Renewables Integration Using Advanced Storage Devices

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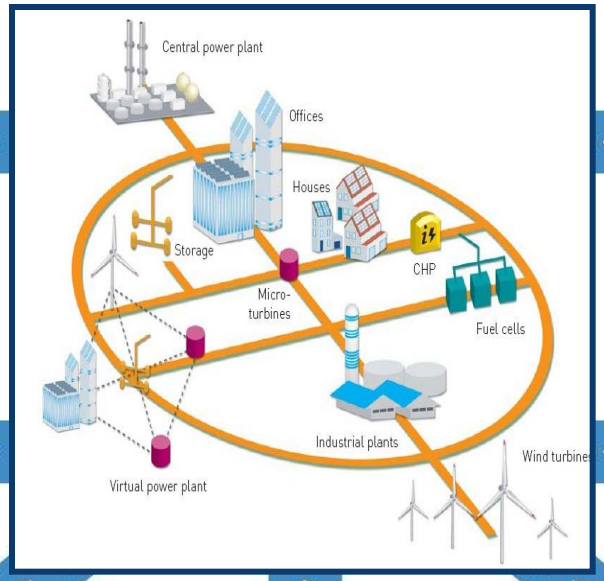
KEMA Inc. – A Global Energy Consulting Firm

- Breadth & Depth – From the Generator to the Energy Consumer
- Over 1800 professionals in more than 20 countries

In The Future, Utilities Will Operate An Intelligent Network; One That Is Supported By A Portfolio Of Technologies And Advanced Communications

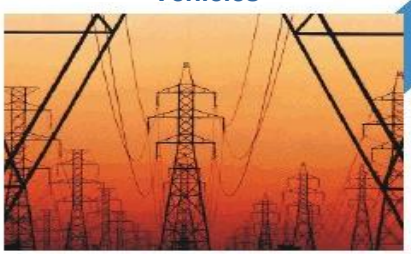
Efficiency in Buildings, Industry and End-Use Products



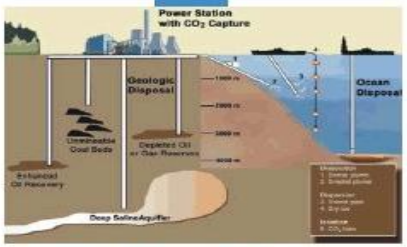
Renewable Energy Technologies

Plug-in Hybrid Electric Vehicles

Biomass, Synfuels, CHP



Advanced Power Generation and Grids



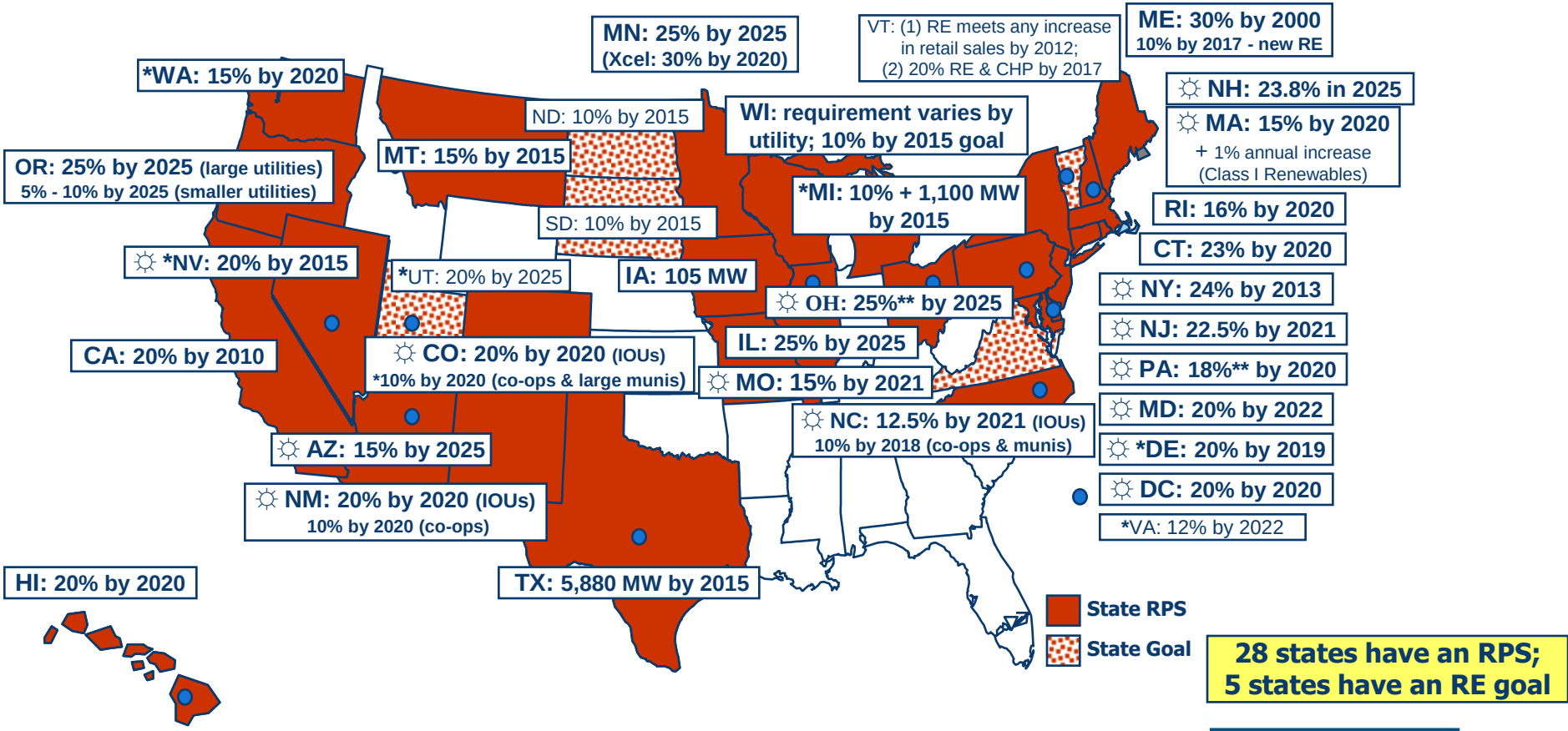
CO_2 Capture and Storage

Advanced Nuclear Fission and Fusion

Source: International Energy Agency (Vigotti)

Renewable Implementation is Increasing Across the U.S.

Chart of Renewables Portfolio Standards



28 states have an RPS; 5 states have an RE goal

DSIRE: www.dsireusa.org March 2009

Issues that Arise with Increasing Renewable Penetration

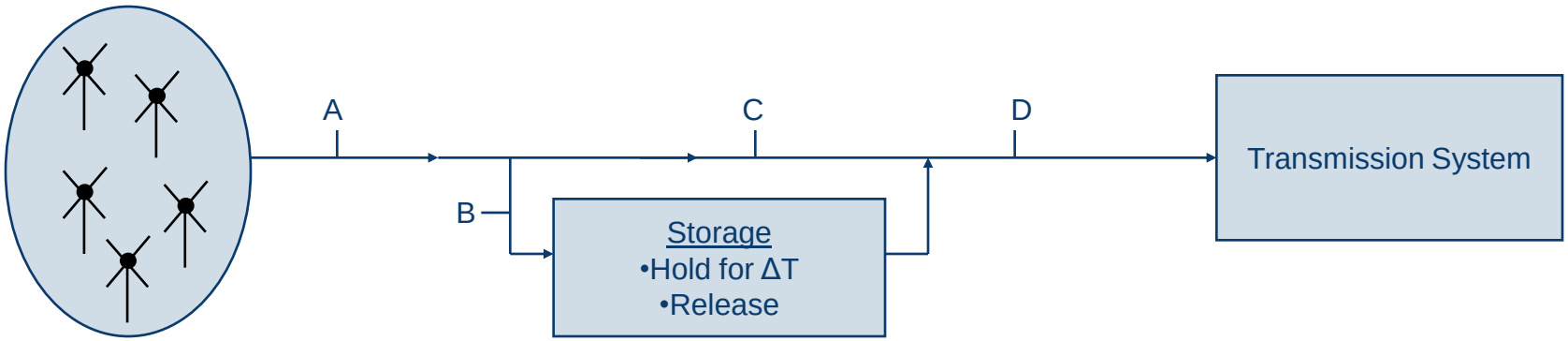
- Greater Impact of minute-to-minute volatility
  - Characteristics of storms, onset/fall of wind needs to be more closely monitored.
  - Impact of renewable dynamic behavior on real time energy needs, market prices, and total real time energy costs.
  - The resulting impact on traditional power plants that are required to "make up" the regulation needs imposed by renewables.
  - Dynamics can place strains on maintaining grid operations.

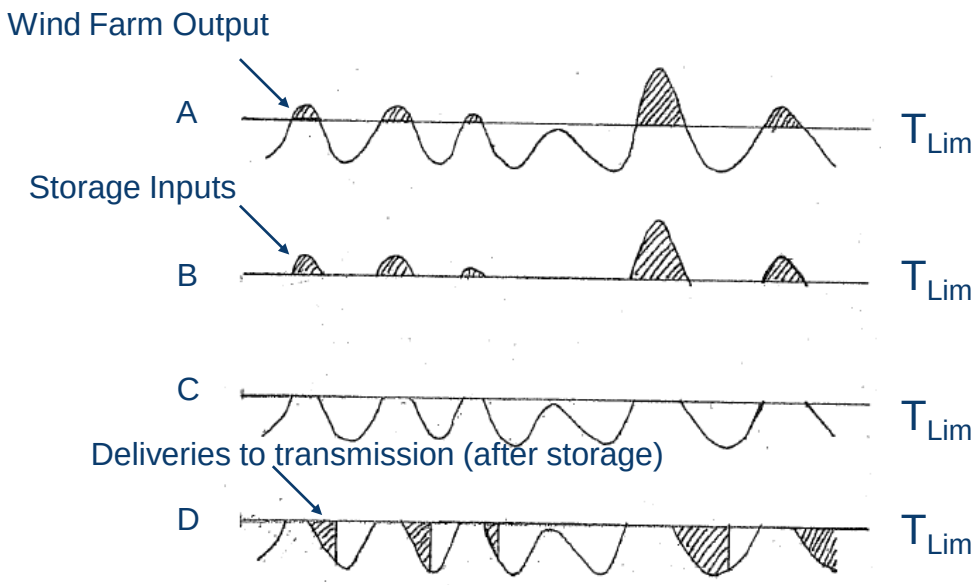
Can Energy Storage Help With Renewables Integration?

- Characteristics of advanced storage that allow it to assist with renewable integration
  - Fast response characteristics for regulation and operations
  - Transportability – allows devices to be placed at any location

- Some promising examples include:
  - Accommodating Transmission limits from remote generators
  - Reducing transmission congestion
  - Providing improved frequency regulation

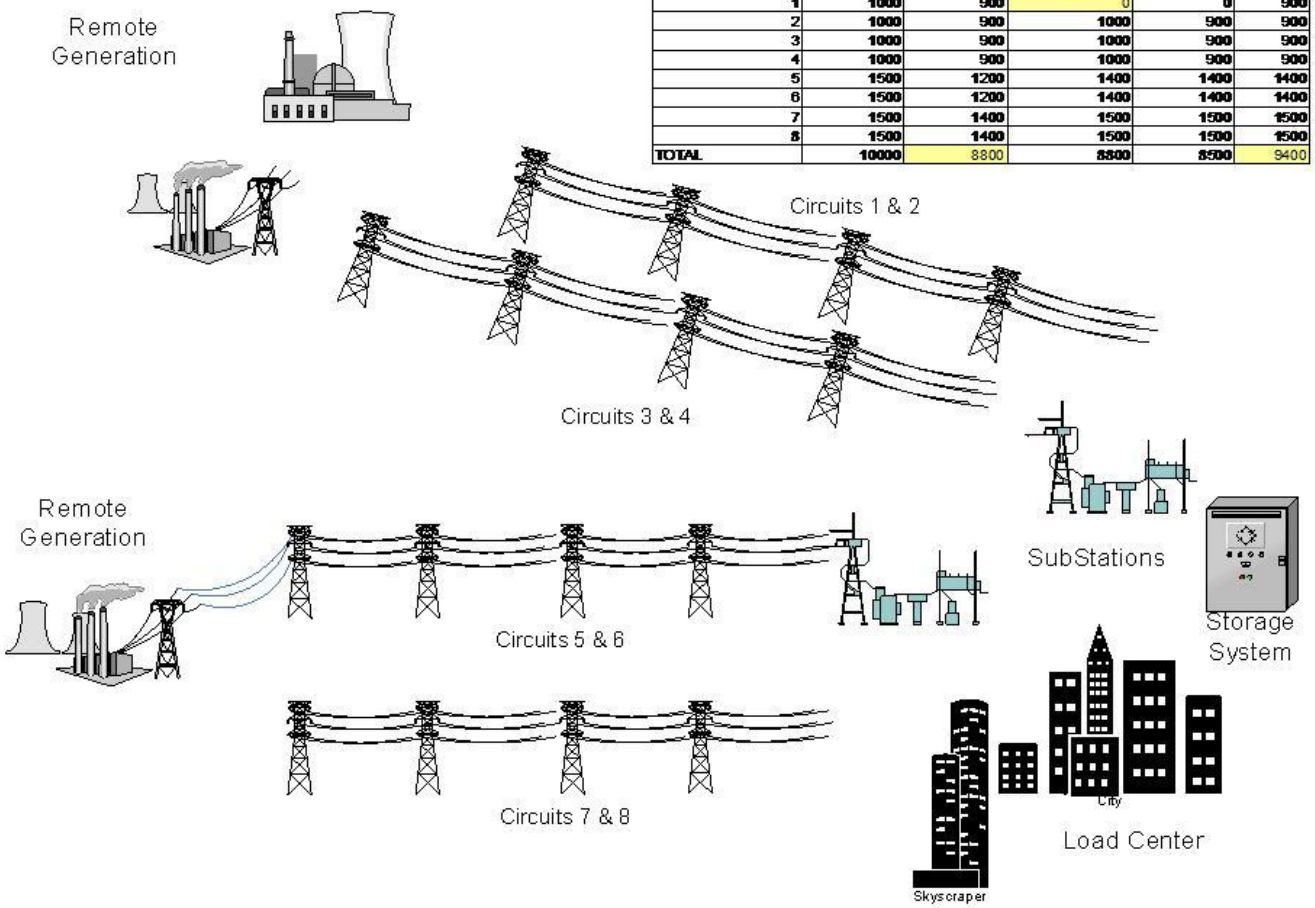
Accommodating Transmission Limits from Wind Farms





Reducing Transmission Congestion

Circuit	Rating	SCUC Allowed Flow	Post Contingency Flow	Post Contingency Flow w Storage	Allowed Flow w Storage
1	1000	900	0	0	900
2	1000	900	1000	900	900
3	1000	900	1000	900	900
4	1000	900	1000	900	900
5	1500	1200	1400	1400	1400
6	1500	1200	1400	1400	1400
7	1500	1400	1500	1500	1500
8	1500	1400	1500	1500	1500
TOTAL	10000	8800	8800	8500	9400



Providing an Improved Regulating/Balancing Resource

- Requirement – Generation and Load must be kept in balance in real time
- Challenge – Renewables make this more difficult
  - Large, rapid swings in wind farm outputs
  - Sudden losses or increases in PV output
- Large Imbalances result in frequency excursions
- Advantage – Advanced storage provides faster response than conventional resources.
  - May reduce carbon emissions as well

Conclusions

- Advanced storage can reduce the volatility of renewable deliveries from remote sites.
- Increased T&D congestion may be relieved with storage on “load-side.”
- Fast energy storage may be an improved substitute for conventional (non-renewable) regulating reserves.
- Other promising applications also exist, but economics are unclear at present.

Questions?

Thank you for your time.

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