SCADA telemetry and the control centre's real-time situational awareness of network condition, the control centre can ramp DG up or down to avoid unplanned outages and offer additional products and services. Value-added services could include ancillary services to the TSO as well as bundled DG solutions (district heating, rooftop PV, air-conditioning maintenance service or free installation of efficient water-heaters in exchange for demand response enrolment etc.)

The ability to schedule and dispatch DG will create further flexibility on GSU's system and enable the avoidance of unplanned outages.

8.9.5. Introduce network condition based distributed storage scheduling and dispatch

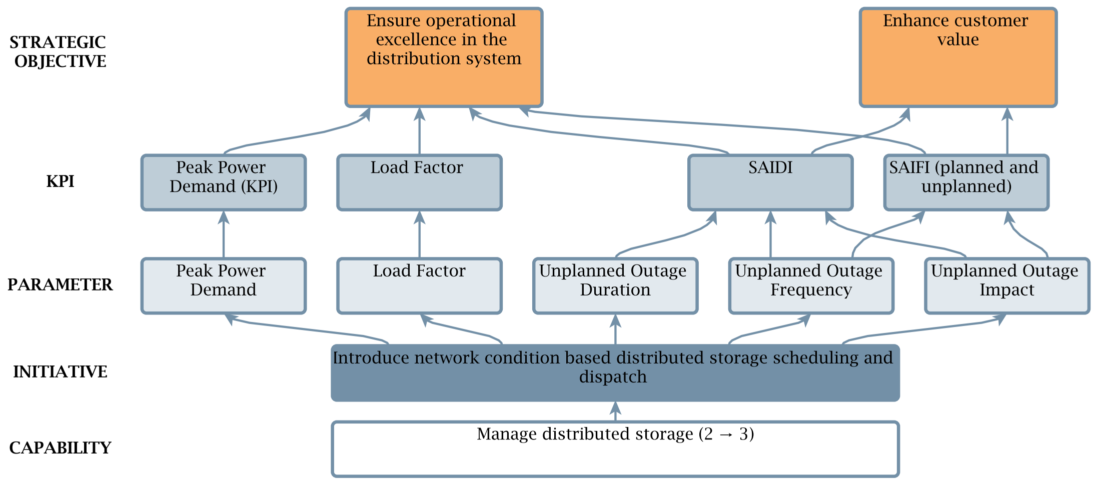


Figure 8.127.: VP.9 - Initiative No.6: Impact Chain

Table 8.97.: VP.9 - Initiative No.6: Impact Table

Parameter	Baseline	Impact Table	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	Number
Unplanned Outage Duration	44	↓	12	N/A	Minutes
Unplanned Outage Impact Table	335	↓	184	N/A	Customers
Peak Power Demand	184	↓	↓	145	MW
Load Factor	0.66	↑	↑	0.95	Ratio

This initiative introduces distributed storage scheduling and dispatch in response to current network conditions. Integrating storage controllers with SCADA telemetry and the control centre's real-time situational awareness of network condition, the control center can utilize distributed storage to avoid unplanned outages and offer additional products and services. Value-added services could include ancillary services to the transmission system operator.

The initiative impacts the strategic objectives of ensuring operational excellence in the distribution system and enhanced customer value.

8.9.6. Introduce management of components in terms of aspects of product/service elements

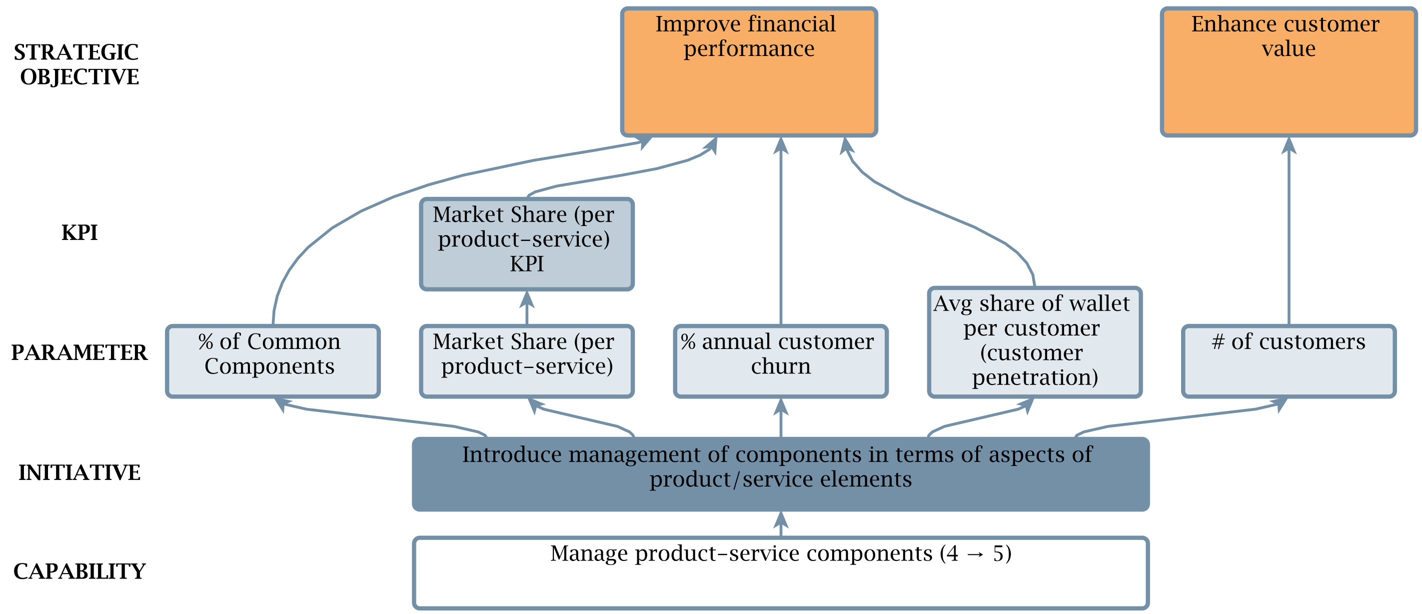


Figure 8.128.: VP.9 - Initiative No.7: Impact Chain

Table 8.98.: VP.9 - Initiative No.7: Impact Table

Parameter	**Baseline**	**Impact Table**	**Forecast**	**Target**	**Unit**
% of Common Components	0.00	↑	↑	0.60	Ratio
Market Share (per product-service)	0.15	0.05	0.65	0.70	Ratio
# of customers	10,400	↑	↑	60,000	Number
% annual customer churn	0.05	↓	↓	0.02	Ratio
Avg share of wallet per customer (customer penetration)	36.11	↑	↑	100.00	$

This initiative will increase the granularity of product/service component management. Instead of just being able to create and manage multiple component elements, the process will need to handle the management of a great variety of different aspects for each of the component elements. Utilizing those aspects will be the basis to create highly individual, but widely standardized products and services.

This initiative will contribute to increasing market share for GSU's value-added services, by increasing the number of customers per product, and increasing the number of products offered. Together they will contribute to the achievement of GSU's strategic target of improved financial performance.

8.10. VP.10: Advanced Demand Side Management

Extending the scheduling and dispatch capabilities for distributed energy resources developed in previous Value Packs, an expanded management toolkit is realized in this value pack for GSU enabling it to relieve network congestion on a global as well as potentially local basis.

Implementation of DER forecasting capabilities will allow GSU to integrate both distributed generation and loads in its balancing scheme by forecasting unpredictable behaviour of residential/commercial loads and the stochastic output of DG. Utilizing the generated DG and DSM profile forecasts, GSU will be capable of balancing local loads with local generation by scheduling and dispatching them in response to network condition. Benefits of this Value Pack range from managing customer demand for grid benefit, system reliability, customer retention, customer satisfaction and market share.

Balancing renewable generation through both generation and load management, along with advancing reliability and power quality, are the themes of this value pack.

Initiatives:

- Consider distributed energy resources, equipment health and history to minimize outages
- Introduce online PQ measurement mapped to topology
- Automatic determination of improved network configuration
- Introduce balancing renewable outcome with residential DSM scheduling and dispatch
- Introduce balancing renewable outcome with C&I DSM scheduling and dispatch
- Introduce supply and demand balancing with DG scheduling and dispatch
- Introduce active integration of distributed generation capabilities into network design and planning

Technology Deployments:

- DER Control DER Control Forecasting (DER)
- DER Control DER Control Balancing
- Distribution Management System (DMS) Network Analysis Reliability Analysis (DMS)
- Distribution Management System (DMS) Network Management Loss Optimization
- Distribution Management System (DMS) Network Analysis Short Circuit Calculation

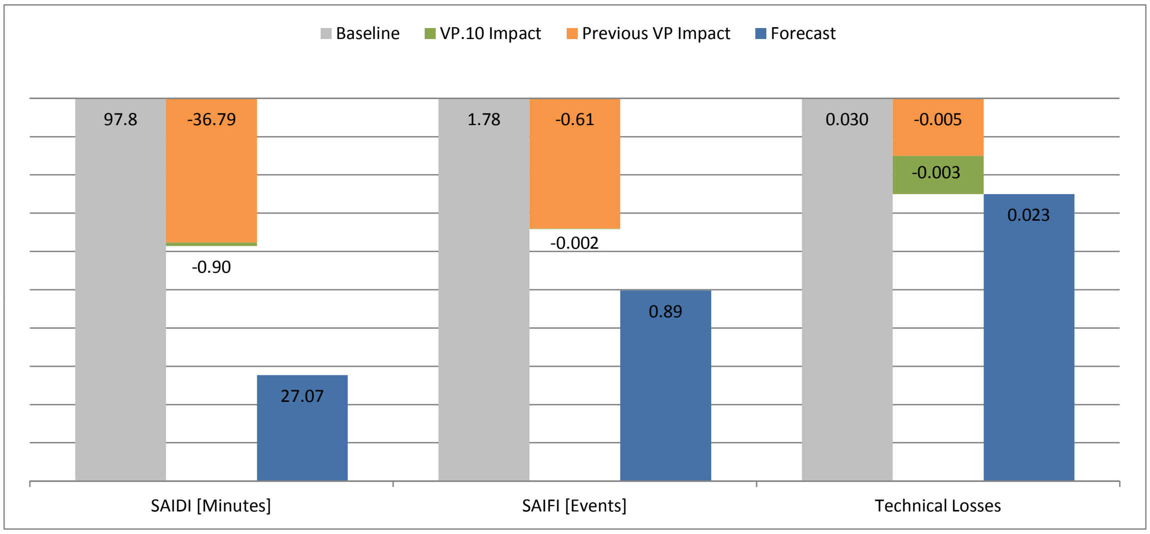
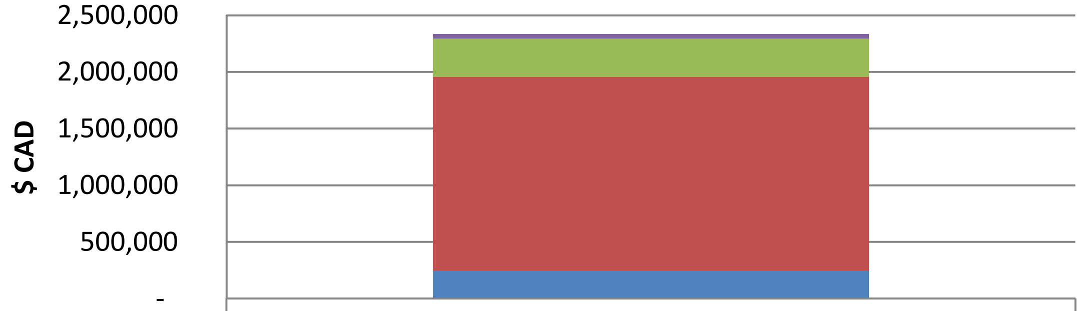


Figure 8.129.: VP.10 - Impact on KPIs



	8
Service	40,000
Risk	341,255
Personnel	1,706,273
Material	250,000

Figure 8.130.: VP.10 Budgets

Table 8.99.: VP. 10 Costs per Initiative & Technology

Items	Material	Personnel	Service	Risk	Grand Total
Contribution Category 1		**$ 1,112,335.97**	**$ 40,000.00**	**222,467.19**	**$ 1,374,803.16**
Manage C&I DSM		**$ 184,792.26**	**$ 15,000.00**	**36,958.45**	**$ 236,750.72**
Introduce balancing renewable outcome with C&I DSM scheduling and dispatch		$ 184,792.26	$ 15,000.00	36,958.45	$ 236,750.72
Manage DG		**$ 402,895.56**		**80,579.11**	**$ 483,474.67**
Introduce supply and demand balancing with DG scheduling and dispatch		$ 201,447.78		40,289.56	$ 241,737.34
Introduce active integration of distributed generation capabilities into network design and planning		$ 201,447.78		40,289.56	$ 241,737.34
Manage power quality		**$ 150,109.13**		**30,021.83**	**$ 180,130.95**
Introduce online PQ measurement mapped to topology		$ 150,109.13		30,021.83	$ 180,130.95
Manage residential DSM		**$ 196,984.26**	**$ 25,000.00**	**39,396.85**	**$ 261,381.12**
Introduce balancing renewable outcome with residential DSM scheduling and dispatch		$ 196,984.26	$ 25,000.00	39,396.85	$ 261,381.12
Manage technical losses		**$ 177,554.75**		**35,510.95**	**$ 213,065.70**
Automatic determination of improved network configuration		$ 177,554.75		35,510.95	$ 213,065.70
Contribution Category 2		**$ 212,080.44**		**42,416.09**	**$ 254,496.53**
Manage planned outages		**$ 212,080.44**		**42,416.09**	**$ 254,496.53**
Consider distributed energy resources, equipment health and history to minimize outages		$ 212,080.44		42,416.09	$ 254,496.53
Infrastructure	**$ 250,000.00**	**$ 381,856.64**		**76,371.33**	**$ 708,227.97**
DER Control	**$ 100,000.00**	**$ 184,401.93**		**36,880.39**	**$ 321,282.31**
Balancing	$ 50,000.00	$ 92,200.96		18,440.19	$ 160,641.16
Forecasting (DER)	$ 50,000.00	$ 92,200.96		18,440.19	$ 160,641.16
Network Analysis	**$ 100,000.00**	**$ 133,237.15**		**26,647.43**	**$ 259,884.58**
Short Circuit Calculation	$ 50,000.00	$ 66,618.57		13,323.71	$ 129,942.29
Reliability Analysis (DMS)	$ 50,000.00	$ 66,618.57		13,323.71	$ 129,942.29
Network Management	**$ 50,000.00**	**$ 64,217.57**		**12,843.51**	**$ 127,061.08**
Loss Optimisation	$ 50,000.00	$ 64,217.57		12,843.51	$ 127,061.08
Grand Total	**$ 250,000.00**	**$ 1,706,273.05**	**$ 40,000.00**	**341,254.61**	**$ 2,337,527.66**

8.10.1. Consider distributed energy resources, equipment health and history to minimize outages

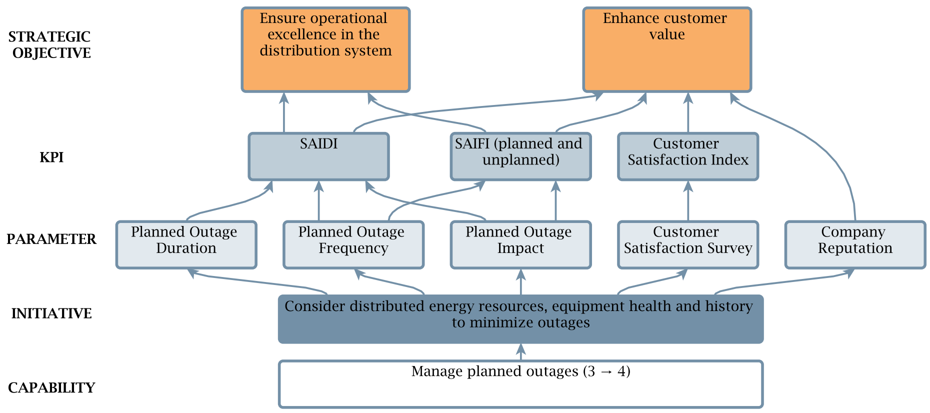


Figure 8.131.: VP.10 - Initiative No. 1: Impact Chain

Table 8.100.: VP.10 - Initiative No. 1: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Planned Outage Frequency	153	-2	147	N/A	Number
Planned Outage Duration	199	-5	169	N/A	Minutes
Planned Outage Impact	37	-0.4	33	N/A	Customers
Customer Satisfaction Survey	0.95	↑	0.97	1.00	Ratio
Company Reputation	0.75	0.05	0.90	1.00	Ratio

In the previous value pack, the use of real-time connectivity data from the grid (feeder monitoring, smart meters, substation monitoring etc.) to automatically determine the switching schedule that minimizes customer impact was introduced. This initiative extends these capabilities by introducing additional parameters such as distributed energy resources and equipment health for automatically determining switching schedules.

As distributed generation resources are integrated with switching schedule determination routines, they can be used to sustain supply to impacted customers during planned outage periods. Similarly, consideration of real-time equipment condition for determining switching schedules increases the utility's room for manoeuvre. For example, through this initiative, GSU will be able to overload certain transformers during lower temperature periods (increased thermal capacity) in order to avoid outages. This only comes into play once GSU integrates real-time equipment health and condition in the process that automatically determines the optimum switching schedule.

The primary effect of this initiative will be a positive impact on the strategic objective of ensuring operational excellence in the distribution system by improving SAIDI and SAIFI figures.

8.10.2. Introduce online PQ measurement mapped to topology

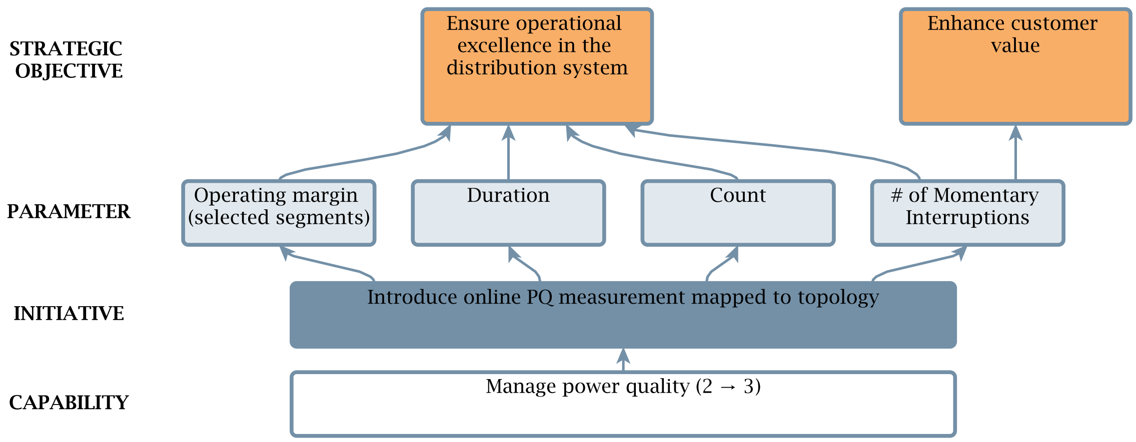


Figure 8.132.: VP.10 - Initiative No.2: Impact Chain

Table 8.101.: VP.10 - Initiative No.2: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Operating margin (selected segments)	0.40	↓	0.40	0.20	Ratio
Duration	0.00	↓	↓	0.00	Minutes
Count	0.00	↓	↓	0.00	Number
# of Momentary Interruptions	82,500	↓	↓	N/A	Customer-Interruptions

This initiative will enable GSU to monitor power quality online. Utilizing smart sensors in the distribution grid at critical points, the data will be mapped onto the network topology enabling analysis and functions which determine the root cause of power quality problems. Online monitoring of power quality will allow GSU to identify stressed grid components/areas and take remedial measures in order to reduce unplanned outages and momentary interruptions.

GSU is currently monitoring power quality 'hot spots', however, there is currently no proactive work being done to prevent power quality issues. There is an opportunity to measure the voltage from smart meters and then plug this information into the GIS.

This initiative will introduce the capabilities to monitor power quality online as well as mapping it onto the network topology. Additional analysis functions extend the process and support identification of root causes of power quality problems.

While numerical impacts were not assessed, this initiative contributes to GSU's strategic objectives to ensure operational excellence in the distribution system and enhance customer value.

8.10.3. Automatic determination of improved network configuration

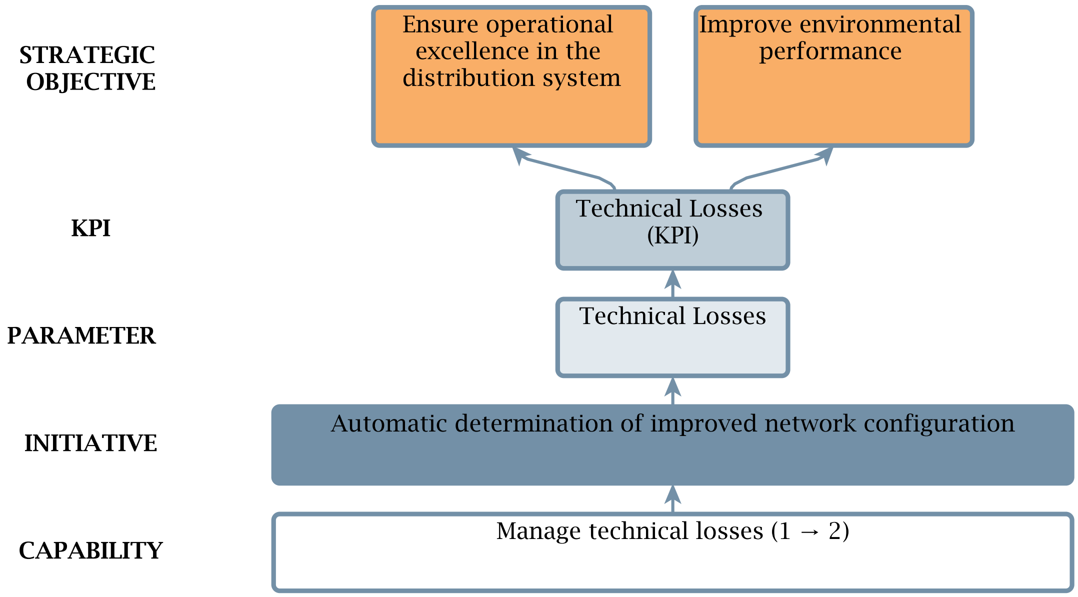


Figure 8.133.: VP.10 - Initiative No. 3: Impact Chain

Table 8.102.: VP.10 - Initiative No. 3: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Technical Losses	0.0300	-0.0030	0.0225	0.0300	Ratio

By implementing this initiative, GSU will be able to use feeder head monitoring data to automatically determine improved network configurations with least losses and then use remotely controllable field devices to optimize energy delivery.

Data from feeder monitoring provides real-time visibility of feeder load condition which is then fed to network model management systems running optimization algorithms (branch and bound, expert systems etc.) These optimization algorithms determine which network configuration and switch combination leads to least losses. Automating this process of determining improved network configuration will help GSU to quickly measure, localize and avoid configurations that involve significantly higher conversion rates of electricity to heat and electromagnetic energy.

Using actuators deep in the grid, GSU will then be able to implement the optimum network configuration by choosing the best switching combination in order to ensure operational excellence in the distribution system which is an important strategic objective.

8.10.4. Introduce balancing renewable outcome with residential DSM scheduling and dispatch

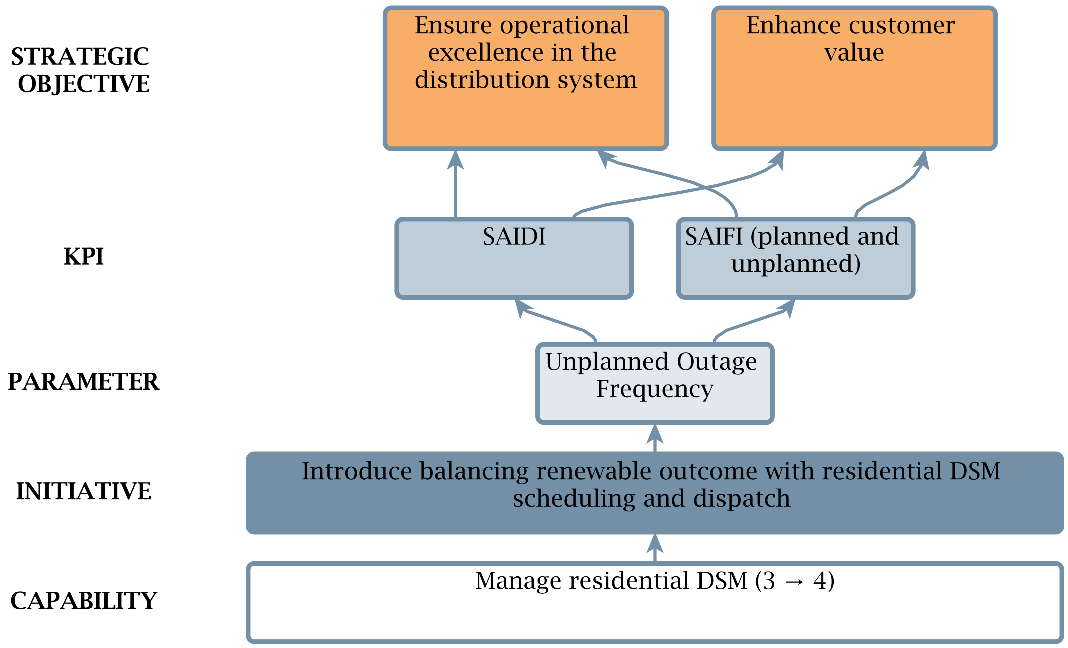


Figure 8.134.: VP.10 - Initiative No.4: Impact Chain

Table 8.103.: VP.10 - Initiative No. 4: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	Number

The implementation of this initiative extends GSU's capabilities to include configuration, scheduling and dispatch of residential DSM depending on the network condition as well as providing of ancillary services to the transmission system operator.

The intermittency problems of renewable sources are an important barrier in their widespread adoption. The stochastic weather patterns of wind and solar sources mean the forecasting of renewable generation can never be as stable or reliable as forecasting of fossil fuel generation. One way to deal with this intermittency is to couple the output of renewables with flexible loads. This initiative will enable GSU to use DSM levers to increase or decrease load in tandem with output from renewables through mechanisms such as direct control or, potentially, pricing signals. DSM schemes will also act as a lever to generate revenue from Value Added Services and support the strategic objective of ensuring operational excellence in the distribution system.

8.10.5. Introduce balancing renewable outcome with C&I DSM scheduling and dispatch

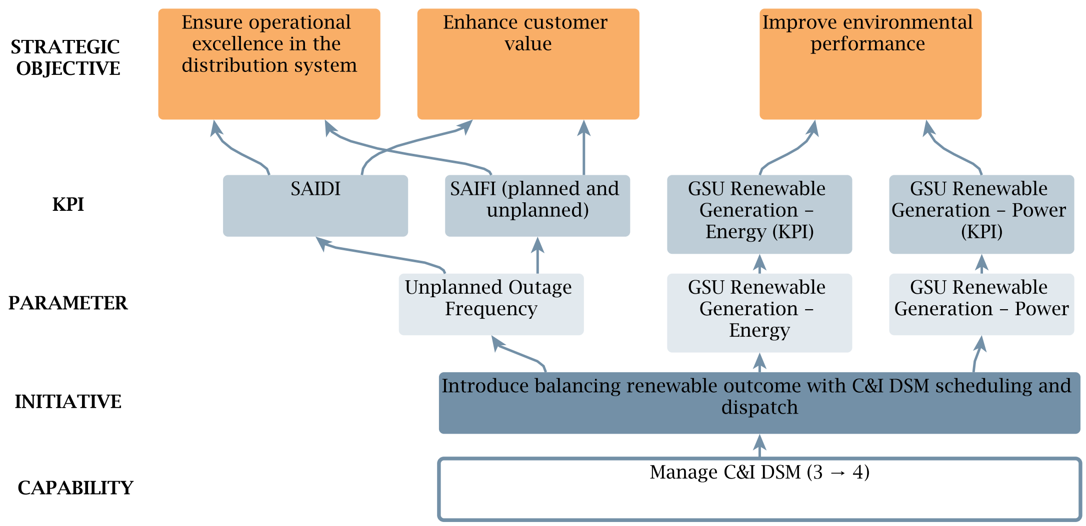


Figure 8.135.: VP.10 - Initiative No. 5: Impact Chain

Table 8.104.: VP.10 - Initiative No. 5: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Unplanned Outage Frequency	233	↓	200	N/A	number
GSU Renewable Generation - Energy	5,643	↑	5,869	56,430	MWh
GSU Renewable Generation - Power	1.63	↑	1.70	180	MW

Similar to the previous initiative, this initiative extends the process to actively use configuration, scheduling and dispatching of C&I DSM to help balance energy consumption and the fluctuating generation of renewable energy resources. By balancing renewable outcome with C&I DSM scheduling and dispatch, GSU can optimize renewable generation.

The intermittency problems of renewable sources are an important barrier in their widespread adoption. The stochastic weather patterns of wind and solar sources mean the forecasting of renewable generation can never be as stable or reliable as forecasting of fossil fuel generation. One way to deal with this intermittency is to couple the output of renewables with flexible loads. This initiative will enable GSU to use DSM levers to increase or decrease large industrial or commercial load in tandem with output from renewables through mechanisms such as direct control, on- and off-peak tariffs and dynamic tariffs etc.

This initiative would not only reduce the unplanned outage frequency and increase overall system reliability, it would also encourage renewable energy generation. Although the impact of this initiative on the percentage of renewable generation is not quantified, it creates the necessary conditions which enable an indirect increase in DER grid interconnection.

8.10.6. Introduce supply and demand balancing with DG scheduling and dispatch

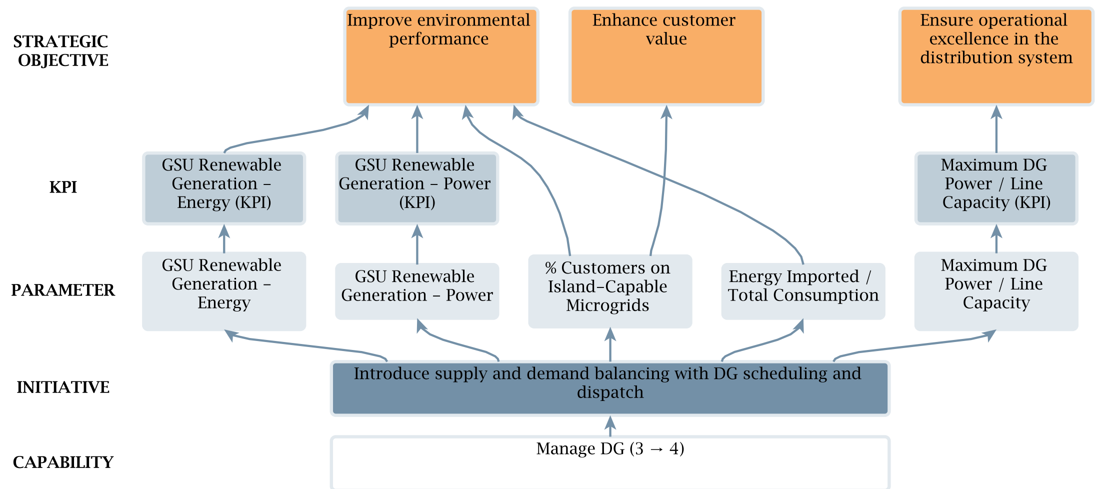


Figure 8.136.: VP.10 - Initiative No. 6: Impact Chain

Table 8.105.: VP.10 - Initiative No. 6: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
GSU Renewable Generation - Energy	5,643	↑	5,869	56,430	MWh
GSU Renewable Generation - Power	1.63	↑	1.70	180	MW
Maximum DG Power / Line Capacity	0.19	↑	↑	0.40	Ratio
% Customers on Island-Capable Microgrids	0.00	↑	↑	0.70	Ratio
Energy Imported / Total Consumption	1.00	↓	↓	0.40	Ratio

Using controllers for DG as well as load controllers, GSU will be able to anticipate demand accurately and assign generation schedules to DG sources such as wind or solar in accordance with their generation forecasts.

With real-time load and generation visibility, it will also be possible for GSU to dispatch chosen DG sources in response to deviations from load or generation forecasts, or in case of network congestion. Additionally, this will also allow balancing local loads with local DG sources which will reduce power losses that would be incurred otherwise since generation is sourced from distant central power plants.

This initiative will enable increased deployment of renewable energy on GSU's grid, as well as reduce reliance on imported energy and increase the number of customers on island-capable microgrids.

8.10.7. Introduce active integration of distributed generation capabilities into network design and planning

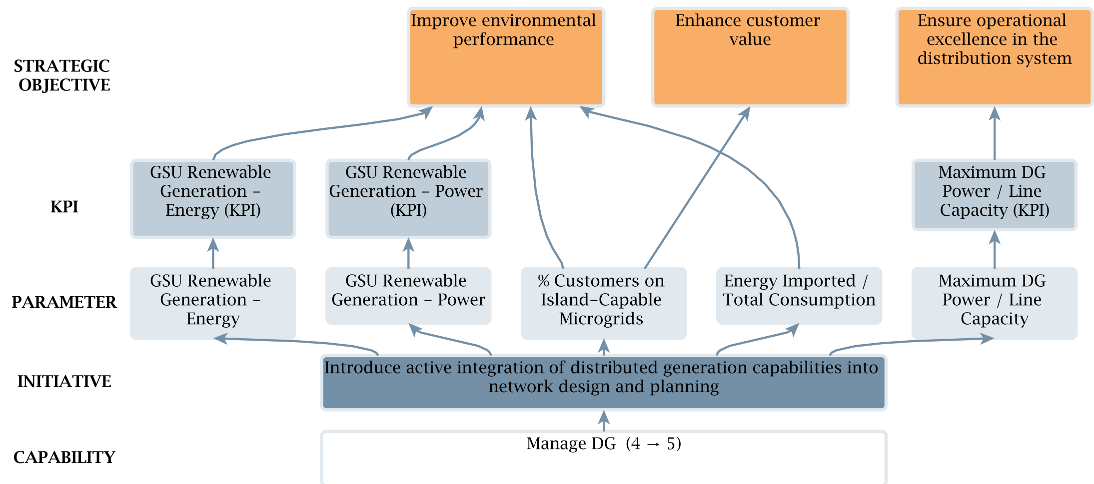


Figure 8.137.: VP.10 - Initiative No. 7: Impact Chain

Table 8.106.: VP.10 - Initiative No. 7: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
GSU Renewable Generation - Energy	5,643	↑	5,869	56,430	MWh
GSU Renewable Generation - Power	1.63	↑	1.70	180	MW
Maximum DG Power / Line Capacity	0.19	↑	↑	0.40	Ratio
% Customers on Island-Capable Microgrids	0.00	↑	↑	0.70	Ratio
Energy Imported / Total Consumption	1.00	↓	↓	0.40	Ratio

This initiative will introduce consideration of monitoring and control capabilities of distributed generators as additional criteria in the design and planning guidelines. GSU will be able to identify and classify relevant context parameters such as mode of production, controllability, intermittency, reliability of generation profile, etc. Further enhancement of design and planning processes to actively consider DG monitoring and control capabilities.

Although no quantified effects were attributed to this initiative, workshop participants felt this initiative will enable increased deployment of renewable energy on GSU's grid, and will help achieve three key strategic objectives: improve environmental performance, enhance customer value and ensure operational excellence in the distribution system.

8.11. VP.11: Advanced Grid Management Based on Substation Automation

This value pack characterizes GSU's grid with advanced grid management capabilities by taking advantage of a broad spectrum of synergies with technologies introduced in previous value packs.

Comprehensive and consistent asset loading information integrated with a sophisticated network management toolkit will create the necessary inputs for substation automation applications.

Taken together, technical and process changes in this value pack will provide GSU with considerable strategic value due to significant improvements in service reliability, loss reduction and customer satisfaction.

Advanced network management and feeder automation functionalities introduced in this Value Pack will enable GSU to move from passive to active grid management to meet the demands imposed by renewable integration which will undoubtedly create challenges like large voltage / load variations and higher number of faults. Using the real-time connectivity data from the grid (feeder monitoring, smart meters, substation monitoring etc.), GSU will be able to automatically determine the switching schedule which results in least customer impact and outage duration. Moving from passive to active and automatic grid management gives the network self-healing characteristics which will also enable GSU to automatically detect, isolate and rectify faults as they occur (FLISR).

A common and comprehensive online view of asset loading status, together with short-term load forecast capabilities, will help identify upcoming congestion issues. In case of faults, protection device alarms, smart meters and remote intelligent electronic devices (IEDs) will provide system support by communicating with the control centre using standard protocols to update the status of the grid and indicate de-energized sections. Dynamic fault calculation tools will carry out computational analysis of the system model to calculate fault currents taking into account protection, planning and operational settings.

Integrating comprehensive and consistent asset loading information with design and planning applications will extend the application of lean design techniques.

Initiatives:

- Introduce automatic initiation of dynamically determined remedial actions
- Leverage measurements collected from all sources to assess PQ

- Introduce automatic determination of fault location, isolation and service restoration

Technology Deployments:

- Distribution Management System (DMS) - Network Management - Voltage / VAR Optimization
- Distribution Management System (DMS) - Network Analysis - Protection Simulation (DMS)
- Distribution Automation - Substation Automation - Local Intelligence
- Protection - Protection - Alarms (Protection)
- Protection - Protection - Fault Analysis
- Distribution Management System (DMS) - Network Management - Fault Location (DMS)
- Distribution Management System (DMS) - Network Management - Fault Isolation (DMS)
- Distribution Management System (DMS) - Network Management - Service Restoration (DMS)
- Distribution Management System (DMS) - Network Analysis - Static Fault Analysis
- Distribution Management System (DMS) - Network Analysis - Dynamic Fault Analysis

Budgets:

- For Yearly Budgets see Figure 8.139
- For a Budget breakdown see Table 8.107

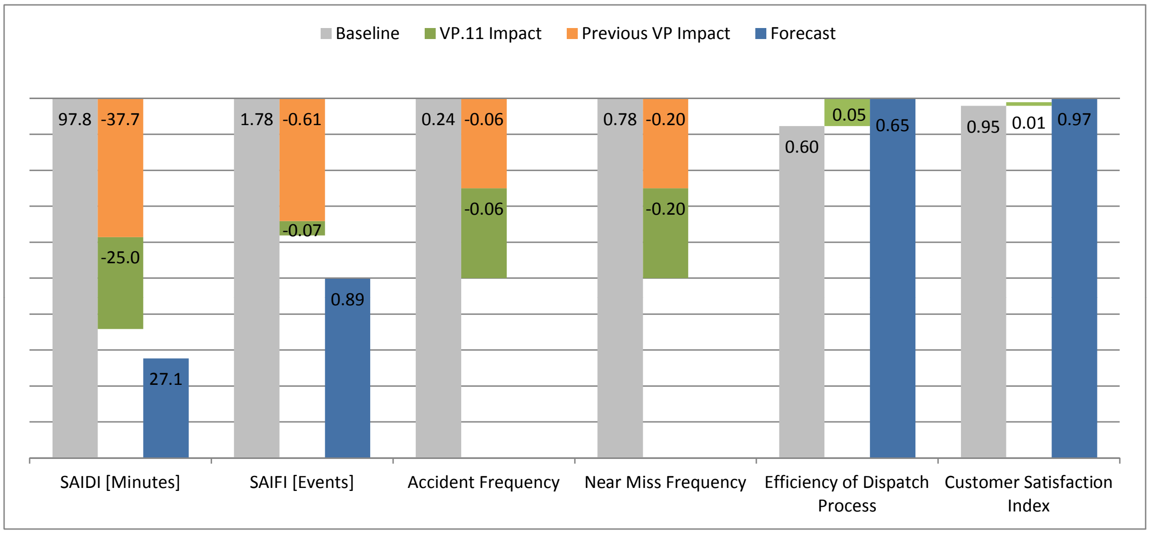


Figure 8.138.: VP.11 - Impact on KPIs

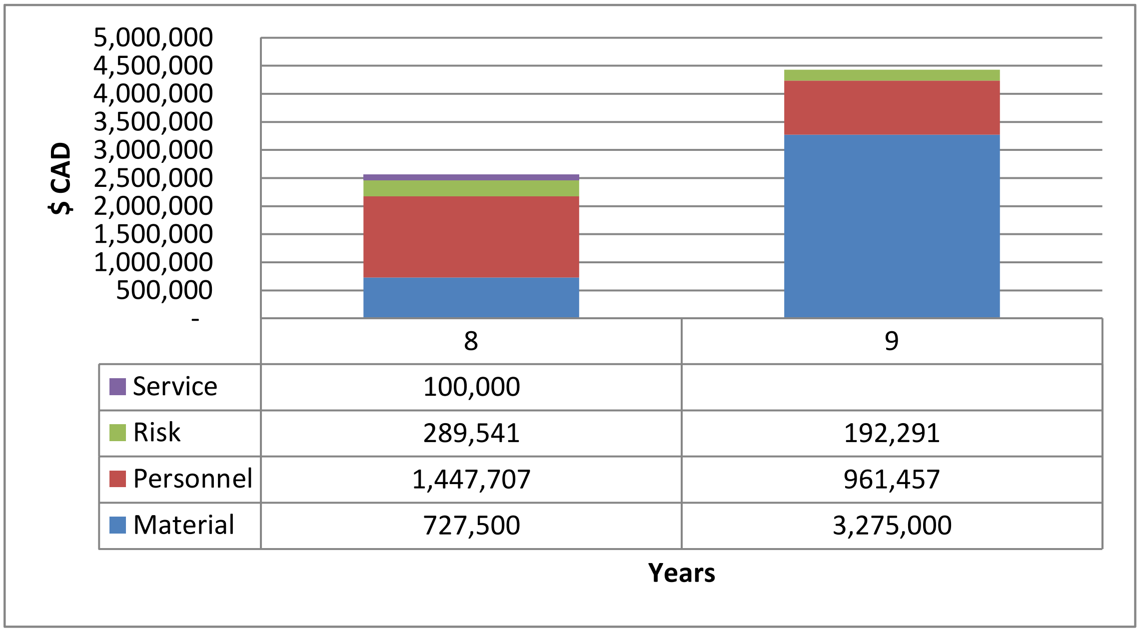


Figure 8.139.: VP.11 Budgets

Table 8.107.: VP. 11 Costs per Initiative & Technology

Items	Material	Personnel	Service	Risk	Grand Total
Contribution Category 1		**$ 351,504.42**	**$ 100,000.00**	**70,300.88**	**521,805**
Manage network congestion		**$ 188,203.29**		**37,640.66**	**225,844**
Introduce automatic initiation of dynamically determined remedial actions		$ 188,203.29		37,640.66	**225,844**
Manage power quality		**$ 163,301.13**	**$ 100,000.00**	**32,660.23**	**295,961**
Leverage measurements collected from all sources to assess PQ		$ 163,301.13	$ 100,000.00	32,660.23	**295,961**
Contribution Category 2		**$ 211,666.39**		**42,333.28**	**254,000**
Manage unplanned outages		**$ 211,666.39**		**42,333.28**	**254,000**
Introduce automatic determination of FLISR		$ 211,666.39		42,333.28	**254,000**
Infrastructure	**$ 4,002,500.00**	**$ 1,845,993.58**		**369,198.72**	**6,217,692**
Network Analysis	**$ 150,000.00**	**$ 199,855.72**		**39,971.14**	**389,827**
Dynamic Fault Analysis	$ 50,000.00	$ 66,618.57		13,323.71	**129,942**
Static Fault Analysis	$ 50,000.00	$ 66,618.57		13,323.71	**129,942**
Protection Simulation (DMS)	$ 50,000.00	$ 66,618.57		13,323.71	**129,942**
Network Management	**$ 200,000.00**	**$ 264,073.29**		**52,814.66**	**516,888**
Fault Isolation (DMS)	$ 50,000.00	$ 66,618.57		13,323.71	**129,942**
Fault Location (DMS)	$ 50,000.00	$ 66,618.57		13,323.71	**129,942**
Service Restoration (DMS)	$ 50,000.00	$ 66,618.57		13,323.71	**129,942**
Voltage - VAR Optimisation	$ 50,000.00	$ 64,217.57		12,843.51	**127,061**
Substation Automation	**$ 3,600,000.00**	**$ 1,191,774.28**		**238,354.86**	**5,030,129**
Local Intelligence	$ 3,600,000.00	$ 1,191,774.28		238,354.86	**5,030,129**
Protection	**$ 52,500.00**	**$ 190,290.30**		**38,058.06**	**280,848**
Alarms (Protection)	$ 52,500.00	$ 156,339.51		31,267.90	**240,107**
Fault Analysis		$ 33,950.78		6,790.16	**40,741**
Grand Total	**$ 4,002,500.00**	**$ 2,409,164.39**	**$ 100,000.00**	**481,832.88**	**6,993,497**

8.11.1. Introduce automatic initiation of dynamically determined remedial actions

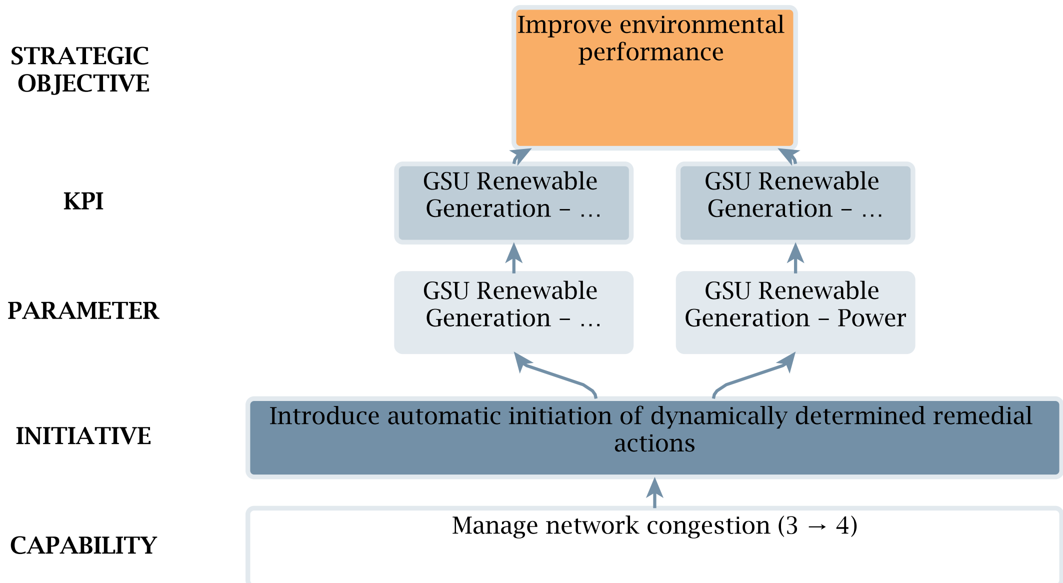


Figure 8.140.: VP.11 - Initiative No. 1: Impact Chain

Table 8.108.: VP.11 - Initiative No. 1: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
GSU Renewable Generation - Energy	5,643	↑	5,869	56430	MWh
GSU Renewable Generation - Power	1.63	↑	1.70	180.00	MW

GSU currently has no congestion related constraints on its system, and does not directly manage load shedding programs. The Province-wide Peaksaver program currently provides a load shedding program which is directed by the IESO. However, it is considered likely that in the near future, factors such as an increase in distributed generation on GSU's grid could create constraints and require local balancing to match intermittent or variable sources of generation, such as renewables.

Utilizing sensor data from the Smart Grid Backbone and processing it for analysis and forecasting of network congestion, GSU will be able to achieve predictive awareness for the network load. This predictive awareness of potential congestion will allow GSU to automatically initiate remedial actions and receive confirmation feedback from all loads.

Apart from demand side management and direct load control, authorizing energy delivery from DERs such as windpower generators and solar farms are also an integral part of automatic remedial mechanisms for congestion relief. These remedial actions will be dynamically determined in contrast to remedial actions from previous initiatives that were 'pre-defined'.

While numerical impacts were not assessed, this initiative will enable GSU to deploy more renewable generation on their system and support the goal of increasing distributed generation.

8.11.2. Leverage measurements collected from all sources to assess PQ

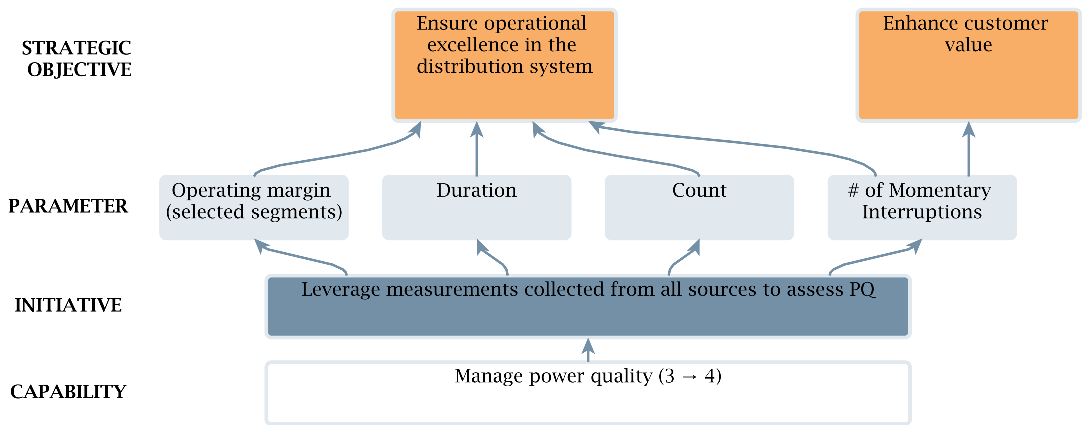


Figure 8.141.: VP.11 - Initiative No. 2: Impact Chain

Table 8.109.: VP.11 - Initiative No. 2: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Operating margin (selected segments)	0.40	↓	0.40	0.20	Ratio
Duration	0.00	↓	0.00	0.00	min
Count	0.00	↓	0.00	0.00	number
# of Momentary Interruptions	82,500	↓	82,500	52	number

This initiative introduces a methodological approach to power quality analysis which considers all relevant measurements collected from all available sources. Includes potential utilization of distributed energy resources equipped with smart inverters to address identified issues, and IP-based power quality metering.

The initiative is expected to reduce the number of momentary interruptions through earlier detection and triggering remedial actions to avoid and solve PQ issues.

Due to better understanding of power quality issues, the control centre is also able to predict network segments under stress and can rectify the situation before unplanned outages occur. This is expected to reduce the frequency of unplanned outages which will improve GSU's SAIDI and SAIFI.

While numerical impacts were not assessed, this initiative contributes to GSU's strategic objective of ensuring operational excellence in the distribution grid.

8.11.3. Introduce automatic determination of fault location, isolation and service restoration

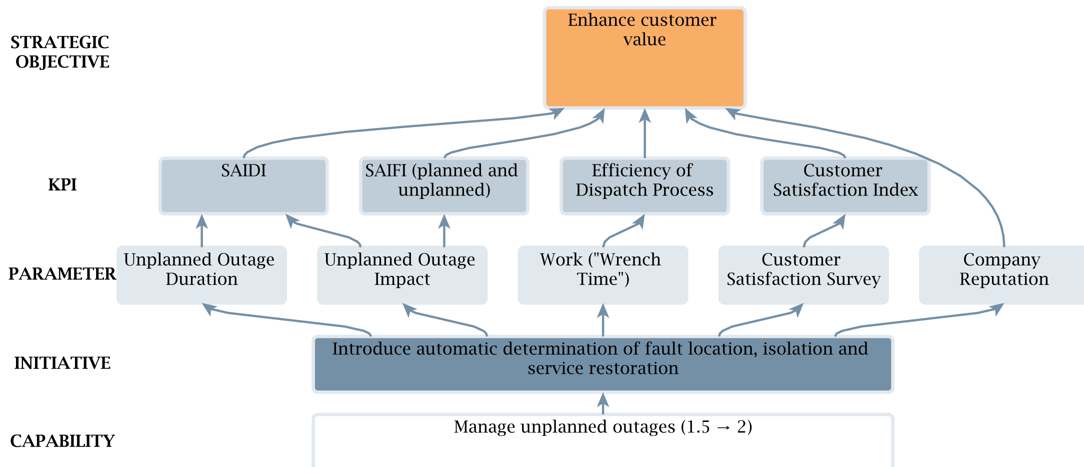


Figure 8.142.: VP.11 - Initiative No. 3: Impact Chain (a)

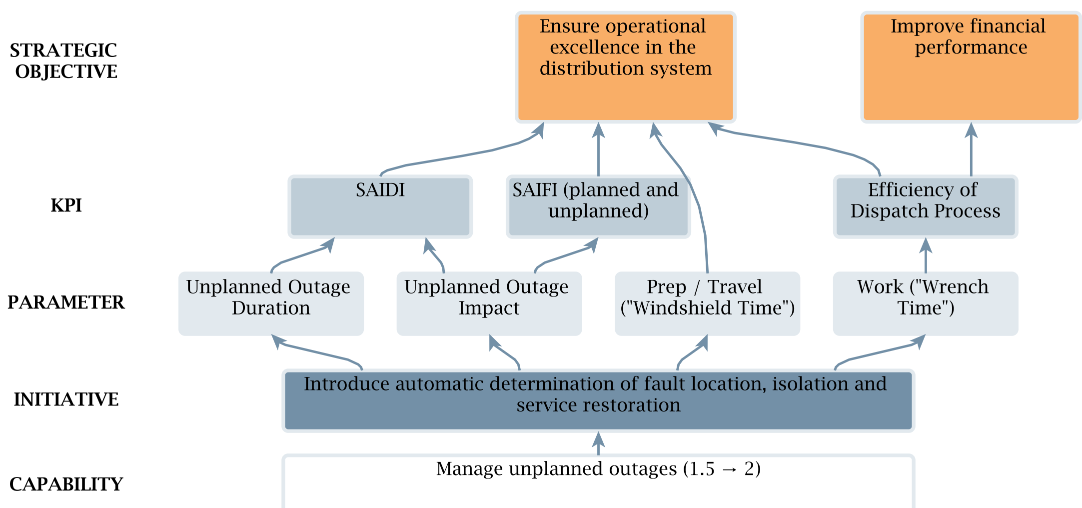


Figure 8.143.: VP.11 - Initiative No. 3: Impact Chain (b)

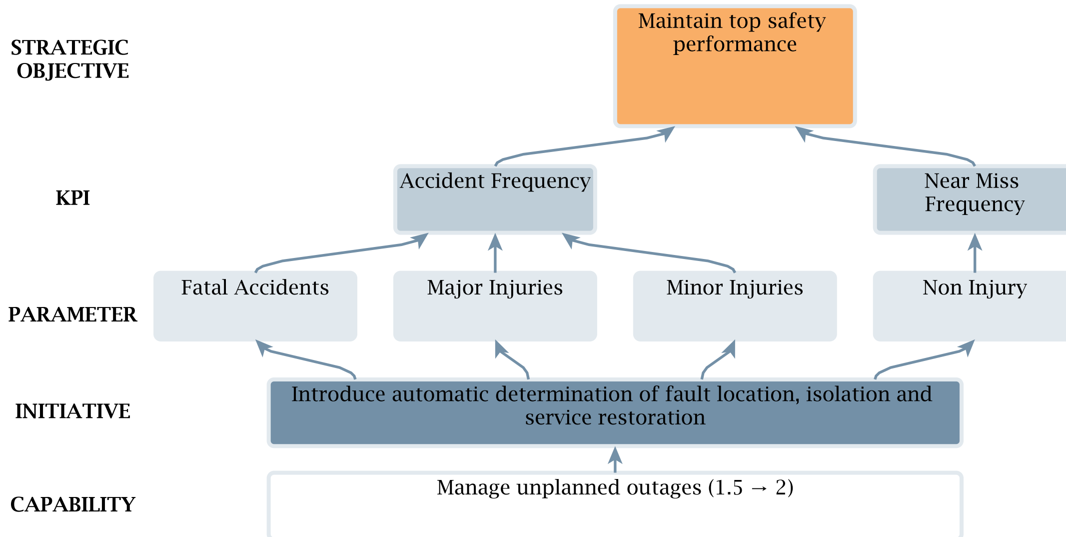


Figure 8.144.: VP.11 - Initiative No. 3: Impact Chain (c)

Table 8.110.: VP.11 - Initiative No. 3: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Unplanned Outage Duration	44.34	-22.17	12.42	40.00	min
Unplanned Outage Impact	335.00	-16.75	184.25	0.00	customers
Fatal Accidents	0.00	↓	0.00	0.00	number
Major Injuries	0.00	↓	0.00	0.00	number
Minor Injuries	4.00	-1.00	0.00	0.00	number
Non Injury	13.00	-3.25	0.00	0.00	number
Work ("Wrench Time")	0.60	0.05	0.65	0.75	Ratio
Prep / Travel ("Windshield Time")	0.40	-0.05	0.35	0.25	Ratio
Customer Satisfaction Survey	0.95	0.01	0.97	1.00	Ratio
Company Reputation	0.75	0.05	0.90	1.00	Ratio

This initiative introduces systems and applications that utilize feeder protection information to automatically determine fault location and execution schedules for isolating faults and restoring power to customers. This means the system must balance the load within a feeder by moving the Normally Open Point and isolate the faulty section of the feeder for maintenance without affecting other sections. A switching schedule will next be determined to be executed by the operator in the control centre or the field crew.

Through this initiative, GSU will be able to localize, isolate, reconfigure and resupply grid segments if an unplanned outage occurs. This leads to dramatic improvement in outage times. Improvements in outage duration, outage impact and SAIFI will support GSU's strategic target of providing enhanced customer value. Quicker resolution of problems, fewer customer outages and improved workplace safety will together address GSU's strategic objectives around safety, operational excellence and customer value.

8.12. VP.12: Introduction of Self-Healing Network Characteristics

The core of this final value pack characterizes GSU's grid with self-healing capabilities and rests on two key planks: first, the technologies and initiatives for automatic FLISR (fault location, isolation and service restoration), second, technologies and initiatives that optimize energy delivery efficiency.

Implementation of advanced capabilities in these two areas will also take advantage of a broad spectrum of synergies with technologies introduced in previous value packs. A sophisticated toolkit for network analysis will create the necessary inputs for advanced network management and feeder automation applications which, when leveraged together, will provide GSU with significant strategic benefits due to significant improvements in service reliability, loss reduction and customer satisfaction.

Initiatives:

- Introduce self healing network configuration concepts
- Introduce a common and comprehensive online view to asset status

Technology Deployments:

- Distribution Management System (DMS) Network Management Feeder Reconfiguration (DMS)
- High Speed Measurements High Speed Measurements Phasor Measurement Unit
- Distribution Automation Feeder Automation Fault Location
- Distribution Automation Feeder Automation Reconfiguration
- Distribution Automation Feeder Automation Fault Isolation

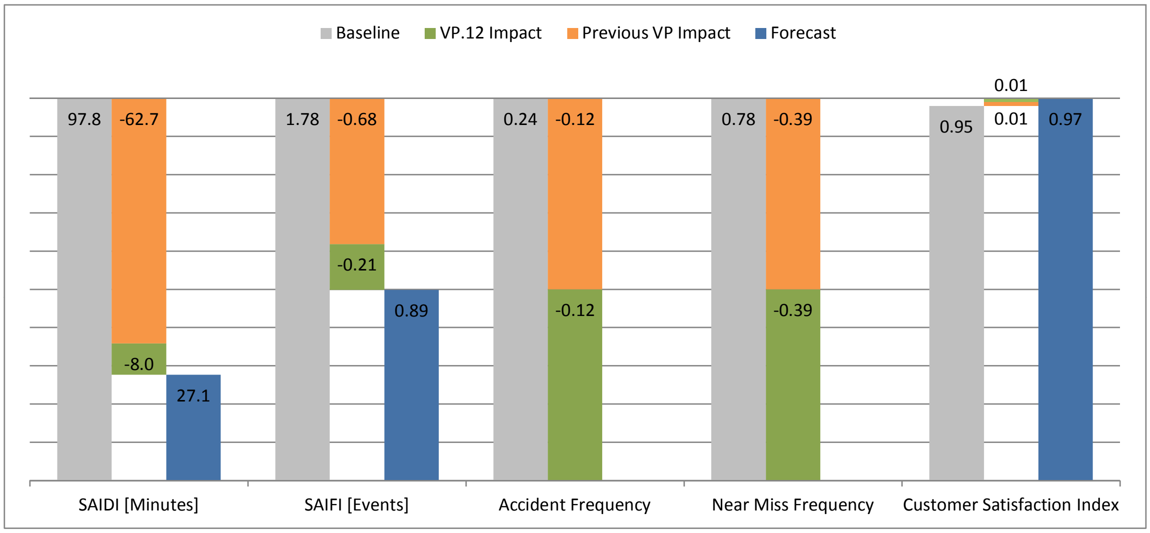


Figure 8.145.: VP.12 - Impact on KPIs

Budgets:

- For Yearly Budgets see Figure 8.146
- For a Budget breakdown see Table 8.111

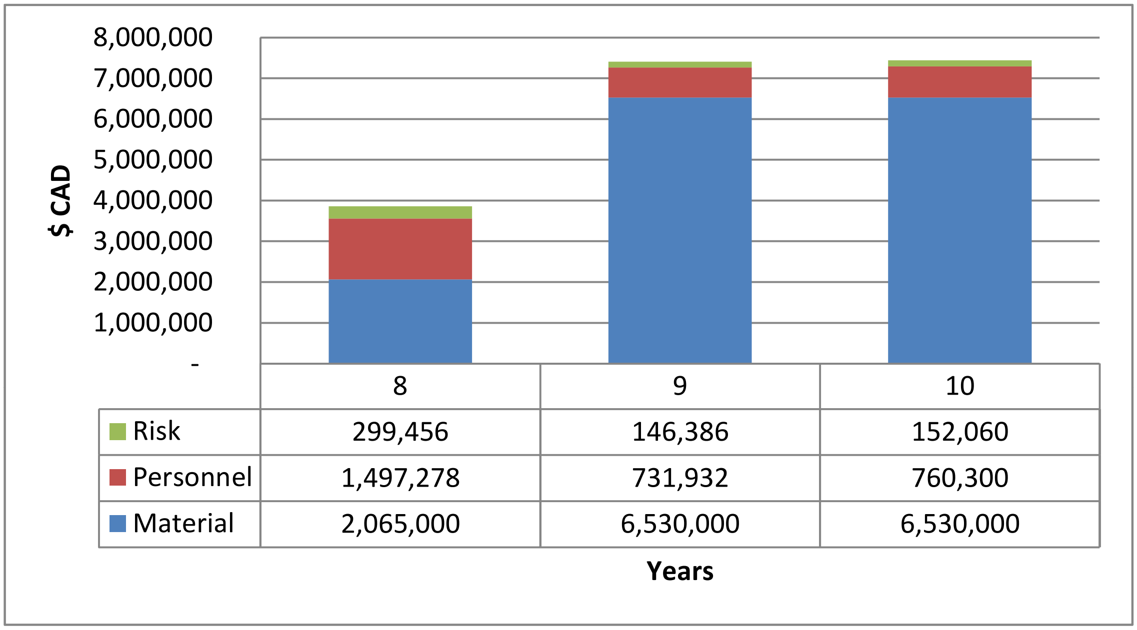


Figure 8.146.: VP.12 Budgets

Table 8.111.: VP. 12 Costs per Initiative & Technology

Items	Material	Personnel	Risk	Grand Total
Contribution Category 2		**$ 390,077.09**	**$ 78,015.42**	**468,092.51**
Manage unplanned outages		**$ 390,077.09**	**$ 78,015.42**	**468,092.51**
Introduce a common and comprehensive online view to asset status		$ 209,259.59	$ 41,851.92	251,111.51
Introduce self healing network configuration concepts		$ 180,817.50	$ 36,163.50	216,981.00
Infrastructure	**$ 15,125,000.00**	**$ 2,599,432.55**	**$ 519,886.51**	**18,244,319.06**
Feeder Automation	**$ 15,000,000.00**	**$ 2,435,406.67**	**$ 487,081.33**	**17,922,488.00**
Fault Isolation		$ 254,771.88	$ 50,954.38	305,726.25
Fault Location	$ 15,000,000.00	$ 1,925,862.91	$ 385,172.58	17,311,035.49
Reconfiguration		$ 254,771.88	$ 50,954.38	305,726.25
Network Management	**$ 50,000.00**	**$ 66,618.57**	**$ 13,323.71**	**129,942.29**
Feeder Reconfiguration (DMS)	$ 50,000.00	$ 66,618.57	$ 13,323.71	129,942.29
High Speed Measurements	**$ 75,000.00**	**$ 97,407.31**	**$ 19,481.46**	**191,888.77**
Phasor Measurement Unit	$ 75,000.00	$ 97,407.31	$ 19,481.46	191,888.77
Grand Total	**$ 15,125,000.00**	**$ 2,989,509.64**	**$ 597,901.93**	**18,712,411.57**

8.12.1. Introduce self healing network configuration concepts

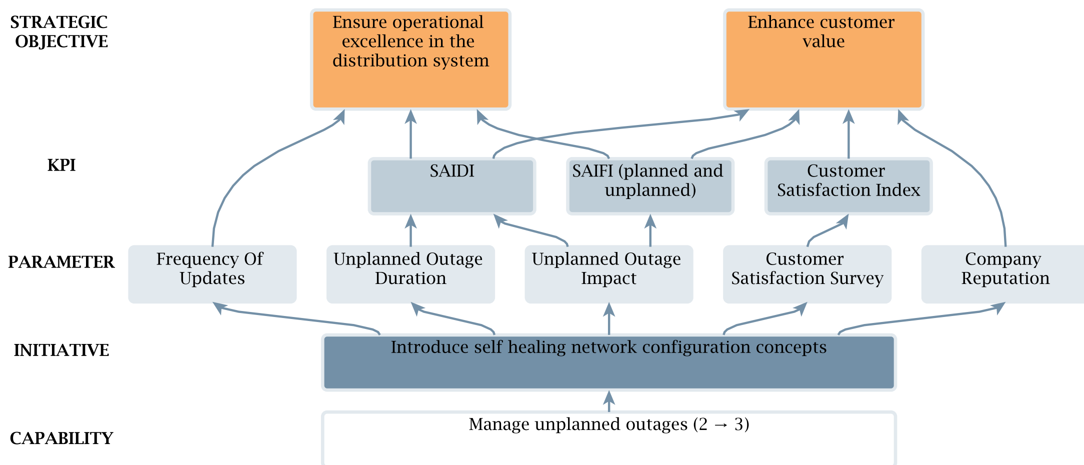


Figure 8.147.: VP.12 - Initiative No. 1: Impact Chain (a)

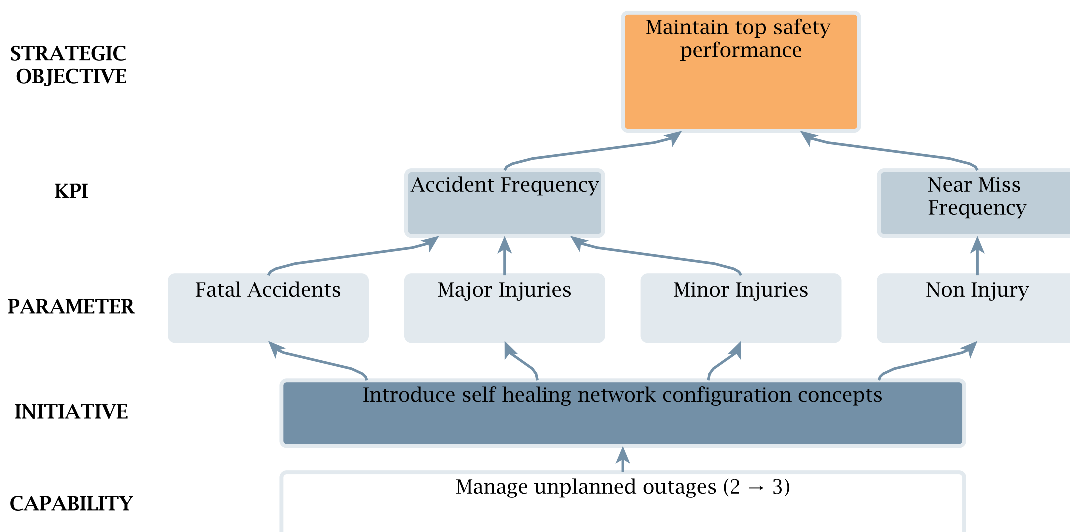


Figure 8.148.: VP.12 - Initiative No. 1: Impact Chain (b)

Table 8.112.: VP.12 - Initiative No. 1: Impact Table

Parameter	Baseline	Impact	Forecast	Target	Unit
Unplanned Outage Duration	44.34	-4.43	12.42	40.00	min
Unplanned Outage Impact	335.00	-33.50	184.25	0.00	customers
Fatal Accidents	0.00	↓	0.00	0.00	number
Major Injuries	0.00	↓	0.00	0.00	number
Minor Injuries	4.00	-1.00	0.00	0.00	number
Non Injury	13.00	-3.25	0.00	0.00	number
Frequency Of Updates	200.00	↑	200.00	Real time	number
Customer Satisfaction Survey	0.95	0.01	0.97	1.00	Ratio
Company Reputation	0.75	0.05	0.90	1.00	Ratio

Previously, the capability to do automatic *determination* of fault location, isolation and service restoration measures was introduced. This initiative extends these capabilities by *executing* these measures automatically. The self-healing characteristics in the grid are enabled by automatic execution of switching schedules based on real-time data from the grid. As a result of complete FLISR capabilities, GSU is expected to reduce the outage duration and number of impacted customers significantly in order to enhance customer value.

In case of an unplanned outages, information from the feeder automation and smart meters will be used to automatically localize, isolate, reconfigure and resupply grid segments. This means the grid will start exhibiting not only self-diagnosing but self-healing characteristics. As fewer customers are impacted by unplanned outages which are restored faster, this initiative will support GSU's strategic objectives of ensuring operational excellence in the distribution system and enhancing customer value.

8.12.2. Introduce a common and comprehensive online view to asset status

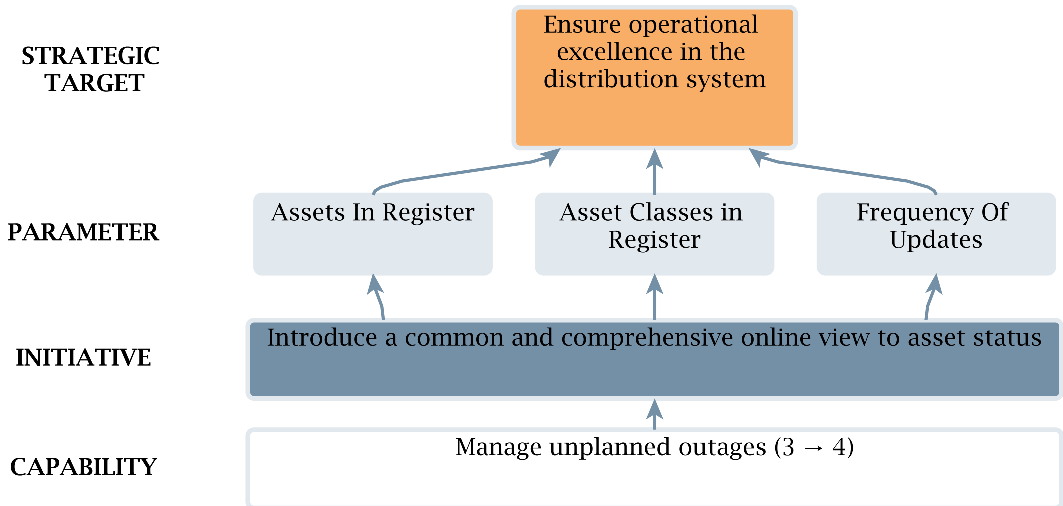


Figure 8.149.: VP.12 - Initiative No. 2: Impact Chain (a)

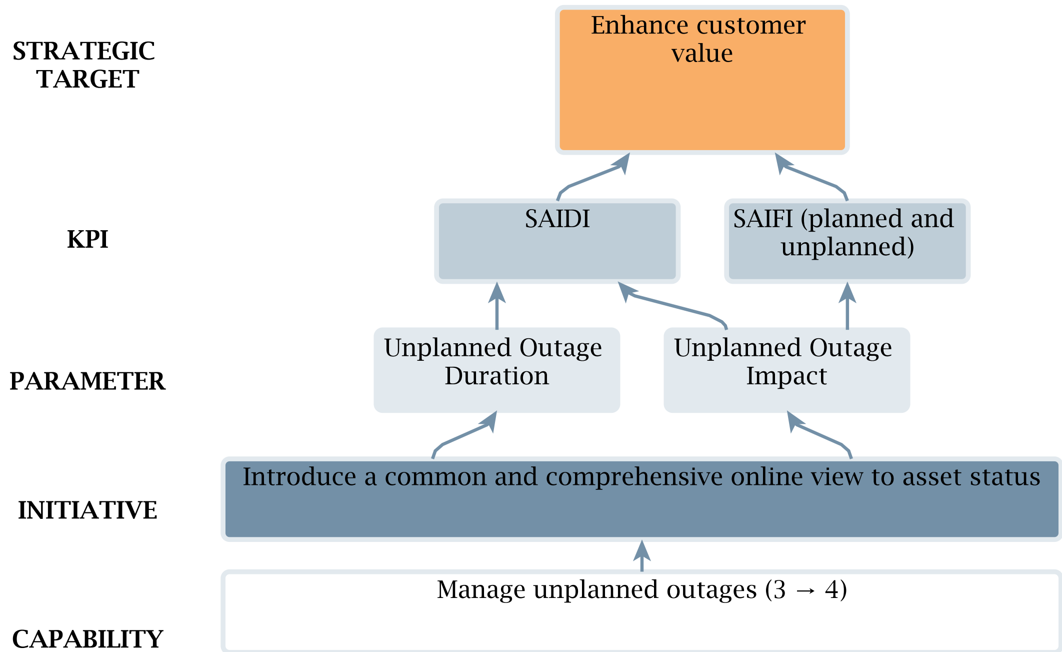


Figure 8.150.: VP.12 - Initiative No. 2: Impact Chain (b)

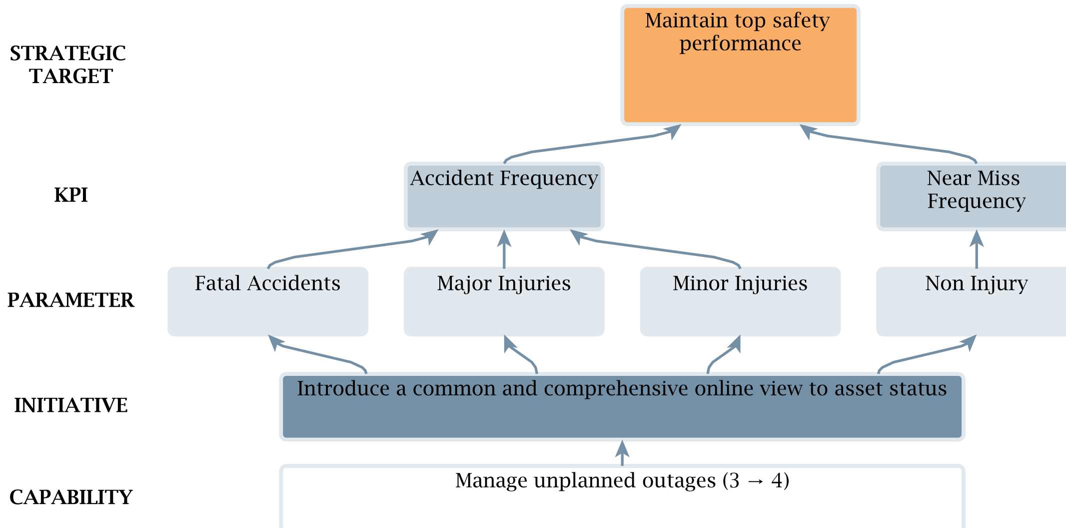


Figure 8.151.: VP.12 - Initiative No. 2: Impact Chain (c)

Table 8.113.: VP.12 - Initiative No. 2: Impact Table

Parameter	**Baseline**	**Impact**	**Forecast**	**Target**	**Unit**
Unplanned Outage Duration	44.34	-0.89	12.42	40.00	min
Unplanned Outage Impact	335.00	-16.75	184.25	0.00	customers
Fatal Accidents	0.00	↓	0.00	0.00	number
Major Injuries	0.00	↓	0.00	0.00	number
Minor Injuries	4.00	-1.00	0.00	0.00	number
Non Injury	13.00	-3.25	0.00	0.00	number
Assets In Register	102,873	↑	102,873	Increase	number
Asset Classes in Register	20.00	↑	20.00	Increase	number
Frequency Of Updates	200.00	↑	200.00	Updates in real time	number

This initiative establishes a common and comprehensive online view of asset status that is transparent to the control center as well as field crews. Together with self-healing network elements and control capabilities for smart energy resources, DSM and storage, the real-time comprehensive online transparency will enable GSU to minimize the duration and impact of unplanned outages and support its strategic target of enhancing customer value.

Part IV.

Program Management

Chapter 9.

Program Management

The GSU grid modernization program is comprised of 12 Value Packs that are to be executed within 10 years. These Value Packs are built from 103 initiatives addressing 40 business capabilities in six business domains, requiring the deployment of 62 technology features. This means that GSU will execute up to 103 initiatives plus 62 technology deployments resulting in 165 projects to implement its grid modernization program.

To ensure the synchronization of these 165 projects and their interdependencies, the Smart Grid Compass® methodology proposes an initial value pack ($\mathrm{VP_i}$) that establishes a Program Management Office (PMO) for coordinating and managing the grid modernization program guided by the Executive Oversight Committee (please see Section 7.2).

The principles of Program Management are normally reasonably well understood but often confused with Project Management. Given the complexity of the entire grid modernization program, superior program management is required to ensure successful achievement of all targets within budget constraints and on time. The Program Management Office structure designed by Siemens is therefore expected to serve as GSU's mission control for the entire grid modernization program.

The PMO responsibilities will include the following:

- Perform the detailed annual program planning based on the defined Value Packs.
- Perform the detailed planning of the individual projects.
- Perform the formal acceptance procedures for each project.
- Control the progress and costs on the program level.
- Prepare and moderate Executive Oversight Committee meetings and decisions.
- Manage vendors and GSU participants as contributors to the program.

A summary of resources that the PMO will need to coordinate can be seen in Section 11.3.

Chapter 10.

Value Management

While the Siemens Smart Grid Compass® provides a strategic framework for capturing the vision of GSU through quantifying the company's objectives and recommending concrete actions to fulfill them, the implementation of these concrete actions takes place through the Value Improvement Program which provides a systematic and structured process of team oriented decision-making. The aim is to achieve the best value for every process required to achieve the value objectives of GSU. This is accomplished by delivering the deployment program steps at least cost and consistent with the required levels of quality and performance.

As discussed earlier, the realization of GSU's strategic targets is carried out by executing the 103 initiatives maintaining the fine-grained view of requirements and continuously monitoring their progress in order to decide whether further actions will be necessary to reach the aspired target value. Scheduled meetings with all stakeholders at crucial stages of the project will be necessary to develop such a common understanding of the status of the deliverables, key functions and risks, as well as necessary remedial measures when and if future projections show underachievement of targets.

Parameters and KPIs (Key Performance Indicator) jointly defined by GSU and Siemens during the Routing phase will be used as metrics to measure the progress on a continuous basis. The remedial measures will be defined in a flexible, team-based environment, planned and directed by a dedicated Program Management Office and driven by collaboration. Additionally, in order to capture the full range of influences, it will be necessary to liaise with participants who have the right balance of skills, judgment, experience and knowledge. The Program Management Office must, therefore, ensure that such a diverse skill set will be available at every stage of the Value Improvement Program.

As the Value Improvement Program will focus on the project as a whole rather than its modular components, it will also be crucial to explore opportunities for innovation at every stage to find the most cost-effective means of implementation. The Value Improvement Program described in the coming section is a well-established procedure at Siemens. Siemens has valuable experience in implementing such complex and multifarious Value Improvement Programs. The feedback mechanisms proposed in this closed-loop implementation approach ensures that potential business improvements are recognized in an iterative process that sets clear goals, drives the implementation of well-defined actions and evaluates the impact of each action through a defined set of KPIs. (See Section A.1 Key Performance Indicators).

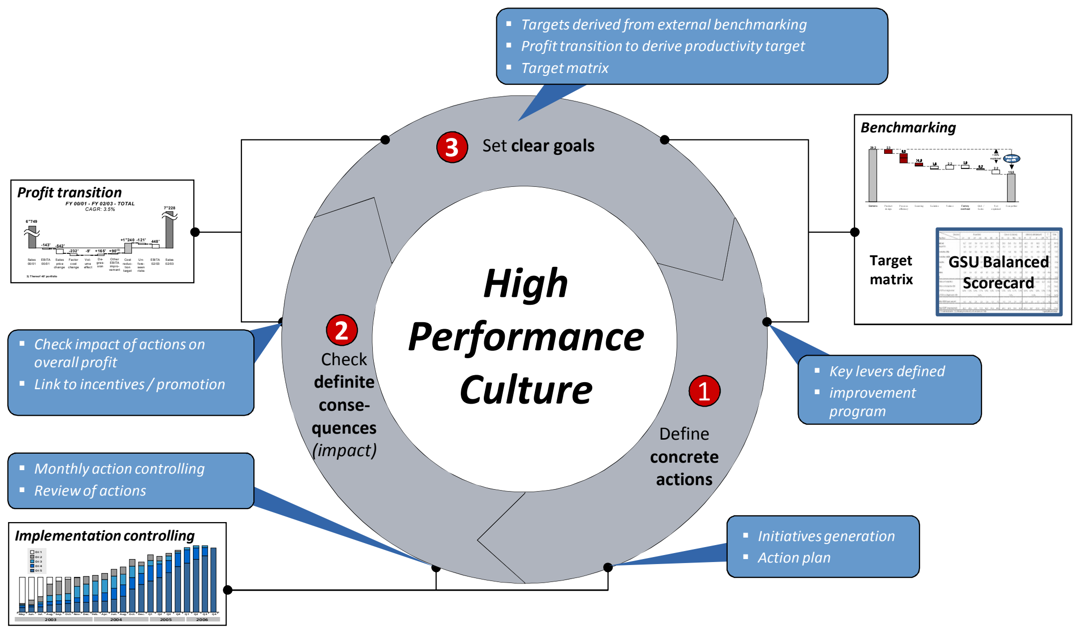


Figure 10.1.: Value Management Loop

The application of these key management principles delivers a manifold increase in transparency and operational excellence through the High Performance Culture within the company. This culture is based on following drivers:

- Continuously benchmarking with the best
- Setting ambitious goals
- Creating transparency
- Clear responsibilities
- Concrete actions with clear milestones
- High predictability through degree of implementation controlling
- Continuous readjustment of targets

Since a lever can have dozens of actions, a systematic approach is essential for success. Implementation controlling is much more than a simple reporting tool. It is an effective management instrument for business improvement. The Implementation Controlling helps as a structured approach for generating, implementing and controlling all these actions. The degree of Implementation (DI) logic helps to measure whether the actions are sufficient for reaching the target.

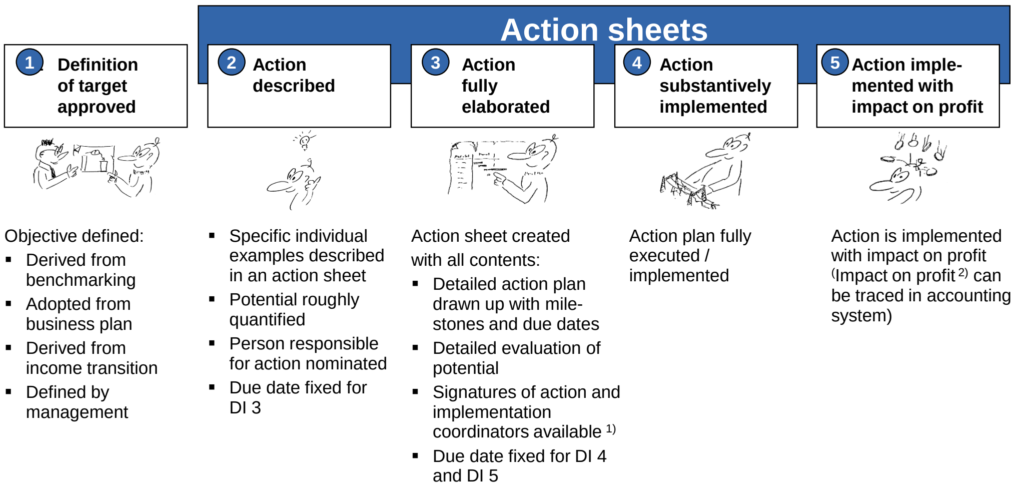


Figure 10.2.: Degree of Implementation (DI) Logic

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[1] An action requiring clarification remains at DI 2

[2] In industrial plant / project business: possibly cost effectiveness in place of profit effect

Chapter 11.

Governance Structure

The grid modernization program is comprised of 12 Value Packs that are executed in the next ten years. These Value Packs are built from 103 initiatives belonging to 40 business capabilities. These initiative cover all six business domains and require the deployment of 62 technology features. Taken together, GSU plans to execute 103 initiative projects and 62 technology deployments for a total of 165 projects. To ensure synchronized execution of these 165 projects and management of their inter-dependencies, the Smart Grid Compass® methodology requires the establishment of a robust governance structure that coordinates and manages the program.

11.1. Program Management Office

Aim
The aim of the PMO is to keep GSU's grid modernization program on target, on time, and on budget. To ensure that, the PMO shall provide effective management oversight for the entire program regarding:

- Program execution according to scope, schedule, and budget
- Compliance to corporate and regulatory guidelines
- Timely and effective decision-making
- Performance monitoring and reporting
- Contract administration

In addition, the PMO shall also be responsible for managing communication to internal and external stakeholders in order to help them achieve an understanding of the GSU grid modernization program.

Team
While the Program Management Office and relevant roles in the context of executing the work are described in complete detail in Section 11.2, following administrative roles are specific to operate the Program Management Office and are described below:

- Program Manager
- Resource Pool Manager
- Financial Controller
- Value Controller
- Quality Management & Assurance Officer
- Team Assistant

Please note that this does not equal six people as a person can fulfill more than one role. The Program Management Office will basically cover the following responsibilities:

- Perform the detail planning of the next year based on the Value Packs defined in this document
  - Review the estimations
  - Refine the staff requirements based on the revised estimations
  - Define the milestones and synchronization points of all the projects
- Perform the detail plan of the individual projects
  - Set start, end and milestone dates
  - Assign Project Manager to each Initiative or Technology Deployment
  - Assign staff to each project
  - Roles and Responsibilities of each project member
- Perform the formal acceptance procedures for each project
- Control the progress and costs on program level
- Prepare and moderate Executive Oversight Committee meetings and decisions
- Manage Vendors and GSU as contributors to the program

The following sections will explain in more detail certain aspects of the Program Management Office such as the role definitions and the staffing requirements of the program.

11.2. Roles

The different skill sets needed to execute the program are described by fourteen distinct roles. Each Initiative and every Technology deployment has been estimated in terms of effort for each role.

11.2.1. Program Manager

The Program Manager leads the Program Management Office and coordinates all activities regarding process change initiatives and technology deployment projects to ensure efficient implementation, effective leveraging of resource synergies, and integration within GSU processes. At the early planning stages of the Program, particularly during VPi activities, the Program Manager shall be actively involved with the Resource Pool Manager as well as key internal and external stakeholders to define and elaborate Program outcomes, roadmap and overall timeline, synchronization of resource requirements, available budgets, as well as identification of potential risks, their classification regarding severity and proposed mitigation measures.

As GSU's grid modernization program transitions out of VPi and into VP1, the Program Manager shall perform an increasingly consultative and supportive role for project managers while communicating on project progress to the Executive Oversight Committee and liaising with the advisory board to resolve conflicting demands or technical hurdles.

The Program Manager shall demonstrate relevant experience as well as depth and breadth of knowledge and certification regarding program planning, program governance and implementation of grid modernization programs. In addition, he or she shall demonstrate management experience of multiple teams, diverse leadership roles and a proven track record of advancing the strategic, operational and business interests of the organization.

11.2.2. Project Manager

The Project Manager is responsible for the planning, staffing and controlling of the individual technology project. He or she ensures the productivity of the team, the quality of the work and the timely completion of all tasks within the planned budget. Moreover, the Project Manager anticipates problems before they occur and finds ways to accomplish project goals in case of changing circumstances.

In addition, he or she has to report current milestones and status updates to the program management office as well as communicating with all stakeholders to ensure everyone is on the same page. All project managers are coordinated by the program management office to ensure the overall consistency of the work. Preferably, the Project Manager has the appropriate industrial background in project execution.

11.2.3. Managing Consultant

The Managing Consultant will carry all responsibilities of a project manager within initiative/process related projects. He or she will coordinate and steer all consulting activities. Additionally he or she will support the project members in the execution of the initiatives by providing support in research, engineering and design activities as well as in implementing services of technical, commercial and administrative nature. Additionally, the Managing Consultant will be responsible for close interaction with the senior management as a business advisor.

11.2.4. Consultant

The responsibility of the Consultant focuses on the operational execution of consulting activities such as conceptual design work, gathering of requirements, creation of documentation, etc. Moreover he or she conducts workshops and develops plans in close alignment with the Managing Consultant. At the same time he or she will steer project modules and initiatives and guide the project team members using analytical and conceptual skills. Besides having significant communication with the operational management and project members, the consultant will also prepare status presentations together with the Managing Consultant or Project Manager.

11.2.5. System (IT/OT) Architect

The System (IT/OT) Architect spearheads all of the software/system development activities (IT commodity, as well as industrial specific) such as defining the software architecture and taking the responsibility of the software delivery through the planning, coordinating and controlling process. During the architecture definition, his or her main tasks are the selection of the appropriate technology, the evaluation of the architecture and the management of non-functional requirements. During the delivery phase he or she has to design, develop and test the architecture through coaching and mentoring, as well as leading the software engineers and executing the quality assurance by always keeping the ownership of the bigger picture. His or her goal is to gain a complete understanding of client needs and effectively communicate them to the team of software engineers. The successful implementation of software enables a successful project/initiative.

11.2.6. Software Engineer

The Software Engineer is responsible for designing the software application from conception to completion in close collaboration whether with the system (IT/OT) architect, the software engineering team or on an individual base. Using a structured approach he or she has to identify the need for the application, understand and define the user requirements as well as specifications and resources needed to complete the project. The application will be completed through network, system and software programming/customizing. Afterwards the application is tested and modified if needed. Besides general IT skills, the Software Engineer should also have a good industrial specific understanding for smart grid applications and IT processes of a utility.

11.2.7. Business Architect

Based on the underlying business architecture, the Business Architect conducts technical requirement analysis in order to design the implementation sequence of initiatives that meet business needs within the financial budget guidelines. It is crucial that the Business Architect has a deep technical understanding of the customer's system combined with the understanding of the utility business drivers and aspired level of sophistication for the business capability. In addition, he or she possesses expertise in industrial protocols and regulatory constraints. The Business Architect should also have a firm technical grasp on knowledge of available solutions and technologies in the market. This may include researching software and hardware products or services, and finding best solutions and prices to meet business requirements.

11.2.8. Field Engineer

The Field Engineer has to create electrical drawings and engineering cost estimates for activities in the control centre and field related to the technical implementation of initiatives. In addition, he or she has to perform on-site investigations which help to prepare analytical studies and reports in order to create specifications to evaluate and select the necessary equipment. After the equipment layout, his or her responsibility is to lead field installations, test and commission equipment, as well as trouble-shoot the system by steering his or her team of Field Technicians. Besides coordinating the activities and steering the Field Technicians, Field Engineer also has to mentor and train them.

11.2.9. Field Technician

The Field Technician is responsible for inspecting, installing and troubleshooting power supply, power transmission and distribution equipment in complex electrical systems (e.g. transformers, switches, generators, meters and breakers). The duties of the Field Technician begin with repair, replacement and regular maintenance of the equipment on basic problems, such as loose or damaged wiring. He or she has troubleshooting capabilities of complex electrical systems and needs to maintain strong client relationships. Further, the preparation of project estimates and the expansion of project work scope with technical specifications adds to his or her duties. However, all activities of the Field Technician will be coordinated by the Field Engineer.

11.2.10. Team Assistant

The Team Assistant mainly supports the Project Manager regarding all administrative tasks. In many cases the Team Assistant is also available for the whole project team with regards to assisting with administrative as well as specific tasks. Other responsibilities include the coordinating of project meetings, project materials and the creation meetings minutes. In addition, he or she maintains the client list and retains purchase order and invoices for project materials.

11.2.11. Communication Specialist

The Communication Specialist is a key expert with regard to external project communication. He or she is responsible for designing, refining and executing communication campaigns in a close alignment with the Program Management Office. This may include press releases, memorandums as well as marketing materials to support the Program Management Office as well as sales and marketing departments of the utility to communicate certain key messages and information to enable the success of the project or its resulting activities. Besides customers, additional stakeholder groups can be addressed (e.g. regulator, province, and technology partner).

11.2.12. Legal Counsel

The Legal Counsel supports the Program Management Office in regard of any legal concerns due to the execution of a project to make sure they fall within legally satisfactory parameters. This can include helpful legal assistance on issues in regard of hardware (e.g. technical equipment), software, services (e.g. commercial contracts), regulatory constraints, stakeholder interests and intelligent property rights. Besides identifying the legal issues, his or her main task is to prevent and solve the issues in collaboration with the PMO, assuring they are compliant with all legal requirements.

11.2.13. Purchasing Specialist

The Purchasing Specialist is responsible for procuring necessary supplies such as stationery, services, software and hardware necessary for the project execution. The procurement process requires an industry-specific knowledge and close alignment with the business units which place the order. The Purchasing Specialist must coordinate all purchases and purchasing procedures as well as maintain documentation that keeps track of purchases created by the project and use that information to communicate with Project Manager and accounting so they have all the invoices. The Purchasing Specialist is also responsible for placing project orders and answering all questions in regards to the status of orders.

11.2.14. Trainer

The Trainer helps to design and execute training for the employees of the utility resulting in new implemented procedures, methods, applications and technologies. In most cases the Trainer also assembles user guides. The nature and content of training, as well as who will be trained, shall be based on identification of skills gaps and training needs arising from newly defined process changes. Coordinating closely with the Program Management Office, the Trainer shall first identify these needs and then create appropriate training content (curricula, materials, tests etc.), develop training schedules and deliver the training as well.

The Trainer is also responsible for the development and execution of training for program team members, including the Program Management Office, and project staff. He or she will evaluate team performance and identify training needs, organize and conduct refresher training sessions for existing team members and orientation for newly hired team members. Throughout VPi execution, he or she shall ensure that skill acquisition is efficient with the appropriate skills training for relevant personnel at the right time with minimum disruption to regular VPi activities.

11.3. Staffing Requirements

The staffing requirements have been estimated in terms of the roles described in Section 11.2 - Roles.

Figure 11.1 shows a steady rise in personnel requirements over the program. This ensures efficient human resource management by building the program team over time, ensuring adequate ramp-up and acquiring talent when it is needed.

The smooth ramping up of budgetary needs and headcount avoids the common pitfalls of delayed task execution because of a lack of qualified personnel, or, hiring staff without clearly defined tasks.

Table 11.1 shows a quantified breakdown of the resources required to execute the program as planned.

In total about 133 person-years of effort are forecast over the 10 year period with the peak occurring in year 8 with about 24 FTE required. For purposes of the Program estimates these resources have been grouped into 14 roles.

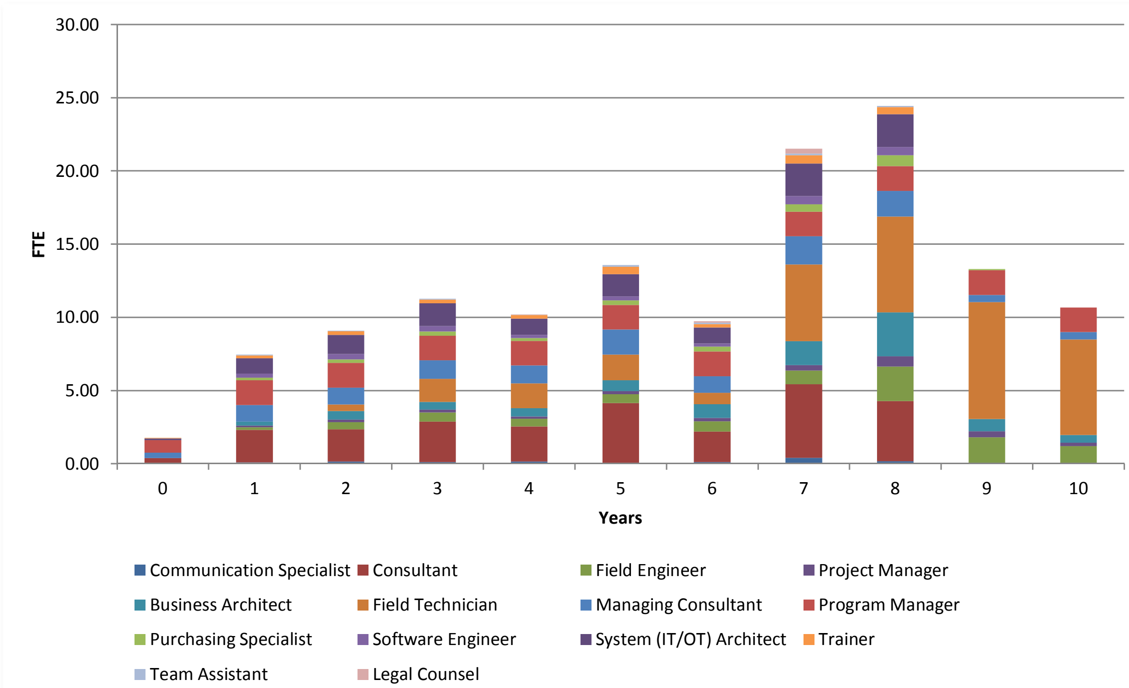


Figure 11.1.: Headcount Overview

Table 11.1.: Required Program FTE

Program Year **Calendar Year**	**0** **2016**	**1** **2017**	**2** **2018**	**3** **2019**	**4** **2020**	**5** **2021**	**6** **2022**	**7** **2023**	**8** **2024**	**9** **2025**	**10** **2026**	**Grand Total**
Communication Specialist	0.0	0.1	0.2	0.1	0.1	0.0	0.1	0.4	0.2	0.0	0.0	1.2
Consultant	0.4	2.2	2.2	2.8	2.4	4.1	2.1	5.0	4.1	0.0	0.0	25.3
Field Engineer	0.0	0.2	0.5	0.6	0.5	0.6	0.7	0.9	2.4	1.8	1.2	9.4
Project Manager	0.0	0.1	0.2	0.2	0.1	0.2	0.2	0.4	0.7	0.4	0.2	2.8
Business Architect	0.0	0.3	0.6	0.5	0.6	0.7	0.9	1.6	3.0	0.9	0.5	9.6
Field Technician	0.0	0.0	0.4	1.6	1.7	1.8	0.8	5.2	6.6	8.0	6.5	32.5
Managing Consultant	0.4	1.1	1.2	1.3	1.2	1.7	1.1	1.9	1.7	0.5	0.5	12.7
Program Manager	0.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	17.7
Purchasing Specialist	0.0	0.2	0.2	0.3	0.2	0.3	0.3	0.5	0.7	0.1	0.0	2.9
Software Engineer	0.0	0.3	0.4	0.4	0.2	0.3	0.2	0.6	0.6	0.0	0.0	2.8
System (IT/OT) Architect	0.1	1.1	1.3	1.6	1.1	1.5	1.1	2.2	2.2	0.0	0.0	12.2
Trainer	0.0	0.2	0.2	0.2	0.2	0.5	0.2	0.6	0.5	0.0	0.0	2.8
Team Assistant	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.6
Legal Counsel	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.4
Grand Total	**1.8**	**7.5**	**9.1**	**11.3**	**10.2**	**13.6**	**9.7**	**21.5**	**24.4**	**13.3**	**10.7**	**133.0**

Chapter 12.

Estimates

All Initiatives and Technology Deployments have been estimated using a formalized estimation framework. Items of this framework are:

- **Phases**
  The framework defines a set of phases for each project type (initiatives or technology deployment) as explained in 12.1 and 12.2.
- **Work packages**
  each phase comprises several work packages that have to be executed to successfully implement the initiative or technology. Hours are estimated for each work package.
- **Roles**
  Each phase of an initiative or technology deployment will have a requirement in terms of FTE per role. This will give the amount of hours per role and phase.
- **Services**
  Any special know how or service that is not needed continuously or is not a core competency of the project team is estimated in terms of service cost.
- **Materials**
  Any hard- and software that is necessary to successfully execute the project.

Please see Table 3.5 in Chapter 3 for an overview of the calculation rates for the different roles.

12.1. Initiatives

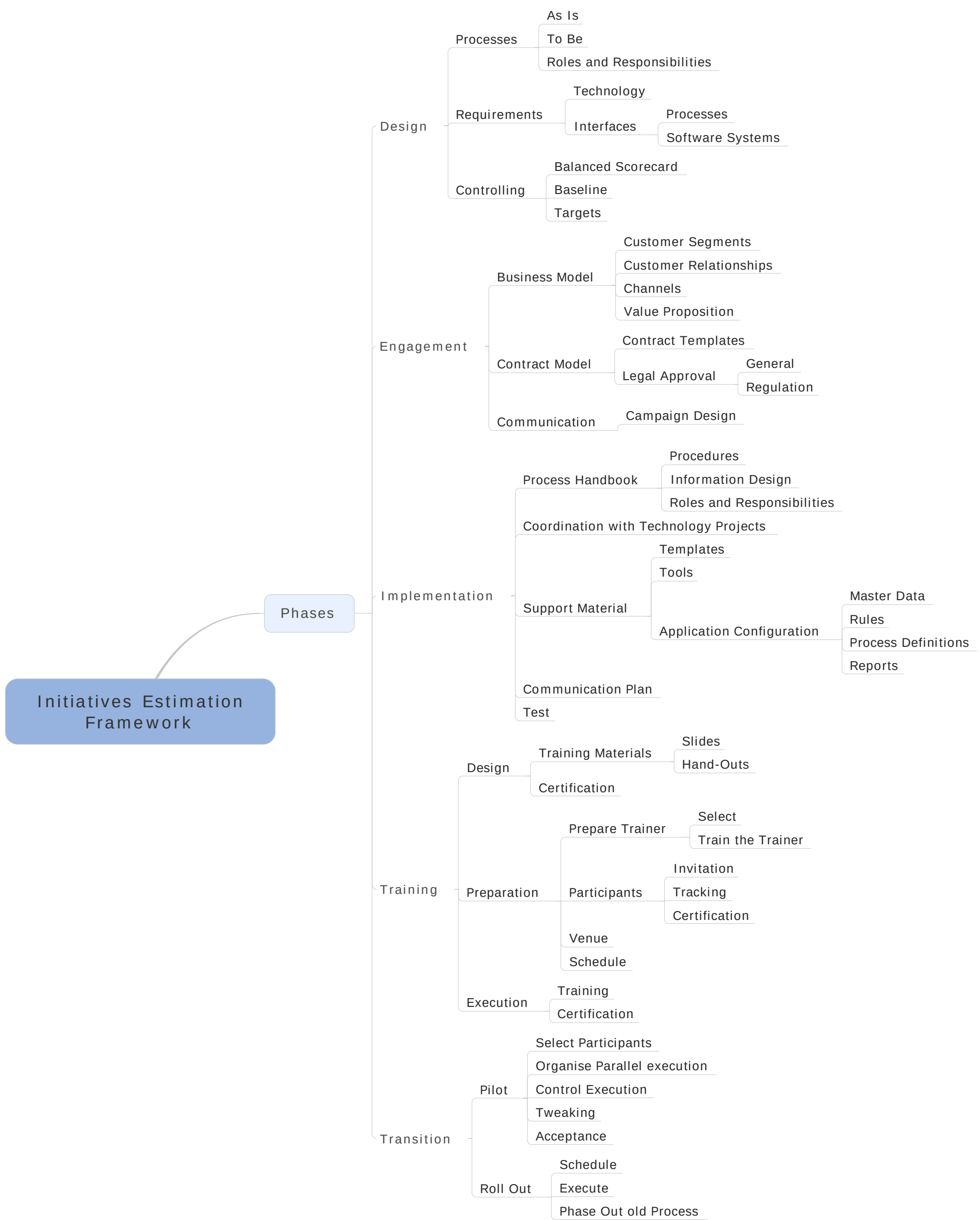


Figure 12.1.: Initiatives Estimation Framework

The execution of initiatives, driven by the Program Management Office, is generally done in five distinct phases: Design, Engagement, Implementation, Training and Transition (see 12.1.1 to 12.1.5 for details). Relevant roles for initiatives are (see 11.2):

- Project Manager
- Managing Consultant
- Consultant
- System (IT/OT) Architect
- Business Architect
- Team Assistant
- Communication Specialist
- Legal Counsel
- Trainer

All estimates have been done based on phases, work packages and roles.

It is important to refer back to Figure 1.3, which shows the planned 'Capability' enhancement components starting in year 1 and concluding in year 8. Figure 12.2 below shows the detail behind Figure 1.3 by indicating the person-hours needed for initiative-specific roles in each initiative phase in each year.

Since 'Capability' enhancement components conclude in year 8, the efforts required to implement the initiatives of all 12 Value Packs also conclude in year 8.

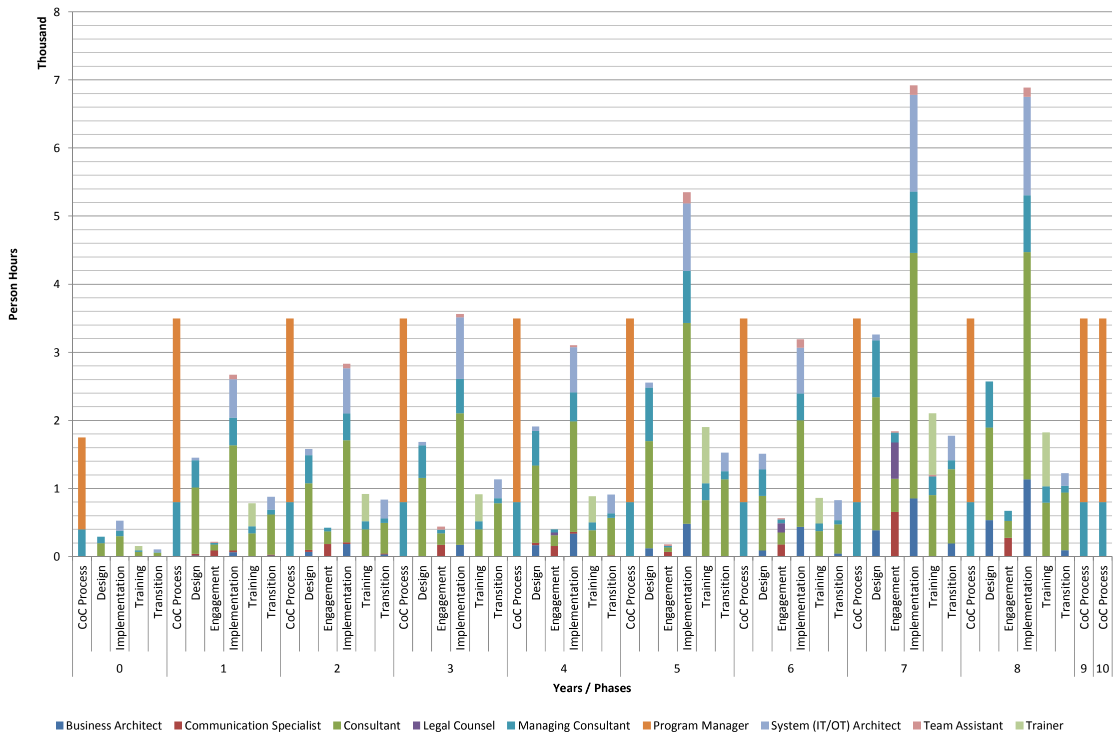


Figure 12.2.: Effort for Initiatives by Role, Phase and Year

12.1.1. Design

The starting point of each initiative is the design phase that will define the necessary changes in the processes. These changes are defined in terms of As-Is process, To-Be process and roles and responsibilities derived from the new process design.

Coming from the new process design the requirements on technologies are defined to support the technology deployments. In addition to that interfaces to other processes and software systems are defined as needed.

12.1.2. Engagement

The engagement phase is not present in every initiative. It is used whenever there is a need to engage with customers or other stakeholders.

The engagement phase starts with the definition of the envisioned business model encompassing things like:

- Value Proposition - which products and services shall be offered to the customers?
- Customer Segments - which customer segments shall be addressed with which product or service?
- Customer Relationship - how shall the customer relationships look like?
- Channel - which channels shall be used?

Then the project team is going to create a contract template with the necessary checks regarding legal and regulatory issues.

Finally a market communication strategy is set up and executed, possibly with the help of an external marketing agency.

12.1.3. Implementation

The implementation phase starts with changing the process description in the process manual with activity descriptions, the resulting information model and roles and responsibilities.

The project team will ensure a close coordination between the initiative and related technology deployment activity.

If the new process version requires templates and tools, they will be created in this phase. In addition any master data configuration, rule, process and report definition required to configure software applications deployed earlier is done in this phase.

The new process version together with support materials and application configurations are thoroughly tested before the transition starts.

Finally a communication plan for employees, customers and other stakeholders is developed and executed.

12.1.4. Training

First the training materials like presentation slides and handouts are designed and created. If necessary a certification procedure is defined to ensure the operational excellence.

To prepare for the execution of the training a trainer will be selected together with a venue and a list of participants. The training sessions are scheduled and the participants are invited and tracked.

Finally the training and the certification process will be executed.

12.1.5. Transition

The transition phase starts by selecting a pilot group. The pilot group executes the revised process under close monitoring and to derive necessary changes / required tweaks that will directly be implemented until the process works as expected. The pilot phase will be finalized by a formal acceptance.

After that the process is rolled out to all involved employees and partners.

12.2. Technology Deployments

The implementation of the technology functions, driven by the Program Management Office, is generally done in either four or seven distinct phases (see 12.2.1 to 12.2.7 for details):

- Pilot - Initial Design
- Pilot - Purchasing
- Pilot - Rollout
- Pilot - Refinement
- Rollout - Planning
- Rollout - Execution
- Rollout - Finish

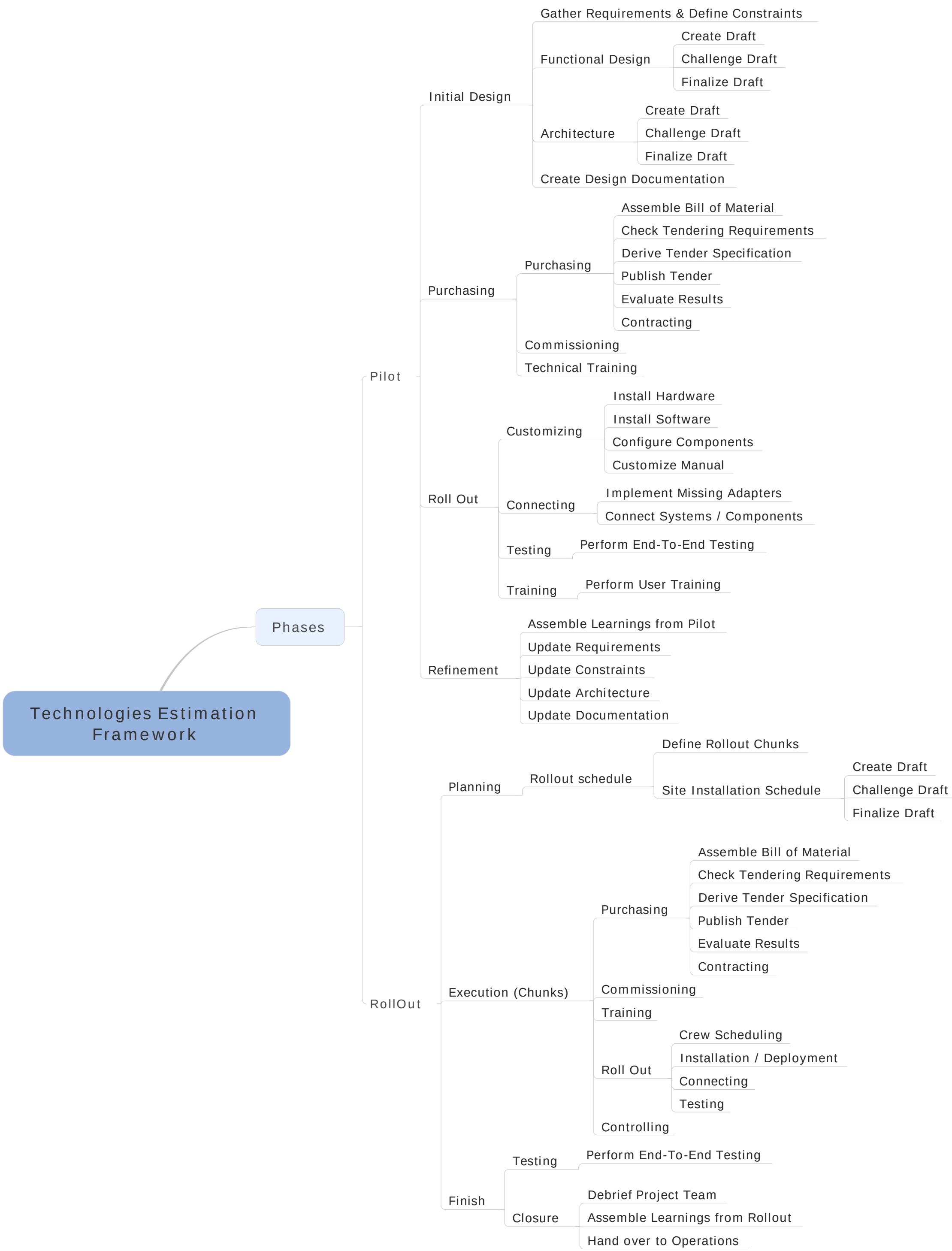


Figure 12.3.: Technology Estimation Framework

While the first four phases are applicable to every technology, the last three phases only apply if a device rollout (e.g. Smart Meters, Home Controllers, etc.) is required after the pilot implementation.

Relevant roles for technologies are (see 11.2):

- Project Manager
- System (IT/OT) Architect
- Business Architect
- Field Engineer
- Purchasing Specialist
- Field Technician

All estimates have been done based on phases, work packages and roles. Figure 12.4 shows the total person-hours required to implement technologies for each role in each technology phase in each year. As expected, there are significant peaks in Field Technician person-hour requirements every time a roll out is planned.

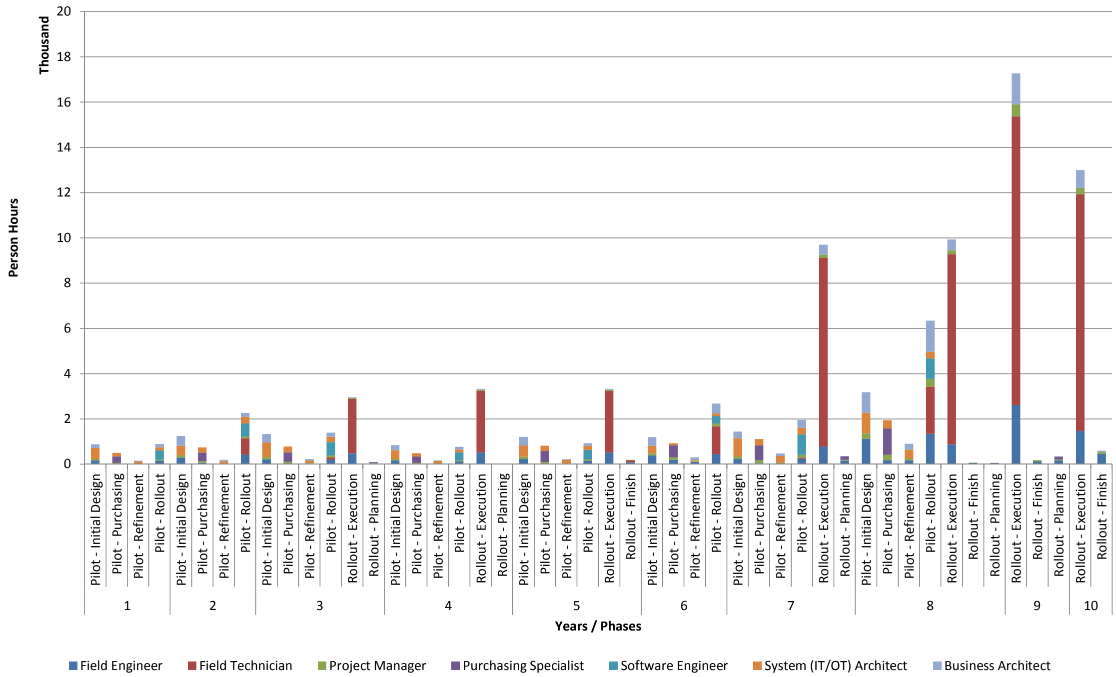


Figure 12.4.: Effort for Technologies by Role, Phase and Year

12.2.1. Pilot - Initial Design

The starting point for the implementation of every technology function is the gathering of relevant requirements as well as the definition of constraints.

Once those prerequisites are settled, the project team can start the actual design work. The first step in this process is the creation of functional design drafts that need to be challenged from the requirements and constraints perspective, before the functional design can be finalized. After the finalization of the functional design the next step is the creation of architecture drafts, which need to be challenged similarly, before the final architecture can be derived.

The ultimate step of the design phase is the documentation of the design, which will be the basis for the pilot purchasing phase.

12.2.2. Pilot - Purchasing

To enable the rollout of a technology function, after it has been initially designed, it is necessary to have the right materials (e.g. devices, software, licenses, etc.) available. The target of the pilot purchasing phase is to ensure the availability of the material as well as compliance with purchasing / tendering requirements.

The first parallel steps for the project team in this phase are the assembling of the rough bill of material as well as a check of the tendering requirements for the individual case. Once this has been done the tender specification can be derived out of the design specification, the bill of material and the tendering requirements. As soon as the specification is finished it can be published to enable participation of different vendors. Finally all proposals need to be evaluated and compared prior to the contracting with the winning vendor.

In case either large numbers of devices are being purchased or the required items have a very high complexity, one or two additional steps need to be added to this phase:

- Manual commissioning
- Technical training

12.2.3. Pilot - Rollout

Within the pilot rollout phase the actual implementation of a technology function is realized. In a first step the project team has to install and configure the necessary hard- and software. As soon as this is done missing adapters need to be identified and implemented to enable connection of the systems and devices.

To ensure that the function has been installed correctly and is working properly a comprehensive End-to-End test needs to be executed.

In special cases it might be necessary to train certain individuals on how to configure or manually adapt a function. This would be some kind of expert user training (e.g. to enable somebody to design new reports instead of just using the existing ones).

12.2.4. Pilot - Refinement

The pilot refinement phase has two different purposes. It is either used to finalize and close a technology project that does not require a large device rollout or it is used to prepare the transition from pilot phases to the rollout phases.

In both cases the phase starts with the assembling of learnings from the prior project phases as well as with updates of the architecture and documentation. This is necessary to make sure that there is no gap between what has been documented about the initial design and what has really been implemented.

In case a large device rollout is required the last step is to update the requirements and to define additional constraints that became visible during the pilot phase.

12.2.5. Rollout - Planning

The target of the rollout planning phase is to prepare an adequate schedule for the device rollout, considering the timeframe, the available resources and additional constraints.

As a first step the project team needs to get clarity on how many devices are to be installed, how long does it take to install a device, how many resources will be available and what implications this has onto the required timeframe. As soon as those things have been settled the required number of rollout chunks can be defined.

The second step is the creation of a draft site installation schedule, which needs to be challenged and finalized to enable to rollout execution.

12.2.6. Rollout - Execution

The rollout execution starts with the same activities as the pilot purchasing phase. The bill of material needs to be assembled for every rollout chunk and the tendering requirements need to be rechecked, as they might be different due to the potentially higher purchasing volume. During the revision of the tender specification the updates / results from the pilot refinement phase need to be considered. Afterwards the tender can be published and all proposals need to be evaluated and compared prior to the contracting with the winning vendor.

In contrast to the pilot purchasing phase, commissioning becomes a mandatory step within the rollout execution, because of much larger amounts of devices.

The actual rollout has four key steps:

- The crews need to be scheduled based on availability and constraints
- The devices need to be installed at the relevant sites
- The devices need to be connected to the control systems
- The functions as well as the connectivity need to be tested thoroughly

12.2.7. Rollout - Finish

Once all devices have been deployed the rollout can be finished. In the context of the rollout finishing a final End-to-End test needs to be performed to validate full functionality.

Once everything is working correctly and nothing needs to be reworked the closure of the project starts. This includes the debriefing of the project team and the assembling of learning to improve future projects. As final step everything will be handed over to operations with adequate documentation.

Part V.

Conclusion

Chapter 13.

Outlook

13.1. Conclusion

Overall, the GSU grid modernization program is anticipated to produce significant impact, both for GSU and its customers and community, by directly impacting GSU's proposed strategic targets.
Highlights of the anticipated benefits are as follows:

- Leverage operational information to improve asset utilization efficiency.
- Optimize investments and operational expenditures.
- Provide means to expand the business footprint by offering additional value added services.
- Facilitate a sustainable energy system for Sudbury.
- Realize GSU's strategic vision.

The Siemens Smart Grid Compass® Framework is concluded by the Routing Study which creates an execution blueprint in the form of the GSU grid modernization program covering all aspects of GSU's aspired capabilities.

The grid modernization program at GSU is geared towards enabling GSU to survive and thrive with the upcoming paradigm shift where the conventional model of "Generation Follows Load" gives way to "Load Follows Generation". This momentous paradigm shift in the conventional business and operational models will impact all aspects of the economy, politics and society.

The other side of the upcoming paradigm shift is a very steep rise in replacement costs as assets near their end of design life. As the asset demographic data for many utilities in North America indicates, critical utility assets like transformers, cables and poles will need to be replaced in the next 10 to 15 years. Operating such assets beyond their design life carries increased risk for supply reliability, corrective maintenance budgets and safety. These risks can be somewhat mitigated by undertaking preemptive actions in the direction of preventive maintenance as well as early retirement of aging assets.

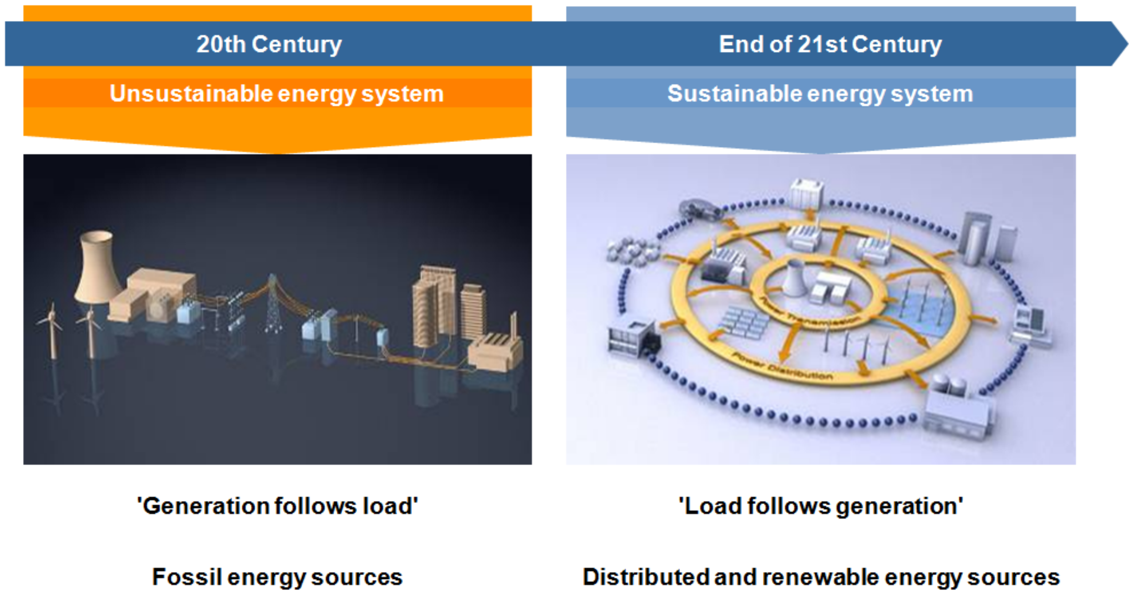


Figure 13.1.: Paradigm Change

To balance these needs, GSU, and other utilities around the world, must choose in which direction they want to drive their business. Do they either want to follow a path where energy is a commodity and the lowest possible price is the key driver or do they want to follow the path of energy based services, with a much more intimate relationship between the utility and its customers, where customers pay for comfort and value added services instead of for kWhs.

Figure 13.2.: Energy Based Services vs. Energy as Commodity

GSU, by the virtue of its close and stable customer relationships and its experience with grid technologies and value added services, has a head start on its competitors on the path of becoming an energy services provider. The grid modernization program therefore not only helps GSU seamlessly continue this journey, it helps identify crucial turns along the way and prepare accordingly.

While the general contours of the upcoming paradigm change are becoming clearer, continuous planning is required to exploit dynamic opportunities and synergy potentials that will arise. As with all game-changing technologies, smart grid applications are no exception to the so-called “Hype Cycle”. The following graphic describes a smart grid adaptation of the hype cycles that shows anticipated innovations in the electricity sector impacting the GSU grid modernization program as it is deployed.

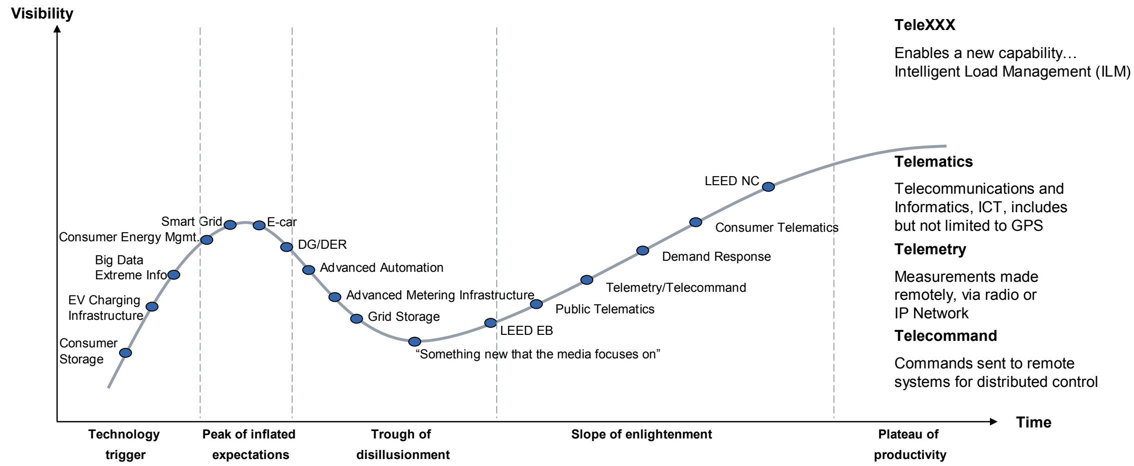


Figure 13.3.: Hype Cycle

A simplified explanation of the anticipated innovation is that the energy sector, and particularly the electricity sector, will benefit enormously from the imminent convergence of the utility sector with the information and communication technologies (ICT)sector. This convergence will create further component linkages across the electricity value chain so that the current solitudes of generation, transmission, distribution and consumption will become fully interconnected. Innovative concepts like Intelligent Load Management that leverage new revolutionary technologies such as substation intelligence, feeder automation, self-healing grid characteristics, home automation and smart phone/tablet apps for energy management etc. have the potential to completely reinvent the utility sector.

Figure 13.4.: Smart Energy World

Electricity will be produced and consumed in a fully diversified technology landscape where producing consumers will actively engage in the market and their production and consumption decisions will be integrated and monetized in active and complex bi-directional interchanges. The active consumer participation will be a foundation block of our quality of life and economic prosperity. The utility's capability to enable this consumer participation will be the key that unlocks future energy sustainability and security.

A continual striving for excellence and improvement are the bedrock of a successful business journey. Siemens is glad to be part of this journey with GSU and looks forward to continued fruitful collaboration.

Part VI.

Appendix

Appendix A.

Key Performance Indicators (KPIs)

A.1. Key Performance Indicators

The project team identified a set of 29 KPIs to set the targets for the grid modernization program. See Table A.1 for the committed targets.

The '**Current**' column indicates self-reported baseline values of the KPIs, based on input directly from GSU either in the Routing workshops or through follow-up correspondence.

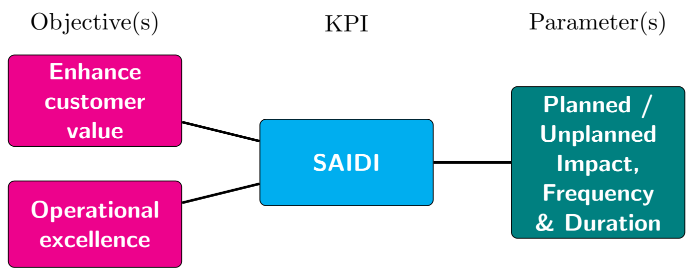
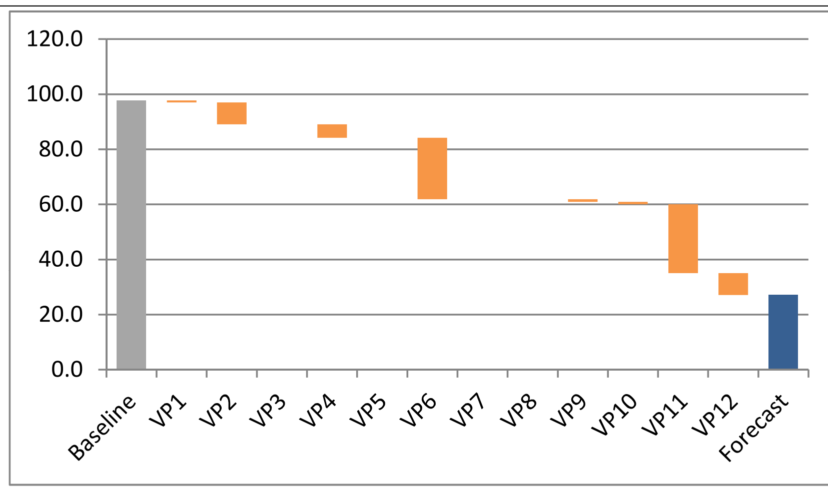
The '**Forecast**' column indicates the forecast values for each KPI based on the discussions of the initiatives during the Routing workshops. For each initiative, an impact value on the parameters that constitute the KPI was discussed; the values given for each KPI in the Forecast column constitute the forecast value of the KPI at the end of the program if each initiative affects its respective parameters in the way the Routing workshop participants anticipate.

The '**Target**' column represents the aspired level of the KPI as determined in the early Routing workshops. These target aspirations formed the guidelines of the workshop discussions, but ultimately the Forecast values will be used as metrics against which program progress will be measured. (N/A indicates that no specific target was aspired to in the workshop.)

Table A.1.: KPI Targets

ID	KPI	Current	Forecast	Target	Unit
1	SAIDI	97.8	27.1	N/A	min/cust/y
2	SAIFI (planned and unplanned)	1.78	0.89	N/A	outages/cust/y
3	Customers experiencing multiple interruptions (CEMI4)	3.00	2.70	0.0	cust/y
4	Load Factor	66	66	95	%
5	Technical Losses	3.00	2.25	N/A	%
6	Non-Technical Losses	2.4	1.74	N/A	%
7	Energy Savings from Efficiency and Conservation	6.90	39.17	34.74	GWh/y
8	Peak Power Demand	184	184	145	MW
9	Accident Frequency	0.24	0.00	0.00	inc/200,000h
10	Accident Severity	0.30	0.23	0.00	lostdays/200,000h
11	Near Miss Frequency	0.78	0.00	0.00	inc/200,000h
12	Billing Efficiency Index - Customers	46.51	45.58	N/A	/cust
13	Billing Efficiency Index - Energy	68.31	66.94	N/A	/kWh
14	OPEX (Maintenance)	2.15	1.49	1.65	$M/y
15	OPEX (Maintenance) per Customer	45.74	31.79	35.10	$/cust
16	OPEX (Maintenance) per Energy Delivered	67.19	46.70	51.56	$/MWh
17	OPEX / CAPEX	27	19	N/A	%
18	Efficiency of Dispatch Process	60	65	75	%
19	Effort for Regulatory Reporting	3.00	1.50	2.0	FTE
20	Time to Change	180	90	90	days
21	Av. Size of Projects	1200	800	700	hours
22	Interaction Cost per Customer	9.57	5.11	7.44	$/cust
23	Customer Satisfaction Index	95	97	100	%
24	Value Added Services Revenue / Total Revenue	7.2	45.6	30	%
25	Value Added Services Gross Margin	1.00	17.46	15.00	$M/y
26	Market Share (per product / service)	15	65	70	%
27	GSU Renewable Generation - Power	1.63	1.70	180	MW
28	Maximum DG Power / Line Capacity	19	19	40	%
29	GSU Renewable Generation - Energy	5,643	5,869	56,430	GWh/y

A.1.1. KPI-1: System Average Interruption Duration Index (SAIDI)

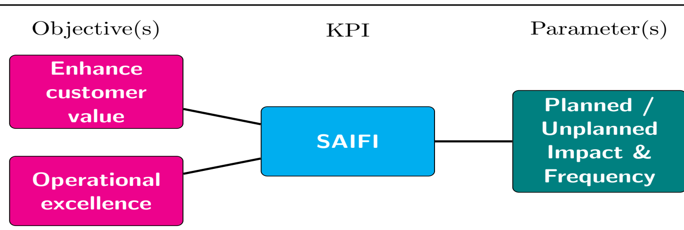
Description	This KPI gives the number of minutes per year that service to an average customer is interrupted, including both planned and unplanned outages.
Parameter(s)	Planned Outage Impact, Planned Outage Frequency, Planned Outage Impact, Unplanned Outage Frequency, Unplanned Outage Duration
Strategic Objective(s)	Enhance Customer Value Ensure operational excellence in the distribution system
Formula	∑ (Unplanned_Outages x Unplanned_Outage_Duration x Unplanned_Outage_Impact) + ∑ (Planned_Outages x Planned_Outage_Duration x Planned_Outage_Impact)
Baseline & Target	*Current Value* 97.8 cust-min/y; *Forecast Value* 27.1 cust-min/y; *Target Value* N/A cust-min/y
Impact Chain	
Impact Overview	

A.1.2. KPI-2: System Average Interruption Frequency Index (SAIFI)

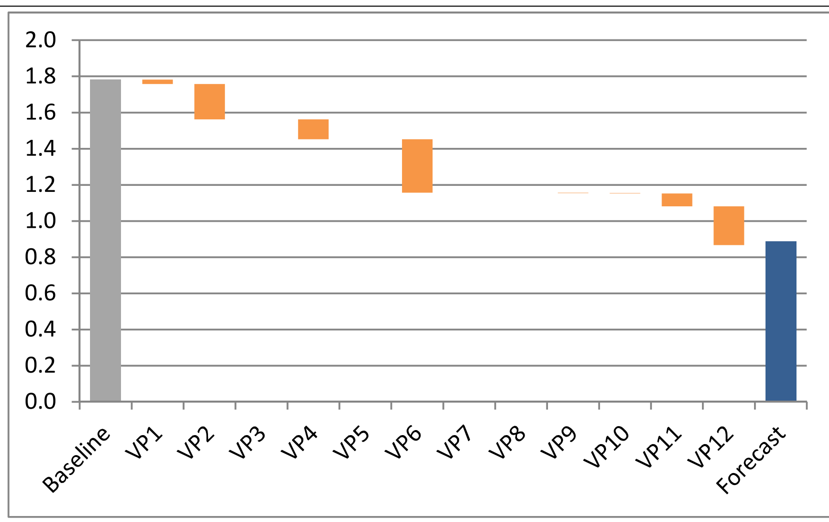
Description	SAIFI is the average number of interruptions that a customer would experience during a given year, including both planned and unplanned outages. This indicator is currently measured by GSU, but will not be monetized by the Program.
Parameter(s)	Planned Outage Impact Planned Outage Frequency Unplanned Outage Impact Unplanned Outage Frequency
Objective(s)	Enhance customer value Ensure operational excellence in the distribution system
Formula	$\sum(Unplanned\_Outages \times Unplanned\_Outage\_Impact) + \sum(Planned\_Outages \times Planned\_Outage\_Impact)$

Baseline & Target	*Current Value*	*Forecast Value*	*Target Value*
	1.78 Outages / Year	0.89 Outages / Year	N/A Outages / Year

Impact Chain



Impact Overview

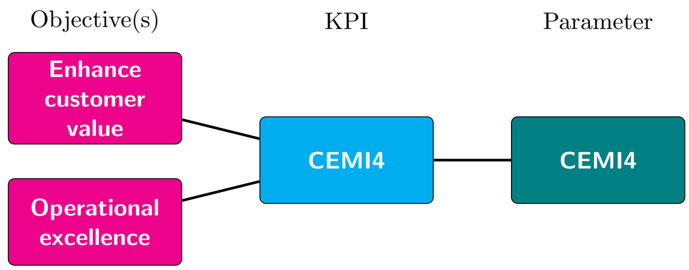


A.1.3. KPI-3: Customers Experiencing Multiple Interruptions (CEMI4)

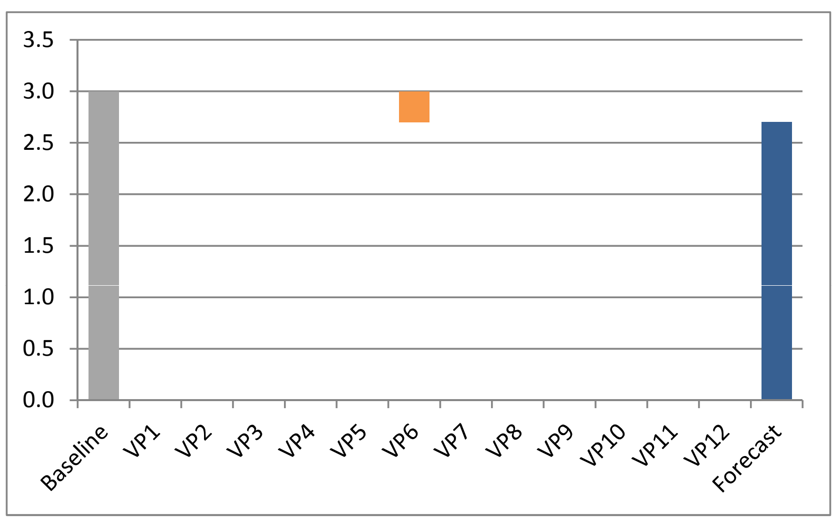
Description	CEMI4 is defined as the number of customers on GSU's grid experiencing greater than 4 interruptions per year. This indicator is currently measured by GSU, but it will not be monetized by the Program.
Parameter(s)	CEMI4
Objective(s)	Enhance customer value Ensure operational excellence in the distribution system
Formula	Directly Measured

Baseline & Target	*Current Value*	*Forecast Value*	*Target Value*
	3.0 Customers / Year	2.7 Customers / Year	0 Customers / Year

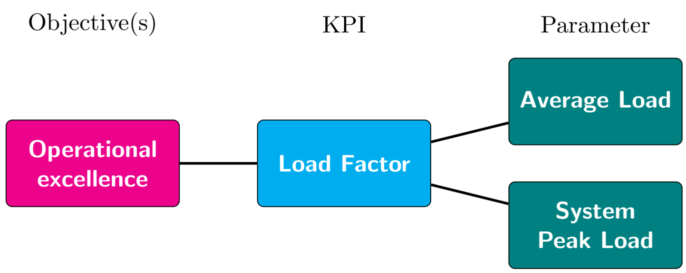
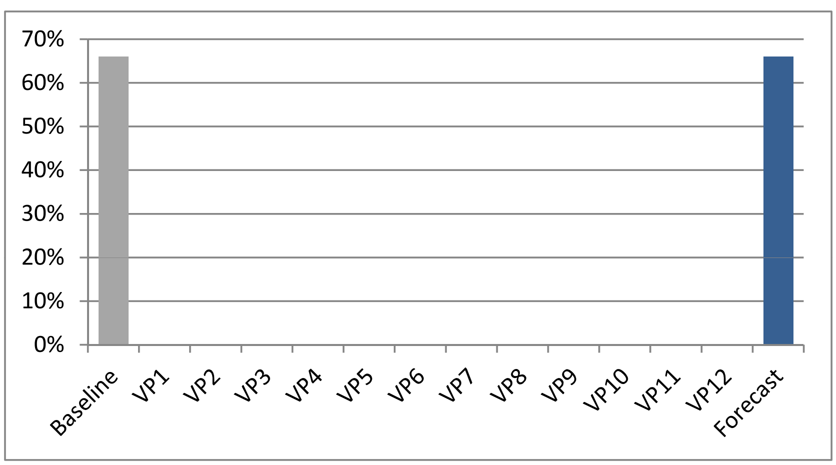
Impact Chain



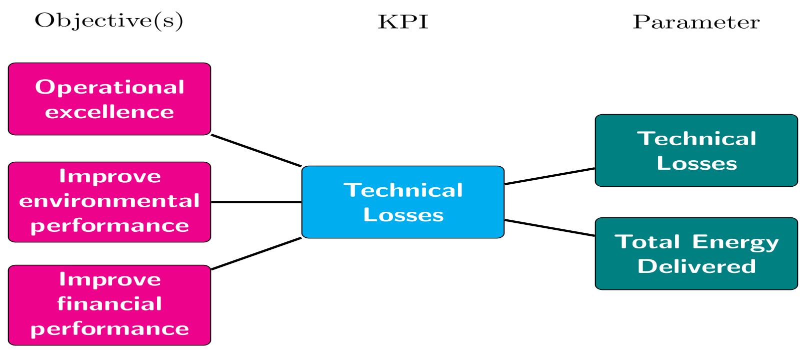
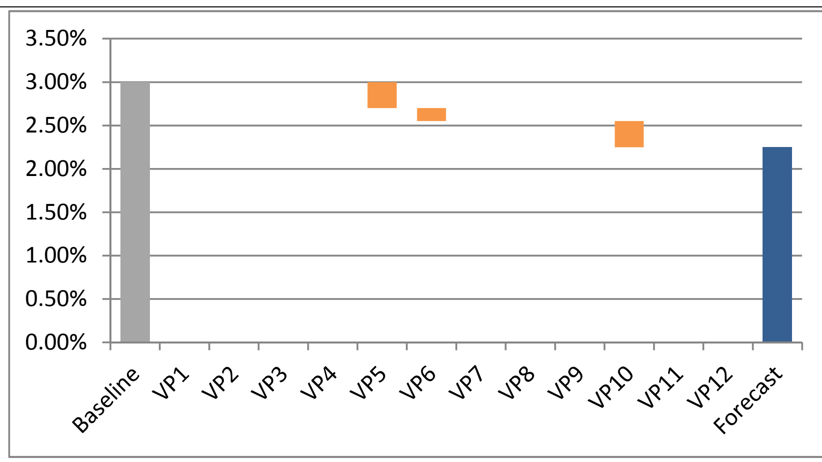
Impact Overview



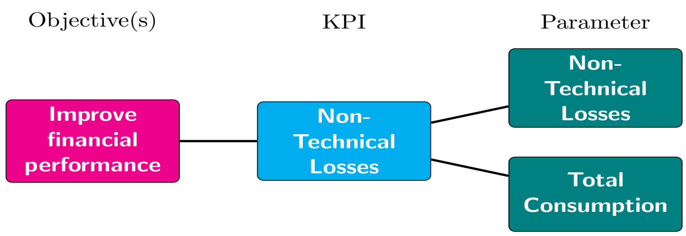
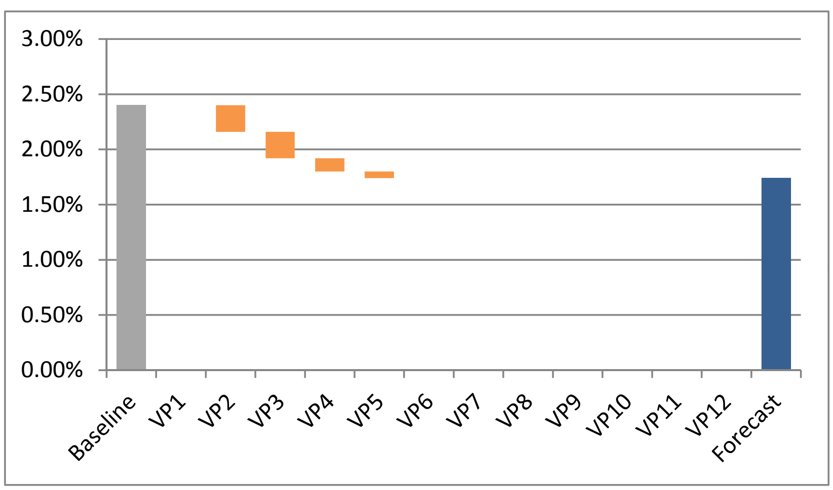
A.1.4. KPI-4: Load Factor

Description	Load Factor is defined as the ratio of average power consumption divided by peak power consumption on GSU's grid. A lower load factor generally indicates a greater difference between times of peak demand and low demand, leading to constraints during periods of high demand and/or excess capacity during low demand. A higher load factor indicates a more even load profile and more efficient utilization of distribution assets.
Parameter(s)	Average_Load, System_Peak_Load
Objective(s)	Ensure operational excellence in the distribution system
Formula	$\frac{Average\_Load}{System\_Peak\_Load}$
Baseline & Target	*Current Value* 66 % — *Forecast Value* ↑ % — *Target Value* 95 %
Impact Chain	
Impact Overview	

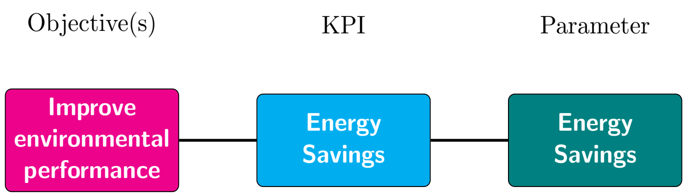
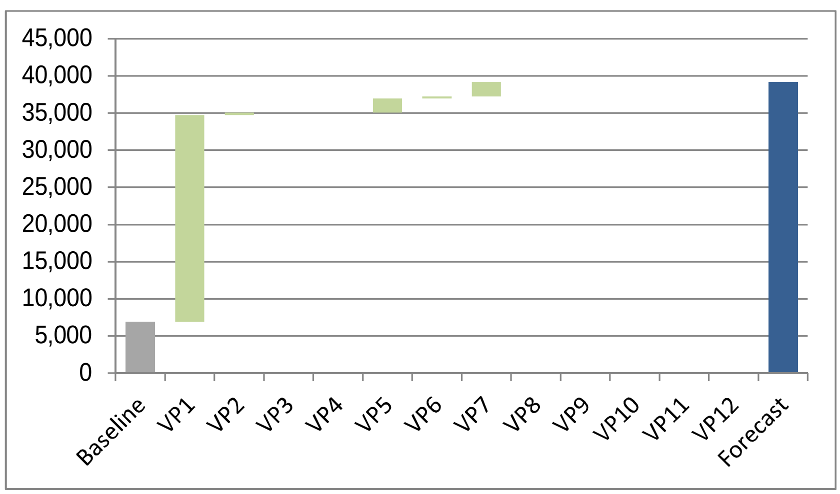
A.1.5. KPI-5: Technical Losses

Description	This KPI measures the total technical losses responsible for energy waste in the distribution system. This indicator is currently measured by GSU, and will be monetized by the Program.
Parameter(s)	Technical_Losses, Total_Energy_Delivered
Objective(s)	Ensure operational excellence in the distribution system Improve environmental performance Improve financial performance
Formula	$Technical\_Losses \times Total\_Energy\_Delivered$
Baseline & Target	*Current Value* 3.00 % *Forecast Value* 2.25 % *Target Value* ↓ %
Impact Chain	
Impact Overview	

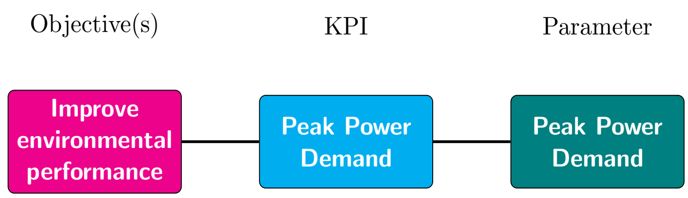
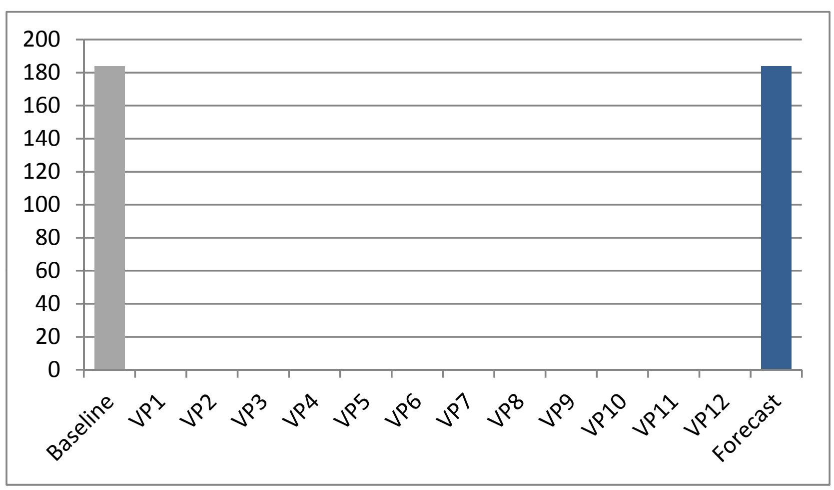
A.1.6. KPI-6: Non-Technical Losses

Description	This KPI measures the total non-technical losses in the distribution system. Non-technical losses are quantities of electricity which are not billed due to unauthorized connections or meter failure. This indicator is currently measured by GSU, but will not be monetized by the Program.
Parameter(s) Total Consumption	Non-Technical Losses
Objective(s)	Improve financial performance
Formula	$\frac{Non-Technical\_Losses}{Total\_Consumption}$
Baseline & Target	*Current Value* 2.4 % *Forecast Value* 1.7 % *Target Value* ↓ %
Impact Chain	
Impact Overview	

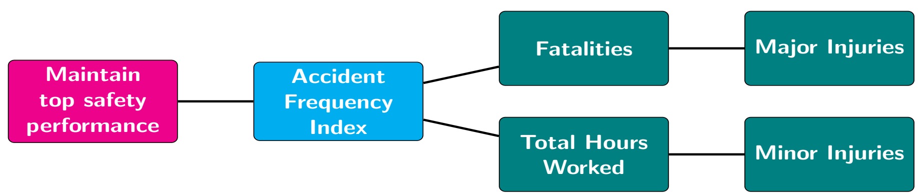
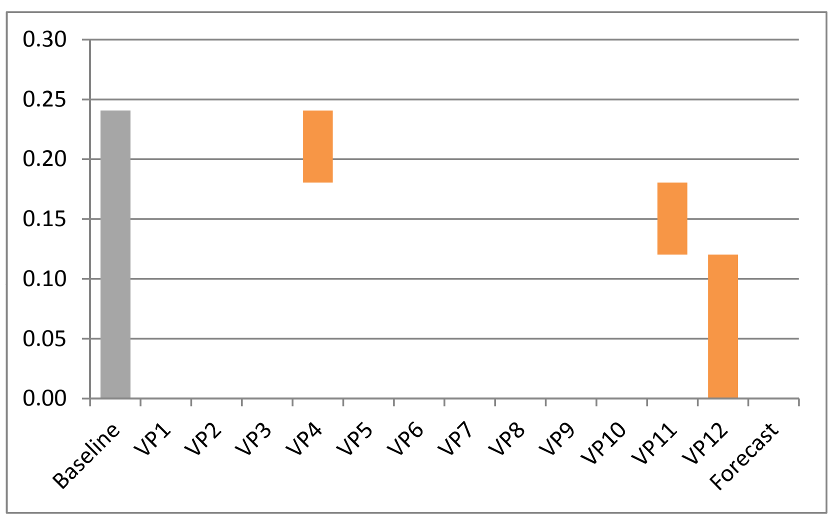
A.1.7. KPI-7: Energy Savings from Efficiency and Conservation

Description	This KPI gives the annual quantity of avoided electricity use (savings) acheived through energy savings and conservation initiatives. This indicator is currently measured by GSU, but will not be monetized by the Program.
Parameter(s)	Energy Savings from Efficiency and Conservation
Objective(s)	Improve environmental performance
Formula	Directly Measured
Baseline & Target	*Current Value* 6.9 MWh; *Forecast Value* 39.2 MWh; *Target Value* 34.7 MWh
Impact Chain	
Impact Overview	

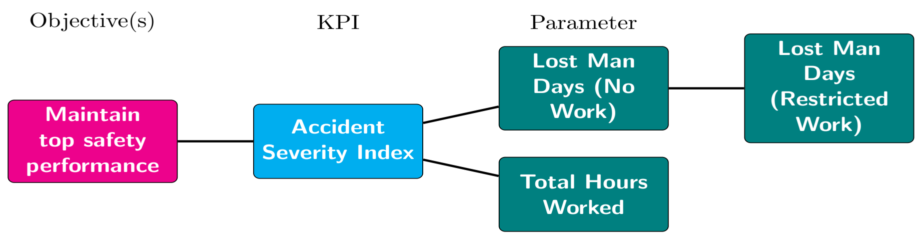
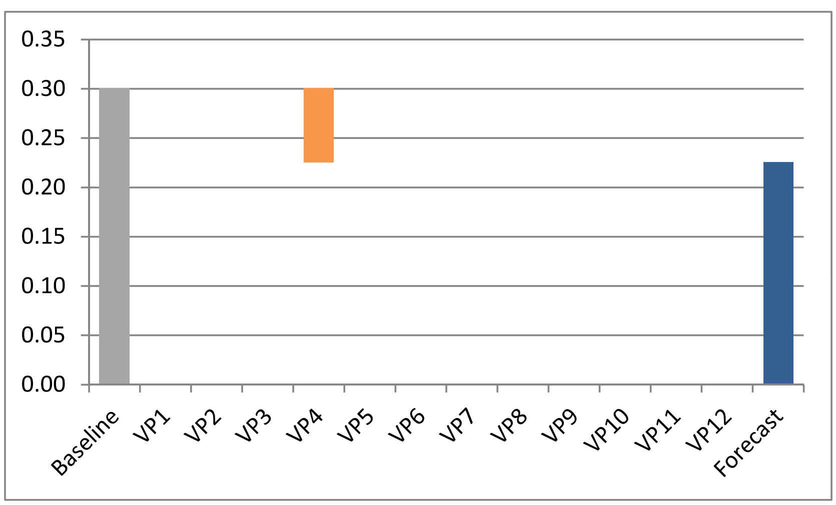
A.1.8. KPI-8: Peak Power Demand

Description	This KPI indicates the peak power demand experienced by GSU's grid over the course of the year. This indicator is currently measured by GSU, but will not be monetized by the Program.		
Parameter(s)	Peak Power Demand		
Objective(s)	Ensure operational excellence in the distribution system		
Formula	Directly Measured		
	Current Value	*Forecast Value*	*Target Value*
Baseline & Target	184 MW	↓ MW	145 MW
Impact Chain			
Impact Overview			

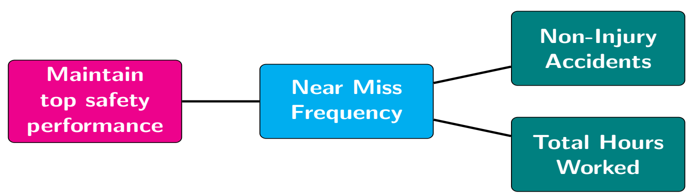
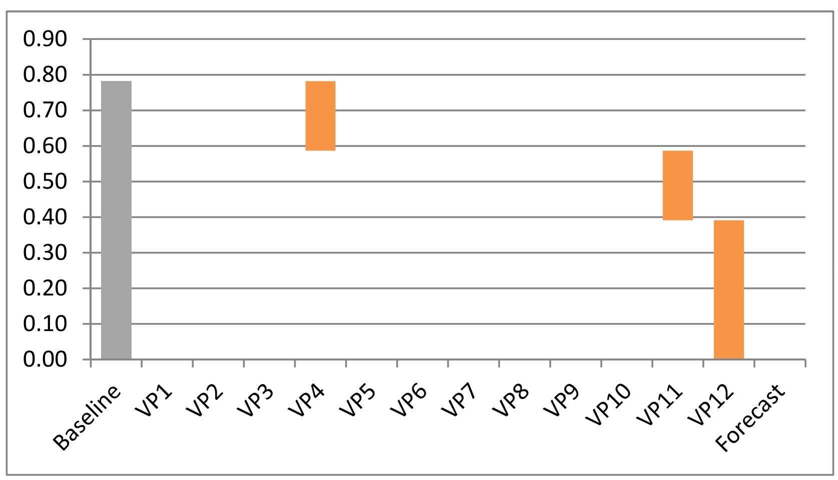
A.1.9. KPI-9: Accident Frequency Index

Description	This KPI is an index for measuring employee safety. It is measured in incidents per 200,000 person-hours worked. This indicator is currently measured by GSU, but will not be monetized by the Program.
Parameter(s)	Fatalities, Major_Injuries, Minor_Injuries, Total_Hours_Worked
Objective(s)	Maintain top safety performance
Formula	$\frac{Fatalities+Major\_Injuries+Minor\_Injuries}{Total\_Hours\_Worked} \times 200{,}000$
Baseline & Target	*Current Value* 0.24 $\frac{Incidents}{200{,}000h}$; *Forecast Value* 0.00 $\frac{Incidents}{200{,}000h}$; *Target Value* 0.00 $\frac{Incidents}{200{,}000h}$
Impact Chain	Objective(s) KPI Parameter 
Impact Overview	

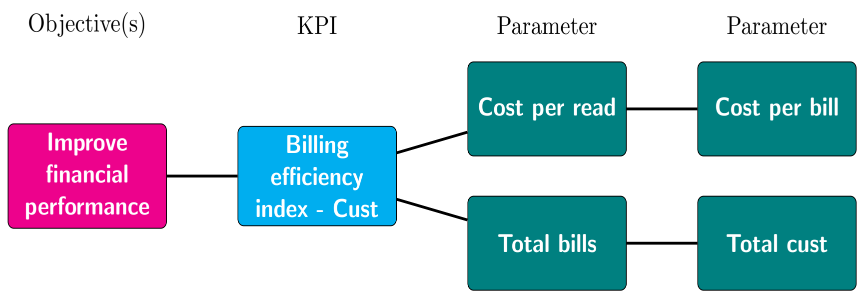
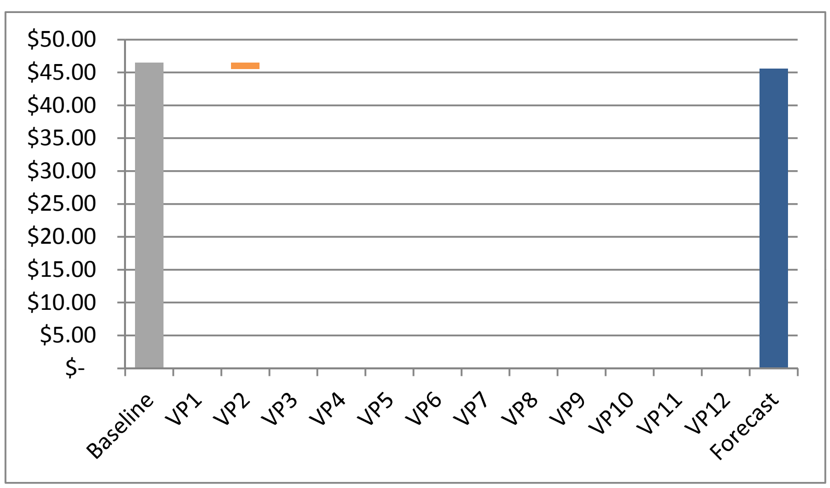
A.1.10. KPI-10: Accident Severity Index

Description	This KPI is an index for measuring employee productivity loss caused by accidents. It is measured in days lost per 200,000 person-hours worked. This indicator is currently measured by GSU, and will be monetized by the Program.
Parameter(s)	Lost_Man_Days(No_Work), Lost_Man_Days(Restricted_Work), Total_Hours_Worked
Objective(s)	Maintain top safety performance
Formula	$\frac{Lost\_Man\_Days(No\_Work)+Lost\_Man\_Days(Restricted\_Work)}{Total\_Hours\_Worked} \times 200,000$
Baseline & Target	*Current Value* 0.30 $\frac{DaysLost}{200{,}000h}$; *Forecast Value* 0.23 $\frac{DaysLost}{200{,}000h}$; *Target Value* 0.00 $\frac{DaysLost}{200{,}000h}$
Impact Chain	
Impact Overview	

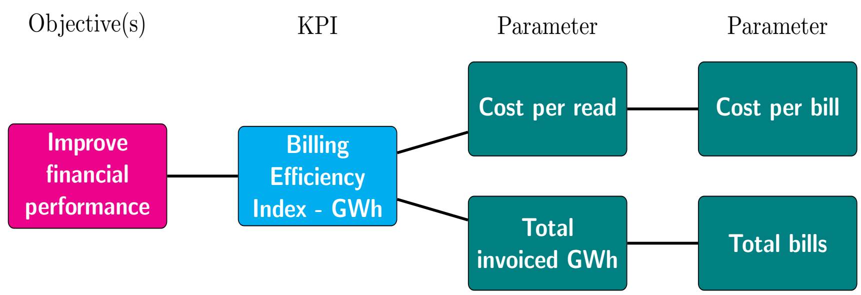
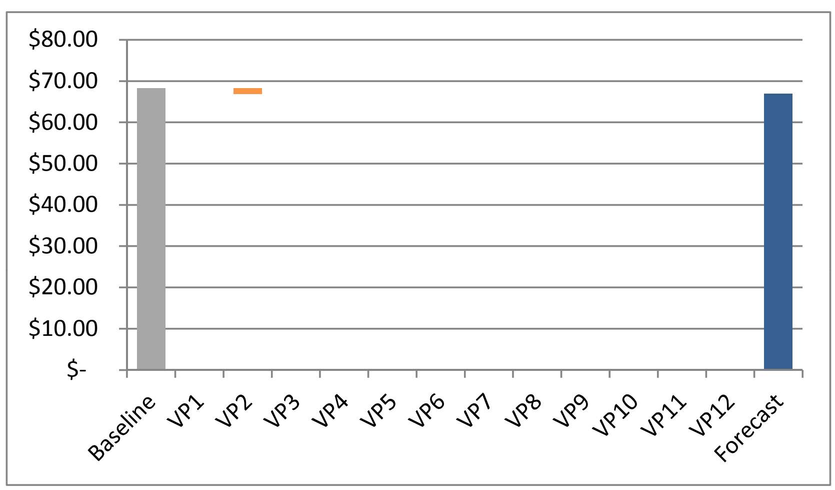
A.1.11. KPI-11: Near Miss Frequency

Description	This KPI is an index for measuring total number of non-injury saftey incidents (near misses) per 200,000 person-hours worked. This indicator is currently measured by GSU, and will not be monetized by the Program.
Parameter(s)	Accidents(Non Injury)
Objective(s)	Maintain top safety performance
Formula	$\frac{Non-Injury\_Accidents}{PersonHours\_Worked} \times 200,000$
Baseline & Target	*Current Value* 0.78 $\frac{Incidents}{200{,}000h}$ *Forecast Value* 0 $\frac{Incidents}{200{,}000h}$ *Target Value* 0 $\frac{Incidents}{200{,}000h}$
Impact Chain	Objective(s) KPI Parameter 
Impact Overview	

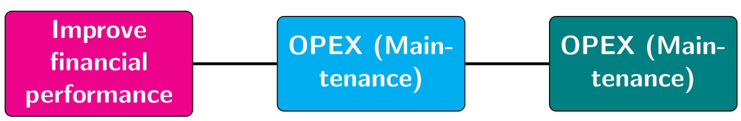
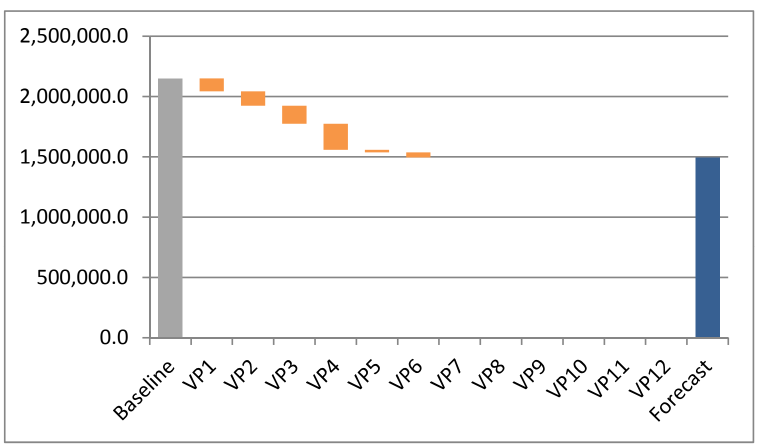
A.1.12. KPI-12: Billing Efficiency Index - Customers

Description	This KPI is an overview of the billing cost per customer. This indicator is currently being measured by GSU, and will be monetized by the Program.
Parameter(s)	Number_of_bills, Cost_per_read, Cost_per_bill, Total_invoiced_GWh
Objective(s)	Improve financial performance
Formula	$Number\_of\_bills \times \left(\frac{Cost\_per\_read+Cost\_per\_bill}{Total\_Customers}\right)$
Baseline & Target	*Current Value* 46.51 $ / Customer; *Forecast Value* 45.58 $ / Customer; *Target Value* N/A $ / Customer
Impact Chain	
Impact Overview	

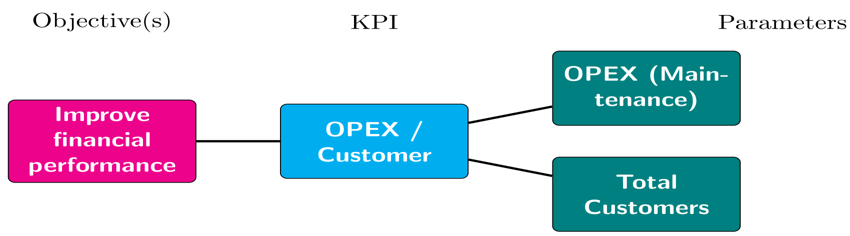
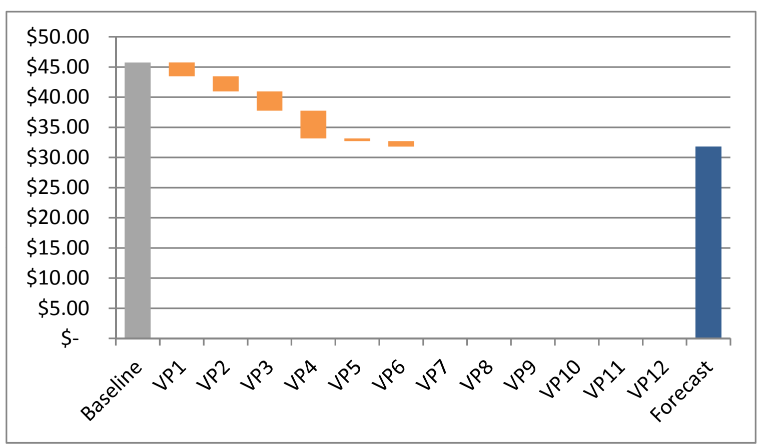
A.1.13. KPI-13: Billing Efficiency Index - Energy

Description	This KPI is an overview of the billing cost per billed kWh. This indicator is currently being measured by GSU, but will not monetized by the Program.
Parameter(s)	Number_of_bills, Cost_per_read, Cost_per_bill, Total_invoiced_GWh
Objective(s)	Improve financial performance
Formula	$Number\_of\_bills \times \left(\frac{Cost\_per\_read+Cost\_per\_bill}{Total\_invoiced\_GWh}\right)$
Baseline & Target	*Current Value* 68.31 $ / kWh *Forecast Value* 66.94 $ / kWh *Target Value* N/A $ / kWh
Impact Chain	
Impact Overview	

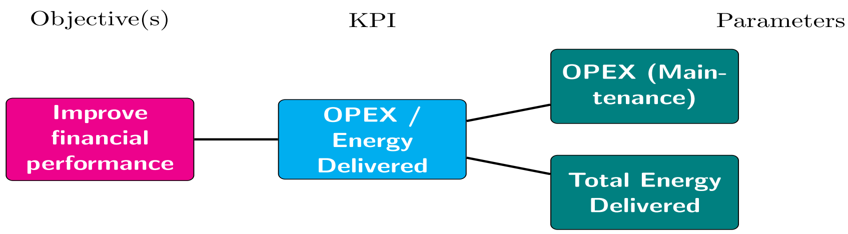
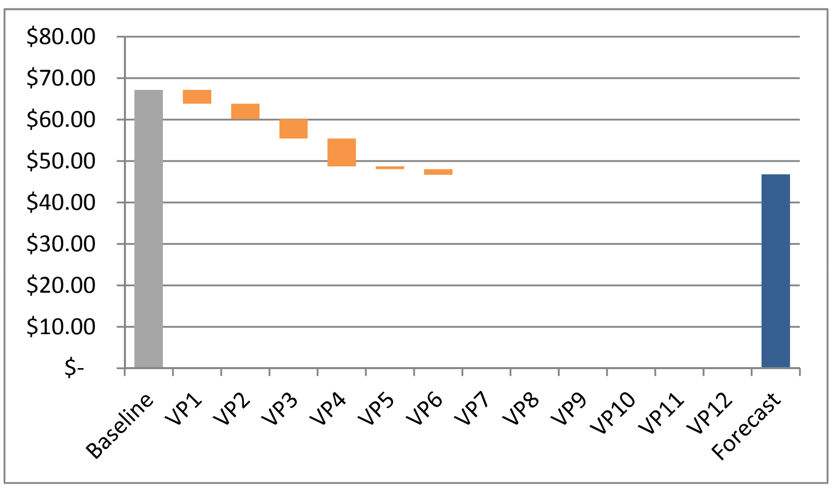
A.1.14. KPI-14: OPEX (Maintenance)

Description	This KPI represents the total annual amount of operational expenses (OPEX) attributed to maintenance activities on GSU's distribution system. The forecasts and targets assume the number of customers and size of GSU's territory remain constant. This indicator is currently being measured by GSU, and will be monetized by the Program.		
Parameter(s)	OPEX (Maintenance)		
Objective(s)	Improve financial performance		
Formula	Directly Measured		
	Current Value	*Forecast Value*	*Target Value*
Baseline & Target	2,150,000 $ / Year	1,494,250 $ / Year	1,650,000 $ / Year
	Objective(s)	KPI	Parameters
Impact Chain			
Impact Overview			

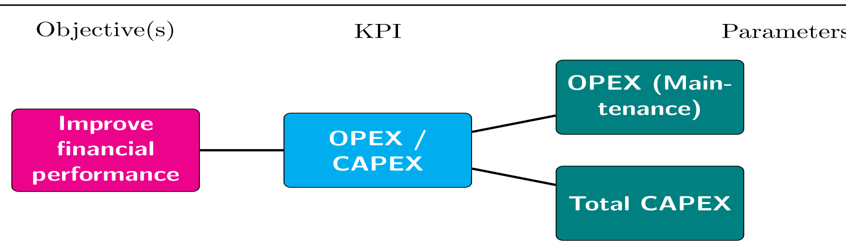
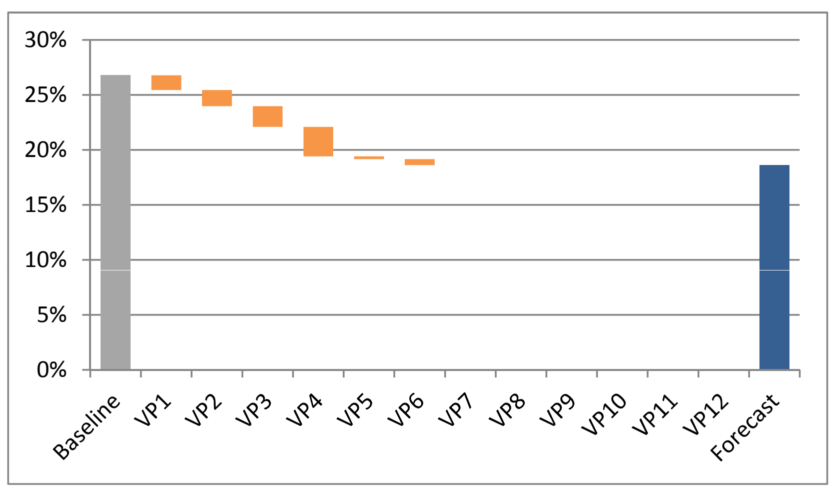
A.1.15. KPI-15: OPEX per Customer

Description	This KPI represents the total annual amount of operational expenses (OPEX) attributed to maintenance activities on GSU's distribution system, divided by the total number of customers. The forecasts and targets assume the number of customers and size of GSU's territory remain constant. This indicator is currently being measured by GSU, but will not be monetized by the Program.
Parameter(s)	OPEX (Maintenance), Total Customers
Objective(s)	Improve financial performance
Formula	$\frac{OPEX(Maintenance)}{Total\_Customers}$
Baseline & Target	*Current Value* 45.74 $ / Customer-Year; *Forecast Value* 31.79 $ / Customer-Year; *Target Value* 35.10 $ / Customer-Year
Impact Chain	
Impact Overview	

A.1.16. KPI-16: OPEX per Energy Delivered

Description	This KPI represents the total annual amount of operational expenses (OPEX) attributed to maintenance activities on GSU's distribution system, divided by the amount of energy delivered.
Parameter(s)	Corrective_Maintenance_Costs, Preventive_Maintenance_Costs, Total_Energy_Delivered
Objective(s)	Improve financial performance
Formula	$\frac{Corrective\_Maintenance\_Costs+Preventive\_Maintenance\_Costs}{Total\_Energy\_Delivered}$
Baseline & Target	*Current Value* 67.19 \$ / MWh; *Forecast Value* 46.70 \$ / MWh; *Target Value* 51.56 \$ / MWh
Impact Chain	
Impact Overview	

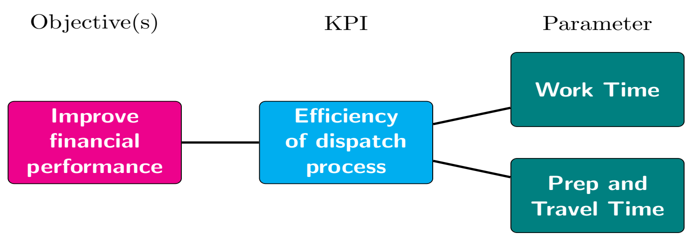
A.1.17. KPI-17: OPEX / CAPEX

Description	This KPI gives the ratio of OPEX to CAPEX.
Parameter(s)	OPEX (Maintenance) CAPEX Ch.5.C.a) System Access CAPEX Ch.5.C.b) System Renewal CAPEX Ch.5.C.c) System Service - (Not-)Renewables CAPEX Ch.5.C.d) General Plant
Objective(s)	Improve financial performance
Formula	$\frac{OPEX(Maintenance)}{Total\_CAPEX}$
Baseline & Target	*Current Value* 27 % *Forecast Value* 19 % *Target Value* N/A %
Impact Chain	
Impact Overview	

A.1.18. KPI-18: Efficiency of Dispatch Process

Description	This KPI provides an overview of the proportion of time employees spend working as a proportion of total work time. This indicator is currently measured by GSU, and will be monetized by the Program.
Parameter(s)	Work_Time, Prep_and_Travel_Time
Objective(s)	Ensure operational excellence in the distribution system Improve financial performance Enhance customer value
Formula	$\frac{Work\_Time}{Work\_Time+Prep\_and\_Travel\_Time}$
Baseline & Target	*Current Value* 60 % *Forecast Value* 65 % *Target Value* 75 %

Impact Chain



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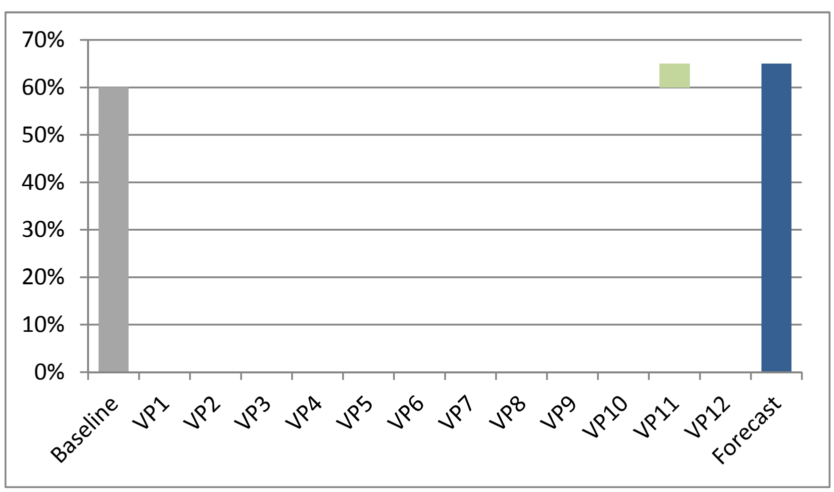
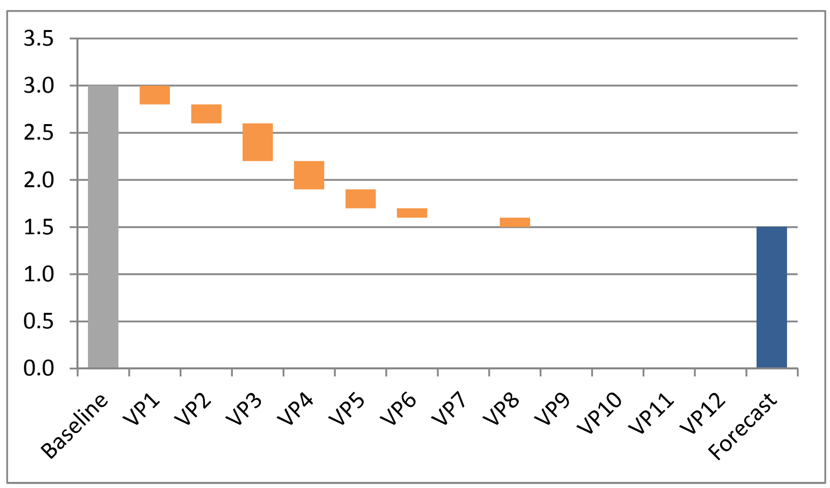


A.1.19. KPI-19: Effort for Regulatory Reporting

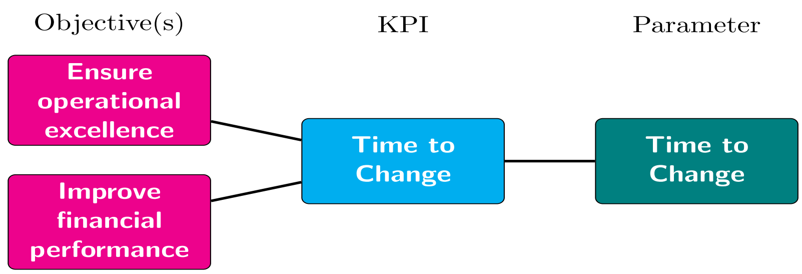
Description	This KPI gives insight into the costs of preparing regulatory reports. This indicator is currently measured by GSU, and will be monetized by the Program.
Parameter(s)	Effort_Regulatory_Report
Objective(s)	Improve financial performance
Formula	Directly Measured
Baseline & Target	*Current Value*: 3 FTE *Forecast Value*: 1.5 FTE *Target Value*: 2 FTE
Impact Chain	Objective(s) / KPI / Parameter
Impact Overview	



A.1.20. KPI-20: Time to Change

Description	This KPI gives insight into the amount of time required to implement a procedural or organizational change, such as a change in a business process or method of how to do something (workflow) on a department-wide or organization-wide level.
Parameter(s)	Total_Duration_of_Change_Projects, Number_of_Projects
Objective(s)	Ensure operational excellence in the distribution system Improve financial performance
Formula	$\frac{Total\_Duration\_of\_Change\_Projects}{Number\_of\_Projects}$
Baseline & Target	*Current Value* 180 Days / Change; *Forecast Value* 90 Days / Change; *Target Value* 90 Days / Change

Impact Chain



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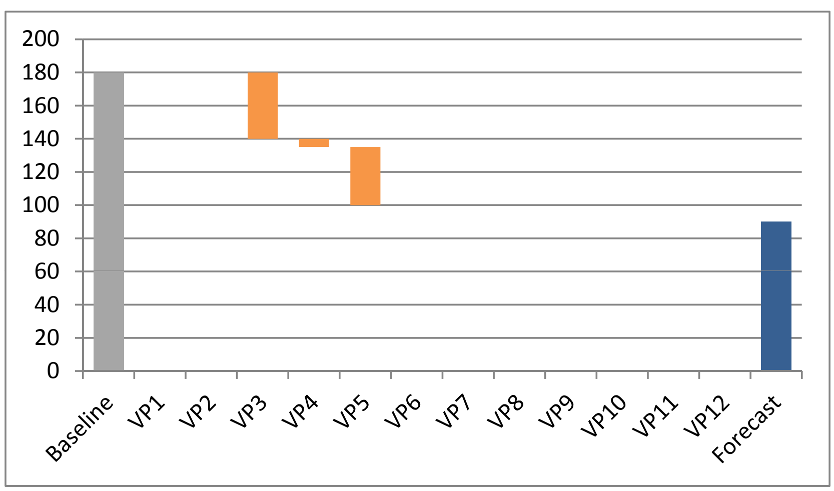
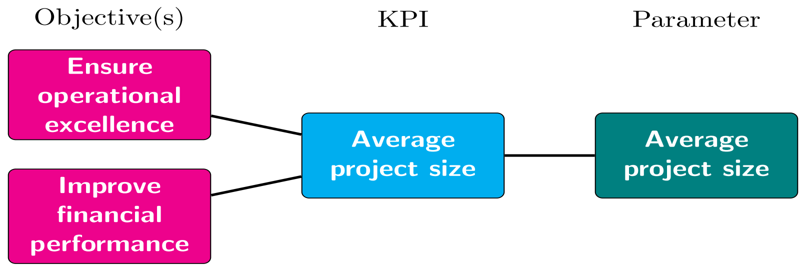
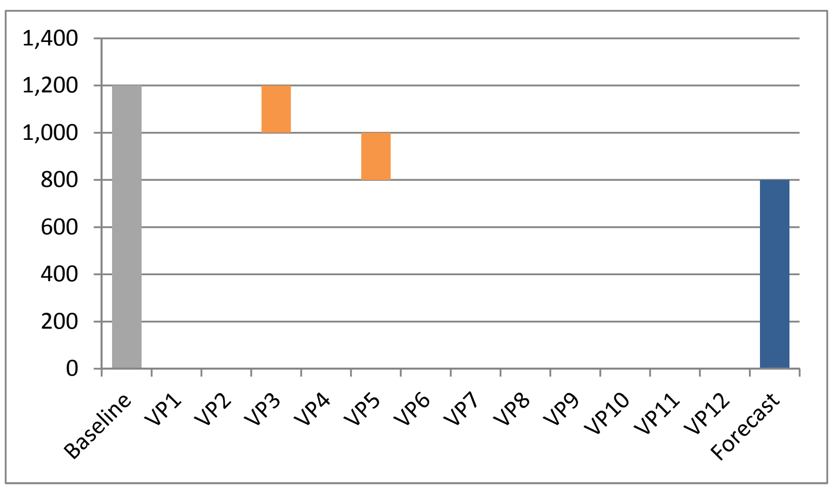


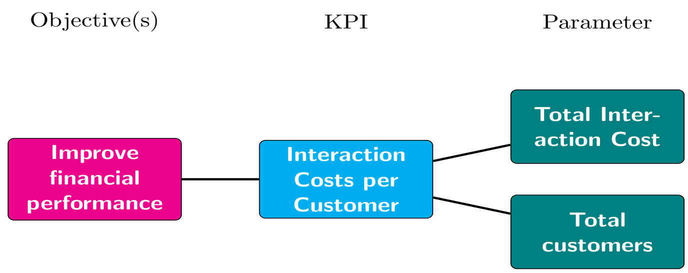
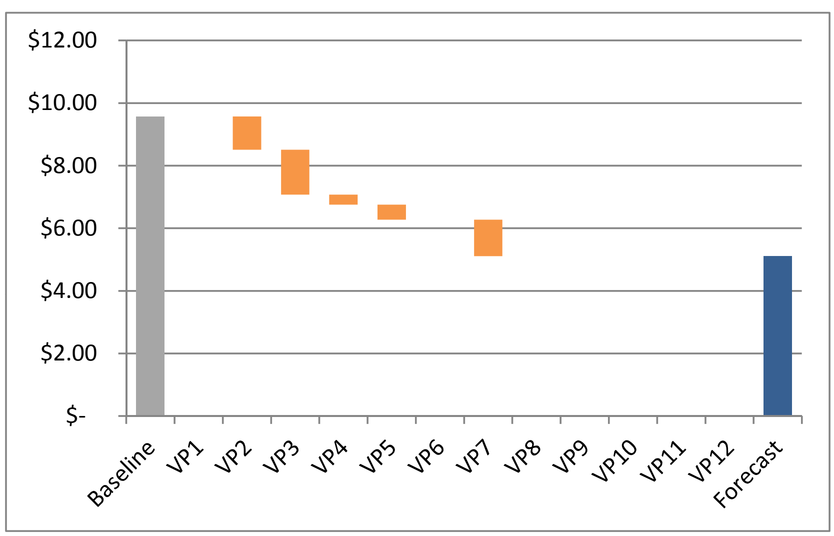
A.1.21. KPI-21: Average Project Size

Description	This KPI gives insight into the average size of an organizational change project. This indicator is not currently measured by GSU, and will not be monetized by the Program.
Parameter(s)	Average_Project_Size
Objective(s)	Ensure operational excellence in the distribution system Improve financial performance
Formula	$Average\_Project\_Size$
Baseline & Target	*Current Value* 1200 Person-Hours / Project; *Forecast Value* 800 Person-Hours / Project; *Target Value* 700 Person-Hours / Project
Impact Chain	
Impact Overview	

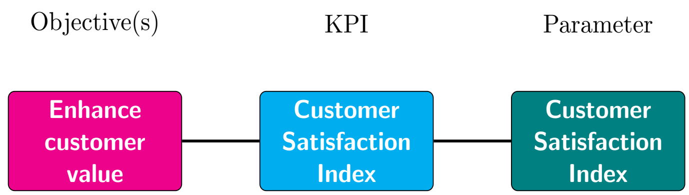
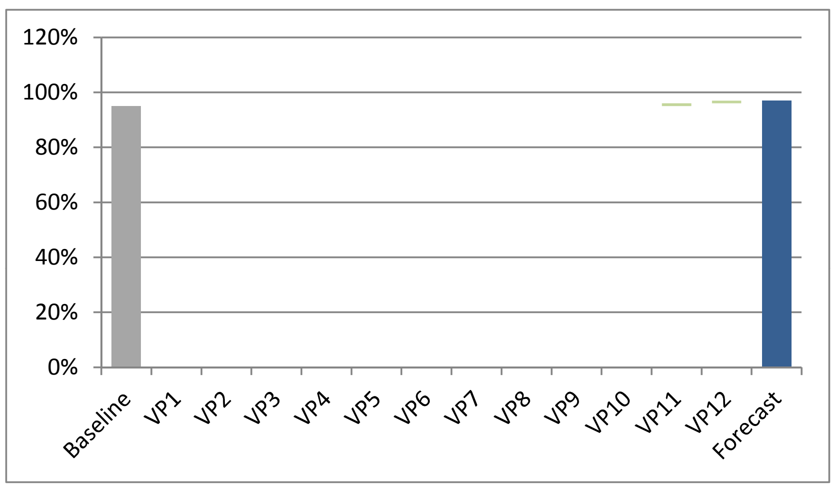




A.1.22. KPI-22: Interaction Cost per Customer

Description	This KPI measures the administrative expenditure per customer in a year. This indicator is currently being measured by GSU, and will be monetized by the Program.
Parameter(s)	Total Interaction_Cost, Total_Customers
Objective(s)	Improve financial performance
Formula	$\frac{Total\_Transaction\_Cost}{Total\_Customers}$
Baseline & Target	*Current Value* 9.57 $ / Customer-Year; *Forecast Value* 5.11 $ / Customer-Year; *Target Value* 7.44 $ / Customer-Year
Impact Chain	
Impact Overview	

A.1.23. KPI-23: Customer Satisfaction Index

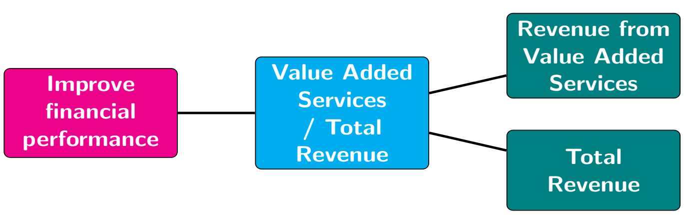
Description	This KPI reflects the satisfaction of GSU's customers as measured by GSU's Customer Survey. This indicator is currently measured by GSU, but will not be monetized by the Program.
Parameter(s)	Customer Satisfaction Index
Objective(s)	Enhance customer value
Formula	Directly Measured
Baseline & Target	*Current Value* 95 % — *Forecast Value* 97 % — *Target Value* 100 %
Impact Chain	
Impact Overview	

A.1.24. KPI-24: Value Added Services / Total Revenue

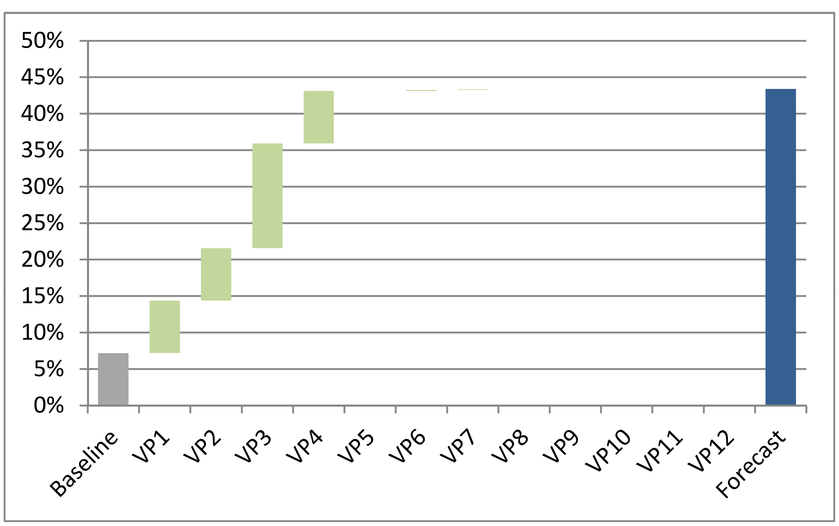
Description	This KPI measures the revenues gained from value added services. This indicator is currently measured by GSU, but will not be monetized by the Program.
Parameter(s)	Value Added Services Revenue, Total Revenue
Objective(s)	Improve financial performance Enhance customer value
Formula	$\frac{Value\_Added\_Services\_Revenue}{Total\_Revenue}$
Baseline & Target	*Current Value* 7.2 % *Forecast Value* 45.6 % *Target Value* 30 %

Objective(s) KPI Parameter

Impact Chain



Impact Overview



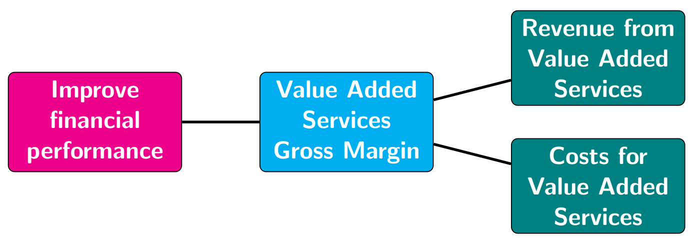
A.1.25. KPI-25: Value Added Services Gross Margin

Description	This KPI measures the net income gained from value added services. This indicator is currently measured by GSU, and will be monetized by the Program.
Parameter(s)	Value Added Services Revenue, Value Added Services Cost
Objective(s)	Improve financial performance
Formula	Value Added Services Revenue - Value Added Services Cost
Baseline & Target	*Current Value* 1,000,000 $ / Year; *Forecast Value* 17,460,400 $ / Year; *Target Value* 15,000,000 $ / Year

	Current Value	*Forecast Value*	*Target Value*
Baseline & Target	1,000,000 $ / Year	17,460,400 $ / Year	15,000,000 $ / Year

Objective(s) KPI Parameter

Impact Chain



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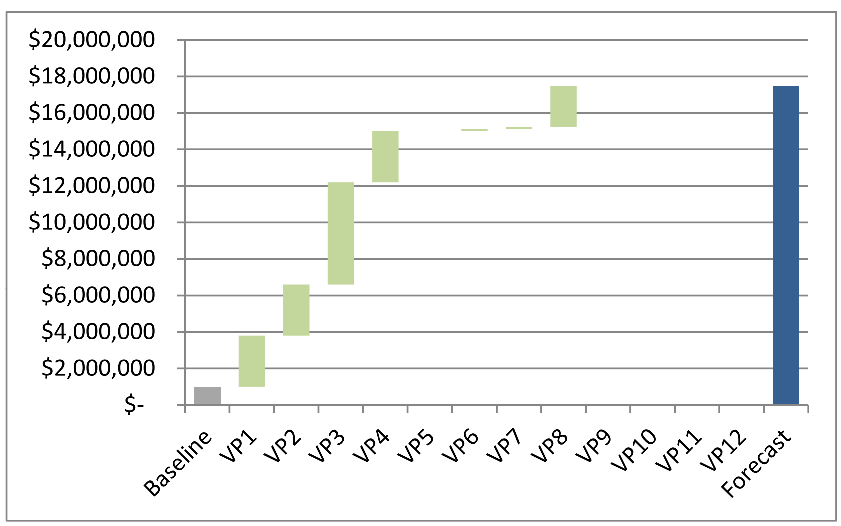


A.1.26. KPI-26: Market Share (Per Product / Service)

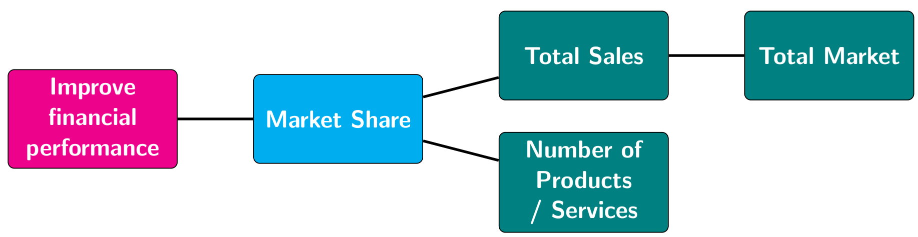
Description	This KPI measures the average market share per value added product or service. This indicator is currently measured by GSU, but will not monetized by the Program.
Parameter(s)	Market Share (Per Product / Service)
Objective(s)	Improve financial performance
Formula	$\frac{\sum \frac{Total\_Sales}{Total\_Market}}{Number\_of\_Products/Services}$

Baseline & Target

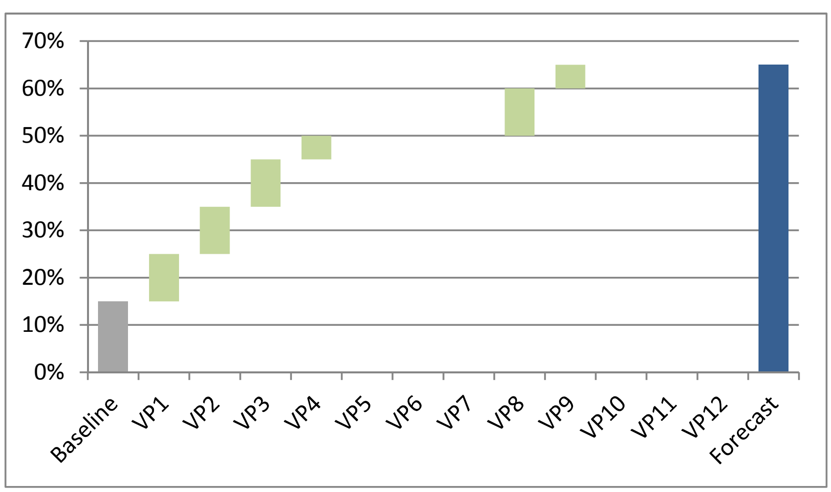
Current Value	*Forecast Value*	*Target Value*
15 %	65 %	70 %

Objective(s) KPI Parameter

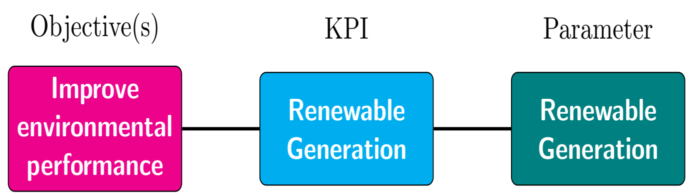
Impact Chain



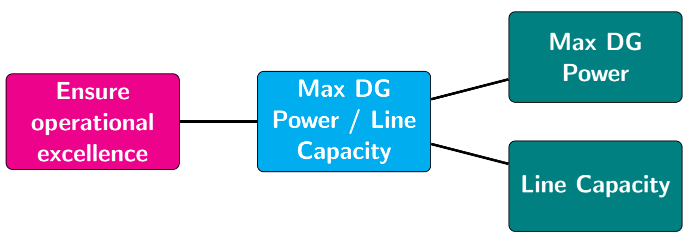
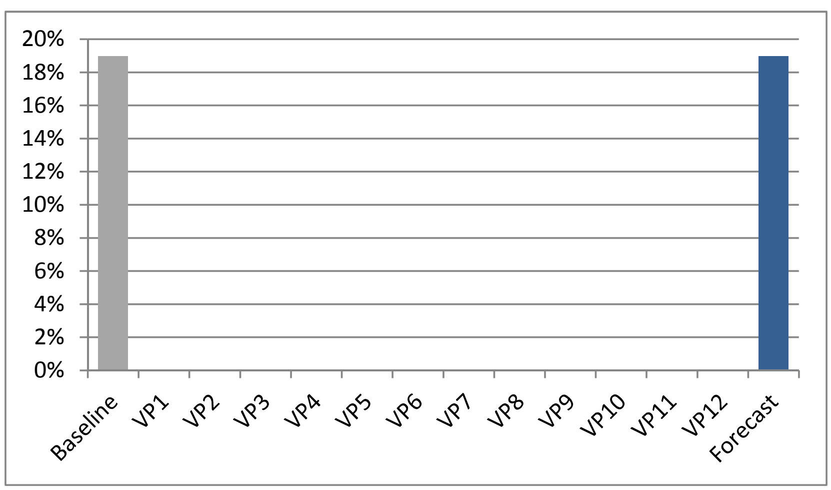
Impact Overview



A.1.27. KPI-27: GSU Renewable Generation - Power

Description	This KPI measures the maximum generation capacity from renewable sources owned by GSU. This indicator is currently measured by GSU, but will not be monetized by the Program.
Parameter(s)	GSU Renewable Generation - Power
Objective(s)	Improve environmental performance
Formula	Measured Directly
Baseline & Target	*Current Value* 1.6 MW; *Forecast Value* 1.7 MW; *Target Value* 180 MW
Impact Chain	
Impact Overview	

A.1.28. KPI-28: Maximum DG Power / Line Capacity

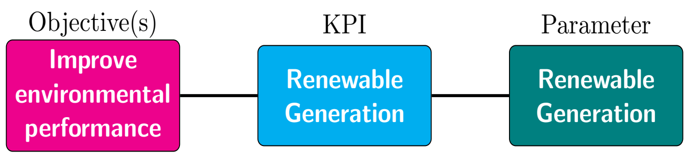
Description	This KPI measures the maximum available connection capacity for DG as a fraction of total line capacity. This indicator is not currently measured by GSU, and will not be monetized by the Program.
Parameter(s)	Maximum DG Power / Line Capacity
Objective(s)	Ensure operational excellence in the distribution system
Formula	$\frac{Maximum\_DG\_Connection\_Capacity}{Total\_Line\_Capacity}$
Baseline & Target	*Current Value* 19 % *Forecast Value* 19 % *Target Value* 40 %
Impact Chain	Objective(s) KPI Parameter 
Impact Overview	

A.1.29. KPI-29: GSU Renewable Generation - Energy

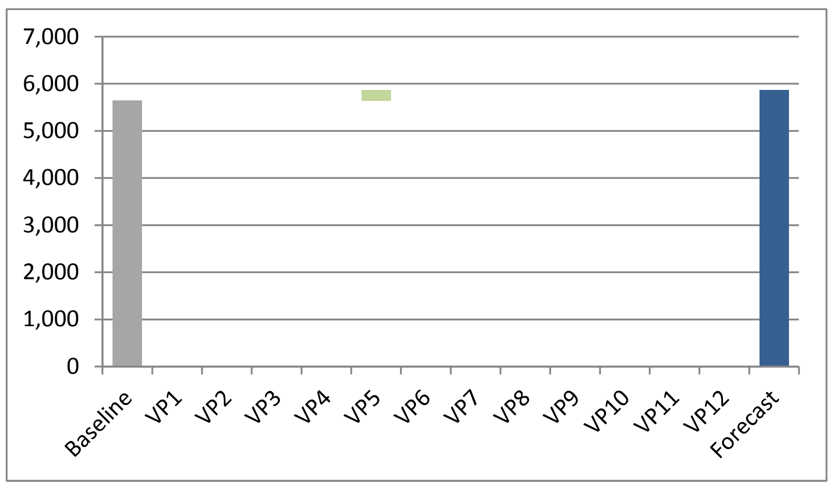
Description	This KPI measures the total generation from renewable sources owned by GSU. This indicator is not currently measured by GSU, and will not be monetized by the Program.
Parameter(s)	GSU Renewable Generation - Energy
Objective(s)	Improve environmental performance
Formula	Measured Directly

Baseline & Target	*Current Value*	*Forecast Value*	*Target Value*
	5,643 GWh / Year	5,869 GWh / Year	56,430 GWh / Year

Impact Chain



Impact Overview



Appendix B.

Performance Parameters

The project team has identified and quantified several performance parameters. These parameters enable the control of the progress of the grid modernization program based on the KPIs described in A.1.

Please note that parameters that were considered irrelevant by the joint Siemens/GSU team, or are not measured currently, have not been quantified for their baselines and/or targets.

B.1. Smart Network Operations

Parameter		Current	Unit	Forecast	Target
Congestion	Operating margin (selected segments)	40%		40%	20%
	Event Duration	N/A	Minutes	N/A	N/A
	Event Count	N/A	Events/Year	N/A	N/A
Momentary Interruptions	Momentary Interruptions	82,500	Interruptions /Year	↓	N/A
Planned Outages	Planned Outage Frequency	153	Outages /Year	147	N/A
	Planned Outage Duration	199	Minutes /Incident	169	N/A
	Planned Outage Impact	37	Customers /Outage	33	N/A
Unplanned Outages	Unplanned Outage Frequency	233	Outages /Year	200	N/A
	Unplanned Outage Duration	44	Minutes /Incident	12	N/A
	Unplanned Outage Impact	335	Customers /Outage	184	N/A
Service Interruption	Customers Experiencing Multiple Interruptions (CEMI4)	3	Customers /Year	2.7	0
Accidents	Fatalities	0	Number/Year	0	0
	Major Injuries	0	Number/Year	0	0
	Minor Injuries	4	Number/Year	0	0
	Near Misses (Non-Injury)	13	Number/Year	0	0
	Lost Man Days: No Work	0	Days/Year	0	0
	Lost Man Days: Restricted Work	5	Days/Year	4	0
Safety Survey	Workplace Safety Audits	54%	Compliance	↑	100%

Parameter		Current	Unit	Forecast	Target
Physical Security Breaches	Major Incident	4	Incidents /Year	↓	0
	Minor Incident	0	Incidents /Year	0	0
Energy Delivery	Technical Losses	3.00%		2.25%	3.00%
	Power Factor	90%		96%	96%

Table B.1.: Parameters for Smart Network Operations

B.1.1. Congestion: Operating Margin (selected segments)

Description	Operating margin of selected grid segments.		
Business Objective	Improve Power Quality		
Baseline, Forecast & Target	*Current Value* 40% Ratio	*Forecast Value* 40% Ratio	*Target Value* 20% Ratio

B.1.2. Congestion: Event Duration

Description	Length of time it takes to resolve a congestion event.		
Business Objective	Improve Power Quality		
Baseline, Forecast & Target	*Current Value* Not meas.	*Forecast Value* Not meas.	*Target Value* Not meas.

B.1.3. Number of Momentary Interruptions

Description	Number of momentary interruptions. Momentary interruptions are brief time periods where the electric service is disrupted. These interruptions are caused by temporary faults in the distribution system, commonly caused when a recloser detects an object interfering with a line.		
Business Objective	Improve Power Quality		
Baseline, Forecast & Target	*Current Value* 82,500 Customer-Interruptions / Year	*Forecast Value* ↑ Customer-Interruptions / Year	*Target Value* N/A Customer-Interruptions / Year

B.1.4. Planned Outages: Planned Outage Frequency

Description	The number of times per year that customers experience an outage as a result of planned activities. Outages are scheduled frequently to carry out system upgrades or repairs to improve service.
Business Objective	Improve Service Reliability
Baseline, Forecast & Target	*Current Value* 153 Outages / Year; *Forecast Value* 147 Outages / Year; *Target Value* N/A Outages / Year

B.1.5. Planned Outages: Planned Outage Duration

Description	The average duration of a planned outage per year that customers experience as a result of planned activities. Outages are scheduled frequently to carry out system upgrades or repairs to improve service.
Business Objective	Improve Service Reliability
Baseline, Forecast & Target	*Current Value* 199 Minutes / Incident; *Forecast Value* 169 Minutes / Incident; *Target Value* N/A Minutes / Incident

B.1.6. Planned Outages: Planned Outage Impact

Description	The average number of impacted customers per outage (cumulative impact of activities in distribution as well as transmission network).
Business Objective	Improve Service Reliability
Baseline, Forecast & Target	*Current Value* 37 Customers / Incident; *Forecast Value* 33 Customers / Incident; *Target Value* N/A Customers / Incident

B.1.7. Unplanned Outages: Unplanned Outage Frequency

Description	This figure reflects the number of times per year that at least one customer experienced outages or service disruption as a result of unplanned events/outages.		
Business Objective	Improve Service Reliability		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	233 Times / Year	200 Times / Year	N/A Times / Year

B.1.8. Unplanned Outages: Unplanned Outage Duration

Description	This figure reflects the average duration per outage caused by unscheduled activities.		
Business Objective	Improve Service Reliability		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	44 Minutes / Incident	12 Minutes / Incident	N/A Minutes / Incident

B.1.9. Unplanned Outages: Unplanned Outage Impact

Description	The average number of customers affected by an outage.		
Business Objective	Improve Service Reliability		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	335 Customers / Incident	184 Customers / Incident	N/A Customers / Incident

B.1.10. Outages: CEMI4 (Customers Experiencing Multiple Interruptions - 4+ / year)

Description	The CEMI parameter measures the percentage of total customers experiencing multiple interruptions, with CEMI4 indicating the number of customers experiencing 4 or more outages per year.		
Business Objective	Improve Service Reliability		
Baseline, Forecast & Target	*Current Value* 3 Customers / Year	*Forecast Value* 2.7 Customers / Year	*Target Value* 0 Customers / Year

B.1.11. Accidents: Fatalities

Description	Number of fatalities per year caused by accidents.		
Business Objective	Improve Safety and Security		
Baseline, Forecast & Target	*Current Value* 0 Number / Year	*Forecast Value* 0 Number / Year	*Target Value* 0 Number / Year

B.1.12. Accidents: Major Injuries

Description	Number of Accidents resulting in major injuries.		
Business Objective	Improve Safety and Security		
Baseline, Forecast & Target	*Current Value* 0 Number / Year	*Forecast Value* 0 Number / Year	*Target Value* 0 Number / Year

B.1.13. Accidents: Minor Injuries

Description	Number of Accidents resulting in minor injuries.		
Business Objective	Improve Safety and Security		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	4 Number / Year	0 Number / Year	0 Number / Year

B.1.14. Accidents: Non-Injury (Near-Misses)

Description	Number of near-misses.		
Business Objective	Improve Safety and Security		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	13 Number / Year	0 Number / Year	0 Number / Year

B.1.15. Accidents: Lost Man Days - No Work

Description	Total loss of mandays per year when no work could be carried out as a result of accidents.		
Business Objective	Improve Safety and Security		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0 Days / Year	0 Days / Year	0 Days / Year

B.1.16. Accidents: Lost Man Days - Restricted Work

Description	Number of man days where restricted work (light duties) was performed as a result of an accident.		
Business Objective	Improve Safety and Security		
Baseline, Forecast & Target	*Current Value* 5 Days / Year	*Forecast Value* 4 Days / Year	*Target Value* 0 Days / Year

B.1.17. Safety Survey: Workplace Safety Audits

Description	Compliance score in workplace safety audits.		
Business Objective	Improve Safety and Security		
Baseline, Forecast & Target	*Current Value* 54% Ratio	*Forecast Value* ↑ Ratio	*Target Value* 100% Ratio

B.1.18. Physical Security Breaches: Major Incident

Description	Major security breach of a protected facility such as a substation or control center etc.		
Business Objective	Improve Safety and Security		
Baseline, Forecast & Target	*Current Value* 4 Incidents / Year	*Forecast Value* ↓ Incidents / Year	*Target Value* 0 ncidents / Year

B.1.19. Physical Security Breaches: Minor Incident

Description	Minor security breach of a protected facility (vandalism, attempted break-in, etc.).
Business Objective	Improve Safety and Security
Baseline, Forecast & Target	*Current Value* 0 Incidents / Year; *Forecast Value* 0 Incidents / Year; *Target Value* 0 Incidents / Year

B.1.20. Energy Delivery: Technical Losses

Description	Energy losses commonly resulting from inefficiencies across feeders, power lines and transformers that result in the conversion of electricity to waste heat and electromagnetic energy.
Business Objective	Improve Energy Delivery efficiency
Baseline, Forecast & Target	*Current Value* 3.00 % / Year; *Forecast Value* 2.25 % / Year; *Target Value* 3.00 % / Year

B.1.21. Power Factor

Description	A measure of the power factor at a critical point in the network. The point where it should be monitored is chosen by the utility.
Business Objective	Improve Energy Delivery efficiency
Baseline, Forecast & Target	*Current Value* 90% Ratio; *Forecast Value* 96% Ratio; *Target Value* 96% Ratio

B.2. Smart Customer Service

Parameter		Current	Unit	Forecast	Target
Cost	Number of Bills	552,000		540,960	N/A
	Cost per read	$ 0.79		$ 0.79	$ 0.79
	Cost per bill	$ 3.17		$ 3.17	$ 3.17
	Coverage from eBilling	0%		16%	40%
Risk	Time to Payment	21.0	Days / Bill	20.6	20
Shift Demand	Peak Power Demand	184	MW / Year	149	145
	Load Factor	66%		92%	95%
Interaction: Push Mechanism	Coverage	12	Information Types / Year	N/A	N/A
	Channels of Communication	5		6	6
Interaction: Time to Asnwer Request	Time Per Call	10	Minutes / Incident	9.5	5
Interaction: Time to Resolve	Time to Resolve	1.5	Hours / Incident	1	1
Interaction: Amount	Number of Complaints	292	Calls / Year	167	100
Interaction: Cost	Total Interaction Cost	$ 450,000		$240,000	$ 350,000
Metering Failures / Theft	Non-technical Losses (Energy)	2.4%		1.7%	N/A
	Number of Detections	5		N/A	N/A

Table B.2.: Parameters for Smart Customer Service

B.2.1. Cost: Number of Bills

Description	The total number of bills issued to customers in a year.		
Business Objective	Improve meter-to-bill efficiency and effectiveness		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	552,000 Number / Year	540,960 Number / Year	N/A Number /Year

B.2.2. Cost: Cost Per Read

Description	Average cost incurred in a single meter reading.		
Business Objective	Improve meter-to-bill efficiency and effectiveness		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0.79 $	0.79 $	0.79 $

B.2.3. Cost: Cost Per Bill

Description	Average cost of presenting a bill.		
Business Objective	Improve meter-to-bill efficiency and effectiveness		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	3.17 $	3.17 $	3.17 $

B.2.4. Cost: % Coverage from eBilling

Description	Percentage of customers receiving electronic bills.		
Business Objective	Improve meter-to-bill efficiency and effectiveness		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0 %	16 %	40 %

B.2.5. Risk: Time to payment

Description	The average time for the payment of a single invoice. The timeframe starts with bill creation and ends with payment by the customer.
Business Objective	Improve meter-to-bill efficiency and effectiveness
Baseline, Forecast & Target	*Current Value* 21.0 Days; *Forecast Value* 20.6 Days; *Target Value* 20 Days

B.2.6. Shift Demand: Peak Power Demand

Description	This parameter indicates the peak domestic power demand.
Business Objective	Manage customer demand for the benefit of the grid
Baseline, Forecast & Target	*Current Value* 184 MW; *Forecast Value* 149 MW; *Target Value* 145 MW

B.2.7. Shift Demand: Load Factor

Description	The average power divided by the peak power over a period of time. A high load factor indicates that power consumption is relatively stable without large peaks. Low load factor indicates that demand for power occasionally peaks and must be met by installed capacity that mostly remains on standby.
Business Objective	Manage customer demand for the benefit of the grid
Baseline, Forecast & Target	*Current Value* 66 %; *Forecast Value* 92 %; *Target Value* 95 %

B.2.8. Interaction: Push Mechanism - Coverage

Description	Number of information types communicated through push mechanisms.		
Business Objective	Improve customer satisfaction and engagement		
Baseline, Forecast & Target	*Current Value* 12 Number	*Forecast Value* N/A Number	*Target Value* N/A Number

B.2.9. Interaction: Push Mechanism - Channels of Communication

Description	Number of channels used to communicate push information.		
Business Objective	Improve customer satisfaction and engagement		
Baseline, Forecast & Target	*Current Value* 5 Number	*Forecast Value* 6 Number	*Target Value* 6 Number

B.2.10. Interaction: Average time to answer request - Time per call

Description	Average time spent on responding to a telephone customer request.		
Business Objective	Improve customer satisfaction and engagement		
Baseline, Forecast & Target	*Current Value* 10 Minutes / incident	*Forecast Value* 9.5 Minutes / Incident	*Target Value* 5 Minutes / Incident

B.2.11. Interaction: Average time to resolve complaint - Time to resolve

Description	Average time spent to resolve a customer complaint.		
Business Objective	Improve customer satisfaction and engagement		
Baseline, Forecast & Target	*Current Value* 1.5 Hours / Incident	*Forecast Value* 1 Hours / Incident	*Target Value* 1 Hours / Incident

B.2.12. Interaction: Amount - Number of complaints

Description	Number of customer requests received by telephone. This excludes customers who register complaints or notify of a problem.		
Business Objective	Improve customer satisfaction and engagement		
Baseline, Forecast & Target	*Current Value* 292 Number	*Forecast Value* 167 Number	*Target Value* 100 Number

B.2.13. Interaction: Cost - Total interaction cost

Description	The total cost of a interactions with customers by telephone.		
Business Objective	Improve customer satisfaction and engagement		
Baseline, Forecast & Target	*Current Value* 450,000 $ / Year	*Forecast Value* 240,000 $ / Year	*Target Value* 350,000 $ / Year

B.2.14. Metering Theft: Non-Technical Losses (Energy)

Description	Estimated percentage losses caused by theft and unauthorized tapping of power lines.		
Business Objective	Reduce non-technical losses		
Baseline, Forecast & Target	*Current Value* 2.4 %	*Forecast Value* 1.7 %	*Target Value* N/A %

B.2.15. Metering Theft: Number of Detections

Description	Number of unauthorized connections detected in a year.		
Business Objective	Reduce non-technical losses		
Baseline, Forecast & Target	*Current Value* 5 Number	*Forecast Value* N/A Number	*Target Value* N/A Number

B.3. Smart Asset and Work Management

Parameter		Current	Unit	Forecast	Target
CAPEX	CH.5.C.a) System Access	$ 450,000		N/A	N/A
	Ch.5.C.b) System Renewal	$ 5,699,222		N/A	N/A
	CH.5.C.c) System Service - Renewables	$ 110,000		N/A	N/A
	Ch.5.C.c) System Service - Non-Renewables	$ 414,278		N/A	N/A
	CH.5.C.d) General Plant	$ 1,351,000		N/A	N/A
OPEX	Preventive Maintenance Costs	30%	of Total	83%	70%
	Corrective Maintenance Costs	70%	of Total	17%	30%
	Total Maintenance Costs	$2,150,000	/Year	$1,494,250	$1,650,000
	Book Value / Replacement Costs	N/A		N/A	N/A
Balancing Physical Risk	Std. Dev. of SAIDI Across Grid Segments	40%		24%	20%
Time	Work ("Wrench Time")	60%		65%	75%

Parameter		Current	Unit	Forecast	Target
	Prep and Travel (”Windshield Time”)	40%		35%	25%
Cost	Equipment	$ 172,000	/Year	$ 168,560	$ 200,000
	Vehicle	$ 1,100,000	/Year	1,078,000	$ 1,000,000
Quality	# Of Assets In Register	102,873		↑	N/A
	Asset Classes in Register	20	Classes	↑	N/A
	Condition Assessment Completeness Indicator	83%		89%	90%
	Frequency Of Updates	200	Updates/Year	↑	↑
Scope	Commercial	0%		N/A	N/A
	Properties	0%		100%	100%
	Coordinates	0%		N/A	N/A
	Condition / Health	0%		100%	100%
	Usage	0%		100%	100%
Availability	SLA	99%		100%	100%
	Access Centrally	75%		75%	100%
	Access In The Field	50%		55%	N/A

Table B.3.: Parameters for Smart Asset and Work Management

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B.3.1. CAPEX: Ch.5.C.a) System Access

Description	Investments to the dsitribution system required to provide customers with access to electricity.		
Business Objective	Optimize CAPEX vs OPEX spend on grid		
Baseline, Forecast & Target	*Current Value* 450,995 $ / Year	*Forecast Value* N/A $ / Year	*Target Value* N/A $ / Year

B.3.2. CAPEX: Ch.5.C.b) System Renewal

Description	Investments to replace or refurbish system assets to extend service life and maintain the ability to operate the distribution system.		
Business Objective	Optimize CAPEX vs OPEX spend on grid		
Baseline, Forecast & Target	*Current Value* 5,699,222 $ / Year	*Forecast Value* N/A $ / Year	*Target Value* N/A $ / Year

B.3.3. CAPEX: Ch.5.C.c) System Service - Renewables

Description	Investments in the distribution system made to accommodate and connect renewable energy generation sources.		
Business Objective	Optimize CAPEX vs OPEX spend on grid		
Baseline, Forecast & Target	*Current Value* 110,000 $ / Year	*Forecast Value* N/A $ / Year	*Target Value* N/A $ / Year

B.3.4. CAPEX: Ch.5.C.c) System Service - Non-Renewables

Description	Investments in the distribution system made to ensure the sytem continues to meet operational objectives while addressing anticipated futrue coustomer service requirements.		
Business Objective	Optimize CAPEX vs OPEX spend on grid		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	414,278	N/A	N/A
	$ / Year	$ / Year	$ / Year

B.3.5. CAPEX: Ch.5.C.d) General Plant

Description	Investment in assets that are not part of the distribution system; includes land and buildings; tools and equipment; rollings tock and electronic devices and software used tos upport dayt oday business and operations activities.		
Business Objective	Optimize CAPEX vs OPEX spend on grid		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	1,351,000	N/A	N/A
	$ / Year	$ / Year	$ / Year

B.3.6. OPEX: Preventive Maintenance Costs

Description	Portion of total maintenance costs used for preventative maintenance. Power system reliability depends on preventive maintenance programs including types and frequency of selected maintenance activities which are routine, scheduled activities intended to keep a system running at its best. It is designed to prevent breakdowns and is performed whether or not there are any problems with an asset.		
Business Objective	Optimize CAPEX vs OPEX spend on grid		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	30%	83%	70%
	Ratio	Ratio	Ratio

B.3.7. OPEX: Corrective Maintenance Costs

Description	Portion of total maintenance costs used for corrective maintenance. Corrective maintenance refers to action only taken when a system or asset failure has occurred. The task of the maintenance team in this scenario is usually to effect repairs as soon as possible. Costs associated with corrective maintenance include repair costs (replacement components, labour and consumables), lost production and lost sales for distribution assets.		
Business Objective	Optimize CAPEX vs OPEX spend on grid		
Baseline, Forecast & Target	*Current Value* 30% Ratio	*Forecast Value* 17% Ratio	*Target Value* 70% Ratio

B.3.8. OPEX: Book Value / Replacement Costs

Description	This parameter is the ratio of the total value of all assets in the company's books compared to the cost required to replace all assets.		
Business Objective	Optimize CAPEX vs OPEX spend on grid		
Baseline, Forecast & Target	*Current Value* N/A Ratio	*Forecast Value* N/A Ratio	*Target Value* N/A Ratio

B.3.9. Balancing Reliability Risk: Std. Dev. of SAIDI Across Grid Segments

Description	Variability of SAIDI across grid segments. Lower variance means risks are equally distributed within the grid. Higher variance means there might be some grid segments/assets that are highly prone to failure.		
Business Objective	Optimize risk distribution across grid		
Baseline, Forecast & Target	*Current Value* 40% Ratio	*Forecast Value* 24% Ratio	*Target Value* 20% Ratio

B.3.10. Time: Work ("Wrench Time")

Description	The proportion of time spent on the execution of actual work (excluding preparation and travel time) is considered productive time and is measured as a percentage of total work time.		
Business Objective	Improve work process efficiency		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	60% Ratio	65% Ratio	75% Ratio

B.3.11. Time: Prep and Travel ("Windshield Time")

Description	The proportion of time spent on preparation, gathering relevant tools and traveling to the specific location is counted as Prep/travel time and is measured as a percentage of total work time.		
Business Objective	Improve work process efficiency		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	40% Ratio	35% Ratio	25% Ratio

B.3.12. Cost: Equipment

Description	Annual budget expenditure on equipment acquisition, maintenance and repair.		
Business Objective	Improve work process efficiency		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	172,000 $ / Year	168,560 $ / Year	200,000 $ / Year

B.3.13. Cost: Vehicles

Description	Annual budget expenditure on vehicle acquisition and maintenance/repair of the fleet.		
Business Objective	Improve work process efficiency		
Baseline, Forecast & Target	*Current Value* 1,100,000 $ / Year	*Forecast Value* 1,078,000 $ / Year	*Target Value* 1,000,000 $ / Year

B.3.14. Quality: Number of Assets in Register

Description	Number of assets that are maintained in the asset register.		
Business Objective	Improve availability and quality of asset information		
Baseline, Forecast & Target	*Current Value* 102,873 Number	*Forecast Value* ↑ Number	*Target Value* N/A Number

B.3.15. Quality: Asset Classes in Register

Description	Total number of discrete asset classes maintained in the asset register.		
Business Objective	Improve availability and quality of asset information		
Baseline, Forecast & Target	*Current Value* 20 Number	*Forecast Value* ↑ Number	*Target Value* N/A Number

B.3.16. Quality: Condition Assessment Completeness Indicator

Description	Degree of completeness of condition assessment information for assets.		
Business Objective	Improve availability and quality of asset information		
Baseline, Forecast & Target	*Current Value* 83% Ratio	*Forecast Value* 89% Ratio	*Target Value* 90% Ratio

B.3.17. Quality: Frequency of Updates

Description	The frequency with which the asset register is updated.		
Business Objective	Improve availability and quality of asset information		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	200	↑	↑
	Number	Number	Number

B.3.18. Scope: Commercials - Commercials

Description	Percentage of commercial assets that have financial and commercial information about them maintained in the asset register.		
Business Objective	Improve availability and quality of asset information		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0%	N/A	N/A
	Ratio	Ratio	Ratio

B.3.19. Scope: Properties

Description	Percentage of real estate owned by the utility that have accompanying information maintained in the asset register.		
Business Objective	Improve availability and quality of asset information		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0%	100%	100%
	Ratio	Ratio	Ratio

B.3.20. Scope: Coordinates

Description	Percentage of real estate owned by the utility that have accompanying geospatial information such as GPS coordinates maintained in the asset register.		
Business Objective	Improve availability and quality of asset information		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0%	N/A	N/A
	Ratio	Ratio	Ratio

B.3.21. Scope: Condition/Health

Description	Percentage of assets that also have accompanying health and condition assessment information in the asset register.		
Business Objective	Improve availability and quality of asset information		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0%	100%	100%
	Ratio	Ratio	Ratio

B.3.22. Scope: Usage

Description	Percentage of assets that also have usage information in the asset register.		
Business Objective	Improve availability and quality of asset information		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0%	100%	100%
	Ratio	Ratio	Ratio

B.3.23. Availability: SLA

Description	Percentage of assets that have Service Level Agreements.		
Business Objective	Improve availability and quality of asset information		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	99%	100%	100%
	Ratio	Ratio	Ratio

B.3.24. Availability: Access Centrally

Description	Percentage of assets whose complete information is available from a single source (e.g. central database).		
Business Objective	Improve availability and quality of asset information		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	75%	75%	100%
	Ratio	Ratio	Ratio

B.3.25. Availability: Access in the Field

Description	Percentage coverage of asset information that is accessible to field crews.		
Business Objective	Improve availability and quality of asset information		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	50%	55%	N/A
	Ratio	Ratio	Ratio

B.4. Smart Energy

	Parameter	Current	Unit	Forecast	Target
Energy	GSU Renewable Generation - Energy	5,643	MWh/Year	26,184	56,430
	GSU Renewable Generation - Power	1.6	MW	73	180
	Energy Savings from Efficiency and Conservation	6,900	MWh/Year	39,174	34,740
Capacity Optimization	% Of Curtailed Infeed	0%		0%	0%
	Maximum DG Power / Line Capacity	19%		22%	40%
	eVehicles Share	0.003%		2%	15%
	Maximum eVehicle Charger Power / Line Capacity	18%		22%	40%
Microgrid	% Customers on Island-Capable Microgrids	0%		28%	70%
	Energy Imported / Total Consumption	100%		64%	40%
	Energy Exported / Total Consumption	0%		0%	0%
	Number of Microgrids in Operation	1		↑	4
Distributed Generation	Number of DG Sites in Operation	54		↑	200
Storage	Total Installed Capacity of Energy Storage	0.5	MW	↑	3

Table B.4.: Parameters for Smart Energy

B.4.1. Energy: GSU Renewable Generation - Energy

Description	Total generation from renewable sources owned by GSU.		
Business Objective	Enable achievement of emission reduction targets		
Baseline, Forecast & Target	*Current Value*	*Forecast Value*	*Target Value*
	5,643 MWh / Year	26,184 MWh / Year	56,430 MWh / Year

B.4.2. Energy: GSU Renewable Generation - Power

Description	Maximum generation capacity from renewable sources owned by GSU.		
Business Objective	Enable achievement of emission reduction targets		
Baseline, Forecast & Target	*Current Value*	*Forecast Value*	*Target Value*
	1.6 MW	73 MW	180 MW

B.4.3. Energy: Energy Savings from Efficiency and Conservation

Description	Energy savings per year as a result of energy efficiency and conservation measures.		
Business Objective	Enable achievement of emission reduction targets		
Baseline, Forecast & Target	*Current Value*	*Forecast Value*	*Target Value*
	6,900 MWh / Year	39,174 MWh / Year	34,740 MWh / Year

B.4.4. Capacity Optimization - Percentage Of Curtailed Infeed

Description	A measure of renewable energy that is curtailed at times of grid stress or surplus.		
Business Objective	Enable achievement of DG targets		
Baseline, Forecast & Target	*Current Value*	*Forecast Value*	*Target Value*
	0% Ratio / Year	0% Ratio / Year	0% Ratio / Year

B.4.5. Capacity Optimization - Maximum DG Power / Line Capacity

Description	Measures the grid's capability to handle DG interconnections on critical grid segments.		
Business Objective	Enable achievement of DG targets		
Baseline, Forecast & Target	*Current Value* 19% Ratio	*Forecast Value* 22% Ratio	*Target Value* 40% Ratio

B.4.6. Capacity Optimization - eVehicles Share

Description	The maximum percentage of electric cars over all cars that the grid access policies and existing charging post infrastructure can support.		
Business Objective	Enable electrification of transportation		
Baseline, Forecast & Target	*Current Value* 0.003% Ratio	*Forecast Value* 2% Ratio	*Target Value* 15% Ratio

B.4.7. Capacity Optimization - eVehicle Charger Power / Line Capacity

Description	Quantifies the estimated percentage of electric vehicle loads the grid can support on relevant grid segments.		
Business Objective	Enable electrification of transportation		
Baseline, Forecast & Target	*Current Value* 18% Ratio	*Forecast Value* 22% Ratio	*Target Value* 40% Ratio

B.4.8. Microgrid - % Customers on Island-Capable Microgrids

Description	The percentage of customers connected to microgrids capable of operating in island mode during an outage on the distribution system.		
Business Objective	SUpport customers' desire for localised energy surety		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0%	28%	70%
	Ratio	Ratio	Ratio

B.4.9. Microgrid - Energy Imporated / Total Consumption

Description	The ratio of energy imported from outside of GSU's distribution system to the total consumption of energy in the distribution system.		
Business Objective	Support customers' desire for localised energy surety		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	100%	64%	40%
	Ratio	Ratio	Ratio

B.4.10. Microgrid - Energy Exported / Total Generation

Description	The ratio of energy exported for use outside of GSU's distribution system to the total amount of energy generated by sources within GSU's distribution system.		
Business Objective	SUpport customers' desire for localised energy surety		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0%	0%	0%
	Ratio	Ratio	Ratio

B.4.11. Microgrid - Number of Microgrids in Operation

Description	The total number of microgrids operating within GSU's distribution system.		
Business Objective	SUpport customers' desire for localised energy surety		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	1	↑	4

B.4.12. Distributed Generation - Number of DG Sites in Operation

Description	The total number of DG sites operating within GSU's distribution system.		
Business Objective	Enable Acheivement of DG targets		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	54	↑	200

B.4.13. Storage - Total Installed Capacity of Energy Storage

Description	The total installed capacity of grid-connected energy storage operating within GSU's distribution system.		
Business Objective	Enable Acheivement of DG targets		
	Current Value	*Forecast Value*	*Target Value*
Baseline, Forecast & Target	0.5 MW	↑ MW	3 MW

B.5. Smart Organization

Parameter		Current	Unit	Forecast	Target
Regulatory Reporting	Coverage of Regulatory KPIs in KPI System	0%		80%	100%
	Effort for Regulatory Report	3	FTE	1.5	2
Decision Making	% documented decisions	60%		↑	80%
Forecasting	Effort to prepare	2	FTE	↓	1.8
Change	Time to Change	180	Days / Change	90	90
	Av. size of Projects	1200	Person-Hours / Projet	800	700
	# Changes	10	Changes / Year	34	15
Enterprise Architecture Management	# of Application Architecture Elements	128		↓	↓
	Av. # of Architecture Elements per Function	1.75		↓	1
	# Point 2 Point Interfaces	23		↓	↓

Parameter		Current	Unit	Forecast	Target
Cyber Security	# of Test Cases	0	Cases / Year	↑	1
	# Incidents	2	Incidents / Year	↓	0
Relationship Building	Customer Satisaction Survey	95%		97%	100%
	Transaction Evaluation	73%		↑	100%
	Service Reliability	90%		92%	100%
	Corporate Citizenship	54%		↑	100%
	Company Reputation	75%		90%	100%
	Public Safety Survey	63%		↑	100%

Table B.5.: Parameters for Smart Organization

B.5.1. Regulatory Reporting: Coverage of Regulatory KPIs in KPI system

Description	Number of distribution regulatory KPIs covered in the KPI system.		
Business Objective	Complexity reduction		
Baseline, Forecast & Target	*Current Value* 0% Ratio	*Forecast Value* 80% Ratio	*Target Value* 100% Ratio

B.5.2. Regulatory Reporting: Effort for Regulatory Reporting

Description	Labour effort (in equivalent full-time employees) generating all regulatory reports.		
Business Objective	Complexity reduction		
Baseline, Forecast & Target	*Current Value* 3 FTE	*Forecast Value* 1.5 FTE	*Target Value* 2 FTE

B.5.3. Decision Making: Percentage of Documented Decisions

Description	Percentage of Board decisions that are documented internally for future monitoring.		
Business Objective	Complexity reduction		
Baseline, Forecast & Target	*Current Value* 60% Ratio	*Forecast Value* ↑ Ratio	*Target Value* 80% Ratio

B.5.4. Forecasting: Cost to prepare

Description	Average effort (in equivalent full-time employees) spent on forecasting activities.		
Business Objective	Complexity reduction		
Baseline, Forecast & Target	*Current Value* 2 FTE	*Forecast Value* ↓ FTE	*Target Value* 1.8 FTE

B.5.5. Change: Time to Change

Description	The average time to implement a procedural or organizational change such as a change in a business process or the method of how to do something (workflow) on a department or organization-wide level.		
Business Objective	Flexibility to adapt to changes of business environment		
Baseline, Forecast & Target	*Current Value* 180 Days / Change	*Forecast Value* 90 Days / Change	*Target Value* 90 Days / Change

B.5.6. Change: Average size of Projects

Description	Average amount of employee time spent on change projects.		
Business Objective	Flexibility to adapt to changes of business environment		
Baseline, Forecast & Target	*Current Value* 1200 Person-Hours / Project	*Forecast Value* 800 Person-Hours / Project	*Target Value* 700 Person-Hours / Project

B.5.7. Change: Number of Changes

Description	Number of business decisions regarding change reached by management.		
Business Objective	Flexibility to adapt to changes of business environment		
Baseline, Forecast & Target	*Current Value* 10 Changes / Year	*Forecast Value* 34 Changes / Year	*Target Value* 15 Changes / Year

B.5.8. Enterprise Architecture Management: Number of Application Architecture Elements

Description	Number of elements in the business process architecture.		
Business Objective	Improve information security		
Baseline, Forecast & Target	*Current Value* 128 Number	*Forecast Value* ↓ Number	*Target Value* ↓ Number

B.5.9. Enterprise Architecture Management: Average Number of Architecture Elements per Function

Description	Average number of architecture elements defining each function.		
Business Objective	Improve information security		
Baseline, Forecast & Target	*Current Value* 1.75 Number / Function	*Forecast Value* ↓ Number / Function	*Target Value* 1 Number / Function

B.5.10. Enterprise Architecture Management: Number of Point-to-Point Interfaces

Description	The number of point-to-point interfaces measures the degree of data integration.		
Business Objective	Improve information security		
Baseline, Forecast & Target	*Current Value* 23 Number	*Forecast Value* ↓ Number	*Target Value* ↓ Number

B.5.11. Cyber Security: Number of Test Cases

Description	Number of test cases that simulate attacks on cyber security while covering the complexity and scale of the utility's OT and IT infrastructure.		
Business Objective	Improve information security		
Baseline, Forecast & Target	*Current Value* 0 Number / Year	*Forecast Value* ↑ Number / Year	*Target Value* 1 Number / Year

B.5.12. Cyber Security: Number of Incidents

Description	Number of cyber attack incidents.		
Business Objective	Improve information security		
Baseline, Forecast & Target	*Current Value* 2 Number / Year	*Forecast Value* ↓ Number / Year	*Target Value* 0 Number / Year

B.5.13. Relationship Building: Customer Satisfaction Survey

Description	Annual customer satisfaction survey score.		
Business Objective	Optimize stakeholder relationship		
Baseline, Forecast & Target	*Current Value* 95% Ratio	*Forecast Value* 97% Ratio	*Target Value* 100% Ratio

B.5.14. Relationship Building: Transaction Evaluation

Description	Results of customer survey, preception of providing customers with "reliable and good service".		
Business Objective	Optimize stakeholder relationship		
Baseline, Forecast & Target	*Current Value* 73% Ratio	*Forecast Value* ↑ Ratio	*Target Value* 100% Ratio

B.5.15. Relationship Building: Service Reliability

Description	The Service Reliability parameter measures through customer surveys whether the customers are satisfied with the reliability of power services in general.		
Business Objective	Optimize stakeholder relationship		
Baseline, Forecast & Target	*Current Value* 90% Ratio	*Forecast Value* 92% Ratio	*Target Value* 100% Ratio

B.5.16. Relationship Building: Corporate Citizenship

Description	The Corporate Citizenship parameter assesses the perceived social responsibility and safety of the utility.		
Business Objective	Optimize stakeholder relationship		
Baseline, Forecast & Target	*Current Value* 54% Ratio	*Forecast Value* ↑ Ratio	*Target Value* 100% Ratio

B.5.17. Relationship Building: Company Reputation

Description	The Company Reputation parameter tracks the customer view of the company management, transparency and openness.		
Business Objective	Optimize stakeholder relationship		
Baseline, Forecast & Target	*Current Value* 75% Ratio	*Forecast Value* 90% Ratio	*Target Value* 100% Ratio

B.5.18. Relationship Building: Public Safety Survey

Description	Results of annual customer survey on the perception of GSU's committment to public safety.		
Business Objective	Optimize stakeholder relationship		
Baseline, Forecast & Target	*Current Value* 63% Ratio	*Forecast Value* ↑ Ratio	*Target Value* 100% Ratio

B.6. Smart Product and Portfolio Management

Parameter		Current	Unit	Forecast	Target
Increasing Gross Margin	Value Added Services Revenue	\$10,000,000	/ Year	\$60,310,400	\$60,000,000
	Value Added Services Cost	\$9,000,000	/ Year	\$42,000,000	\$45,000,000
	Number of Common Components	0%		↑	60%
Customer Value	Customer Service Rating - @home	94%		↑	99%
	Customer Service Rating - Agilis	85%		↑	95%
	Average Number of Components Per Offering - @home	1		↑	15
	Average Number of Customer Segments - @home	2		↑	↑
Market Share Growth	Market Share / Product-Service	15%		65%	70%
	Number of Products-Services	10		25	30
	Number of Components Resold	3		3	10
	Number of Sales Channels	2		12	10

Parameter		Current	Unit	Forecast	Target
Customer Loyalty	Number of Customers	10,400	Customers / Year	62,480	60,000
	Annual Customer Churn	5%	/ Year	0%	2%
	Average Share of Wallet Per Customer	$36.11	/ Year	$103.19	$100.00

Table B.6.: Parameters for Smart Product and Portfolio Management

B.6.1. Increasing Gross Margin: Value Added Services Revenue

Description	Annual revenues for value-added services delivered through GSU's non-regulated affiliates.		
Business Objective	Increase Gross Margin		
Baseline, Forecast & Target	*Current Value* $10,000,000 / Year	*Forecast Value* $60,310,400 / Year	*Target Value* $60,000,000 / Year

B.6.2. Increasing Gross Margin: Value Added Services Cost

Description	Annual cost to deliver value-added services delivered through GSU's non-regulated affiliates.		
Business Objective	Increase Gross Margin		
Baseline, Forecast & Target	*Current Value* $9,000,000 / Year	*Forecast Value* $42,000,000 / Year	*Target Value* $45,000,000 / Year

B.6.3. Increasing Gross Margin: Number of Common Components

Description	Proportion of components shared across multiple products/services within GSU's non-regulated affiliates' value added services portfolio.		
Business Objective	Increase Gross Margin		
Baseline, Forecast & Target	*Current Value* 0% Ratio	*Forecast Value* ↑ Ratio	*Target Value* 60% Ratio

B.6.4. Customer Value: Customer Service Rating - @home

Description	Customer service rating of @home products and services.		
Business Objective	Increase Customer Perceived Value		
Baseline, Forecast & Target	*Current Value* 94% Ratio	*Forecast Value* ↑ Ratio	*Target Value* 99% Ratio

B.6.5. Customer Value: Customer Service Rating - Agilis

Description	Customer service rating of Agilis products and services.		
Business Objective	Increase Customer Perceived Value		
Baseline, Forecast & Target	*Current Value* 85% Ratio	*Forecast Value* ↑ Ratio	*Target Value* 95% Ratio

B.6.6. Customer Value: Average Number of Components Per Offering in @Home

Description	Average number of individual product-service components offered for each @home product or serviced.		
Business Objective	Increase Customer Perceived Value		
Baseline, Forecast & Target	*Current Value* 1 Number / Product-Service	*Forecast Value* ↑ Number / Product-Service	*Target Value* 15 Number / Product-Service

B.6.7. Customer Value: Number of Customer Segments - @Home

Description	Number of individual customer segments identified for @home product or service marketing.		
Business Objective	Increase Customer Perceived Value		
Baseline, Forecast & Target	*Current Value* 2 Number	*Forecast Value* ↑ Number	*Target Value* ↑ Number

B.6.8. Market Share Growth: Market Share Per Product-Service

Description	Average market share for value-added products or services.		
Business Objective	Increase Market Share		
Baseline, Forecast & Target	*Current Value* 15% Ratio	*Forecast Value* 65% Ratio	*Target Value* 70% Ratio

B.6.9. Market Share Growth: Number of Products and Services

Description	Total number of value-added products or services offered.		
Business Objective	Increase Market Share		
Baseline, Forecast & Target	*Current Value* 10 Number	*Forecast Value* 25 Number	*Target Value* 30 Number

B.6.10. Market Share Growth: Number of Components Resold

Description			
Business Objective	Increase Market Share		
Baseline, Forecast & Target	*Current Value* 3 Number	*Forecast Value* 3 Number	*Target Value* 10 Number

B.6.11. Market Share Growth: Number of Sales Channels

Description	Total number of sales channels for value-added products or services.		
Business Objective	Increase Market Share		
Baseline, Forecast & Target	*Current Value* 2 Number	*Forecast Value* 12 Number	*Target Value* 10 Number

B.6.12. Improve Customer Retention: Number of Customers

Description	Total number of customers for value-added products or services.		
Business Objective	Improve Customer Retention		
Baseline, Forecast & Target	*Current Value* 10,400 Number / Year	*Forecast Value* 62,480 Number / Year	*Target Value* 60,000 Number / Year

B.6.13. Improve Customer Retention: Annual Customer Churn

Description	Annual proportion of total customers terminating services.		
Business Objective	Improve Customer Retention		
Baseline, Forecast & Target	*Current Value* 5% Ratio / Year	*Forecast Value* ↓ Ratio / Year	*Target Value* 2% Ratio / Year

B.6.14. Improve Customer Retention: Average Share of Wallet Per Customer

Description	Average annual spend per customer on value added products or services.		
Business Objective	Improve Customer Retention		
Baseline, Forecast & Target	*Current Value* $36.11 / Year	*Forecast Value* $103.19 / Year	*Target Value* $100.00 / Year

Appendix C.

Glossary

Abbreviation	**Explanation**
CAPEX	Capital Expenditure
C&I	Commercial and Industrial
DER	Distributed Energy Resources
DG	Distributed Generation
DNO	Distribution Network Operator
DSM	Demand Side Management
HV	High Voltage
IHD	In-Home-Display
IT	Information Technology
KPI	Key Performance Indicator
MV	Medium Voltage
OPEX	Operational Expenditure
OT	Operational Technology
RCAM	Reliability Centred Asset Management
TOU	Time-of-Use
TSO	Transmission System Operator

List of Tables

List of Figures

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4-CCMBC-12 OM&A Cost Per Customer & FTE - GSHi Employees

Question:

Reference: Exhibit 4, Tab 1, Schedule 1, Page 6, Table 2 – OM&A Cost per Customer and FTE

Question:

Please confirm that the line “Number of FTEs” only shows employees of GSHI and does not include any employees GSHPi, Agilis or of any other affiliate of GSHi.

Response:

This statement cannot be confirmed. As outlined in the evidence, the table in question summarizes data from Chapter 2, Appendix 2-L, which calculates Recoverable OM&A Cost per Customer and per FTE. The "Number of FTEs" line is not manually input but is automatically populated using data from Appendix 2-K. Appendix 2-K was prepared on an allocated FTE basis, consistent with GSHi’s interpretation of the filing guidelines, which require the inclusion of allocated FTEs.

4-CCMBC-13 Shared Services Corporate Cost Allocation

Question:

Reference: Exhibit 4, Tab 1, Schedule 1, page 3, and Exhibit 4, Tab 2, Schedule 1, Page 11

Preamble:

"*Shared Services Corporate Cost Allocation (44.5%):* This increase is largely due to additional staff in GSHPi, general wage and progression increases, and fair market rent charges recommended as part of the Cost Allocation review audit performed by KPMG."

Questions:

a) Do GSHPi and Agilis use Modified International Reporting Standards MIFRS for financial reporting?
b) Does the $$220,847 Amount Charged back to GSHi through Corporate Services include any markup or profit?
c) Please confirm that Labour & Burden only relates to GSHi employees and not to GSHPi or Agilis employees.

Response:

a) No, the financial statements for GSHPi and Agilis are prepared as notice-to-reader statements. However, at the consolidated level, Greater Sudbury Utilities (GSU) applies International Financial Reporting Standards (IFRS). As a result, GSHPi and Agilis are required to follow IFRS on a material basis to ensure the accuracy and compliance of the consolidated financial statements, which must meet the requirements of an audit opinion under IFRS.

b) No, it does not include any mark up or profit.

c) GSHi confirms that this line and description relates to employees of GSHi only.

4-CCMBC-14 Billing and Collecting Cost Per Customer

Question:

Reference: **Exhibit 4, Tab 1, Schedule 1, Page 4, Table 5 – OM&A by Program Summary**

Question:

Please provide the Billing and Collecting cost per customer for each column shown in Table 5 if it is not already in evidence. If it is in evidence, please provide reference.

Response:

GSHi has prepared the table below as requested.

	2020 Board Approved	2020 Actuals	2021 Actuals	2022 Actuals	2023 Actuals	2024 Budget	2025 Budget
Billing and Collecting OM&A	$ 997,931	$ 1,341,063	$ 1,293,294	$ 1,338,148	$ 1,564,557	$ 1,740,168	$ 1,717,354
Cutomers per Appendix 2-L	58,422	58,431	58,560	58,656	58,857	59,001	59,146
Billing and Collecting Cost/Customer	$ 17.08	$ 22.95	$ 22.08	$ 22.81	$ 26.58	$ 29.49	$ 29.04

4-CCMBC-15 USoA Accounts After Realignment

Question:

Reference: Exhibit 4, Tab 1, Schedule 1, Page 6

Preamble: "GSHi also notes that during the IRM period, it realigned Billing and Collecting and Community Relations expenses to more appropriate USoA Accounts and as such has aligned the 2020 Board Approved budget to match the current expense USoA accounts used where possible for comparative purposes".

"Typically, when an inflation rate assumption was needed, GSHi applied the 2025 Input Price Index of 3.6% published by the OEB for IRM applications."

Questions:

a) Were costs that were previously charged to Billing and Collecting charged to Community Relations after realignment to match USoA accounts? Please explain.
b) To which cost categories did GSHi apply the 2025 Input Price Index of 3.6% published by the OEB for IRM applications and to which it did not.

Response:

a) Yes, costs that were previously charged to Billing and Collecting are now charged to Community Relations. Historically, GSHi charged all expenses related to Billing, Collecting, and its Customer Service functions to Account 5315 – Customer Billing or Account 5305 – Supervision. Following the realignment to better match USoA accounts, GSHi now allocates costs more accurately:

- Costs related specifically to the Customer Billing function are charged to Account 5305 – Supervision and Account 5315 – Customer Billing.
- Costs related to Customer Service functions (e.g., call center operations) are charged to Account 5405 – Supervision and Account 5410 – Community Relations.

b) GSHi applied the 2025 Input Price Index (IPI) of 3.6% to cost categories where it was reasonable and aligned with the nature of those costs, such as materials, and services directly tied to inflationary pressures. For other cost categories, where the IPI was not deemed appropriate—due to unique cost drivers, historical trends, or specific contractual terms—GSHi used alternative methods to estimate the required adjustments.

4-CCMBC-16 Station Maintenance Outsourcing

Question:

Reference: **Exhibit 4, Tab 2, Schedule 1, page 9**

Question: Please confirm GSHi outsourced Station Maintenance activities to unaffiliated parties.

Response:

This is confirmed, GSHi has not outsourced Station Maintenance activities to affiliated parties.

4-CCMBC-17 GSHPi Unionized Employee Relevance

Question:

Reference: Exhibit 4, Tab 4, Schedule 1, Page 2

Preamble: "The majority of GSHi and GSHPi's workforces are unionized, with 85% for GSHi and 68% for GSHPi."

Question:

a) What is the relevance of the information about the percentage of unionized employees of GSHPi.?

b) Please confirm that GSHPi is not a utility regulated by the OEB and that in this proceeding it is not seeking approval for rebasing of its costs.

Response:

a) The inclusion of the percentage of unionized employees at GSHPi was intended to provide context for the discussion, offering a more comprehensive understanding of the workforce composition across both GSHi and GSHPi.

b) Confirmed.

4-CCMBC-18 Employee Wellness and Benefits GSHi and GSHPi

Question:

Reference: Exhibit 4, Tab 4, Schedule 1, Page 3

Preamble: "The employee benefit plans are designed to address the health and wellness needs of GSHi and GSHPi employees. A comprehensive benefit package exists which includes health and dental benefits, health spending accounts, life insurance, vacation and leave programs, employer portions of government deductions and the OMERS defined benefit pension plan for which the employer matches the employee's contributions."

Questions:

a) Is GSHi responsible for the health and wellness needs of GSHPi employees?

b) Is GSHi paying for employer portions of the OMERS defined benefit pension plan of GSHPi employees? Please explain.

Response:

a) As part of the shared services charged by GSHPi to GSHi, GSHi contributes to the funding of benefit costs for GSHPi employees, which are recovered on a cost basis. Therefore, to the extent that GSHi funds these benefit costs, it is partially responsible for fulfilling the monetary obligations related to the employee benefit plans.

b) GSHi pays the employer portions of the OMERS defined benefit pension plan for GSHPi employees to the extent that these costs are allocated to GSHi through shared services. These allocations are charged at cost by GSHPi to GSHi.

4-CCMBC-19 Appendix 2-K

Question:

Reference: Exhibit 4, Tab 4, Schedule 1, pages 6 and 7 and Table 1 – Adjusted 2020 Board Approved Appendix 2K

Preamble: "GSHi has prepared Appendix 2-K, included as Exhibit 4, Tab 4, Schedule 1, Attachment 1, based on the total full-time equivalents (FTEs). This includes FTEs directly employed by GSHi as well as those allocated through shared services and corporate cost allocations described in Exhibit 4, Tab 4, Schedule 2."

Questions:

a) Why has GSHi decided to include non-employees in Appendix 2k?
b) Please re-file Appendix 2K excluding FTEs allocated through shared services and corporate cost allocations.

Response:

a) Per the filing guidelines with respect to appendix 2K "Distributors that are virtual distributors (i.e., distributors that have outsourced all or the majority of functions, including employees, to affiliates) must also complete this appendix in relation to the employees of the affiliates who are doing the work of the regulated distributor[1]." GSHi has interpreted these guidelines to include all FTEs in the appendix, consistent with the approach used in its previous applications.

[1] Ontario Energy Board, Filing Requirements for Electricity Distribution Rate Applications – 2023 Edition for 2024 Rate Applications, Chapter 2, Cost of Service, dated December 15, 2022, Page 31, Section 2.4.3.1

b) Please see attachment 1 to this interrogatory for an updated version of Appendix 2K prepared by company. Please note: GSHi has corrected for a small error in the 2020 – 2023 actual FTE’s submitted in the initial application.

Attachment 1 (of 1):

4-CCMBC-19 Attachment 1: Appendix 2-K by Company

File Number:	EB-2024-0026
Exhibit:	4
Tab:	4
Schedule:	1
Page:	1
Date:	28-Jan-25

TO BE UPDATED AT THE DRAFT RATE ORDER STAGE

Appendix 2-K
Employee Costs - Combined GSHi & GSHPi

	Last Rebasing Year 2020 - OEB Approved	Last Rebasing Year (2020 Actuals)	2021 Actuals	2022 Actuals	2023 Actuals	2024 Bridge Year	2025 Test Year
Number of Employees (FTEs including Part-Time)[1]							
Management (including executive)	17.5	17.6	18.1	17.4	18.0	19.6	19.8
Non-Management (union and non-union)	85.4	78.6	79.4	79.9	77.8	77.1	87.9
Total	102.9	96.1	97.5	97.3	95.8	96.7	107.7
Total Salary and Wages including ovetime and incentive pay							
Management (including executive)	$ 2,398,316	$ 2,481,824	$ 2,550,294	$ 2,546,584	$ 2,792,157	$ 3,157,522	$ 3,181,226
Non-Management (union and non-union)	$ 7,403,141	$ 7,269,645	$ 7,270,989	$ 7,447,174	$ 7,440,082	$ 7,735,340	$ 8,820,921
Total	$ 9,801,457	$ 9,751,469	$ 9,821,283	$ 9,993,758	$ 10,232,239	$ 10,892,862	$ 12,002,146
Total Benefits (Current + Accrued)							
Management (including executive)	$ 735,220	$ 634,402	$ 736,709	$ 742,278	$ 767,437	$ 871,470	$ 894,408
Non-Management (union and non-union)	$ 2,259,846	$ 1,784,452	$ 2,325,505	$ 2,382,475	$ 2,239,559	$ 2,010,627	$ 2,365,467
Total	$ 2,995,066	$ 2,418,855	$ 3,062,214	$ 3,124,753	$ 3,006,995	$ 2,882,098	$ 3,259,875
Total Compensation (Salary, Wages, & Benefits)							
Management (including executive)	$ 3,133,536	$ 3,116,226	$ 3,287,003	$ 3,288,862	$ 3,559,594	$ 4,028,992	$ 4,075,633
Non-Management (union and non-union)	$ 9,662,986	$ 9,054,098	$ 9,596,494	$ 9,829,649	$ 9,679,641	$ 9,745,967	$ 11,186,388
Total	$ 12,796,523	$ 12,170,324	$ 12,883,497	$ 13,118,511	$ 13,239,235	$ 13,774,959	$ 15,262,021
Total Compensation Breakdown (Capital, OM&A)							
OM&A	$ 10,067,874	$ 9,412,507	$ 9,749,070	$ 10,286,633	$ 10,148,841	$ 10,471,741	$ 12,176,241
Capital	$ 2,728,649	$ 2,757,817	$ 3,134,427	$ 2,831,878	$ 3,090,393	$ 3,303,219	$ 3,085,780
Total	$ 12,796,523	$ 12,170,324	$ 12,883,497	$ 13,118,511	$ 13,239,235	$ 13,774,959	$ 15,262,021

File Number:	EB-2024-0026
Exhibit:	4
Tab:	4
Schedule:	1
Page:	1
Date:	28-Jan-25

TO BE UPDATED AT THE DRAFT RATE ORDER STAGE

Appendix 2-K
Employee Costs - GSHi

	Last Rebasing Year 2020 - OEB Approved	Last Rebasing Year (2020 Actuals)	2021 Actuals	2022 Actuals	2023 Actuals	2024 Bridge Year	2025 Test Year
Number of Employees (FTEs including Part-Time)[1]							
Management (including executive)	8.0	7.7	7.1	7.0	7.4	8.8	9.0
Non-Management (union and non-union)	58.7	52.5	51.9	52.2	49.0	47.9	55.9
Total	66.7	60.2	59.0	59.2	56.4	56.7	64.9
Total Salary and Wages including ovetime and incentive pay							
Management (including executive)	$ 1,074,732	$ 1,037,174	$ 962,129	$ 983,961	$ 1,104,990	$ 1,382,112	$ 1,380,814
Non-Management (union and non-union)	$ 5,396,915	$ 5,382,631	$ 5,362,832	$ 5,467,975	$ 5,293,335	$ 5,495,467	$ 6,217,736
Total	$ 6,471,647	$ 6,419,805	$ 6,324,961	$ 6,451,936	$ 6,398,324	$ 6,877,579	$ 7,598,550
Total Benefits (Current + Accrued)							
Management (including executive)	$ 329,587	$ 258,814	$ 279,945	$ 285,396	$ 299,252	$ 355,316	$ 390,256
Non-Management (union and non-union)	$ 1,645,169	$ 1,291,763	$ 1,492,597	$ 1,520,351	$ 1,364,871	$ 1,393,055	$ 1,635,161
Total	$ 1,974,756	$ 1,550,577	$ 1,772,541	$ 1,805,747	$ 1,664,123	$ 1,748,371	$ 2,025,417
Total Compensation (Salary, Wages, & Benefits)							
Management (including executive)	$ 1,404,318	$ 1,295,987	$ 1,242,073	$ 1,269,357	$ 1,404,242	$ 1,737,428	$ 1,771,070
Non-Management (union and non-union)	$ 7,042,084	$ 6,674,395	$ 6,855,428	$ 6,988,326	$ 6,658,205	$ 6,888,522	$ 7,852,897
Total	$ 8,446,403	$ 7,970,382	$ 8,097,502	$ 8,257,683	$ 8,062,447	$ 8,625,950	$ 9,623,967
Total Compensation Breakdown (Capital, OM&A)							
OM&A	$ 5,820,976	$ 5,345,901	$ 5,108,024	$ 5,598,637	$ 5,184,087	$ 5,491,595	$ 6,698,631
Capital	$ 2,625,426	$ 2,624,481	$ 2,989,478	$ 2,659,046	$ 2,878,360	$ 3,134,355	$ 2,925,336
Total	$ 8,446,403	$ 7,970,382	$ 8,097,502	$ 8,257,683	$ 8,062,447	$ 8,625,950	$ 9,623,967

TO BE UPDATED AT THE DRAFT RATE ORDER STAGE

File Number:	EB-2024-0026
Exhibit:	4
Tab:	4
Schedule:	1
Page:	1
Date:	28-Jan-25

Appendix 2-K
Employee Costs - GSHPi

	Last Rebasing Year 2020 - OEB Approved	Last Rebasing Year (2020 Actuals)	2021 Actuals	2022 Actuals	2023 Actuals	2024 Bridge Year	2025 Test Year
Number of Employees (FTEs including Part-Time)[1]							
Management (including executive)	9.5	9.9	10.9	10.5	10.6	10.9	10.8
Non-Management (union and non-union)	26.8	26.1	27.5	27.6	28.8	29.2	32.0
Total	36.2	35.9	38.5	38.1	39.5	40.0	42.7
Total Salary and Wages including ovetime and incentive pay							
Management (including executive)	$ 1,323,585	$ 1,444,650	$ 1,588,165	$ 1,562,622	$ 1,687,168	$ 1,775,409	$ 1,800,412
Non-Management (union and non-union)	$ 2,006,225	$ 1,887,014	$ 1,908,157	$ 1,979,199	$ 2,146,748	$ 2,239,873	$ 2,603,185
Total	$ 3,329,810	$ 3,331,664	$ 3,496,322	$ 3,541,822	$ 3,833,915	$ 4,015,282	$ 4,403,596
Total Benefits (Current + Accrued)							
Management (including executive)	$ 405,633	$ 375,589	$ 456,764	$ 456,882	$ 468,184	$ 516,155	$ 504,151
Non-Management (union and non-union)	$ 614,677	$ 492,689	$ 832,909	$ 862,124	$ 874,688	$ 617,572	$ 730,306
Total	$ 1,020,310	$ 868,278	$ 1,289,673	$ 1,319,006	$ 1,342,872	$ 1,133,727	$ 1,234,458
Total Compensation (Salary, Wages, & Benefits)							
Management (including executive)	$ 1,729,218	$ 1,820,239	$ 2,044,929	$ 2,019,505	$ 2,155,352	$ 2,291,564	$ 2,304,563
Non-Management (union and non-union)	$ 2,620,902	$ 2,379,703	$ 2,741,066	$ 2,841,324	$ 3,021,436	$ 2,857,445	$ 3,333,491
Total	$ 4,350,120	$ 4,199,942	$ 4,785,995	$ 4,860,828	$ 5,176,787	$ 5,149,009	$ 5,638,054
Total Compensation Breakdown (Capital, OM&A)							
OM&A	$ 4,246,897	$ 4,066,606	$ 4,641,046	$ 4,687,996	$ 4,964,754	$ 4,980,146	$ 5,477,610
Capital	$ 103,223	$ 133,336	$ 144,949	$ 172,832	$ 212,033	$ 168,863	$ 160,444
Total	$ 4,350,120	$ 4,199,942	$ 4,785,995	$ 4,860,828	$ 5,176,787	$ 5,149,009	$ 5,638,054

4-CCMBC-20 Executive Positions

Question:

Reference: Exhibit 4, Tab 4, Schedule 2, Attachment 2, *KPMG Report on Shared Services and Cost Allocations Review*, page 12

Preamble: "GSHP is a corporate services company that provides management and administrative services to its affiliates, including executive leadership, IT services, human resources and safety, accounting, finance, communications, marketing, innovation, utility customer billing and account maintenance, purchasing and inventory, and other support services."

Questions:

a) Please list the executive positions of GSHi that occupied by employees of GSHPi.
b) Please list the executive positions of GSHi that are occupied by employees of GSHi.

Response:

a) The executive positions at GSHi that are occupied by employees of GSHPi are:

- President and CEO
- Vice President, Corporate Services and Chief Financial Officer (CFO)
- Vice President, Human Resources and Safety
- General Counsel

b**)** The executive position at GSHi that is occupied by an employee of GSHI is:

- Vice President, Operations and Engineering

4-CCMBC-21 Affiliate Shared Services

Question:

Reference: Exhibit 4, Tab 4, Schedule 2, Attachment 2, *KPMG Report on Shared Services and Cost Allocations Review* Page 13, *Exhibit 7: Workforce and Capital Assets by Affiliate*

Questions:

a) Please confirm that of the affiliates of GSHi shown in the table, only GSHPi and Agilis provide services to GSHi.
b) Please confirm that the capital assets shown in the table are total capital assets of each entity.
c) How do GSHPi and Agilis charge GSHi for the use of their assets?

Response:

a) GSHI confirms that, for the sake of this analysis, GSHPi and Agilis are the only affiliated companies that provide services to GSHI. While @Home provides rental water heater services to GSHi, the annual cost of approximately $680 in 2024 is considered immaterial for this analysis.

b) GSHI confirms that the capital assets shown in the table reflect the capital assets of each entity as of December 31, 2021.

c) GSHPi allocates the amortization of its capital assets to various cost centers based on their usage. These cost centers are then allocated to affiliates, including GSHi, ensuring that the charges accurately reflect the consumption of the assets. This approach ensures transparency and equitable cost recovery across all users.

Agilis, on the other hand, does not directly charge GSHi for the use of its capital assets. Instead, Agilis charges GSHi monthly telecommunication fees, which cover the services provided. These fees are offered at a discounted rate compared to the prevailing market rates, providing GSHi with cost-effective telecommunication services.

4-CCMBC-22 Shared Services Tracking

Question:

Reference: Exhibit 4, Tab 4, Schedule 2, Attachment 2, *KPMG Report on Shared Services and Cost Allocations Review* Page 24, *Exhibit 8: Shared Services Arrangements,* and pages 24-26, Section *5.2 Summary of Cost Allocation Approach*

Questions:

a) Please describe the method used to track actual volumes of various shared services listed in Exhibit 8 such as time sheets, invoices for work etc.
b) How does GSHi management ensure that GSHi is not overcharged?
c) Are shared services charges audited by an outside auditor? If the answer is yes, is KPMG that auditor? If the answer is no, please explain why not.

Response:

a) Method used to track actual volumes of shared services

GSHi tracks the actual volumes of shared services using a combination of methods tailored to each service type. These methods include:

- **Time Sheets and Work Order System:** Employee time is tracked through a work order system, where specific hours are recorded for projects or affiliates. This data is linked to employee hourly rates, which recover actual payroll costs (including wages, salaries, and benefits) in some instances. In other instances, the hours tracked are used as a driver to allocate the entire cost of the cost centre to the appropriate company.

- **Invoices and Records:** Invoices are used for services such as accounts payable, where the number of invoices processed is a driver for cost allocation.
- **Physical Metrics:** Metrics like square footage for building costs and vehicle usage hours are also recorded using appropriate systems, such as actual vehicle usage hours tracked via employee timesheets.
- **Other Drivers:** For IT services, data such as the number of tickets, PC units, and phone users is collected. For customer service, metrics like call volumes, number of bills, and number of meters are tracked.

b) Ensuring GSHi is not overcharged

GSHi management has several controls to ensure that charges for shared services are reasonable and accurate:

1. **Direct Assignment of Costs:** Where possible, costs are directly assigned to affiliates based on actual usage or provision of services.
2. **Cost Allocation Reviews:** At the beginning of each year, budgeted allocation drivers are established based on historical data and future activity expectations. These are compared to actual figures at the end of the fiscal year.
3. **True-Up Adjustments:** Material variances between budgeted and actual figures trigger true-up or true-down adjustments to correct any discrepancies.
4. **Monthly Financial Statements:** GSHi prepares monthly financial statements that are reviewed by management. These reviews help identify and address any discrepancies in shared service charges.

c) Auditing of shared services charges

KPMG LLP performs a financial statement audit and issues an audit opinion on both GSHi and the consolidated entity of GSU. To the extent that shared services costs are relevant to the financial statements of GSHi, KPMG obtains sufficient audit evidence to support their audit opinion. However, KPMG does not issue a separate audit opinion on shared services charges specifically, as their audit opinion is issued on the overall financial statements of GSHi and GSU.

The shared services arrangements and cost allocation methodologies are not separately audited because this is not a standard requirement of a financial statement audit. Instead, KPMG's report on shared services and cost allocations, commissioned by GSHI, provides an independent assessment of these arrangements and satisfies overlapping regulatory and operational requirements.

The scope of the KPMG report includes:

1. Reviewing and understanding GSHI/GSHP's historical cost allocation approach;
2. Assessing whether shared services provided to GSHI are charged at market rates;
3. Evaluating the approach in light of OEB regulatory requirements and adherence to the ARC, APH, and OECD transfer pricing guidelines;
4. Analyzing costs compared to arm's-length rates; and
5. Identifying potential refinements based on leading practices.

This report, procured by GSHI, will help to ensure compliance with OEB regulatory requirements and provides management with recommendations to refine methodologies, support forecasting and budgeting, and prepare for rate rebasing applications. The use of this report addresses the need for an independent review without requiring a specific audit of shared services charges.

4-CCMBC-23 Shared Services Peer Comparisons

Question:

Reference: Exhibit 4, Tab 4, Schedule 2, Attachment 2, *KPMG Report on Shared Services and Cost Allocations Review* Page 31, Section *6.2 Assessment of Market Rates*

Questions:

a) Do any of the 9 peer Ontario LDCs that were selected have shared services arrangements with affiliates like GSHi's arrangement with GSHPi and Agilis? If the answer is yes, please identify them and describe the arrangements.
b) Are any of the 9 peer Ontario LDCs operating as a virtual utility?

Response:

a) GSHi does not have access to detailed corporate structures or the specific shared services arrangements of the nine peer LDCs included in KPMG's benchmarking analysis.

   The nine peer LDCs were selected as comparators based on criteria such as size, geographic service area, and customer composition, ensuring a fair and meaningful comparison of cost allocations and market rates for shared services. While GSHi cannot confirm whether these peer LDCs have affiliate arrangements comparable to GSHi's arrangements with GSHP and Agilis, the selected peer group represents a reasonable basis for assessing market-based allocations.

b) GSHi does not have information on whether any of the nine peer LDCs identified in the KPMG Report operate as virtual utilities. Similar to part (a), this specific operational detail was not necessary for the scoped analysis in the report.

The peer LDCs were chosen based on their similarity to GSHi in terms of operational factors such as customer count, service territory characteristics, and the scope of electricity distribution activities. This ensures that the benchmarking analysis provided a relevant comparison without requiring knowledge of whether any peers operate as virtual utilities.

7-CCMBC-24 Incremental EV Load

Question:

Reference: Exhibit 7, Tab 1, page 12

Preamble: "Incremental EV load of 757 kW is added using a simplified assumption that demand will be equal in each hour. Incremental hourly heating load is added by multiplying the total annual incremental heating load by the share of total weather-normal HDD in each hour, though there was no heating load in this hour."

Questions:

a) Is the incremental EV load of 757 kW based on a Level 1 or a Level 2 charger or a combination of both?
b) Please explain how the load of 757 kW was calculated.
c) Please explain why the assumption quoted in the preamble is reasonable considering that EV charging is unlikely to be equal each hour of the day.

Response:

a) Hourly incremental EV load is forecasted based on the annual consumption forecast, which relies on forecasts of the number of EVs in Greater Sudbury and forecasted annual consumption per type of vehicle. The forecast is not based on the number of EVs being charged with Level 1 or Level 2 chargers in a given hour because GSHi does not have sufficient information to produce this type of forecast.

b) The 757 kW forecast is calculated as forecast 2025 Residential EV consumption of 6,628,636kWh, as detailed in Section 6.1 of the Load

Forecast report (Exhibit 3, Tab 1, Schedule 1, Attachment 1), divided by 8,760 hours.

c) EV charging is expected to fluctuate from hour to hour, however, the hours in which demands are low or high cannot be reasonably forecasted. GSHi does not have historic EV charging hourly load data to accurately forecast when demands will occur and whether higher or lower demands will coincide with monthly peak demands.

7-CCMBC-25 Load Displacement Under ICI

Question:

Reference: Exhibit 7, Tab 1, Page 13

Preamble: "GSHi does not currently have a standby rate and is not seeking approval of a standby rate in this application."

Questions:

a) Does GSHi have any customers that generate their own power for load displacement at peak under the Industrial Conservation Initiative? If the answer is yes, would a standby rate ensure that other customers of GSHi do not subsidize those customers?

b) Some distributors have gross load billing. Has GSHi considered gross load billing? Please explain your answer.

Response:

a) GSHi has one customer who generates their own power for load displacement at peak under the industrial conservation initiative. The OEB recently underwent a consultation on policy for standby rates (EB-2023-0278). The conclusion of that consultation is that the OEB is not prepared to impose or recommend a default approach to pricing Load-displacing generation (LDG) at this time. The OEB further specified that cost causation should remain a key consideration in development of any standby rate proposal. GSHi has to date not identified any incremental costs in support of its customer with LDG. The benefits of calculating and implementing a standby rate for GSHi's sole load-displacing ICI customer is uncertain - the customer in question has a consistent load profile that does not fluctuate greatly similar to how you'd expect an industrial or manufacturing customer to fluctuate. So because of the customers load profile, and because GSHi has only one customer with LDG, GSHi is not proposing a standby rate in this application.

b) GSHi performed analysis to quantify the impact of gross load billing for this single customer. For this customer, GSHi bills approximately 96.5% of the demand value it would bill under gross load billing. Given that GSHi only has one LDG customer in its service territory, and given the small incremental revenue that would be billed should this customer be transitioned to gross load billing, GSHi maintains that it will not be seeking gross load billing for this customer in this rate application. GSHi will abide by any future guidance or request from the OEB as it pertains to implementing gross load billing in the future.

7-CCMBC-26 Revenue Reduction - GS Greater than 50

Question:

Reference: Exhibit 7, Tab 1, Schedule 2, Page 3, *Table 6 – Revenue to Cost Ratios*

Question:

Please explain the main reason for the large reduction in the revenue to cost ratio for the GS greater than 50 rate class.

Response:

The primary reason the revenue-to-cost ratio of GS>50 kW decreased is because of an increase in the coincident peak and non-coincident peak allocations to the class, despite declining billed volumes. The demand data used in tab ‘I8 Demand Data’ of GSHi’s cost allocation model in its 2020 COS (EB-2019-0037) was based on 2004 load data calculated by Hydro One. The updated demand data ‘I8 Demand Data’ used in the 2025 cost allocation model uses two years of weather-normalized data from June 2022 to May 2024 and more accurately reflects current coincident peak and non-coincident peaks.