DERMS Systems – Managing DERs as a Portfolio

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Global energy markets will be driven by four overarching factors driving change:

1. **Diversification of energy supply and reserves**
   - Increasing costs of oil and gas production in difficult environments
   - Increasing global competition for energy resources
   - Increasing risk of energy import dependency
   - Alternative sources: unconventional/renewable resources

2. **Increasing focus on climate change**
   - Decreasing variance in climate predictions
   - Increasing convergence of political and public opinions
   - Increasing industry concerns over curtailing “climate liabilities”
   - Increasing potential of regulatory certainty

3. **Increased electric power intensity of economy**
   - Increasing demand for electric power
   - Expanding role for energy efficiency solutions
   - Increasing power reliability and quality requirements
   - Emergence of hybrid transportation options

4. **Increasing pressure for infrastructure renewal**
   - Electric grid revitalization
   - Alternative fuels transport network
This has resulted in Four major interrelated energy S&T challenges

| Reliable, diversified alternative sources of energy | Expanding domestic supplies  
▪ Air and water neutral hydrocarbon production  
▪ Heavy hydrocarbon integration |
|---------------------------------------------------|------------------------------------------------------------------|
| Decarbonization: Reduction in carbon emissions | Fossil emissions capture and disposition  
▪ Integration of renewables  
▪ Nuclear power expansion and fuel cycle resolution  
▪ Aggressive economically sustainable efficiency improvements  
▪ Sustainable biofuels systems |
| Reconceiving electric power systems management | National transmission grid with real time control  
▪ Dispatched demand management: Two-way systems control  
▪ Utility scale energy storage |
| Reduced capital options for energy systems expansion | Effective, economic and safe nuclear fuel-cycle closure options  
▪ Transmission and distribution grid capacity management |
Energy efficiency options provide lower-cost options for early carbon signature reduction.

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### 2000 Reference energy use

As a baseline, energy use at the turn of the century was nearly 90 percent dependent on fossil fuels. Carbon dioxide capture and storage methods were not in use. The atmospheric concentration of CO₂ was 371 parts per million.

**GLOBAL ENERGY USE:** 387 EXAJOULES

- Oil
- Natural Gas
- Coal
- Wind, solar, and hydropower
- Nuclear

### 2100 No long-term climate policy

Under this simulation, the CO₂ concentration rises to what many scientists consider a dangerous level of 875 parts per million. With oil prices expected to remain relatively high, fossil fuel dependence drops to 82 percent. Cars get 70 miles a gallon of gas, power plants become more efficient and renewable energy use increases.

**1.344 EXAJOULES**

### 2100 Global tax on all carbon dioxide emissions

Under this more restrictive simulation, CO₂ emissions are limited to 526 parts per million. Dependence on fossil fuels drops to 60 percent. Carbon capture and storage is common and emissions carry a substantial tax. Ethanol and other biofuels are widely used in cars and with fuel even more costly, energy conservation is a personal and societal priority.

**803 EXAJOULES**

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**Energy efficiency gains from above**

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**Source:** The New York Times & MIT

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### List of DERs

<table>
<thead>
<tr>
<th>Photovoltaic (PV) cells</th>
<th>Thermal, Biogas, Cogeneration, Compressed air, Flywheel, Combustion generators</th>
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<tr>
<td>Fuel cell</td>
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<td>Battery storage</td>
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<td>Hydro*</td>
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<td>Demand Response (DR)</td>
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<td>Energy Efficiency</td>
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Key Characteristics of Renewable Resources

- Intermittency and timing
- Ability to dispatch – Variability of generation
- Remote siting
- Ability to forecast
- Needs lots of land space
- Still expensive
- Non-utility owned generation
A Framework for Managing and Operating Renewable Resources
This framework from 2010 gave birth to the DERMS systems of today

But, to get there – we need to start with the Advanced Distribution Management System (ADMS)
An ADMS is a system of computer-aided tools used by operators of electric distribution networks to monitor, control, and optimize the performance of distribution systems.
What is missing here!!! – Why can’t the ADMS do it all. Do we really need a new system called the DERMS??

- Mix of renewables and non-renewables
- Mix of dispatchable and non-dispatchables
- Interaction from several utility departments and systems that need to integrate and work together
- Some controls are sent from the customer service department and some from operations
- Some are driven by utility/state mandated programs and some re not.
- Most of these are not SCADA or operations observable
DERMS is an operational system for active management of DERs from a single unified platform, through a common set of user interfaces, that aggregate and exploit the capabilities of DERs, in support of utility and community goals.
DERMS is still in its infancy – in the US and worldwide

Heavily focused on solar and wind integration

Key applications mainly focused on forecasting

What is not yet prevalent – some examples (not an exhaustive list)

- Load shedding integration with DR
- Integrating wind (mostly blows at night), solar (mostly works in the daylight)
- Integrating storage at an enterprise level
- Using DR to increase demand instead of focusing only on Demand reduction
- Using other storage mechanisms – such as residential water heaters

Need to move from individual segments – to portfolio management
Thank You !!!!