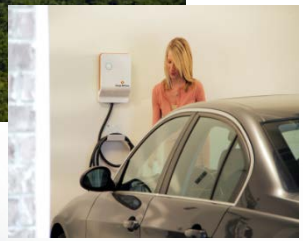
Engaging Customers in Smart Grid Technology



www.powershiftatlantic.com

POWER SHIFT ATLANTIC ATLANTIQUE

An energy research project • Un projet de recherche sur l'énergie

Michel Losier, Program Director, New Brunswick Power
Praveen Rosario, Systems Integration Lead
July 2, 2014

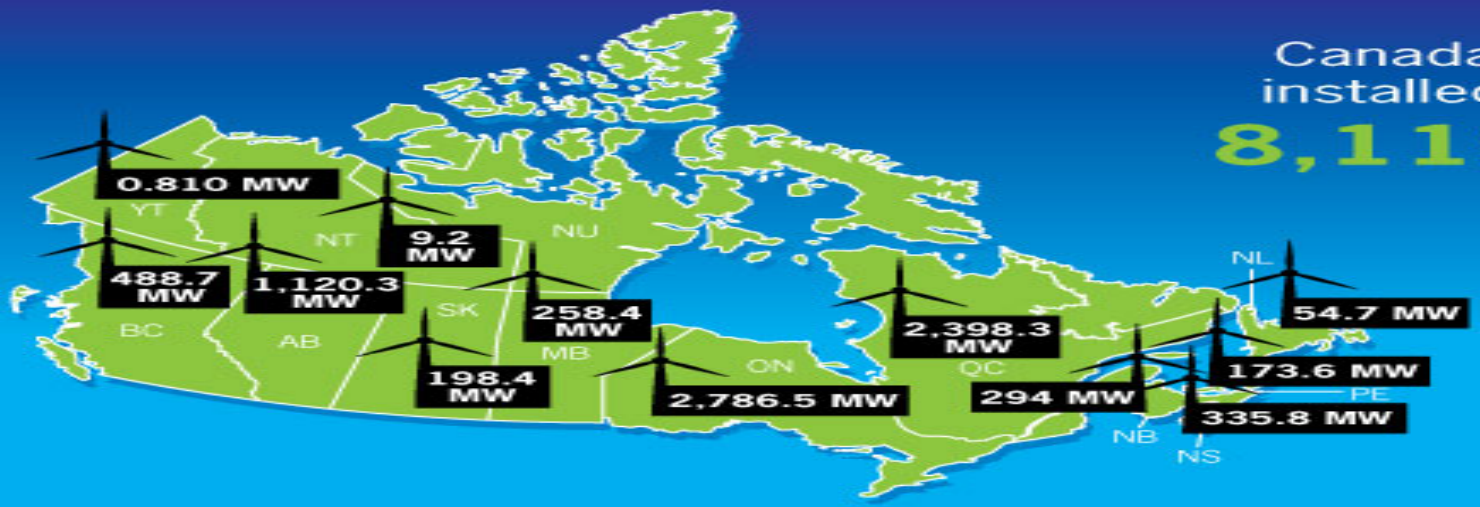
Énergie NB Power

Natural Resources Canada Ressources naturelles Canada

Canada

PowerShift Atlantic

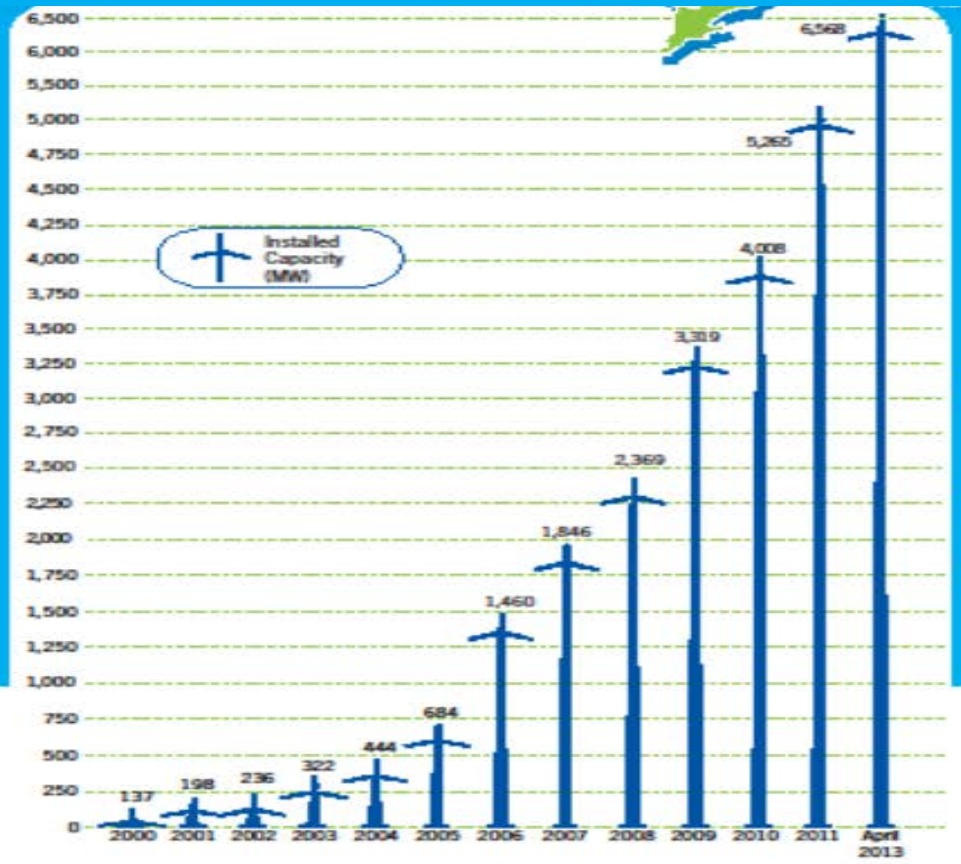
Wind Integration via Load Shifting



Canada's current installed capacity:

8,119 MW

(as of May 2014)



Across Canada, electricity generated from wind is already powering over 1.5 million homes and businesses in a clean, reliable and efficient manner. With Canada's unparalleled wind resource, there are still opportunities to do more to maximize the economic, industrial development, and environmental benefits associated with wind energy for Canada.

- The wind energy industry installed 936 MW in 2012 with new projects commissioned in British Columbia, Alberta, Ontario, Manitoba, the Northwest Territories, Quebec and Nova Scotia
- Canada will see an average of 1,500 MW of new projects commissioned annually over the next four years
- Creating 68,000 additional person-years of employment and attracting $15 billion in new investment

canwea

www.canwea.ca

Project Vision and Goals

Determine if shifting patterns in energy consumption through load shifting can enable utilities to more effectively integrate renewable energy such as wind

- Is load shifting cost effective and reliable?
- How load shifting performs in sync with system balancing & forecasted wind power
- Understand the customer's role with new smart grid technology

PSA Participants

Canada

Énergie NB Power

New Nouveau Brunswick
Be...in this place • Être...ici on le peut

Prince Edward Island
CANADA

MARITIME ELECTRIC
A FORTIS COMPANY

NBSO ERNB

Saint John Energy

UNB

PM and Integration

Stantec

Accreon
advantage... you

leidos

Aggregators

STEFFES CORPORATION

INTEGRAL ANALYTICS

UNB

enbala POWER NETWORKS

End-Use Connectivity

SEQUENTRIC™
Smart Grid Technologies

Dimplex®

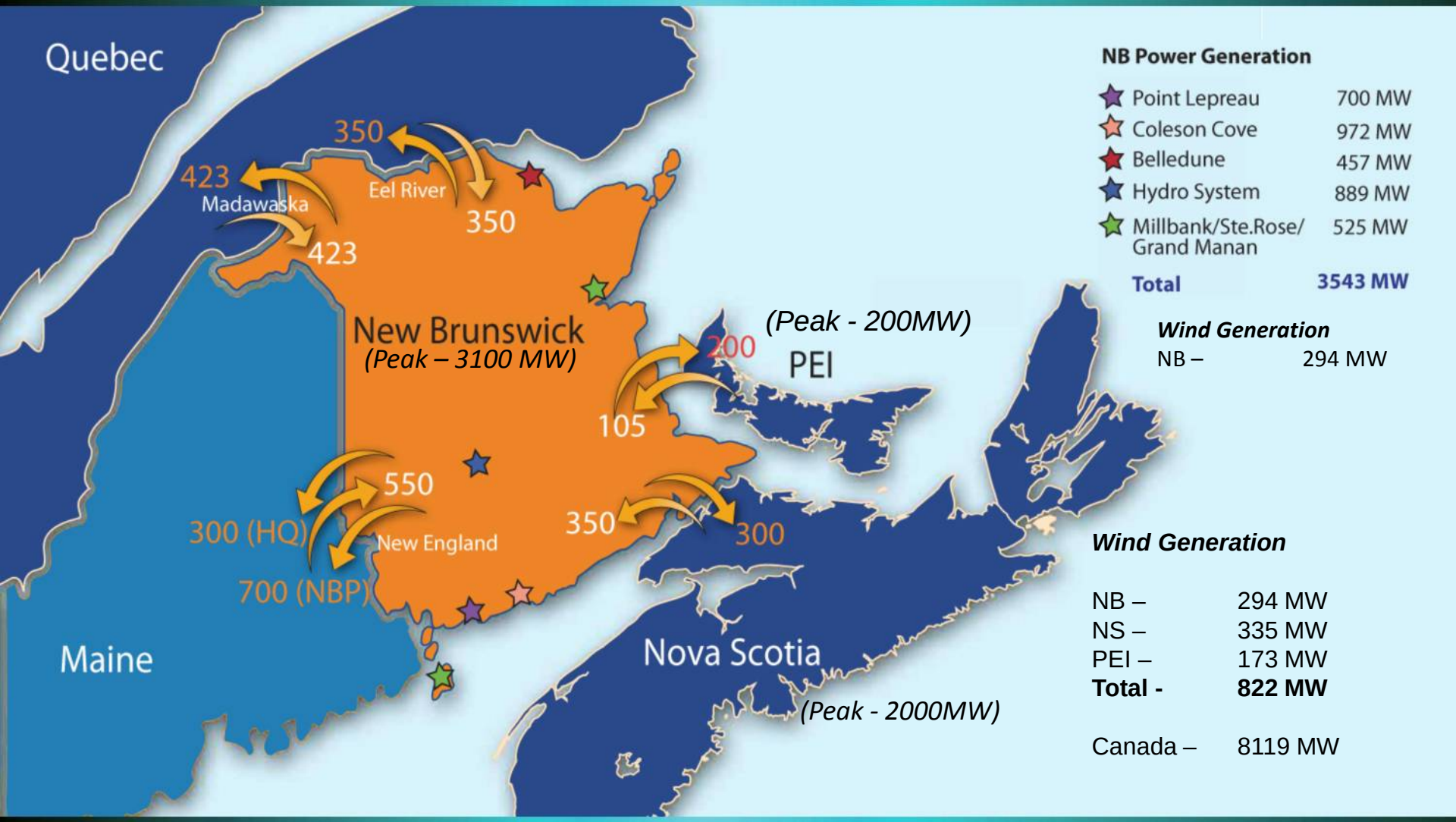
Tantalus

BellAliant

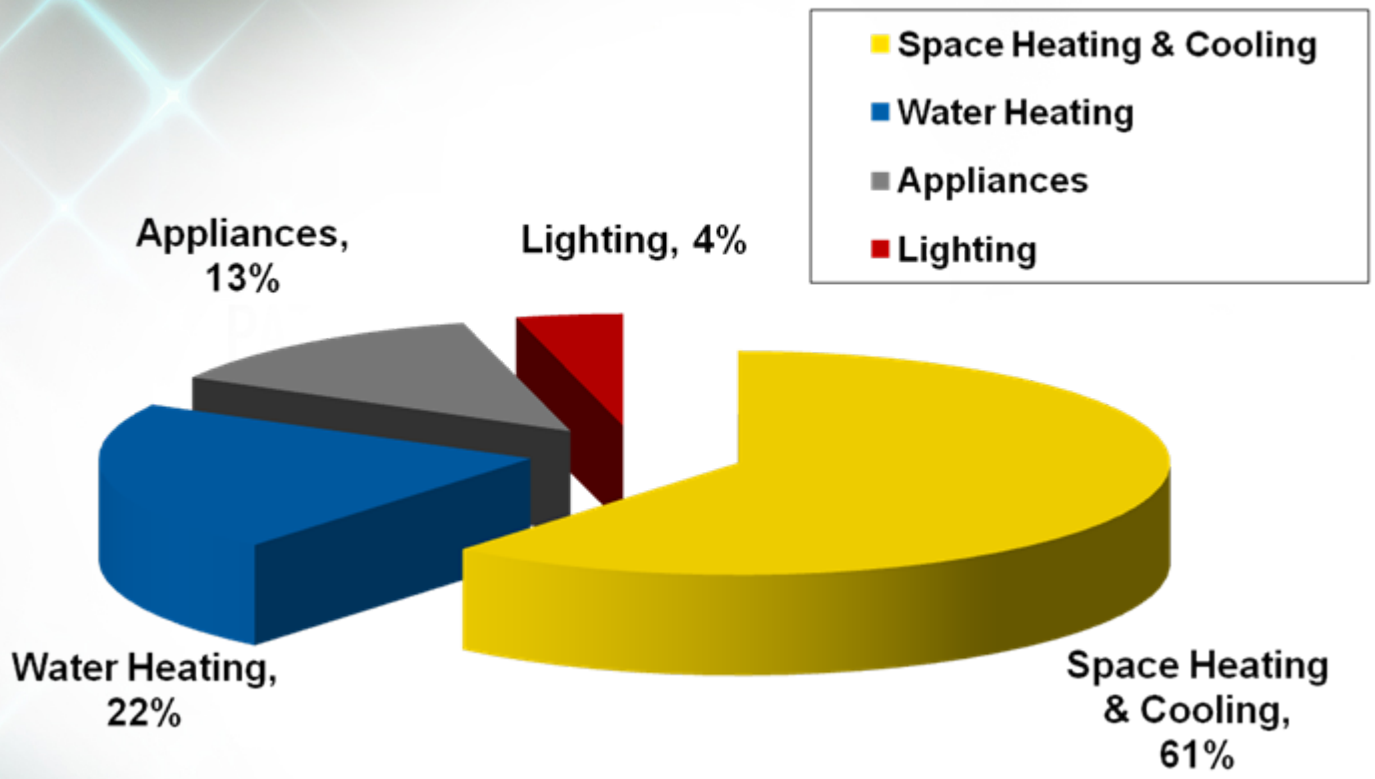
STEFFES CORPORATION

enbala POWER NETWORKS

NB Power and Atlantic Canada



Typical Household Energy Usage – New Brunswick



Énergie NB Power

Virtual Power Plant – Intelligent Load Management

Original VPP Concept

Currently, generation controlled and managed to meet customer demand

Power Generated = Power Consumed (Customer Demand)

Integration of Wind Energy to Supply

Conventional Generation + Wind Generation = Customer Demand

Initial Concept:

- *Perform a "Wind Following" service using load shifting*

Research Outcomes:

- *This could cause additional system demand peaks, stressing the electrical grid further*

Implemented VPP Design Concept

Actual Requirement:

- Optimize to net system forecasted load minus net wind generation forecast

VPP will reduce strain on conventional generation and the grid as wind generation is integrated

Conventional Generation = Customer Load Demand - Wind Generation

Controllable

Partially Controllable using Load shifting

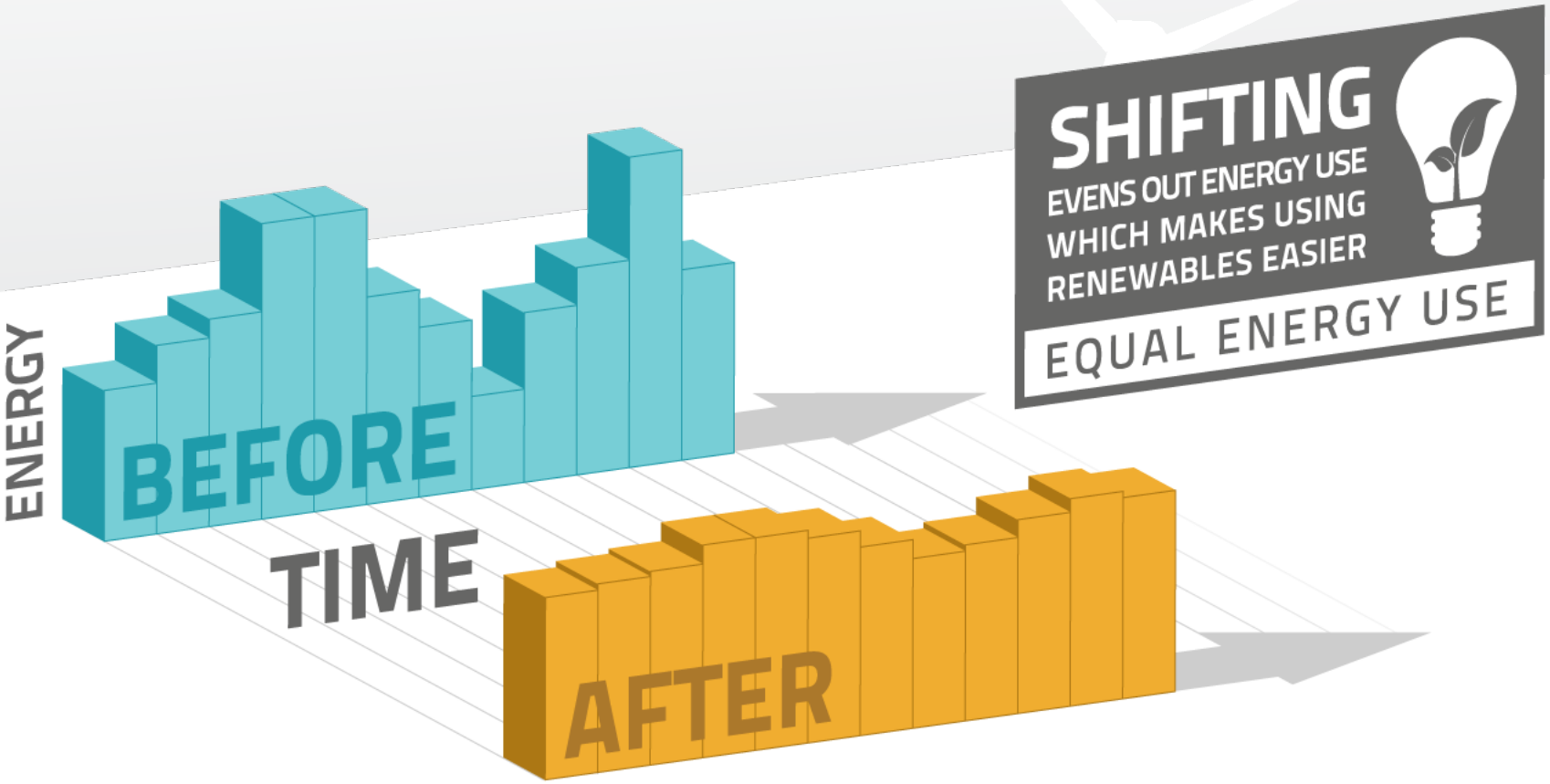
Weather dependent

The Proposed Solution

- Shift consumer load demand to reduce effects of the variability of wind generation (intelligent load management)

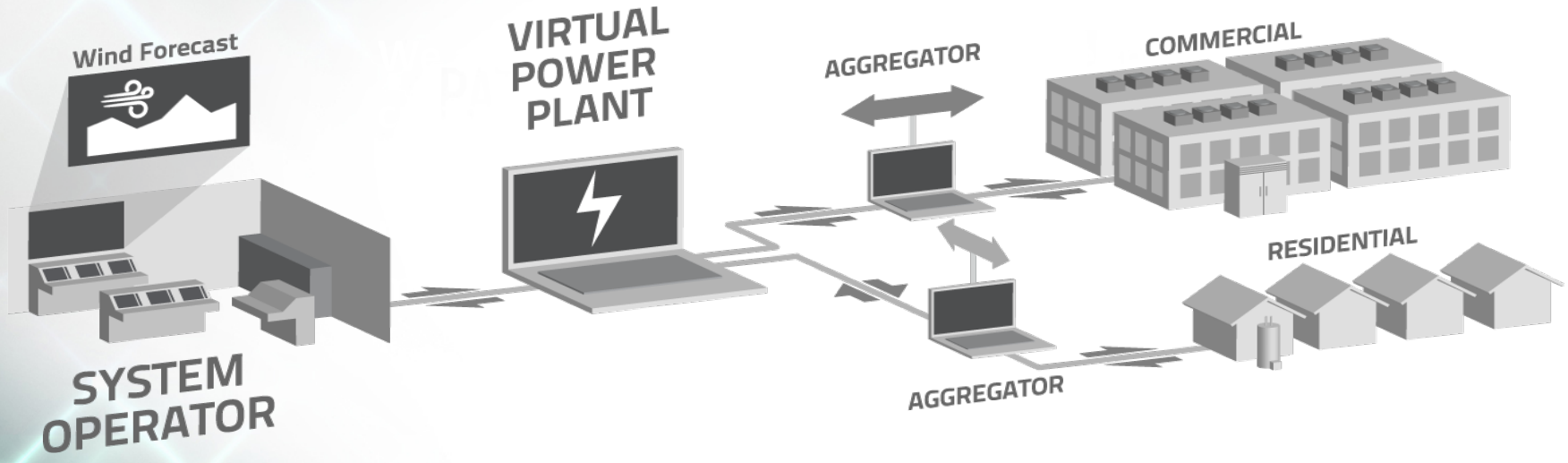
- Provide a new tool to allow the SO to more easily and efficiently balance the power grid

“SHIFTING” = INTELLIGENT LOAD MANAGEMENT



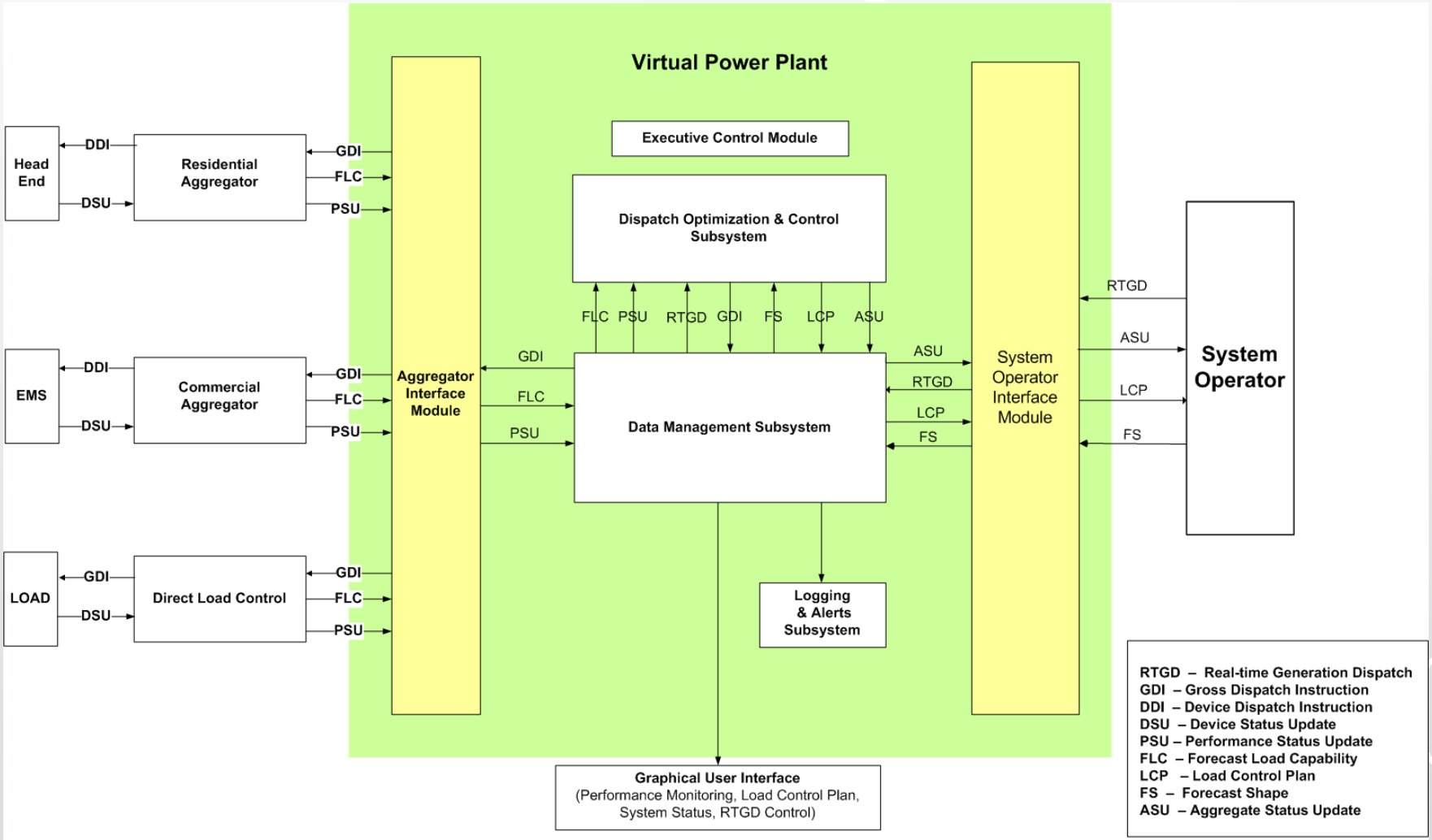
VIRTUAL POWER PLANT

Intelligent Load Management – engaged customers and new technology solutions



Énergie NB Power

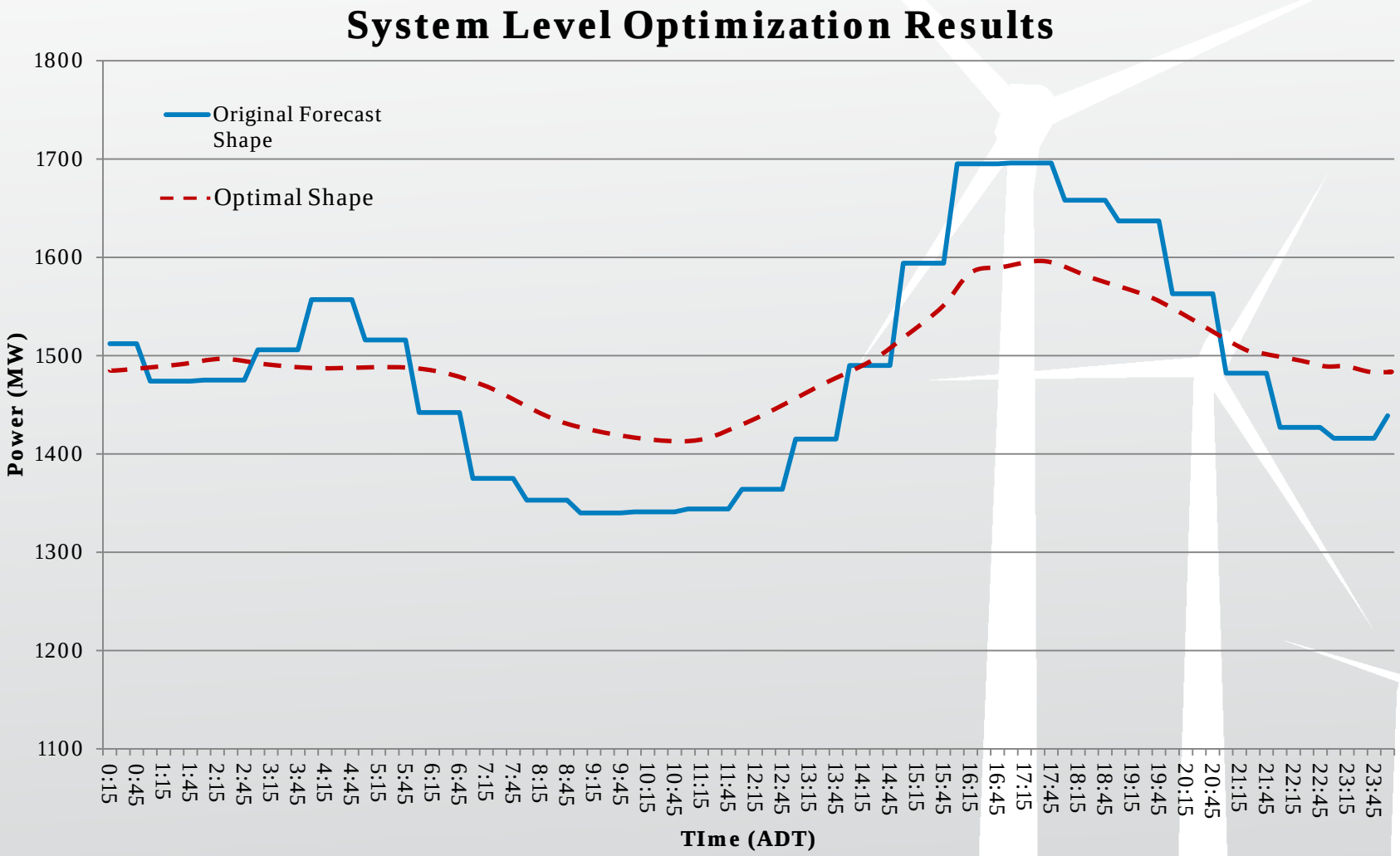
System Architecture



VPP Functions

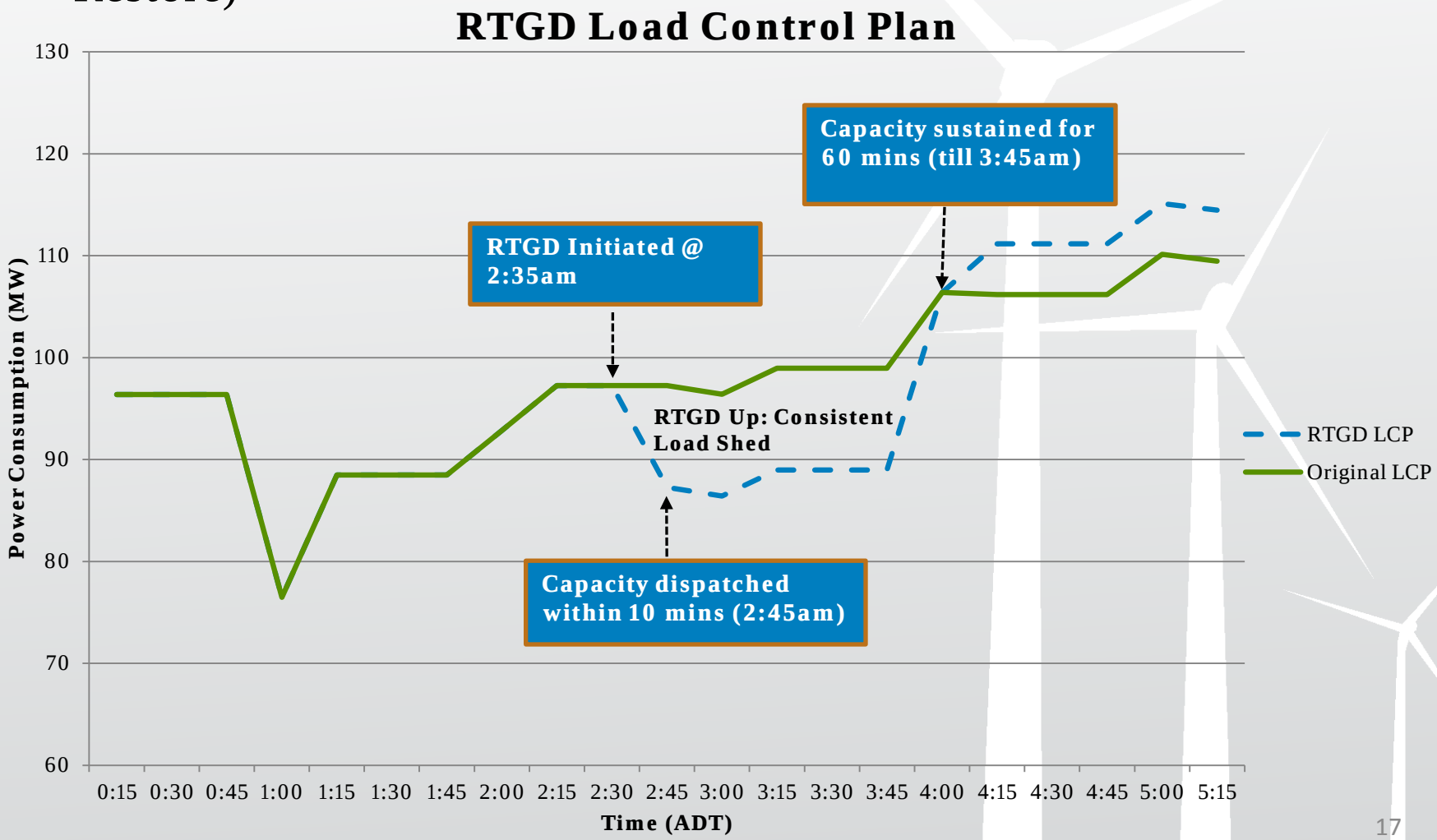
- Primary Function: Assist the system operator's job of balancing the grid (Load Shape Management)
  - Reduce the effects of wind generation variability on the system
- Secondary Function: Provide the equivalent of a 10 minute spinning reserve ancillary service (RTGD)

Load Shape Management Effects (Simulated)

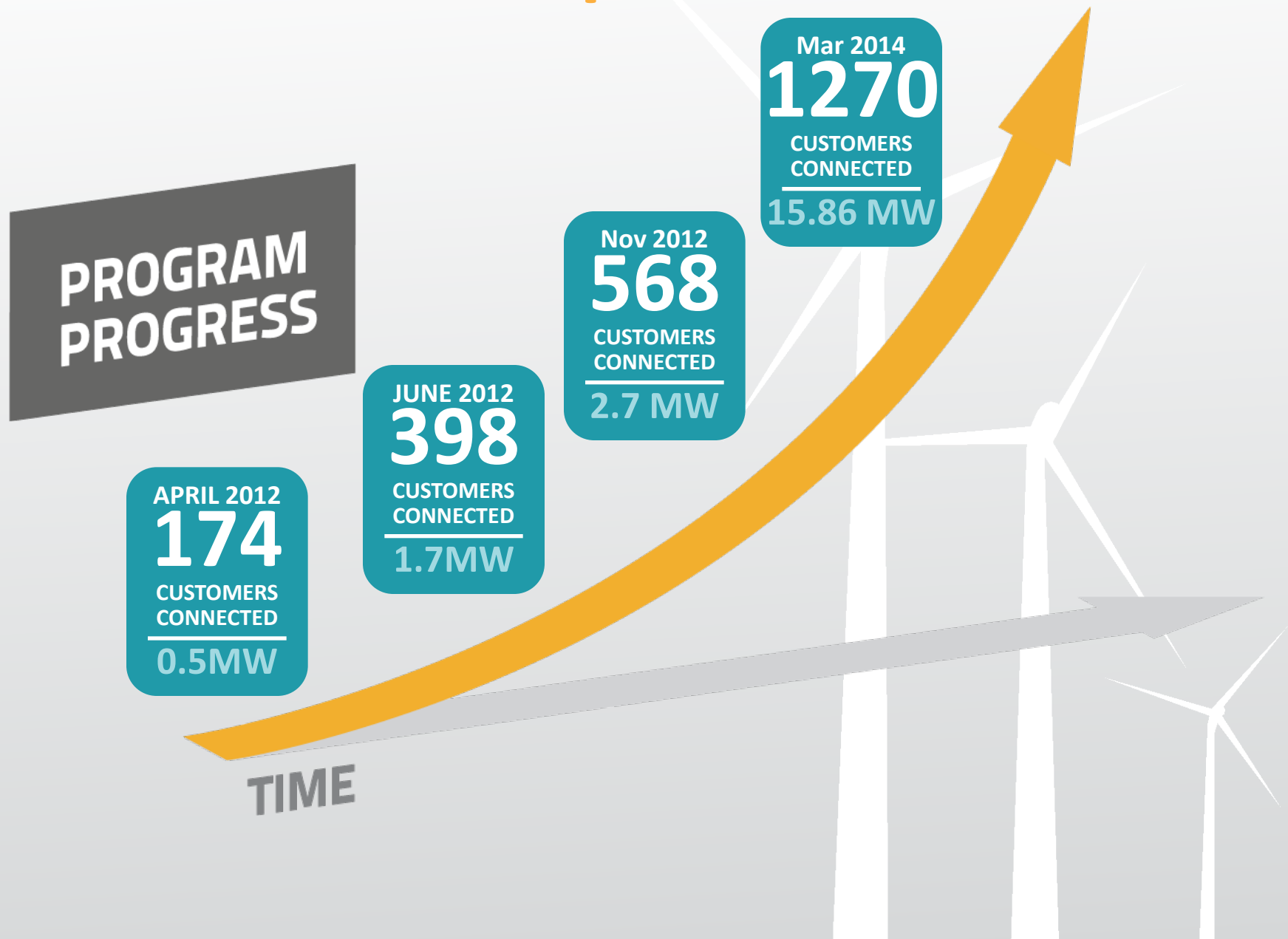


Real Time Generation Dispatch (Example)

- RTGD Up Operation shown below (Load Shed)
- Same operation in opposite direction for an RTGD Down (Load Restore)



Customer Participation



End-Uses Implemented

ETS Space Heater

Residential	Commercial	No. of Devices	MW Connected
94		147	*1.0*
	15	40	*0.18*

138		353	*0.96*

Commercial ETS

	27	86	*4.6*

End-Uses – Implemented Cont'd

enbala POWER NETWORKS

HVAC, Refrigeration, Pumping stations

Residential	Commercial	No. of Devices	MW Connected
	25	25	*5.5*

INTEGRAL ANALYTICS

UNB

STEFFES CORPORATION

Instrumented DEWH

Un - Instrumented DEWH

189		189	*0.8*
741		741	*2.5*

SEQUENTRIC Smart Grid Technologies

Tantalus

Dimplex

What did I just say?

- 1270 Customers across Maritimes 18MW (residential and commercial)
- Open architecture – common interface (inter-operability)
- Variety of end-use providers
- Variety of Aggregators
- All year round and seasonal loads

Electric Thermal Storage
In the home

Existing Baseboard

(60% of New Brunswick homes)

Electric Thermal Storage

(Potential solution for the future)

Electric Thermal Storage – In the Home

Énergie NB Power

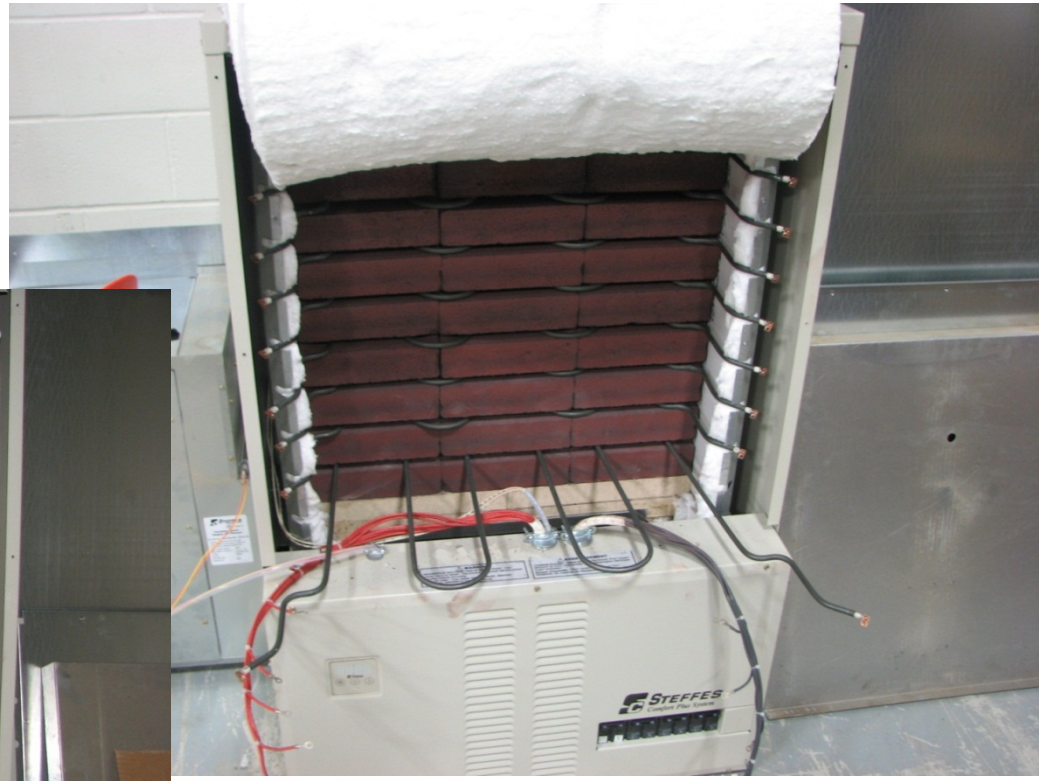
Hampton Middle School

Electric thermal storage in public buildings

NB Power's Woodstock Office

Electric thermal storage in public buildings

Electric Thermal Storage
Storing Heat in Ceramic Bricks “off peak”



A Customer Project (with Technology)

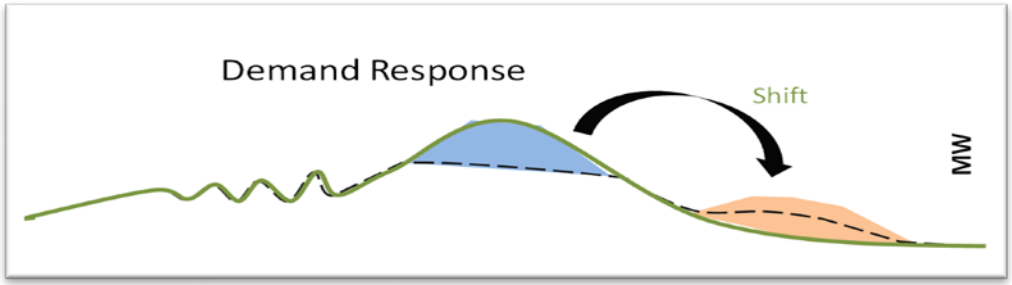
A
new Partnership with
new solutions

Énergie NB Power

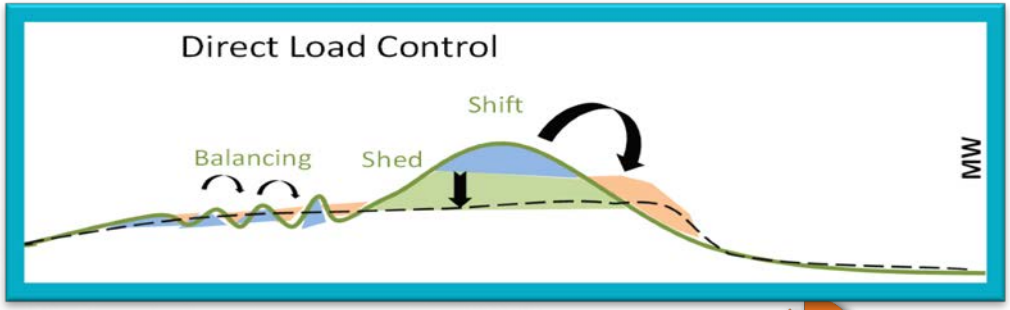
Energy Efficiency (Reduce) and Load Shifting (Shift)

Customer Issue:
Investment
(Efficiency programs)

Customer Issue:
Behaviour



Customer Issue:
Trust



Énergie NB Power

Co-branding and “Thank You” Program

Corporate Social Responsibility

Énergie NB Power

PowerShift Atlantic Recognized

"Recipient of Three major awards"

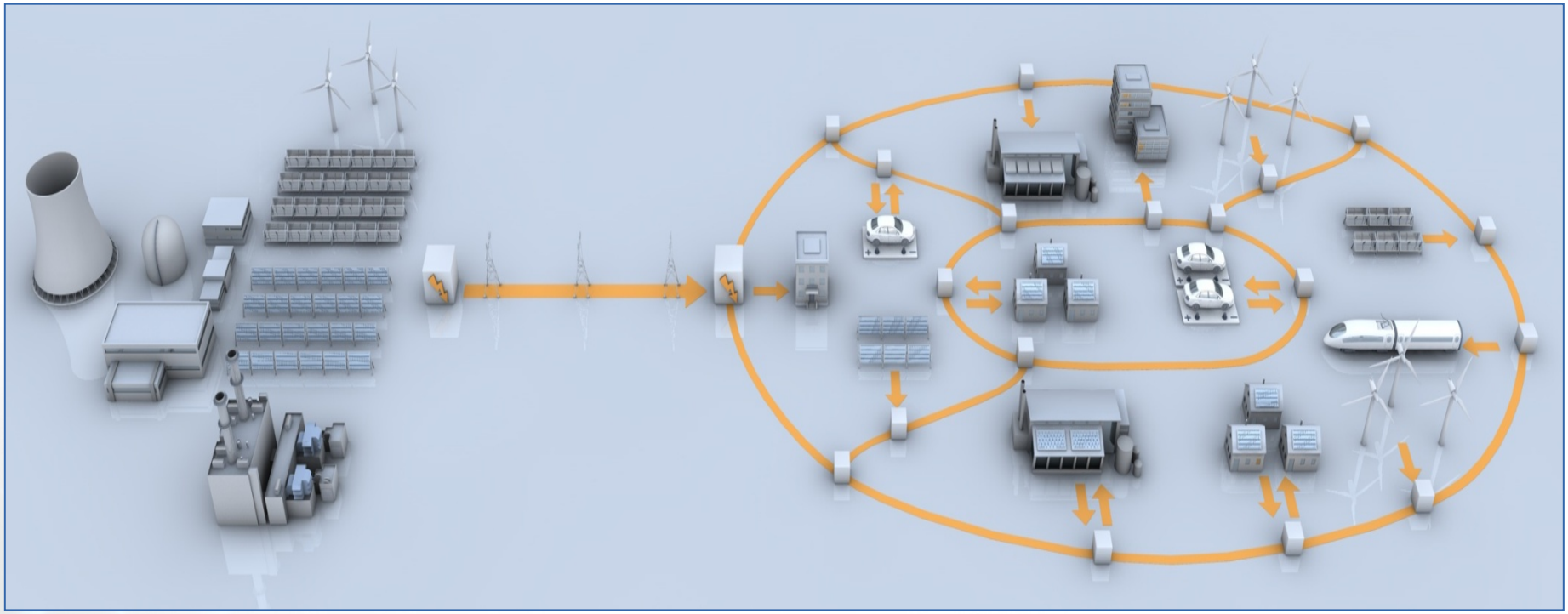
Canadian Electricity Association - Sustainability Award for Economic Excellence for 2012

Canadian Wind Energy Association – RJ Templin Award for 2012

Peak Load Management Alliance (U.S. based - Denver, Colorado) 2014 award for "Innovation in Demand Response"

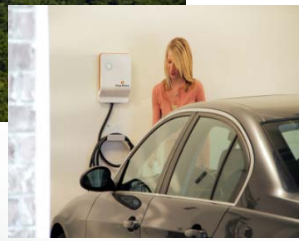
The Future

Bulk generation meets Distributed Energy Resources



Bulk Generation	**“meets”**	**Distributed Energy Resources**
Traditional Large Generation		Engaged Customers with new technologies
Hydro, Nuclear, Fossil, Wind,	“meets”	EE, DR, DG, EV’s, HAN, WAN

Engaging Customers in Smart Grid Technology



www.powershiftatlantic.com

POWER SHIFT ATLANTIC ATLANTIQUE

An energy research project • Un projet de recherche sur l'énergie

Michel Losier, Program Director, New Brunswick Power
Praveen Rosario, Systems Integration Lead
July 2, 2014

Énergie NB Power

Natural Resources Canada Ressources naturelles Canada

Canada