“Distributed Bulk” Storage!

The Future of Batteries in Grid Applications

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Where are We Coming from? - Challenges

- Utilities had no energy storage choice but pump-hydros
- It would take almost a decade to decide investing on one
- It would take about a decade to build one
- Too slow for area regulation and some other ancillary services
- Little backup value when T&D lines were severed
- Its downtime had severe impact on grid operation

These challenges are still mostly valid with today’s central storage options
Why is Energy Storage Moving to the Grid Edge?

1. Commercial Drivers
   - End User Incentives
   - Vendor Incentives
   - Synergy with Smartgrids
   - Other Factors

2. Higher Incentives for Government Funding
   - Issues of National Interest
What is Driving Storage to the Grid Edge?

End User Incentives:

• Easier to get management approval to start a project
• Compatible with Smart Grid initiatives
• Closer to distributed generation (renewable)
• Buffering EV charging impacts on Distribution circuits
• Improved service reliability (backup power closer to customers)
• Speed & ease of “plug-n-play” deployment
• Geological and Permitting Challenges (none or little)
• Down time of unit is a lesser concern (low maintenance)
What is Driving Storage to the Grid Edge?

Vendor Incentives:

• Much easier to sell to a new user (easier project approval)
• More cost competitive (mostly factory-assembled)
• Synergy with electric transportation batteries (lower cost)
• Easier maintenance (or replacement)
What is Driving Storage to the Grid Edge?

Synergy with Smartgrids:

• Smartgrid has passed the disillusionment stage & is happening
• Hierarchy of communication & control is being established
• It has inherent synergy with distributed resources
• Distributed storage fits smartgrid and enhances it
What is Driving Storage to the Grid Edge?

Other Factors:

• **MARKET** - Rapid growth of renewables at customer sites

• **REGULATORY** – FERC (order 745) is allowing participation of distributed resources (storage) in ancillary services

• **TECHNOLOGY**
  
  Emergence of aggregated “Distributed Inverters”
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Government Incentives for Funding

Distributed Storage is closer to issues of National Interest:

• Through enabling Renewables & EV:
  • Less Fossil Fuel
  • Less Oil Import
  • Cleaner Environment

• Through enhancing the Grid / Smartgrid
  • Efficiency
  • Reliability
  • Stability
  • Security
Would Central Storage still Make Sense?

• **YES** for Pumped Hydro and CAES type units
  – Still the lowest cost storage devices
  – Still the **best option** over 100MW, 1000MWh

• **No** for Electrochemical Batteries
  – Battery cells are small & stacking has many challenges
  – There is a **better option** for batteries
“Distributed Bulk” Storage!

Aggregation of Distributed Storage Units

- Realizing Distributed Benefits
- Exercising Central Control
Where are We Going To? – More Values

“Distributed Bulk” Storage

Central Dispatch
1000’s MW

10’s MW

1.0 MW, 3.0 MWh

Smart Grid Infrastructure

MW

kW

MW

kW

1.0 MW, 3.0 MWh

Community Energy Storage

Community Energy Storage

NAS Battery Station

Courtesy of AEP

Two 1 MW NAS Units

PCS

Transformer

Courtesy of A123

2 MW H-APU HYBRID AUXILIARY POWER UNIT

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Questions?

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