Canadian Technology Development in Storage and Demand Response

Distributed Energy Storage Conference

Toronto, 2012

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CanmetENERGY

Natural Resources Canada | Ressources naturelles Canada

Canada

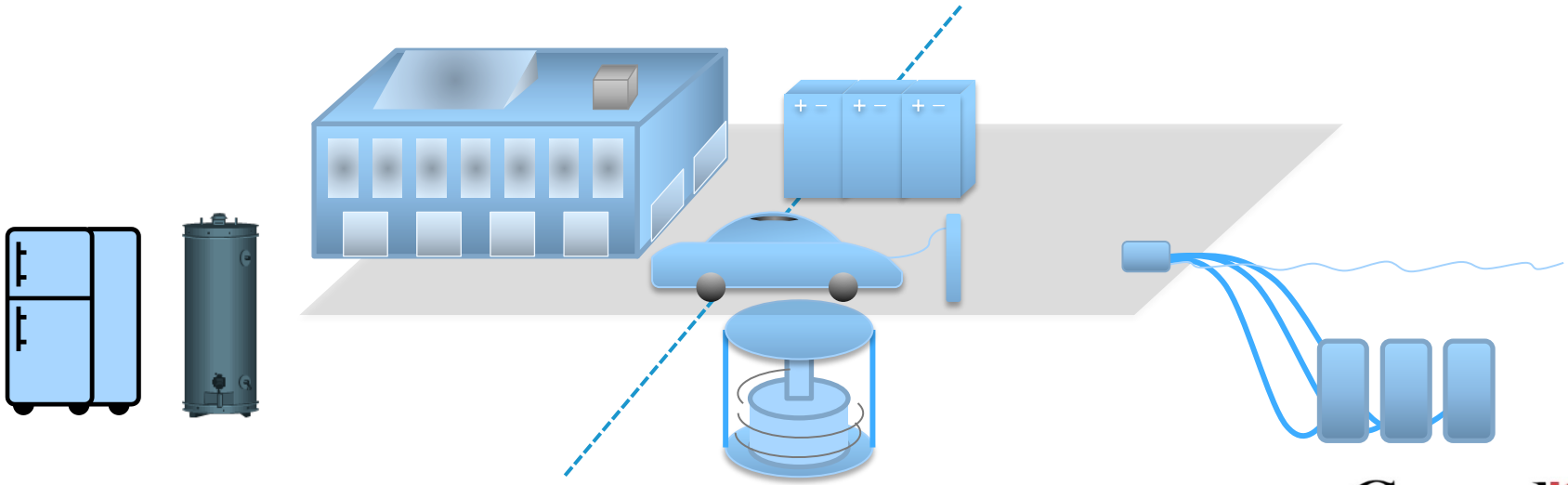
Definition for today's discussion

Demand Response / Demand-side Management/ Load Management

- Distribution system connected
- Connected loads
- kW scale that can aggregate to MW scale

Distributed Energy Storage / Microstorage

- Distribution system connected
- Connected to key points on the grid, often closer to the load
- kW scale that can aggregate to MW scale



Applications for Storage

Application	Description
Wholesale Energy Services	Arbitrage
	Ancillary Services
	Frequency Regulation
	Spinning Reserve
Renewables Integration	Wind Integration; ramp & voltage support
	Wind Integration; off-peak storage
	Photovoltaic integration; time-shift, voltage sag, rapid demand support
Stationary T&D Support	Urban & Rural T&D deferral and congestion mgt.
Transportable T&D Support	Urban & Rural T&D deferral and congestion mgt.

Application	Description
Distributed Energy Storage Systems	Utility sponsored; on utility side of meter; feeder line, substation
Comm. & Ind. Power Quality	Solutions for voltage sags and momentary outages
Comm. & Ind. Power Reliability	UPS bridge to back-up power, outage ride through
Comm. & Ind. Energy Management	Reduce energy cost, increase reliability,
Home Energy Management	Efficiency, cost savings
Home Backup	Reliability

EPRI (2010)

Highest Value Applications for Storage

Application	Description
Wholesale Energy Services	Arbitrage
	Ancillary Services
	Frequency Regulation (15 min)
	Spinning Reserve
Renewables Integration	Wind Integration; ramp & voltage support
	Wind Integration; off-peak storage
	Photovoltaic integration; time-shift, voltage sag, rapid demand support
Stationary T&D Support	Urban & Rural T&D deferral and congestion mgt.
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EPRI (2010)

Benefits from Storage

Value Chain	Benefits
Electric Supply	Electric Energy Time-shift
	Electric Supply Capacity
Ancillary Services	Load Following
	Area Regulation
	Electric Supply Reserve Capacity
	Voltage Support
Grid System	Transmission Support
	Transmission Congestion Relief
	Transmission and Distribution Upgrade Deferral
	Substation On-site Power

Value Chain	Benefits
End User/Utility Customer	Time-of-use Energy Cost Management
	Demand Charge Management
	Electric Service Reliability
	Electric Service Power Quality
Renewables Integration	Renewables Energy Time-shift
	Renewables Capacity Firming
	Wind Generation Grid Integration

Sandia (2010)

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Sandia (2010)

Benefits from Storage

Value Chain	Benefits
Incidental	Increased Asset Utilization
	Avoided Transmission and Distribution Energy Losses
	Avoided Transmission Access Charges
	Reduced Transmission and Distribution Investment Risk
	Dynamic Operating Benefits
	Power Factor Correction
	Reduced Generation Fossil Fuel Use
	Reduced Air Emissions from Generation
	Flexibility

Sandia (2010)

Benefits from Storage & Demand Response

Value Chain	Benefits
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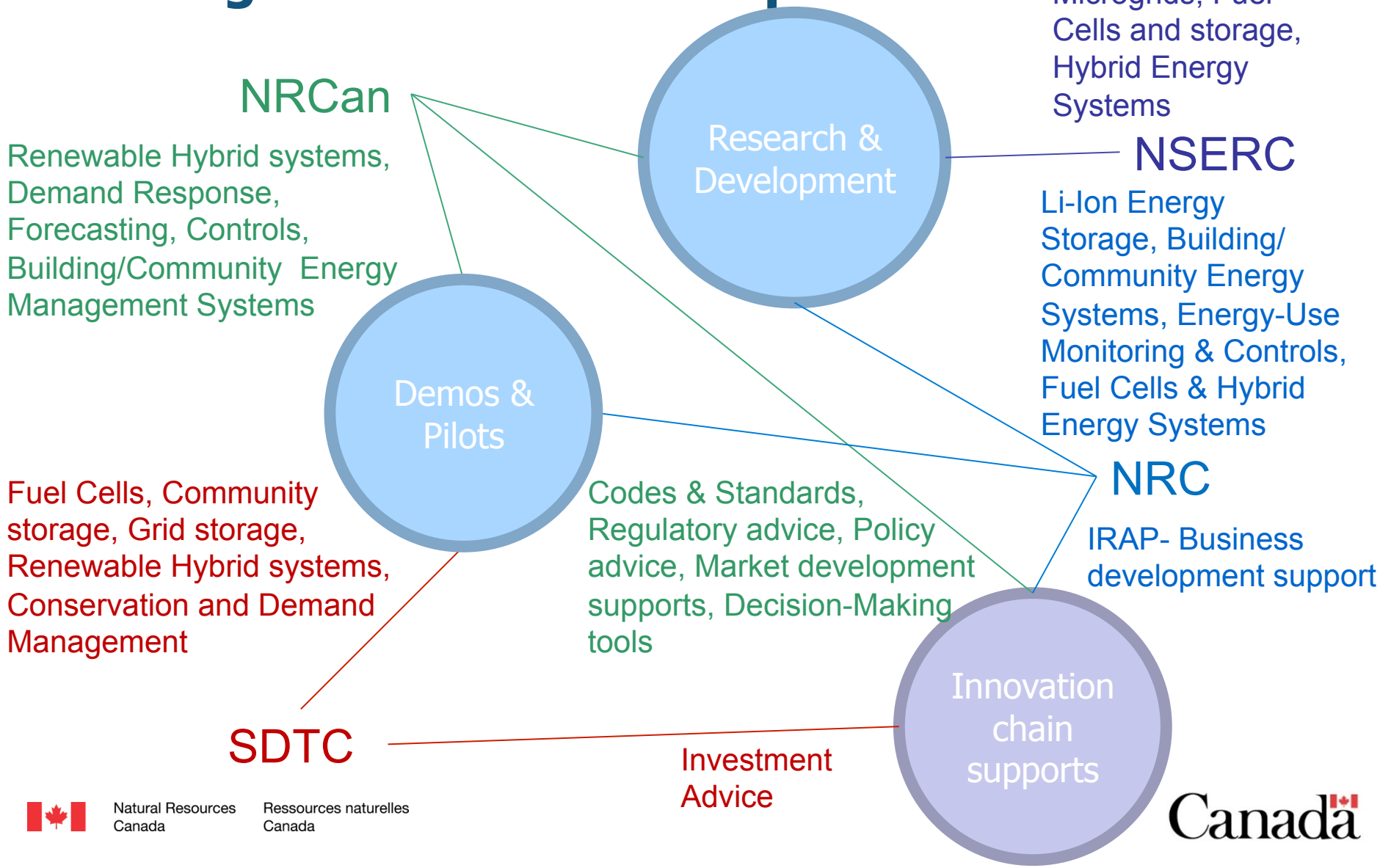
Sandia (2010)

Conventional Business Models

- Utility-owned Electric Supply Resource
- Power Purchase Agreement
- Merchant
  - electric energy time-shift
  - electric supply capacity
  - ancillary services
- End-User Electricity Cost Reduction
  - time-of-use energy cost reduction (on-peak)
  - demand charge reduction (on-peak)
  - power quality and/or reliability (backup)
  - future: wholesale market during non-peak?

Sandia (2010)

Federal R,D&D project areas relevant to Storage and Demand Response



NRCan Clean Energy Fund Storage and Demand Response Demonstration Projects

Cowessess First Nation
$5.5M project
•Saskatchewan First-nation managed wind/storage system

Storage: Ren. Integration

Storage: Ren. Integration, Energy management

Electrovaya
$7.6M Project
•1.2MW re-purposed Li-ion batteries for renewable integration and energy efficiency in urban settings

Power Measurement Ltd
$10M project
•Load curtailment and peak shaving in large commercial buildings
•Partners include Brookfield Properties, ENMAX

Storage: Ren. Integration

Demand Response: Energy management

Wind Energy Institute of Canada $25M Project
•9MW wind-based research park combined with energy storage on a weak grid

New Brunswick Power
$32M project
4 utilities involved
•Project will install monitoring and control systems in buildings in PEI,NB and NS. Load control will be driven by availability of regional wind power

BC Hydro
$13.4M project
•Installation of two 1MW storage systems at two locations to support remote and weak grid systems

Storage: T&D Deferral, Substation power

Demand Response: Ren. Integration

Storage VS Demand Response

Angelo Gravina
Vice-President,
Canadian Business Unit
S&C Electric

Opened S&C Brazil

Opened S&C Europe

EDA Commercial Members
Steering Committee

Ron Dizy
President, CEO
ENBALA Power Networks

Board Member
Ontario Energy Association

Chair
Corporate Partners Committee
Smart Grid Forum

Board Member
Association for Demand Response and Smart Grid

Why is storage important to the power system?

Why is demand response important to the power system?

Point of Debate 1:

Whereas storage is not tied to any other service or function (as demand response loads are)…

…be it resolved that storage is more flexible and thus more capable than demand response in supporting the integration of renewable generation.

Point of Debate 2:

Whereas demand response capacity can be captured from already existing or necessary equipment (loads) already in place…

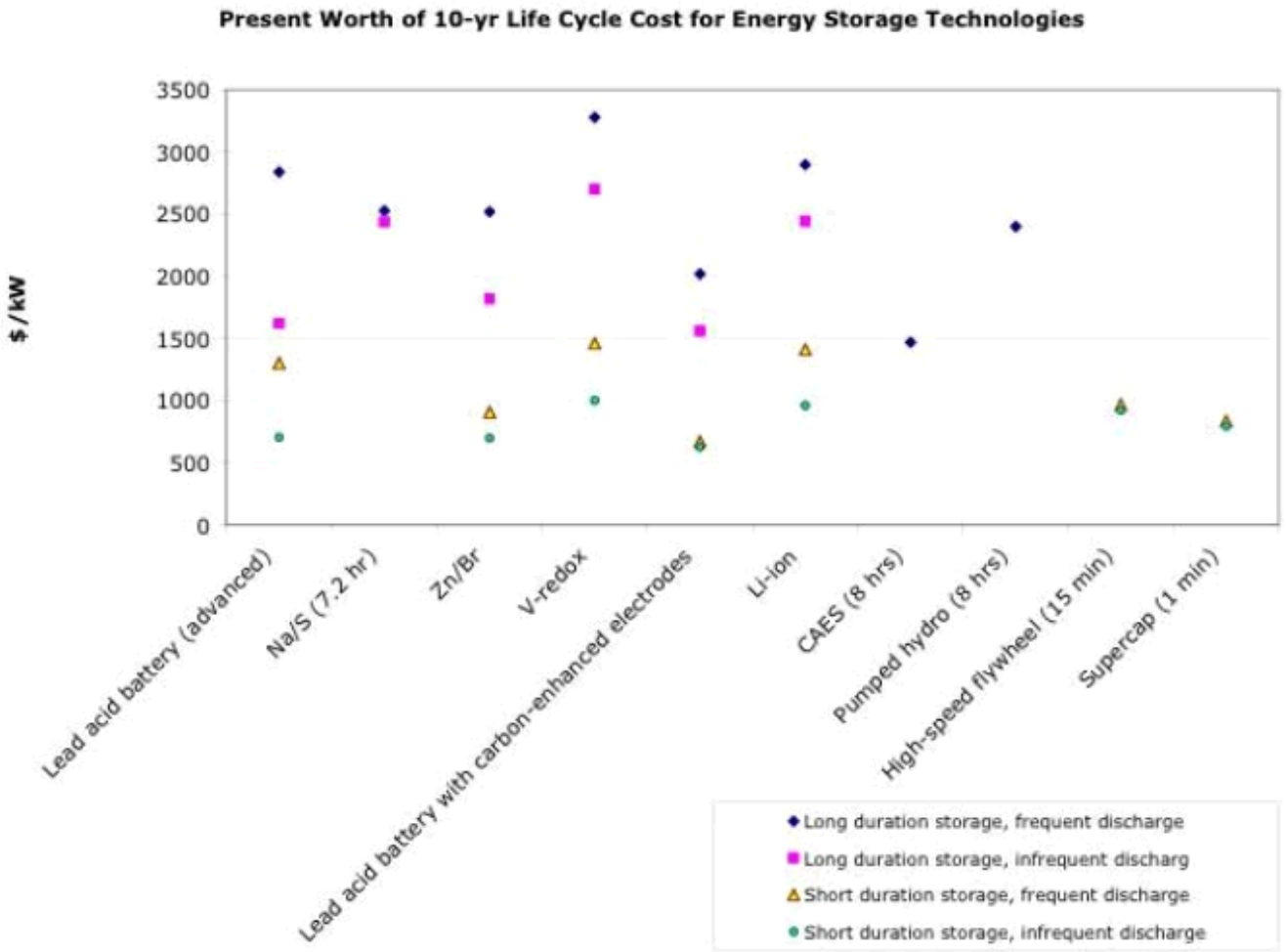
…be it resolved that demand response is a more cost effective option for providing support services (e.g. load following, ramping, frequency response) to the grid than electrical storage.

Point of Debate 3

Whereas many storage technologies are still in the developmental phase…

…be it resolved that DR be the focus of deployment funding while storage be the focus of R&D and demonstration funding.

Present Cost of Storage



PC of 10yr operation in year 1:

$626 $/kW → $3280 $/kW

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