Business Case Summary

Project #	ICICO009 Capital – ICO83696 OM&A – ICO83574		**Controlled Doc #**	Refer to the BCS Writing Guidance	
Project Title	Monitoring and Diagnostic Center				
Facility	Pickering, Darlington, RPGM		**Investment Classification**	Value Enhancing	
Project Level (Scalability)	C	**Financial Classification**	☒ OM&A ☒ Capital ☐ Capital Spare ☐ MFA ☐ CMFA ☐ Provision ☐ Others: [if applicable]		
Release: Gate and Project Phase	☐ Choose an item. G0☐: Initiation ☐ Choose an item. G1☐: Choose an item.		☐ Choose an item. G2☐: Definition ☒ Full G3☐: Execution		
Estimate Class (overall project)	Class 3		**Target Project Completion Date**	Aug-2020	

Recommendation

We recommend a release of $589K (Capital)

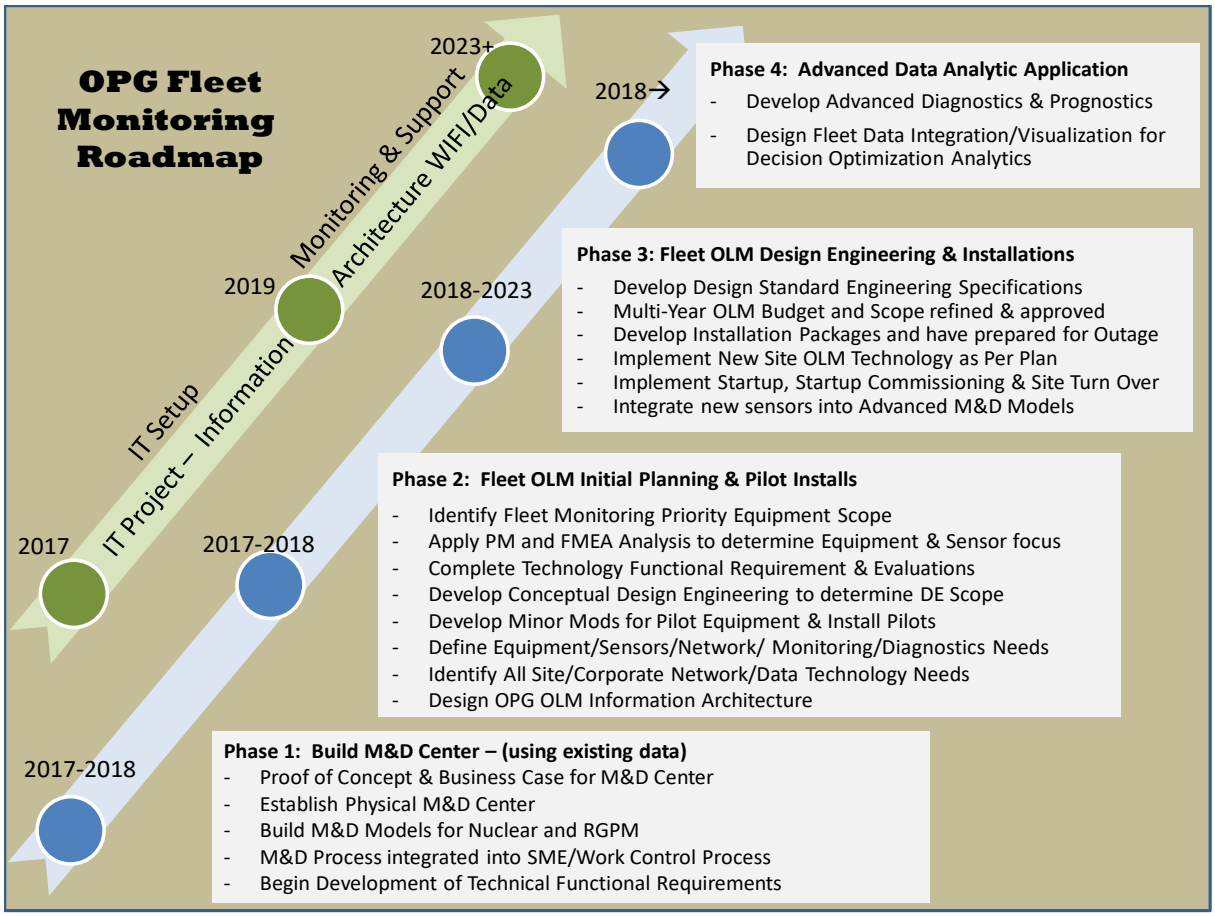
The total project cost is now estimated at $6230 K with 100K contingency, compared to $7,491K in the previous release.

This release will fund the completion of implementation of thermal performance monitoring software for each nuclear power generation unit to identify thermal performance losses and allow for corrective actions to improve plant heat rate.

Note: This is a value enhancing business case as there are cost savings associated with the project.

This project is part of the Nuclear Fleet Initiatives and is in the lockdown list.

The Anticipated In-Service Date is June,2020



Project #: OM&A – ICO83574
Project Title: Monitoring and Diagnostic Center
Document #: Refer to the BCS Writing Guidance

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Business Case Summary

Investment Cash Flows									
$K	**LTD OM&A**	**LTD Capital**	**2019 OM&A**	**2019 CAP**	**2020 CAP**	**2021**	**2022**	**Future**	**Total**
Previous releases	1,067	4,574							5,641
Current request	-				589				589
Total released to date	**1,067**	**4,574**	**-**	**-**	**589**	**-**	**-**	**-**	**6,230**
Future required	-								-
Total Project Cost	**1,067**	**4,574**	**-**	**-**	**589**	**-**	**-**	**-**	**6,230**
Ongoing Costs	-								
					Gate:	**G3**	**OAR Approval:**		$6,230 K

Approvals	Signatures	Date
The recommendation, including the identified ongoing costs, if any, represents the best option to meet the validated business need.		
Recommended by: Project Sponsor Jenny Leung Manager Fleet Equipment Reliability		
I concur with the business decision as documented in this BCS.		
Finance Approval: Bryan Shaddock Finance Controller per OPG-STD-0076		
I confirm that this investment/project, including the identified ongoing costs, if any, will address the business need, is of sufficient priority to proceed, and provides value for money.		
Line Approval per OAR 1.1: Kim Bosselle Director of IT Projects		

EXECUTIVE SUMMARY – Project Overview

Business Need

OPG has been implementing an Advanced Monitoring & Diagnostic Center (M&DC) function to apply new Advanced Pattern Recognition (APR) technology and to implement new Continuous On-Line Monitoring (COLM) sensor technology with diagnostic & prognostic analytics and advanced equipment health visualization. This allows early detection of equipment degradation/anomalies to initiate repairs and avoid catastrophic or consequential failures, avoid safety and environmental events, reduce costly time based PM tasks and optimize maintenance planning. These new technologies will also provide workforce optimization by enabling skilled workforce with more remote analytical capabilities to provide fleet-wide diagnostics.

Business need related to this BCS is the implementation of thermal performance software (benefits listed above) and IT support to the M & D Center.

Preferred Alternative

Phase 1: Build M&D Centre – (Using existing data)

- Proof of Concept & Business Case for M&D Centre
- Establish M&D Centre
- Build M&D Models for Nuclear and RGPM
- M&D Process integrated into SME/Work Control Process

Benefit Assumptions (based on expert opinion provided by consultant (WSC)

- $1,000k avoided cost from early detection of equipment failures
- 0.5 % reduction of heat rate / nuclear unit annually ($2 million/year)
- $200k annual net redistribution of Performance Engineering labour

EXECUTIVE SUMMARY – Project Overview
This BCS is for the completion of work related to Thermal Performance Monitoring project **Current Project Status** The project has delivered the following: • M & D Center Evaluation, Implementation and Change Management Plan • Hardware set up of M & D Center • PriSM Advanced Pattern Recognition software • Thermal Performance Software purchase • Planning and requirements of reporting database This BCS will deliver the Thermal Performance Monitoring System (without the cycle isolation module). The equipment monitoring support and reporting database implementation work will be implemented as part of a separate project – M & D Sensor network. **Key Risks** A key risk, with a high probability is the schedule. The access to interface may be delayed. We will attempt to mitigate this risk by closely working with all parties regarding interface needs and timeline.

Business Need	For Project Level A or B
N/A for Project Level C	

Preferred Alternative:	**Ontario Power Generation M&D Centre**	For Project Level A, B or C
Description of Preferred Alternative		
Phase 1: Build M&D Centre – (Using existing data) • Proof of Concept & Business Case for M&D Centre • Establish M&D Centre • Build M&D Models for Nuclear and RGPM • M&D Process integrated into SME/Work Control Process Benefits • $1,000k avoided cost from early detection of equipment failures • 1/2 % reduction of heat rate / nuclear unit annually ($2 million/year) • $200k annual net redistribution of Performance Engineering labour This BCS is for the completion of work related to Thermal Performance Monitoring. Cons: • Resources needed from many stakeholder groups, including CCD (for PI interface) • Effort required by station staff in providing design input, verification and validation • Time and support required for on-site training, UAT and SESA certification		

Deliverables:	**Associated Milestones (if any):**	**Target Date:**
Previous releases:		
M&D Center Evaluation, Center Implementation & Change Management Plan	Completed	Sept 30, 2017
Prism Installation	Completed	July 14, 2018
Current release:		

Deliverables:	Associated Milestones (if any):	Target Date:
Thermal Performance Software UAT Complete –Phase 1		Nov. 29, 2019
Thermal Performance Software Go-Live Complete – Phase 1		December 13, 2019
Thermal Performance Software UAT Complete –Phase 2		May 29, 2020
Thermal Performance Software Go-Live Complete – Phase 2		June 26, 2020
In-Service		*June 2020*
Project Closure complete		August 28, 2020
Future release:		

Alternative 2:	**Base Case – No Project**	For Project Level A, B or Value-Enhancing
Not doing this project is not an option. The project is strategic to better support thermal performance management and higher plant efficiency and will results in support staff reductions into the future.		

Alternative 3:	**Delay Work**	For Project Level A or B or Value-Enhancing
Delaying work will mean that the potential benefits associated with this project will be delayed.		

Alternative 4:	**[Input Summary Title for the Alternative]**	For Project Level A or B
N/A for Project level C		

Key Risk Assessment — For Project Level A, B or C

Risk Class	Description of Risk	Response Type/ Actions/Final TCD	For Additional Review	Residual Ranking
Cost	Cost estimate exceeded. The estimates are definition and considered Class 3.	Mitigate: • Monitor closely the 3rd party vendors and NHSS contractors **Final TCD: N/A**	No	Low
Schedule	Access to interfaces may be delayed.	Mitigate: • Closely work with all parties regarding interface needs and timelines **Final TCD: N/A**	No	Medium
Quality	Project may not deliver quality deliverables	Mitigate: Project documents will be reviewed closely and testing/validation will be done on final products **Final TCD: N/A**	No	Low

Additional Risk Analysis — For Project Level A or B

N/A

Financial Evaluation					For Project Level A, B (with multiple feasible alternatives) or Value-Enhancing
$K	Preferred Alternative	Base Case (No Project)	Delay work	Alternative 4	Alternative 5
Project Cost	$6,627k	N/A	N/A		
NPV	$457k	N/A	N/A		
IRR	9.5%	N/A	N/A		

Analysis of Financial Evaluation – Key Assumptions and Key Results:

- Actual vendor quotes have been used for the evaluation. Benefits were provided by Business

Qualitative Factors For Project Level A or B

- N/A for Project Level C

Post Implementation Review (PIR) Plan (refer to OPG-PROC-0056)

Type of PIR Report	Simplified/Standard PIR	**PIR Completion Date**	07-2020

☐ Detailed PIR KPIs will be provided in future BCS(s) when Choose an item. Phase BCS release is requested.

PIR KPIs	Current Baseline	Target Result	How to measure?	Who will measure?
Thermal Performance Improvements per Nuclear Finance Spreadsheet attached	Spreadsheet Attached Baseline	Spreadsheet Attached Improvements	Will be shown via data captured.	Nuclear Finance

Definitions and Acronyms

[Delete this section if not needed. See Guidance]

Project #: OM&A – ICO83574
Project Title: Monitoring and Diagnostic Center
Document #: Refer to the BCS Writing Guidance

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Business Case Summary

APPENDICES

Appendix A1: Summary of Estimate - Total Project Cost										
Project Number:	**ICICO009 (Cap ICO83696/OM&A - ICO83574)**									
Project Title:	**M&D Center**									
$K	**LTD OM&A**	**LTD Capital**	**2019 OM&A**	**2019 Capital**	**2020 OM&A**	**2020 Capital**	**2021**	**Future**	**Total**	**%**
Execution Build Code		238	119	150		523			1,030	17%
Equipment or Material	119	2,341		114					2,574	41%
Planning	695	1,421							2,116	34%
NHSS				85					85	1%
Misc			134						134	2%
									-	0%
									-	0%
									-	0%
Subtotal	814	4,000	253	349	-	523	-	-	5,939	95%
Outside WBS									-	0%
Contingency						100			100	2%
Subtotal w/ Contingency	814	4,000	253	349	-	623	-	-	6,039	97%
Interest		129		35		27			191	3%
Other									-	0%
Total	**814**	**4,129**	**253**	**384**	**-**	**650**	**-**	**-**	**6,230**	**100%**

Appendix A2: Summary of Estimate – Notes			
Escalation Rate	2%	**Interest Rate (going-forward)**	5%

Appendix A3: Summary of Estimate – In-Service Estimates				
$K	Only applicable to capital projects. In-Service amount shall include interest but exclude removal costs.			
Project #	**Date (YYYY-MM-DD)**	**Description**	**Amount**	**%**
ICICO009	7/14/2018	PRiSM purchase and installation complete	4,306	85%
ICICO009	30/6/2020	Thermal performance solution purchase and installation complete	757	15%
Total			5,063	100%

Prepared by:		**Reviewed and Endorsed by:**	
Shehzad Qureshi		Jennifer Lafferty	
IT Projects	[Insert Date]	Nuclear IT Projects	[Insert Date]
Project Manager	Date	Program Manager	Date

$K	**LTD OM&A**	**LTD CAP**	**2019 OM&A**	**2019 Capital**	**2020**	**2021**	**2022**	**Future**	**Total**
G3A EXEP	814	4,130	353	2,194					7,491
G3B EXEF	814	4,129	119	384	550				5,996

Total Project Estimate Variance Explanation (delete if not required)

Variance from previous business case is due to the face that equipment monitoring support and reporting database implementation work will be implemented as part of a separate project – M & D Sensor network.

APPENDICES (Continued)**Appendix C: Financial Evaluation Assumptions** For Project Level A, B (with multiple feasible alternatives) or Value-Enhancing

NPV Evaluation

ONTARIO POWER GENERATION

Business Case Summary: Financial Evaluation
INTERNAL USE ONLY

Revision 2017r01

Name of Project: Monitor and Diagnostic Project
Alternative: Traditional On-line Monitor M&D Centre
Description of Alternative:

Global Inputs

In-Service Date (Jan 1)	2019	year
Assumed Life	10	years
Final evaluation year (Dec 31)	2028	year
Rate Regulated or Non-Regulated	R	Regulated or PPA
Discount rate	7.0%	%
Project Type	V	Value Enhancing
Costs are in:	$k	esc $k

Output Summary

NPV	457	2017 PV$k
IRR	9.5%	

	Constant	Unit	Total	LTD	Present	2017	2018	2019	2020	2021	2022	2023	2024
REVENUE/SAVINGS				2018 (show cash inflows as positive values)									
		esc $k	0										
See Fleet Monitoring Initiative Executive Summary		esc $k	9,000						1,000	2,000	2,000	2,000	2,000
		esc $k	0										
		esc $k	0										
Total Revenue		esc $k	9,000	0	0	0	0	0	1,000	2,000	2,000	2,000	2,000
OPERATING COSTS (OM&A, Fuel, etc.)				(show cash outflows as negative values)									
		esc $k	0										
See Cost Tracking Tab - Project OM&A		esc $k	-933			-567	-247	-119					
		esc $k	0										
		esc $k	0										
		esc $k	0										
		esc $k	0										
		esc $k	0										
Total Operating Costs		esc $k	-933	0	0	-567	-247	-119	0	0	0	0	0
CAPITAL EXPENDITURES													
Enter Class into Col.A from "CCA Rates" sheet (Col.A) to select CCA Classes				(show cash outflows (capital expenditures) as negative values // show cash inflows (salvage value, asset sale) as positive values)									
1 Dams, Buildings & other structures	4%	esc $k	0										
1.1 New non-residential buildings	6%	esc $k	0										
17 Generating equipment, road, sidewalk, parking area	8%	esc $k	0										
L Land	0%	esc $k	0										
12 Computer application software	100%	esc $k	-5,003			-2,574	-1,556	-384	-489				
50 Nuclear Cost Not Covered by CIO	100%	esc $k	0										
8 Office equipment, miscellaneous equipment	20%	esc $k	0										
13 Leasehold improvements	straight-line	esc $k	0										
0	0%	esc $k	0										
0	0%	esc $k	0										
Total Capital Expenditures		esc $k	-5,003	0	0	-2,574	-1,556	-384	-489	0	0	0	0
CASHFLOW													
Revenue		esc $k	9,000		0	0	0	0	1,000	2,000	2,000	2,000	2,000
Operating Costs		esc $k	-933		0	-567	-247	-119	0	0	0	0	0
EBITDA		esc $k	8,067		0	-567	-247	-119	1,000	2,000	2,000	2,000	2,000
Tax on EBITDA		esc $k	-2,017		0	142	62	30	-250	-500	-500	-500	-500
Capital Expenditures		esc $k	-5,003		0	-2,574	-1,556	-384	-489	0	0	0	0
Tax Shield on CCA		esc $k	1,251		0	322	516	243	109	61	0	0	0
Proceeds of Dispositions of Capital Property		esc $k	0		0	0	0	0	0	0	0	0	0
Tax impact of Capital Gain		esc $k	0		0	0	0	0	0	0	0	0	0
Tax impact of CCA Recapture		esc $k	0		0	0	0	0	0	0	0	0	0
Tax impact of CCA Terminal Loss		esc $k	0		0	0	0	0	0	0	0	0	0
Tax impact of CCA Terminal Value		esc $k	0		0	0	0	0	0	0	0	0	0
Other		esc $k	0										
Changes in Working Capital and Reserves		esc $k	0										
Project Cashflow	2,298	esc $k	2,298		0	-2,678	-1,225	-231	370	1,561	1,500	1,500	1,500
Project Cashflow over Evaluation Period	2,298	esc $k	2,298		0	-2,678	-1,225	-231	370	1,561	1,500	1,500	1,500
RESULTS													
NPV of Cash Flow	457	2017 PV $k	457		0	-2,588	-1,107	-195	292	1,151	1,034	966	903
Cumulative NPV of Cash Flows	457	2017 PV $k			0	-2,588	-3,695	-3,890	-3,598	-2,447	-1,413	-446	457
IRR	9.5%	%											
Payback Period (from I/S)	5 yrs	years			0	0	0	0	0	0	0	0	1
Cumulative NPV becomes positive in Year:	2024	year	2024		0	0	0	0	0	0	0	0	2024

RE PROPOSED SAVINGS FROM M&

APPENDICES (Continued)**Appendix C: Financial Evaluation Assumptions** For Project Level A, B (with multiple feasible alternatives) or Value-Enhancing

	A	B	C	D	E	F	G	H	I	J	K	L	M
9		P4	2.668	3.774	2.949	3.774							
10		P5	4.311	2.884	2.489	4.311							
11		P6	2.181	4.311	2.919	3.463							
12		P7	4.311	2.195	3.891	2.931							
13		P8	2.895	4.180	3.891	2.546							
14		PA	6.23	7.47	5.11	7.47							
15		PB	13.70	13.57	13.19	13.25							
16		PN	19.93	21.04	18.30	20.72							
17		DN	19.28	19.65	17.79	16.62							
18		ON	39.21	40.69	36.09	37.34							
19													
20		Station/Ui	2018	2019	2020	2021		FLR					
21	TWH	D1	7.4831	7.1097	5.093	3.3332		3.4% PB	3.4% PB	3.35% PB	3.35% PB		
22		D2	-0.1539	-0.1539	4.8648	5.9766		0.95% DN	0.9% DN	0.9% DN	0.9% DN		
23		D3	5.3263	7.4871	0.7998	-0.1539							
24		D4	6.6354	5.2312	7.053	7.4871							
25		P1	3.5873	3.7191	2.1846	3.7191							
26		P2	-0.0125	-0.0125	-0.0125	-0.0125							
27		P3	-0.0125	-0.0125	-0.0125	-0.0125							
28		P4	2.6676	3.7737	2.9486	3.7742							
29		P5	4.3159	2.8868	2.4929	4.3183							
30		P6	2.1833	4.3159	2.9241	3.4683							
31		P7	4.3159	2.1973	3.8977	2.936							
32		P8	2.8987	4.1845	3.8977	2.5505							
33		PA	6.2299	7.4678	5.1082	7.4683							
34		PB	13.714	13.585	13.212	13.273		-0.02	-0.01	-0.02	-0.02		
35		PN	19.944	21.052	18.321	20.742							
36		DN	19.291	19.674	17.811	16.643		-0.01	-0.02	-0.02	-0.02		
37		ON	39.235	40.727	36.131	37.385							
38								2018	2019	2020	2021		
39							MWh	-25804.35	-36698.79	-42237.74	-40681.15		
40							$	(1,806,304.36)	(2,568,915.61)	(2,956,641.89)	(2,847,680.58)		
41													
42													
43													
44													

References For Project Level A or B

N/A

Additional Documentation

Executive Steering Committee

Fleet Monitor Initiative Executive Summary