

**City of Austin  
Resource Management Commission**

***Dispatchability:  
The Next Step for a  
Clean Energy Grid in ERCOT***

**Paul Robbins  
April 17, 2018**

# **Austin's Clean Energy Progress Step-By-Step**

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**2017 – Established 65% Renewable Goal**

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**2015 – First Conservation Voltage Regulation**

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**2011 – First Utility Solar Purchase**

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**2006 – Electric Vehicle Program Begins**

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**2004 – First Rooftop Solar Rebates**

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**1995 – First Wind Power Purchase**

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**1987 – First Commercial Energy Efficiency**

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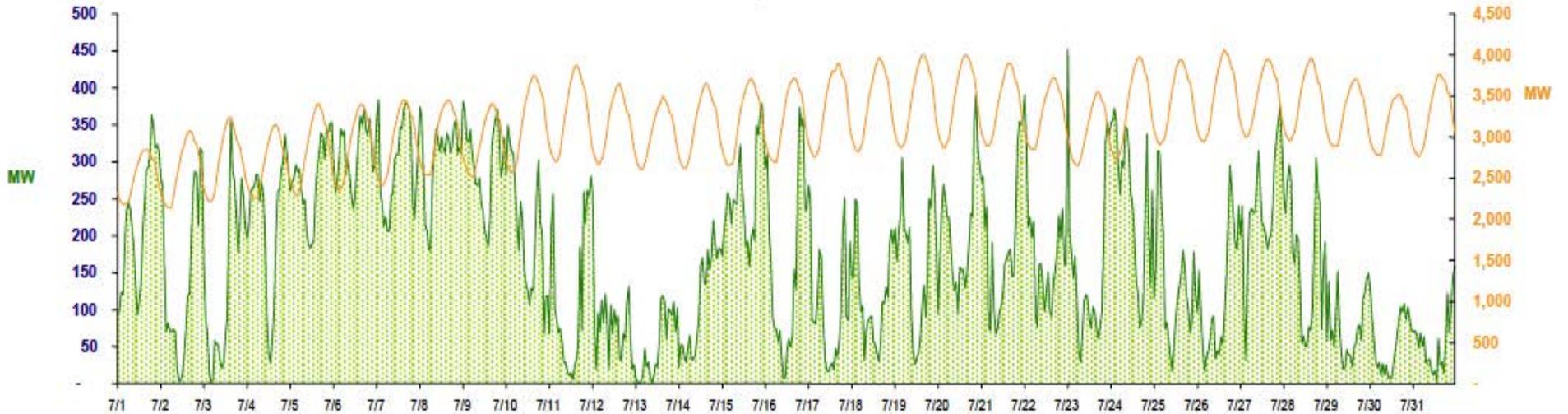
**1982 – First Residential Energy Efficiency**

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**1981 – First Progressive Residential Rate**

# *Wildly Erratic West Texas Wind Profile*

V-3 a Wind Hourly Production – Unshaped  
Starting Date --Jul-1



# **TONIGHT'S PRESENTATION**

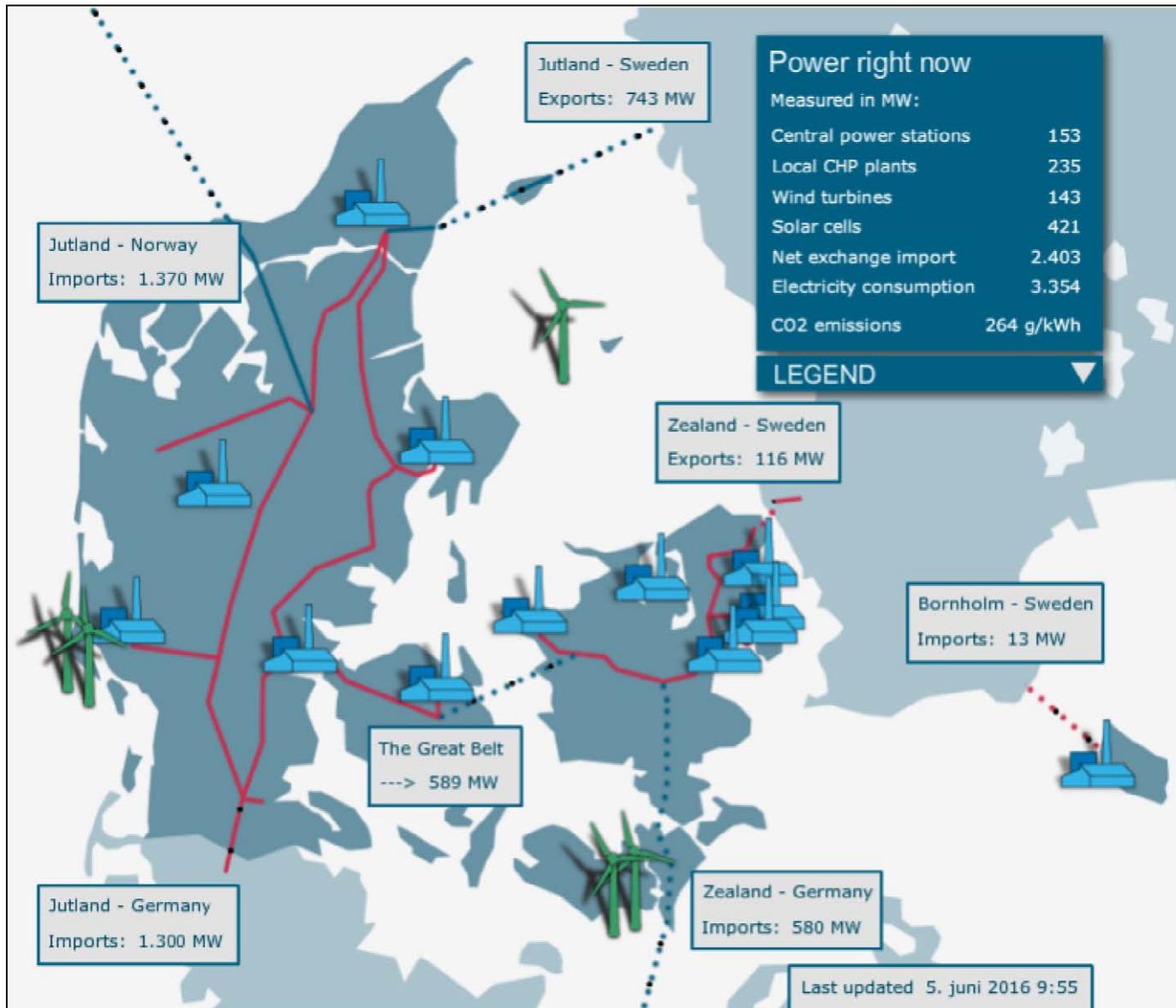
- 1. Ways that other places have dealt with dispatchability (or not)**
- 2. Options for dispatchable renewable electricity in Texas**
- 3. Strategies to put more renewable energy on the electric grid**



**Georgetown – 100%...On Paper  
But ERCOT is 83% Gas, Coal, and Nuclear**

**Paula Gold-Williams, CEO of CPS Energy:**

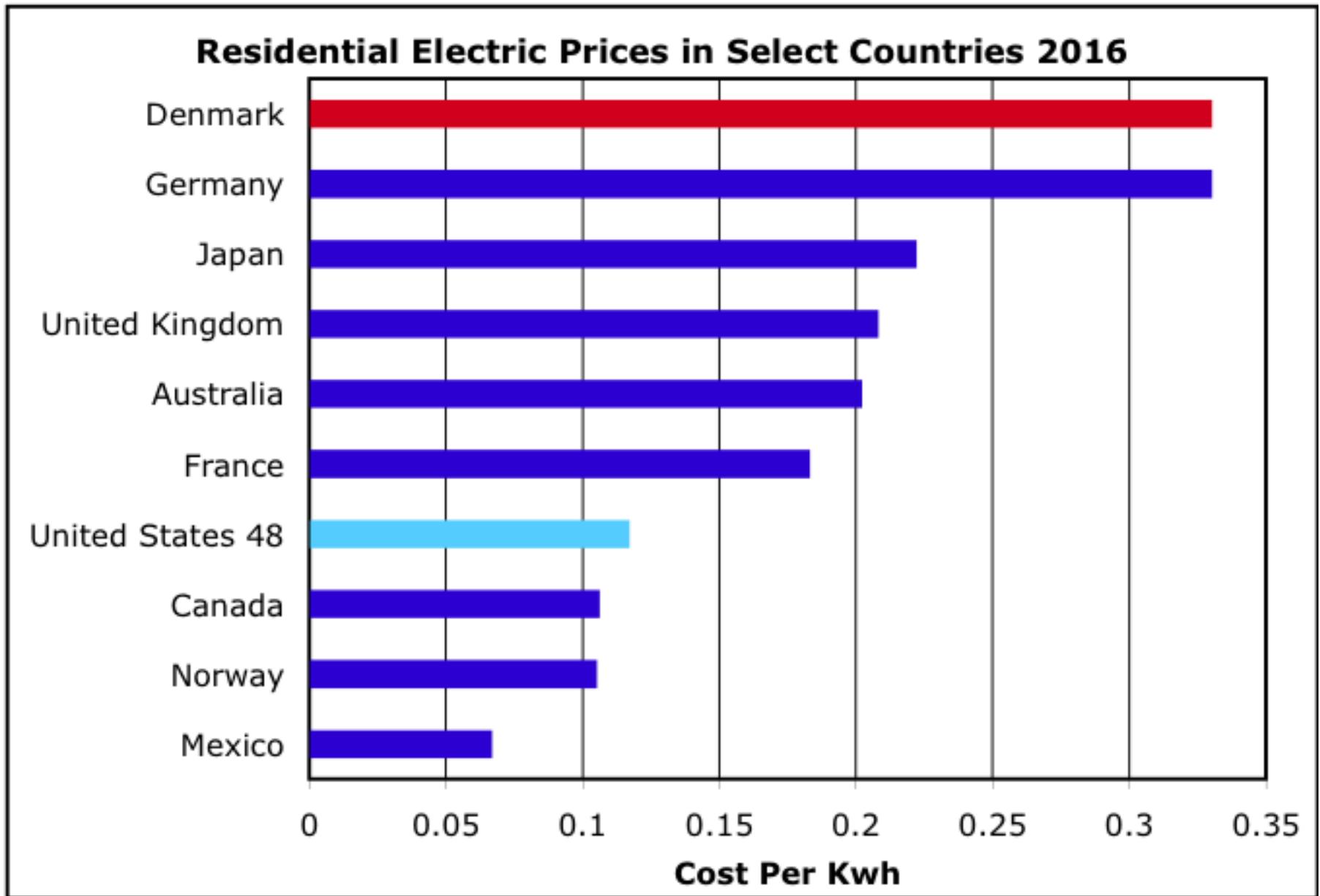
*“electrons love everybody, and in reality  
...they’re getting power from other units.”*



**Denmark - 46% Intermittent Electricity, But only 16% in Region (Germany, Denmark, Norway, Sweden)**



*In 2016, Denmark Generated 13% of Its Electricity from Biomass Including Domestic Straw, Imported Wood Pellets, and Domestic and Imported Solid Waste*



*Denmark Has Very High Electricity Costs*



*25% of Denmark's 2016 electricity from combustion was in Combined Heat & Power plants. Heat storage tanks allow them to function as reserve when there is too much power on the grid.*



**Iowa Transmission Grid (Purple)**  
**37% Wind-Share Traded With Other States...**  
**But the Heartland Only Got 12% from Wind in 2017**



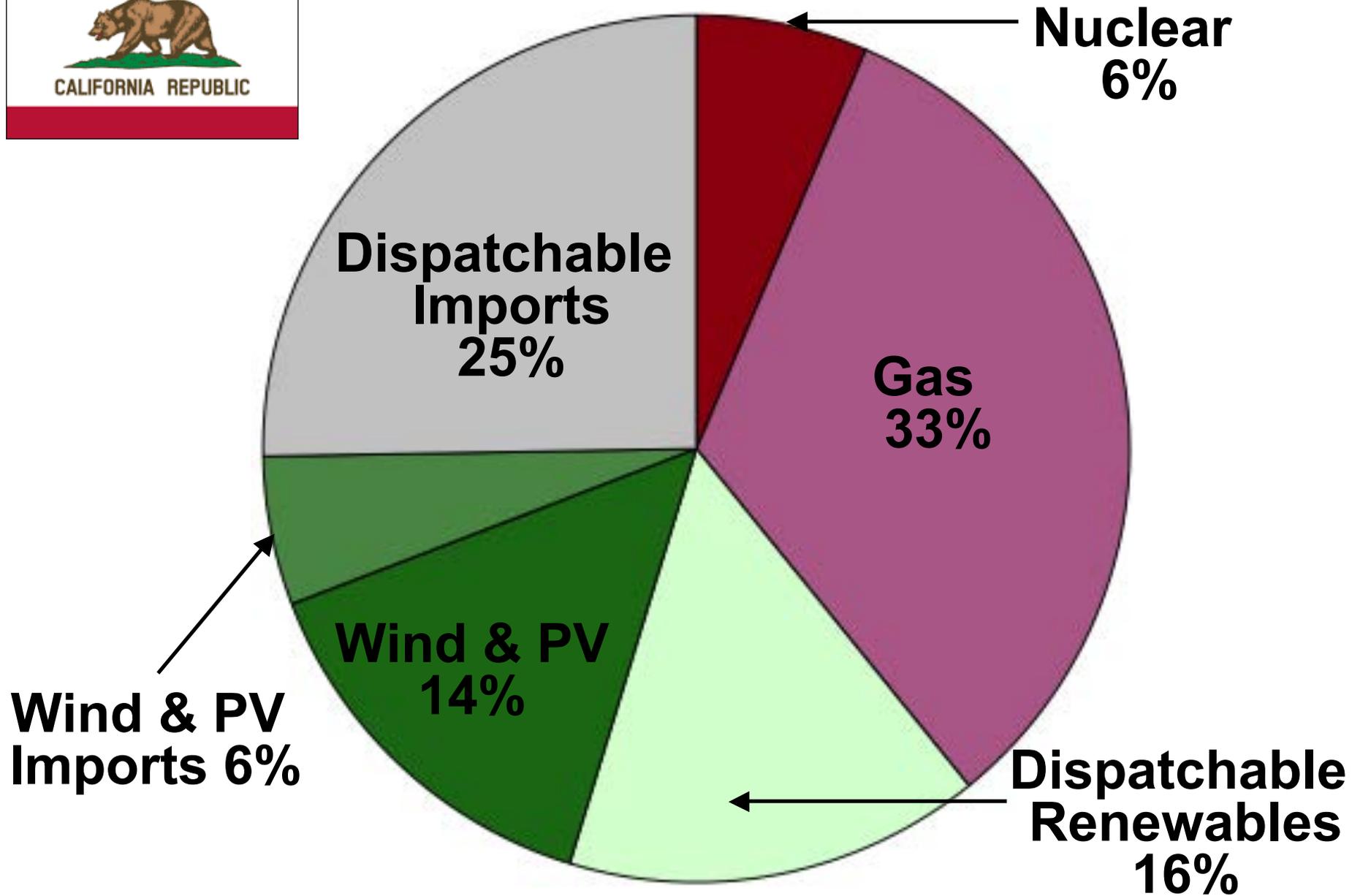
 **Kaua'i Island  
Utility Cooperative**

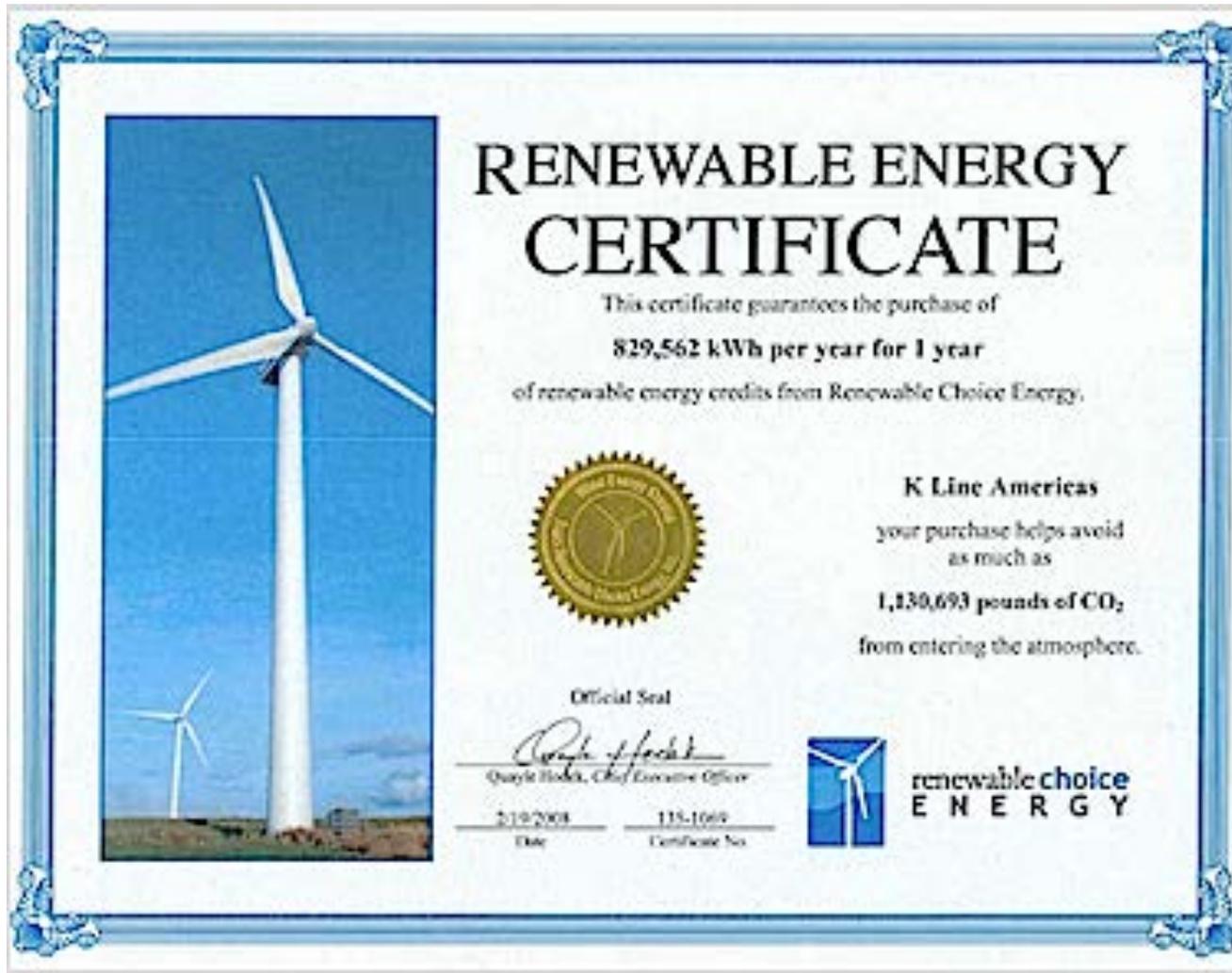
**Solar • Biomass • Hydro  
38% in 2017**



**Lithium Storage Batteries: Adjust Your Expectations**  
***More Than 40% Subsidy***  
***Storage Does Not Match Production***

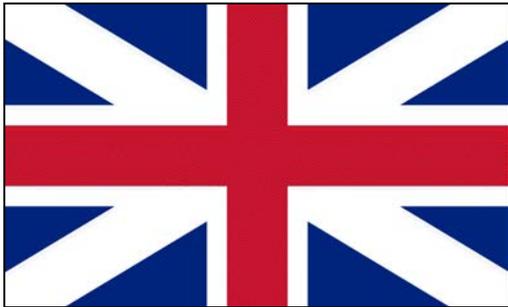
# California Electric Supply By Source 2016





*California RECs can come from production as far away as West Texas or Alberta, Canada*

## OTHER COUNTRIES WITH HIGH SHARE OF RENEWABLES



**UK/Ireland: 25% Renewables /19% Intermittent**

- Imported 4% of its Electricity from 4 Under-Sea lines
- Building \$2.4 billion Cable to Norway
- World's Largest Biomass Plants



**Iceland: 100% Hydro and Geothermal**

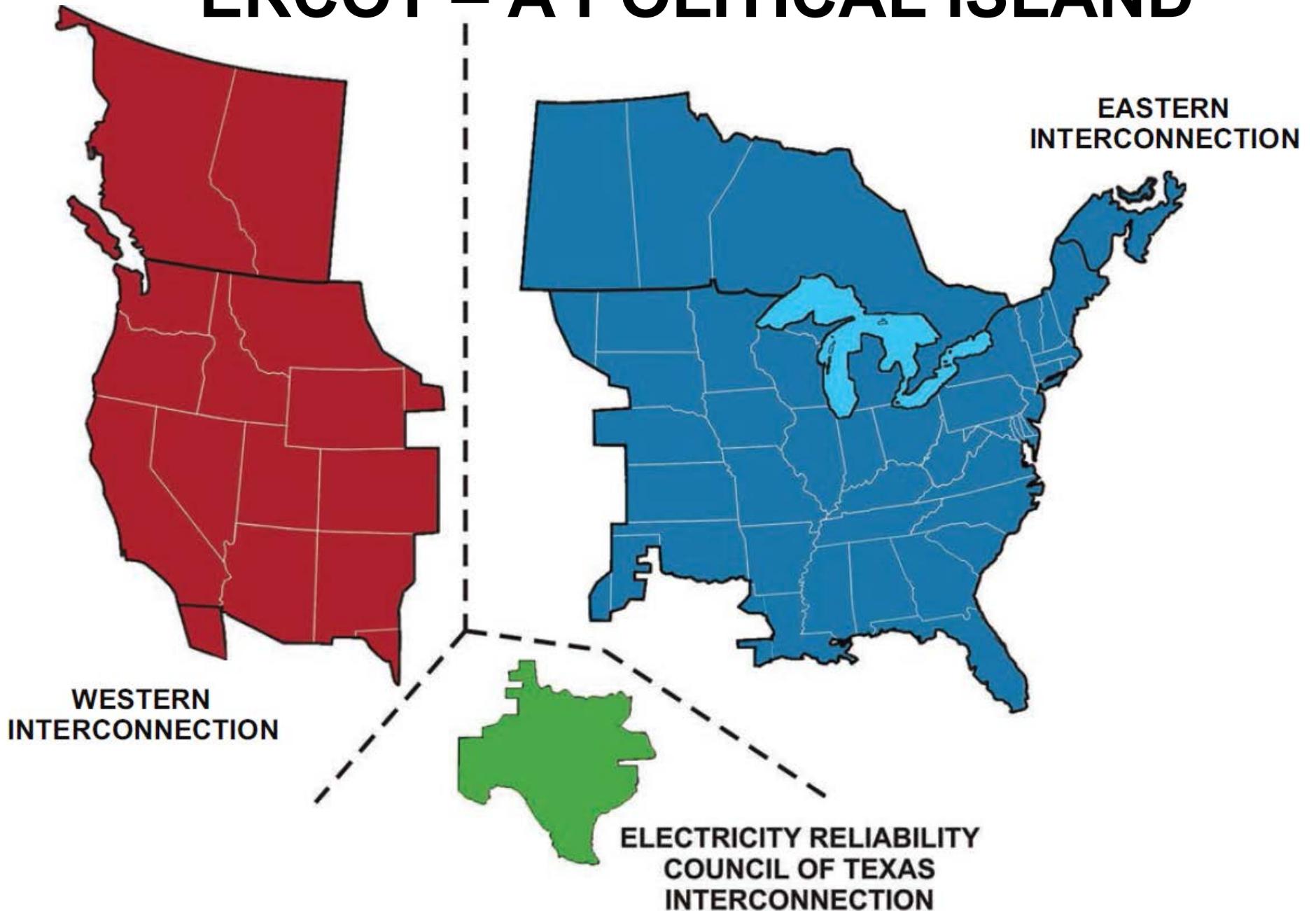
- Nothing Intermittent
- Discussion of Exports to UK via Longest Undersea Electric Cable in the World



**South Australia: 39% Wind & PV**

- Supported by East-coast Grid
- HIGH Electric Costs
- LOW PV Costs
- Aspires to 75% Renewables w/25% Dispatchable or Storage

# ERCOT – A POLITICAL ISLAND



# DISPATCHABILITY CHALLENGES

- **In Texas, Hydroelectric Potential is Minuscule**
- **Geothermal Electricity Does Not Exist**
- **Transporting Power from Other Regions is Politically Tenuous**
- **Wood chips and pellets are expensive and would require many years to establish supply chains**
- **Lithium Battery Costs Are VERY High – 28¢ per kwh according to Lazard's (2017)**

# **DISPATCHABLE ALTERNATIVES IN TEXAS?**

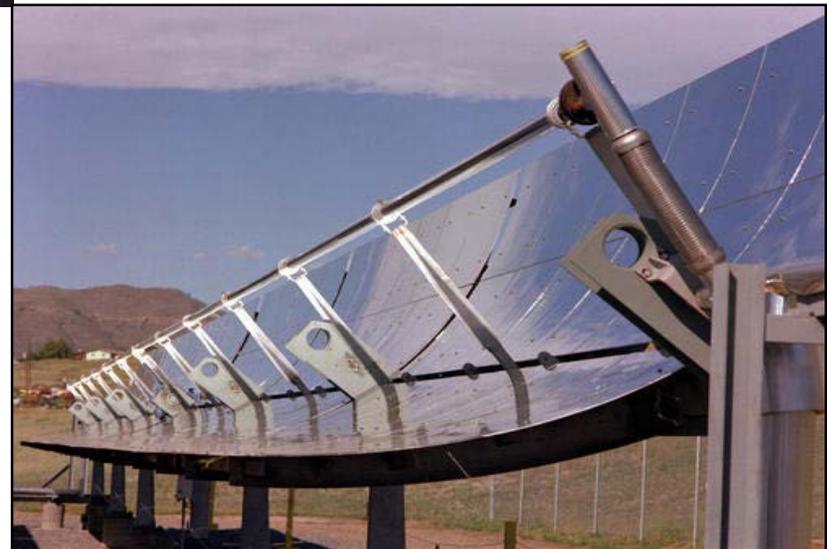
- **Biogas**
- **Concentrating Solar Power w/ Storage**
- **Thermal Storage**
- **Compressed Air Energy Storage**
- **Pumped Hydro**



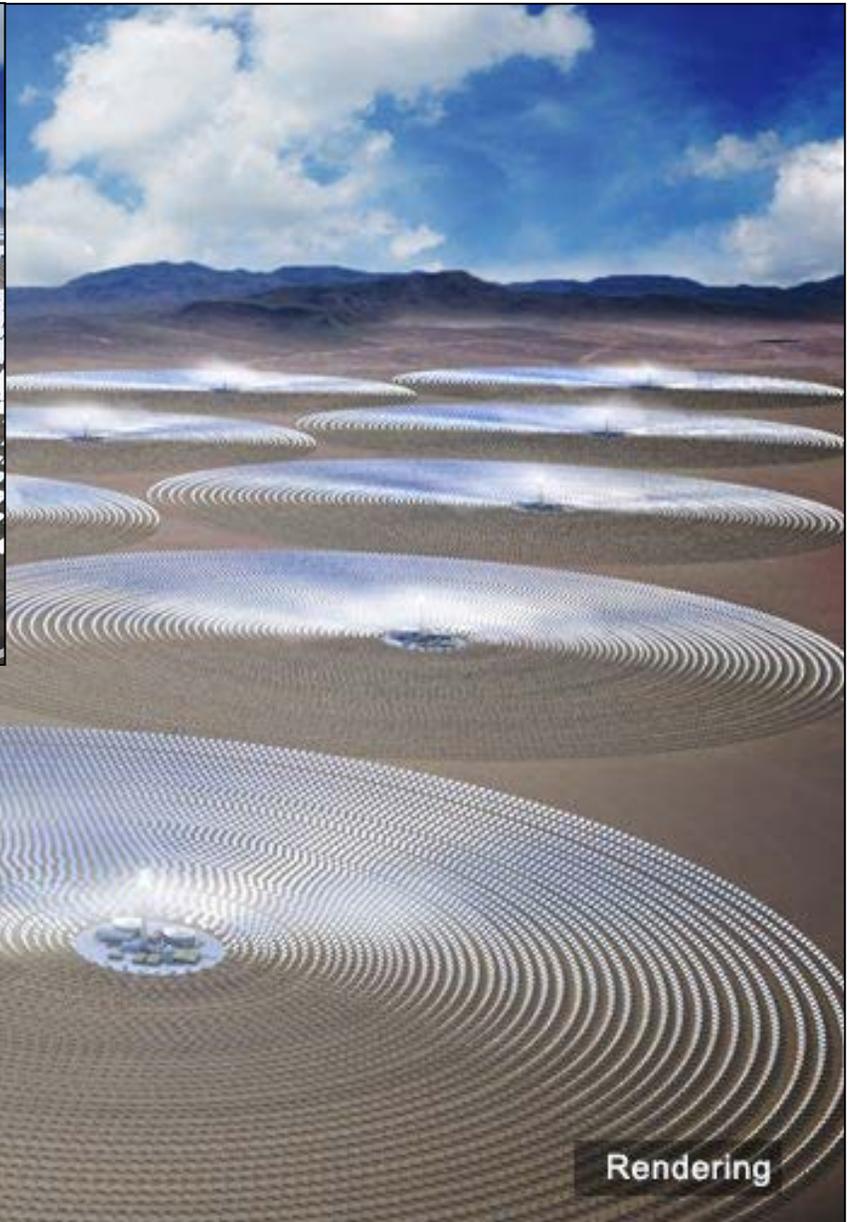
## Biogas From Anaerobic Digestion



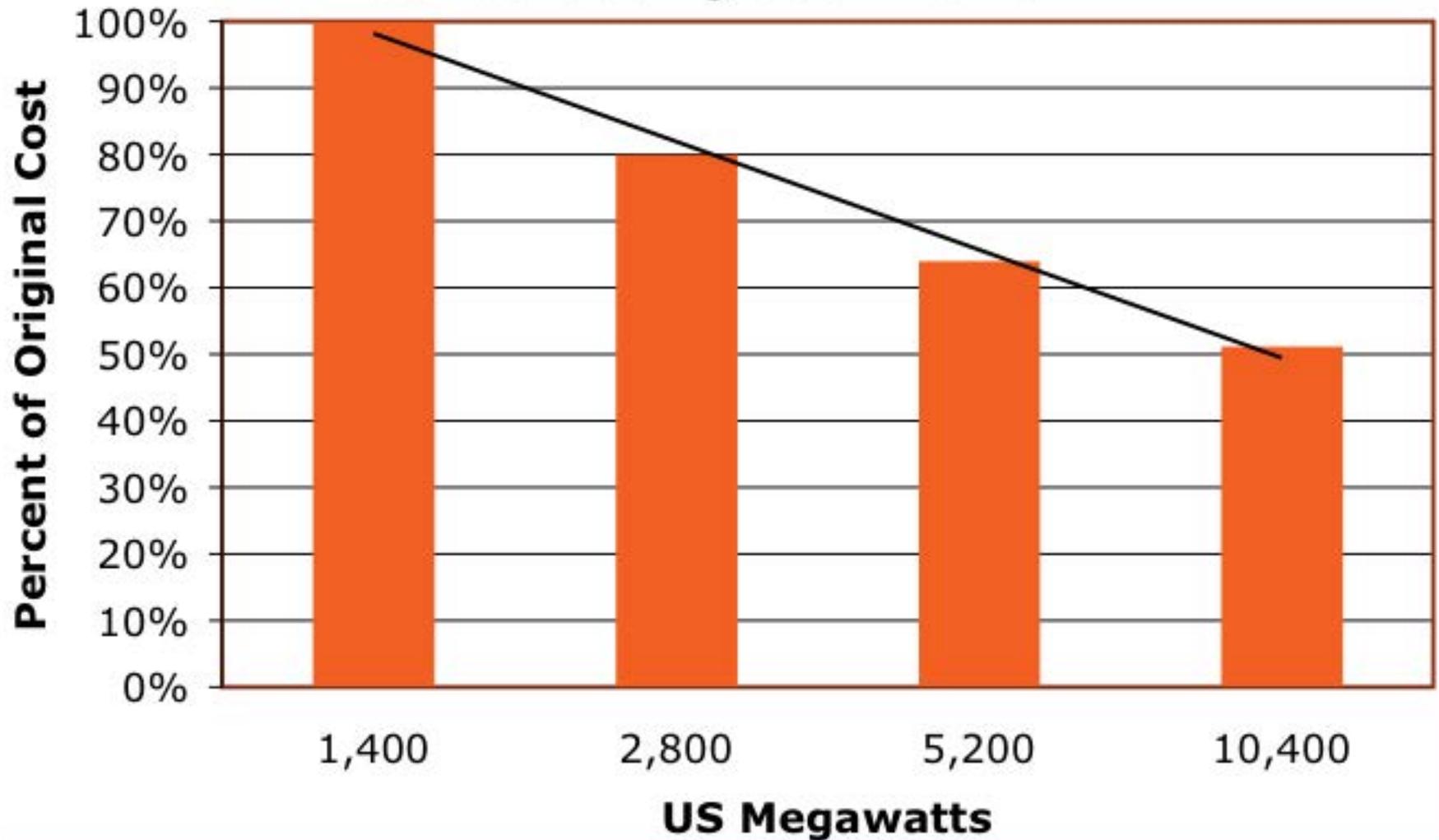
**Desert Star – Concentrating Solar Power Tower**



## **Desert Star – Concentrating Solar Power Troughs**



## Learning Curve of Concentrating Solar Power

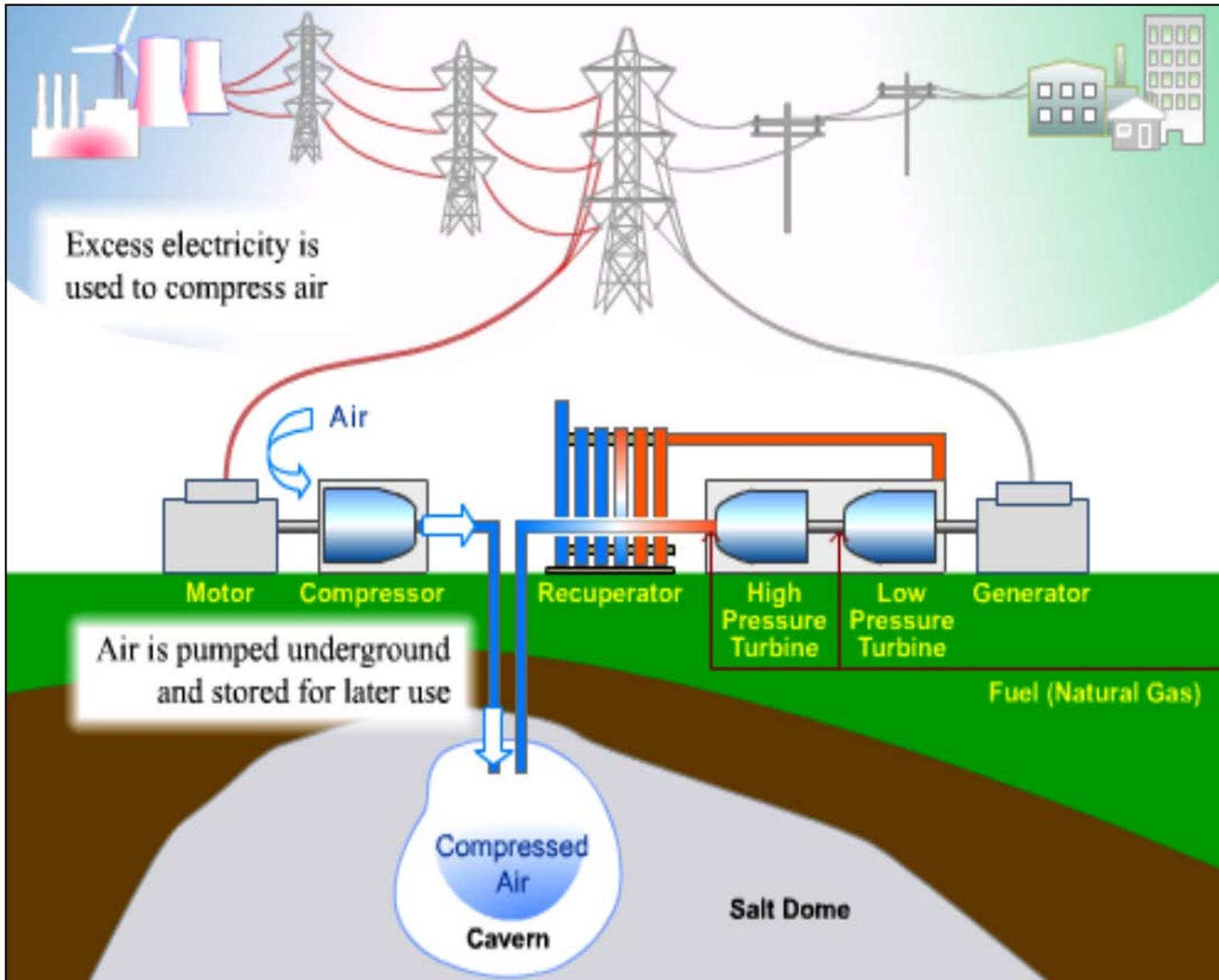


***20% REDUCTION PER DOUBLING OF CAPACITY***

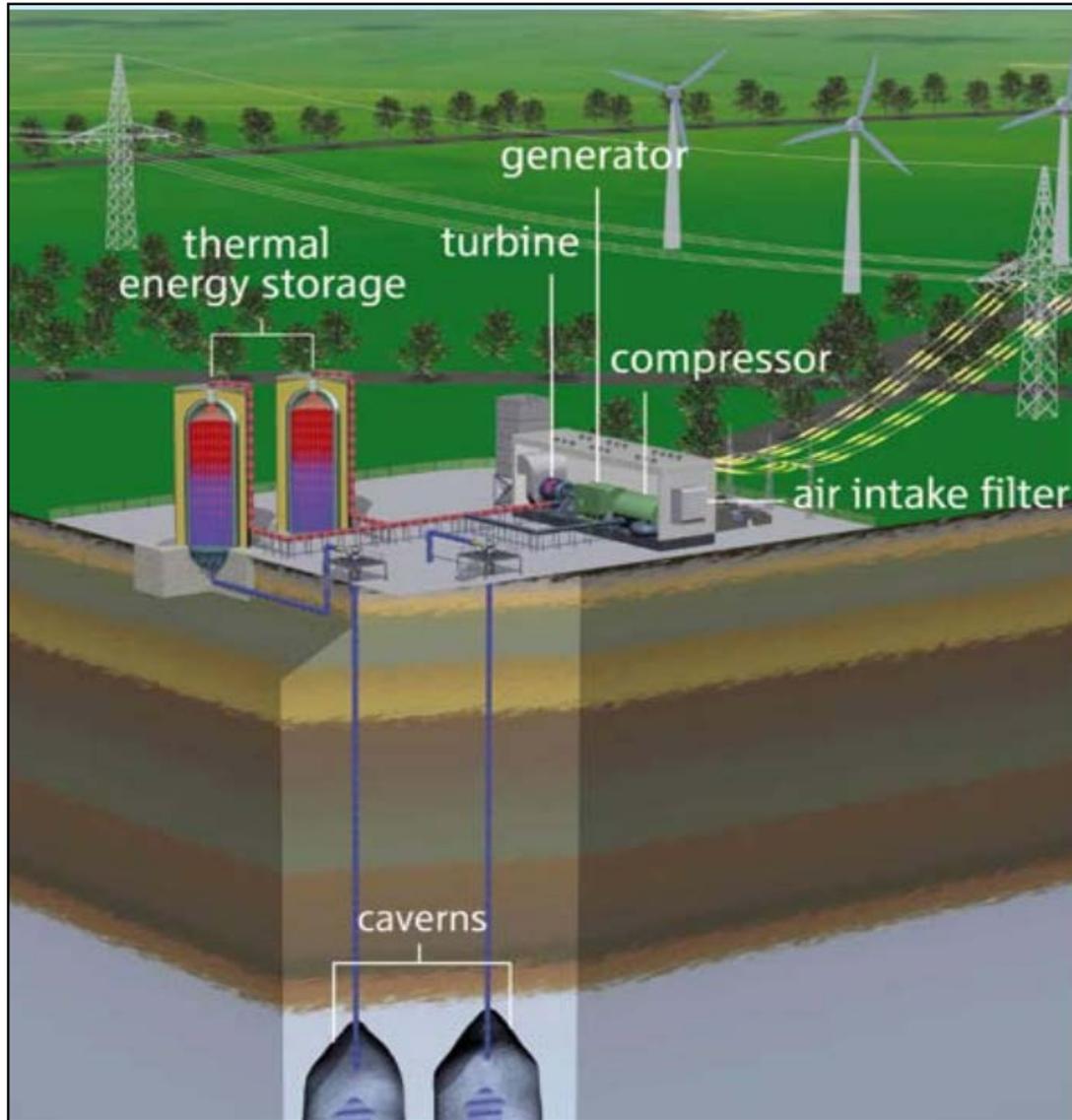
# Thermal Energy Storage



*COST EFFECTIVE IN COMMERCIAL APPLICATIONS  
BUT INCENTIVES AND MANDATES ARE NEEDED*



## Air Mine – Compressed Air Energy Storage (CAES)

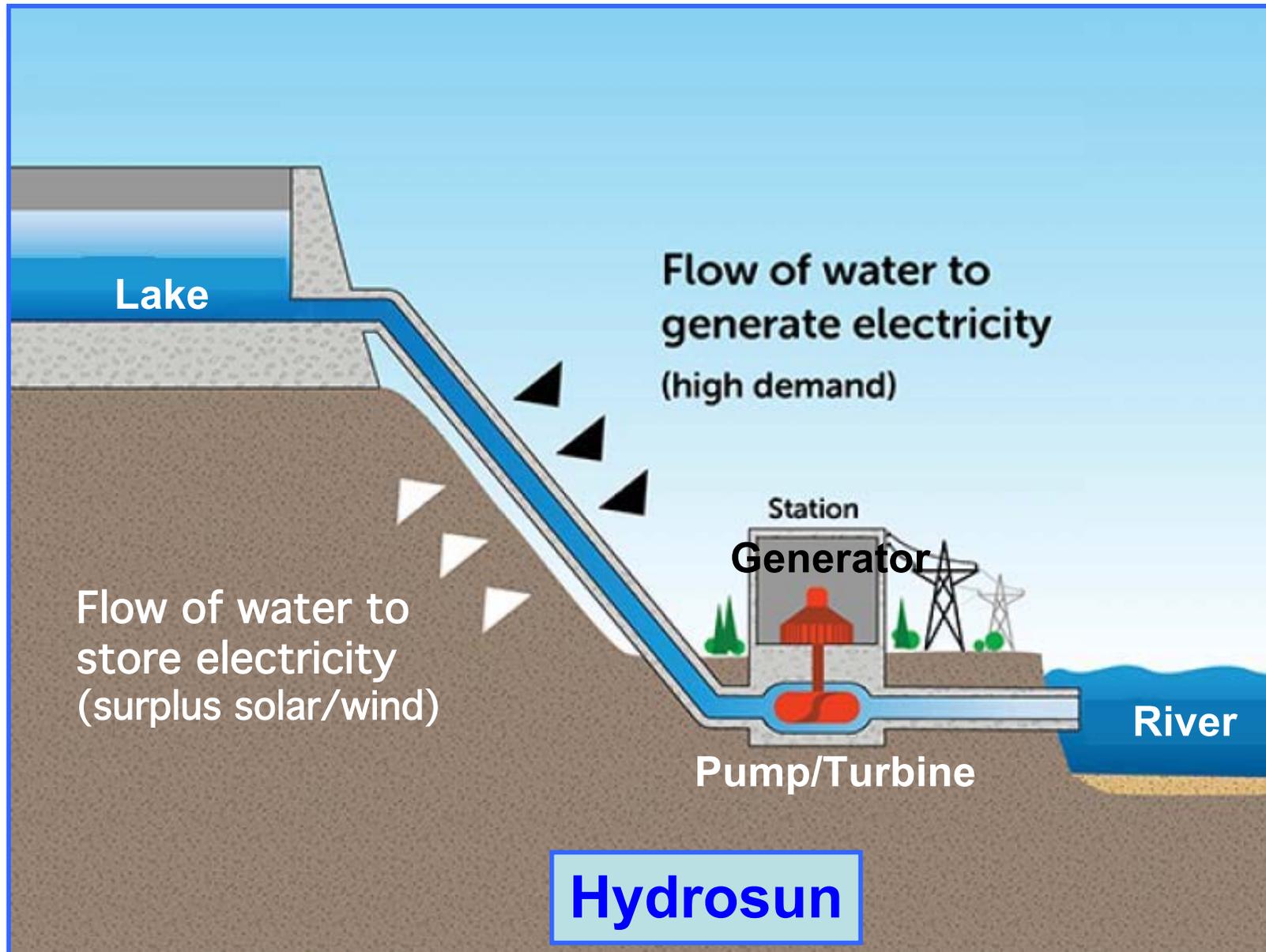


## CAES With Waste Heat



## CAES with Hydrogen

# Highland Lakes Pumped Hydro



# Hydrosun Pumped Hydro

- **295 MW / 2,000 Gwh if Cycled Daily**
- **Barely Used (13% Capacity in 2016)**
  - **Need to compensate LCRA**

DISPATCHABLE GENERATION ESTIMATED COST - 2016 DOLLARS	
Generation Type	Cost/Kwh
Combined Cycle Gas Plant	\$0.044
CAES/Wind/Gas	\$0.050
Combine Cycle Gas Plant with Biogas	\$0.059
CAES/Wind/H2 - Future	\$0.061-\$0.062
Wood Pellets in Existing Plant	\$0.061-\$0.097
Concentrating Solar Power - Now	\$.06-\$.10
Concentrating Solar Power - Future	\$0.048

*FUTURE CONCENTRATING SOLAR POWER AND CAES WITH WIND & GAS COME CLOSE TO COMPETING WITH NEW GAS PLANT*

# **Strategies to Develop Concentrating Solar Power**

- 1. Consortium – Collaborative Investment To Create Economies of Scale with Other Texas Utilities**
- 2. Change Voluntary GreenChoice to CSP Smaller Surcharge on Regular Customers**
- 3. Invest in CSP in Other States with Higher Rate of Return**
- 4. Special “30-Year” Rate Class Guaranteeing Wholesale Price for CSP Purchasers**

# **Other Strategies for Dispatchable Renewable Energy**

- 1. Biogas – Seek Bids**
- 2. CAES Partnership – Share in Cost of Texas Pilot Plant**
- 3. Evaluate Pumped Hydro Costs**
- 4. TES Requirement – Mandate for New Commercial Buildings & Grocery Stores**



**FOR MORE INFORMATION, CONTACT:  
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