

# Making the Case for Energy Storage to Customers – ERCOT Case Study

**Platt's 3<sup>rd</sup> Annual Power Storage Conference**

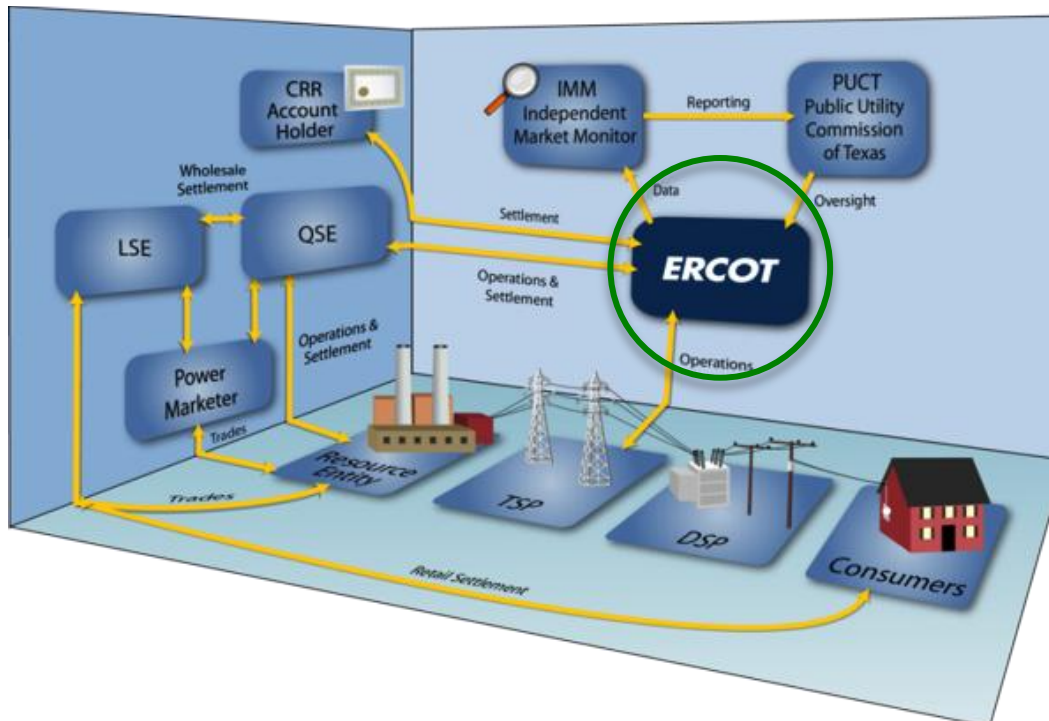
February 23, 2011

**Apex**•CAES

## MAKING THE CASE FOR ENERGY STORAGE TO CUSTOMERS – ERCOT CASE STUDY

- The benefits of energy storage are often framed from a system operators perspective...
  - **Reliability**
  - **Efficient dispatch**
- However, construction of utility-scale energy storage assets ultimately requires buy-in by load serving entities (LSEs) – municipal & cooperative utilities, as well as competitive retailers
- The extraordinary operating performance and unique load shifting capability of Compressed Air Energy Storage (CAES) can deliver attractive economics to load serving entities...
  - **Lower cost to serve**
  - **Reduce commodity risks**

## VALUE OF CAES TO THE SYSTEM OPERATOR



### Reliability

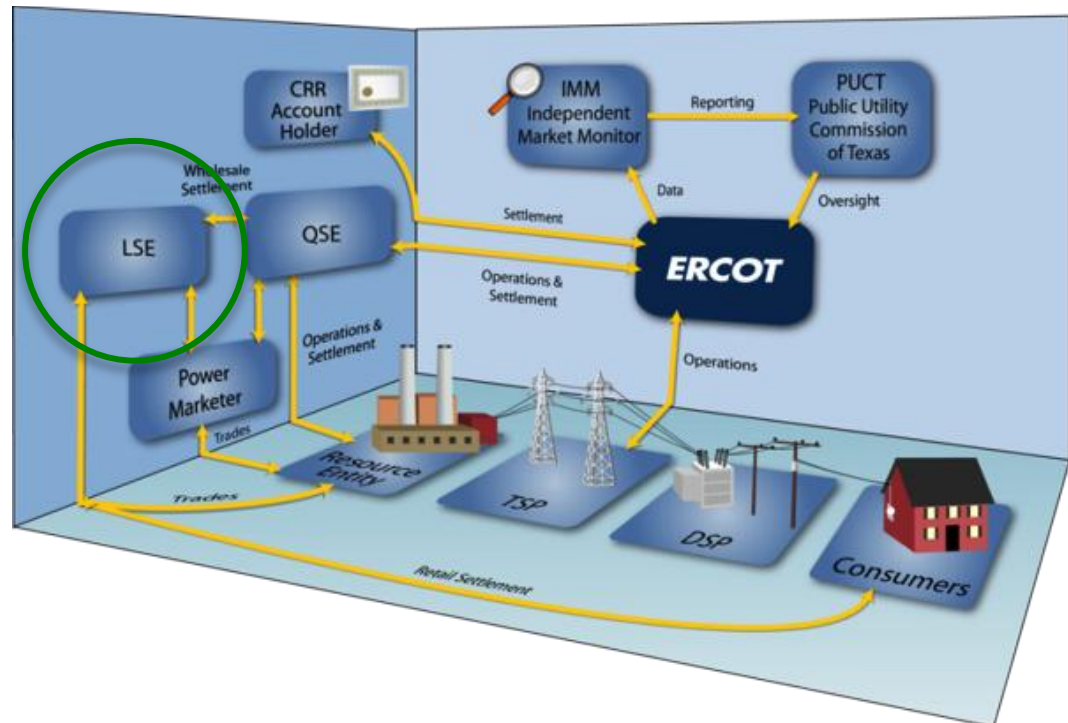
- 24/7 fast ramping regulation
- Sustain energy production for +24 hours
- Capacity resource
- Black start capability

### Efficient dispatch

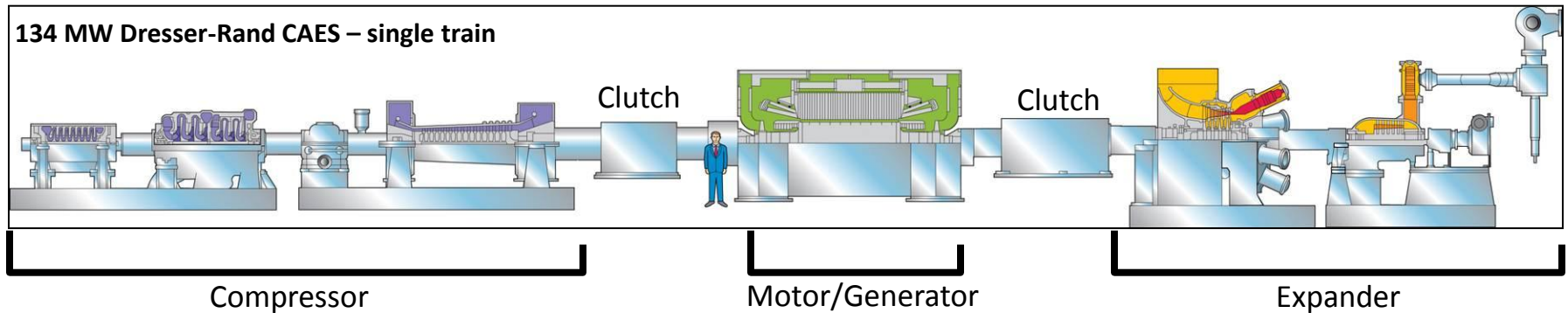
- Time shift electricity from over-supplied intervals to under-supplied intervals
- Improve supply curve for regulation/ancillary services

## NEED FOR CUSTOMER BUY-IN FOR ENERGY STORAGE

- **LSE support required** - Efficient capital structure for energy storage investment requires long-term customer revenues via contract or rate-recovery
- **Meeting LSE needs** - only willing to commit to long-term contract if value is compelling...
  - Lower costs to serve load obligation
  - Reduce commodity risks inherent in serving load obligation
  - Comply with regulatory mandate

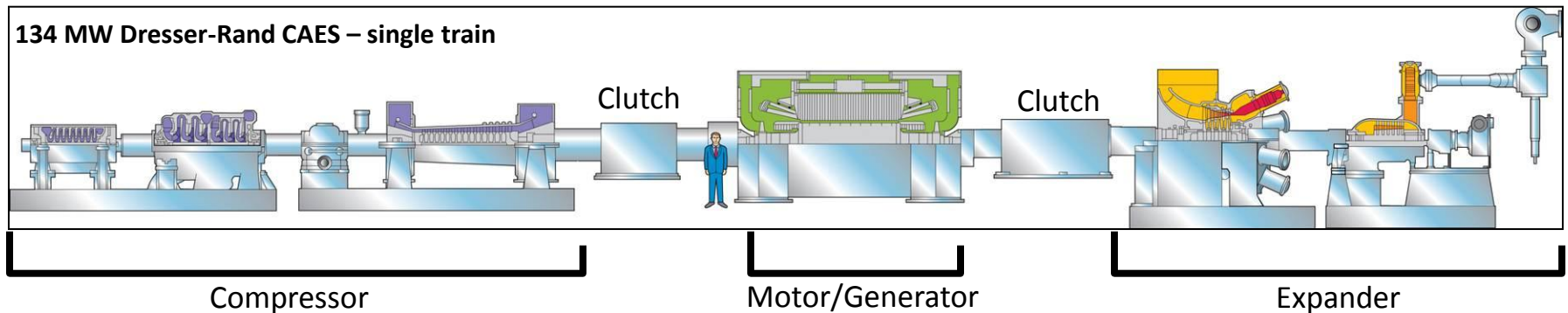


## CAES BASIC CHARACTERISTICS



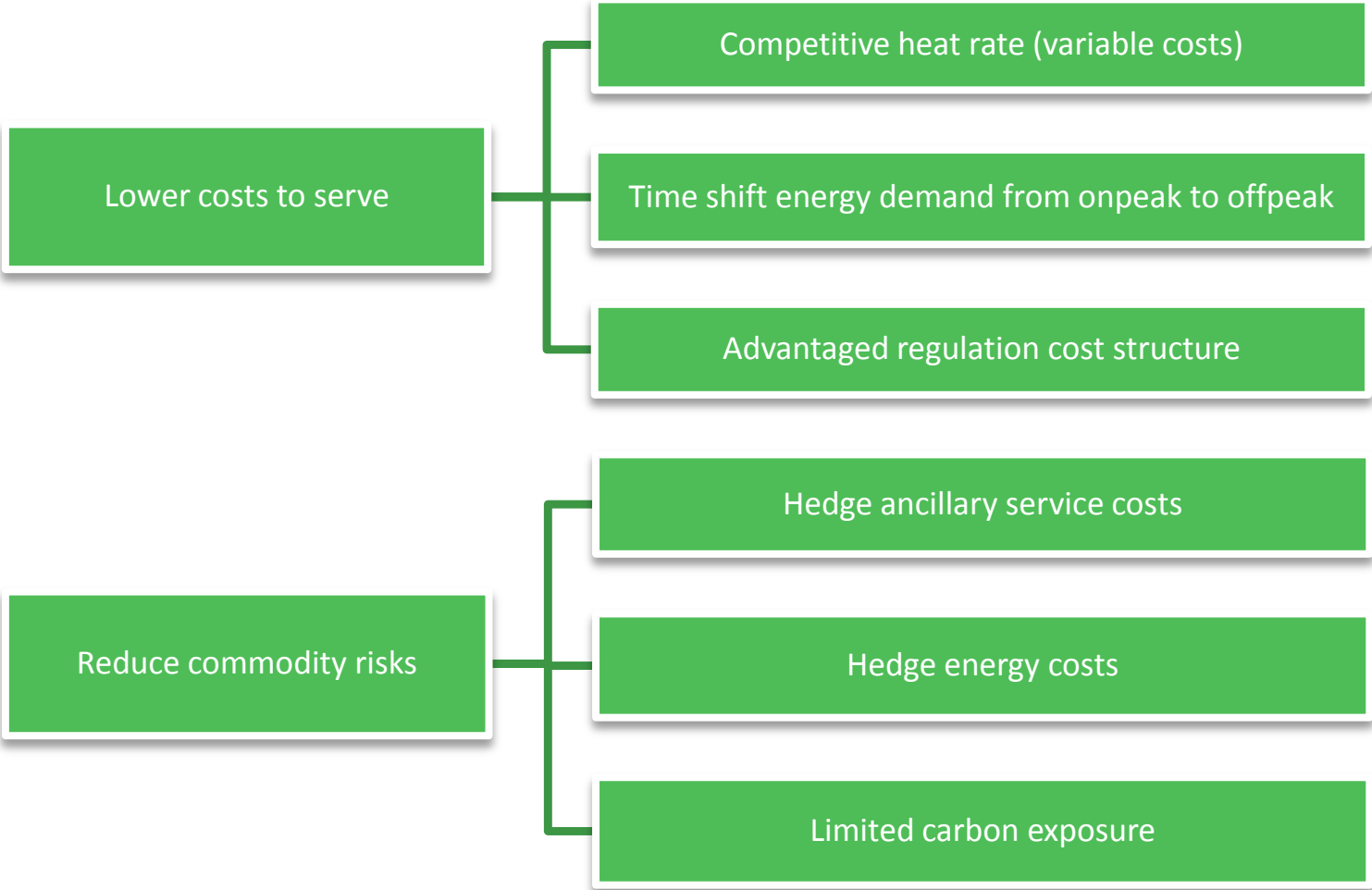
- 135 MW electric production
- 110 MW compression load
- Fuel requirements: part offpeak electric compression of high pressure air + part natural gas
- Economy of shared motor-generator
- Multiple trains/units provide commercial and operational flexibility, as well as greater reliability

## CAES SALIENT OPERATING CAPABILITIES



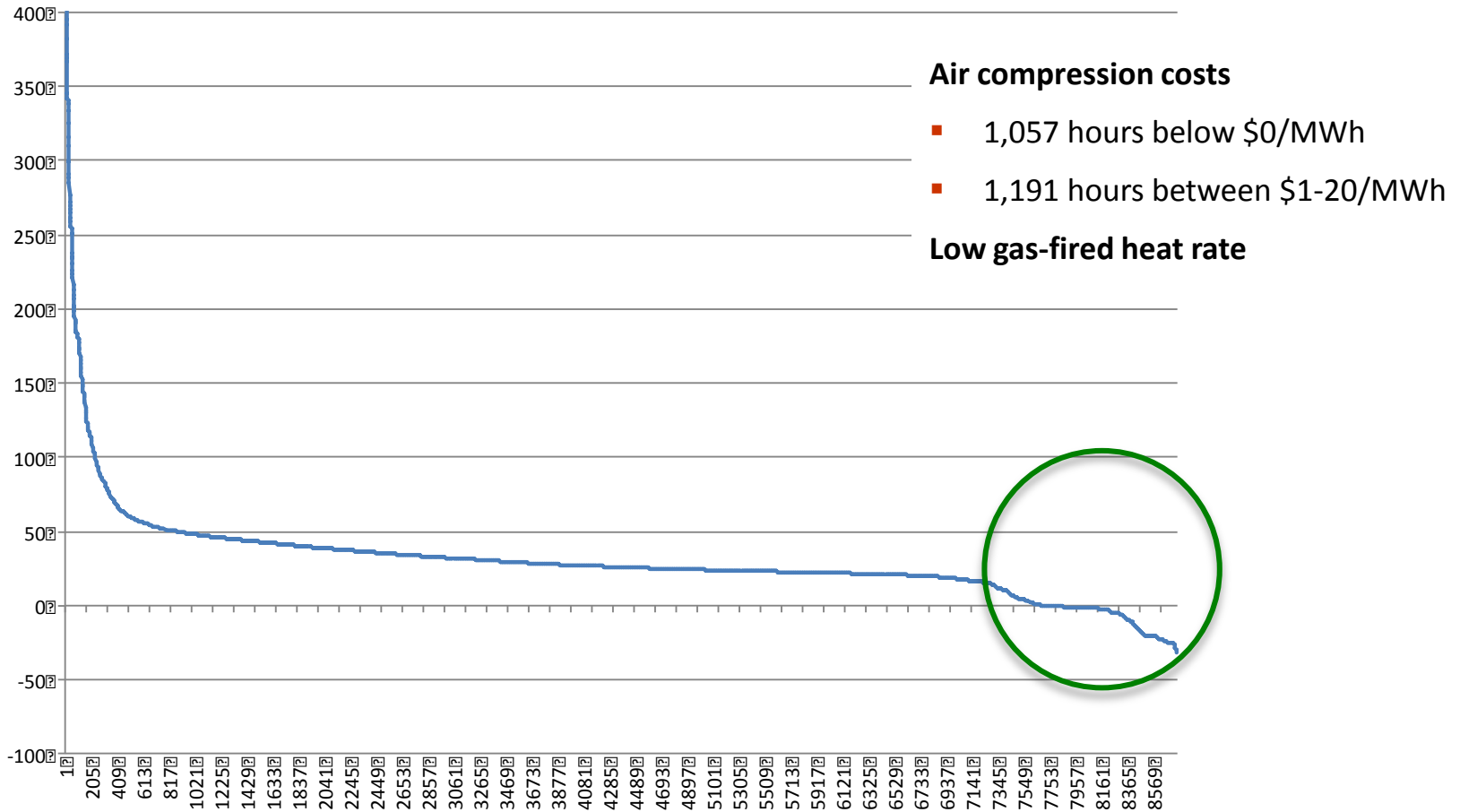
- Excellent reliability
- Can sustain energy production +24 hours
- Low effective heat rate (i.e., variable costs) – part natural gas + part offpeak electricity
- Superior ramp rate for generation and compression
- 5x operating range of conventional gas-fired generators (with little degradation in heat rate at minimum load)
- Low environmental profile – CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>

# CAES VALUE TO LSE/CUSTOMERS IN ERCOT



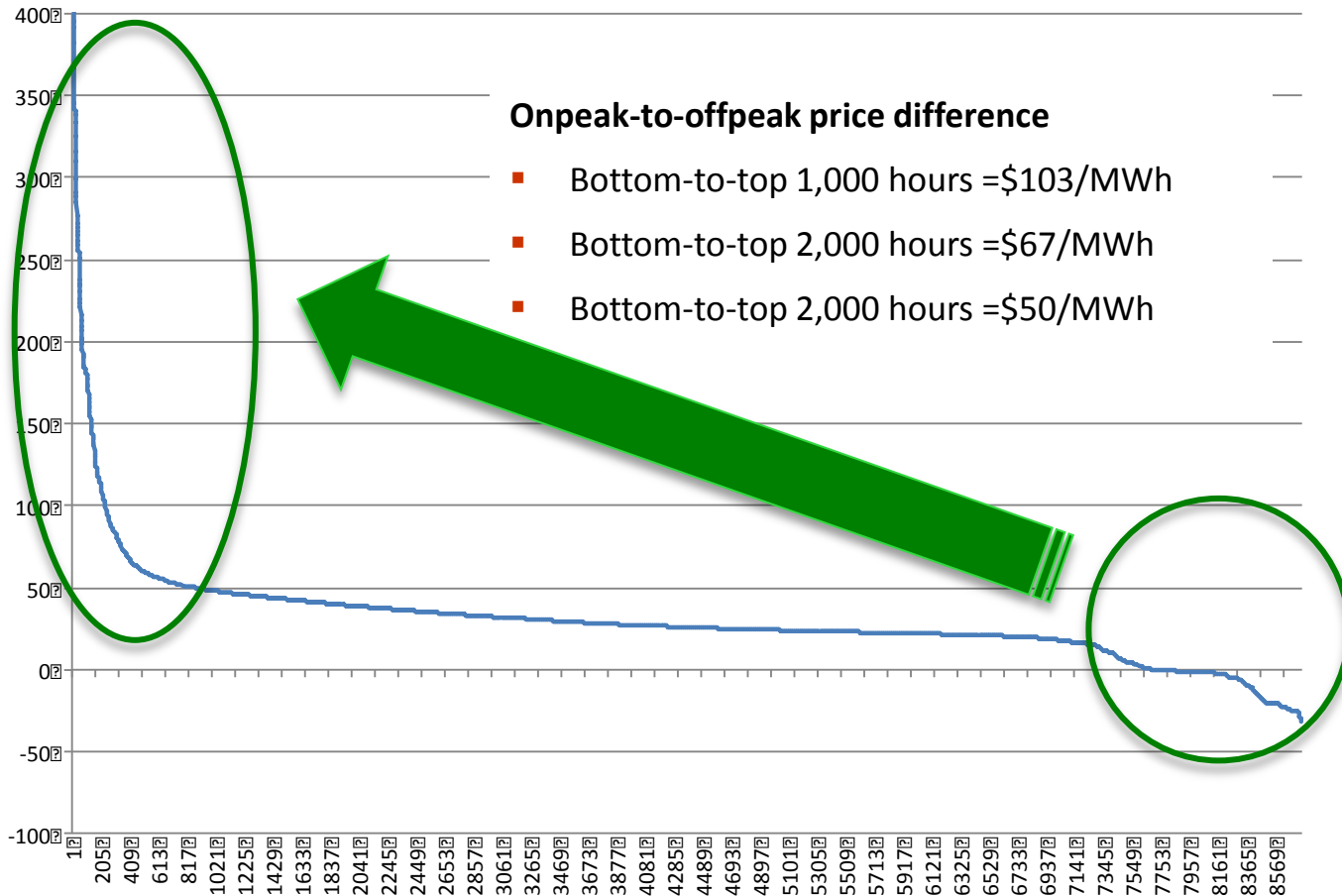
# CAES VALUE TO CUSTOMERS – COMPETITIVE ENERGY COSTS

2010 ERCOT - West Zone hourly prices (\$/MWh)



# CAES VALUE TO CUSTOMERS – TIME SHIFT ENERGY

2010 ERCOT - West Zone hourly prices (\$/MWh)

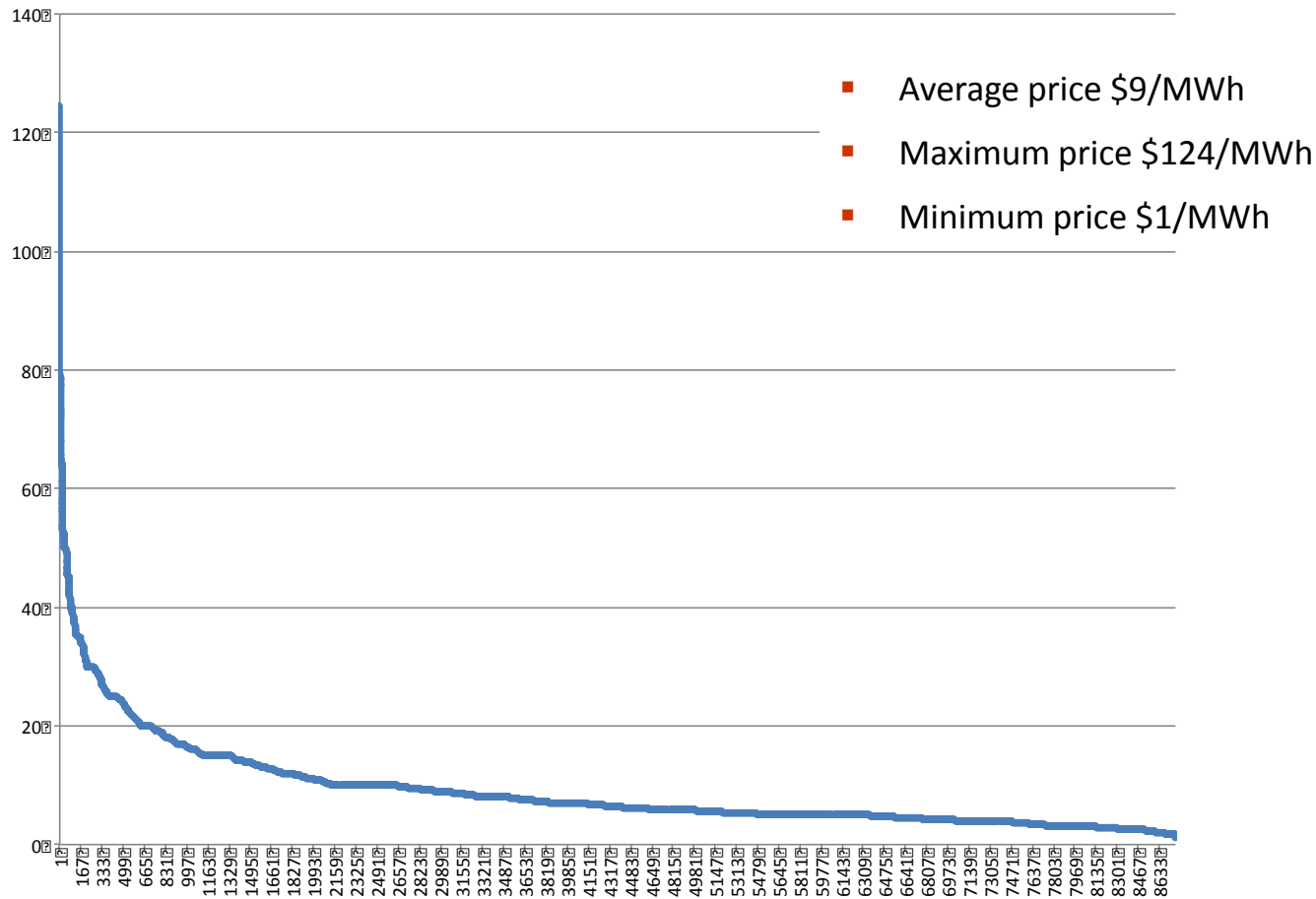


## CAES VALUE TO CUSTOMERS – ADVANTAGED COST STRUCTURE FOR REGULATION

- **Extraordinary operating range** – very low minimum sustainable load level
  - 5x greater range than conventional gas-fired generators (CCGT or OCGT)
- **Little degradation** in variable costs between maximum and minimum sustainable load levels
  - 2 to 4x lower incremental costs to generate at minimum load levels relative to conventional gas-fired generation
  - Must synchronize generator to qualify to provide regulation in ERCOT
- **Superior ramp rate** – compressed air at high PSI at flip of switch and less rotating mass
  - +25 MW per minute

# CAES VALUE TO CUSTOMERS – HEDGE FOR ANCILLARY SERVICE COSTS

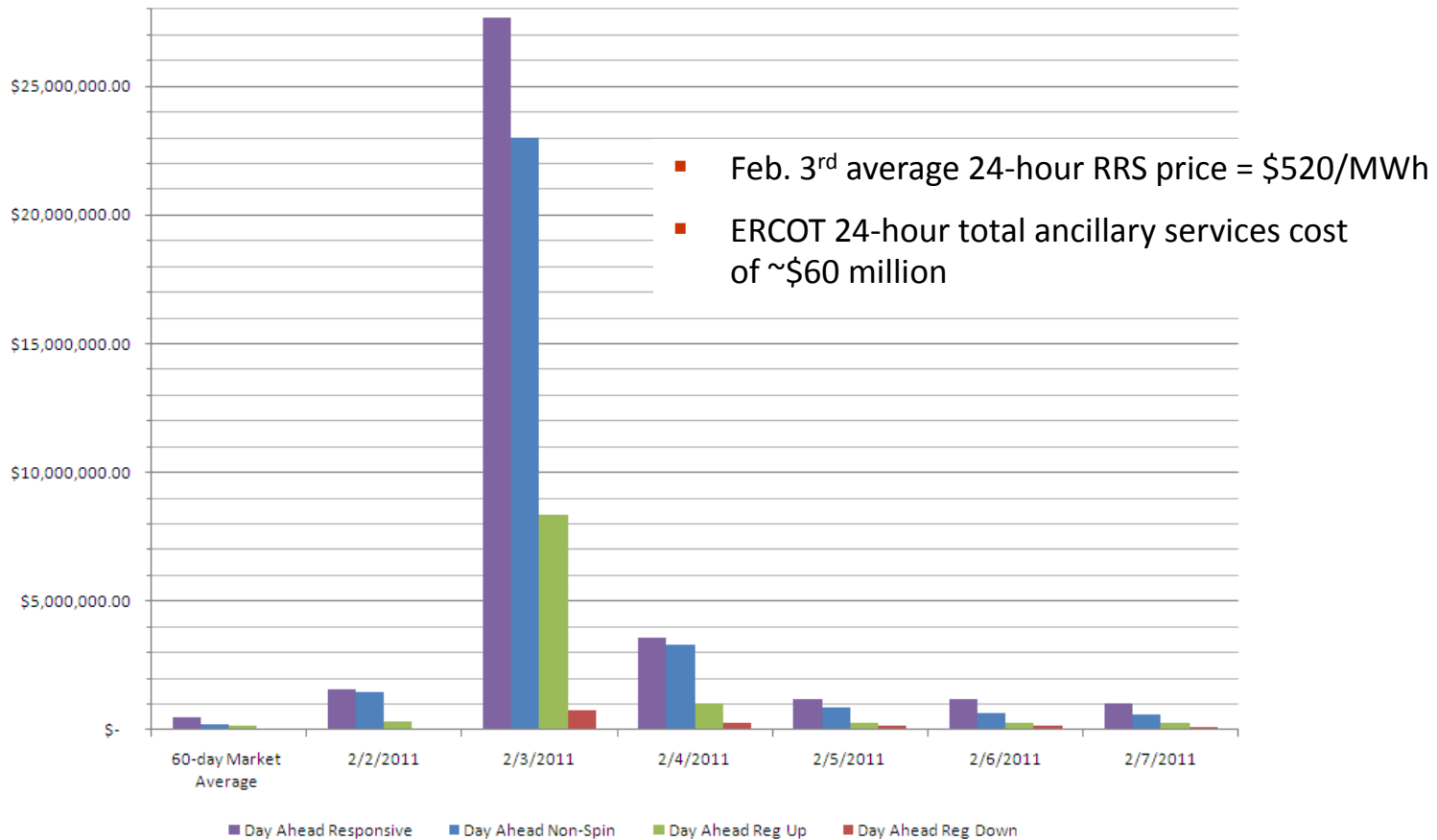
## 2010 ERCOT – Responsive Reserves hourly prices (\$/MWh)



# CAES VALUE TO CUSTOMERS – HEDGE FOR ANCILLARY SERVICE COSTS

## ERCOT rolling blackout event – week of Feb. 2<sup>nd</sup>, 2011

Average Ancillary Services Settlements versus Early February AS Settlements



## MAKING THE CASE FOR ENERGY STORAGE TO CUSTOMERS

The extraordinary operating performance and unique load shifting capability of Compressed Air Energy Storage (CAES) can deliver attractive economics to load serving entities...

- **Lower cost to serve**
  - **Competitive heat rate (variable costs)**
  - **Time shift energy demand from onpeak to offpeak**
  - **Advantaged cost structure for regulation services**
  
- **Reduce commodity risks**
  - **Hedged ancillary service costs**
  - **Hedged energy costs**
  - **Limited carbon exposure**

Apex Compressed Air Energy Storage LLC

Jack Farley, President

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