

ENERGY STORAGE IN TEXAS

Robert J. King
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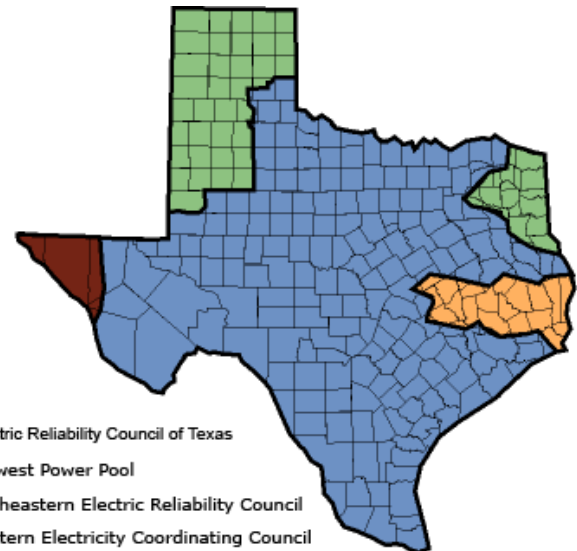
- Austin-based firm specializing in clean energy,
- Services include:
 - Policy & Regulatory
 - Business Development
 - Coalition Building
 - Analysis & Technical Consulting
- Industries include:
 - Energy Efficiency
 - Renewable Energy
 - Energy Storage
 - Smart Energy
 - Alternative Transportation

TEXAS MARKET BACKGROUND



Texas PUC Commissioners and Legislators Handle Issues That Are Handled By FERC Nationally

- The ERCOT ISO, which serves 75% of TX, is intra-state and therefore is not under FERC jurisdiction

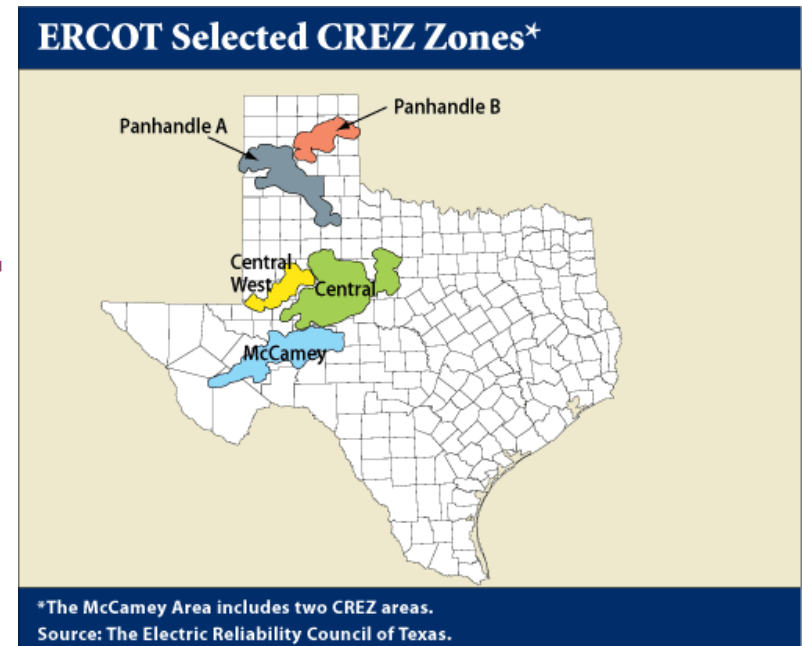
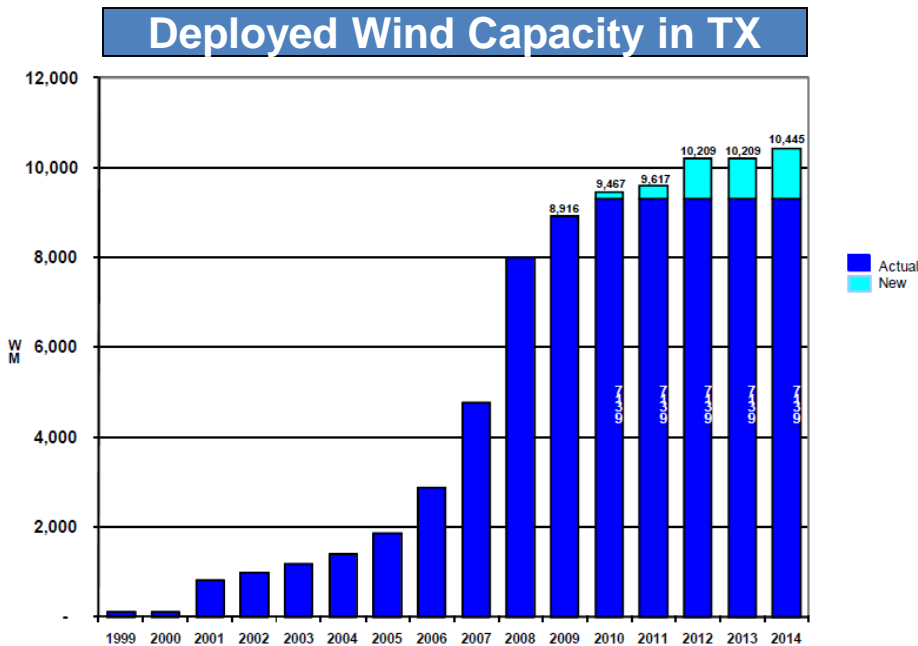


ERCOT - Electric Reliability Council of Texas
SPP - Southwest Power Pool
SERC - Southeastern Electric Reliability Council
WECC - Western Electricity Coordinating Council

Texas Has a Partially De-regulated Electricity Market

- In “competitive” areas, utilities have been unbundled into generators, transmission/distribution utilities (TDUs), and retail electric providers (REPs)
- Austin, San Antonio, and other cities still have municipally-owned, vertically-integrated utilities
- Some areas are served by electric cooperatives or incumbent utilities

10,000 MW of Deployed Renewables Over 18,000 MW Soon... Opportunity for Storage?



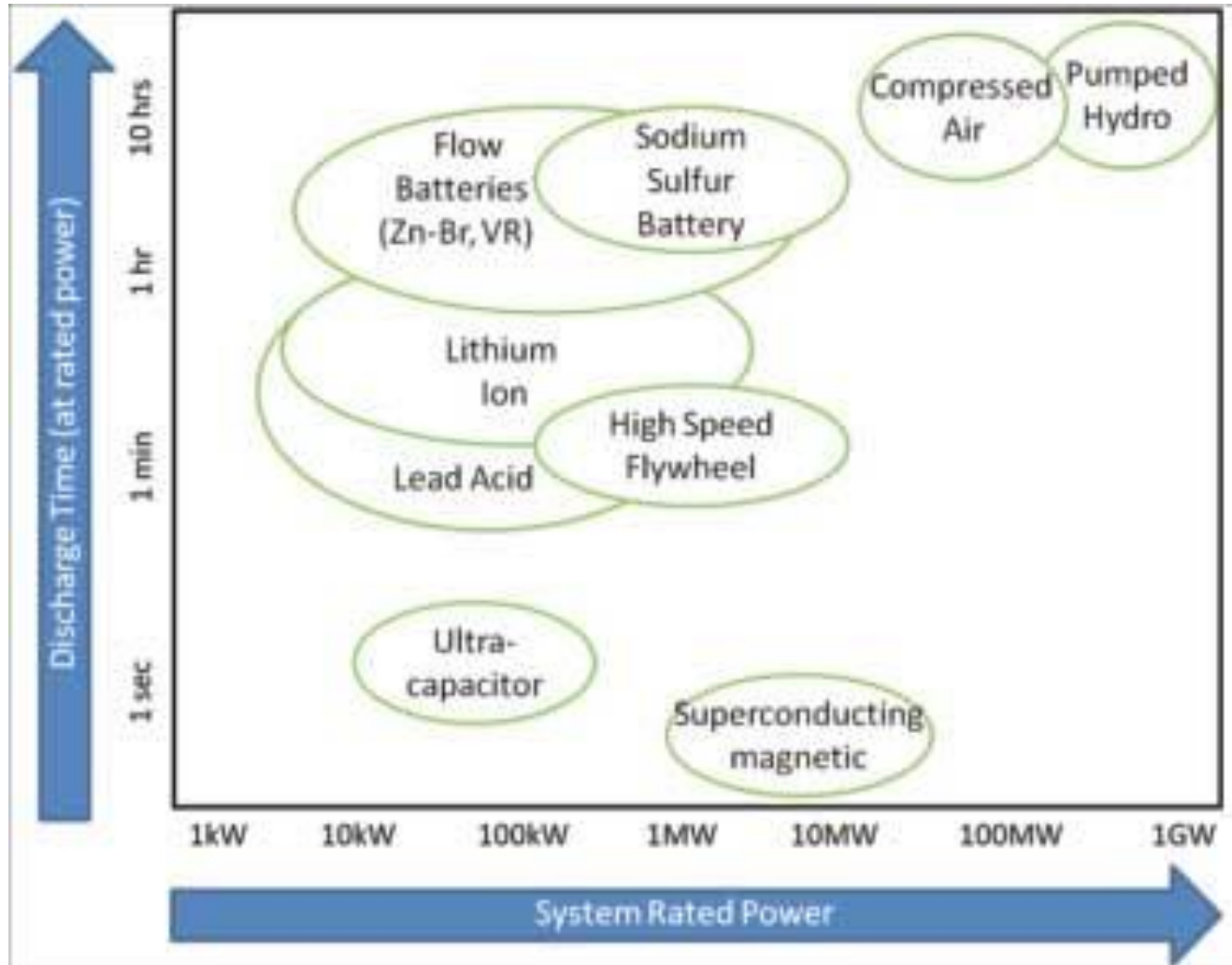
Thermal Storage as Peaking Resource

- Thermal storage offers excellent benefits in the way of peak shaving
- Option for Large Customers with the right rate or incentive structure (not just TOU)
- Retailers in competitive markets can't choose this strategy (except in cooperation with customers)

Electric Storage: Basic Knowledge

- Energy storage is viable today and has been commercially deployed
- It is not just one technology
- It can provide multiple services
- Storage reacts quicker than generation
- All grid resources can benefit from storage
- Economics depend on applications and assumptions

Energy Storage is Not Just One Thing...

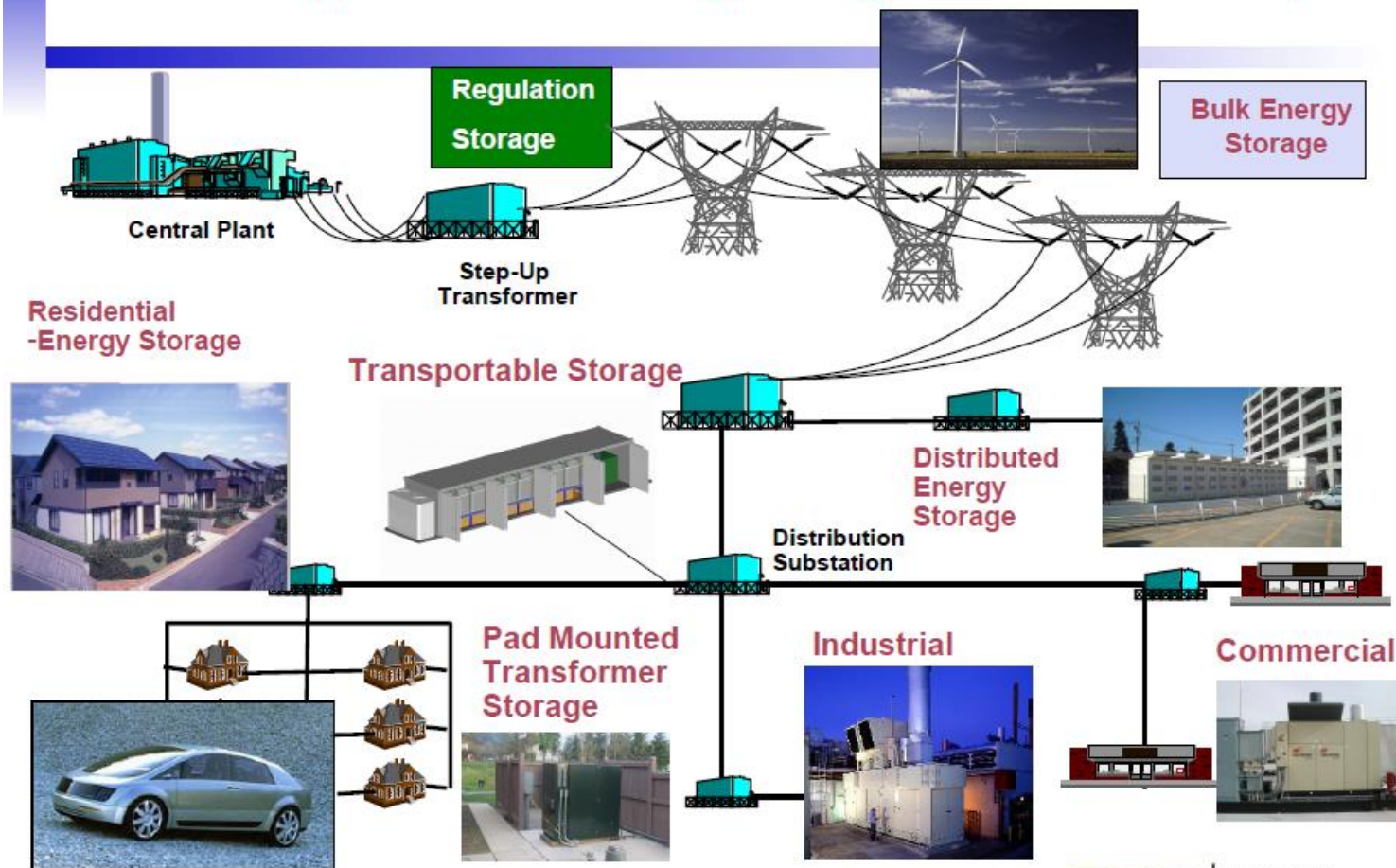


Source: GTM Research

All Grid Resources Can Benefit from Storage...

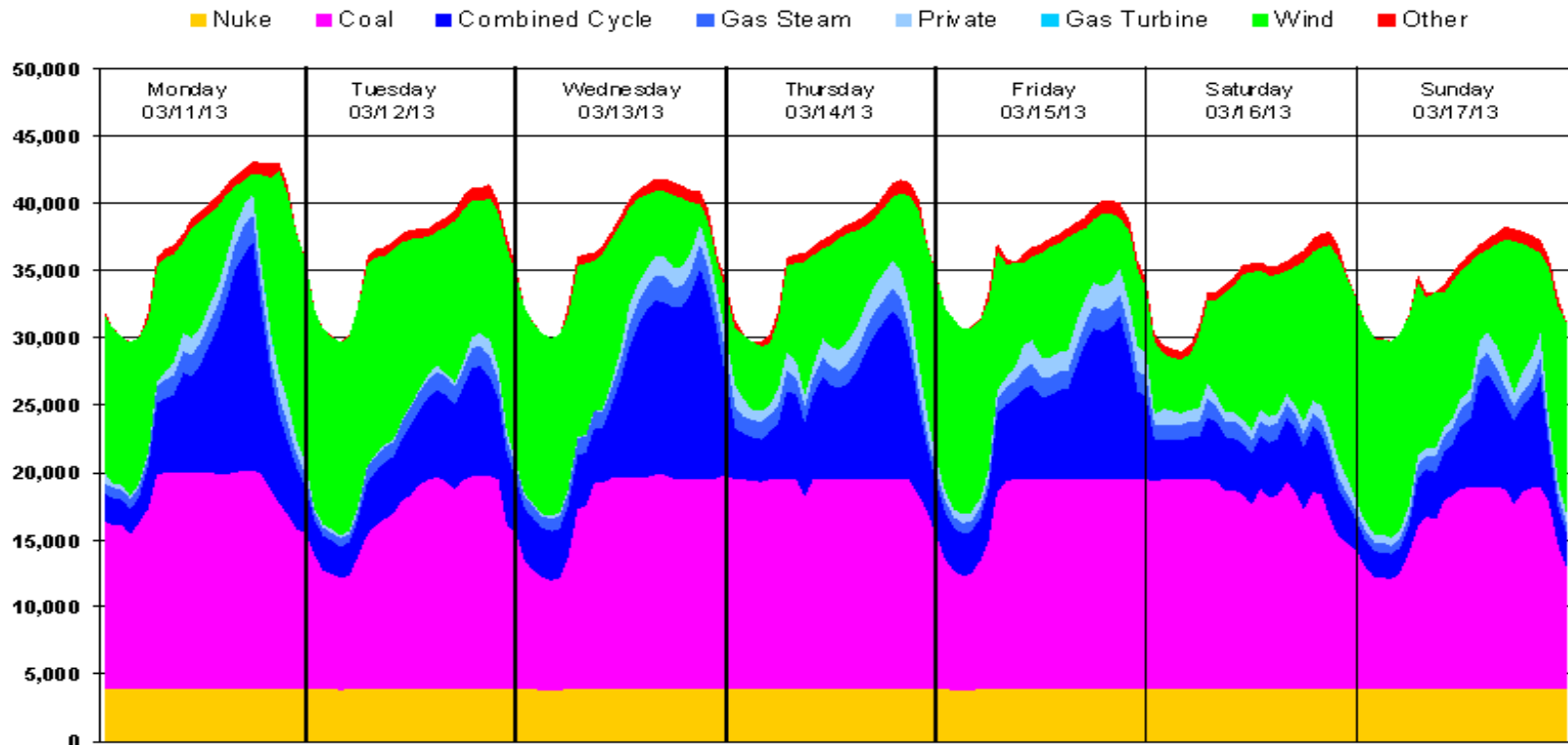
Electric Energy Storage

Locational Opportunities for Energy Storage in the Electric Enterprise



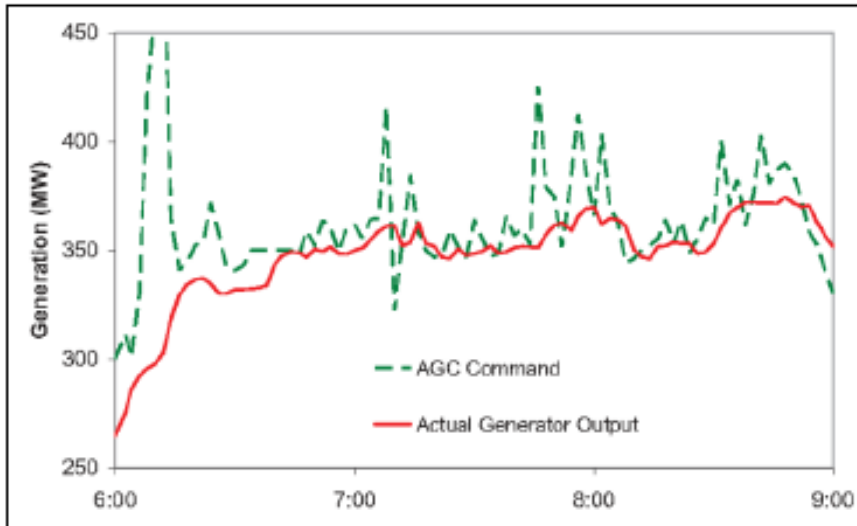
Storage Can Play a Key Role in Ensuring Grid Reliability...

2013 HIGH WIND WEEK - GENERATION BY FUEL TYPE

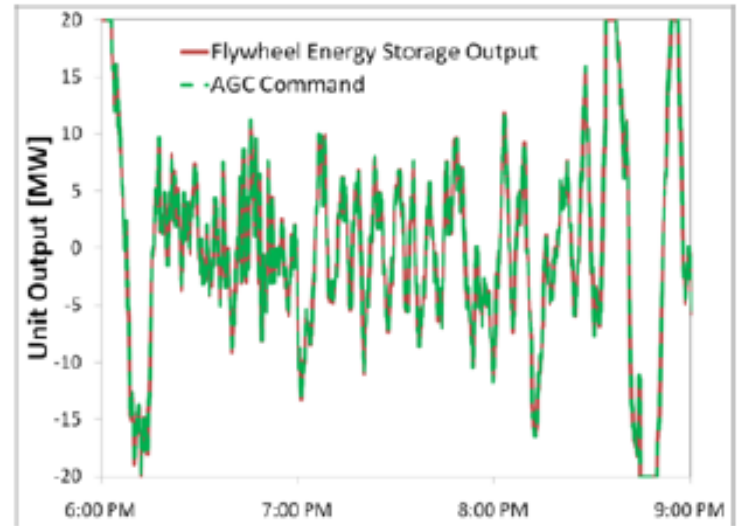


Dan Woodfin, Director, System Planning and John Dumas, Manager, Operations Planning, ERCOT, Key Challenges to Reliability with Increased Wind Penetration, PUCT Project 37339 Workshop 8/20/09

Ancillary Services Provided by Storage Can React Quicker...



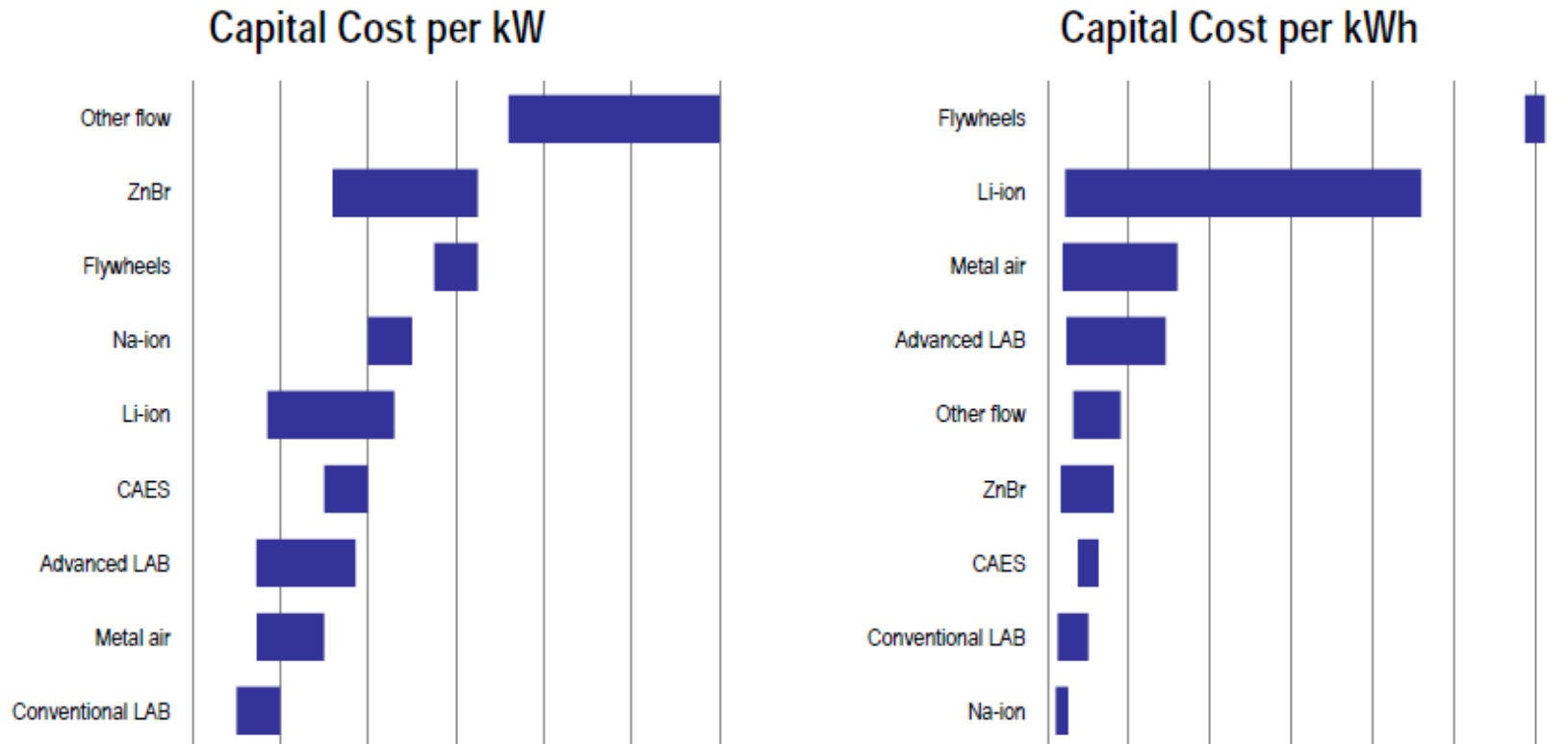
Slow ramping Generator



vs. Advanced Energy Storage

Advanced Storage provides “instantaneous” response to frequent and unpredictable changes in wind/solar

Storage Economics Depend on Applications and Assumptions...



Source: Duke Energy Presentation to DOE

Storage Can Provide Multiple Services...

- Ancillary Services such as frequency regulation
- Local reliability/power quality
- Transmission-level reliability
- Other renewable integration services
- Peak shaving or arbitrage (time-shifting)

And to be economic or most useful to the grid, a device may need to be able to provide multiple services...

TX Market Rules Were Designed By/For Traditional Technologies...

- ERCOT protocols reflect the capabilities and services that traditional generation resources are able to perform
- In ERCOT there is no way for a small generator or storage unit to get credited for reducing load on demand in ancillary services market unless they register as a Generation Resource

Quick Fix Adopted by Legislature...

Law Passed in 2009 Making Energy Storage that Participates in Wholesale Market Generation

Subsequent Rules adopted by the PUCT

Allowed storage units to

- Charge and discharge as a Wholesale Transaction
- Avoid Charges associated with Loads

Allowed ERCOT to adopt pilot initiatives

The Road Ahead: Leadership Required



- Current market participants don't have incentive to make the rule changes required to embrace new competitors
- PUCT, ERCOT, and others must provide vision and have the will to embrace new technologies that can benefit us all

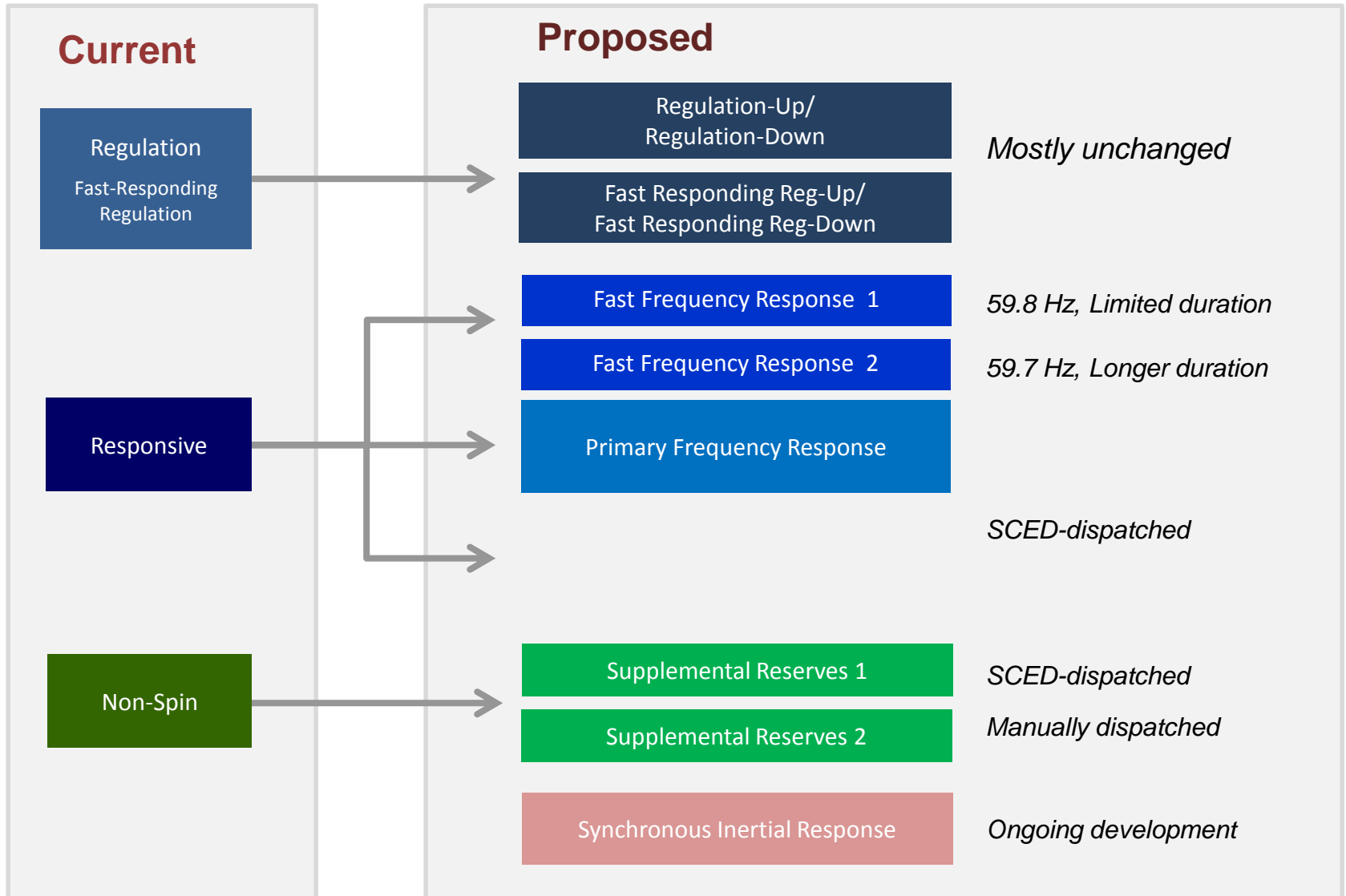
TX Market Rules Were Not Designed for Assets That Can Be Load or Generation...or Replace Transmission or Distribution Assets

- Transmission assets can still recover costs through regulated rates
- Generation assets must recover costs in the competitive markets
- In the competitive markets in Texas, TDUs are **prohibited** from owning generation or taking possession of electricity
- Different registration for generation/loads can lead to dual registration
- ERCOT not ready for small distributed generation/storage resources in Ancillary Services

Storage for Ancillary Services

- Storage does not replace the need for capacity and energy
- Storage provides certain services better than other technologies, and at less cost
- Products like Regulation which were designed for gas turbines may have to be separated
- Storage can increase the capacity of an existing generator or generator fleet to provide Ancillary Services

Future Ancillary Services Proposal



Storage for Arbitrage, T&D Apps

- Must Capitalize on multiple benefits:
 - Arbitrage alone will not finance a larger storage capacity such as CAES
 - Must also offer Ancillary Services, Reliability
- Ownership issues in ERCOT
 - Prevent a wires utility from providing storage as a premium service
 - Prevents a third-party from capturing benefits of storage as an option to T&D investments