



U.S. Department of Energy  
**Energy Efficiency  
and Renewable Energy**

Bringing you a prosperous future where energy  
is clean, abundant, reliable, and affordable

## Geothermal Technologies Program

# Where Does the Small Scale Geothermal Power Plant Fit In the Grand Scheme of Things?



**GEOPOWERING  
THE WEST**

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# Utility Systems

**Oil and Gas**



**Gas**

**Transmission**

**Load**

**Wind**



**Substation**

**Distribution**

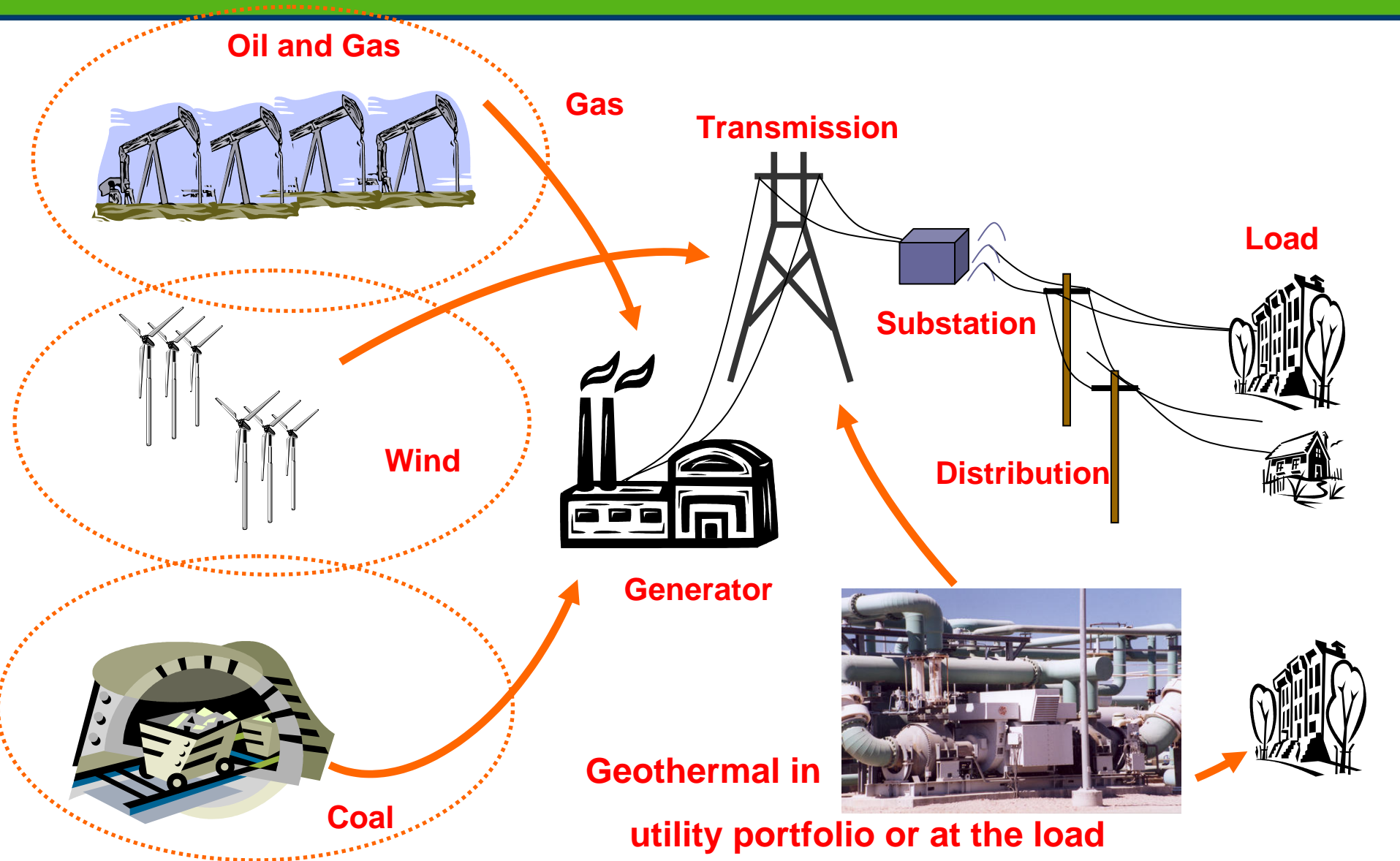


**Generator**

**Coal**

**Geothermal in**

**utility portfolio or at the load**

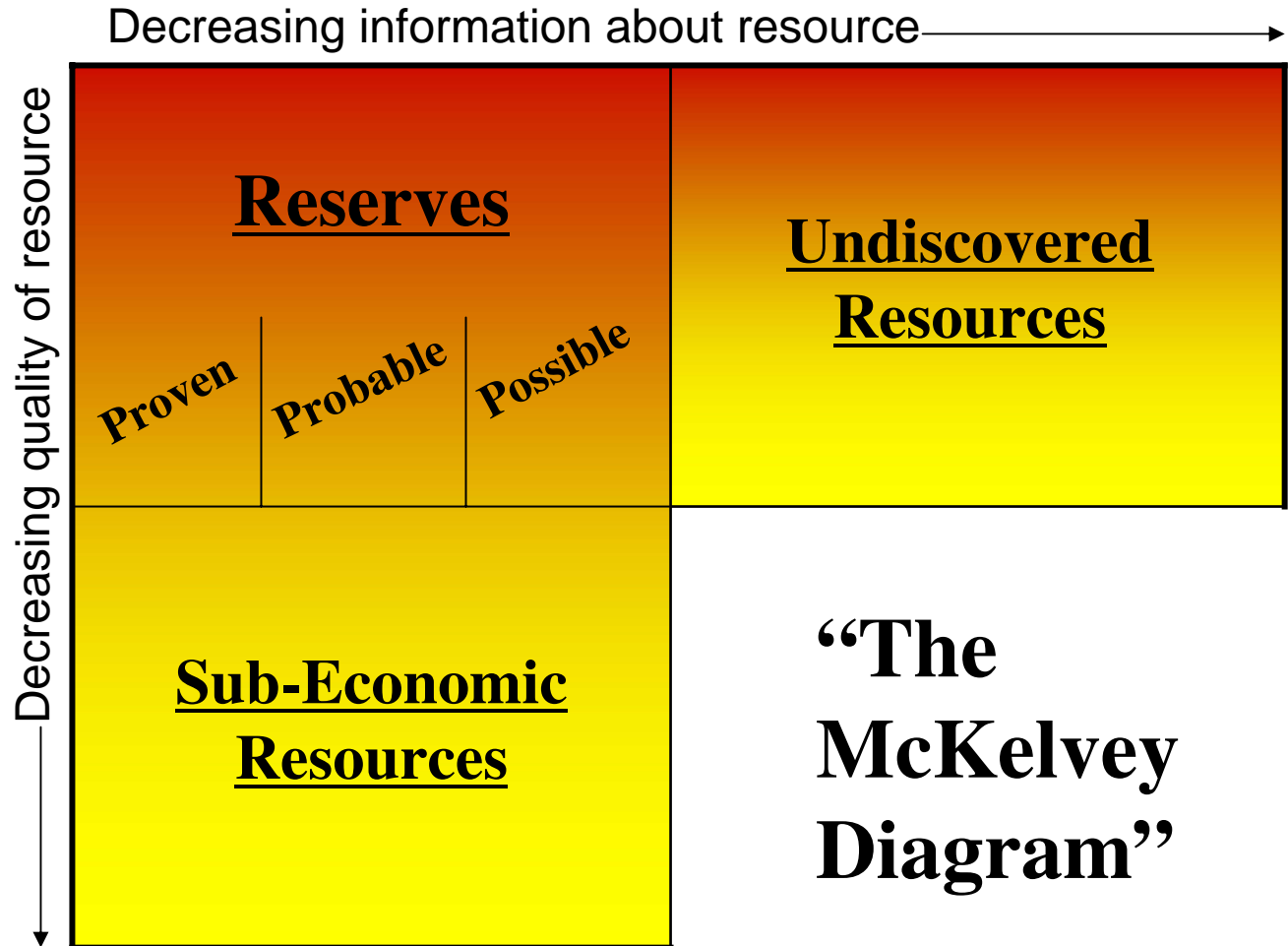




# Geologic Assurance and Economic Feasibility

National R&D helps to expand the geothermal resource base:

- ✓ Geophysics and geoscience to locate and define reservoirs
- ✓ Drilling research to reduce costs
- ✓ Improving capabilities and efficiencies of power plants.



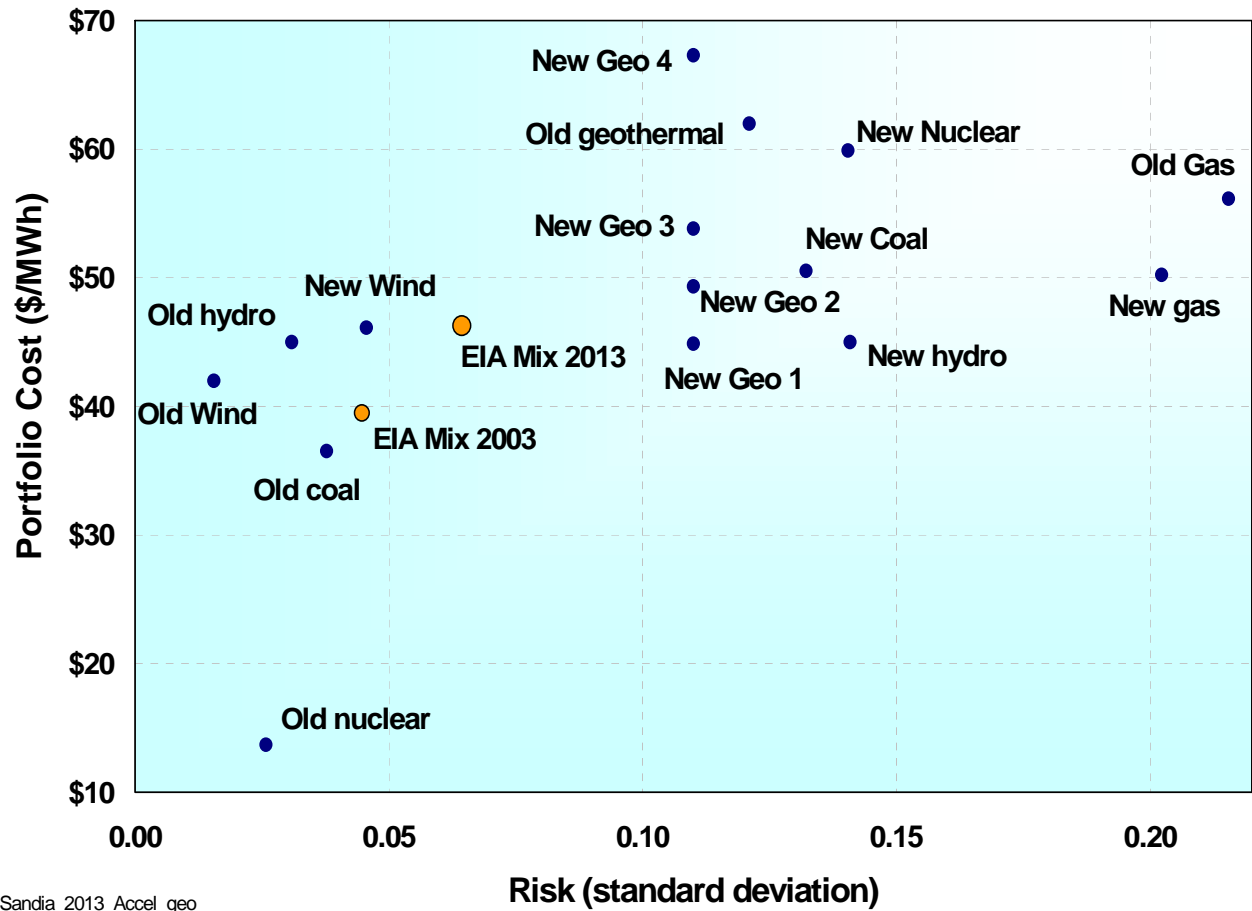


# Western Region Generating Cost-Risk

## Trends

- 2013 EIA Mix has higher cost and risk relative to 2003
- Move to larger gas/coal shares adds to portfolio cost and risk, volatility
- Reduces Energy Diversity/ Security
- Geothermal and wind are ideally positioned to diversify the generating mix and reduce cost/risk

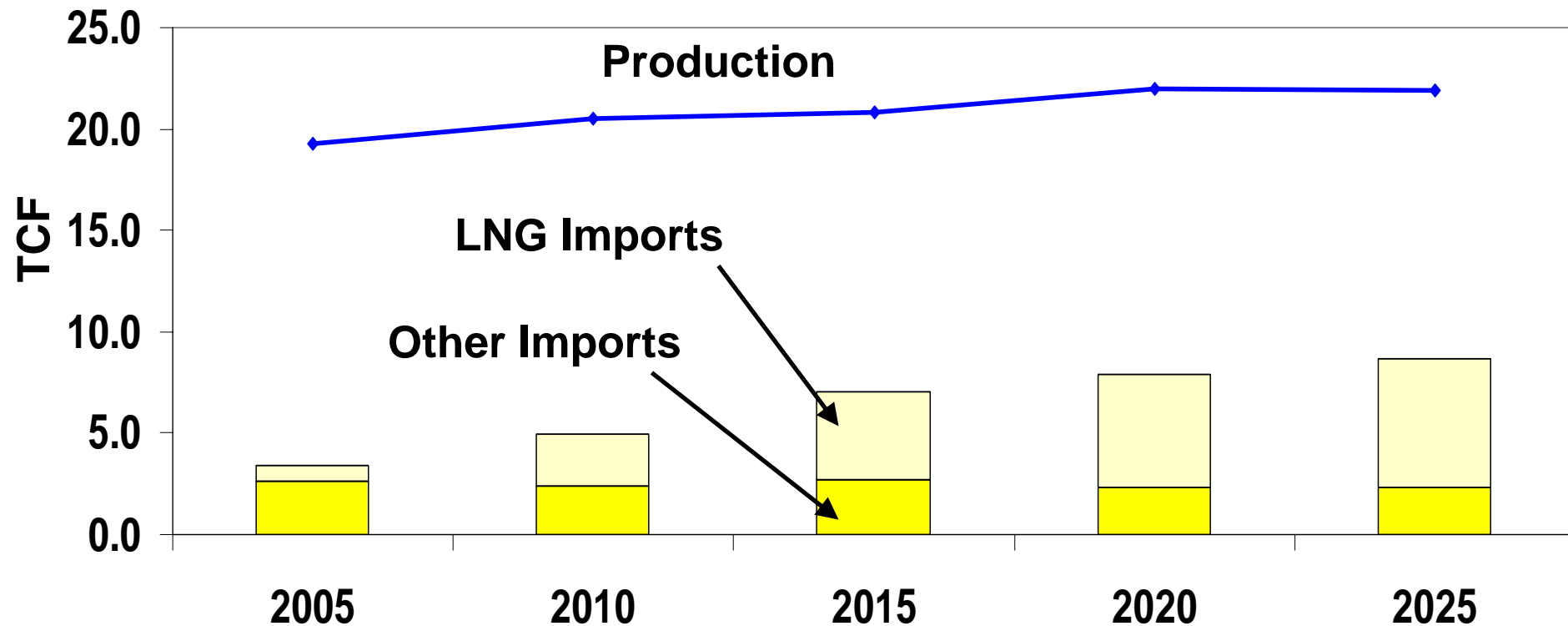
Western US - 2013 Accelerated Geo



Sandia\_2013\_Accel\_geo



## US Natural Gas Prod. Will Grow 13% Imports Will Grow 157%

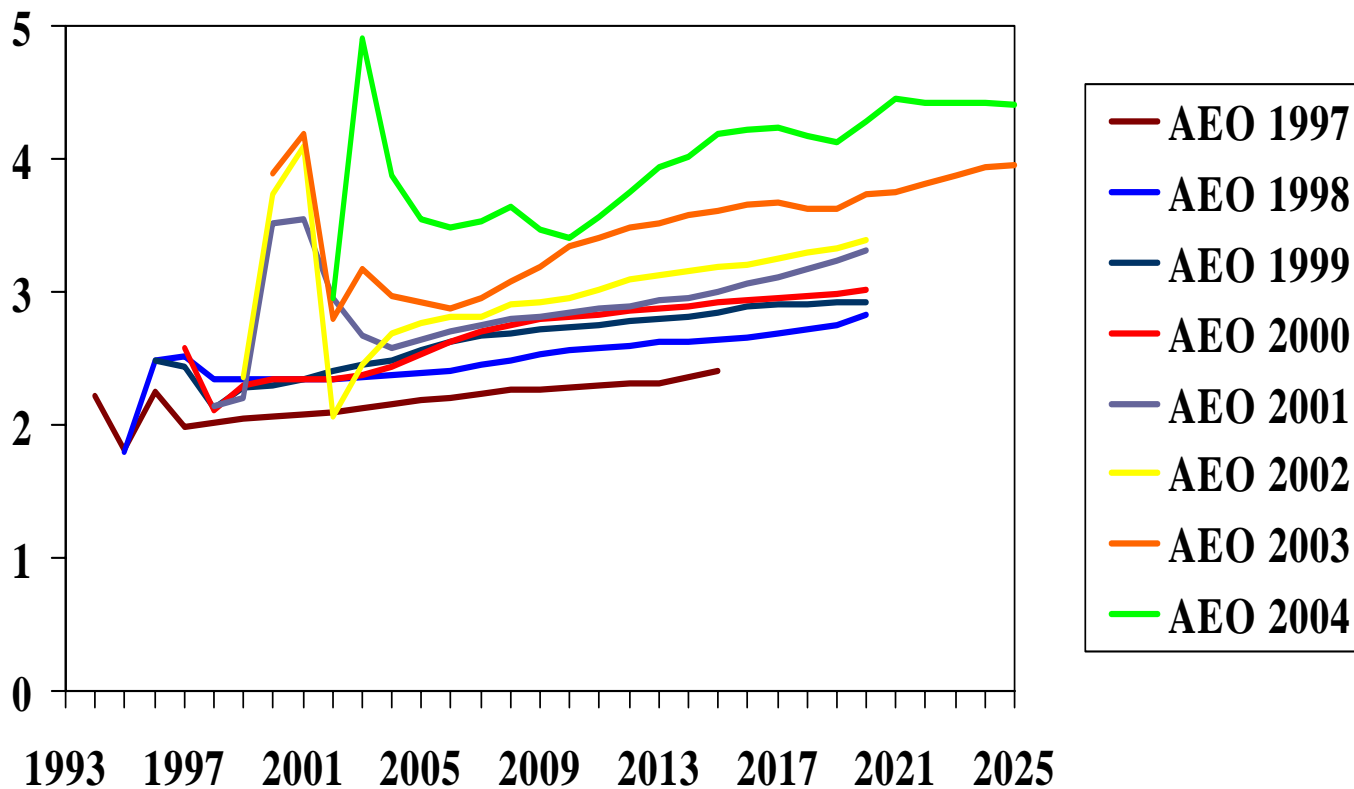


Source: DOE/EIA AEO2005




# *EIA has consistently underestimated gas prices*


## Wellhead Natural Gas Prices (2002\$/Mcf)







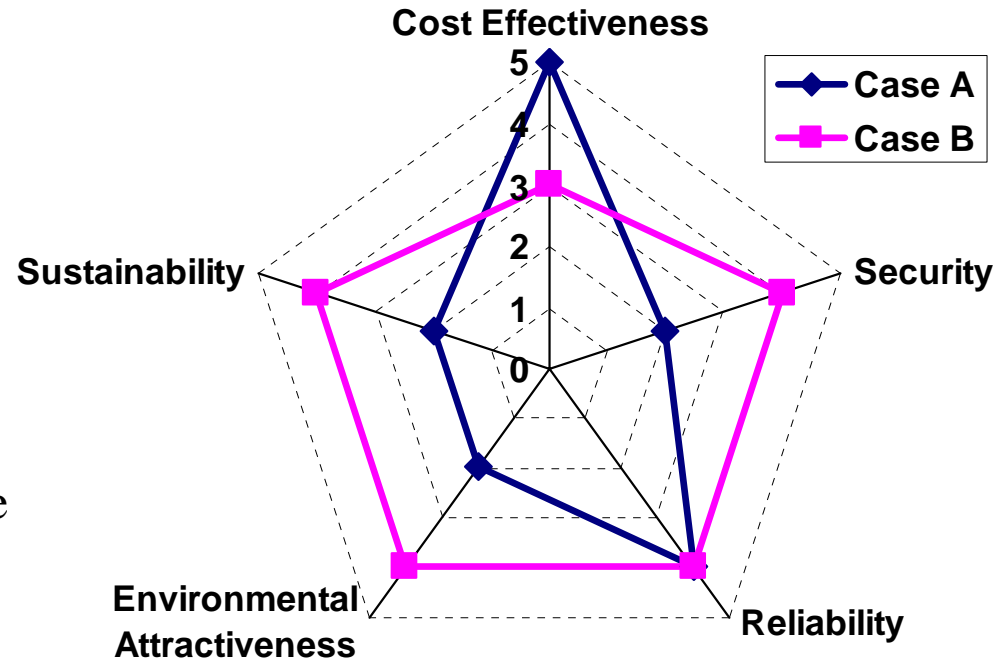
# Expected Trends in Future Energy System Evolution

 Energy safety, security, reliability, and sustainability have become important energy system design parameters

 This will change how energy systems are optimized and upgraded

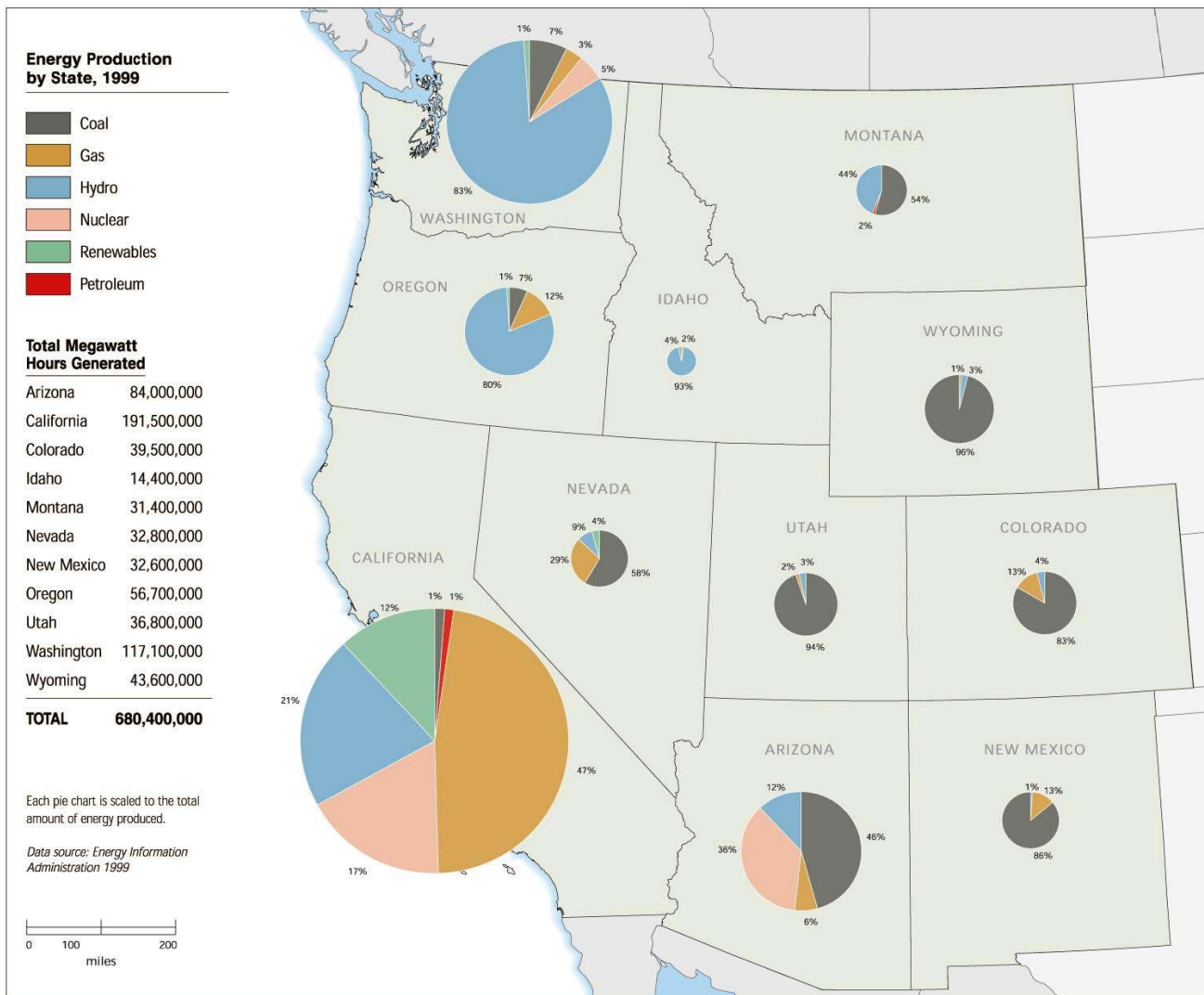
 This will impact future decisions on energy policy, supply, and use

 How do we efficiently and cost-effectively transition to this new future infrastructure?





# Electricity Generation



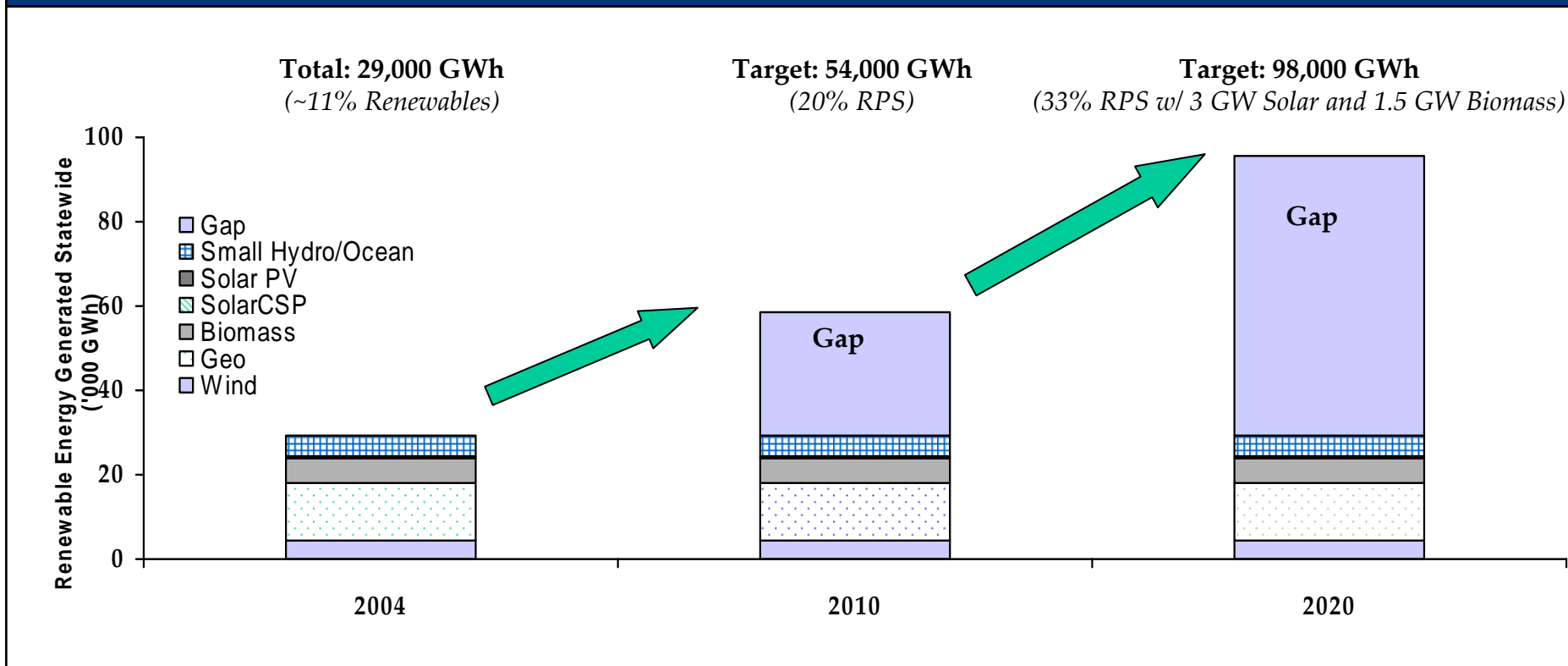
Source:  
 Renewable  
 Energy Atlas





The primary role of PIER Renewables is to help the State meet aggressive renewable energy policy goals by investing in high priority RD&D issues.

## Projected Renewables to Meet California Policy Goals



Data Sources: 2004, CEC Electricity Report which includes all renewables in the State, not just IOUs; 2010 and 2020, PIER Renewables Projections.

Source: CEC



## New Mexico Proposed Rule

- One in which no less than 20% of RPS is met using wind, no less than 20% is met using solar, and no less than 10% is met using one of the other Renewables



## New Mexico Proposed Rule, cont.

- The reasonable cost threshold for 2006 is 1% of customer's annual electrical charges, increasing by 1/5% until 2011, at which time it will be 2%, then increasing by 1/5% until 2015=3%



- Typical geothermal drilling is characterized by underpressured formations that aggravate lost circulation; hard, abrasive, fractured rock; complex geology; corrosive fluids; and, by definition, high temperature.



- This is clearly different than wells drilled in Oil & Gas reservoirs that are candidates for co-producing geothermal energy. There is relative low energy density of water vs. oil or gas and results in different energy produced.



# You've Heard of Combined Heat and Power?

*Geothermal* offers combined:



Heat.....Power..... and Pleasure!



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