Energy Storage and Energy Policy Regime Change: A Comparative Analysis

Ontario Climate Consortium

5th Annual Symposium

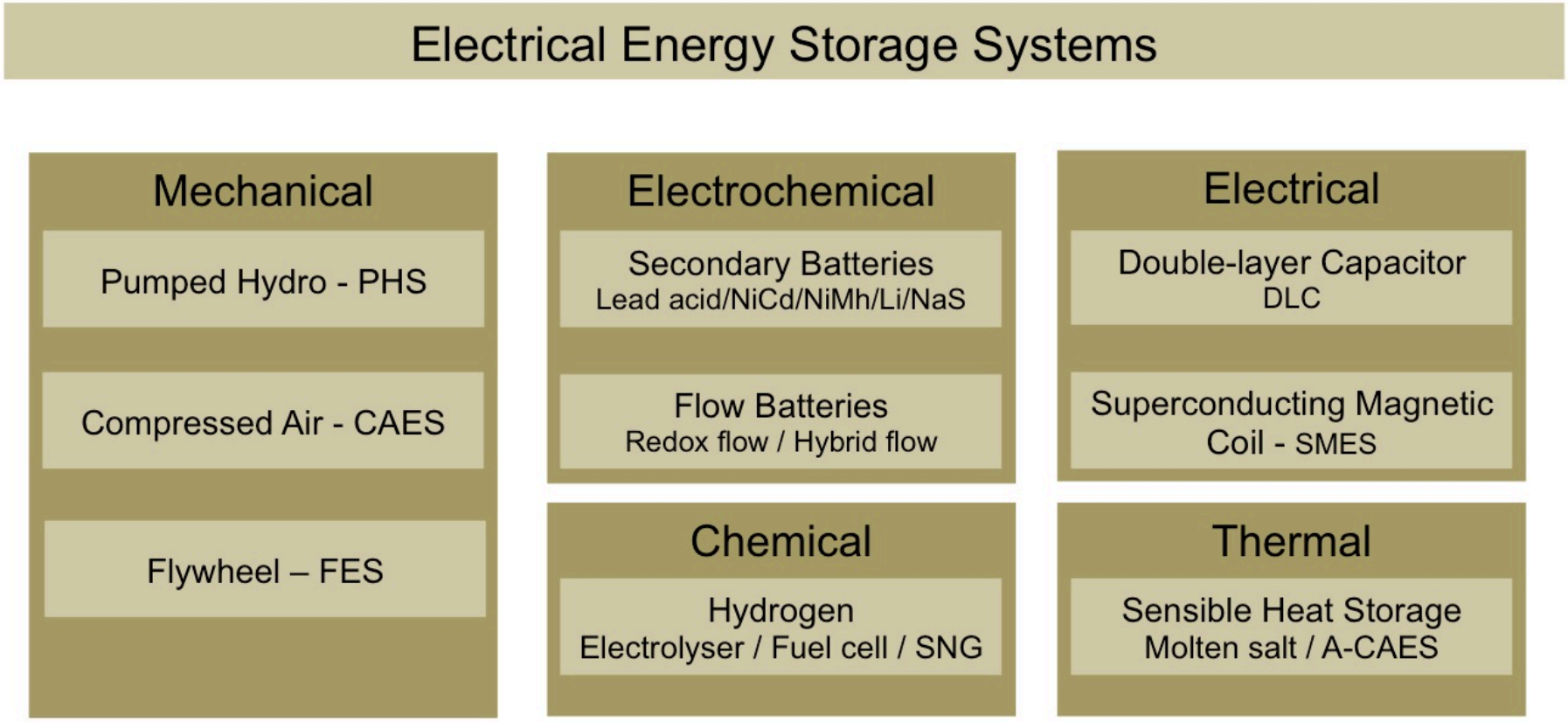
Shahab Shokrzadeh, Ph.D., P.Eng.

May 2017

Research Contributors:

- Mark Winfield – Project Lead
- Shahab Shokrzadeh – Post-Doctoral Fellow
- Adam Jones – MES Student
- Amanda Gelfant - MES Student
- Jenessa Doherty – MES Student
- Adlar Gross – CEKAP MES Student

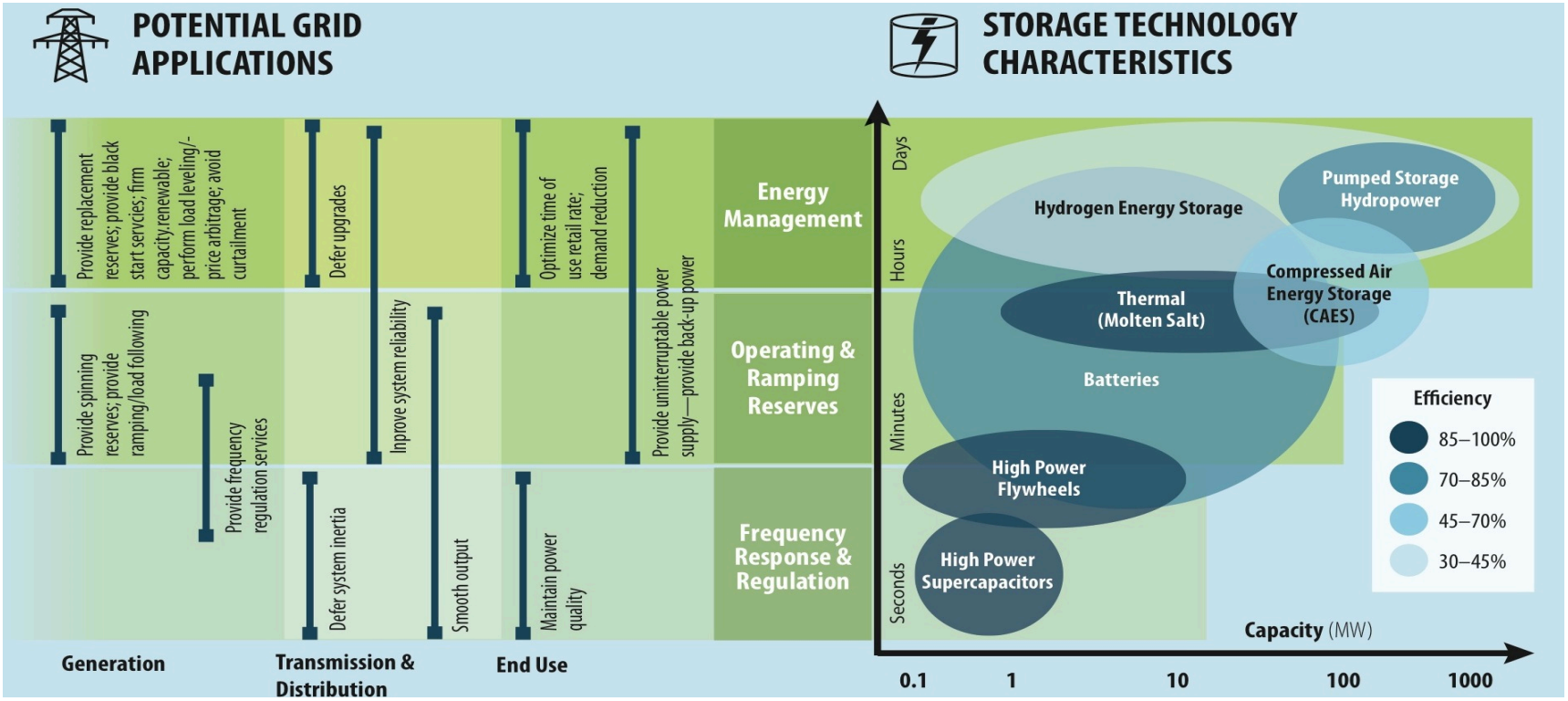
Energy Storage Technologies



Reproduced from IEC 2011

Potential Applications:

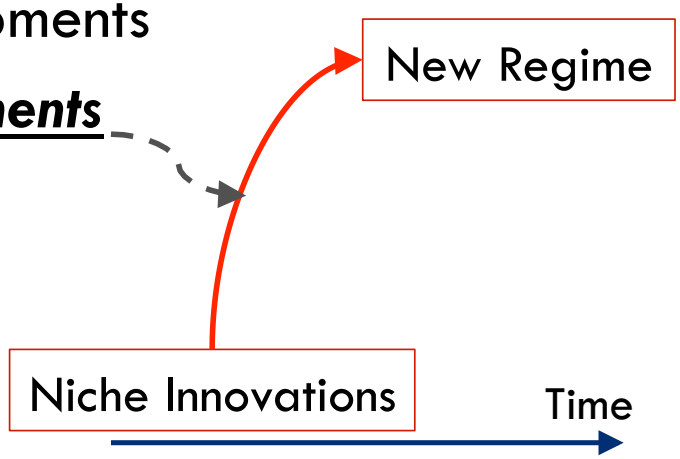
Balancing intermittent RE and DER = Disruptive applications



NREL 2016

Socio-Technological Transitions Framework

- Modern Storage as niche level developments
  - Propelled by ***landscape level developments***
    - Smart Grids
    - DG/BTM Activity
    - Large-scale intermittent renewables
    - Developments in storage technologies



  - Now encountering existing policy, regulatory, technological and institutional regimes

Focus of Research

- **Canada**
  - Ontario (hybrid/organized market) – Adam's paper
  - Alberta (organized market)/ASA Report
  - BC, MB and QC (monopoly markets) + QC has plan on EV storage
  - Federal (NRC - Roadmap)

- **US** - (**working paper posted**)
  - Some states (CA, NY, HI, TX) have single grid operator (RTO) within the state versus others governed by interstate operators and regulated by FERC
- **EU**
  - Germany (**working paper posted**)
  - Denmark (**working paper posted**)

Policy Goals

- ***Transformation*** *- Storage useful set of services and capacities to have available to electricity systems (e.g. FERC, interstate RTOs, Ontario)*
- ***Reconfiguration*** *- Storage as part of a low-carbon energy transition (e.g. Germany, California, Hawaii)*
- ***Re-alignment of Energy System*** *- Storage as disruptive technology enabling distributed energy resources and BTM which may undermine conventional utility business and generation models.*
- ***Economic development*** *potential around technology (NRC, ASA, Mass, NJ, NY).*

Policy Approaches

- Policy approaches to energy technology development:
  - Creating niches in **monopoly** (BC, Quebec, Manitoba)

vs.

  - "**Organized**" markets (FERC regulated RTOs, CA, TX, NY, HI, ON, AB, Germany)

Policy Approaches

- **Monopoly markets**
  - Development of technology (niche to regime transition) is at discretion of utility if found useful for ancillary services, balancing, avoided costs of deferred T&D infrastructure.

- **Organized markets**
  - Theoretically are more open to new entrance to the markets, and are supposed to be technologically neutral.

Policy Approaches

- **Organized markets are theoretically more open to technological innovation:**
  - 3rd parties can develop/offer services/technologies to the energy market or the ancillary services, DSM, capacity/ reserves/balancing markets and be paid for those services.
  - Market determines niche to regime transitions of technology/ services.
  - Role of grid operator is more facilitative.

Organized Market Challenges

- Technical Barriers/Bidding Characteristics
  - Size, period of operation
- Ability to play multiple roles/provide services to multiple markets (generator, consumer, DR/DSM, ancillary services, capacity/balancing) not recognized/accommodated
  - Undermines multi-role business cases
- Lack of clearly defined rules around BTM aggregation
  - Who can do aggregation?
  - How paid?

Organized Market Challenges

- Key barriers embedded in market rules (the regime)
  - Market design is for before ESS and other new technologies existed.
- Conceptual barriers around role of "technological neutrality"
- Ownership and control of storage resources by utilities, RTOs, LDCs vs. 3rd parties

Policy Directions

- FERC (highlights):
  - Ensure that electric storage resources are eligible to provide all capacity, energy and ancillary services;
  - Incorporate bidding parameters reflecting the physical and operational characteristics of electric storage resources;
    - Establish a minimum size requirement for participation in the organized wholesale electric markets that does not exceed 100 kW.
  - Ensure that electric storage resources are both seller and buyer in the wholesale market consistent with existing market rules.

BTM Aggregation

- **FERC:** Role of aggregators – new form of market actor to manage and integrate behind-the-meter activities and distributed energy systems.
  - similar proposals in **Germany**.
- **EDA:** LDCs of the future will assume a critical function in Ontario's energy transition as a Fully Integrated Network Operator (FINO) that will enable, control and integrate distributed energy resources within its distribution service territory.

Contact Info:

- **Mark Winfield, PhD**
  Professor and Co-Chair
  Sustainable Energy Initiative
  Faculty of Environmental Studies, York University
  Email: marksw@yorku.ca
  Phone: 416-736-2100- ext. 21078

- **Shahab Shokrzadeh, PhD, PEng**
  Postdoctoral Fellow
  Sustainable Energy Initiative
  Faculty of Environmental Studies, York University
  Email: shokrzad@yorku.ca
  Phone: 416-736-2100- ext. 44035