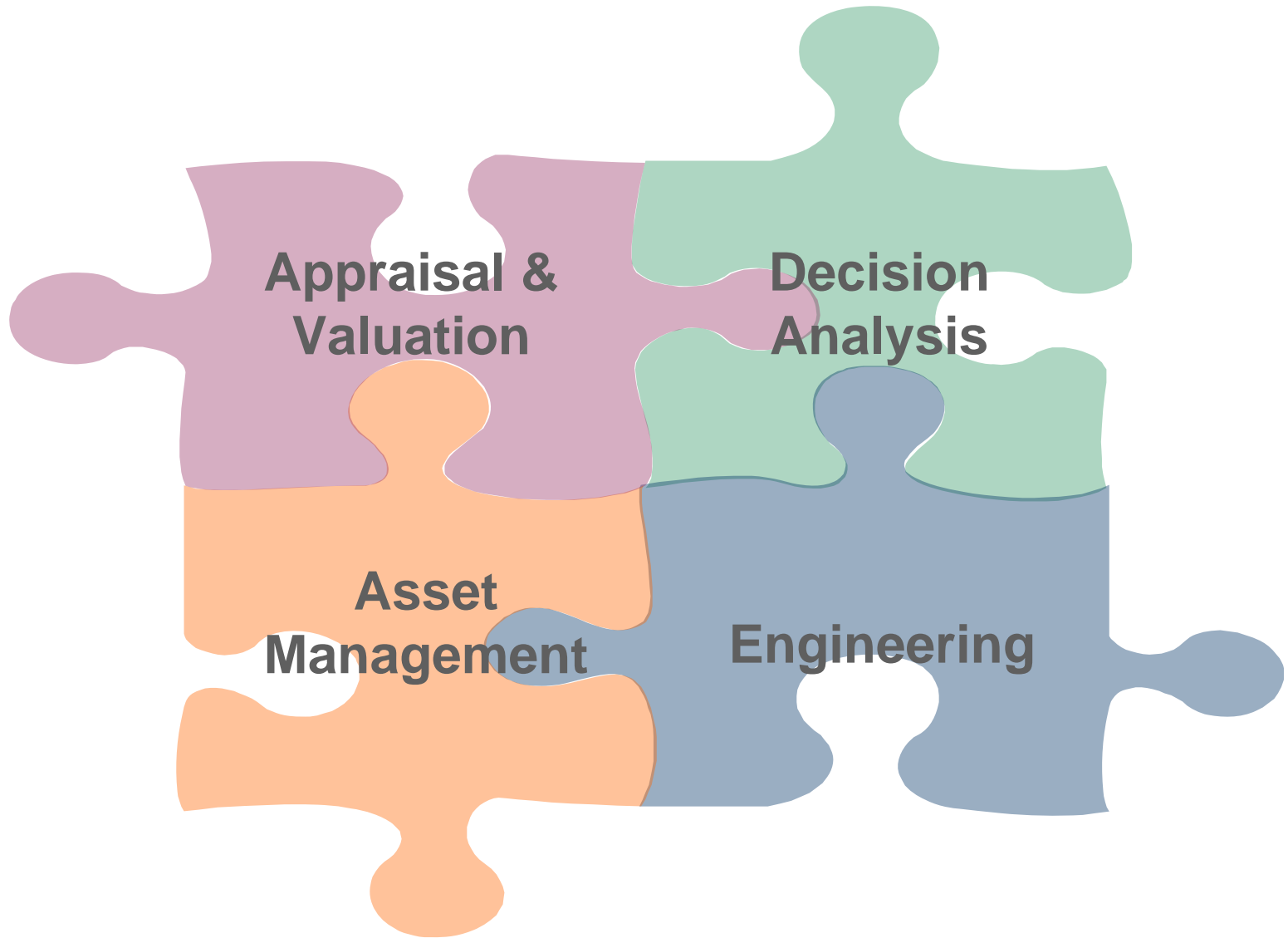


Power Generation in 2005

DAI Management Consultants

Steve Dean, ASA, P.E.

DAI Management Consultants, Inc.
1370 Washington Pike
Bridgeville, PA 15017
(412) 220-8920
www.daimc.com



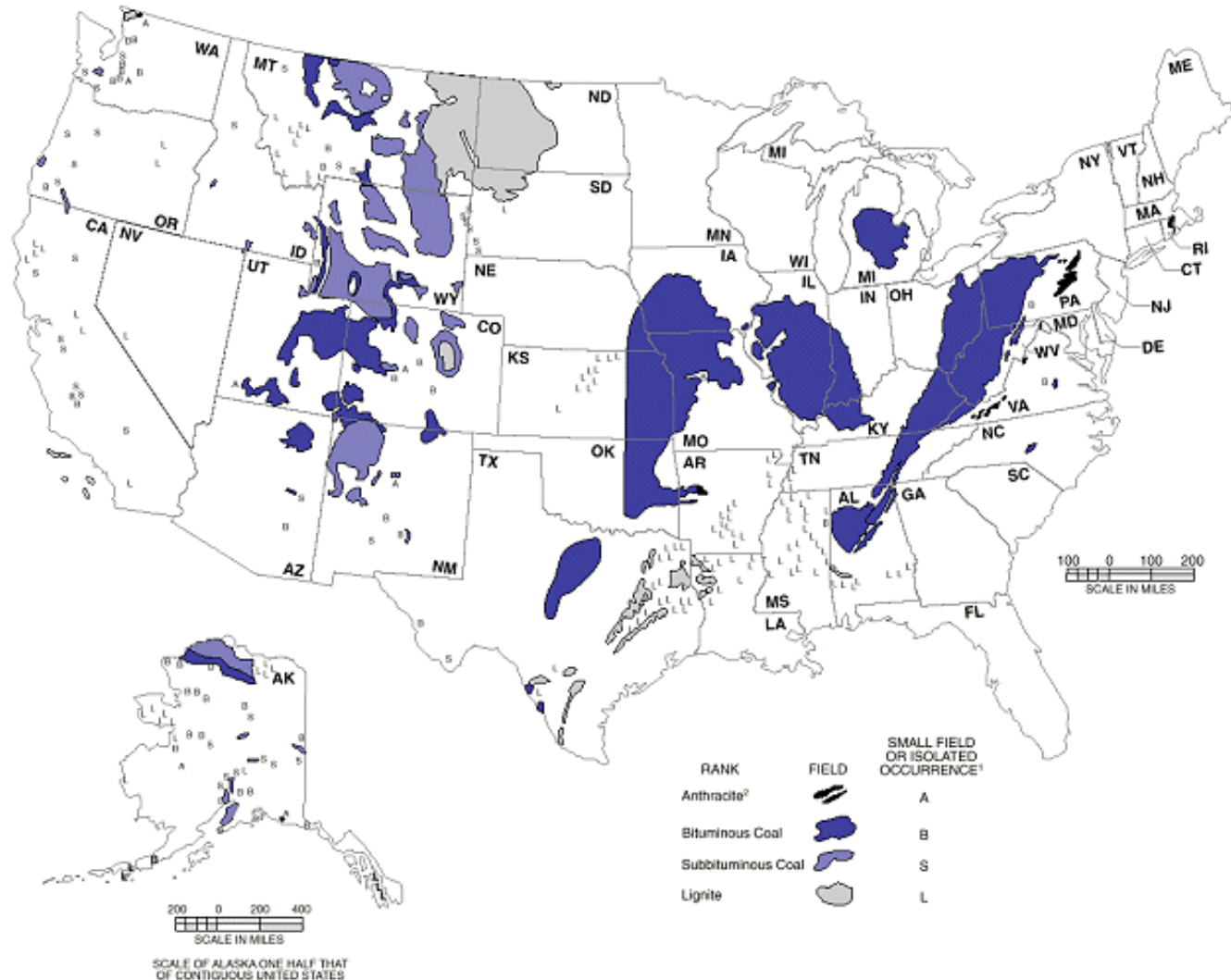
Market “Spaces”

- The power market is not a continuous space; segmentation exists along several dimensions
 - Long-distance transmission of power involves both technical and economic challenges
 - “Seams” problems
 - Regulation
- ✱ Location, Location, Location
 - The location of power generation assets matters significantly – not just their location on the national grid, but also their location in relation to fuel supplies, in relation to regulatory regime boundaries, and in relation to transmission networks

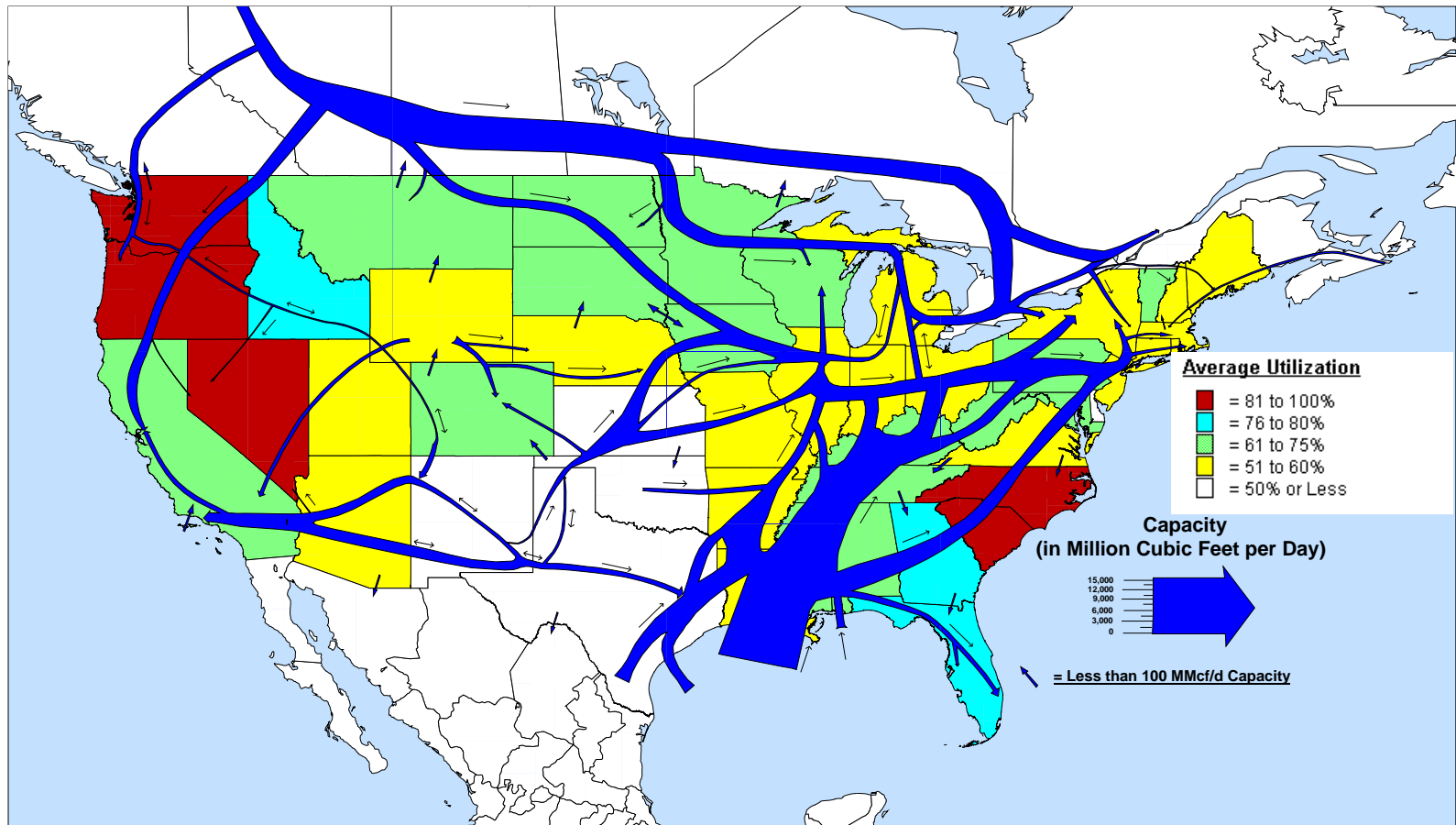
The Evolution of “Space Complexity”

- The following several slides recap the important points made last year:
 - It remains important not to paint the entire power sector with the same broad brush
 - It remains important to recognize that the power sector is far bigger than just generation – a point we shall return to later
 - The heterogeneity of the power market means that great risks and great opportunities often co-exist in close proximity to one another
 - Opportunities exist in transcending inter-market barriers

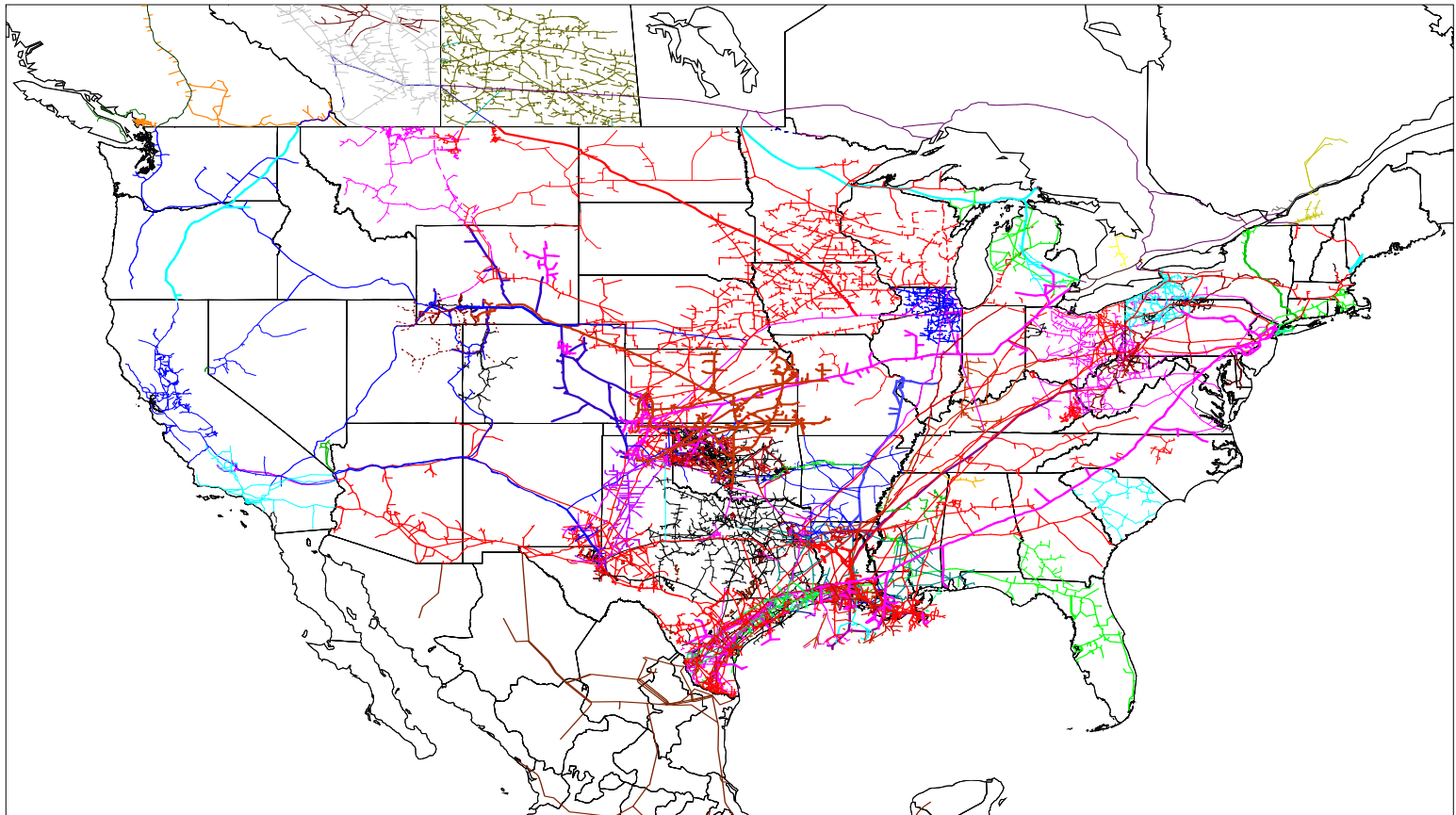
Coal Deposit Regions



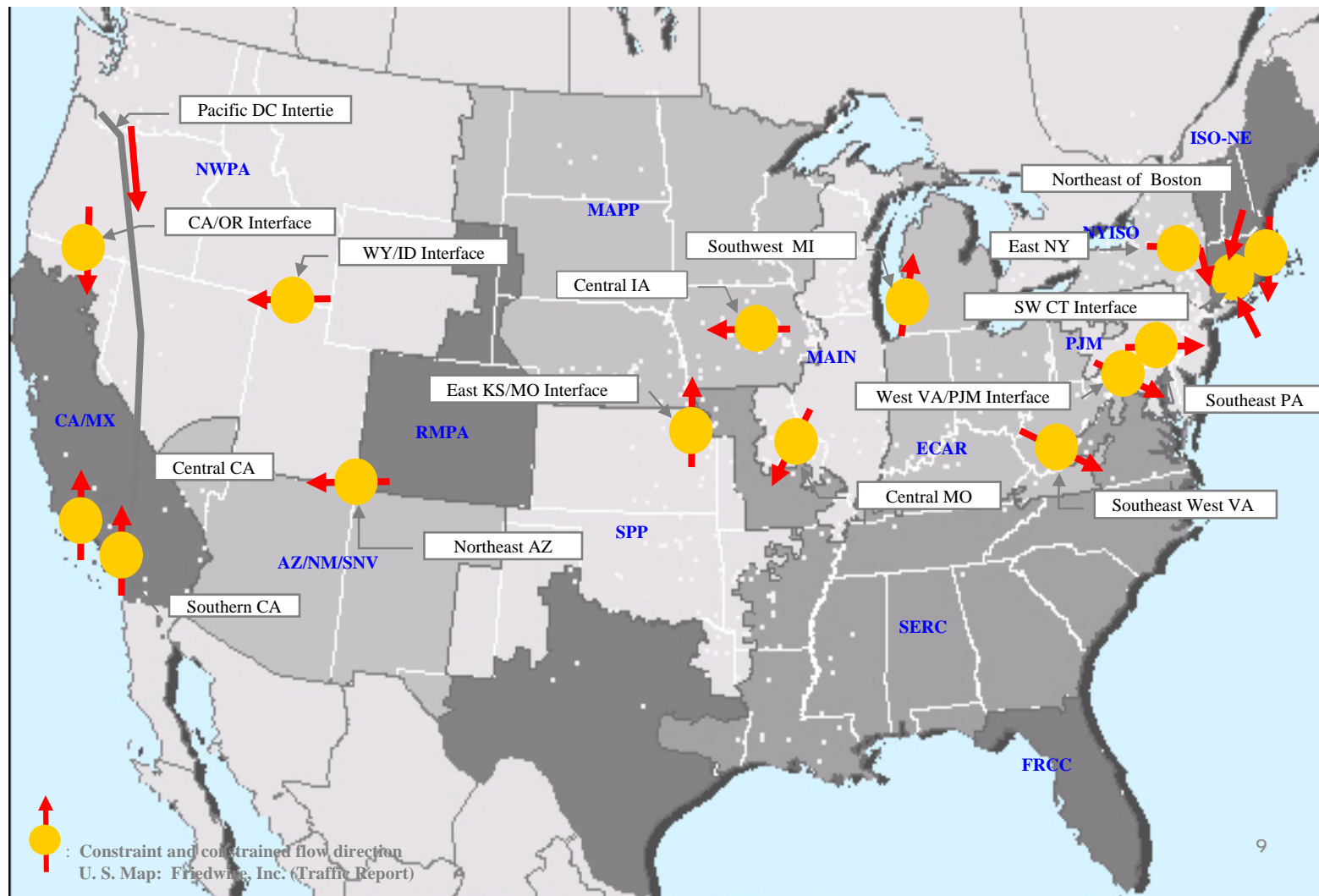
Source-Sink Flows of Natural Gas



Natural Gas Pipeline Network



Electricity Transmission Constraints



Dynamism

- Because of its multi-layered nature, the **dynamism** of the power market is consistently underestimated
- Market participants often don't fully appreciate the role of "feedback"
 - Markets are balancing mechanisms; what is pushed in one area pushes back in another
- Market participants often don't fully appreciate the role of transportation
 - Energy can be moved over wires or by moving coal over rails or...

Today's Agenda

- Market Dynamism
 - Feedback
 - Development and Fuel Economics: The Future of Natural Gas
 - Inter-Market Ties
 - Moving Energy: Transportation vs. Transmission (*substitutes or not?*)
- What are the fundamental value drivers for the power sector?
- How can participants navigate the opportunities and risks present?

Substitutability

- To get 1 MWh of power requires any of the following:

Fuel	Quantity	Unit Cost
Coal	0.41 tons	\$33/ton
Natural Gas	7 MMbtu	\$5.77/MMbtu
Fuel Oil	1.7 bbls	\$43/bbl
Wood Waste	1.4 tons	\$30/ton
Nuclear	0.007 lbs	\$407/lb
MSW	2.1 tons	***

Prices as of August 2004

- Substitutability provides bounds on how far prices can change, but can also exacerbate the speed and intensity of the market's readjustment process

Electric Power-Equivalent Prices

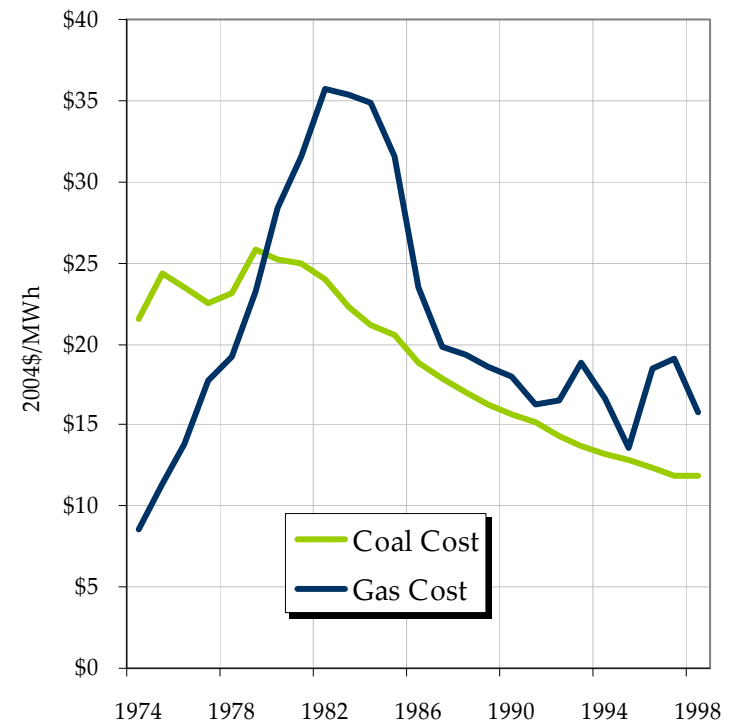
- As of 2004, these prices imply the following fuel-only energy costs for power:

Fuel	Fuel Costs
Coal	\$13.53/MWh
Natural Gas	\$40.39/MWh
Fuel Oil	\$73.10/MWh
Wood Waste	\$42.00/MWh
Nuclear	\$2.85/MWh
MSW	N/A

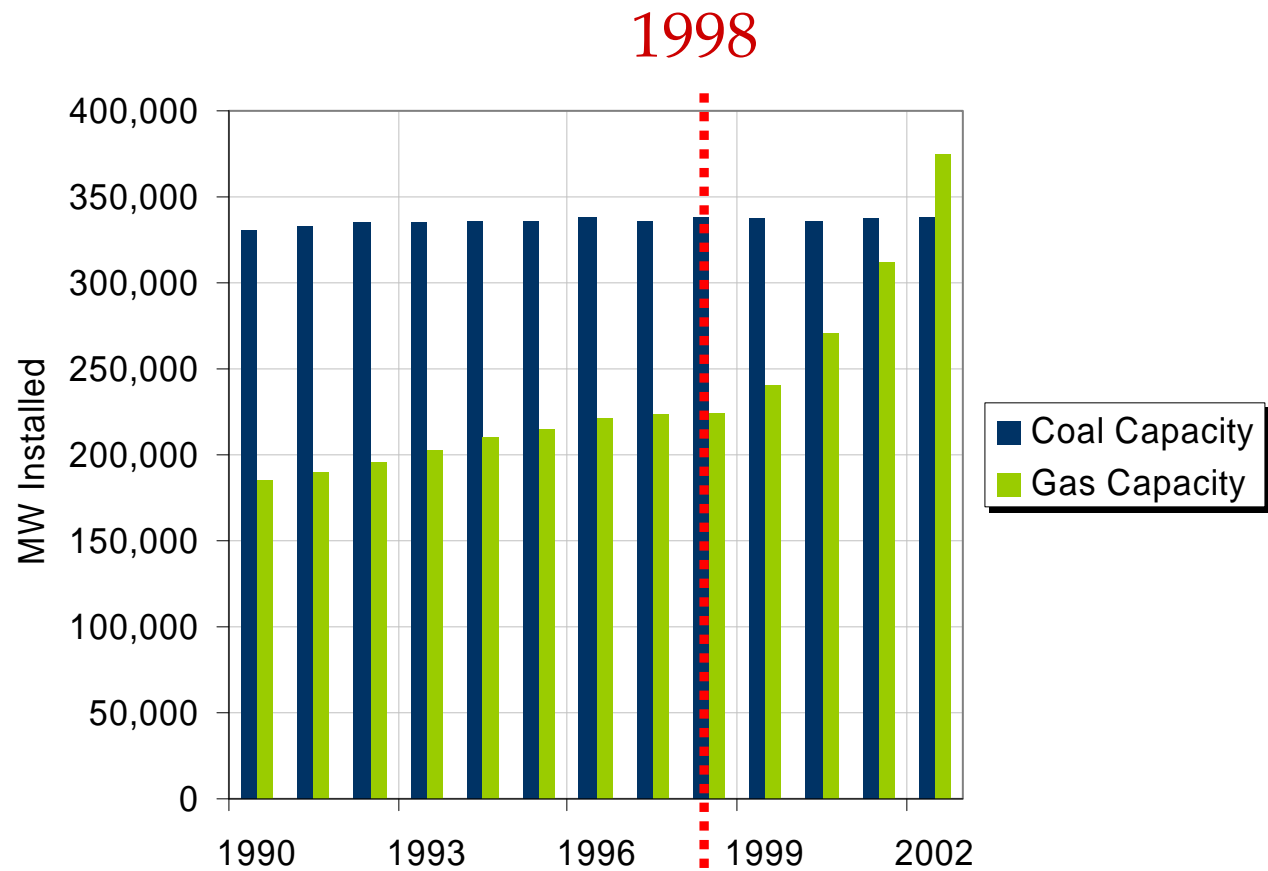
- Today, of course, coal looks cheap, but it wasn't always that way.
- Return to 1998...

Coal vs. Natural Gas: 1998

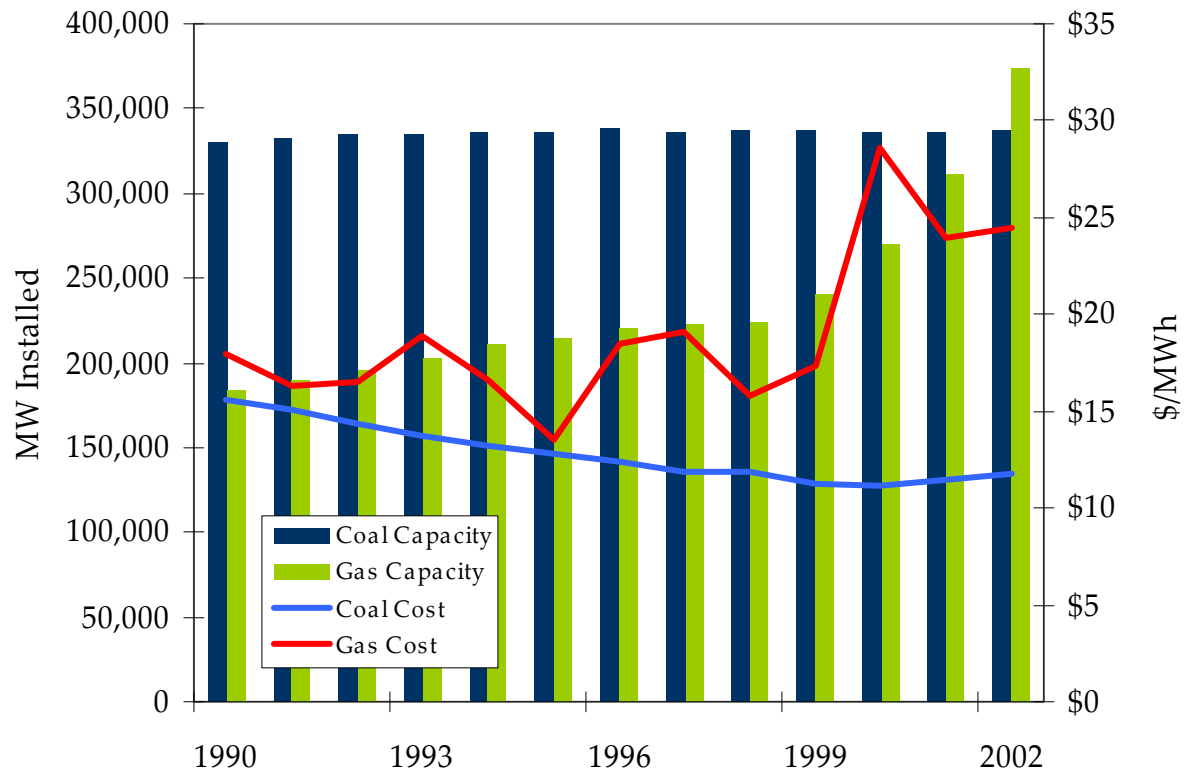
- Natural gas appeared finally as economical as coal – and without the environmental baggage
- Plus, gas-fired plants were faster and cheaper to build
- Investment Thesis:
 - Gas is cheap
 - Gas is plentiful
 - Gas is clean



The Gas-Fired Generation Boom



Market Feedback



- Adding so much gas-fired capacity to the system so quickly placed incredible demands on the natural gas infrastructure, pushing prices up

Consequences: Short- and Long-Term

- Of course, natural gas prices increased, but markets are not isolated, static mechanisms
- Increasing demand for natural gas:

Short-Term

Natural gas prices ↑
Gas transmission prices ↑
Electricity prices ↑
Transmission congestion ↑
Gas-fired capacity factors ↓

Long-Term

Coal prices ↑
Coal transportation costs ↑
Coal shortages ↑
Natural gas demand ↓
Emissions ↑
Emissions control investments ↑

■ Opportunity as a partial mirage

Investment Thesis	Reality
Natural gas is cheap	Natural gas prices are historically high
Natural gas is plentiful	Pipeline capacity is approaching limits
Natural gas is clean	High natural gas prices have increased demand for coal, thereby increasing emissions

■ What went wrong?

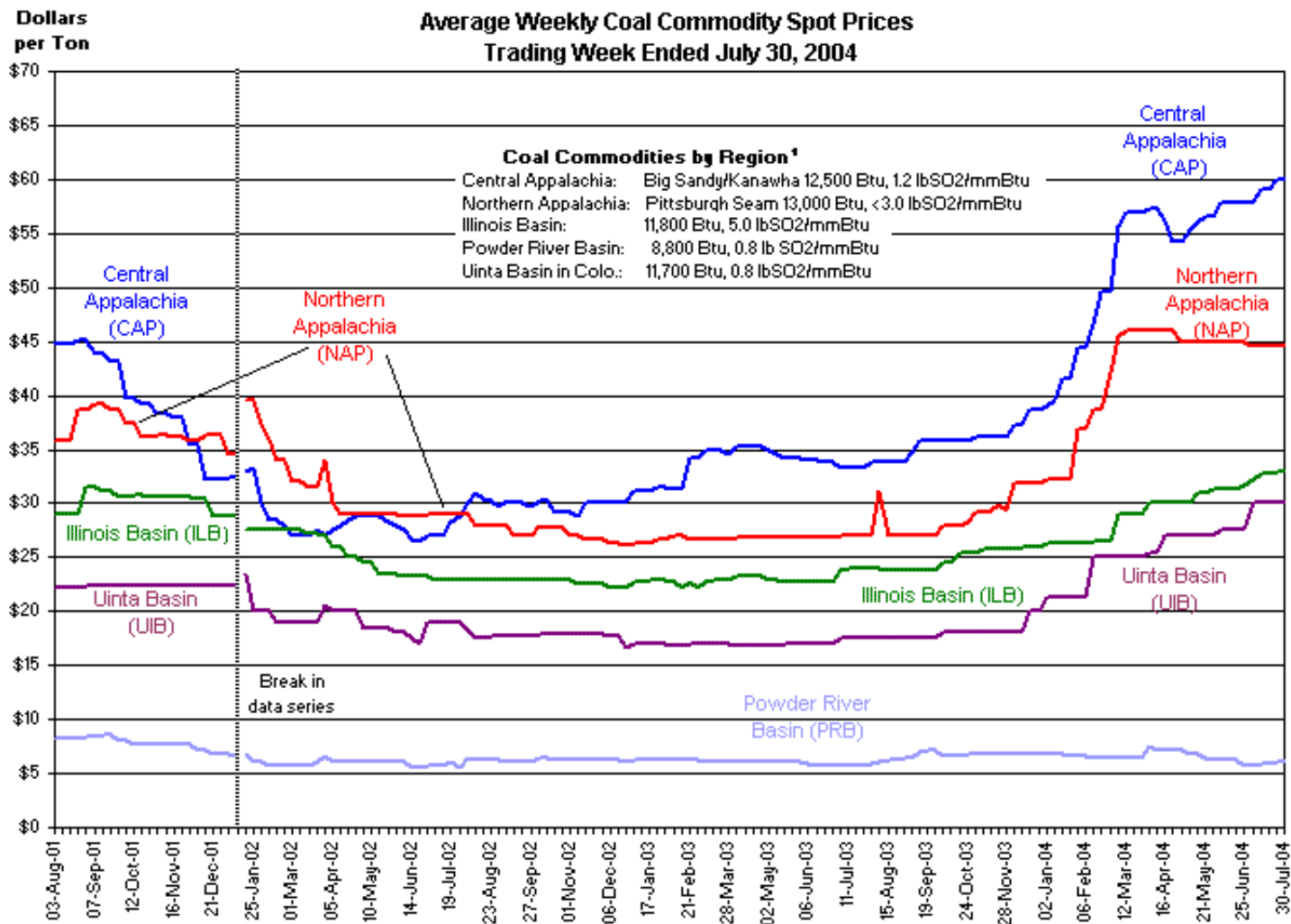
- Ignoring feedback/market dynamics
- Ultra short-term focus neglected signs of market re-equilibration
- Ignoring correlations between value drivers
- Lack of regulatory coordination
- Infrastructure development lags market responses

Those who ignore the past...

- Prompted by high natural gas prices, there has been a recent surge of development interest/activity in coal-fired generation
- *Déjà vu* all over again?
 - The industry was too quick to write off coal in the late 90s
 - Coal is not dead – but it's not going to dominate either
 - Moderation, balance, fuel diversity

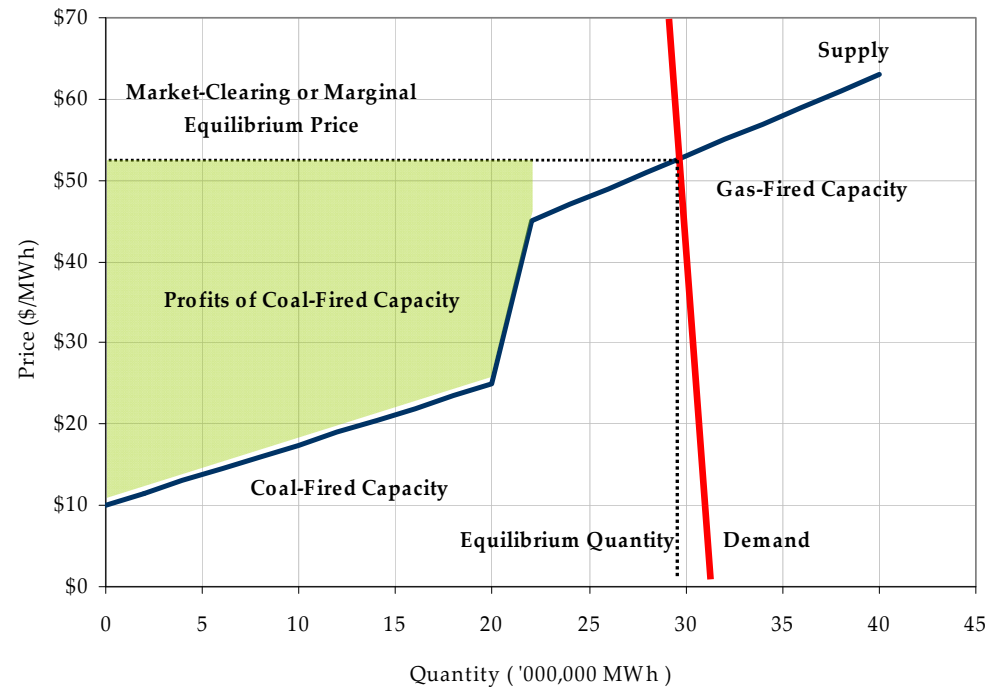
↪ Portfolio Thinking ↩

Coal is the New Natural Gas (???)



Project Economics in a Gas-Driven World

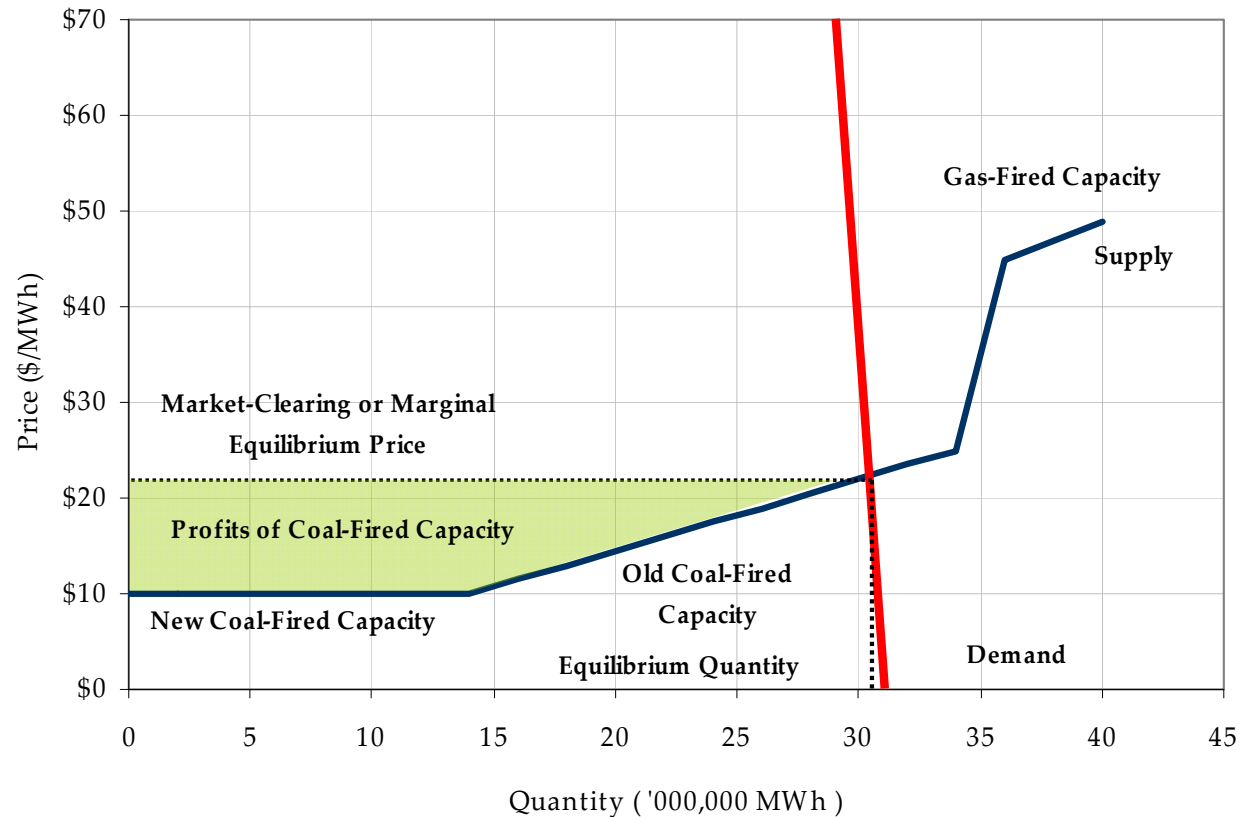
- Supply and Demand



- “Coal looks great! Build more coal!”
- But what happens to profits?

Coal Development Ramps Up

- Profits Drop
 - Extraordinary profits attract additional supply




Type and Location: ERCOT

- The Case of Texas Genco (TGN): *Not everyone suffers when natural gas prices are high*
 - TGN owns a portfolio of 14,153 MW of capacity – all in ERCOT
 - Announced in September 2003 that they were mothballing 2,990 MW of gas-fired capacity due to “lack of bids”
 - Remaining TGN capacity is mostly coal and nuclear
 - Natural gas is the marginal fuel in ERCOT (*i.e.*, electricity prices are driven by gas prices)
 - TGN’s baseload portfolio has been exceptionally profitable...but...




Opportunities


- Even in the midst of overcapacity in many regions, opportunities *can* and *do* exist to capture **inframarginal** profits
- A “contrarian” position was quite lucrative over the past couple of years
- Being in a sub-marginal position can often be functionally equivalent to a contract in the sense that it provides a stable demand
 - Preferential fuel pricing
 - Preferential fuel access (the all-in price of fuel includes what can often be a substantial transportation component)
 - New, highly-efficient technologies
 - Preferential location in “market spaces”
 - ➡ **Sustainable** competitive advantage

- 
- Coal – Direct
 - Own generation, extend leases
 - Coal – Indirect
 - Finance upgrades, emissions controls, clean coal technologies
 - Transmission Infrastructure
 - Rail as a coal play
 - Pipelines
 - Electric transmission
- } Partial Substitutes
- LNG???
 - \$0.80 to liquefy, \$0.40 to regasify, \$0.40-\$1.00 to transport...
 - Economics are very compelling, but there is significant resistance to adding the physical infrastructure
 - A LNG tanker contains energy equivalent to 2-3 nuclear bombs...
 - Whither natural gas?
 - Supply issues
 - Demand issues


Natural Gas Outlook

- 
- Modest production increases
 - Most easy wellheads are already tapped
 - Stable-to-increasing demand
 - Financial recovery of ailing generation companies may place some gas-fired assets back in the market
 - LNG will continue to grow – slowly
 - Speed of adoption will be a function of the profit incentives (how long domestic gas prices stay high)
 - Pricing should remain high through 2005
 - Average wellhead prices of \$5.50-\$6/MMbtu through 2005
 - Long-run prices will ease as market re-equilibrates
 - Accessing new supply, technological advances, substitution away (demand moderation) all take time

Consequences for Power

- 
- Reliability
 - Electric grid reliability can be affected by pipeline bottlenecks as a result of the popularity of non-firm pipeline capacity contracts
 - Ties between market spaces – when is pipeline capacity most likely to be tight? Precisely when demand is greatest!
 - Volatility
 - Volatility may actually moderate somewhat if prices stay high – doubly unfortunate for merchants who depend on option values
 - Potential for permanent substitution
 - OPEC likes to keep oil prices reasonable so people don't have an incentive to develop alternative fuels
 - If natural gas prices remain high, investments in clean coal technologies (and other alternatives) may permanently draw demand away from natural gas
 - Development activity in power markets takes a long time; high gas prices may cause momentum to support newer technologies – this could be a very positive development

Inter-Market Ties

- 
- Substitution appeared to work against investors during the last few years
 - How to make it work for you
 - Substitute remote coal generation + transmission for local gas-fired generation
 - What is the cheapest way to move “energy”?
 - On a per-kw basis, emissions controls for coal plants are roughly 1/2 the cost of a new gas-fired plant: Upgrade or Build New?

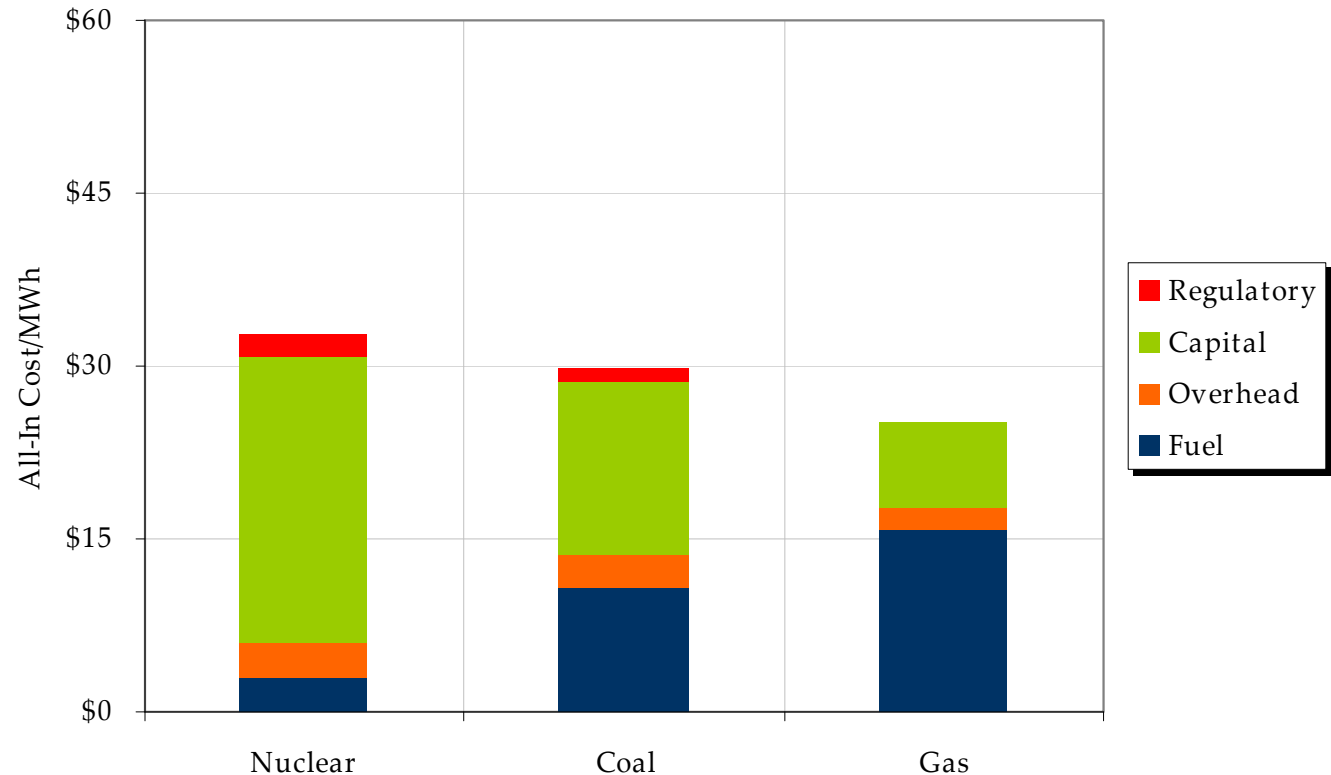
Wheeling or Trucking?

- Depending on congestion, moving energy may be cheaper by shipping coal by truck (or rail) than by transmitting electricity over HV lines.
- Siting, permitting, transmission tariff issues, capacity constraints on surface transportation
- Utilities in the Southeast are now contracting for Powder River Basin coal – rail transportation options may be limited

A “Balanced Costs” Perspective

- The true cost of power contains several components
 - Fuel (incl. transportation charges)
 - Overhead (non-fuel O&M)
 - Capital
 - Regulatory (permits/allowances/decommissioning/waste disposal)
- Effective investment analysis should focus on making true comparisons between projects
 - Comparing coal and natural gas plants on the basis of fuel costs alone is misleading

1998 All-In Costs Example



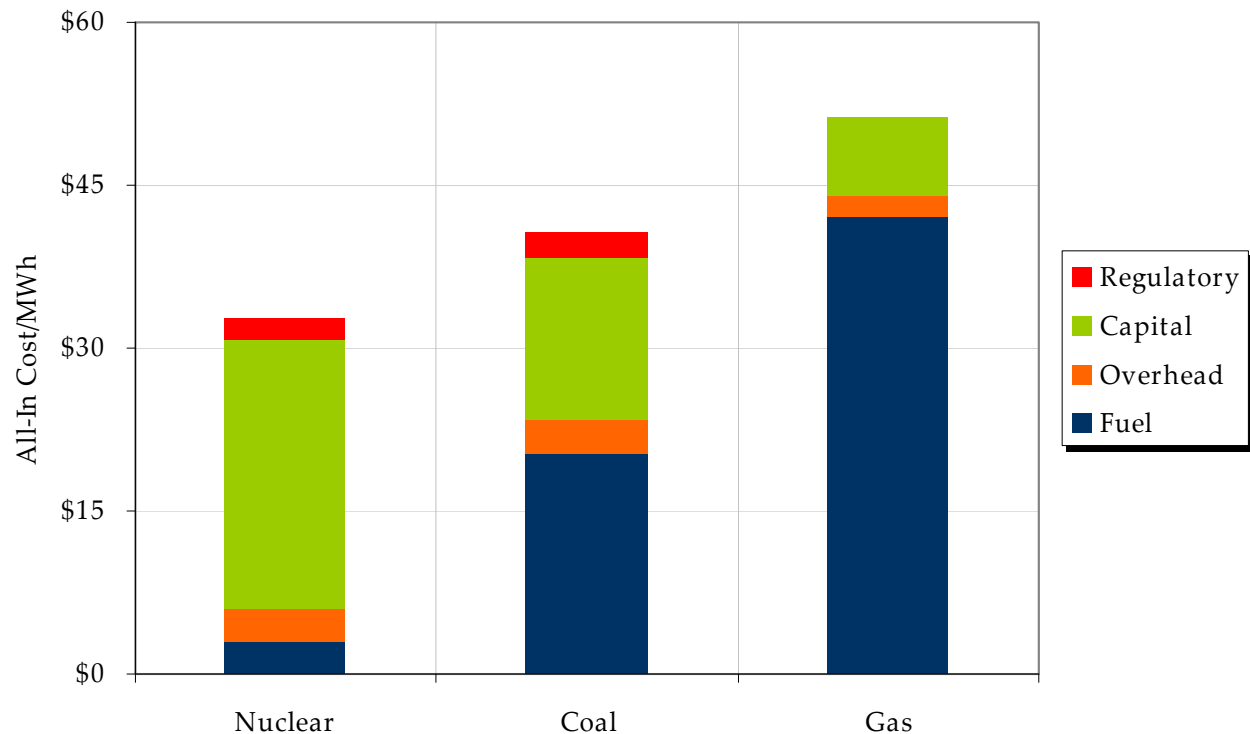
Regulatory = Decommissioning (nuclear) and SO₂ allowances (coal)

Capital = Overnight costs, amortized over useful life, WACC of 10%

Overhead = Non-fuel O&M, assuming 1,000MW plant, 90% capacity factor

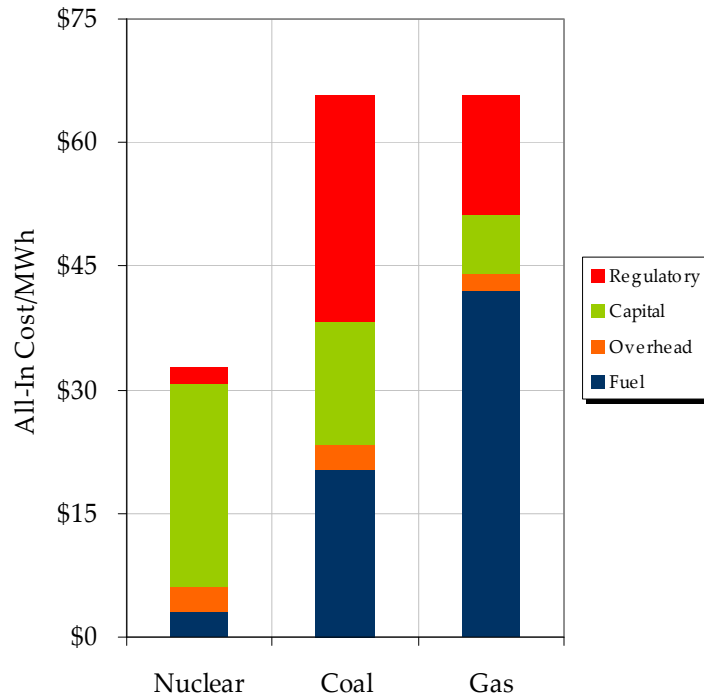
Fuel = Costs assuming average fuel heat content, contemporary technology

2004 All-In Costs Example

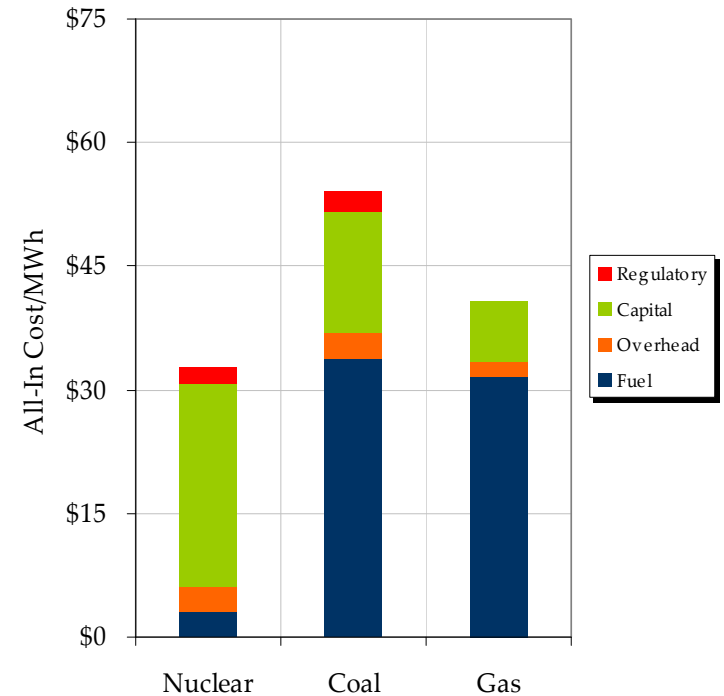


Regulatory = Decommissioning (nuclear) and SO₂ allowances (coal)
 Capital = Overnight costs, amortized over useful life, WACC of 10%
 Overhead = Non-fuel O&M, assuming 1,000MW plant, 90% capacity factor
 Fuel = Costs assuming average fuel heat content, contemporary technology



Future Scenarios?



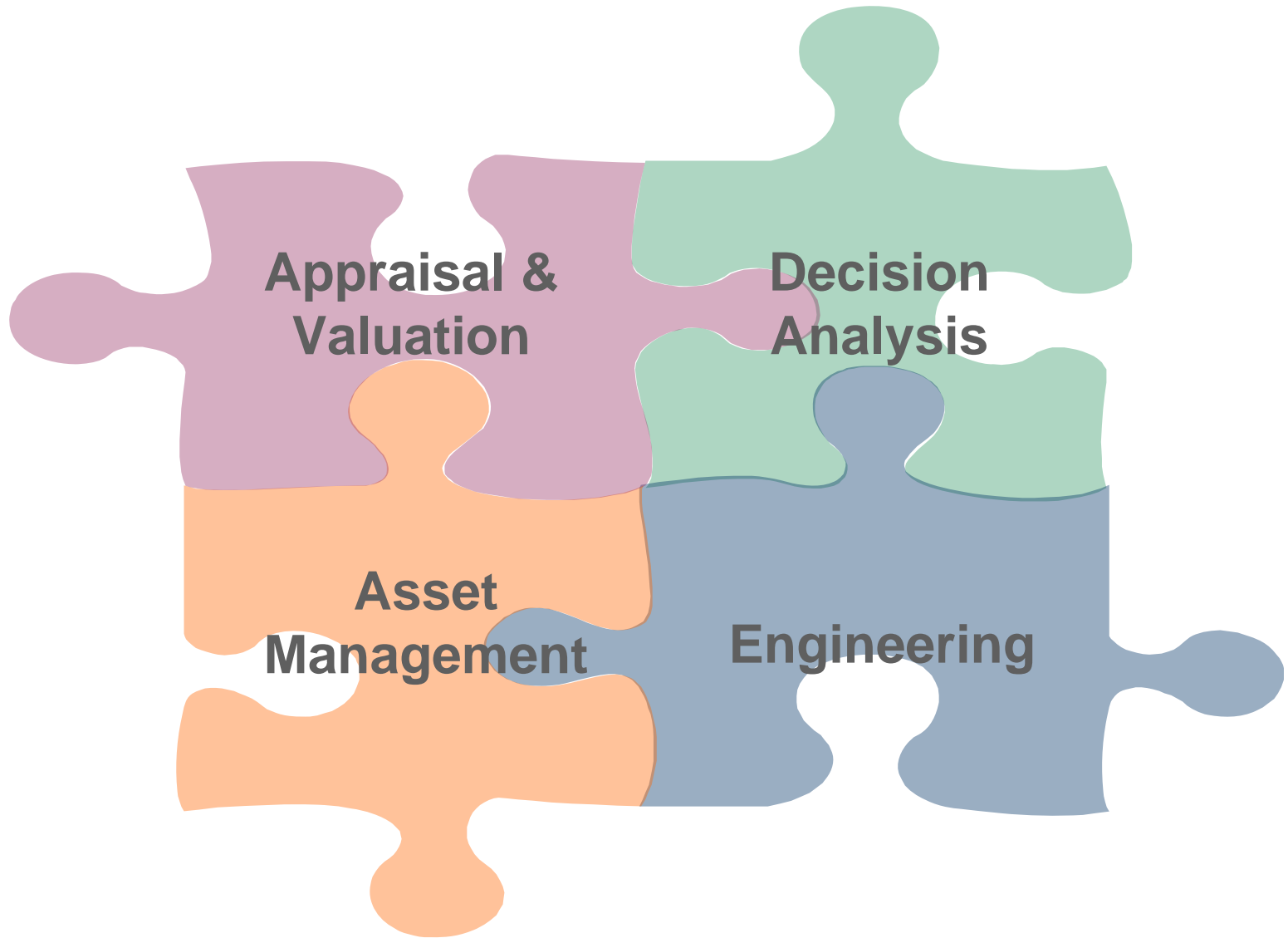
Carbon Tax
(\$25/ton)



Gas-Coal Substitution
(gas demand eases,
coal demand increases)

- 
- 
- Different value components have different levels of volatility that all contribute to the overall uncertainty surrounding project performance
 - What are you hedging?
 - A long-term fuel contract won't hedge regulatory risk (but various control technologies might)
 - Can coal and natural gas assets be real hedges?
 - Never say never...

- Feedback
 - Don't neglect equilibration!
 - In competitive markets, many “problems” often encourage/create their own “solutions”
 - Substitution will bound the **magnitude** of changes, but accelerate the **rate** of change
 - Portfolio Optimization: opportunities are present in market transitions
- Inter-Market Ties
 - Develop a “systems” perspective on power markets to focus on energy flows rather than on electricity alone
 - Transmission remains under-exploited
 - Transmission plays don't just include owning wires...



Recent Clients

Bank of America.



VIACOM.

citibank

BANK ONE.



THE BANK OF
NEW
YORK



NEW
YORK
LIFE



JPMorgan



WACHOVIA



Pacific Gas and
Electric Company™

GMAC
Commercial
Finance

CYPRESS

DaimlerChrysler Capital Services



Constellation
Power Source.

KIRKLAND & ELLIS LLP

WINSTON & STRAWN LLP

BAKER & MCKENZIE

ExelonSM



DAI Management Consultants, Inc.

*1370 Washington Pike
Bridgeville, PA 15017*

(412) 220-8920 voice

(412) 220-8925 fax

www.daimc.com

info@daimc.com