2019 Potential Study Update

NS Power Pre-IRP Workshop
June 28, 2019

Presentation Outline

1. Background
2. Potential Study Scope
3. Potential Study Modelling
4. Baseline Study Results
5. Next Steps

Background

- EfficiencyOne directed to initiate new DSM Potential Study by NSUARB
  - Filing date is August 14th, 2019
- Being developed through a consultative approach with the Demand Side Management Advisory Group (DSMAG)
  - DSMAG comprised of diverse group of demand-side management stakeholders with varied views and interests

Background Cont.

- EfficiencyOne began procurement and development of scope of work in October 2018
  - Scope of work developed in October – November 2018
  - RFP Issued in November 2018
  - RFP Responses obtained in December 2018
- Navigant selected as successful proponent in January 2019

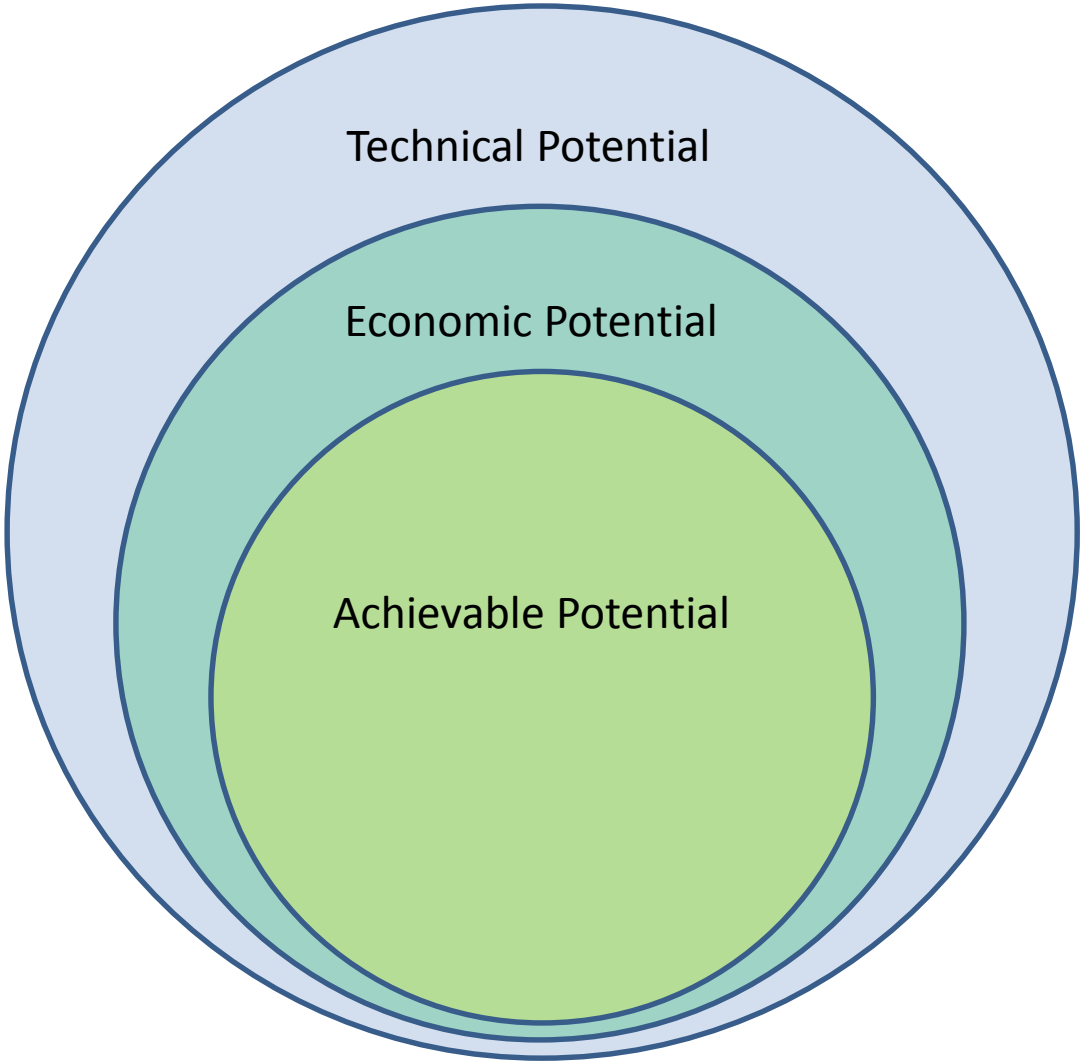
Navigant

- Experienced in DSM and DSM Potential Studies
  - BC, AB, SK, ON, NS and numerous US Potential Studies
- Extensive past experience working within the NS energy sector
  - Previous DSM Plans, DSM Potential Studies
- DSM Potential Studies and models are *"robust and transparent…[and] their methodology for forecasting participation is industry standard best-practice"* - ACEEE

Potential Study Objectives

- Inform 2020 NS Power Integrated Resource Plan
  - Input for IRP modelling processes
- Produce cost and savings (energy and demand) profiles for several different DSM scenarios over IRP period (2021-2045)
- Allows selection of DSM resources to meet future energy and capacity needs of NS electricity system
  - Scenarios to be achievable, cost-effective in IRP context

Types of Potential



Potential Study Scope

- Produce differing scenarios of energy efficiency (EE)-based DSM activity
  - Intent is to cover a wide range of activity levels, and associated cost and savings profiles
  - Based on commercially-available measures
  - Savings represent expected results after adjusting for ongoing baseline changes
    - Codes and Standards
    - “Natural” energy efficiency (i.e. evolving consumer technology preferences and behaviour)

Potential Study Scope Cont.

- Produce differing scenarios of Demand Response (DR)-based DSM activity
  - Cover differing activity levels
  - More challenging than EE, due to less NS historical experience
  - Variety of program types contemplated
    - Direct load control
    - EV charging
    - Dynamic pricing
  - Some activities anticipated to leverage AMI

Potential Study Scope Cont.

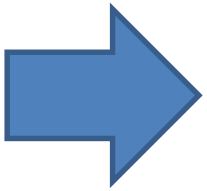
- Both EE and DR potential studies examine diverse customer segments and end-uses
  - Within EE, differentiation for Low-Income, First-Nations populations
  - Different sizes and types of BNI customers examined
  - All major end-uses captured

Potential Study Modelling

Inputs & Outputs

Inputs

- Forecasts
  - NS Power load forecast
  - Account forecasts
- Measure level inputs
  - Fuel shares
  - Density/saturation
  - Energy/demand savings
  - Codes & standards
- Global Inputs
  - Inflation rate
  - Avoided costs
  - Retail rates
  - Line loss factors



Outputs

- Electric energy impact (GWh)
- Peak demand impact (MW)
- Water savings
- GHG reductions
- Costs

Represented by

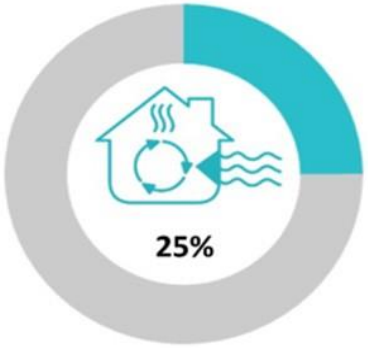
- Sector
- Segment
- End-use
- Years (2021-2045)

Baseline Study

- Purpose:
  - Obtain density and saturation of DSM measures
  - Develop payback acceptance curves
- Online surveys conducted in April/May by Narrative Research
- Completed surveys:
  - 1,000 residential
  - 200 business, non-profit, institutional
- Key demographics in survey match NS demographics (age, gender, region)

Baseline Study

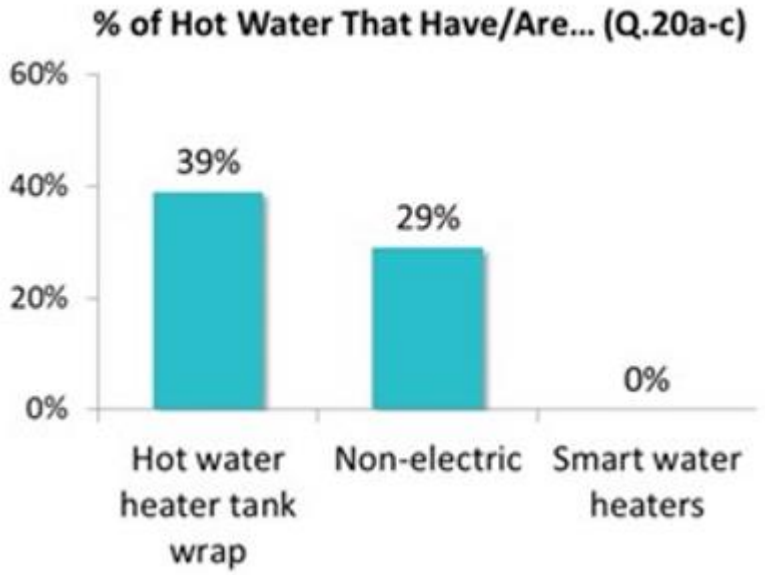
Key Results: Residential

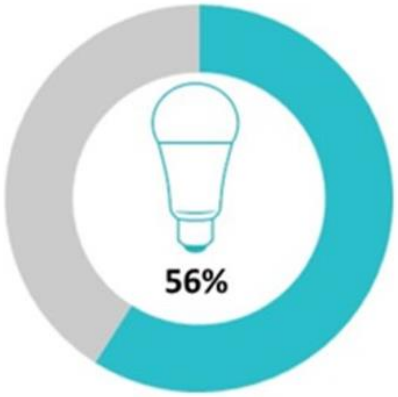


25% of respondents have one or more **mini-split heat pumps** (Q.26)

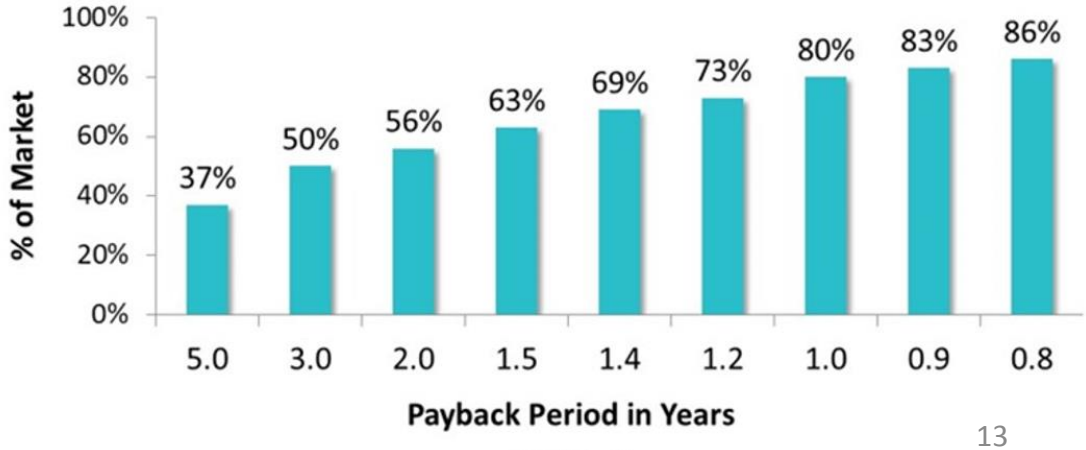
19% have 1
6% have 2+

Of all thermostats, **8%** are **programmable** (Q.28b)





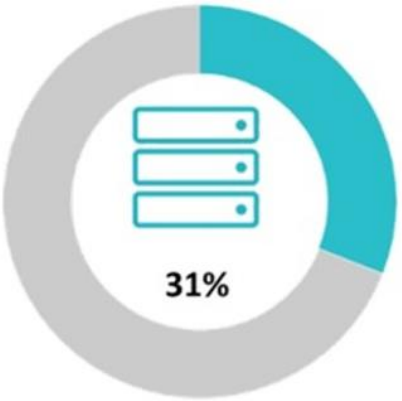
Of all light bulbs, **56%** are **LED** (Q.31b)



(Q.34a-i)

Baseline Study

Key Results: BNI

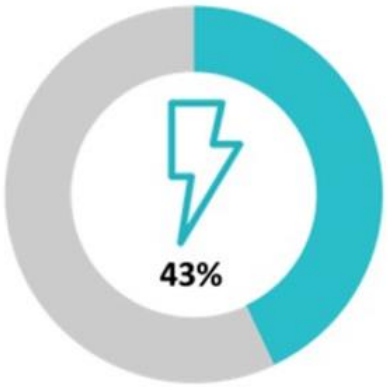


Of all computer servers, **31%** use **virtualization and decommissioning** (Q.6+7)

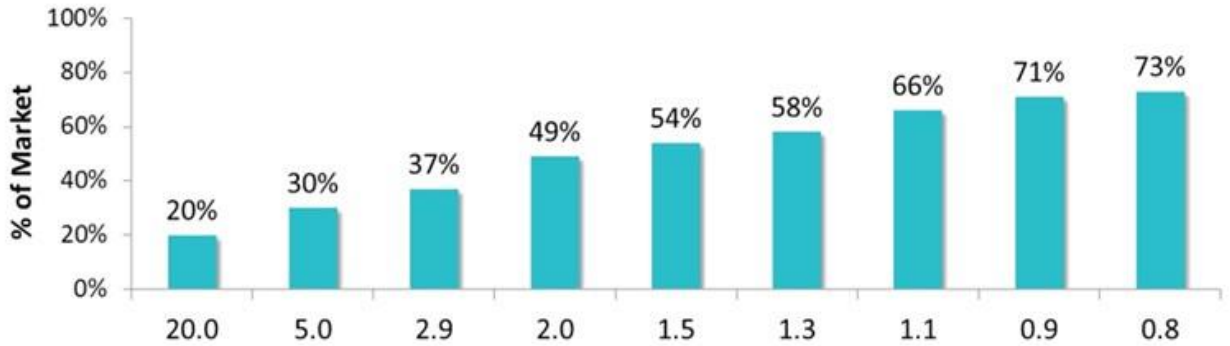
70% of businesses have **general service LED lights** (Q.15f)

60% of businesses have **linear lighting LEDs** (Q.15a)

29% of businesses have **occupancy sensors** (Q.17)



Of all HVAC, refrigeration equipment or appliances, **43%** use **EC motors** (Q.13+14)



(Q.23a-g)

Work Completed

- Final Baseline Study
- Pre-modelling work associated with EE and DR Potential Studies
- Three DSMAG engagement sessions
  - Scope of work
  - Assumptions and modelling document
  - Baseline study and additional assumptions
- Navigant currently performing modelling activities

Next Steps

Activity	Date
Release of draft Potential Study report to DSMAG	July 12
DSMAG Technical Conference on draft Potential Study report	July 16
End of DSMAG review period	July 26
Release of final Potential Study report to DSMAG	August 2
File final documents with NSUARB	August 14

Appendix

EE Potential Study Methodology Steps

1. Develop base year, define customer segments, define end-uses, model base year consumption, develop reference case, compile global assumptions
2. Develop disaggregated energy sales forecasts for Nova Scotia for the period 2021-2045 (25 years), with forecasts broken out by customer segments and end-uses
3. Define and characterize energy efficiency measures, and screen measures for cost-effectiveness
4. Calculate potential savings for all measures, with technical, economic and achievable potential for 2021-2045 (25 years)

EE Potential Study Methodology

Segmentation

Category	Sub-Categories
Sector	• Residential (with low-income treated as a subcomponent) • Business, Non-Profit and Institutional (all non-residential customers)
End-Use	• Cooking and Laundry • Electronics and Information Technology (IT) • Domestic Hot Water (DHW) • Heating, Ventilation and Air-conditioning (HVAC) • Lighting • Refrigeration • Process • Energy Management • Other
Building Type	• Single-Family Market Rate • Multi-Family Market Rate • Single-Family Low Income • Multi-Family Low Income • First Nations • Small Commercial • Large Commercial • Institutional • Industrial
Region	• Based on first three characters of postal codes

EE Potential Study Methodology

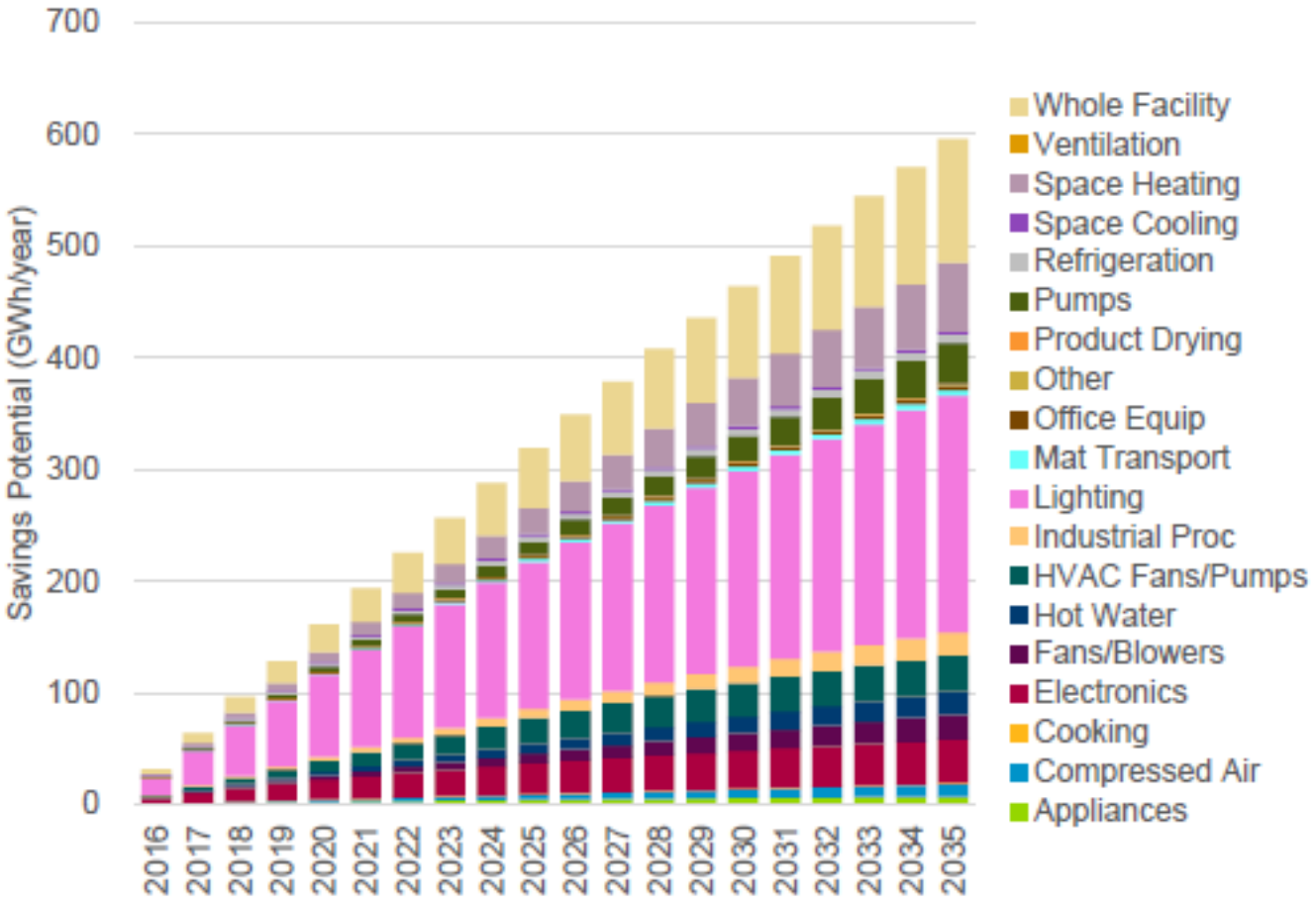
Model Inputs

Input Parameters	Source
Load Forecast • Energy forecast • Demand forecast	NS Power forecasts
Customer Accounts Forecast	NS Power forecasts
Customer Demographics	NS customer surveys and other primary and secondary sources
Measure-level inputs • Fuel Shares • Equipment Shares • Saturations/Densities • Energy/Demand Savings • Codes & Standards	• Nova Scotia end-use surveys • Nova Scotia program evaluation reports • Statistics Canada and NRCan data • Past potential studies
Global Inputs • Inflation rates • Discount rates • Avoided energy and capacity costs • Retail rates • Line loss factors • Non-energy impacts	• Inflation rate forward target of 2% - Bank of Canada • 2019 Approved WACC/AFUDC rate for Discount Rate • "Base-DSM" Avoided Costs from 2014 IRP, with 2018 estimate of T&D avoided costs from NS Power • 2019 Retail Electricity Rates with 2.7% escalation – As in 2014 IRP • Line loss factors from 2014 NS Power Cost of Service Study • No Non-Energy Impacts to be included

EE Potential Study Methodology

Example Output Results

Cumulative Electric Energy Savings Market Potential by End-use (GWh/year)



EE Potential Study Methodology

Scenarios & Sensitivities

	Scenario	Description
1	Base	Model calibrated to E1 historical achievements
2	Maximum Achievable	Incentives at 100% of incremental measure cost and marketing factors increased to maximum realistic levels
3	Low	Reduced incentives and marketing factors relative to base case
4	Mid	Increased incentives and marketing factors relative to base case and lower than maximum achievable
5	PAC screening	Base case calibrated model with Program Administrator (PAC) measure screening instead of Total Resource Cost (TRC) Test measure screening

	Sensitivity Variable	Range
1	Avoided Costs	25%
2	Incentives	25%
3	Discount Rates	25%
4	Carbon Price	$0 - $50
5	Achievable TRC Screen	-25% only
6	Marketing	25%
7	Incremental Costs	25%

DR Potential Study Methodology

1. Characterize market for DR potential by quantifying the number of eligible customers and estimating coincident winter peak load by customer class over the 25-year study period (2021 – 2045).
2. Define and characterize DR options and map applicable options to relevant customer classes and/or building types.
3. Develop participation levels, unit load reductions and cost assumptions for each DR option, by customer class and building type combination.
4. Present potential estimates by DR option, customer class and building type; annual and levelized costs; and cost-effectiveness results.
5. Conduct scenario analysis and present the range of DR potential, cost and cost-effectiveness results for each of the scenarios.

DR Potential Study Methodology

Segmentation

Level	Description
Sector	• Residential • Business, Non-profit and Institutional (BNI)

Segment	• Residential
	  • Market Rate
	  • Low-income
	• Small Commercial (Small, General Commercial)
	• Large General
	• Small Industrial
	• Large Industrial (Medium, Large Industrial)
	• Large Industrial - Interruptible

End Use	• Residential: space heating, electric water heating, electric vehicles, batteries • BNI: HVAC, electric water heating, lighting, industrial processes, electric vehicles, batteries

DR Potential Study Methodology

Programs

DR Options	Description	Customer Classes	Targeted End Uses
Direct Load Control (DLC) ✓ Thermostat ✓ Load Control Switch	Control of electric loads by a thermostat and/or load control switch	Residential Small Commercial Small Industrial	Heat pump, electric furnace, HVAC, hot water
C&I Curtailment ✓ Manual ✓ Auto-DR enabled	Firm capacity reduction commitment $/kW payment based on contracted capacity, plus $/kWh payment based on energy reduction during an event	Large Commercial Large Industrial Interruptible	Various load types including- HVAC, lighting, water heating, industrial process loads
Electric Vehicle Charging Control ✓ Auto-DR enabled	Managed charging of electric vehicles for peak demand reduction	All	Electric vehicles

DR Potential Study Methodology

Programs Cont.

DR Options	Description	Customer Classes	Targeted End Uses
Behind the Meter (BTM) Battery Storage	Use of BTM batteries for load shifting and/or curtailment during peak demand periods	All	BTM batteries
Dynamic Pricing	Critical peak pricing Opt-in and opt-out options	All	All
Behavioural Demand Response	Customer adjusts energy use based on DR event notifications	Residential	All

DR Potential Study Methodology