The Technology and Business of Power

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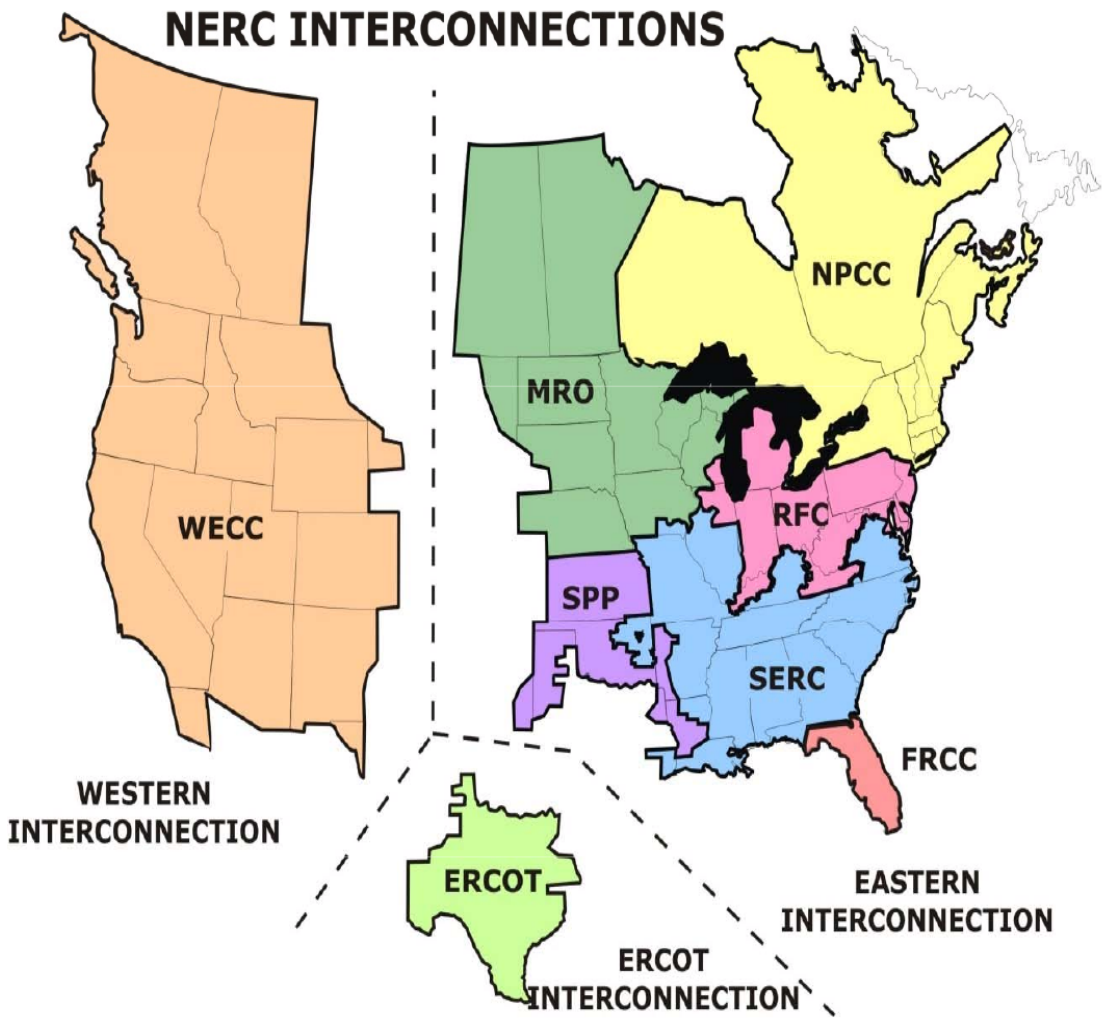
North American Interconnected Grids

ERCOT 'directs traffic' on the grid to maintain reliability and ensure supply of electricity:

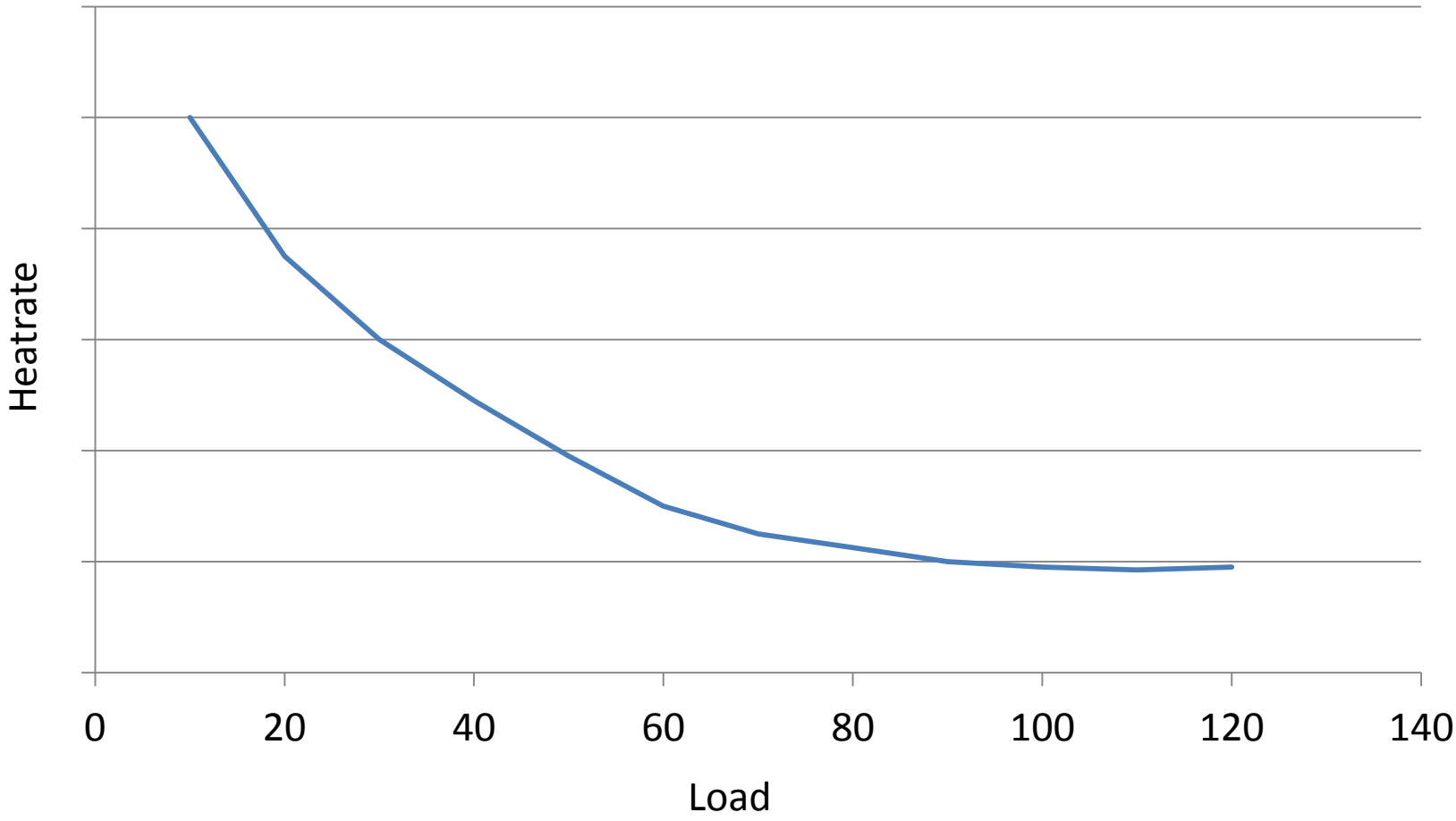
- 75% of Texas land
- 85% of Texas load
- More than 40,000 miles of transmission lines
- 550+ generation units
- Physical assets that are owned by transmission providers and generators
- 68,379 MW Summer peak demand (set August 3, 2011)
- 57,315 MW Winter peak demand (set February 10, 2011)



What is Efficiency?

- Efficiency: What you get divided by what you pay for
- Heatrate is a measure of plant efficiency
  - BTU/KWh
  - Lower is better
- British Thermal Unit: The energy necessary to raise one pound of water (0.1198 gallons) from 39^{o}F to 40^{o}F.

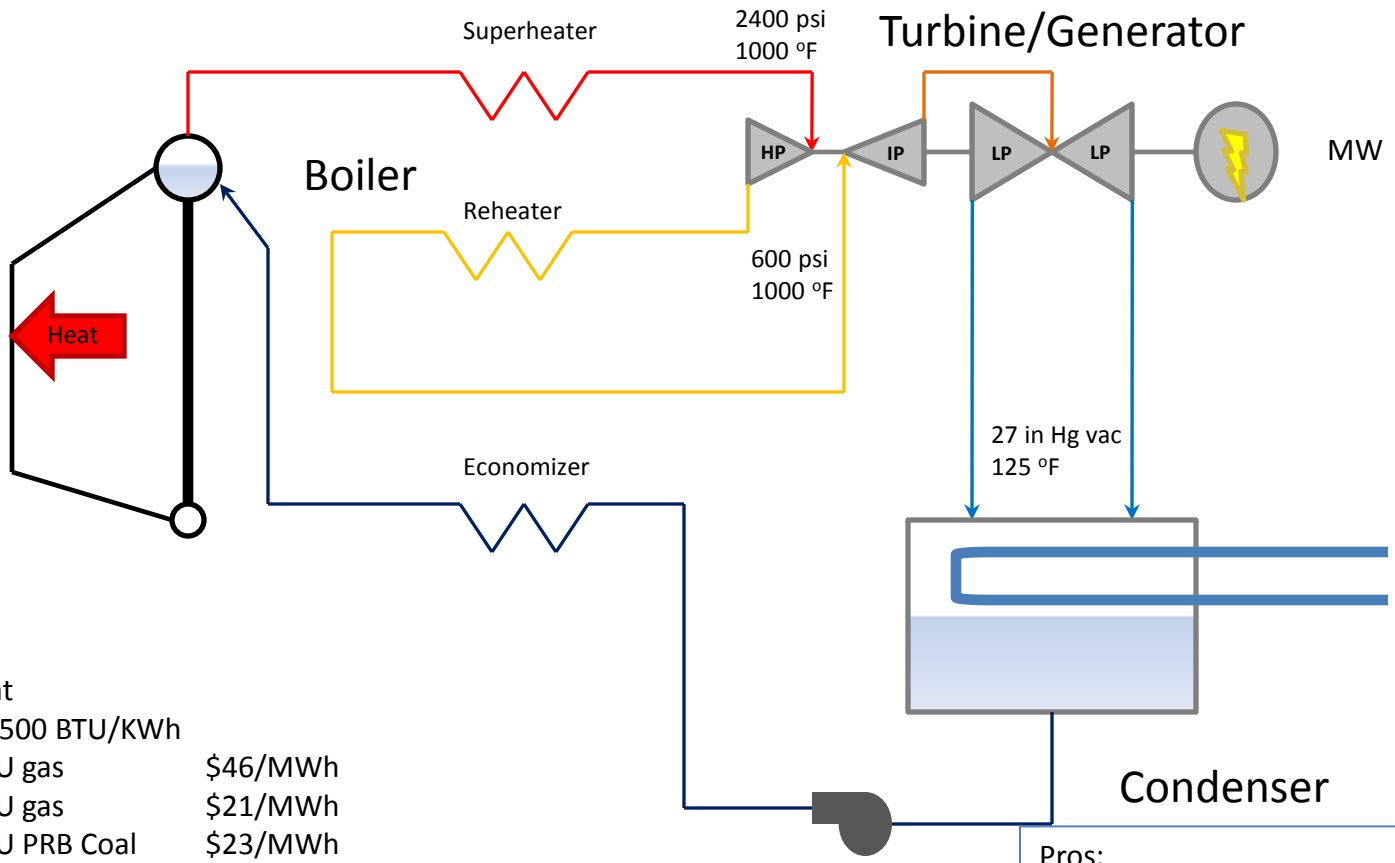
Heatrate



Power Plant Technologies

- Conventional Thermal Plants
- Simple Cycle Gas Turbines
- Combined Cycle Gas Turbine
- Reciprocating Engines
- Renewables

Conventional Subcritical Thermal Power Plant



~ 33% Efficient
Heatrate ~10,500 BTU/KWh

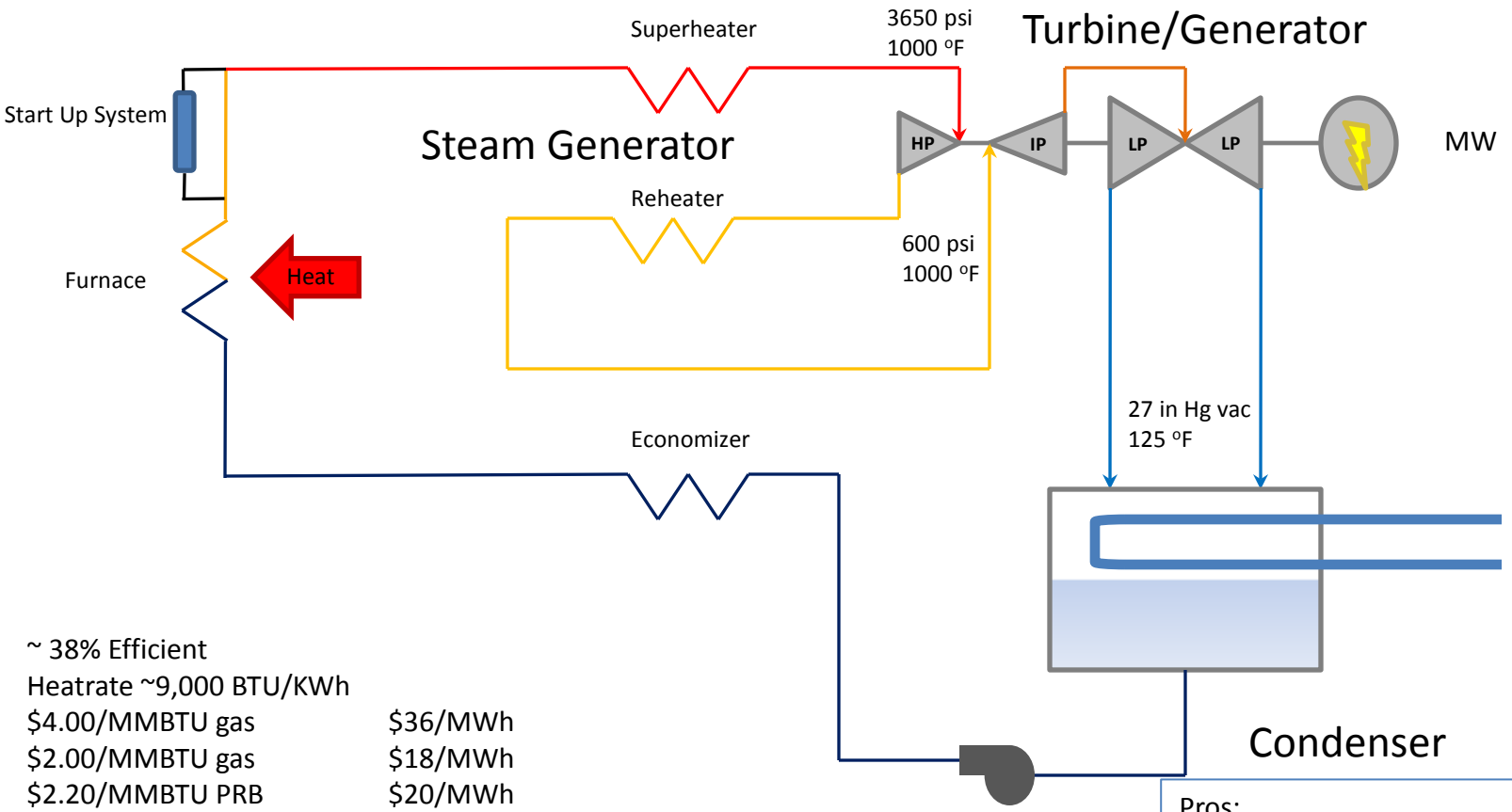
$4.00/MMBTU gas	$46/MWh
$2.00/MMBTU gas	$21/MWh
$2.20/MMBTU PRB Coal	$23/MWh
$1.25/MMBTU Lignite	$13/MWh

Note: PRB Coal and Lignite fuel costs are average values and used for comparison only. Heatrates are nominal based on various available technologies.

Pros:
- Relatively easy to start up and shut down
- Load following capabilities
- Good turndown

Cons:
- Plants are aged and not many left
- Relatively inefficient
- Need cooling source

Conventional Supercritical* Thermal Power Plant



~ 38% Efficient
Heatrate ~9,000 BTU/KWh

$4.00/MMBTU gas	$36/MWh
$2.00/MMBTU gas	$18/MWh
$2.20/MMBTU PRB	$20/MWh
$1.25/MMBTU Lignite	$11/MWh

Note: PRB Coal and Lignite fuel costs are average values and used for comparison only. Heatrates are nominal based on various available technologies.

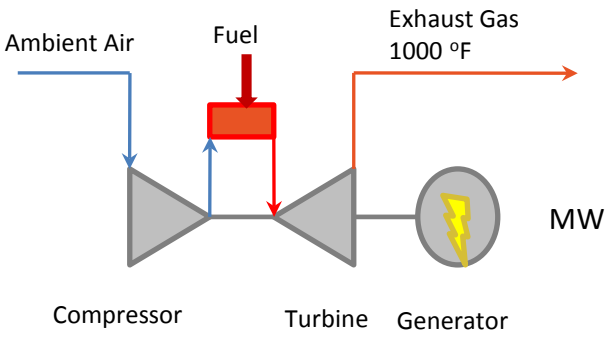
*Critical Point of Water: 3,200 psi/705 °F

Pros:
- Higher efficiency than subcritical plant
- Excellent load following capabilities

Cons:
- Poor turndown capabilities
- Difficult to start up and shut down
- Complex control schemes
- Need cooling source

Simple Cycle Gas Turbine Power Plant

Aeroderivative vs. Frame Machines



~ 26% to 34% Efficient
SSGT Heatrate ~10,000 to 13,000 BTU/KWh

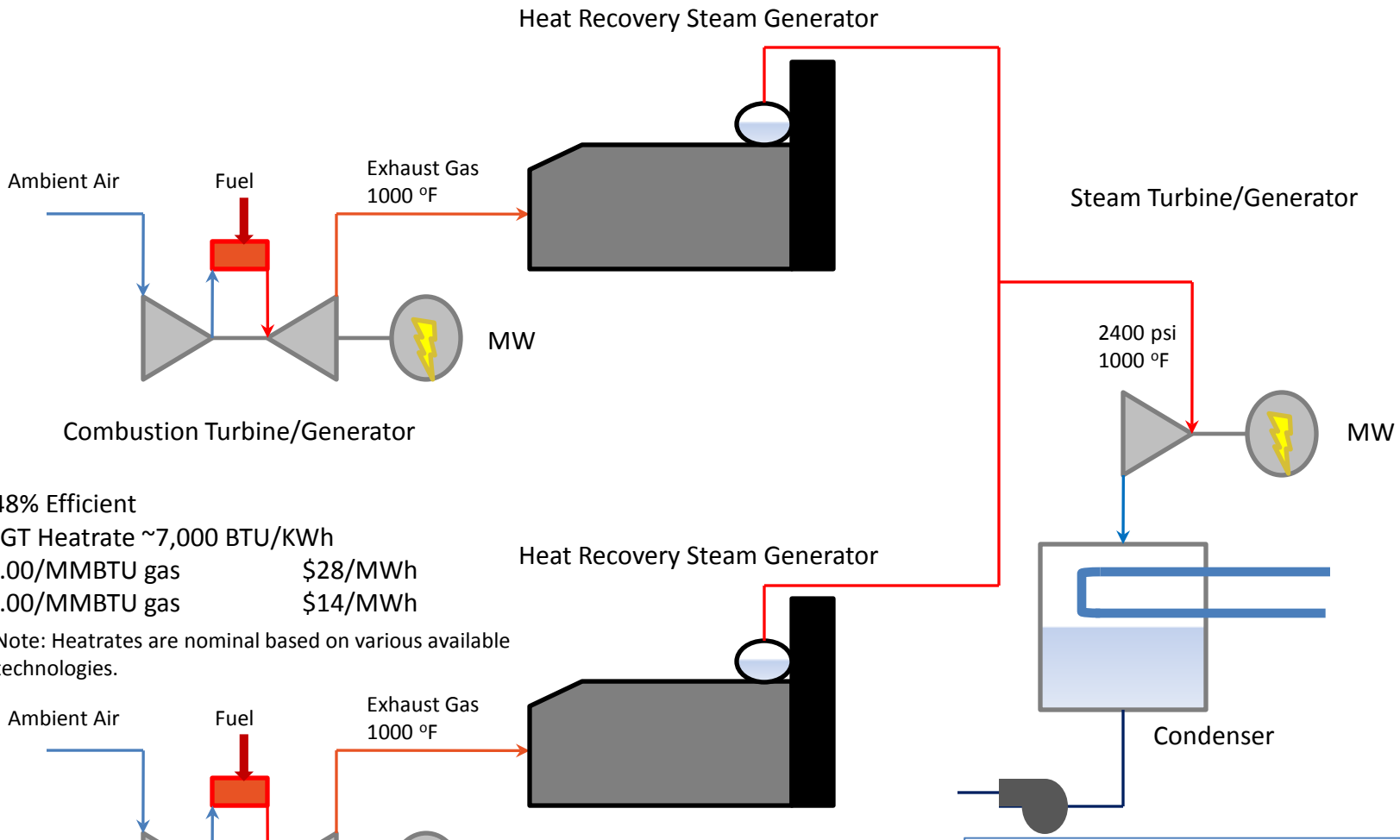
$4.00/MMBTU gas	$40/MWh to $52/MWh
$2.00/MMBTU gas	$20/MWH to $26/MWH

Pros:
- Very Fast Start Up
- Relatively low installation cost
- No large cooling source required

Cons:
- Low efficiency
- Limited load following capability

Note: Heatrates are nominal based on various available technologies.

2 X 1 Combined Cycle Power Plant



~ 48% Efficient
CCGT Heatrate ~7,000 BTU/KWh

$4.00/MMBTU gas	$28/MWh
$2.00/MMBTU gas	$14/MWh

Note: Heatrates are nominal based on various available technologies.

Pros:
- Highest available efficiency

Cons:
- Load following capability
- Older plants were designed as base load
- Need cooling source

Summary

Combined Cycle Power Plant
~ 48% Efficient
CCGT Heatrate ~7,000 BTU/KWh
$4.00/MMBTU gas $28/MWh
$2.00/MMBTU gas $14/MWh

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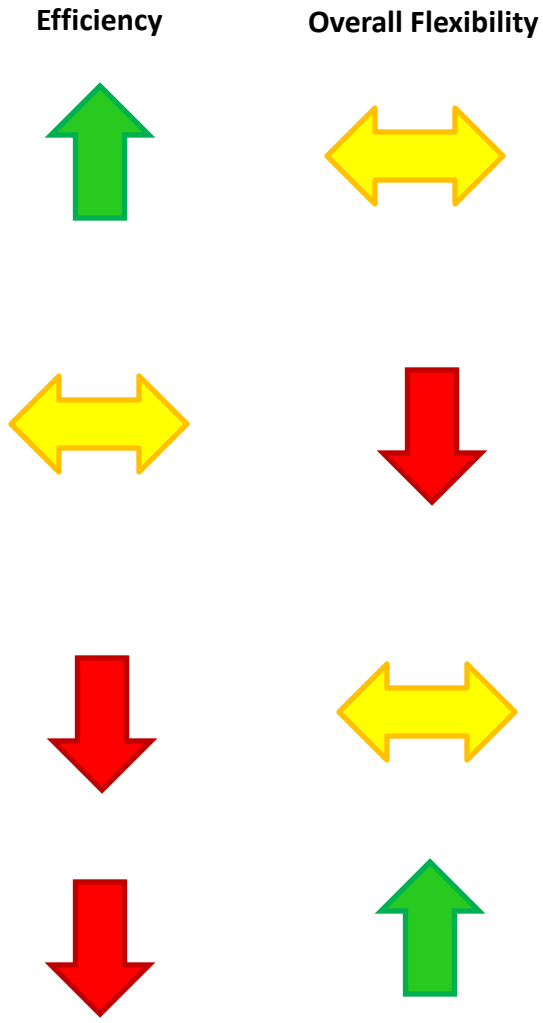

Plant Observations/Conclusions

- Fuel is the driver
- Efficiency affects fuel
- Efficiency and flexibility set by design
- Efficiency limited by technology and cost
- There will always be trade offs

Market Observations/Conclusions

- Natural gas is the basis for power price
- Other forces also impact price
- Coal benefits from high gas price
- Coal subject to changing environmental regulations
- Conventional plants burning gas have limited value
- CCGT are always close to the margin
- SSGT fill a niche
- Nodal market makes generation location sensitive
- Diversification is still prudent

Questions