



Renewed Regulatory Framework for Electricity Distribution Network Investment Planning

Bill Impact Estimation Model

Staff Information Session

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Background and Model Objectives

- Model Development is part of the Distribution Network Investment Planning Initiative
- Estimate bill impacts to reflect as one of the criteria used in network planning decisions – e.g., pacing of investments
- Ontario's Electric distributors invest to:
 - Comply with the Green Energy Act
 - Meet anticipated load growth
 - Replace aging infrastructure
 - Maintain reliability and power quality
- OEB retained Power Advisory to develop a relatively powerful – but easy-to-use spreadsheet model for estimating the impact of infrastructure projects on all relevant elements of distributor customer bills:
 - distribution component based on COS principles
 - potential impacts on the Global Adjustment (GA) and Wholesale Market Service Charges (WMSC) from investments that enable the expansion of renewable energy.
- The model can be used to estimate the impacts of a single project or combinations of projects that comprise a network investment plan.
- Many tradeoffs are reflected in model design

Model Structure: Four Elements

1. User Inputs (Tabs 4 and 5): rate class definitions and typical bill usage levels, project definitions and costs, renewable capacity added by technology, financial cost assumptions (e.g., cost of capital, tax rates), cost allocation and rate design assumptions, and assumptions necessary to estimate the impact on customer bills from the ability to connect new renewable supplies (e.g., contract prices, capacity factors, transmission network service and connection service charges);

The user inputs financial data for potential investment projects including how much the project costs, any increase in operations & maintenance (O&M) expenses or ability to generate “other income” that are attributable to the project. The user also inputs existing charges in order to calculate bill impacts.

2. Model Set-Up and Investment Plan Scenarios (Tab 3): specifying which projects are to be included in a specific network investment plan;
3. Calculations (Approximately 25 tabs): calculations of the incremental cost-of-service, cost-of-service to be paid for by provincial ratepayers, WMSC impacts, GA impacts, cost allocation and rate design, and bill impacts;
4. Reports: print pre-defined summary reports (Tab 3).

Design Considerations – High Level Tradeoffs

- Key Tradeoff: accuracy of bill impacts vs. data requirements
 - Amount of data inputs
 - Availability of data
- It is anticipated that most of the data required to set-up the model is already available or easily compiled from one of two sources: (1) project information that must already be compiled by distribution planners in order to develop a network investment plan, and (2) a recent rate order or ongoing effort to prepare a rate case filing.
- Focus on bill impacts required a streamlined approach to revenue requirements, cost allocation and rate design
- Allow distributor to specify up to five rate classes and three usage levels for class for purposes of calculating bill impacts – most flexible approach
- It is a screening tool to support planning and not a model relied upon to calculate the rates that customers will pay where accuracy is paramount → streamlined approach to certain calculations (e.g., payment in lieu of taxes calculations)
- An example of the tradeoff between data inputs and accuracy is cost allocation – where we assume that cost allocation can be reasonably performed by specifying less than a dozen primary allocation factors and by holding those factors constant over the study period.
- Estimation of Direct Benefits impacts on WSMC and the potential impact on GA of renewable capacity does require a detailed set of input assumptions and calculations

1. Cost of Service Impacts of Network Investment Plan

A. Calculate Existing Rates and Typical Bills

ASSUMPTIONS

- Identify 5 rate classes and whether they have a demand charge
- Specify 3 consumption levels for bill impacts
- Specify Year 1 Rates and IRM Assumptions
- Specify T&D Adders for five years

CALCULATIONS

- Existing Customer, Demand & Volumetric Rates by Year, including T&D Adders
- Typical Monthly Bills

B. Calculate Incremental COS and Bill Impacts

- Specify annual CAPEX, O&M and other income for up to 25 projects (5 categories)
- Specify “% Direct Benefits” for Category 1 projects (Enabling Renewable Energy)
- Specify Classification (C, D, or V) and Allocation Methods (3 load forecast and 7 fixed options, e.g., 1CP, 1NCP)
- Specify Amortization and CCA rates
- Specify Cost of Capital, Working Capital, and Tax Rate Assumptions

- Incremental Plant, Net Plant, Working Capital and Rate Base
- Incremental O&M expenses, Other Income (a deduction to COS), return, depreciation expense, and taxes
- Cost of Service allocated between the distributor (“Direct Benefits”) and the other Provincial Ratepayers (pursuant to 330/09)
- All of this classified to C, D, and V and allocated to customer classes to calculate incremental rate and bill impacts

2. Direct Benefits and GA Impacts of Network Investment Plan

C. Direct Benefits: Avoided Transmission Network and Connection and WSMC (Tab 10)

ASSUMPTIONS

- Annual capacity added by resource type for each project and % exceeding 2 MW in size
- Year 1 Transmission Network and Connection Service Rates and Real Escalation Rates
- Year 1 Average HOEP, GA, and WMSC and Real Escalation Rates
- Capacity and Diversity (CP and NCP) Factors for each of 18 Technologies

CALCULATIONS

- Annual and cumulative capacity qualifying for network and connection service benefits – by resource type
- Annual energy production by resource type
- Network, Connection, and WMS benefits
- Total Direct Benefits
- WSMC Impact (\$/MWh)

D. Global Adjustment Impact (Tab 9)

- Year 1 Contract Prices and proportion to be escalated by inflation – by resource type
- Proportion of Realized HOEP by resource type

- Year 1 AQEW and annual growth rate
- Annual Average HOEP and Contract Prices
- Annual and cumulative capacity by resource type
- Annual energy production by resource type
- Annual Weighted Contract Prices
- Residual Contract Price and GA Impact by resource type by year
- Total GA Impact by resource type by year

Inputs: Run Definition, Customer Classes and Bill Impact Levels

Organization	Ontario Utilities Limited
Initial Year	2012
Run Title	Rate Model 01

Customer Rate Classes

Class	Name	Demand Charge
Class A	Residential	No
Class B	Small GS (<50 kW)	No
Class C	Large GS	Yes
Class D	Large Users 1	Yes
Class E	Large Users 2	Yes

Monthly Bill Impact Level

Class	Level 1	Level 2	Level 3	Measure
Residential	500	800	1,500	kWh
Small GS (<50 kW)	2,000	5,000	10,000	kWh
Large GS	100	500	1,000	kW
Large Users 1	1,500	3,000	5,000	kW
Large Users 2	6,000	8,000	10,000	kW

Cell Explanation

10
A

Yellow shaded cells represent manual data inputs.
Blue shaded cells represent drop down selection inputs.

10
A

Some data input cells have default values. These cells are shaded purple.
Some data input cells are locked and cannot be edited. These cells are not shaded.

Potential Network Investment Projects

Plant Investment

	2012	2013	2014	2015	2016
Investment 1.1.a	1,000,000	500,000	400,000		
Investment 1.1.b	1,500,000	350,000	200,000		
Investment 1.1.c	100,000	30,000			
Total	2,600,000	880,000	600,000	0	0

Classification

Demand
Demand
Customer

Allocation

1 CP
4 CP
Customers

Amortization

40 Years
25 Years
20 Years

CCA Rate

8.0%
8.0%
8.0%

O & M Expenses

	2012	2013	2014	2015	2016
Fixed 1.1	200,000	210,000	220,000	200,000	200,000
Variable 1.1	20,000	25,000	30,000	35,000	40,000
Total	220,000	235,000	250,000	235,000	240,000

Classification

Demand
Volumetric

Allocation

1 CP
Energy

Other Income

	2012	2013	2014	2015	2016
Income 1.1	0	0	0	0	0
Total	0	0	0	0	0

Classification

Volumetric

Allocation

Energy

Capacity (kW)

	2012	2013	2014	2015	2016
Capacity 1.1.a	1,000				
Capacity 1.1.b		2,000			
Capacity 1.1.c			3,000		
Capacity 1.1.d				1,000	
Capacity 1.1.e					1,500
Capacity 1.1.f				800	
Capacity 1.1.g	600				500
Capacity 1.1.h					
Capacity 1.1.i					
Total	1,600	2,000	3,000	1,800	2,000

Renewable Resource (MW)

Onshore Wind (All Sizes)
Biogas (≤ 0.5)
Biomass (≤ 10)
Waterpower (≤ 10)
Landfill Gas (≤ 10)
Solar Rooftop (≤ 0.01)
Solar Ground (≤ 0.01)

> 2 MW (%)

0.0%
0.0%
33.3%
0.0%
0.0%
0.0%
0.0%

Selecting Network Investment Projects to Include in Model Run

Investments to Include in the Model

Category 1 Expansion and Reinforcement for Renewable Resources

Project	Name	Include	Direct Benefits
Project 1.1	Protection and Control Upgrades	Yes	25.0%
Project 1.2	New Feeder	Yes	20.0%
Project 1.3		No	50.0%
Project 1.4		No	100.0%
Project 1.5		No	100.0%

Category 2 Smart Grid

Project	Name	Include
Project 2.1	New Meters and Software	Yes
Project 2.2		No
Project 2.3		No
Project 2.4		No
Project 2.5		No

Category 3 Replace Infrastructure

Project	Name	Include
Project 3.1		No
Project 3.2		No
Project 3.3		No
Project 3.4		No
Project 3.5		No

Category 4 Meet Load Growth

Project	Name	Include
Project 4.1		No
Project 4.2		No
Project 4.3		No
Project 4.4		No
Project 4.5		No

Category 5 Enhance Reliability and Service Quality

Project	Name	Include
Project 5.1		No
Project 5.2		No
Project 5.3		No
Project 5.4		No
Project 5.5		No

Global Adjustment and O. Reg. 330/09 Assumptions

Contract Price (\$/kWh)

Resource (MW)	2012	Portion Esc.	Proportion
Biogas (≤ 0.5)	0.1600	20.0%	100.0%
Biogas ($> 0.5 \leq 10$)	0.1470	20.0%	100.0%
Biogas (> 10)	0.1040	20.0%	100.0%
Biogas (On-Farm ≤ 0.1)	0.1950	20.0%	100.0%
Biogas (On-Farm $> 0.1 \leq 0.25$)	0.1850	20.0%	100.0%
Biomass (≤ 10)	0.1380	20.0%	100.0%
Biomass (> 10)	0.1300	20.0%	100.0%
Landfill Gas (≤ 10)	0.1110	20.0%	100.0%
Landfill Gas (> 10)	0.1030	20.0%	100.0%
Onshore Wind (All Sizes)	0.1350	20.0%	100.0%
Solar Ground (≤ 0.01)	0.6420	0.0%	110.0%
Solar Ground ($> 0.01 \leq 10$)	0.4430	0.0%	110.0%
Solar Rooftop (≤ 0.01)	0.8020	0.0%	110.0%
Solar Rooftop ($> 0.01 \leq 0.25$)	0.7130	0.0%	110.0%
Solar Rooftop ($> 0.25 \leq 0.5$)	0.6350	0.0%	110.0%
Solar Rooftop (> 0.5)	0.5390	0.0%	110.0%
Waterpower (≤ 10)	0.1310	20.0%	98.0%
Waterpower ($> 10 \leq 50$)	0.1310	20.0%	98.0%

Calculation of Indirect Benefits - Reg. 330/09

AQEW Projection (MWh)

<u>Projection</u>	2012	CAGR
AQEW	139,708,079	0.10%

Transmission Rates (\$/kW/Mo)

<u>Charge</u>	2012	Real Esc.
Network Service	3.22	0.50%
Connection Service	0.79	0.50%

Energy Charges (\$/MWh)

<u>Charge</u>	2012	Real Esc.
Average HOEP	37.85	0.50%
Global Adjustment	27.18	0.50%
Wholesale Market Service	5.45	0.50%

Capacity & Diversity Factors

<u>Resource (MW)</u>	Capacity	CP	NCP
Biogas (≤ 0.5)	75.0%	80.0%	75.0%
Biogas ($> 0.5 \leq 10$)	75.0%	80.0%	75.0%
Biogas (> 10)	75.0%	80.0%	75.0%
Biogas (On-Farm ≤ 0.1)	75.0%	80.0%	75.0%
Biogas (On-Farm $> 0.1 \leq 0.25$)	75.0%	80.0%	75.0%
Biomass (≤ 10)	85.0%	90.0%	85.0%
Biomass (> 10)	85.0%	90.0%	85.0%
Landfill Gas (≤ 10)	84.0%	84.0%	84.0%
Landfill Gas (> 10)	84.0%	84.0%	84.0%
Onshore Wind (All Sizes)	30.0%	10.0%	22.0%
Solar Ground (≤ 0.01)	14.0%	90.0%	80.0%
Solar Ground ($> 0.01 \leq 10$)	14.0%	90.0%	80.0%
Solar Rooftop (≤ 0.01)	13.0%	90.0%	35.0%
Solar Rooftop ($> 0.01 \leq 0.25$)	13.0%	90.0%	35.0%
Solar Rooftop ($> 0.25 \leq 0.5$)	13.0%	90.0%	35.0%
Solar Rooftop (> 0.5)	13.0%	90.0%	35.0%
Waterpower (≤ 10)	52.0%	50.0%	50.0%
Waterpower ($> 10 \leq 50$)	52.0%	50.0%	50.0%

Financial Assumptions

Cost of Capital

Component

Return on Equity
Long-Term Debt
Short-Term Debt
Total

Cost

9.58%
5.32%
2.46%

Weight

40.00%
56.00%
4.00%
100.00%

Working Capital & Taxes

Component

Working Capital
Total Tax Rate

Rate

15.00%
25.00%

Inflation Rate

Component

Inflation Rate

Rate

2.50%

Rate Assumptions

Distribution Charges

<u>Customer (\$/Mo)</u>	<u>2012</u>
Residential	14.00
Small GS (<50 kW)	22.00
Large GS	300.00
Large Users 1	4,500.00
Large Users 2	6.00

<u>Demand (\$/kW)</u>	<u>2012</u>
Residential	0.00
Small GS (<50 kW)	0.00
Large GS	2.25
Large Users 1	0.80
Large Users 2	0.00

<u>Volumetric (\$/kWh)</u>	<u>2012</u>
Residential	0.0130
Small GS (<50 kW)	0.0180
Large GS	0.0000
Large Users 1	0.0000
Large Users 2	0.0130

IRM Formula

<u>Component</u>	<u>Rate</u>
Inflation Factor	2.50%
Productivity Offset	0.72%
Stretch Factor	0.50%
Double Counting Offset	0.00%

The IRM formula has been adjusted to include a “double-counting offset”. This is intended to represent the fact that application of the current IRM formula already provides some ability for distributors to fund capital investments, including infrastructure replacement. However, the Board recognized that it may not provide adequate revenues to support extraordinary increases in capital expenditures as it approved an “Incremental Capital Module” as part of the 3rd generation incentive regulation mechanism.

Rate Adders for Calculating Bill Impacts

T & D Adders

Customer (\$/Mo)

	2012	2013	2014	2015	2016
Residential	1.55	1.55	1.55	1.55	1.55
Small GS (<50 kW)	1.55	1.55	1.55	1.55	1.55
Large GS	1.55	1.55	1.55	1.55	1.55
Large Users 1	1.55	1.55	1.55	1.55	1.55
Large Users 2	1.55	1.55	1.55	1.55	1.55

Demand (\$/kW)

	2012	2013	2014	2015	2016
Residential	0.00	0.00	0.00	0.00	0.00
Small GS (<50 kW)	0.00	0.00	0.00	0.00	0.00
Large GS	4.00	4.00	4.00	4.00	4.00
Large Users 1	3.50	3.50	3.50	3.50	3.50
Large Users 2	0.00	0.00	0.00	0.00	0.00

Volumetric (\$/kWh)

	2012	2013	2014	2015	2016
Residential	0.0150	0.0150	0.0150	0.0150	0.0150
Small GS (<50 kW)	0.0140	0.0140	0.0140	0.0140	0.0140
Large GS	0.0550	0.0550	0.0550	0.0550	0.0550
Large Users 1	0.0075	0.0075	0.0075	0.0075	0.0075
Large Users 2	0.0150	0.0150	0.0150	0.0150	0.0150

Load Forecast & Allocation Factor Assumptions

Load Forecast & Cost Allocation Factors

Customers

Class	2012	Annual Esc.		2013	2014	2015	2016
Residential	25,000	1.0%	OR				
Small GS (<50 kW)	10,000	1.0%					
Large GS	500	1.0%					
Large Users 1	0	1.0%					
Large Users 2	100	1.0%					
Other Classes	600	1.0%					
Total	36,200			0	0	0	0

Demand (MW)

Class	2012	Annual Esc.		2013	2014	2015	2016
Residential	68.5	1.0%	OR				
Small GS (<50 kW)	51.9	1.0%					
Large GS	9.5	1.0%					
Large Users 1	0.0	1.0%					
Large Users 2	81.5	1.0%					
Other Classes	0.7	1.0%					
Total	212.1			0.0	0.0	0.0	0.0

Energy (MWh)

Class	2012	Annual Esc.		2013	2014	2015	2016
Residential	300,000	1.0%	OR				
Small GS (<50 kW)	250,000	1.0%					
Large GS	50,000	1.0%					
Large Users 1	0	1.0%					
Large Users 2	500,000	1.0%					
Other Classes	2,400	1.0%					
Total	1,102,400			0	0	0	0

Cost Allocation Factors

Class	1 CP	4 CP	12 CP	1 NCP	4 NCP	12 NCP	Bills
Residential	350	350	1,000	120	450	1,100	25,000
Small GS (<50 kW)	599	599	1,712	205	719	2,055	10,000
Large GS	959	959	2,740	329	1,151	3,288	500
Large Users 1	2,800	2,800	8,000	960	3,360	9,600	0
Large Users 2	3,150	3,150	9,000	1,080	3,780	10,800	100
Other Classes	70	70	200	24	84	240	600
Total	7,928	7,928	22,652	2,718	9,544	27,082	36,200

Model Capabilities and Related Input Requirements

	Capability	Description	Related Input Requirements
1	Incremental Revenue Requirements	Incremental cost-of-service for a multi-project network investment plan (vs. revenue requirements to be borne by provincial ratepayers)	• Direct Benefits % for renewable projects • Annual capital and O&M costs by project • Amortization term & CCA rate by project component • Capital structure, cost of capital and tax rate
2	Typical Bill Impacts by Class with Rate Design	Calculates incremental rates by class (chosen by user) and rate component for investment plan; adds these to existing rates; calculates bill impacts at user-specified usage levels	• Identify costs as service, demand or volumetric • Specify customer classes, typical bill usage levels, and existence of a demand charge • Load forecast by customer class • Other allocation factors (e.g., NCP: Year 1 only) • Existing rates with IRM formula inputs if applicable
3	WMSC Impact	Calculates avoided transmission network service, transmission connection service, and WMSC due to renewable projects	• Annual MW added by technology/size with percentage by under 2 MW (same for all years) • Capacity factor and CP and NCP diversity factors by technology/size • Current network & connection charges with escalation rates • AQEW forecast • % of expansion projects that provide direct benefits
4	GA Impact	Calculates impact of renewable projects on the Global Adjustment	• Contract Prices by technology/size • Realized HOEP % by technology/size