

Buffering the Adverse Impacts of PV and EV on Distribution Circuits with Community Energy Storage

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Emerging Challenges for Electric Utilities

Two key emerging challenges that distribution circuits are facing are:

1. **Renewables** – particularly residential PV

- Availability
- Intermittency / Power quality
- Back feed (safety)

2. **EV charging** - particularly multiple units in same neighborhood

- *Coincidence with the peak demand*
- *Exceeding feeder and equipment power ratings*

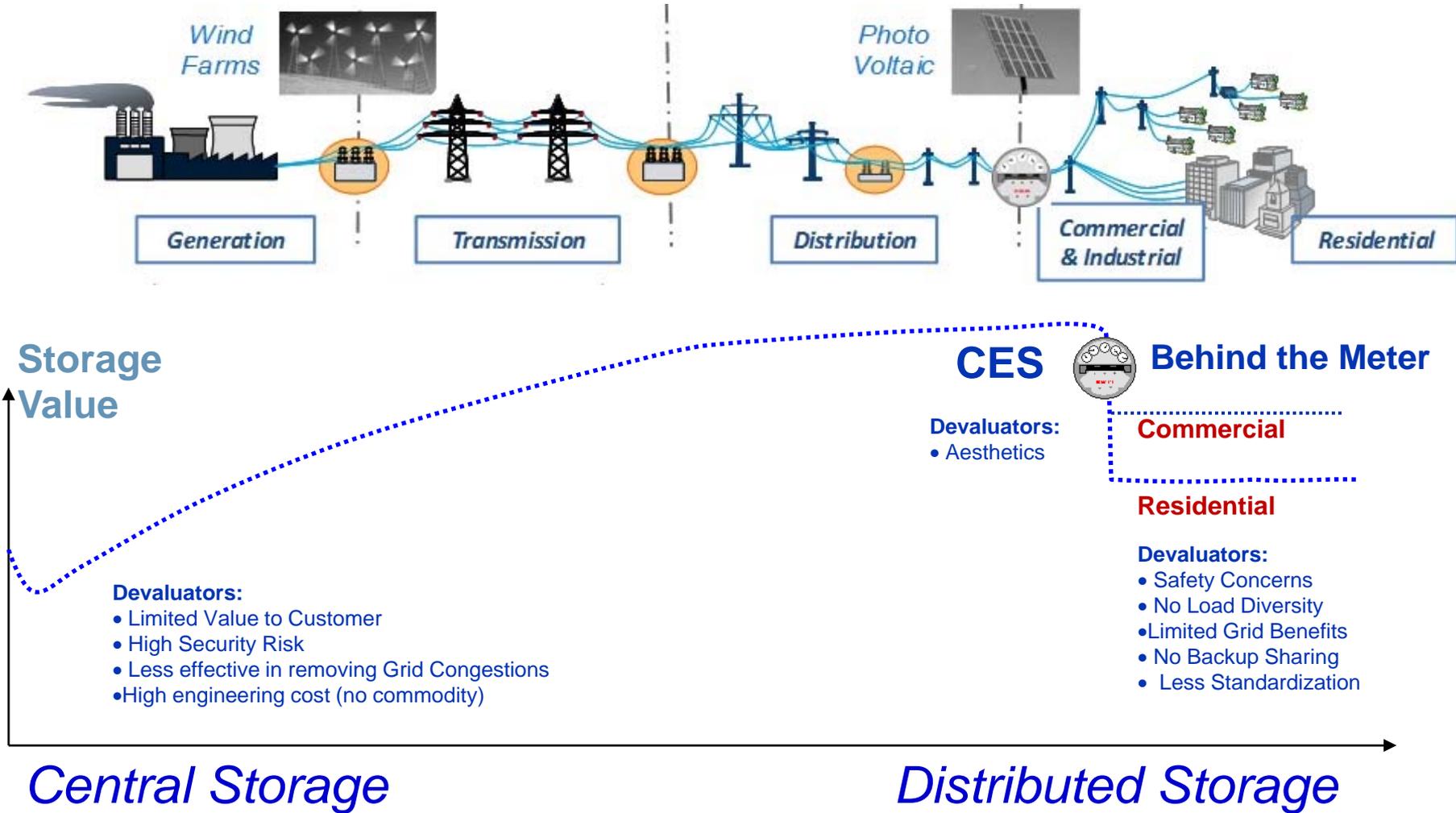
These social benefits come with “adverse impacts” on the local power system that need to be mitigated.

Energy Storage as a “Buffer”

Energy storage may be the most desirable “buffer” for adverse impacts of renewables and EV charging considering:

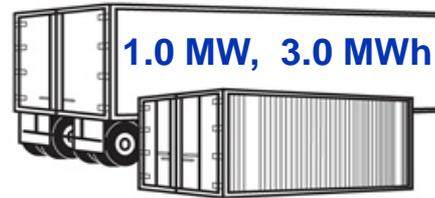
- 1) **Optimal Location** for highest value
- 2) **Optimal Packaging** for lowest cost

Preferred Location for Energy Storage



Preferred Packages for Energy Storage

- Lower cost (Competitive – Mass production)
- Plug-&-Play
- Technology-neutral,
- Flexible



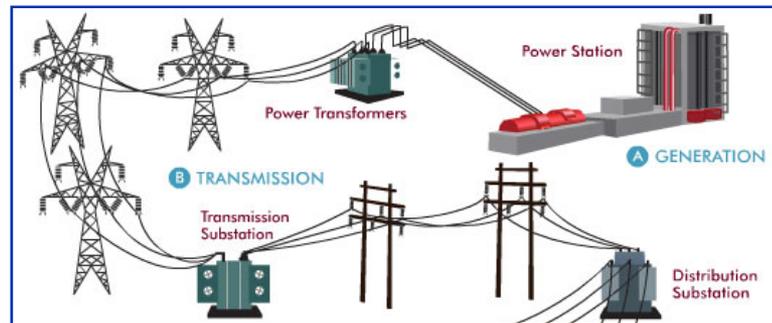
	Mobile Storage	CES
AC Power	1 MW - 2 MW	25kW - 75kW
Preferred Discharge Time (at rated power)	Up to 4 hours	Up to 3 hours
AC Voltage (US)	480V / 3 phase	240/120V
Preferred AC Efficiency	Over 85%	Over 85%
Islanding Capability	Yes	Yes

CES – Multiple benefits increase the total value

A flexible balance between local and system needs

1- Grid Benefits

- System Load Leveling
- Ancillary services
- Spinning reserve



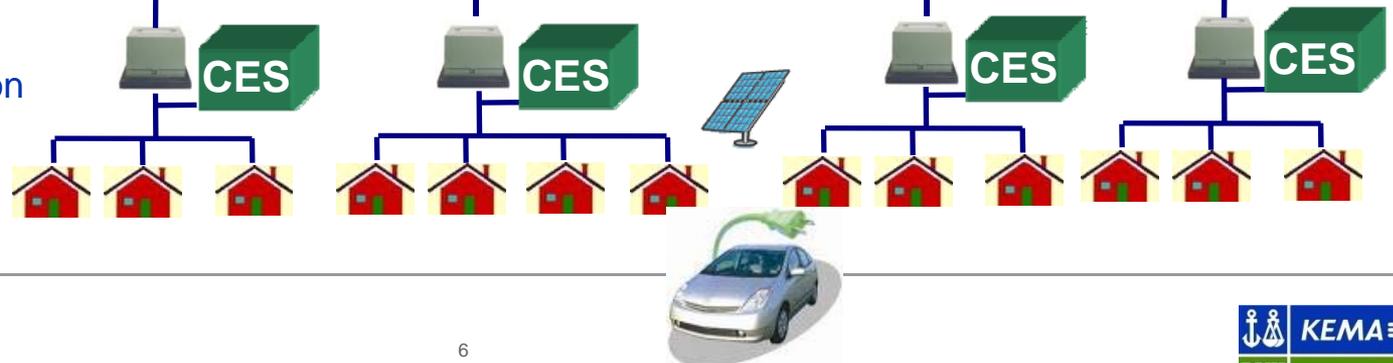
2- Substation Benefits

- T&D Deferral
- Power Factor Correction
- Reliability
- Renewable Integration



3- Local Benefits

- Backup power
- Voltage correction
- EV buffer
- PV buffer



Multiple Values of Community Energy Storage

- Economics {
 1. Smaller project cost
 2. Could become a “low-cost commodity” like small transformers
 3. Leverages EV battery market
 4. Lower installation cost (110/240V)
 5. Lower line losses
- Operations {
 6. **Buffers EV charging and Renewable** (two emerging utility challenges)
 7. Higher flexibility (to target where the problem is)
 8. Higher electric service reliability (Backup power – PUC value)
 9. Redundancy (outage less critical to grid operations)
 10. Better fit in SmartGrid programs

Utilities exploring CES – early 2012

Over 60% apply CES to buffer the Renewable Impact



Manufacturers are adopting CES Platforms

Robust Competition is about to start ...

<p>S&C Electric</p>  <p>SOURCE: S&C</p>	<p>Beckett Energy Systems</p>  <p>SOURCE: Beckett</p>	<p>GreenSmith</p>  <p>SOURCE: GreenSmith</p>	<p>Demand Energy</p>  <p>SOURCE: Demand Energy</p>
<p>RedFlow</p>  <p>SOURCE: RedFlow</p>	<p>ABB</p>  <p>SOURCE: ABB</p>	<p>GS Battery</p>  <p>SOURCE: GS</p>	<p>PowerHub</p>  <p>SOURCE: PowerHub & SMUD</p>

Three more manufacturers will publicize their CES product later in 2012

CES Price & Performance Goals



Conclusions:

1. Energy storage can effectively and economically buffer the adverse impacts of renewables and EV charging on distribution
2. To be effective and economical, “edge of grid” is the recommended location for deployment

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