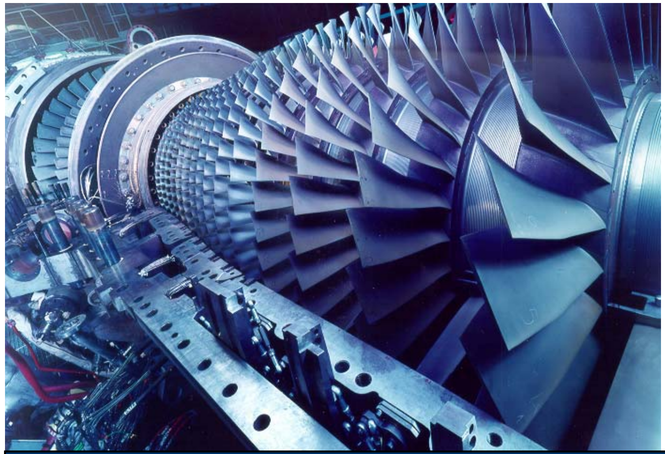

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Electric Power Industry Primer

April 2009

****IMPORTANT DISCLOSURES BEGIN ON PAGE 64 OF THIS REPORT****

Electricity Overview

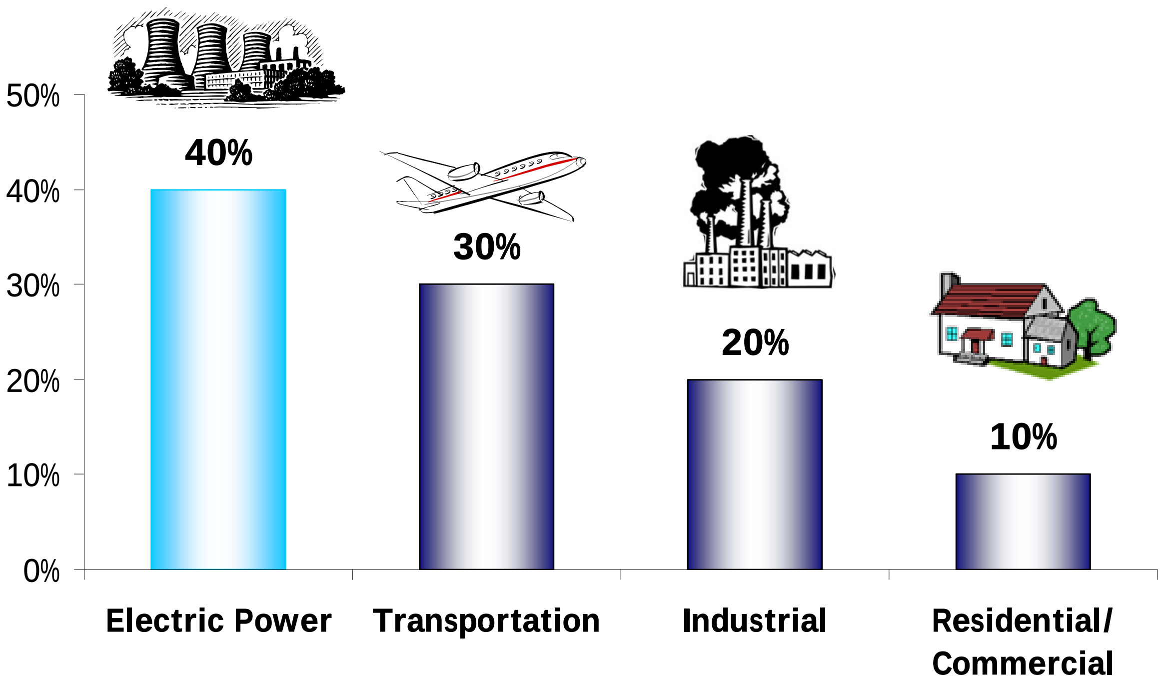
Someday, man will harness the rise and fall of the tides, imprison the power of the sun, and release atomic power.

-Thomas Edison

- Amazing. Thomas Edison invented the light bulb in 1879. Now, 130 years later, those three prophecies are true and the industry continues to evolve.
- Electricity is essential to our everyday life, accounting for 40% of U.S. Energy Consumption. It's so essential that it is, for the most part, regulated, and even those unregulated sectors still have Big Brother watching.
- Long term, demand is driven by GDP (although the pace of electricity demand has been slowing relative to GDP). Short-term – it's all about the weather.
- Since electricity can't be stored or transported long distances, it's one of the most volatile commodities around. And different types of plants are needed to meet changing load throughout the day/season.
- The industry has gone through tremendous evolution since that first light bulb – first a massive buildout of coal-fired plants, then the nuclear era, and most recently a deregulation-driven gas-fired plant overbuild. All signs point to renewables as the next wave of new generation – although there are tremendous implications of relying on Mother Nature for your electricity.
- Although this is an electricity primer – it's geared toward understanding electricity in context of one niche – the Independent Power Producers or IPPs. What drives demand/supply? How do they get paid? Who's looking over their shoulder?
  - Pages 1-37 cover the basics, especially if you are new to the sector.
  - Pages 38-63 are the Appendices with lots of detail if you want dig deeper.
- This is a primer…it explains how the industry works. Our predictions/forecasts will be published separately in two pieces, an industry report entitled "Independent Power Producers: Sector Dynamics and Stock Valuation" and a company piece that covers Calpine, Dynegy, Mirant, NRG Energy & Reliant Energy.

Electricity in Context

Percent of U.S. Energy Consumption, by Sector (2007)



- At 40%, the electricity sector is the largest user of energy in the U.S., consuming:
  - 100% of the nuclear energy produced;
  - 91% of the coal;
  - 51% of renewables;
  - 30% of the natural gas; and
  - 2% of petroleum products.

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

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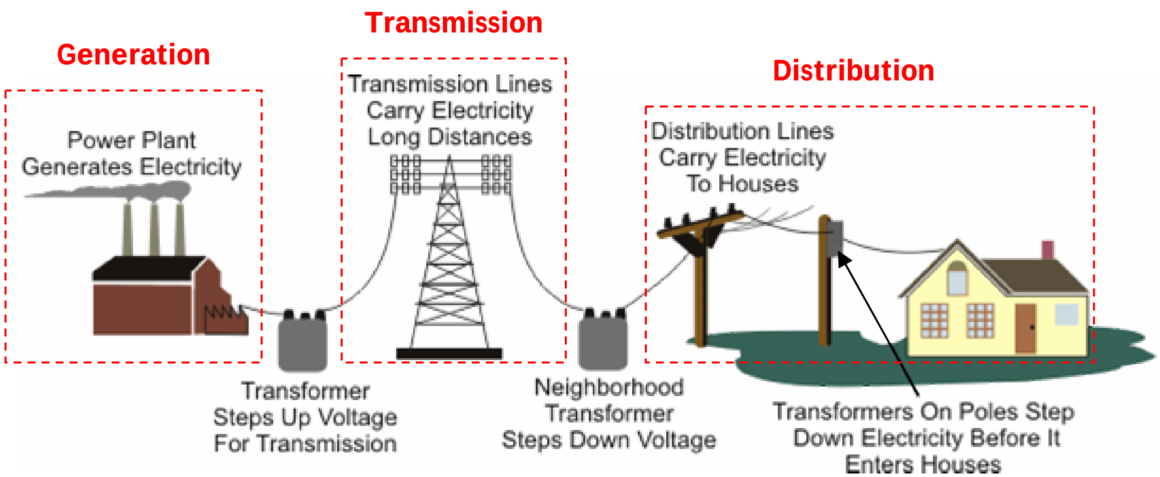
Electricity Supply Chain



Source: EIA/DOE, Tudor, Pickering, Holt & Co.

- The electricity supply chain is complex, with many different owners and rules along the way. In simple terms, there are 3 major components of the chain:
  - Generation
  - Transmission
  - Distribution
- Since we're initiating coverage of the IPPs, we're going to focus on the first part of the chain – generation. IPPs don't participate in the other regulated components of the chain.
- However, keep in mind that bottlenecks in the other two areas, particularly transmission, can impact generation economics.
- Generation is the most expensive part of the chain, accounting for about 55% of major investments for an integrated utility. Distribution represents about 29% and transmission 12%.
- While this primer will focus on generation, or electricity supply, we'll also spend some time on demand – a minor little thing as IPPs can't get paid without it.

History Lesson First

Early History

1879

Thomas Edison invents light bulb

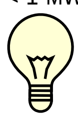
Era of private utilities

Early 1930s

1882

First electric generating station

1882
Installed base:
< 1 MW



- The modern electric utility industry began in the 1880s with street light systems (remember old movies of folks lighting street lamps before then?).
- Thomas Edison's Pearl Street generating station opened in New York City in 1882, serving 59 customers.
- Hydro-electric development of Niagara Falls by George Westinghouse in 1896 started the process of locating generation away from load centers.
- As more efficient steam turbines replaced reciprocating steam engines, heat rates (measure of efficiency) dropped from 93,000 Btu/kWh in 1902 to 21,000 Btu/kWh by 1932. For reference, most efficient gas-fired plants today are ~7,000 Btu/kWh.
- The need to keep plant efficiencies up to par created a desire for (and growth of) private investment.
- From 1901-1932, electric generating capacity grew at an average rate of 12%/yr despite a 14% drop between 1929 and 1932. Power generation capacity was 36,000 MW in 1932.

Era of Federal Power & Utility Prosperity

1935

PUHCA
Broke up utility holding companies

1932
Installed base:
36,000 MW

1939-45

World War II

1965
Installed base:
235,000 MW

1965

Northeast Blackout
Inspired formation of reliability councils and NERC

1974

Energy Policy Act
Banned natural gas for generation

1973-74

Oil Embargo

- By the early 1930s, 19 electric power holding companies controlled 90% of US power generation. A mere three holding companies controlled almost half of the generation.
- PUHCA, or the Public Utility Holding Company Act, was enacted in 1935, aimed at thwarting the monopolies. The SEC was given the authority to break up the massive interstate holding companies by requiring them to divest their holdings until each became a single consolidated system. PUHCA remained in place until 2005.
- The next 30 years were marked by significant investment in the sector, first driven by Roosevelt's post-depression spending, then the post-WWII boom.
- By the late 1960s, growth started to slow, costs were rising more rapidly than demand, and the Northeast Blackout of 1965 exposed flaws in a fragmented industry structure.
- With the oil embargo of the early 1970s, the price of fossil fuels skyrocketed, ushering in the nuclear era.

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Setting Up for Deregulation

1975
Installed base:
490,000 MW

1978
PURPA
First non-utility generation

1979
Three Mile Island

1983
FERC Order 380
Beginning of natural gas deregulation

1992
Energy Policy Act / EWA
Exempted wholesale generators – unconstrained by PUHCA

1995
Installed base:
740,000 MW

- By the late 1970s, the industry was ready for the next wave of change.
- PURPA, the Public Utility Regulatory Polices Act of 1978, is seen as the beginning of the IPP market in the U.S. The law was aimed at reducing the Nation's dependence on foreign oil and encouraging the efficient use of fossil fuels in electric power. What it did, however, was allow non-utilities to build generation and sell it to utilities.
- While PURPA is largely seen as planting the seeds for the growth of IPPs, FERC Order 380 was the beginning of utility deregulation. The landmark order eliminated the requirement for gas utilities to buy their gas from pipelines. That set the stage for gas pipeline open access, the formation of marketing companies and the eventual partial deregulation of the electric utility industry.
- The 1992 Energy Policy Act created the framework for a competitive wholesale electric generation market by allowing limited open access to electric transmission. The law also established a new category of electricity producer, the Exempt Wholesale Generator (EWG), free from the constraints of PUHCA.

Birth of the Merchant Generators

1998
CA market opens to retail competition

1994
DYN IPO

1996
CPN IPO

2000
MIR & NRG spinoffs

2002
RRI spinoff

Current
Installed base: 965,000 MW

1996
FERC Order 888/889
Deregulation of transmission services

2002
ERCOT market opens

Summer 2000
California energy crisis

2008
Energy Policy Act
PUHCA repealed

- Although Dynegy was the first merchant to IPO, the company was founded as Natural Gas Clearinghouse, an energy marketing company.
- Calpine was the first pure merchant to IPO, with a mandate to build new, efficient gas-fired generation.
- In 1996, the FERC issued orders 888 and 889, which opened transmission access to non-utilities and required utilities to provide electronic access to transmission capacity information.
- By 2000, the merchant frenzy was in full force, with spinoffs of Mirant and NRG Energy, followed quickly by Reliant.
- The California Energy Crisis hit in the summer of 2000, with far-reaching implications. Power prices skyrocketed, many a merchant generator was accused of manipulating the market, and the benefits of deregulation were called into question. The aftermath was a screeching halt to further deregulation across the country.

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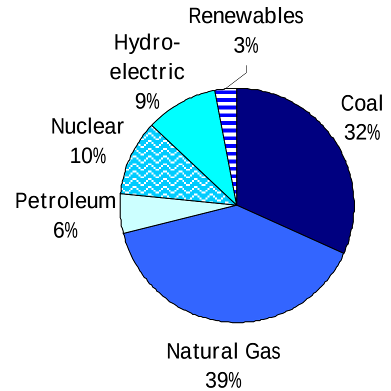
The Electricity Business Circa 2009

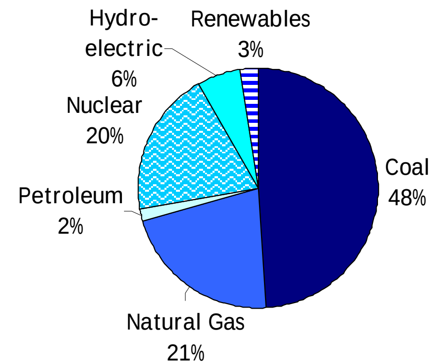
Snapshot

- 76 publicly-traded electric and diversified utilities on the NYSE and NASDAQ
- $4.5B average market cap
- ~$350B total market cap
- Key index – UTY (Philadelphia Utility Index), 3% of S&P 500

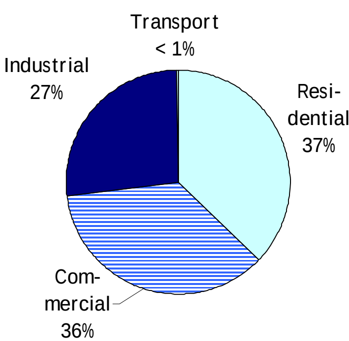
Capacity by Fuel Type (2007)



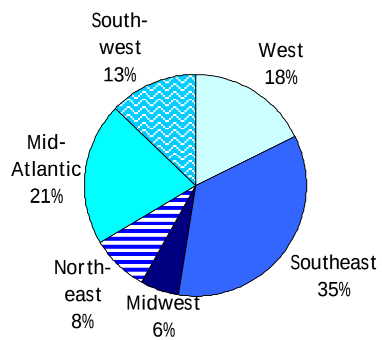
Generation by Fuel Type (2007)



Electricity Demand, Sectors (2007)



Electricity Demand, Regions (2007)



Renewables (Excluding Hydroelectric)

- ~15,500 MW total built in 2007 and 2008
- 3.2% of U.S. capacity is from renewables (2007)
- 2.5% of U.S. generation is from renewables (2007)

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

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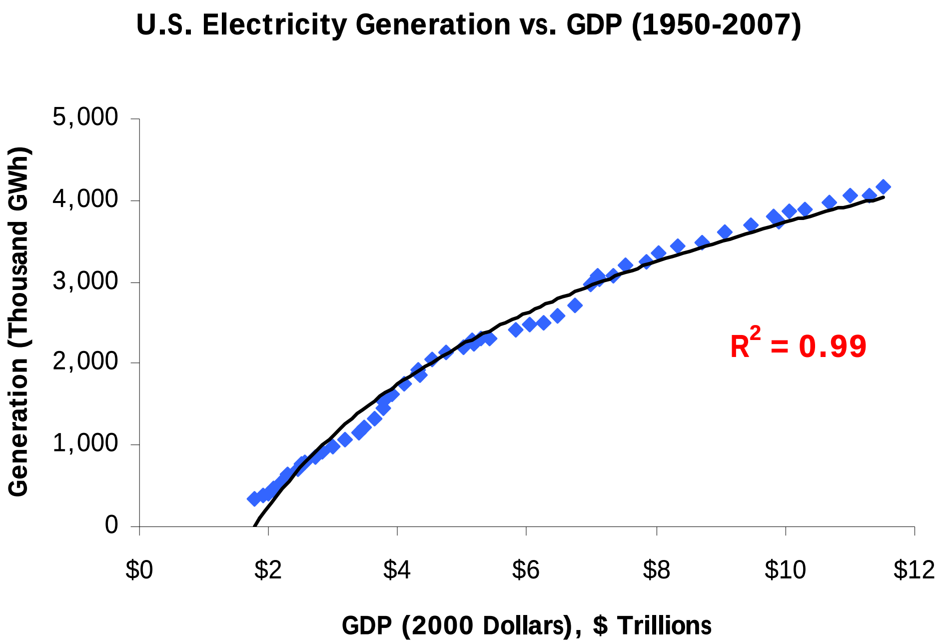
Electricity Demand

Electricity Demand – Historically, It's All About GDP



- Lots of drivers of electricity demand in the short term…weather, time of day, holidays, etc.
- But long term, it's the economy…GDP.

Source: EIA/DOE; BEA; Tudor, Pickering, Holt & Co.

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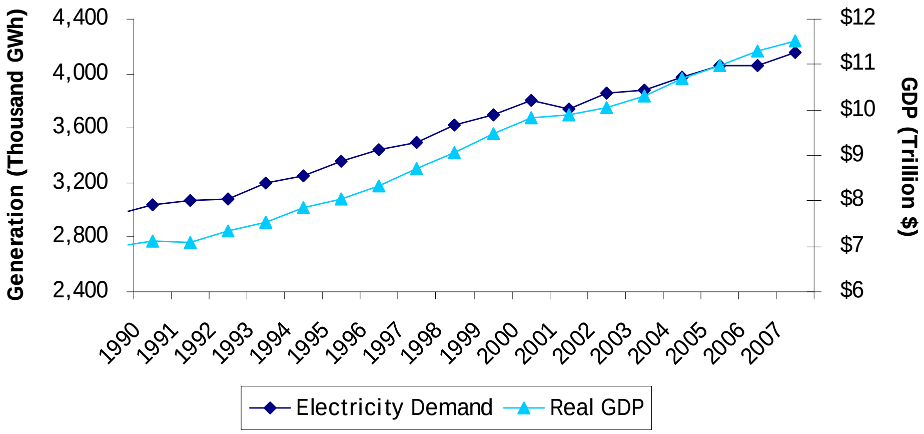
It’s Still About GDP…But Slower Growth

Compound Annual Growth Rate	U.S. Real GDP	Electricity Generation	Elec/GDP Ratio
1950 - 1960	3.5%	8.6%	2.5
1960 - 1970	4.2%	7.3%	1.7
1970 - 1980	3.2%	4.1%	1.3
1980 - 1990	3.3%	2.9%	0.9
1990 - 2000	3.3%	2.3%	0.7
2000 - 2007	2.3%	1.3%	0.6

U.S. Electricity Generation vs. GDP (1990-2007)



- For years prior to 1980, electricity demand grew at an equal or greater pace than GDP.
- As the U.S. began converting from an industrial to a service-based economy in the 1970s/1980s, the trend reversed, with GDP growth exceeding the pace of electricity demand growth.
- Electricity demand growth is now running at about half the pace of GDP.

Source: EIA/DOE; BEA; Tudor, Pickering, Holt & Co.

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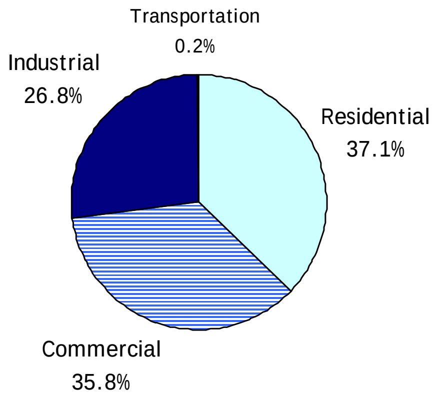
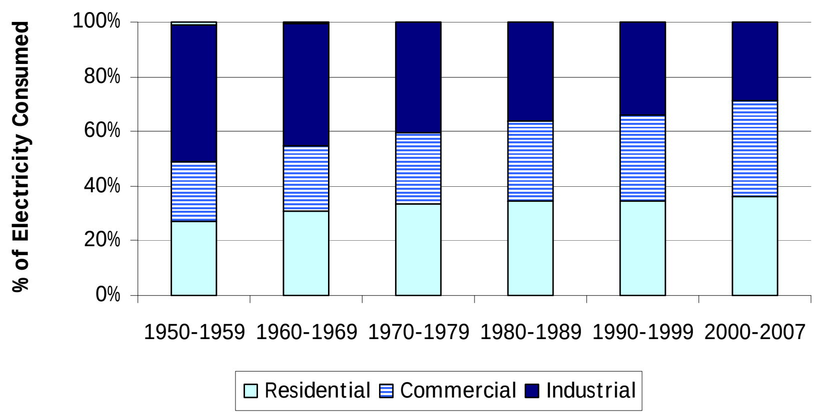
Electricity Demand by Sector





- Since 1950, U.S. electricity consumption has grown an average rate of 4.5%/yr.
    - Commercial: 5.3%/yr
    - Residential: 5.2%/yr
    - Industrial: 4.3%/yr
    - Transportation: 0.2%/yr
- Since 2000, U.S. electricity consumption has grown an average rate of 1.3%/yr.
    - Residential: 2.2%/yr
    - Commercial: 2.1%/yr
    - Industrial: (0.8)%/yr
    - Transportation: 5.3%/yr (tiny but growing)
- Overall, growth in demand has been driven by the residential and commercial sectors. Demand in these sectors is weather-dependent, so demand growth slows in mild-weather years.

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

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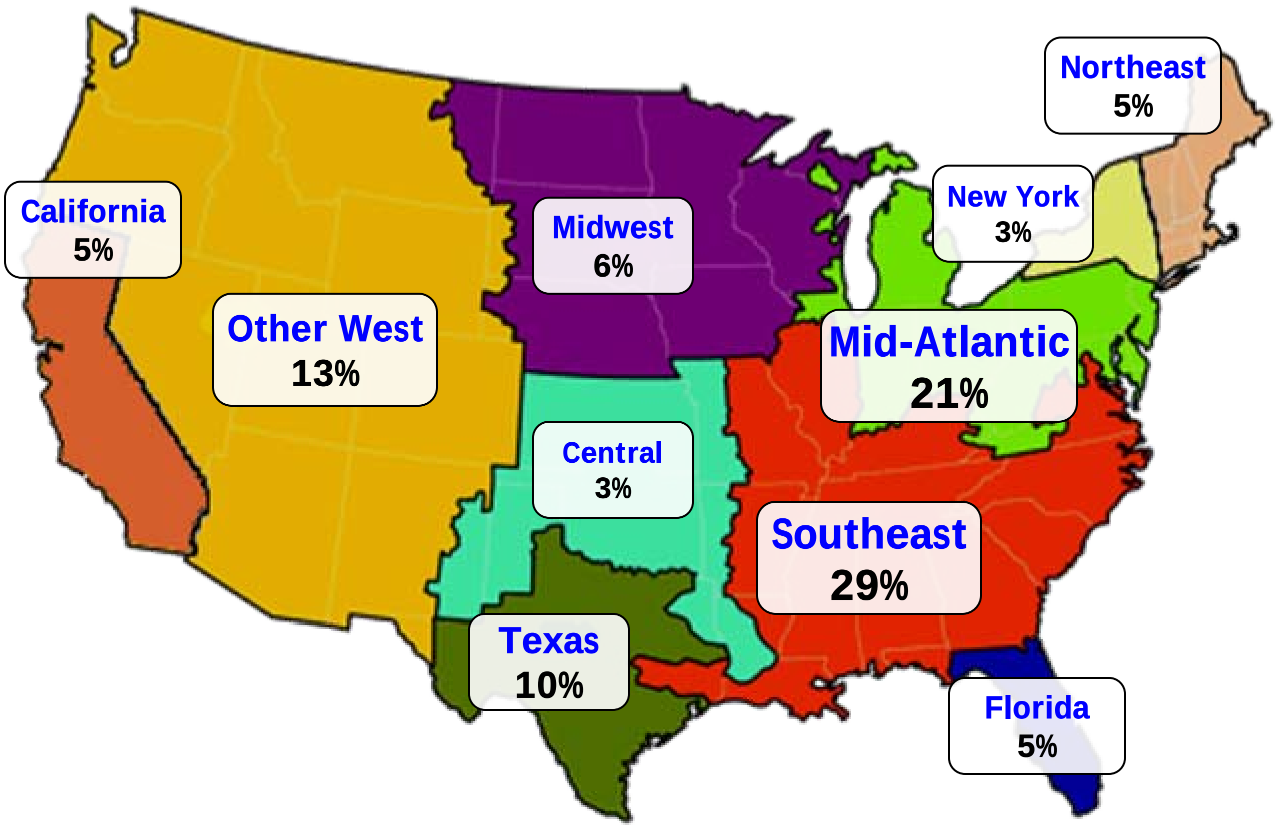
Regional Demand

Percent of U.S. Generation, by Region (2007)



- Five-year average annual growth rate of electricity generation, by region:

Central	2.9%
California	2.7%
Other West	2.5%
Florida	2.1%
Midwest	1.1%
Texas	1.0%
Mid-Atlantic	1.0%
Northeast	1.0%
New York	0.9%

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

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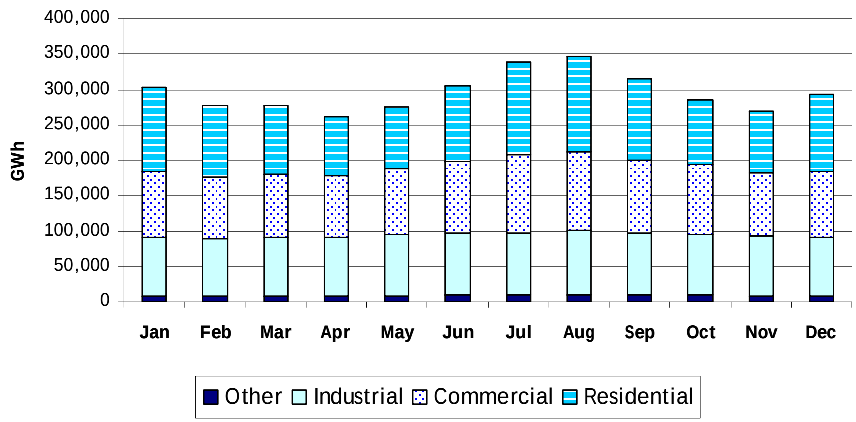
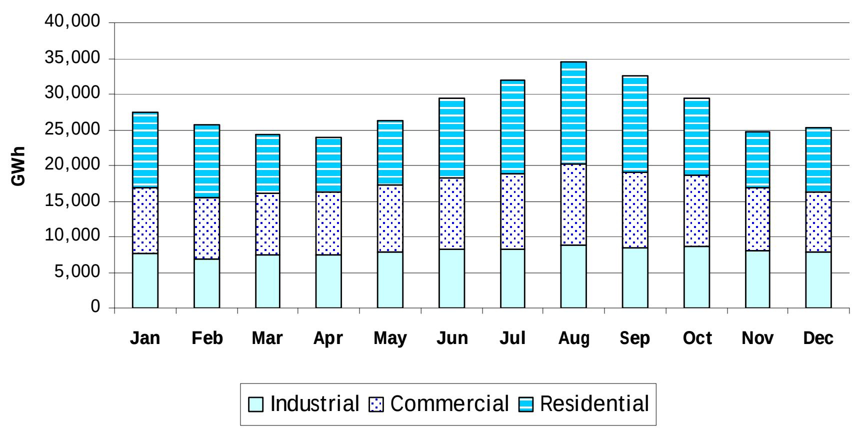
Short-Term Demand...Weather Matters

U.S. Monthly Retail Sales by Sector, 10-Year Average (1998-2007)



Texas Monthly Retail Sales by Sector (2007)



Source: EIA/DOE, Tudor, Pickering, Holt & Co.

- Electricity demand peaks in the summer, driven by air conditioning in the commercial and residential sectors.
- On a 10-year average basis, peak August demand is 33% higher than the April trough.
- Look at Texas in 2007. Peak August was 10,500 GWh, or 45%, higher than trough April demand.
- Normally the hottest week of the summer is in early August. Since 2003 in the U.S., the delta between this week in the hottest and mildest years was generation of 18,000 GWh. This is a ~20% swing from maximum to minimum and the equivalent of 105,000 MW, or ~250 power plants running full out.

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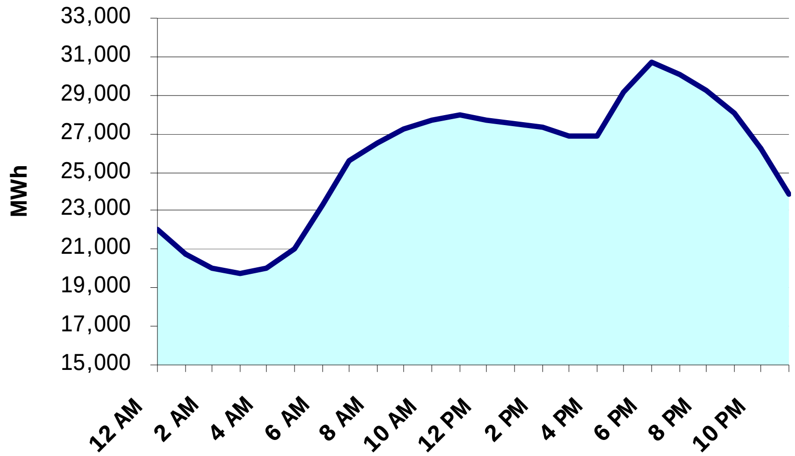
…And So Does the Time of Day

Demand Curve by Hour, California



Source: CAISO, Tudor, Pickering, Holt & Co.

- Not only does electricity demand vary on a seasonal basis (summer peaking), it also varies on an hourly basis.
- Compound that with the fact that electricity can not be stored, nor can it be transported long distances, and you get what is likely the most volatile commodity around.
- As a result, the industry has different types of generation to meet different loads: Base, Intermediate and Peaking.
- Additionally, states have to make sure there is plenty of excess capacity around in case of weather extremes.

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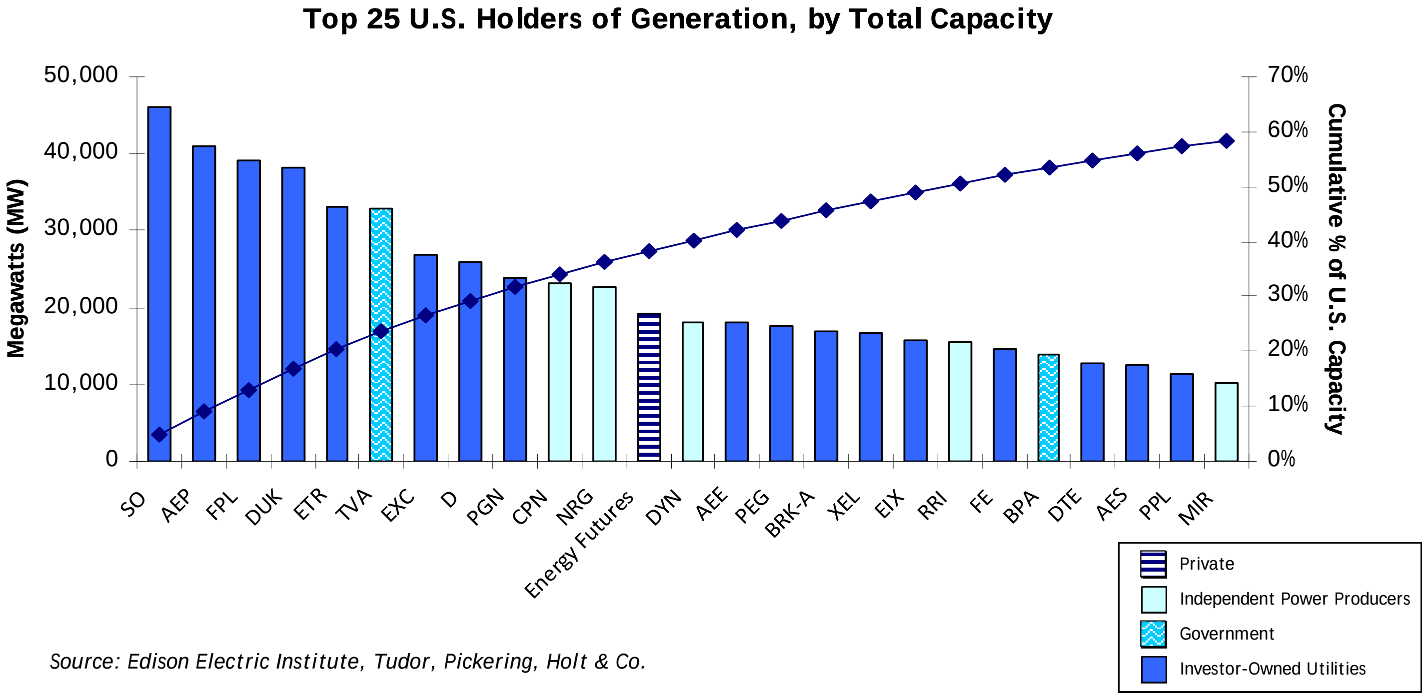
Electricity Supply

Ownership Dominated by Integrated Utilities



Source: Edison Electric Institute, Tudor, Pickering, Holt & Co.

- 25 utilities and independent power producers (IPPs) own about 60% of U.S. generation.
- Today, ~9% of U.S. generation capacity is held by the five pure merchant players (CPN, DYN, MIR, NRG, RRI).
- The U.S. is a fragmented industry compared with Europe, where many countries are dominated by 1-2 utilities.
- Of ~3,200 public and private electric utilities in the U.S., about two-thirds have no generating capacity (they're distribution/retail only), providing a natural market for IPPs.

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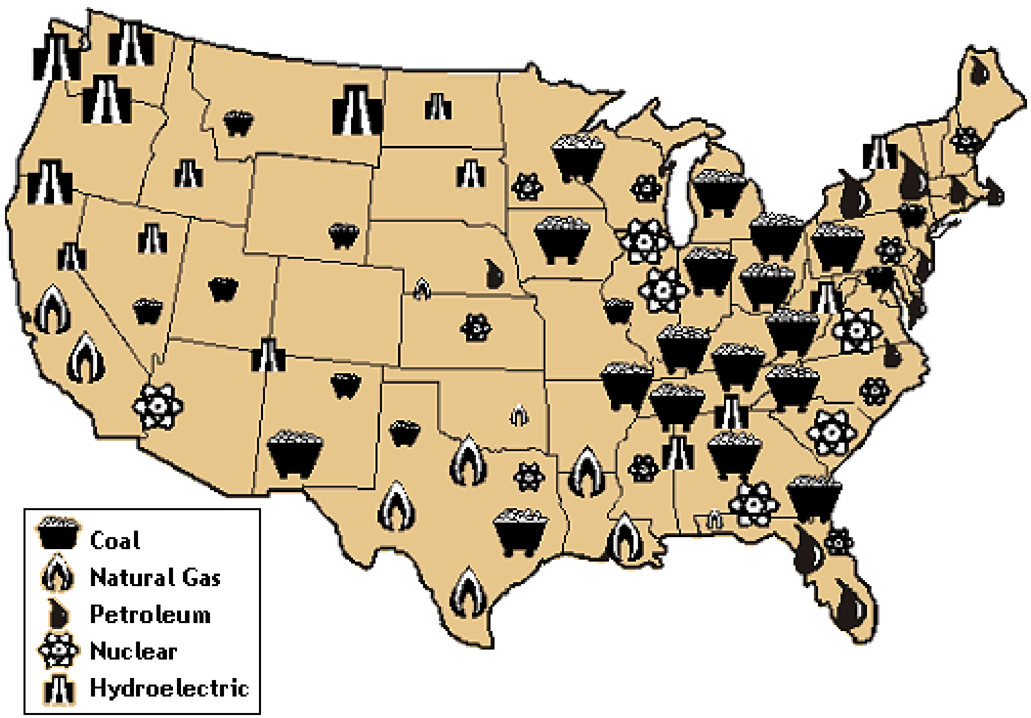
Generation Technology Types

Technology	Fuel	Typical Size of Facility	Heat Rate (Btu/kWh)	Construction Cost ($/kW)	Cost per Facility ($MM)	Time to Construct (years)	Typical Capacity Factor	How it works
Combined Cycle Gas Turbine (CCGT)	Nat Gas	500 MW	7,000	$1,000	$500	3	35-65%	Typically two gas turbines (think big jet airplane engines) each drive a generator. Hot exhaust from the turbines heats water into steam, which spins a turbine, which turns a generator
Simple Cycle Gas Turbine (GT)	Nat Gas	400 MW	10,000	$800	$320	1	10-15%	Gas turbine (again think big jet engine) turns a generator
Steamer	Nat Gas/ Oil	1,000 MW	11,000	30 yr old technology – no new construction			10-35%	Natural gas and/or oil is ignited, heating a boiler, which produces steam, powering a turbine, which turns a generator
Coal	Coal	1,000 MW	10,000	$2,200	$1,100	4	65-95%	Coal ground into a dust is ignited, heating water into steam, which spins a turbine, which turns a generator
Hydro	None	75 MW	NA	$2,000+ (site dependent)	$150	2+	25-65%	Water-powered turbine turns a generator
Solar (Photovoltaic)	None	10 MW	NA	$4,500	$45	1	20-35%	Solar cells convert light energy into electricity
Solar (Thermal)	None	50 MW	NA	$3,000	$150	1	20-35%	Mirrors focus sunlight onto a boiler, which creates steam, which spins a steam turbine, which turns a generator
Wind	None	100 MW	NA	$2,500	$250	1	20-35%	Windmill turns a generator

Source: EIA Electric Market Module 2008, Tudor, Pickering, Holt & Co.

Electricity Supply…Each Region is Unique

Energy Sources for Electricity Generation by Region



Source: EIA/DOE, Tudor, Pickering, Holt & Co.

- The availability of natural resources impacts regional electricity supply.
- Coal producing states (KY, OH, WV, TN) are home to the majority of coal-fired generation. Due to high transport costs, coal-fired generation is usually located near coal mines or major transportation arteries.
- The Pacific Northwest generates most of its power from abundant hydro-electric resources (most government owned). As a result, it has some of the lowest-cost generation in the country, but also is most impacted by weather.
- Texas, Louisiana and Oklahoma are dominated by gas-fired generation.

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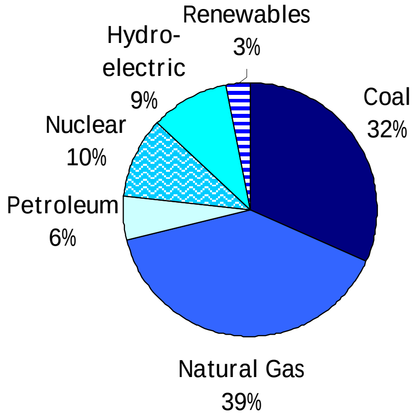
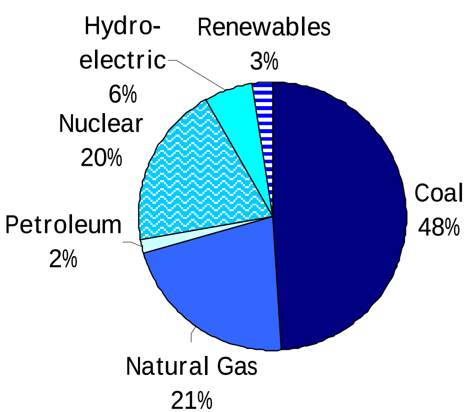
Electricity Supply – The Basics



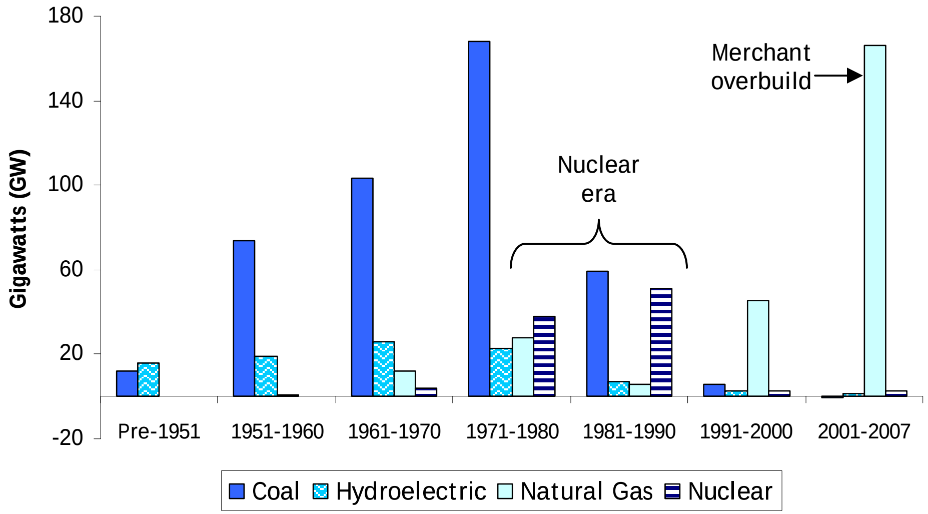


- Generating *capacity* is measured in megawatts (MW). For perspective, 1 MW can power ~1,000 homes.
- Actual generation is measured in megawatt hours (MWh). A MWh represents 1 MW of capacity run continuously for 1 hour.
- Generating units vary in size – nuclear and coal units are the largest, typically ~1,000 MW for each unit. Hydro-electric plants are some of the smallest – frequently < 1 MW.
- Total electric power sector generating capacity was ~1,000,000 MW in 2007. Natural gas-fired generation provides the largest component of capacity (39%), followed by coal (32%).
- So, while natural gas-fired generation represents the majority of available capacity, actual generation is dominated by coal-fired units, meaning these plants are run more often.
- Capacity factor = the amount of time a plant runs.
- Typical capacity factors:
  - Nuclear: 90+%
  - Coal: 75%
  - Natural Gas (combined cycle): 40%
  - Petroleum: <15%
  - Natural Gas (peakers): <15%

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

Supply Timeline – Changing Fuel of Choice

Additions to U.S. Electricity Capacity by Fuel Type (Pre-1951 to 2007)



Source: EIA/DOE, Tudor, Pickering, Holt & Co.

- This one graph succinctly tells the story of buildout of the U.S. power fleet.
- 1950s-early 1970s – New coal generation satisfied the robust growth in electricity demand.
- 1970s-early 1980s – Nuclear age. Trivia question: How many nuclear reactors were ordered from 1971-1974? (answer at bottom).
- Mid 1980s-late 1990s – Uncertainty of deregulation leads to underbuild.
- Late-1990s-early 2000 – Overbuild via natural gas plants.
- What's next? Renewables, of course!

Answer to trivia question: 131 units ordered; 63 units cancelled from 1975-1980

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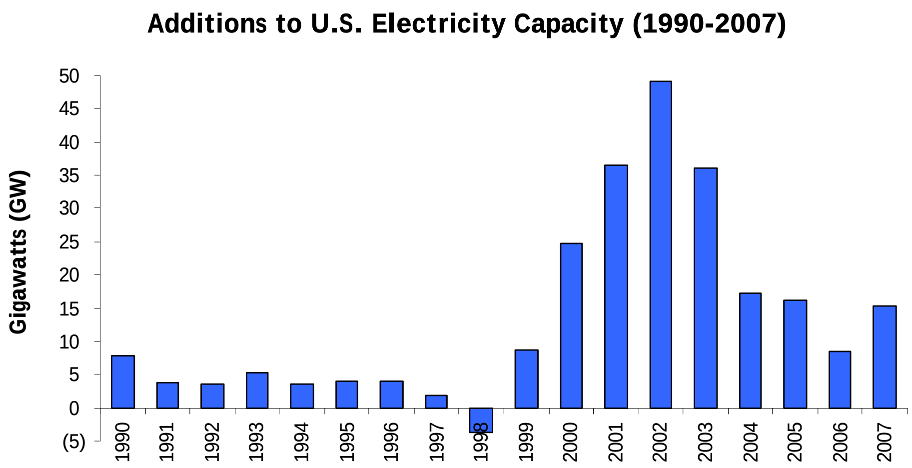
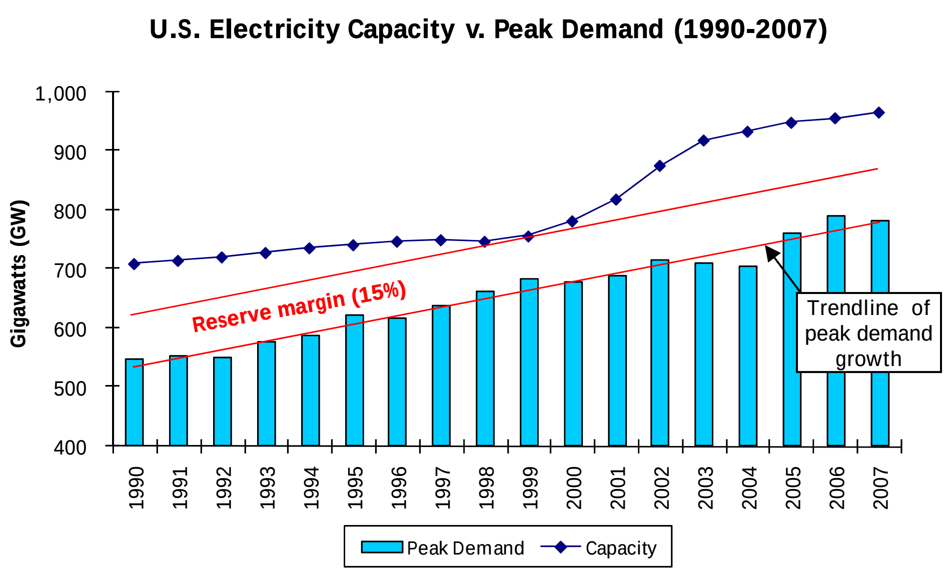
Overbuild Cycle Leads Us to Where We Are Today

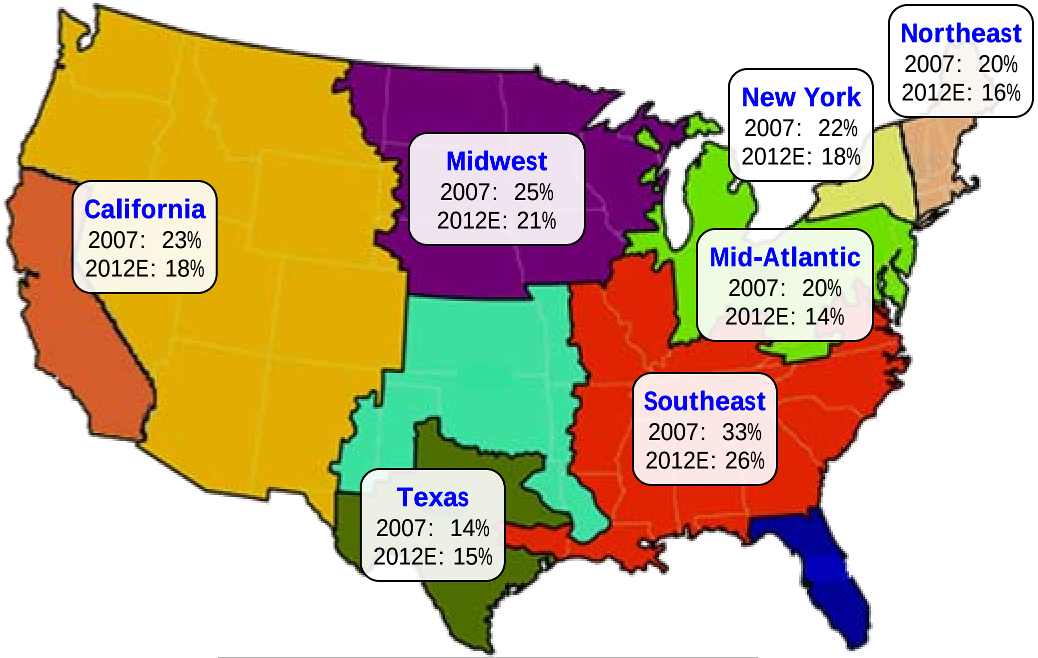




Source: EIA/DOE, Tudor, Pickering, Holt & Co.

- In 1990, the U.S. had 800 GW of generating capacity. So, if peak demand is growing by 1.7%/year (2000-2007), the industry needed to add about 14 GW/year to ensure adequate supply.
- As the industry grappled with the uncertainty of deregulation during the 1990s, utilities all but stopped building new generation (additions of ~4 GW/year).
- But boy-o-boy did the merchants make up for it in the first part of this decade! Peak year for new builds was 2002 – two years after the CA energy crises and a year after the collapse of Enron. The average 2000-2003 capacity added was ~37 GW/year.
- Prior to the recent economic meltdown, the industry was finally recovering somewhat from the overbuild. Now…the recession has delayed equilibrium another two years (now 3-6 years out).

Supply/Demand Balance



*Reserve Margins by Region**

	2007	2010	2012	Time to Equilibrium
California	23%	24%	18%	2014
Midwest	25%	24%	21%	2016
Texas	14%	18%	15%	2013
Southeast**	33%	33%	26%	2016
Mid-Atlantic	20%	19%	14%	2012
New York	22%	19%	18%	2014
Northeast	20%	20%	16%	2013

**Regions with little or no merchant generation have been omitted.*

***Includes 28 GW of uncommitted merchant generation.*

- In the electricity sector, supply/demand balance is measured in terms of "reserve margin" – how much excess generation (reserves) is available in case demand is bigger than expected or plants fail.
- Typically, regulators plan for about 12-15% reserve margins. Below 12%, markets run the risk of severe price spikes. Above 20%, the market is very saturated.
- Our view of reserve margins is shown to the left.
- The Appendix shows more detail of reserve margins by region, on pages 51-58.
- Time to equilibrium assumes no demand growth in '09/'10, returning to normal growth rates (~2%/year) in 2011 and beyond.

Source: EIA/DOE, NERC, Tudor, Pickering, Holt & Co.

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New Build Economics...Not Favorable

Basic Generation Economics (Per 1 MW of Capacity)						
$000 except where noted						
	Coal*	**Intermediate Gas-Fired****	**Peaking Gas-Fired*****	**Wind**	**Solar**	**Nuclear**
Capital Costs	$2,200	$1,000	$800	$2,500	$4,500	$5,000
Capacity Factor	90%	60%	10%	25%	25%	95%
Production (MWh)	7,884	5,256	876	2,190	2,190	8,322
Fuel	$213	$276	$66	$0	$0	$50
O&M	70	23	16	30	11	72
Total Cost of Production	283	299	81	30	11	122
Return on Capital (10%)	220	100	80	250	450	500
Required Revenue	$503	$399	$161	$280	$461	$622
Required Power Price ($/MWh)	**$64**	**$76**	**$184**	**$128**	**$211**	**$75**
2010 Forward Price - Texas ($/MWh)	*$40*	*$40*	*$40*	*$40*	*$40*	*$40*

** Assumes 9 mmbtu/MWh plant and $60 coal.*

*** Assumes 7 mmbtu/MWh plant and $7 gas.*

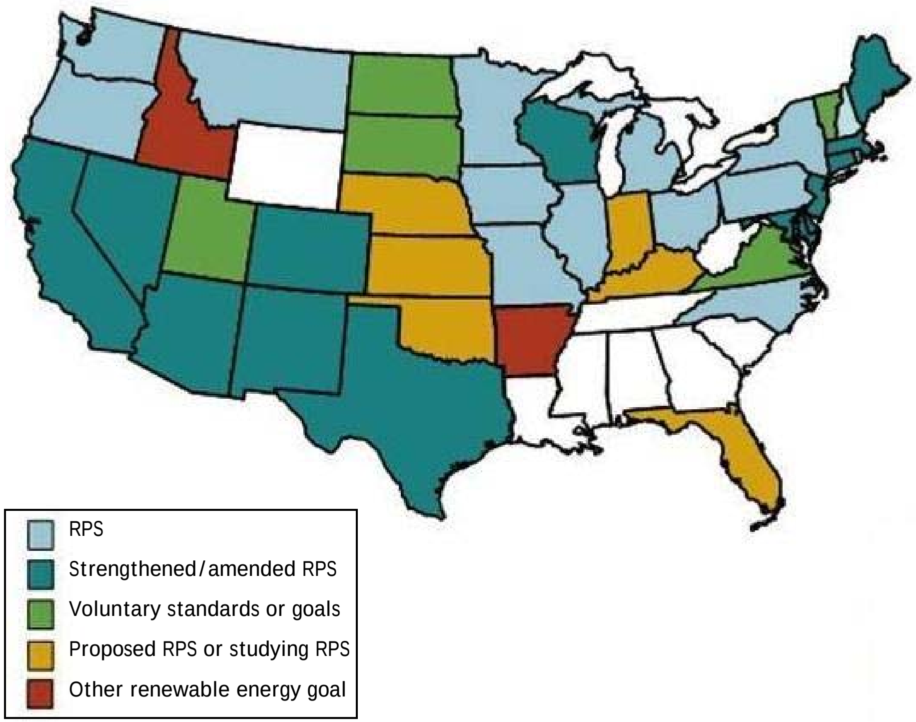
**** Assumes 10 mmbtu/MWh plant and $7 gas.*

- Economics, need, ownership and desire for fuel diversity dictate when and where new plants will be built.
- Wind and solar may not be the lowest cost generation, but state-mandated renewable standards often mean these plants are built anyway.
- States such as Louisiana, that are heavily dependent on gas-fired generation and which have seen electricity prices skyrocket, have opted for more diversity through new coal-fired plants.
- If it's economics alone which determine if a plant is built, the table to the left lays out simple new-build economics for different generation types.
- Note that the required power price reflects the price needed just during the period when the plant runs. Important when evaluating peakers.
- Unfortunately, the prices shown on the left are rarely achieved in the spot power market. So, power markets must provide additional revenue sources to provide adequate returns for new *and* existing generation.

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

Renewables – Not Just About Economics

State Renewable Portfolio Standards (RPS)



Source: FERC, Tudor, Pickering, Holt & Co.
Link: http://www.ferc.gov/market-oversight/mkt-electric/overview/elec-ovr-rps.pdf

- A new administration in Washington, and it’s all about being green (especially if you can create jobs).
- A Renewable Portfolio Standard (RPS) requires a percent of electricity sales or installed capacity to come from renewable resources.
- 29 states, including D.C., already have renewable energy standards. Six more states have goals without financial penalties, and six states have proposed RPS bills or have released studies with proposals.
- CA is one of the most aggressive states, setting a required 20% of generation from renewables by 2010 and 33% by 2020.
- Even though renewables may not be the preferable plant from a pure economics standpoint, renewables will be built, period. Since renewables depend on Mother Nature, they must be backed up by gas-fired generation – a long subject which we’ll discuss at a later time.

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Who are the **Merchants** and How Do They Make Money?

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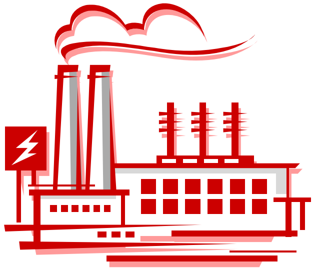
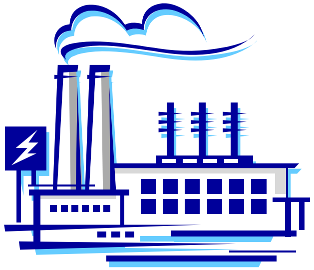
Merchants & Utilities – What's the Difference?



Electric Utility

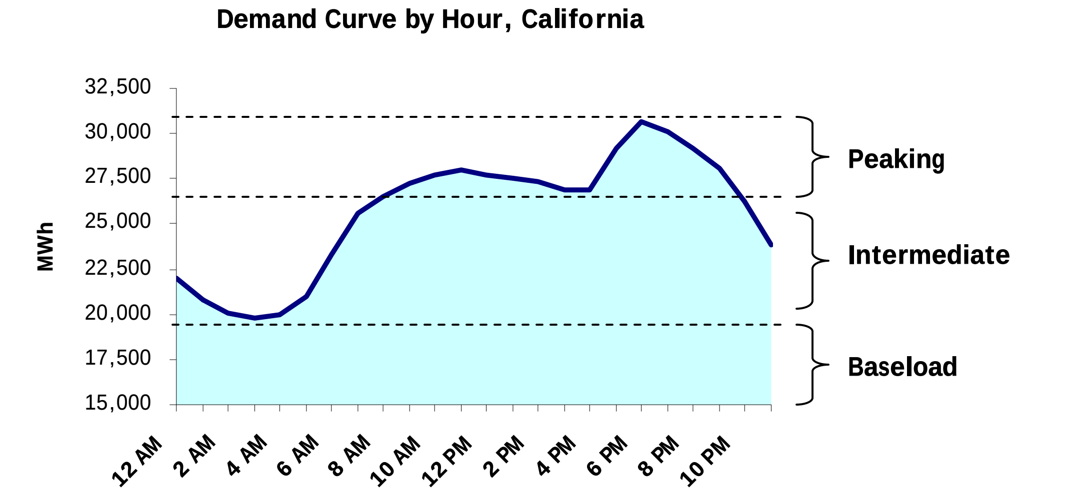
- Produces, distributes and sells power to end user
- Regulated
- IS guaranteed a return on capital deployed – so gets paid regardless of whether plants dispatched
- Rate cases determine income – specified returns on capital are approved by a regulator
- Tend to overbuild generation in favorable *regulatory* environments, as utilities earn returns on amount of net invested capital



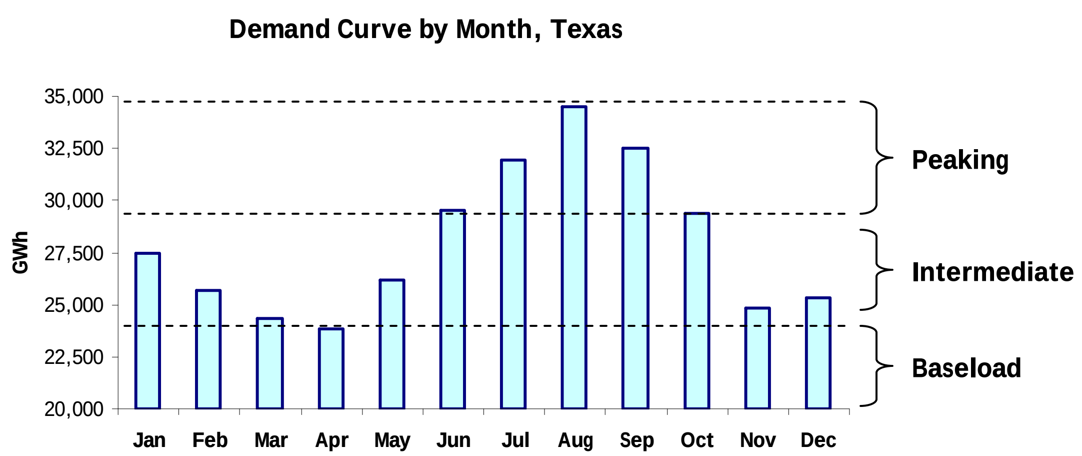
Merchant Generator

- Produces and sells power to wholesale market (usually not end user)
- Unregulated
- IS NOT guaranteed a return on capital deployed – only get paid if plants dispatched or have signed a contract with a counterparty
- Market determines income – returns based on whether or not plants are dispatched/contracted
- Tend to overbuild generation in favorable *growth* markets

Having the Right Plant in the Right Place…



Source: CAISO, Tudor, Pickering, Holt & Co.



Source: EIA/DOE, Tudor, Pickering, Holt & Co.

- We've already shown how power demand varies by region, by weather and by time of day.
- So, different plants are needed at different times and in different regions.
- Power supply (supply stack) can be categorized into three buckets:
  - Baseload – Operates around the clock. Usually have the lowest variable (fuel) costs. Includes nuclear, coal, and renewables.
  - Intermediate – Typically run 30-50% of the time. Usually very efficient combined cycle, gas-fired plants.
  - Peakers – Serve peak load, so only run ~5-10% of the time. Typically small, gas-fired units that can be started and stopped quickly.

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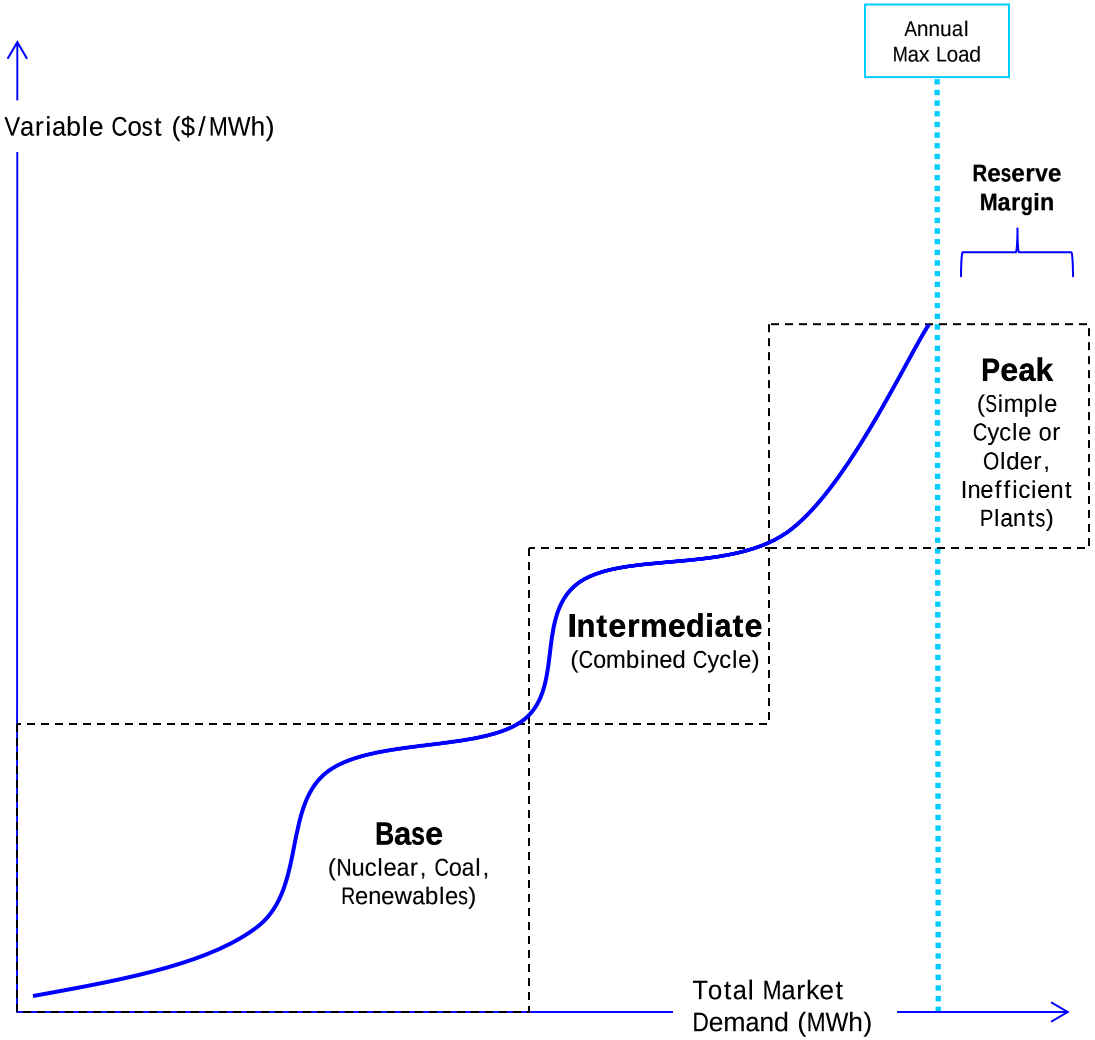
...So Your Plant Will be Dispatched



- As the market demand for power goes up, so does the price of electricity, reflecting the variable cost to run the incremental unit dispatched.
- Variable costs are a function of fuel type/cost and the generating unit's efficiency in converting that fuel to electricity.
- Any point along the load scale tells you the electricity price needed to run the plants.
- Note, there is more peaking capacity available than the annual max load. That delta is the "reserve margin" available in case the load is greater than expected, or one or more of the plants is not available (maintenance, failure, etc).

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What are Typical Variable Costs?

Variable Production Costs ($/MWh)	Coal*	Combined Cycle Gas Turbine (CCGT)	Simple Cycle Gas Turbine (GT)
Fuel Costs			
Commodity			
$/ton	$60.00		
$/mmbtu	$2.50	$7.00	$7.00
Transport			
$/ton	$12.00		
$/mmbtu	$0.50	$0.50	$0.50
Total Fuel Cost ($/mmbtu)	$3.00	$7.50	$7.50
Heat Rate (mmbtu/MWh)	10	7	10
Total Fuel Cost ($/MWh)	**$30.00**	**$52.50**	**$75.00**
*Emission Allowance Costs***			
NOX & SO_2	**$4.00**	**nm**	**nm**
Variable O&M Costs	**$5.00**	**$2.50**	**$3.00**
Total Variable Costs	**$39.00**	**$55.00**	**$78.00**

* *Marginal Appalachia coal-fired facility with no emission control equipment*

** *Pricing NOX @ $1,000/ton, SO2 @ $250/ton, and assuming coal has 3% sulfur content*

- Why is a coal plant cheaper than natural gas and why is combined cycle dispatched before a simple cycle? It all comes down to efficiency, fuel costs and emissions.
- The efficiency of turning fuel into electricity is measured by a term called “heat rate” and is quoted in MMBtus/MWh. A higher heat-rate plant has to use more fuel to generate a MW of power and vice versa.
- Fuel costs factor in the commodity used, the amount a plant needs (based on heat rate) and the transportation to get the fuel to the plant.
- Power plants used to be built next to coal mines to avoid large transportation costs. Many Midwest plants have now converted to much cheaper Powder River Basin coal (currently ~$13/ton vs. $50/ton for Central Appalachia coal), but transportation can cost more than the price of coal itself.
- Coal-fired plants have to factor in emissions costs – currently, just NOX & SO_2 (nitrous oxide and sulphur dioxide). Before long, we will also factor in CO_2 costs.

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

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How is Profitability Measured?

Spark Spreads

=

Electricity Price (Revenue)

-

Cost of Gas to Generate Electricity (COGS)

COGS

=

Heat Rate * Gas Price

(mmbtu/MWh) ($/mmbtu)

- Spark spreads (gas) or dark spreads (coal) are the key economic measure. They're the power equivalent of crack spreads or frac spreads…all measures of gross margin.
- For natural gas, the key variable is plant heat rate – how much fuel you have to burn to generate the electricity.
- Heat rate/efficiency is a function of the type and age of the plant.
- Higher heat rate → increased fuel costs → lower margin (spark spread).

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Dark Spreads – The Coal Equivalent

Dark Spreads

=

Electricity Price (Revenue)

-

Cost of Delivered Coal to Generate the Electricity (COGS)

-

Environmental Credits

COGS

=

Heat Rate * Cost of Coal

(mmbtu/MWh) ($/mmbtu)

- Dark spreads are a measure of a coal-fired plant's gross margin.
- Like natural gas, a coal-fired plant's cost to generate the electricity is a function of heat rate. Just as important is the type of coal burned, proximity to the fuel source and environmental cleanliness of the plant.
- Powder River Basin coal ($13/ton) costs a fraction of Appalachian coal ($50/ton). But transportation costs can add $25/ton to the cost.
- Most coal plants also have to purchase emissions credits.

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Spark & Dark Spreads – Sample Calculations

		Dark Spread @10,000 btu/KWh	Dark Spread @10,000 btu/KWh	Spark Spread @ 7,000 btu/KWh	Spark Spread @ 10,000 btu/KWh
		Central Appalachia Coal	**Powder River Basin Coal**	**Combined Cycle Gas Turbine**	**Simple Cycle Gas Turbine (GT)**
Market price of power ($/MWh)	(a)	$75	$75	$75	$75
Market price of coal ($/ton)		$60	$13		
Transportation costs ($/ton)		$12	$25		
Cost of fuel ($/mmbtu)*	(b)	$3.00	$2.20	$7.00	$7.00
Heat rate (mmbtu/MWh)	(c)	10	10	7	10
Cost of fuel ($/MWh)	(d = b x c)	$30	$22	$49	$70
Emissions costs ($/MWh)	(e)	$4	$4		
Spark/Dark Spread ($/MWh)	**(a - d - e)**	**$41**	**$49**	**$26**	**$5**

** Coal conversion from $/ton to mmbtu varies as a function of the heat content of coal. We assume this heat content is 24 mmbtu/ton for Central Appalachia coal and 18 mmbtu/ton for Powder River Basin coal.*

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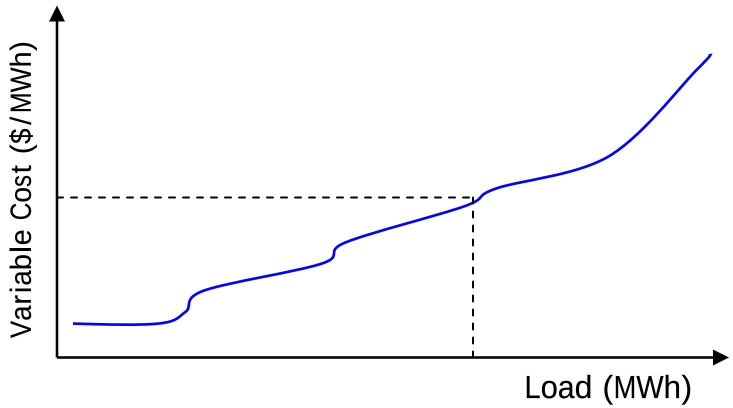
Marginal Heat Rate – The Dispatch Barometer



Marginal Heat Rate = Power Price / Fuel Price

Example:

- Power price = $75/MWh
- Natural gas price = $7/mmbtu
- Marginal heat rate = $75/MWh ÷ $7/mmbtu = **10.7 mmbtu/MWh plant** (So, that heat rate plant and below are being dispatched)

- The other frequently quoted metric is "marginal heat rate."
- The market power price generally reflects the variable costs of the price-setting unit.
- In a power market, "marginal heat rate" gives a quick idea of which type of power units are being run.
- Market heat rate is calculated from market power price and fuel cost.

Merchant Revenues – Take It Any Way You Can

Type of Sale	Typical % of EBITDA
Spot sales	20%
Power purchase agreements	20%
Forward power sales	20%
Tolling agreements	15%
Capacity payments	15%
Other	10%
	100%

- Utilities have captive customers for the electricity they generate…Merchants don't. Merchants rely on a number of different types of sales to generate revenue.
  - **Spot sales** – easiest type to understand. Plant dispatched and power sold based on hourly market needs.
  - **Power purchase agreement** – negotiated bilateral agreement, usually with a utility. Can be seasonal or multi-year.
  - **Forward power sale** – financial transaction usually via a commodity exchange. Short term (seasonal/annual).
  - **Tolling agreement** – fixed payment tied to plant capacity, not production. Covers costs and rate of return. Usually multi-year.
  - **Capacity payment** – fixed payment tied to having capacity available. Usually small, $/kW, with another payment if plant actually dispatched.

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Appendix

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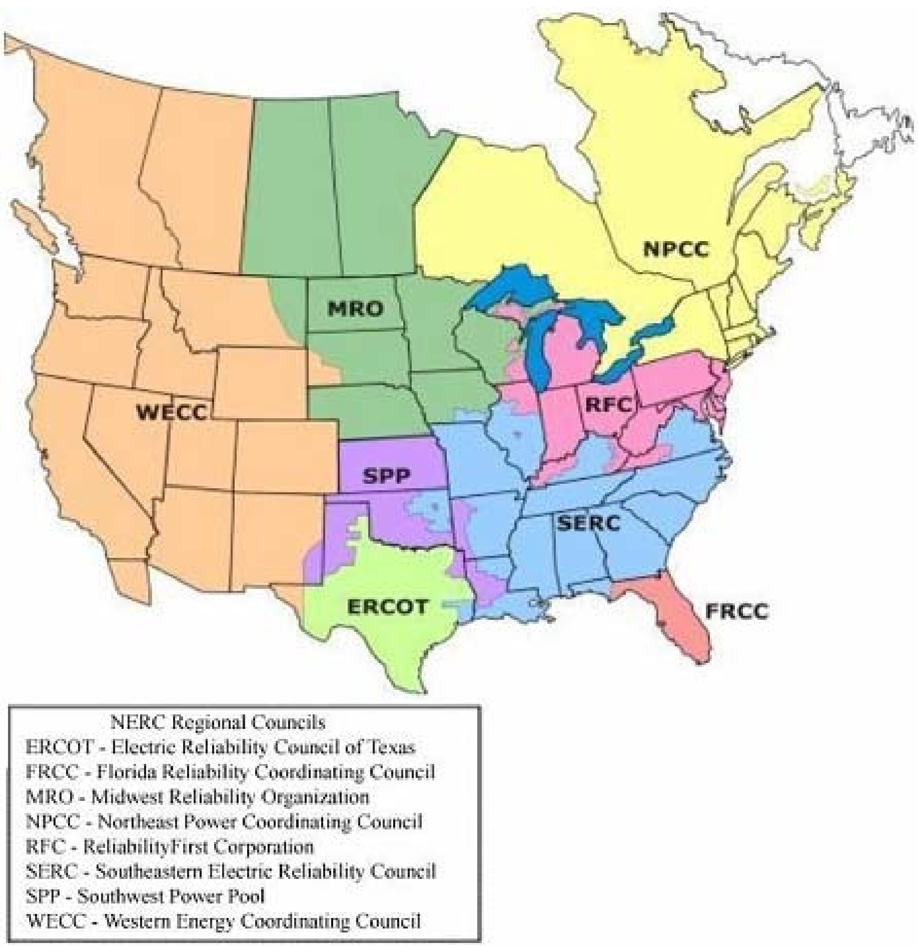
Regulatory Framework

FERC – The Big Kahuna…

- The Federal Energy Regulatory Commission (or FERC) is an independent agency. Among other things, it regulates the interstate transmission of natural gas, oil and electricity.
- FERC is composed of up to five commissioners who are appointed by the President of the United States with the advice and consent of the senate. Each commissioner serves a five-year term.
- Through the Energy Policy Act of 2005, the FERC is also responsible for overseeing operations, developing procedures and enforcing mandatory reliability standards in the electric power industry via an electric reliability organization (now NERC, see next page).

…Which Allocates Authority to NERC

North American Reliability Council (NERC) Regions



Source: EIA/DOE, Tudor, Pickering, Holt & Co.

- In July 2006, the FERC certified the North American Electric Reliability Council (NERC) to be the Electric Reliability Organization (ERO) as mandated in the Energy Policy Act of 2005.
- As the ERO, NERC is responsible for overseeing operations, developing standards and enforcing mandatory reliability standards in the electric power industry.
- Although its official duties are new, this nonprofit council has been around since the late 1960s. NERC was formed after the Northeast Blackout of 1965 left 25 million people without power.
- In response, the Electric Reliability Act of 1967 was passed, creating 8 regional reliability councils. NERC was formed to manage these councils and develop common policies, procedures & training requirements.
- Participation in NERC is voluntary (although compliance is not) and members come from all segments of the industry – utilities, IPPs, markets, customers, etc. Boundaries of NERC regions follow the service territories of utilities.
- In addition to the NERC, most states have their own supply/demand planning regulated by state-run public utility commissions.

Statistics/Characteristics of NERC Regions

Year-End 2007	Electric Reliability Council of Texas	Florida Reliability Coord. Council	Midwest Reliability Org.	Northeast Power Coord. Council	Reliability*First* Corporation	Southeastern Electric Reliability Council	Southwest Power Pool	Western Electricity Coord. Council
	ERCOT	**FRCC**	**MRO**	**NPCC**	**RFC**	**SERC**	**SPP**	**WECC**
Capacity (MW)	81,000	53,000	51,000	71,000	260,000	215,000	57,000	179,000
Peak Demand (MWh)	62,000	46,000	42,000	63,000	192,000	199,000	43,000	142,000
Capacity Profile (% MW)								
Coal	19%	19%	**51%**	9%	**50%**	**33%**	**38%**	18%
Combined Cycle	**31%**	**33%**	6%	**26%**	11%	18%	17%	22%
Oil/Gas Steam	**32%**	20%	1%	**26%**	4%	9%	23%	11%
Combustion Turbine	6%	20%	21%	10%	18%	15%	13%	8%
Renewables	6%	1%	13%	11%	2%	6%	6%	**33%**
Nuclear	6%	7%	8%	14%	13%	15%	2%	5%
Other	0%	0%	0%	4%	2%	4%	1%	3%
Generation Profile (% MWh)								
Coal	**39%**	**30%**	**73%**	15%	**67%**	**54%**	**64%**	**32%**
Natural Gas	**43%**	**46%**	4%	**36%**	7%	14%	**26%**	**30%**
Petroleum	0%	9%	0%	5%	1%	1%	0%	0%
Nuclear	14%	13%	15%	**29%**	**24%**	**29%**	5%	10%
Renewables	3%	1%	8%	15%	1%	2%	5%	**28%**
Other	1%	1%	0%	0%	0%	0%	0%	0%

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

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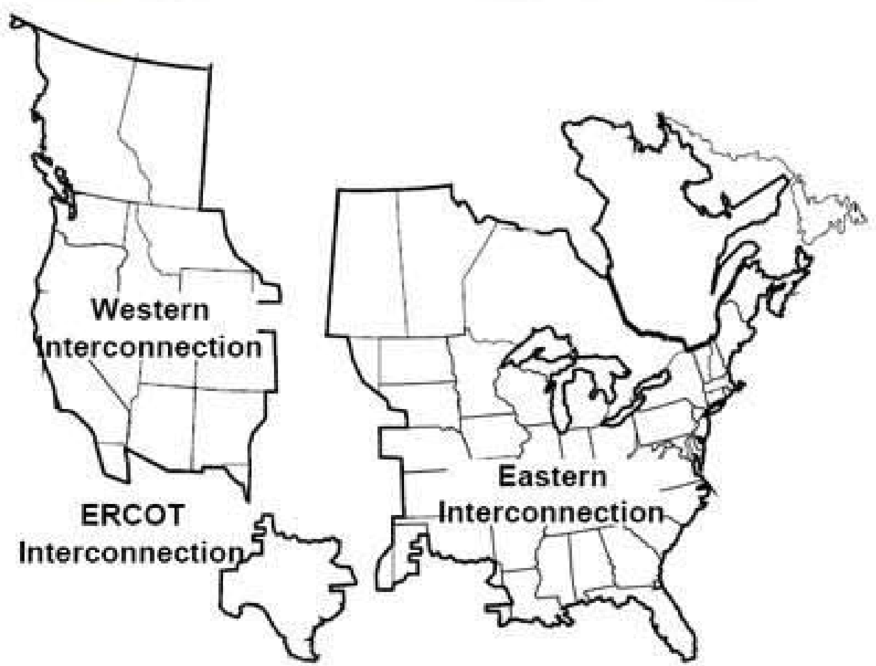
Electricity Transmission

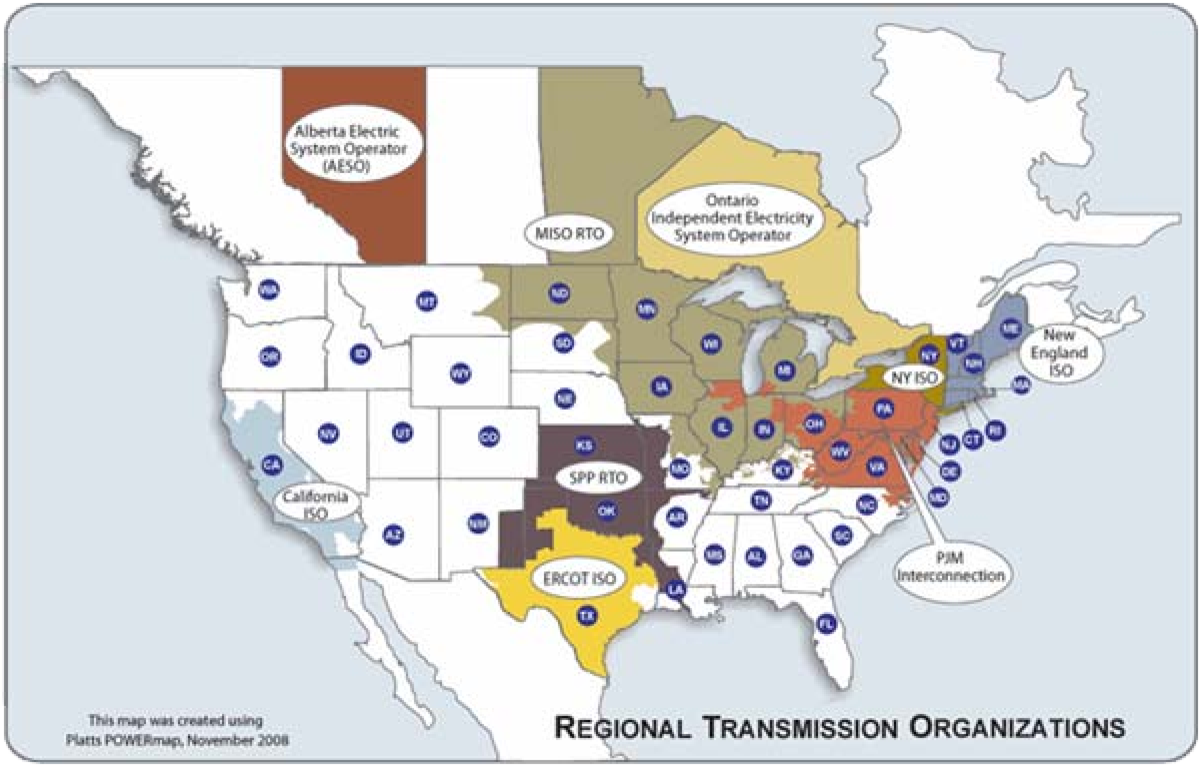
U.S. Electricity Interconnections



Source: EIA/DOE, Tudor, Pickering, Holt & Co.

- The U.S. electric transmission system of high-voltage lines is divided into three power grids, each with only limited connections.
- The Eastern Interconnected systems cover the eastern 2/3 of the U.S. and the Canadian provinces of Saskatchewan, Manitoba, Ontario, new Brunswick and Nova Scotia.
- The Western Interconnect covers the 12 states West of the Rockies and the Canadian provinces of British Columbia and Alberta.
- The bulk of Texas is an electric-island and has its own power grid.
- Although the industry has added a tremendous amount of generation, very little electric transmission has been added over the last 20 years due primarily to siting issues (NIMBY).
- There will need to be significant investment in new transmission if states expect to meet their mandated renewable portfolio standards. This is because most renewable sources (wind/solar) are located far away from large load pockets.

ISOs/RTOs Make the Day-to-Day Work



Source: Platts POWERmap, Tudor, Pickering, Holt & Co.

- Independent System Operators (ISOs) and Regional Transmission Operators (RTOs) are non-profit entities that control, (but do not own) a region's electric transmission system.
- Among other things, ISOs are charged with maintaining system reliability, administering tariffs, managing transmission constraints, providing transparent market information and monitoring the market for manipulation or abuses.
- The ISO basically provides an efficient way for generation to reach demand. By pooling a regions' transmission instead of having individual lines in the hands of many utilities, the grid should be non-discriminatory.
- There are currently 7 ISOs in the US and 2 in Canada. (characteristics of individual each U.S. ISO are listed on the next page).
- ISOs are still very new (the first one was formed in CA in 1998) and evolving. As such, they are still prone to inefficiency and surprises (e.g. unexplained congestion last summer in ERCOT).

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Market Structure - ISO & RTO Characteristics

	CAISO (CA only)	ERCOT	MISO	PJM	NYISO	ISO - NE	No ISO/ RTO
Geographic Region	West	Texas	Mid West	Mid-Atlantic	North East	North East	South East
NERC Region	WECC	ERCOT (now TRE)	Primarily MRO, some RFC overlap	RFC	NPCC	NPCC	SERC & FRCC
Market Size (as of 2006)	56 GW	71 GW	137 GW	165 GW	40 GW	31 GW	300 GW
Marginal Fuel	Natural Gas	Natural Gas/Coal	Coal	Natural Gas/Coal	Natural Gas	Natural Gas	Natural Gas/Coal
Primary Exchange-Traded Hub	SP15	ERCOT	Cinergy	PJM West	NY Zone-A	Mass Hub	Entergy
Other Exchange-Traded Hub	NP15 Mid-C	None	NI Hub	NI Hub	NY Zone-J NY Zone-G	None	Southern TVA
Market Liquidity*	Moderate	High	Low	High	Low	High	Low
Energy Market	Real-time balancing	Real-time balancing	Day-ahead & Real-time	Day-ahead & Real-time	Day-ahead & Real-time	Day-ahead & Real-time	N/A
Capacity Market	Bi-lateral Resource Adequacy (RA)	None	None	Reliability Pricing Model (RPM) – 3-yr forward capacity auction	Regional/ locational Installed Capacity (ICAP) payment	Installed Capacity (ICAP) transitioning to Forward Capacity (FCM) in 2010	N/A
Other	Ancillary & Transmission	Ancillary & Zonal Congestion	Ancillary (2009) & Financial Trans-mission Rights	Ancillary & Financial Trans-mission Rights	Financial Transmission Rights	Ancillary & Financial Transmission Rights	N/A

** Estimate based on ratios of exchange-traded volumes to generation.*

Source: EIA/DOE; FERC; ISO Websites; Tudor, Pickering, Holt & Co.

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Environmental Issues

Emissions

Emissions Allowance Cost

	Uncontrolled Coal *	Controlled Coal **	Combined Cycle Natural Gas	Simple Cycle Natural Gas
NOX				
Allowance price ($/ton)	$1,000			
Emissions (lbs/MWh)	5	0.5	nm	nm
Allowance cost ($/MWh) ***	$1	$0	$0	$0
SO_2				
Allowance price ($/ton)	$250			
Emissions (lbs/MWh) ****	25	2.5	nm	nm
Allowance cost ($/MWh)	$3	$0	$0	$0
Total cost of emissions ($/MWh)	**$4**	**$0**	**$0**	**$0**

** Marginal Appalachia coal-fired facility with no emission control equipment, non-specific boiler type*

*** Selective catalytic reduction, low NOX burners & wet scrubber installed*

**** NOX allowances only purchased during summer ozone season (50% of the time)*

***** Assuming 3% sulfur content coal*

- Almost every electric generation source emits emissions of some form – it's just a question of what pollutant, current emissions control equipment, and fuel type.
- Emissions from power plants are regulated by the Environmental Protection Agency (EPA) through national and state-level programs.
- Historically, regulation has focused on sulfur dioxide (SO2) and nitrogen oxides (NOX) emissions. Both contribute to the formation of acid rain. NOX combines with other pollutants to form smog.
- SO2 emissions are regulated via a market-based cap-and-trade program. Each ton of SO2 emission requires the surrender of an allowance. Allowances are available through allocations to generators based on historic fuel consumption, through annual auctions and through an actively traded emissions market.
- National NOX regulation sets emission limits based on generation unit's technology. Facilities out of compliance have to install emissions controls. A NOX cap-and-trade program exists at the regional level for 22 Eastern and Midwestern states, capping emissions during the summer ozone season.

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

Emissions

Emissions Allowance Cost

	Uncontrolled Coal *	Controlled Coal **	Combined Cycle Natural Gas	Simple Cycle Natural Gas
NOX				
Allowance price ($/ton)	$1,000			
Emissions (lbs/MWh)	5	0.5	nm	nm
Allowance cost ($/MWh) ***	$1	$0	$0	$0
SO_2				
Allowance price ($/ton)	$250			
Emissions (lbs/MWh) ****	25	2.5	nm	nm
Allowance cost ($/MWh)	$3	$0	$0	$0
Cost of NOX & SO_2 ($/MWh)	**$4**	**$0**	**$0**	**$0**
CO_2				
Allowance price ($/ton)	$25			
Emissions (lbs/MWh)	2,050	2,050	819	1,170
Allowance cost ($/MWh)	$26	$26	$10	$15
Total cost - NOX, SO_2, CO_2 ($/MWh)	**$30**	**$26**	**$10**	**$15**

** Marginal Appalachia coal-fired facility with no emission control equipment, non-specific boiler type*

*** Selective catalytic reduction, low NOX burners & wet scrubber installed*

**** NOX allowances only purchased during summer ozone season (50% of the time)*

***** Assuming 3% sulfur content coal*

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

- Assuming an emissions price deck of:
  - NOX - $1,000/ton (historical range $500 to $9,000)
  - SO2 - $250/ton (historical range $100 to $1,600)
  - CO2 - $25/ton (consensus view)
- NOX & SO2 Allowance purchases add roughly $4.50/MWh to the production cost of an older coal facility. For a newer coal plant with full emission controls and gas fired generation, the costs are nominal.
- Coming soon to the generator in your neighborhood will be carbon dioxide/greenhouse gas emission legislation. What form is still very much up in the air (intentional pun!)
- CO2 allowance costs are a wild card. A $25/ton allowance price is often quoted as a possible price, which would add $25/MWh to coal production and $10/MWh to efficient natural gas production – several times the cost of NOX & SO2 allowances.

Emissions – Handling the Problem via Capex

Typical Emission Controls Costs (500 MW Facility)

Pollutant	Control	$MM
NOx	Selective Catalytic Reduction	$125
SO2	Scrubber	60
Mercury	Carbon Injection	5
Particulates	Bag House	30
	Total	$220

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

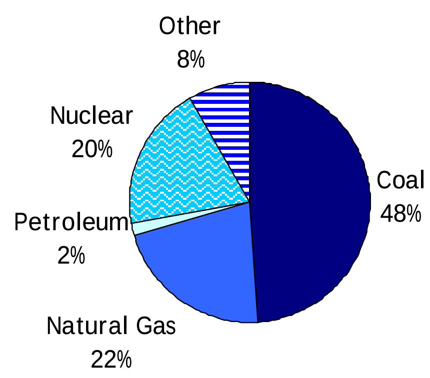
- Beyond purchasing allowances, generators can opt to install emissions control equipment, often at a hefty price tag.
- Typical costs to install pollution control equipment are shown to the left, with the caveat that costs will vary depending on the current generation equipment, age and how "clean" you want to scrub.
- From 2008-2011, DYN, MIR, NRG and RRI (CPN excluded since all natural gas) will spend a combined $3.7B to install pollution controls, or about 50% of their capex budget.

CO_2 Emissions by Fuel Type

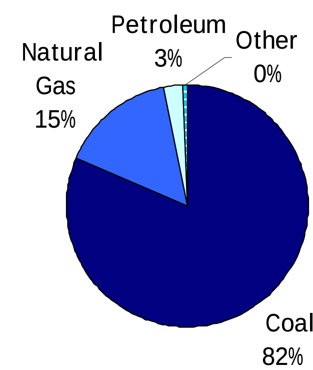
Fuel	CO_2 (lbs/mmbtu)
Petroleum Coke	225
Lignite Coal	215
Subbituminous Coal	213
Waste Oil	210
Bituminous Coal	205
Synthetic Coal	205
Waste Coal	205
Tire-Derived Fuel	190
Residual Fuel Oil	174
Distillate Fuel	161
Kerosene	160
Jet Fuel	156
Propane Gas	139
Natural Gas	117
Municipal Solid Waste	92
Geothermal	17
Nuclear	0
Average	**158**

Source: EIA/DOE, Tudor, Pickering, Holt & Co.

Generation by Fuel Type (2007)



CO2 Emissions by Fuel Type (2007)



- With the exception of nuclear, wind, solar and hydro, all other generation types emit CO_2.
- Coal is clearly the worst emitter of CO_2.
- But natural gas also emits a fair amount of CO_2.

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Regional Reserve Margins*

*The inability to store power requires that installed capacity exceed forecasted demand to ensure system reliability during unplanned plant or transmission outages or abnormal weather events. Reliability is planned for and monitored at the state, system operator and NERC regional levels.

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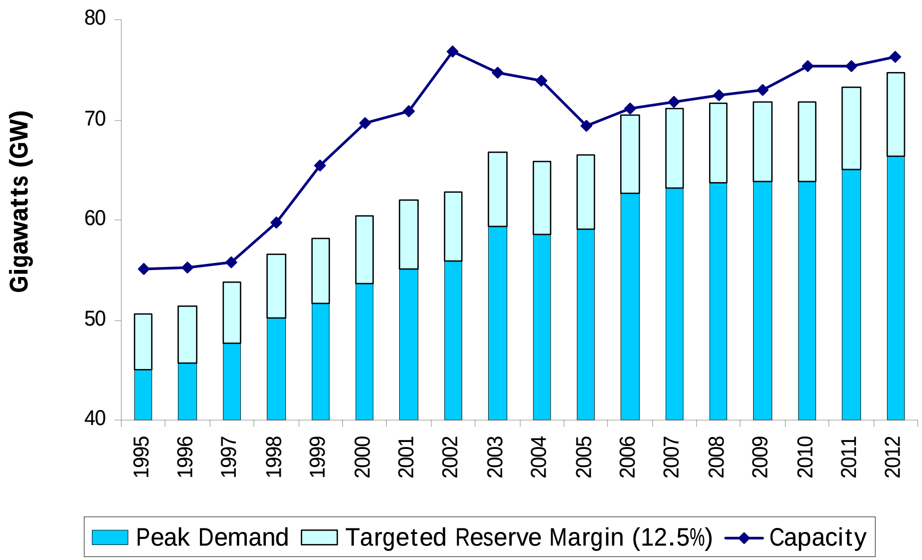
ERCOT Reserve Margins

ERCOT Supply & Demand Characteristics, (1995-2012E)



Estimated ERCOT Reserve Margins					
2007	**2008**	**2009E**	**2010E**	**2011E**	**2012E**
14%	14%	14%	18%	16%	15%

Key Assumptions

- No demand growth though 2010, returning to historical 2%/year (trailing 5 years) growth in 2011.
- February '09 request to mothball 3.8 GW of older generation is granted by year end 2010.
- Wind additions held to those under construction.

Source: EIA/DOE, ERCOT, and NERC websites, Tudor, Pickering, Holt & Co.

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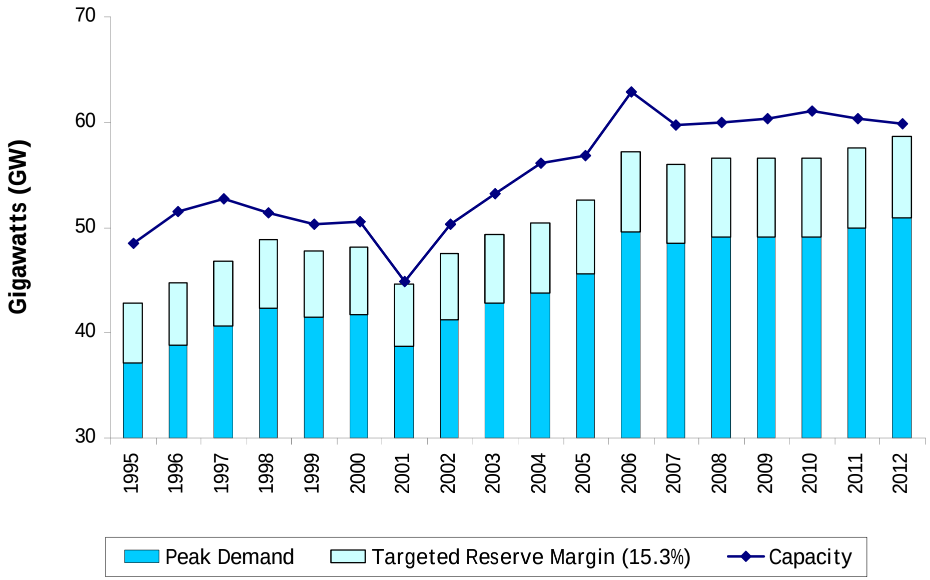
CAISO Reserve Margins

CAISO Supply & Demand Characteristics, (1995-2012E)



Estimated CAISO Reserve Margins					
2007	**2008**	**2009E**	**2010E**	**2011E**	**2012E**
23%	22%	23%	24%	21%	18%

Source: EIA/DOE, CAISO, and California Energy Commission websites, TPH & Co.

Key Assumptions

- No growth through 2010, returning to historical average of 1.8%/year (trailing 10 years) thereafter.
- Older (30+ yrs) gas-fired steam generation (13 GW total) retires at a rate of 5%/year.
- Incremental capacity limited to generation currently under construction.

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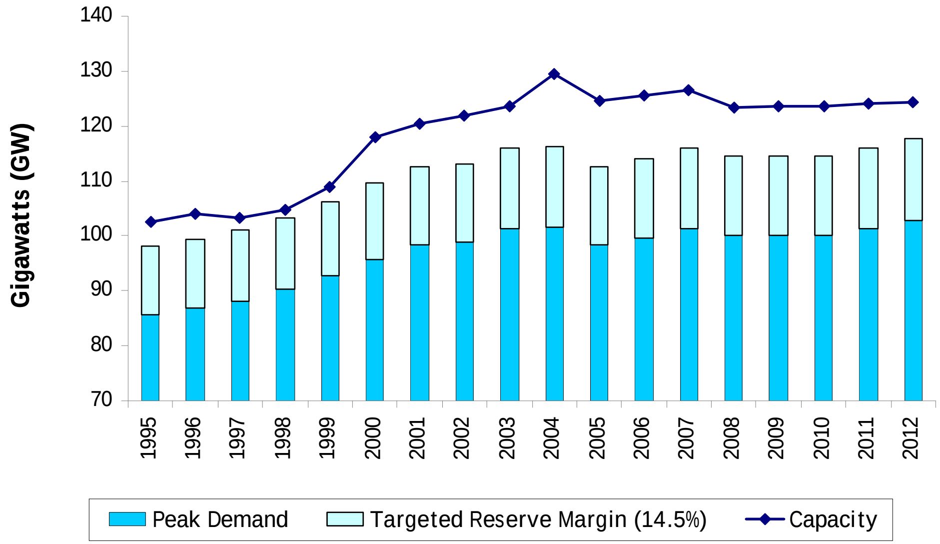
MISO Reserve Margins

MISO Supply & Demand Characteristics, (1995-2012E)



Estimated MISO Reserve Margins					
2007	**2008**	**2009E**	**2010E**	**2011E**	**2012E**
25%	23%	23%	24%	22%	21%

Key Assumptions

- No growth through 2010, returning to 1.3%/year growth thereafter.
- New thermal generation will offset retirements – no net capacity gain through 2017.
- Wind projects in queue discounted at 20% probability of completion and assigned 10% capacity value.

Source: EIA/DOE, MISO, RFC, and NERC websites, Tudor, Pickering, Holt & Co.

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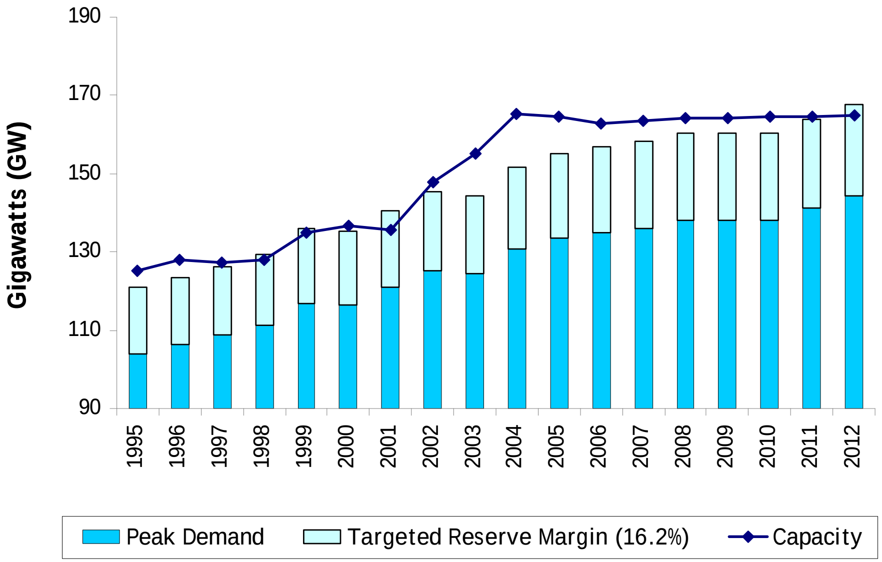
PJM West Reserve Margins

PJM West Supply & Demand Characteristics, (1995-2012E)



Estimated PJM Reserve Margins					
2007	**2008**	**2009E**	**2010E**	**2011E**	**2012E**
20%	19%	19%	19%	17%	14%

Key Assumptions

- No growth through 2010, returning to historical average of 2.3%/year (trailing 10 years) thereafter.
- Haven't included planned generation not currently under construction.
- No material retirements assumed.

Source: EIA/DOE, PJM, ERCOT, and NERC websites, Tudor, Pickering, Holt & Co.

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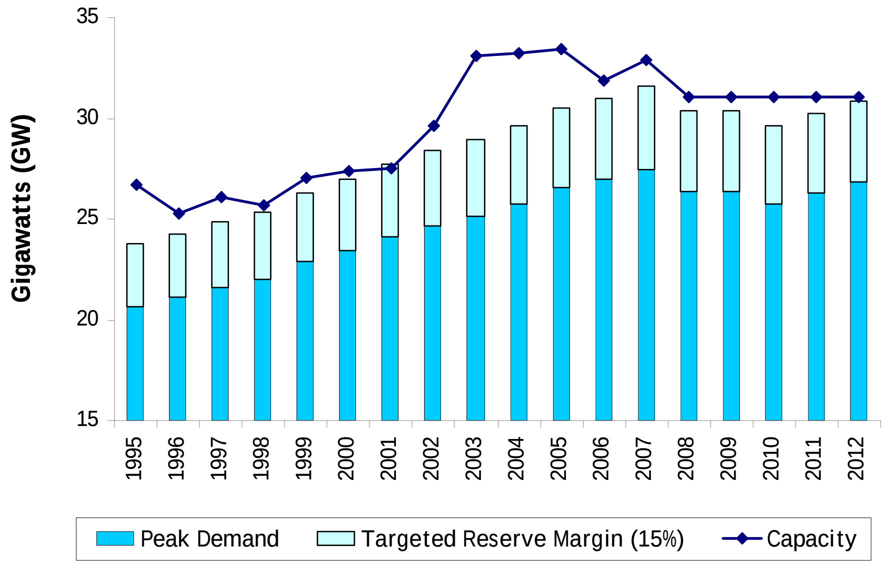
ISO-NE Reserve Margins

ISO-NE Supply & Demand Characteristics, (1995-2012E)



Estimated ISO-NE Reserve Margins					
2007	**2008**	**2009E**	**2010E**	**2011E**	**2012E**
20%	18%	18%	20%	18%	16%

Source: EIA/DOE, ISO-NE, and NERC websites, Tudor, Pickering, Holt & Co.

Key Assumptions

- No growth through 2010, returning to historical average of 1.9%/year (trailing 10 years) thereafter.
- New thermal generation will offset retirements – no net capacity gain through 2012.
- Wind projects are not assumed to be material capacity additions.

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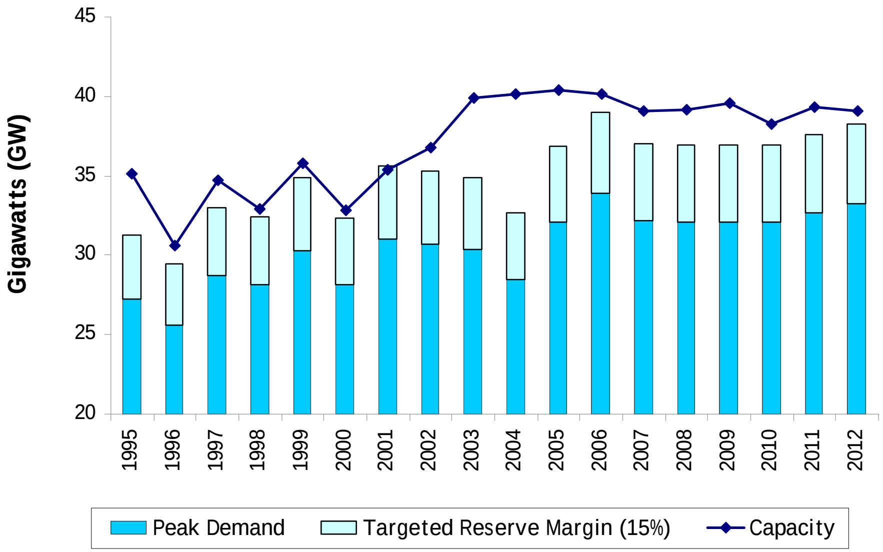
NYISO Reserve Margins

NYISO Supply & Demand Characteristics, (1995-2012E)



Estimated NY-ISO Reserve Margins					
2007	**2008**	**2009E**	**2010E**	**2011E**	**2012E**
22%	22%	23%	19%	20%	18%

Source: EIA/DOE, NYISO, and NERC websites, Tudor, Pickering, Holt & Co.

Key Assumptions

- No growth through 2010, returning to historical average of 1.7%/year (trailing 10 years) thereafter.
- Haven't included planned generation not currently under construction.
- Wind projects are not assumed to be material capacity additions.

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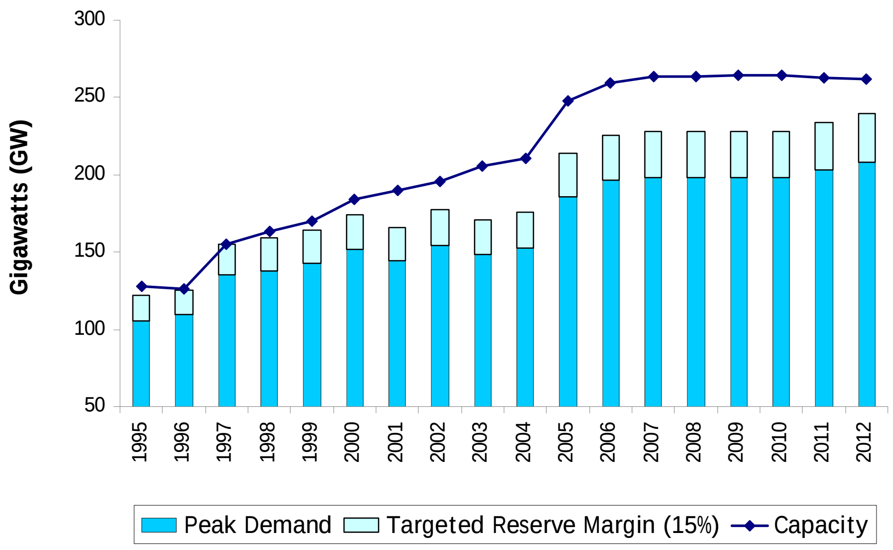
SERC Reserve Margins

SERC Supply & Demand Characteristics, (1995-2012E)



Estimated SERC Reserve Margins					
2007	**2008**	**2009E**	**2010E**	**2011E**	**2012E**
33%	33%	33%	33%	29%	26%

Key Assumptions

- No growth through 2010, returning to historical average of 2.3%/year (trailing 10 years) thereafter.
- Only incremental generation adds are coal plants currently under construction.
- Older (30+ year) fossil fuel steam generation is retired at a rate of 2.0%/year starting in 2011.

Power Marketer Rankings

Rank	Power Marketer	Ticker	Market Share (Q3'08)
1	Constellation Energy Commodities*	CEG	6.9%
2	Exelon Generation	EXC	6.2%
3	Shell Energy North America	RDS.A	4.4%
4	FirstEnergy Solutions	FE	4.1%
5	Morgan Stanley Capital Group	MS	3.4%
6	Sempra Energy Trading	SRE	3.3%
7	PPL EnergyPlus	PPL	3.1%
8	FPL Energy	FPL	2.9%
9	American Electric Power Service	AEP	2.8%
10	Edison Mission Group	EIX	2.6%
11	JP Morgan Chase Bank	JPM	2.5%
12	Calpine Power & Affiliates	CPN	2.3%
13	Fortis Energy Marketing & Trading	FTS	2.3%
14	Merrill Lynch Commodities	BAC	2.2%
15	NRG Power Marketing	NRG	2.2%
16	Ameren Operation Companies	AEE	1.9%
17	Dominion Resources	D	1.8%
18	Dynegy Power Marketing	DYN	1.8%
19	Duke Energy Affiliates	DUK	1.8%
20	Barclays Bank	BCS	1.6%

**Announced sale of business to Goldman Sachs 1/20/09.*

Source: Platts Megawatt Daily, Tudor, Pickering, Holt & Co.

- Power marketers and financial exchanges provide what limited liquidity there is in the electricity sector.
- 14 of the top 20 marketers are in the business in order to trade around their physical assets.
- Enron was once a major electricity trader. When they filed for bankruptcy in 2001, liquidity was significantly impacted.

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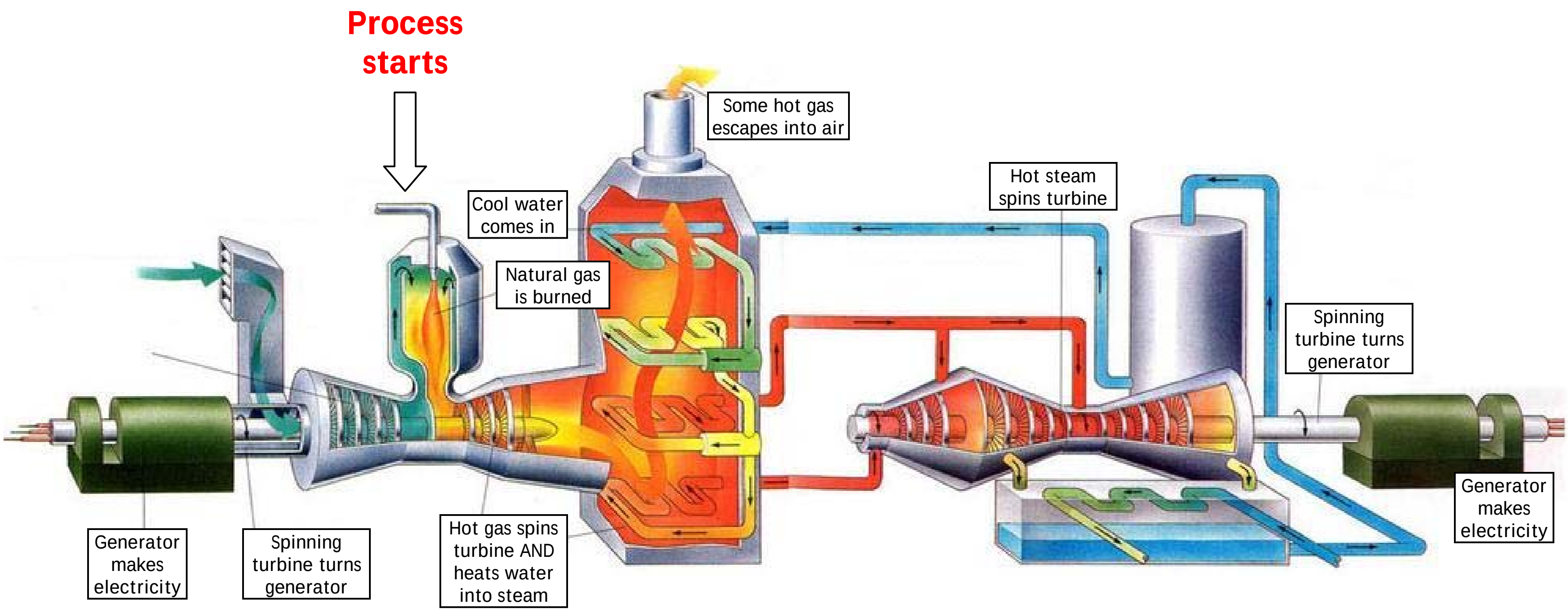
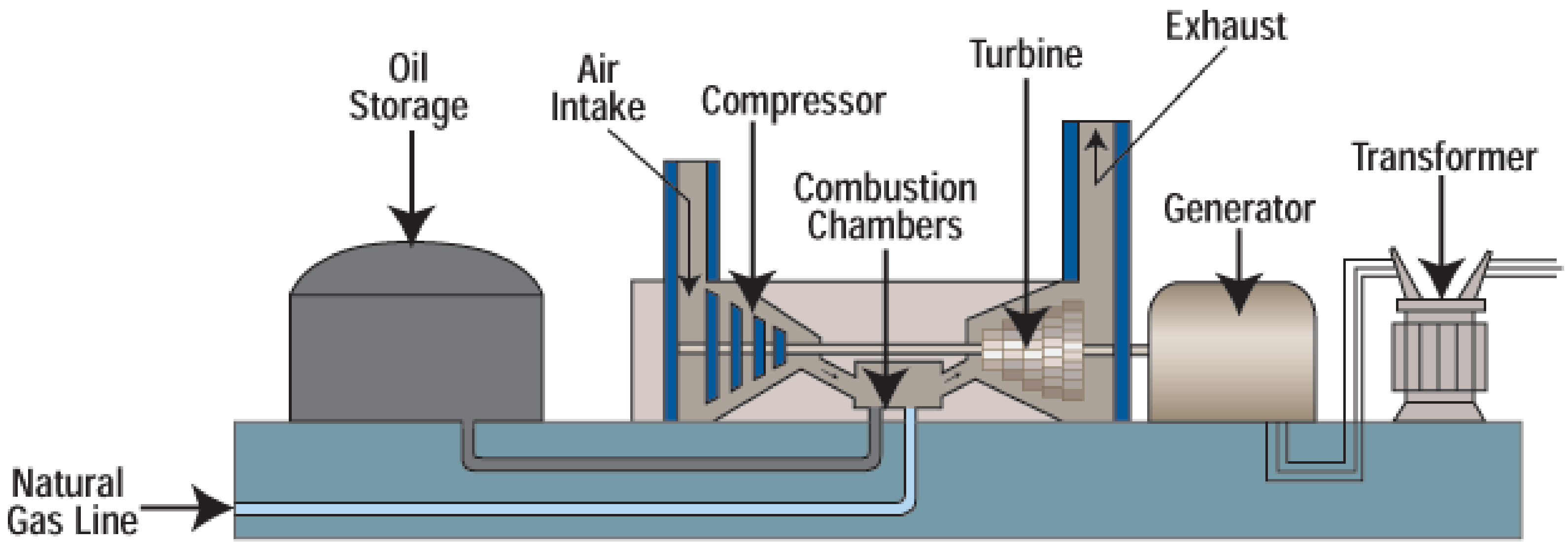
Plant Technology Specifics

How a Combined Cycle Gas Plant Works



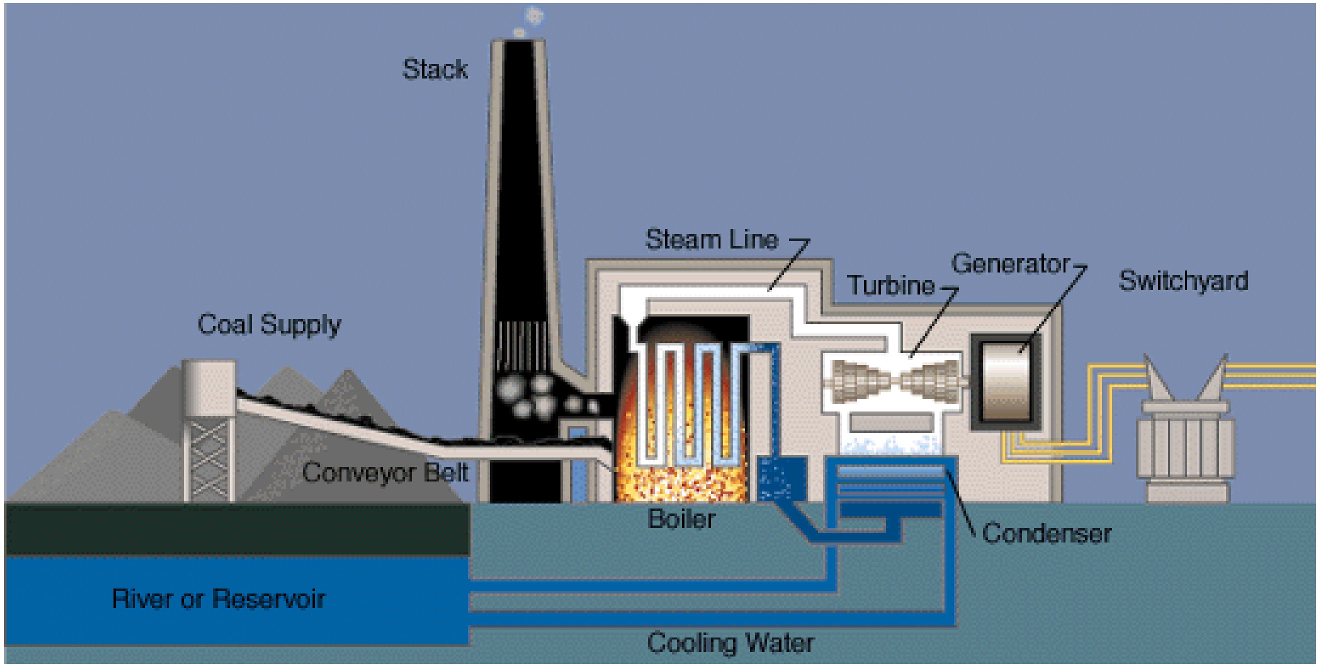
Source: Tudor, Pickering, Holt & Co.

How a Simple Cycle Gas/Oil Plant Works



Source: Tennessee Valley Authority (TVA), Tudor, Pickering, Holt & Co.

How a Coal Plant Works



Source: Tennessee Valley Authority (TVA), Tudor, Pickering, Holt & Co.

Analyst Certification:

We, Becca Followill, Brandon Blossman and Jessica Chipman, do hereby certify that, to the best of our knowledge, the views and opinions in this research report accurately reflect our personal views about the company and its securities. We have not nor will not receive direct or indirect compensation in return for expressing specific recommendations or viewpoints in this report.

Important Disclosures:

One or more of these analysts (or members of their household) have a long stock position in Dynegy Inc. and Reliant Energy Inc.

Analysts' compensation is not based on investment banking revenue and the analysts are not compensated by the subject companies. In the past 12 months, Tudor, Pickering, Holt & Co. Securities, Inc. has not received investment banking or other revenue from any of the companies mentioned within this report. In the next three months we intend to seek compensation for investment banking services from the companies mentioned within this report.

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Ratings: B = buy, A = accumulate, H = hold, T = trim, S = sell, NR = not rated

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