GIWH Product Development

2013 ACEEE Hot Water Forum

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Presentation Outline

Introduction
• Overview of NB Power and water heater program

Discussion
• PowerShift Atlantic, objectives, and learnings with focus on water heater program.
• Reduce and Shift Demand and requirement for a collaborative development of a domestic thermal storage and water heating device.

Questions
Connected to Atlantic Canada, Quebec and New England

Wind Generation
- NB – 294 MW
- NS – 317 MW
- PEI – 164 MW
- Total – 800 MW

Canada – 6000 MW

(Peak – 3100 MW)

(Peak – 2000 MW)

(Quebec – 1057 MW)

NB – 294 MW
NS – 317 MW
PEI – 164 MW
NFLD – 55 MW

5511 MW

3543 MW

Total
Current Water Heater Program

- Over 40 years of experience with approximately 240,000 water heaters across the province
  - 40 imp. Gallon: (80% of total), Rental rate = $6.14 / month
  - 60 imp. Gallon: (20% of total), Rental rate = $7.95 / month
    (Among lowest rental rates in Canada)

- Program includes
  - 24/7 service, installation, maintenance, replacement, & disposal

- Replacement of 6,000 - 10,000 tanks / year due to
  - Failure, or age of tank is (>15 years)
What is PowerShift Atlantic

joint energy demonstration project in the Maritimes

Canada
New Brunswick
Prince Edward Island
Énergie NB Power
Nova Scotia Power
Saint John Energy
Maritime Electric
UNB
Among the Highest Wind Penetration

- Total Peak Load: 5350 MW (Approx.)
- Total Wind Generation Capacity: 825 MW (Approx.)
- Total Minimum Load: 2000 to 2200 MW (Approx.)

- Peak: 3000 MW
  - Wind: 294 MW
- Range: 1000 MW
- Peak: 2000 MW
  - Wind: 316 MW
- Maximum: 294 MW
- Minimum: 42 MW

- Peak: 2000 MW
  - Wind: 165 MW
- Range: 800 MW
- Peak: 150 MW
  - Wind: 42 MW
- Range: 1000 MW
Real Time Dispatchable Load

Supply dispatch relies on “generation following the load” while demand dispatch allows for “load to follow generation” enabling full optimization of both supply and demand.

USDOE – Demand Dispatch – Intelligent Demand for a More Efficient Grid - August 10, 2011

SUPPLY - GENERATION

DEMAND - LOAD

Generation = Load

Generation + ΔWind = Load (+/- Δ Load)

RENEWABLE ENERGY (WIND) IMPACTS THE ABILITY TO MANAGE SUPPLY CREATING THE NEED TO MANAGE DEMAND
Building a Virtual Power Plant

System Operator

Virtual Power Plant

AGGREGATED LOAD (3 classes)

Energy Management Systems

Direct Load Management

Electric Thermal Storage

Customers
VPP Functions

• Primary Function: Assist SO with balancing the grid (Load Shape Management)
  – Reduce the effects of wind generation variability on the system by optimally smoothing the overall forecast shape

• Secondary Function: Provide the equivalent of a 10 minute spinning reserve ancillary service
  – Can be called upon at any time
  – Available within 10 minutes and sustained for 60 minutes

……. Currently in our last year of PSA. Can we take a product that was designed to better integrate wind energy and use it to meet different objectives…. 
What is Reduce and Shift Demand

10YR

Collaborative Smart Grid Modernization Plan
Objectives of RASD

• Customer
  – To achieve success, we need buy in from the customer.
  – Low and stable rates
  – Improved reliability

• Environment
  – More efficient use of current energy sources & less emissions

• NB Power
  – Fuel cost savings for NB Power plants
  – Reduced NB Power purchase requirements
  – Capacity Deferral – defer costs associated with new generation
Peak for 2013: (-32 °C wind chill) Peak of 3117 MW

Oil fired units were required to cover this peak

Peak 3117 MW (Thurs 7-10 am)

2850 MW (Wed – supper time)

Valley 2460 MW (2-3 am)
Typical Household Electricity Usage in N.B.
Goal

Develop a prototype dispatchable thermal storage and water heater device.
Components of the Product

- Temp Sensors
- Heater Controller
- 220 VAC
- Leak Sensor
- Attemperating Valve
- Expansion Tank
- Discharge Temp Sensor
Control Concept
Role of Home Controller vs Water Heater

Global Load Management and a data interface portal

Energy Management and smart grid functions

Mandatory functions for safety and capable of operating autonomously

Integrated Load Management (ILM)
Design Goals Summary

- Product consistent with our quality of service
- Simple and reliable electronics and instrumentation
- Easy to install
- Safe
- Serviceable – Minimum truck rolls
- Can run either in managed or autonomous modes
- Cost effective - existing program, tank lifecycle as benchmark
Timeframe for the Project

• Execute initial pilot to demonstrate capability of peak shift of 30 kW of demand in the spring of 2014

• Pilot program may be expanded to reach 3 MW of peak shifting capacity in 2014-2015

• Possibility of expanding to a full replacement program by 2015
Questions??