Coal and Wind: Thoughts on the future of generation in a high-priced and volatile natural gas market

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NEMS CONFERENCE

- NATIONAL ENERGY MODELING SYSTEM ANNUAL ENERGY OUTLOOK
- March 23, 2004
- **When to build natural gas, coal or wind?**
- **How does the country develop “fuel diversity” without mandates, which have generally been counterproductive**

Generation Decisions Difficult

- **Difficult Period to build Generation**
- **Uncertainties Abound**
  - **Regulatory Model and Recovery of Investments**
  - **Environmental Uncertainties and Standards**
  - **Technological Change, Does GE make progress with wind and what progress does Tennessee Eastman make with IGCC?**

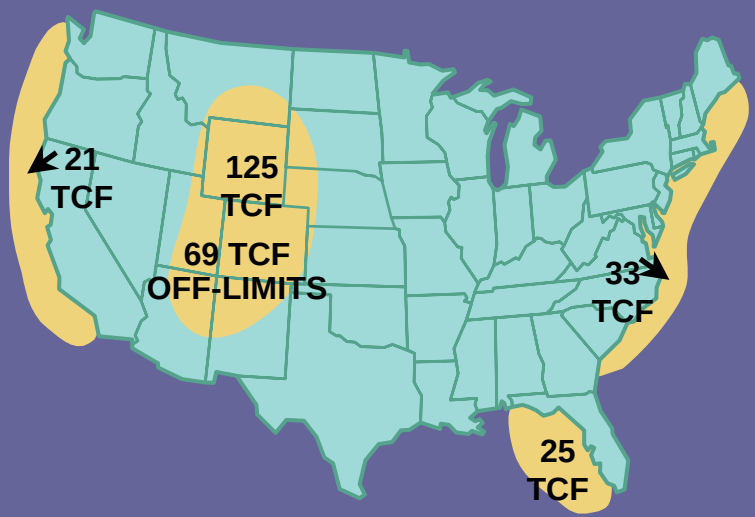
Subscribe to NPC Scenarios

- **Most of you have seen one of several presentations by the NPC**
- **Whether they are absolutely correct or not is not the issue but a role for broad public policy is articulated**

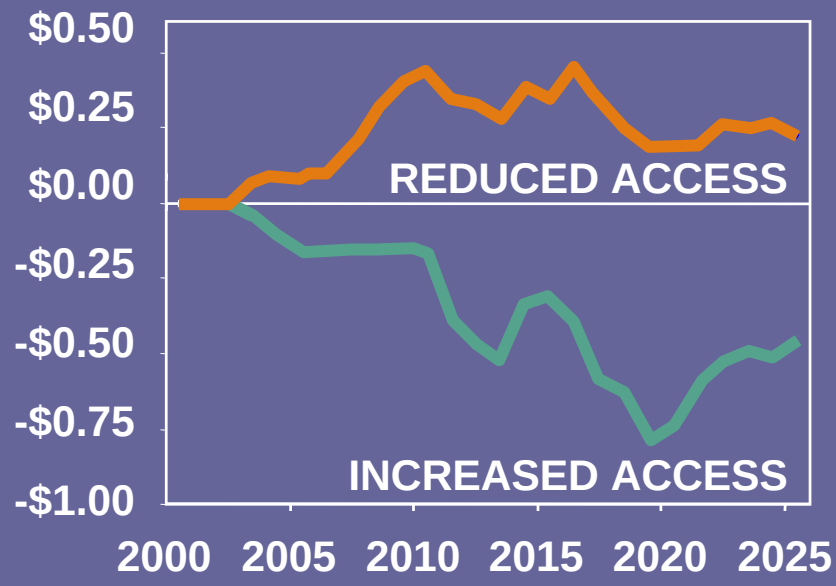
  Large consumers of natural gas need a public discussion about access, both on and off shore for exploration

Access to Indigenous Resources Can Affect Prices For All Consumers

Technical Resource Impacted by Access Restrictions



Pricing Impact vs. Reactive Path $/MMBtu ($2002)



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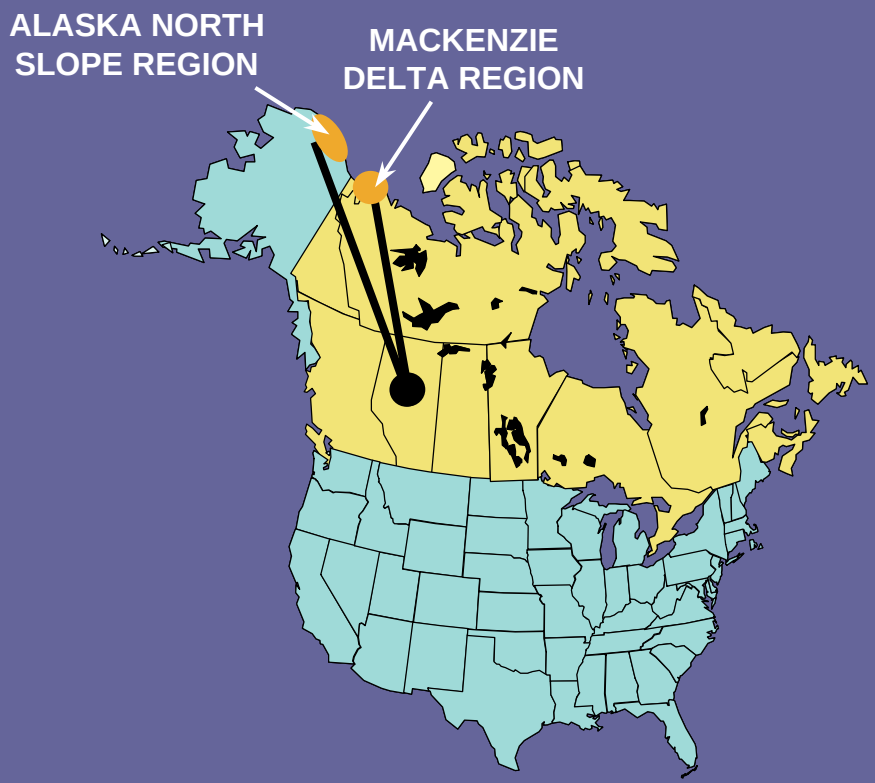
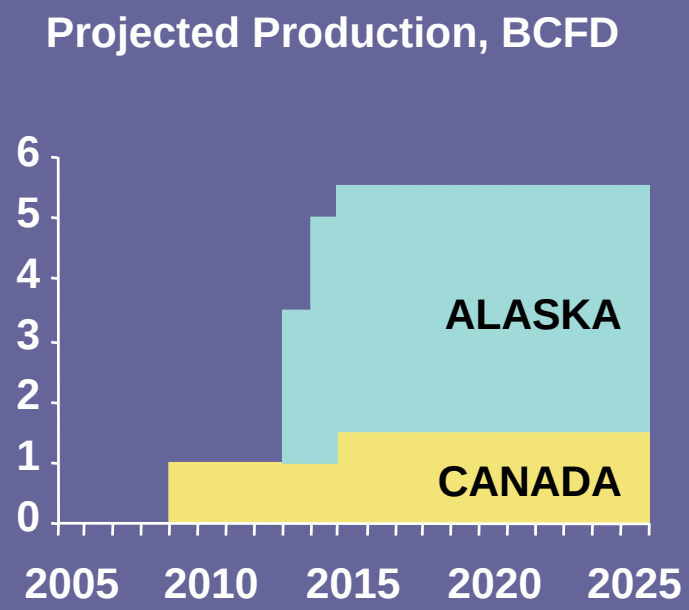
Alaskan Supplies --- Mid-American Beats EIA Schedule

- Recognize that EIA doesn't assume any policy changes
- Believe Mid-American will be successful with Alaskan Legislature this spring
- Alaska is not the sole answer to US gas issues, but it can be a part of the answer

Arctic Pipeline Projects Can Deliver Important New Supplies

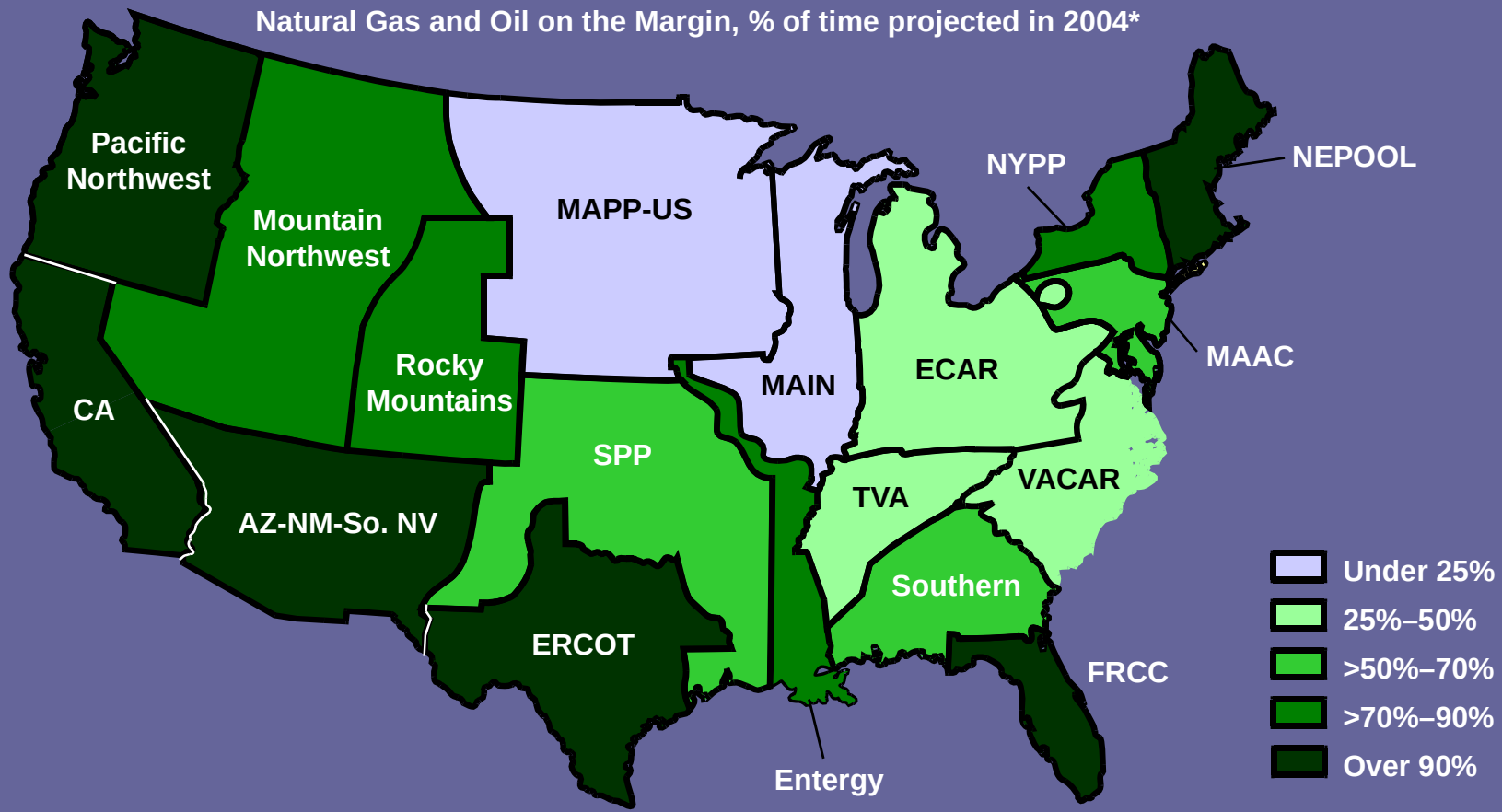




Regionality is Major Concern

- **Some Regions Have Dependency Issues with Other Fuels and Technologies**
- **Concern with Over-reliability is highly regional in nature**
- **Creates Coordination issues between gas and electric industries**

Natural Gas Has Grown in Importance for Power Generation



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*Source: Cambridge Energy Research Associates

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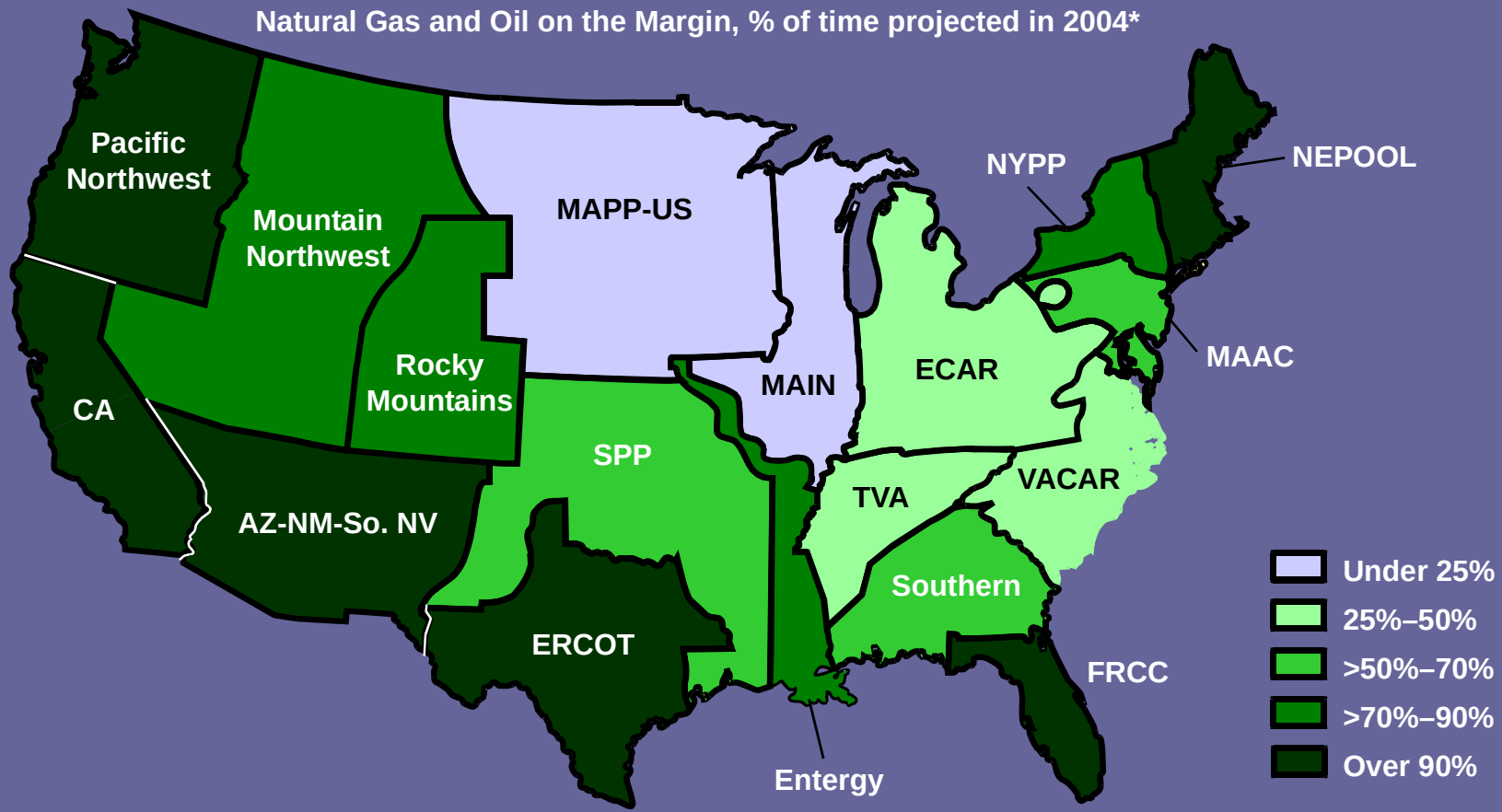

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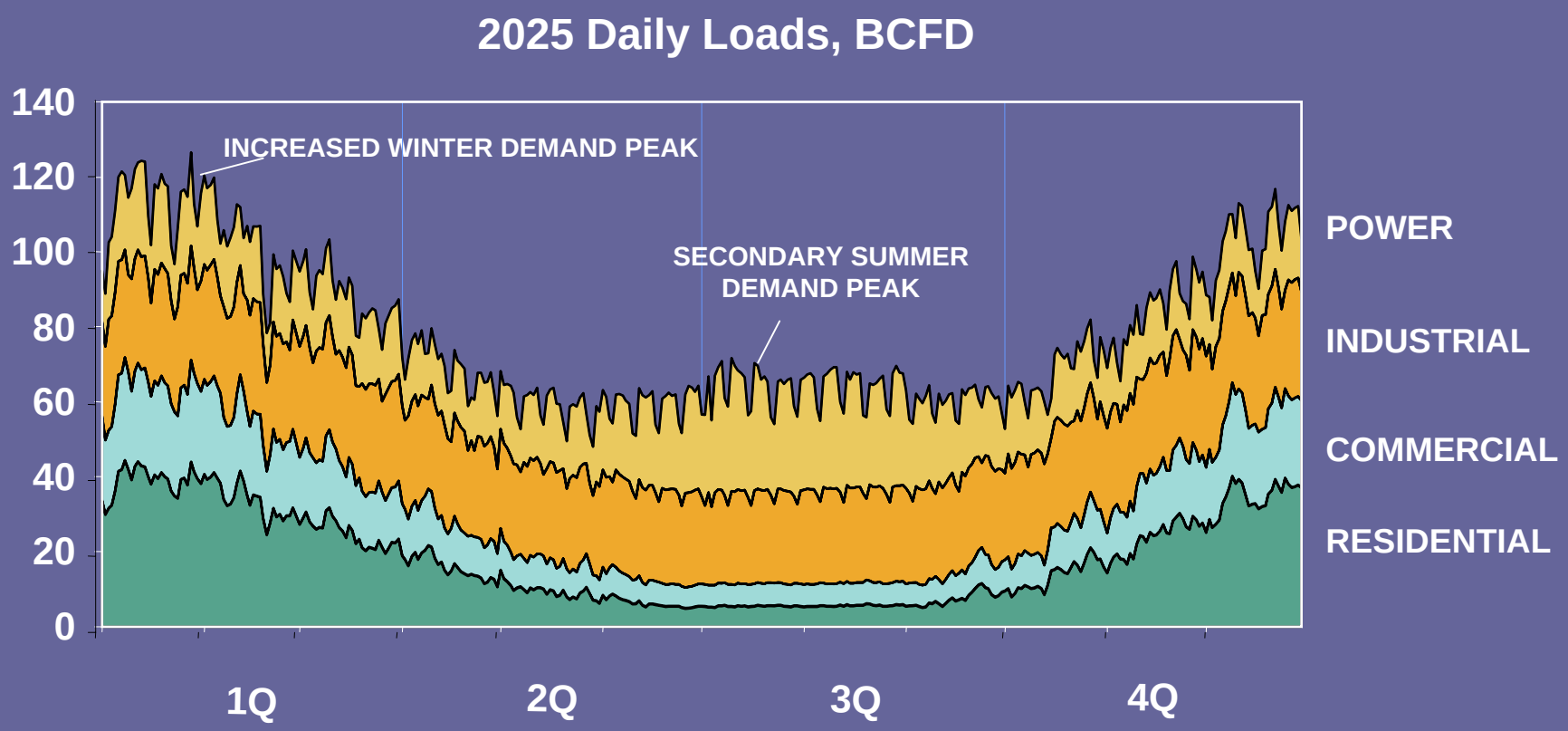
Changing Peak Demands Will Require More Storage Capacity and Different Operations



… 700 BCF new capacity required through 2025

… Historical seasonality of demand/price starting to disappear

… Infrastructure modifications and new resources required for service flexibility

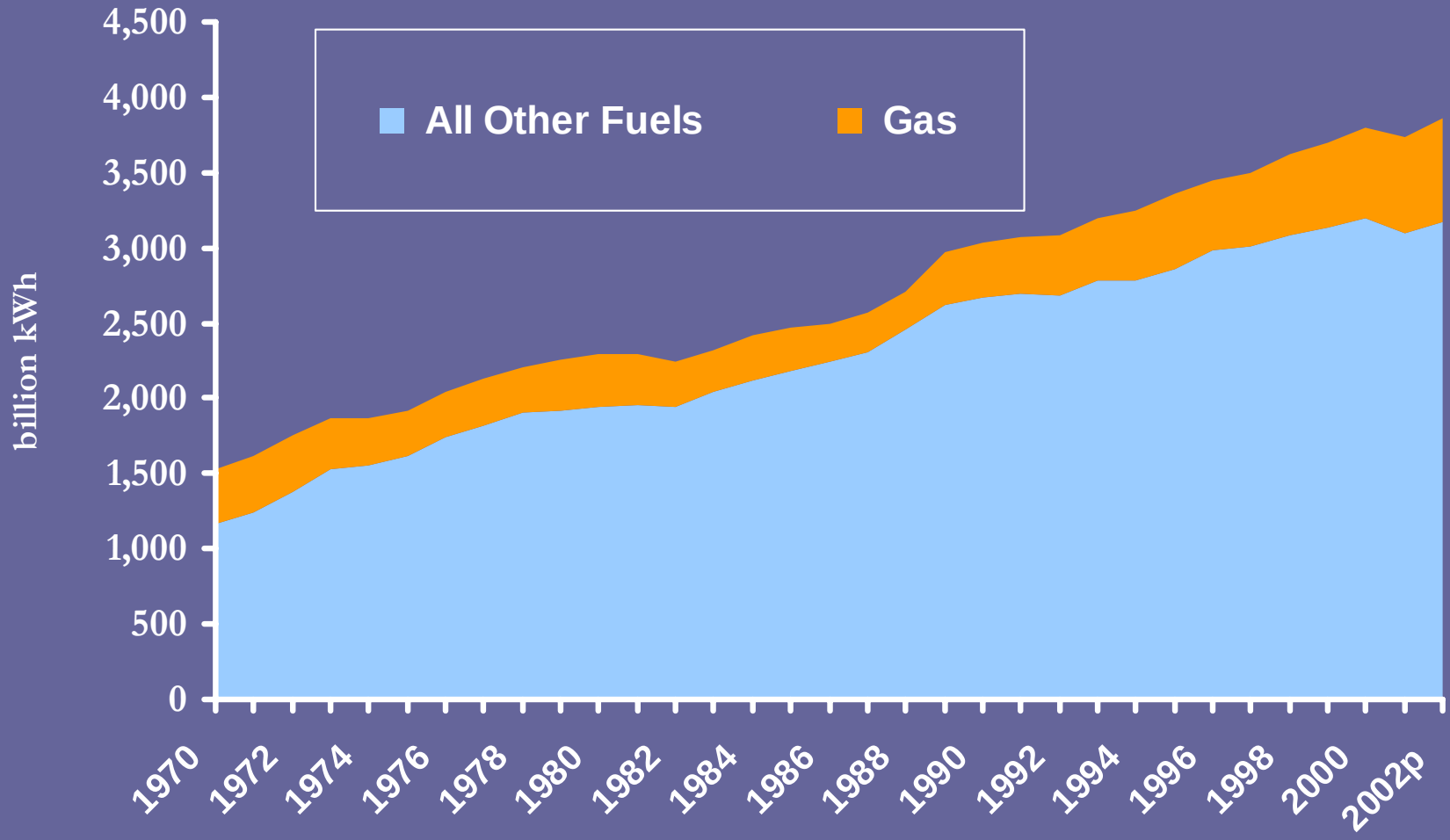
Storage is Crucial to Electric System Operations

- Generators need nearby storage to assist in managing load swings
  - Both the need for gas and as a place to park natural gas when a thunderstorm wipes out the load
- With gas moving at 22-25 mph, and supporting technology which moves at the speed of light, storage is crucial

NATURAL GAS IS ONLY JUST BEGINNING TO GROW IN THE ELECTRIC MARKET

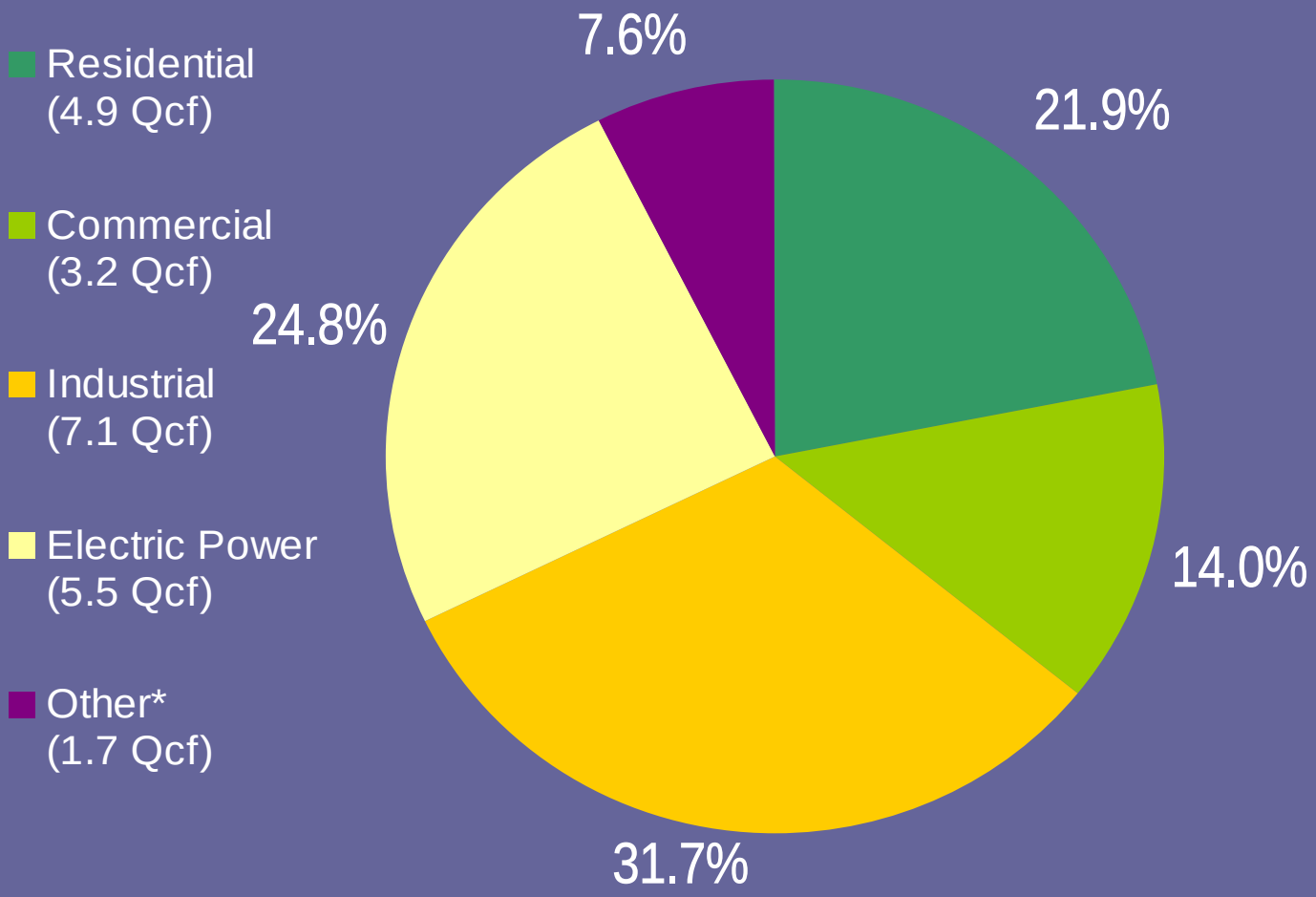
- **Following Slide Shows Gas Consumption for Electric Generation Since 1970**
- **Real Growth is Ahead --- when all the New Gas kicks in for Intermediate and Peaking Applications**

Gas versus all other Fuel Sources since 1970



Source: Energy Information Administration (EIA)

Where is the natural gas going?



*Includes gas consumed for gas production, for pipeline use, and by natural gas vehicles.
Source: Natural Gas Production & Use by United States (EIA)

COAL'S FUTURE ROLE

- **Bullish on coal, but not as exuberant as NETL's recent data**
  - **Not all of those units will be built: planned units have significant uncertainty associated with them**
    - **Mercury Rule is One Example**
    - **Permitting**
    - **Financing**

Is the Public Ready to Embrace Coal?

- A tough sell, environmentally
  - Remember, it was easy to build, economies of mass production that took the market away from coal --- that has not changed
  - Coal Transportation has not become easier
  - Resource base is changing

IGCC

- **Marries Coal with Gas using Technologies**
- **Appears as the Cleanest way of using Coal, but arguably, most Expensive**
- **Changes Resource Base Economics to one based on BTU's not Sulfur content**

SOME EXCITEMENT AROUND IGCC

- **Tennessee-Eastman's Initiative**
- **IGCC Coalition and other Incentive Programs**
- **Potential to produce marketable by-products**
- **Some limited support from environmental community**

Is Wind Ready?

- **Almost with some challenges**
- **Generation Technologies Improving**
- **How many of you saw the Turbine Nacelle GE displayed at Union Station last week?**
- **Largest piece of equipment GE chose to display in their Imagination Nation exhibit**

Is Wind Ready?

- **Transmission System is Not Ready**
- **Huge development potential in Great Plains**
- **How does the nation tap this resource without a major transmission construction program? Multi-state entities needed to move big blocks of power long distances**

Two Hedges with Wind: Natural Gas Price and Environment with Coal

- Wind's financial and environmental attributes need to be recognized by policy makers at the local level
- One other positive as well: Farm Policy
- Risk is Substituted with wind --- need to better understand interruptibility

Summary

- **The dash to gas continues perhaps accelerates in terms of consumption**
- **Wind can dampen some forms of volatility and environmental risk**
- **Coal, while unpopular is a reliable and stable source of generation and IGCC offers many future benefits to make coal more productive in the future.**