



ASIA CLEAN ENERGY FORUM 2015

Canada – India Energy Storage Developments

Presented by

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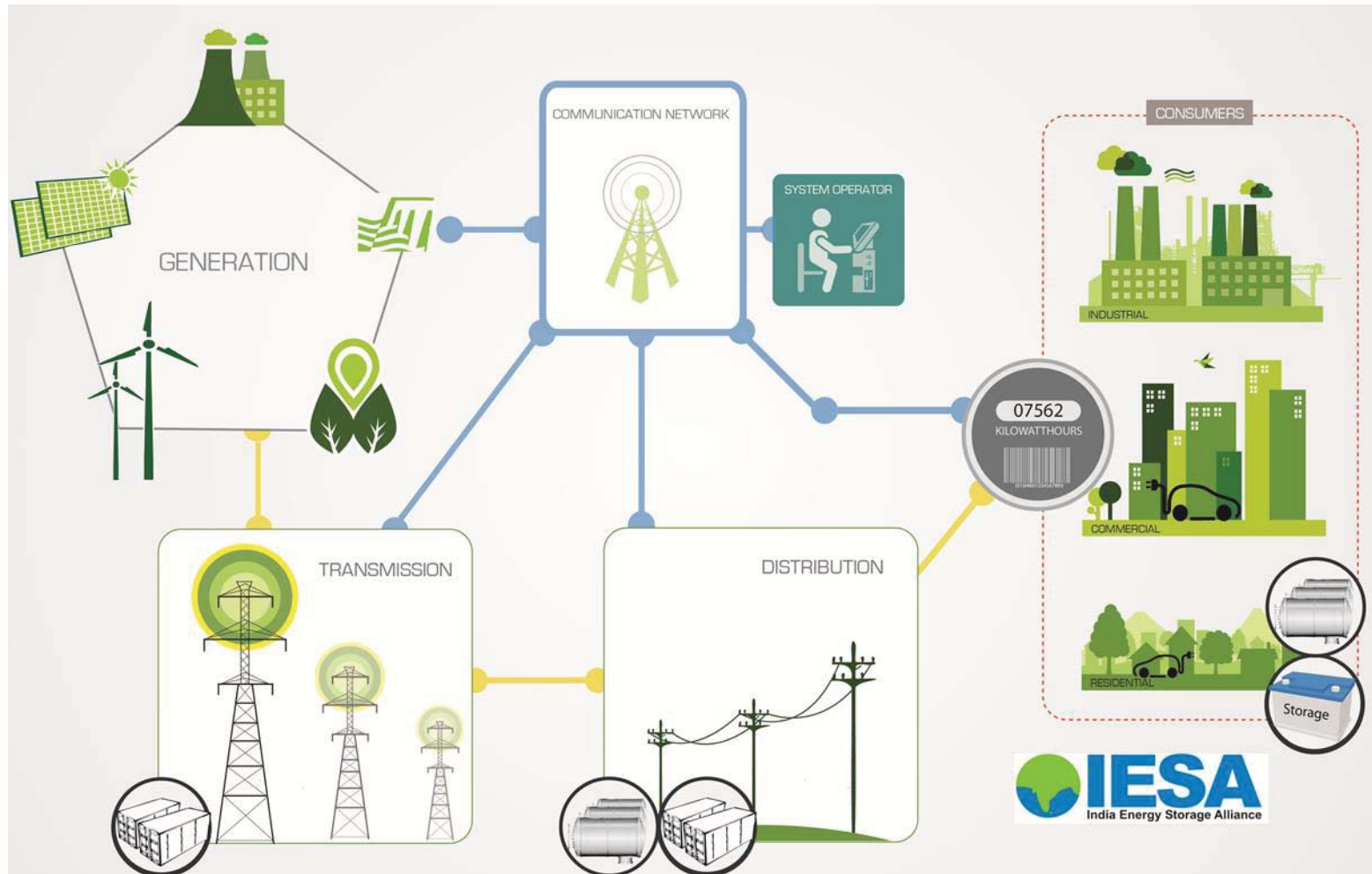
Executive Director, IESA



Vice Chair, GESA



Role of Energy Storage in Electric Grid



Energy storage could play a key enabling role in every aspect of modern grid including Generation, Transmission, Distribution and at Customer Premise (including electric vehicles)

Energy Storage Landscape

IPPs / Project Developers



PCS / Inverter Supplier



Sodium Based



Compressed Air



Flywheel



Lead Acid



Li-Ion Batteries

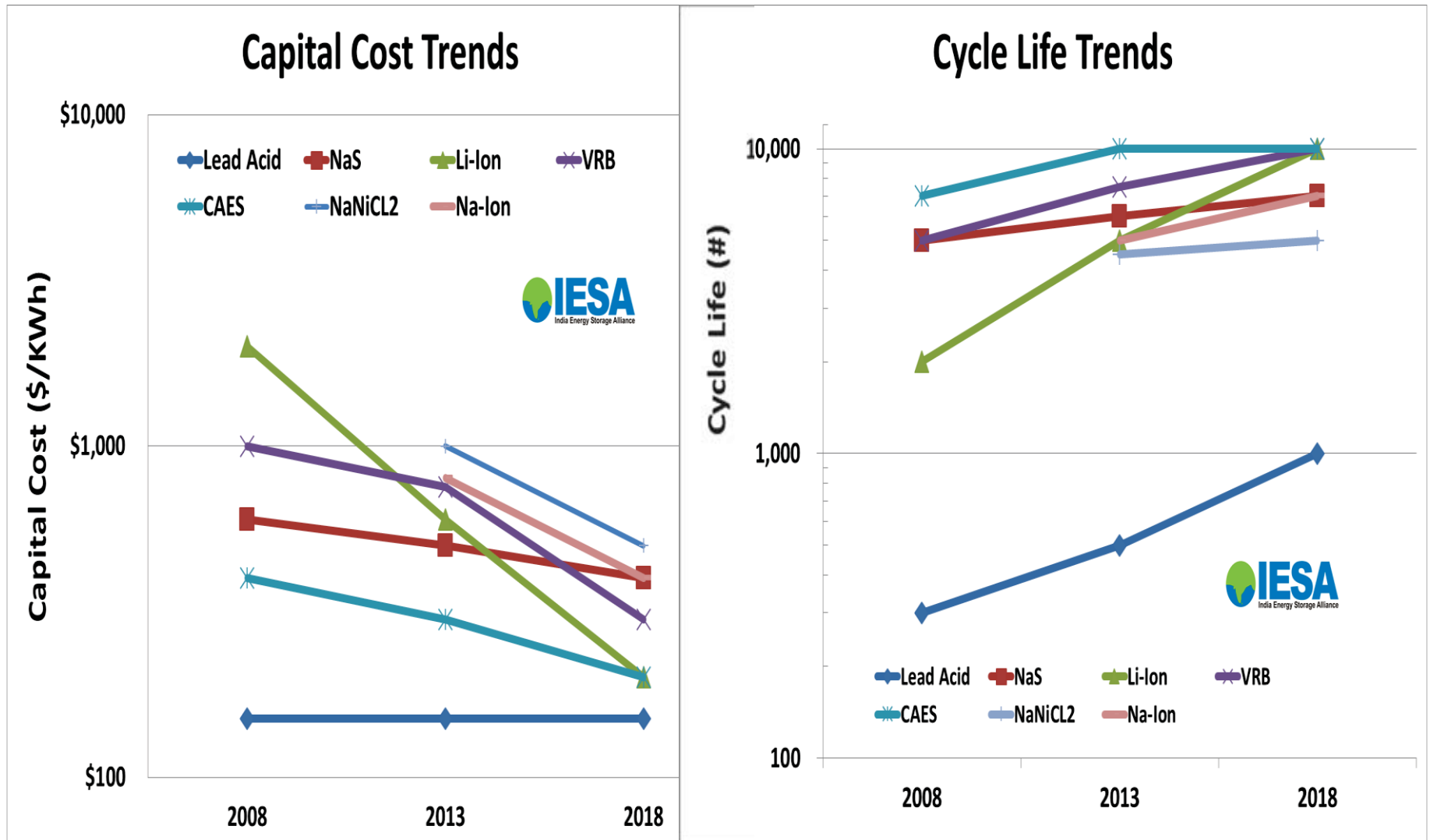


Flow Batteries



Note: The landscape is representative and not complete.

Key Trends in Energy Storage



Energy Storage Applications

Generation

- **Energy Arbitrage**
- **Ancillary Services**
 - Frequency Regulation
 - Spinning Reserves
 - Supplemental Reserves
 - **NEW** Ramping
- **Capacity**
 - Peak Energy
 - **NEW** Flexibility
- **Reliability**
 - Voltage Support/Reactive Power
 - Black Start
 - Frequency Response

Transmission & Distribution

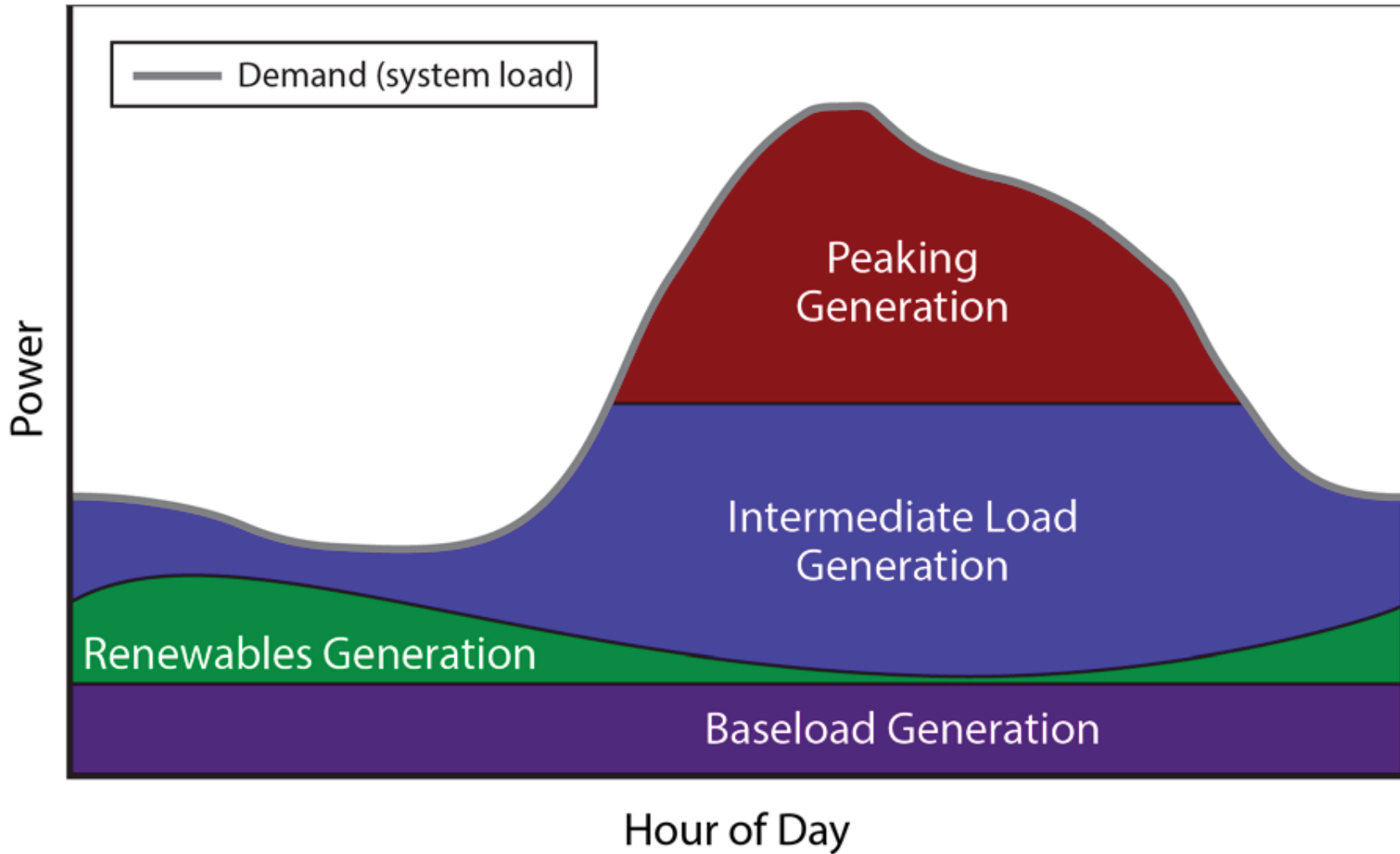
- **Upgrade deferral**
 - Reduce circuit and line overload
- **Grid resiliency**
 - Outage mitigation
 - Back-up power
- **Voltage support/power quality**
- **Congestion relief**

End-users

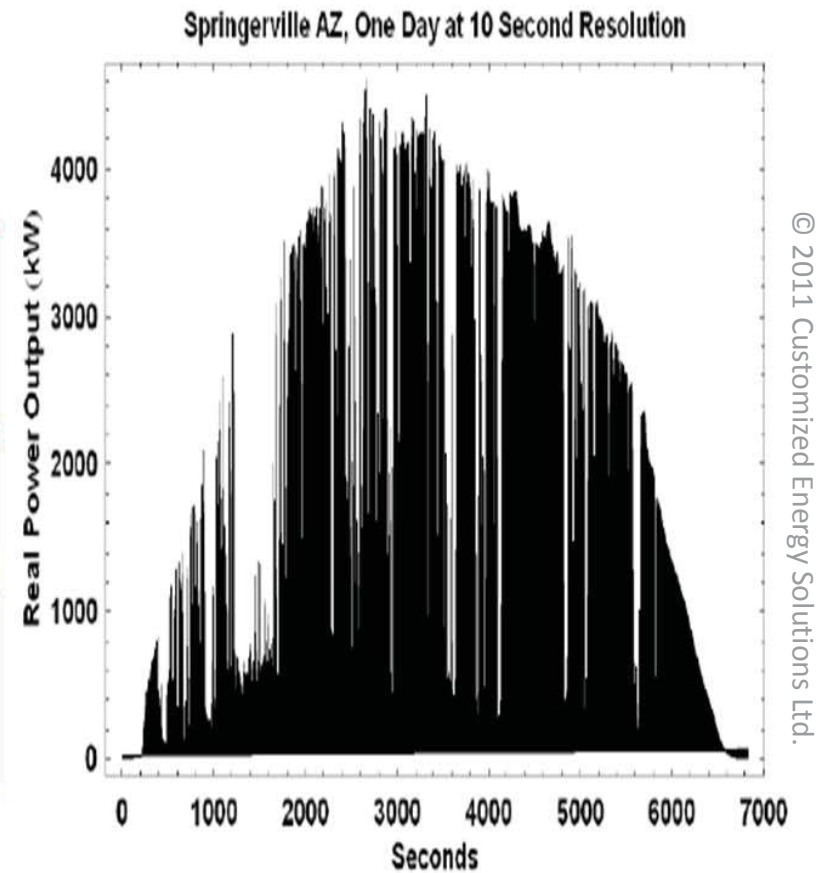
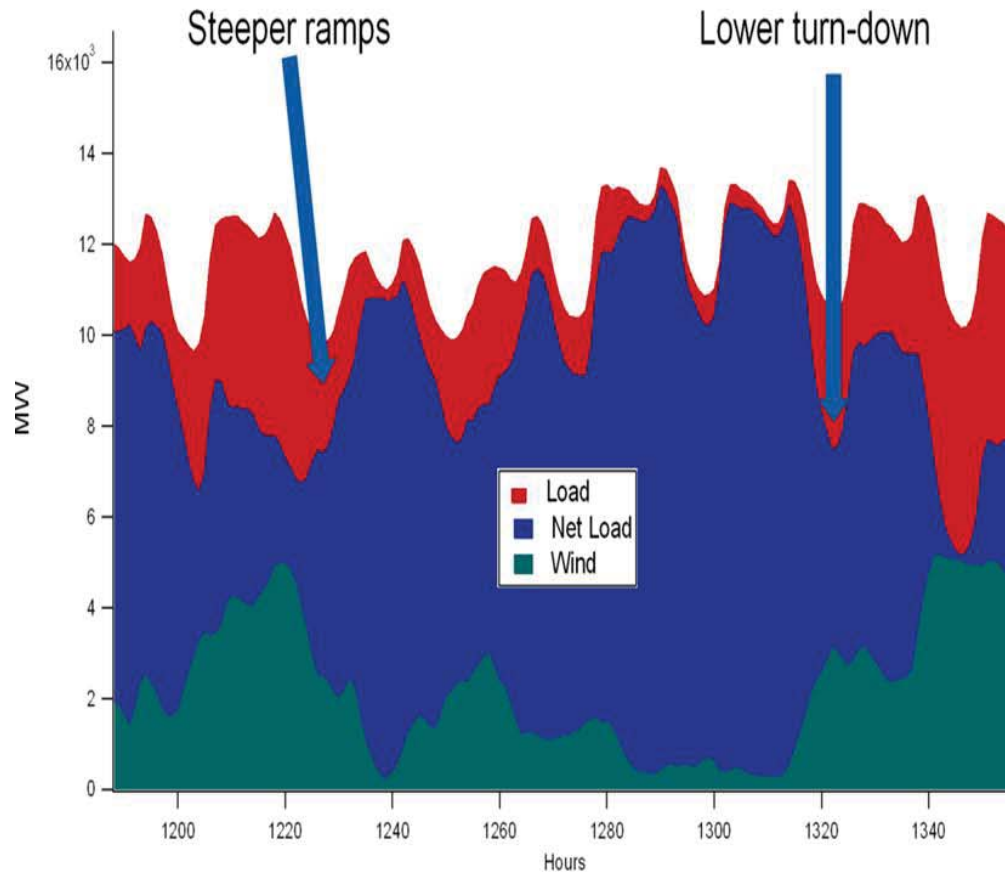
- **Reduce Demand Charges**
- **Optimize Retail Rates**
- **Power Quality/UPS**
- **Onsite renewables**

**Wholesale Markets focused on
“Generation” Applications and Demand
Response , Utilities focused on “T&D”**

Utility Generation Output



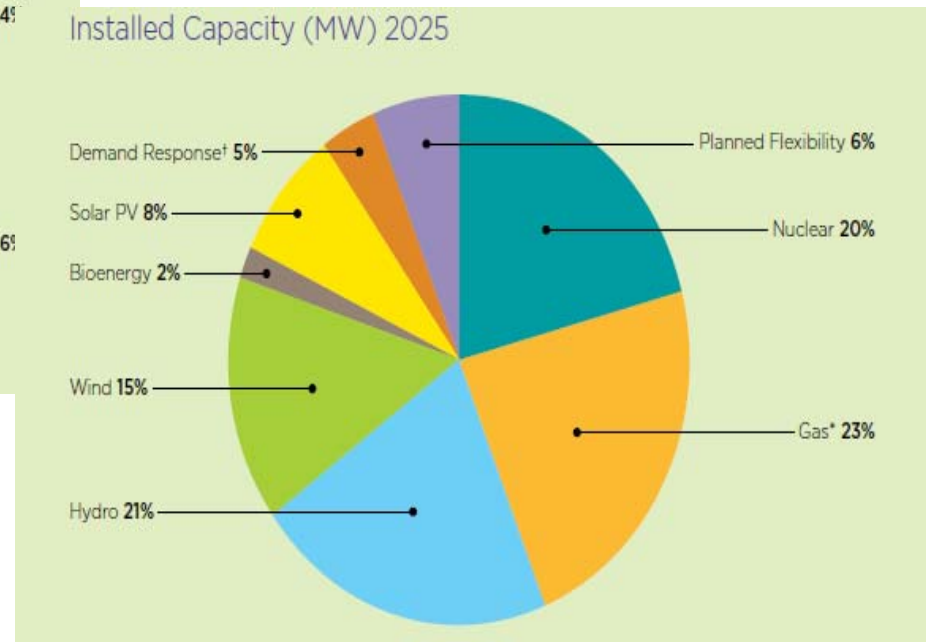
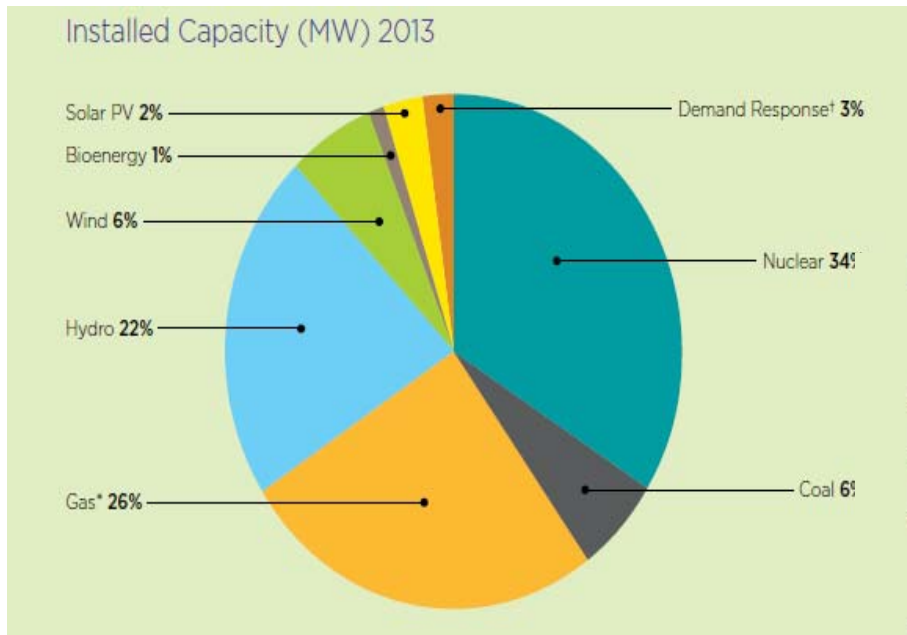
Challenges in integration of renewables



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Source: Dr. Michael Milligan NREL / AWEA : Dr. Jay Apt, CMU

Ontario Supply Mix



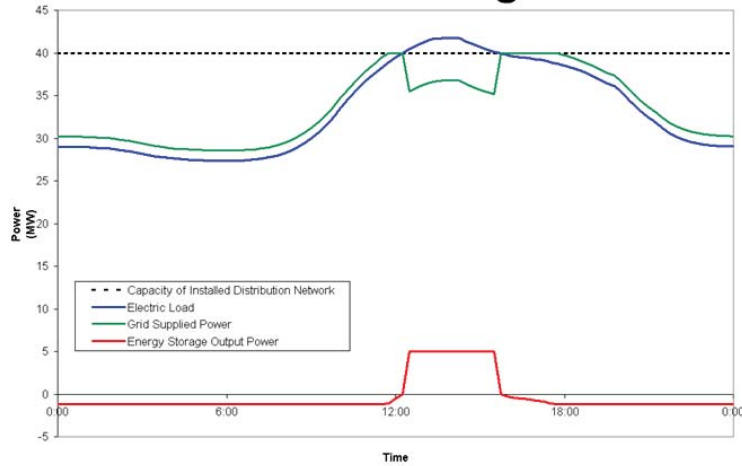
Renewables will grow to 46% of Ontario's generating capability by 2025.
LTEP 2013

Energy Storage In Canada

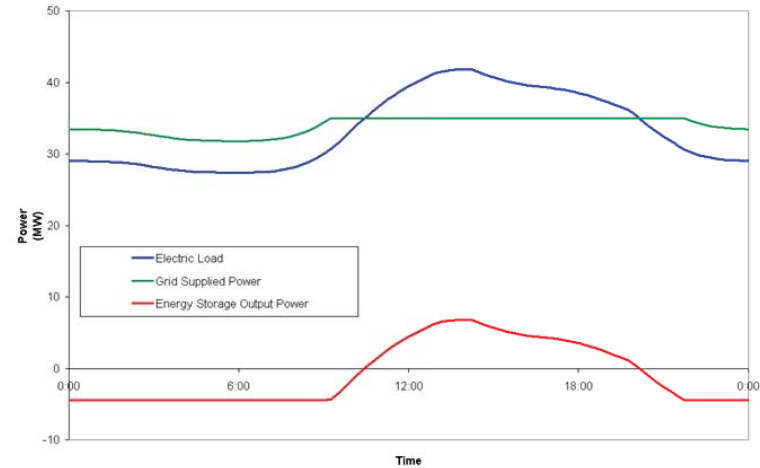
- More than 30 Energy Storage Projects across different provinces
- Mostly demonstration projects
- Primary Drivers
 - Renewable Integration
 - Smart Grid Initiatives
 - Diesel Replacement in mines and remote communities

Energy Storage Applications

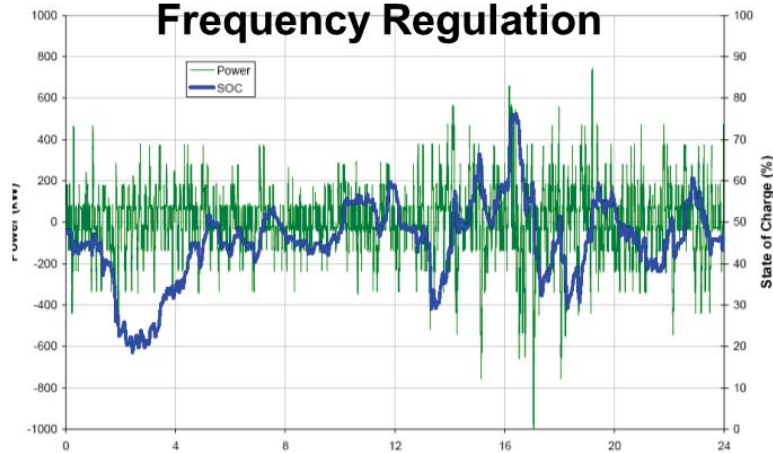
Peak Shaving



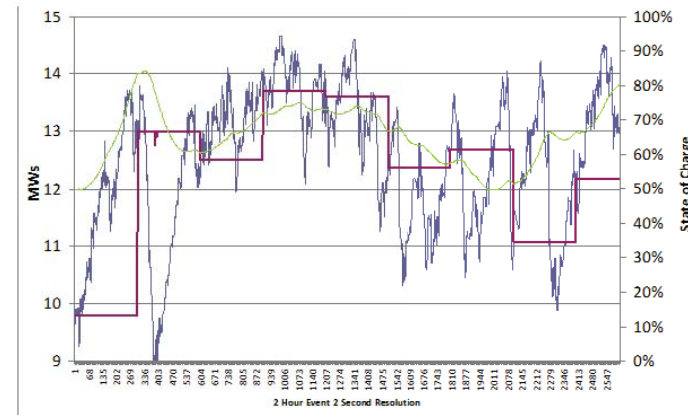
Load Levelling



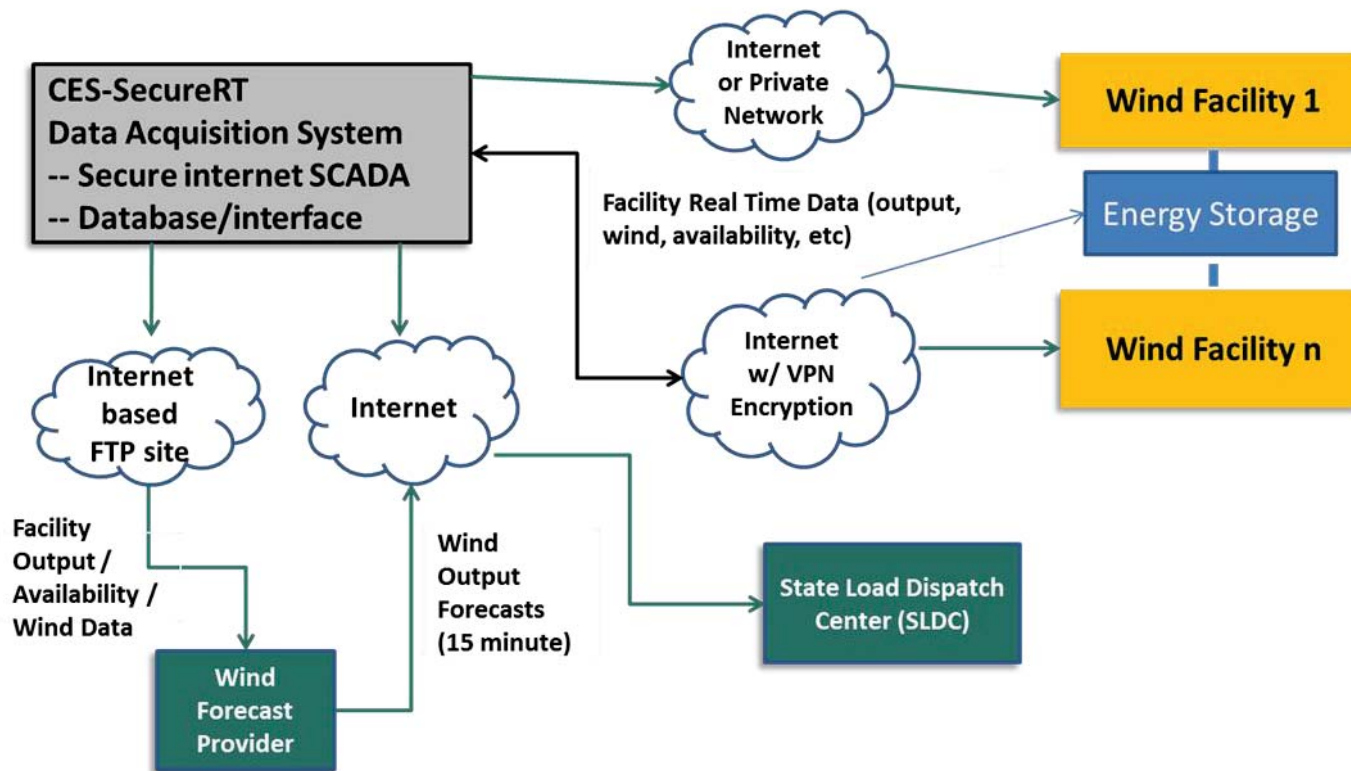
Frequency Regulation



Wind Firming

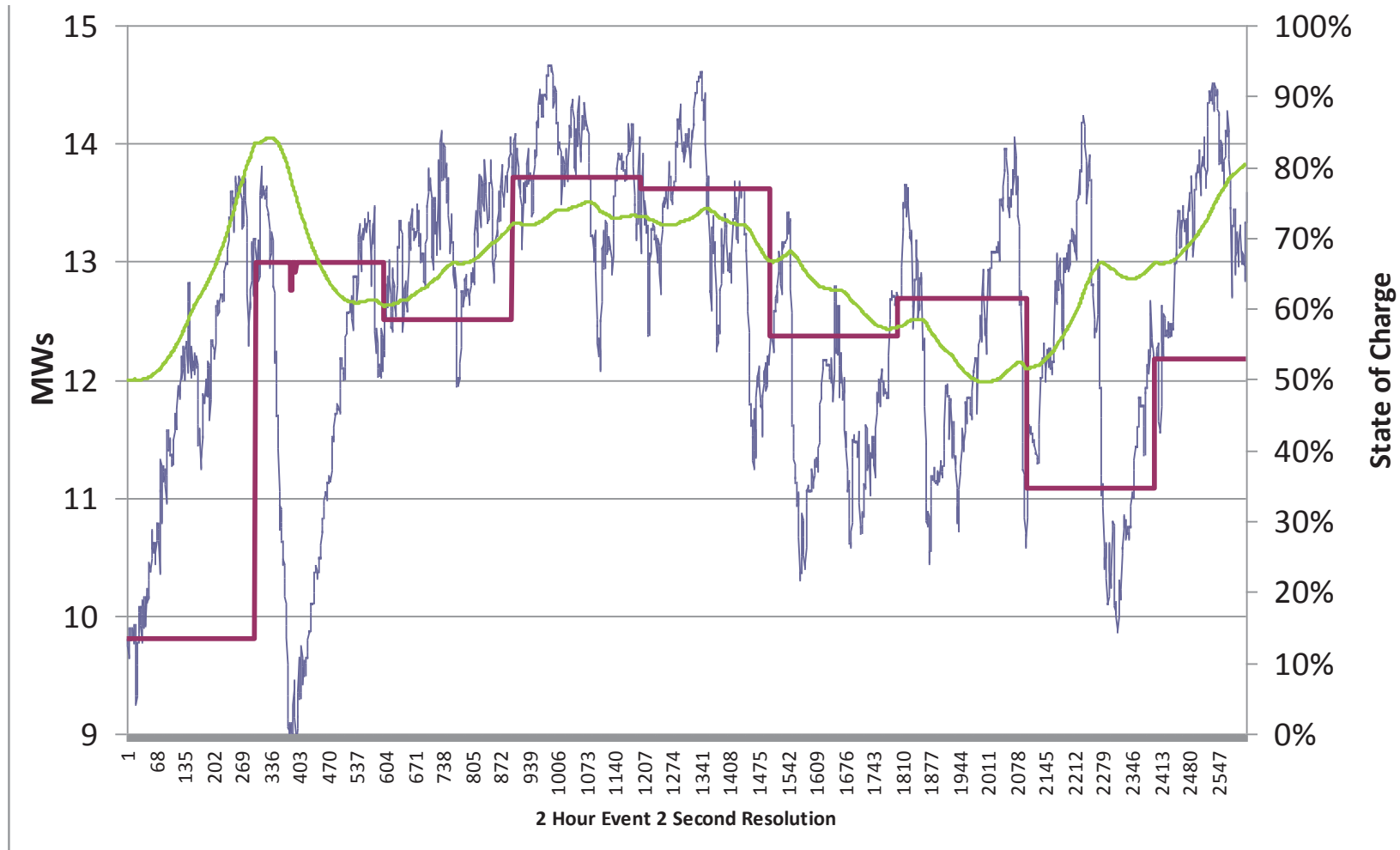


Wind scheduling with Advanced Wind Forecasting and Energy Storage

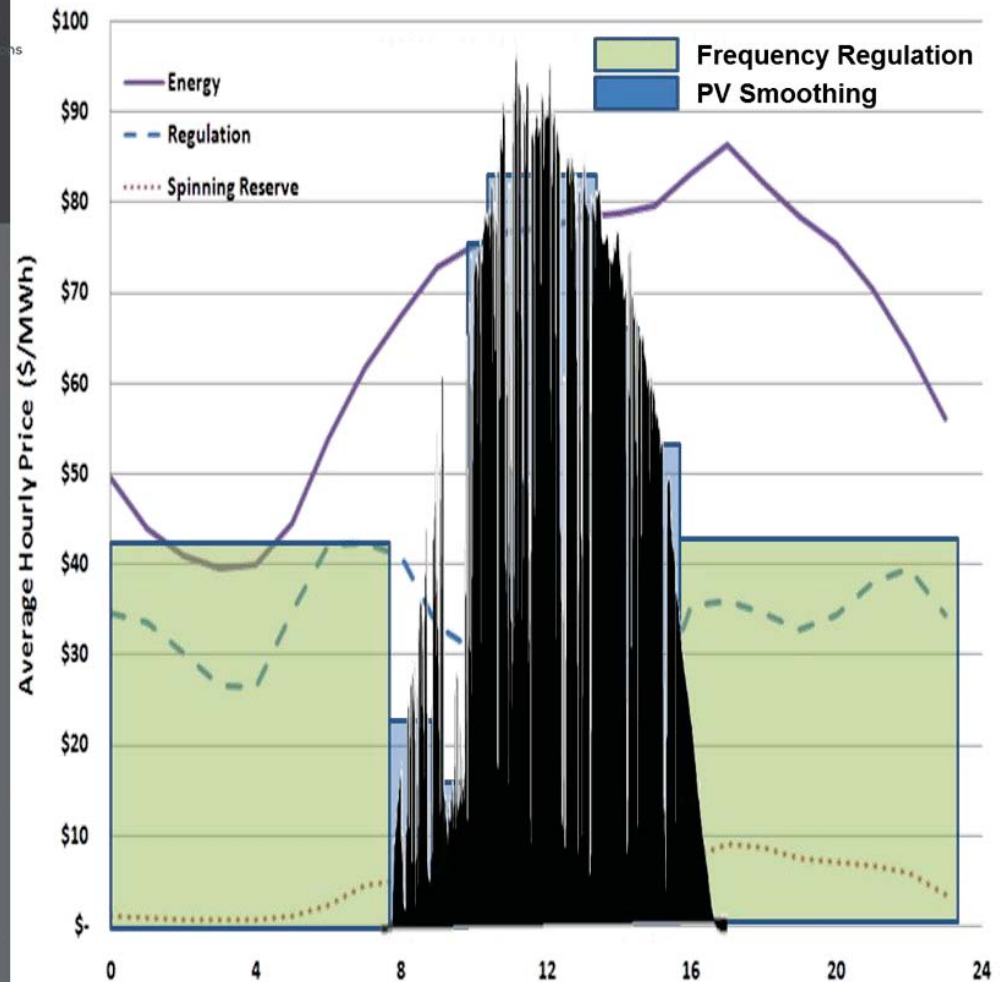
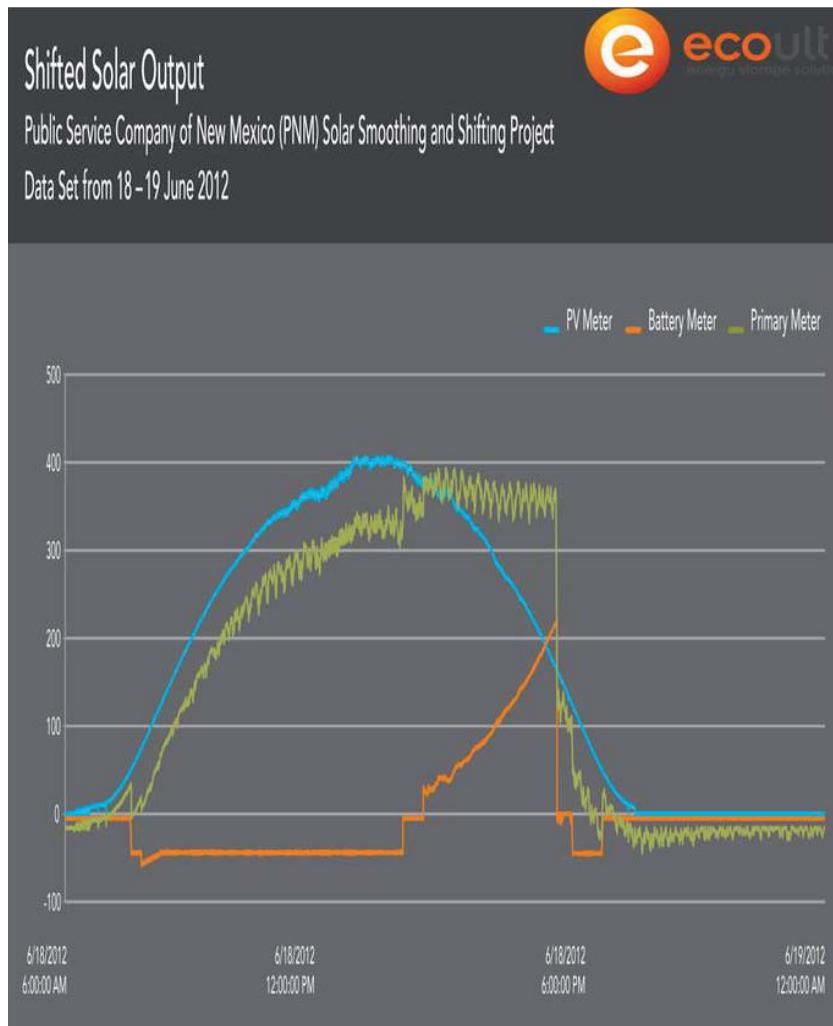


Customized's Market Operations Center currently actively manages over 3000 MW of generation, energy storage and demand response resources to maximize profits for our clients.

Energy Storage for Wind Smoothing



Solar PV – Storage Hybrid Solutions



US DOE Smart Grid- Energy Storage Demonstration Projects 2008



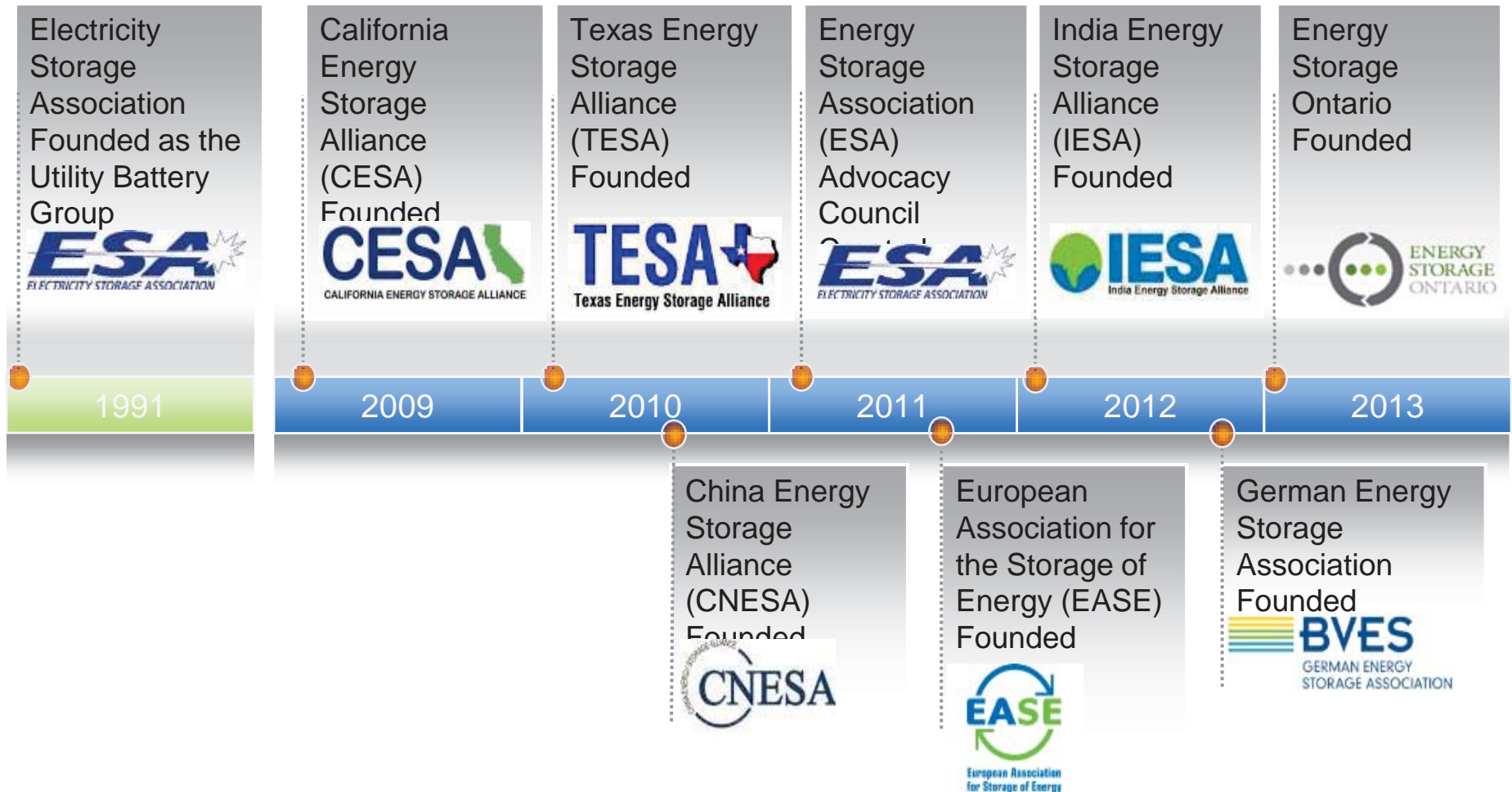
Major projects include: CAES demonstration (NY and CA), Renewable Integration (CA, TX, NM), Peak Shaving, Community Energy Storage and demonstration of new technologies.

Visit www.energy.gov for additional details.

Global Energy Storage Deployments



Storage alliances are being created all over the world to build local ecosystems



IESA & ESO has signed MOU for supporting energy storage developments between Canada and India



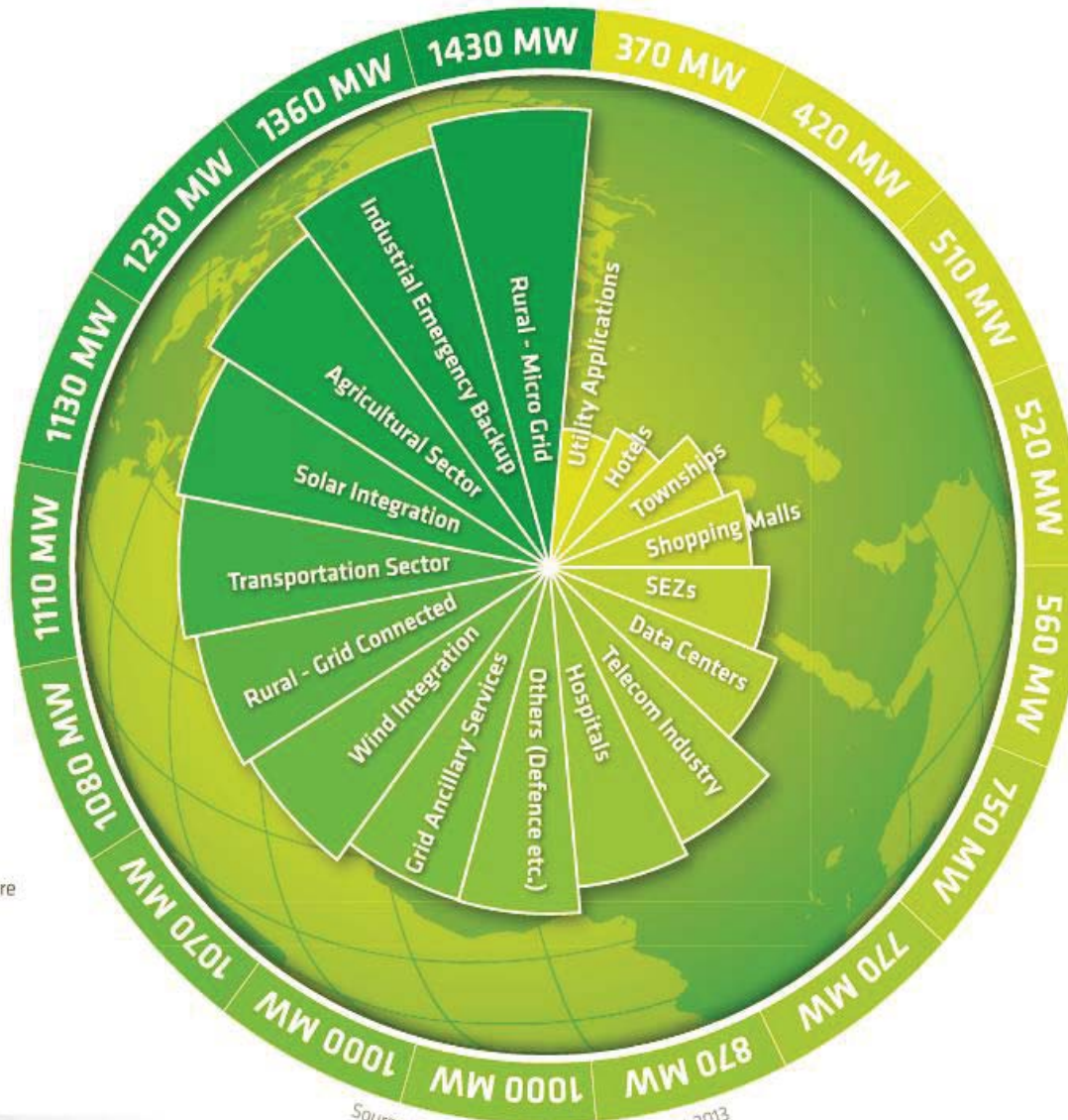
Ontario Energy Storage

- **ONTARIO ENERGY STORAGE RFP PROCESSES**
 - RFP Phase I
 - 35.6 MW
 - RFP Phase II
 - 16.4 MW
- **ONTARIO SMART GRID FUND PROJECTS**
 - test, develop and bring to market the next generation of smart grid solutions
 - \$24 million in support of 17 smart grid projects, with a total budget of about \$54 million
 - Distribution System Applications

Alberta

- **AESO Energy Storage Initiative**
 - Alberta Electric System Operator (AESO) initiated a review of market rules and standards applicable to energy storage facilities
- **AITF Energy Storage Studies**
 - **2011** report to understand the technical and economic aspects of energy storage in Alberta
 - 2014 as an update to the 2011 study with expanded objectives
- **AI-EES Funding Programs** (2.5% of the total generation capacity in Alberta by 2030)
 - Funding different initiatives
 - Call for Expressions of Interest (EOI) to fund Emerging Energy Storage Technologies (EOI submissions was January 29th, 2015)

Indian Market Opportunities



Source: IESA India Market Overview Report 2013

- We anticipate the energy storage market in India to grow to 15-20 GW by 2020 driven by
 - Energy Access
 - Renewable integration
 - Ancillary Services
 - C&I customer demand
 - Telecom sector
 - Agricultural applications

Conclusion

- Energy storage technologies can help in growth of renewables, microgrids and smart grids.
- North America & India present huge markets
 - US & Canada Market is driven by ancillary services, rooftop solar, behind the meter applications and utility mandates.
 - India market is driven by need for diesel replacement, need for power reliability, renewable integration and microgrids for energy access.
- India also presents excellent opportunity for collaborations for R&D, manufacturing and exports
- Policy makers are keen on encouraging energy storage technologies
- Technology & Business Model innovations will drive large scale adoption of energy storage in next 2-3 years.

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