

RAPID

**CURTISS -
WRIGHT**

What Replaces Lost Generation?

May 16th, 2016



Planned And Actual Plant Closures

Kewaunee
Crystal River
San Onofre
Vermont Yankee
JA Fitzpatrick
Pilgrim



Others Are At Risk

Clinton?

Davis-Besse?

Nine Mile?

Ginna?

Indian Point?

Palisades?

Factors Leading to Shutdowns

- Political
 - Regulatory Constraints
 - Supplements to Alternative Sources (Solar)
- Technical
 - CR3 Containment
 - SNO Steam Generators



Economic Drivers Are Prime Factors

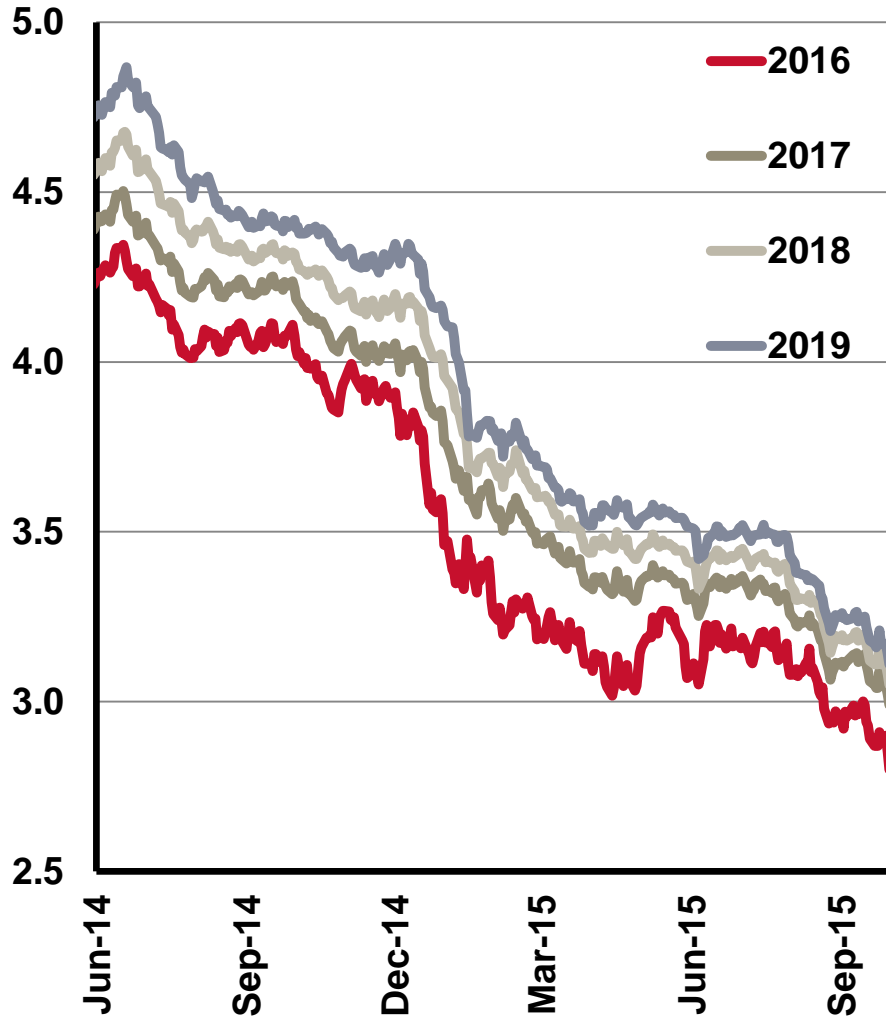
- Innovations Within Natural Gas Industry
 - Hydraulic fracturing - “*fracking*”
 - Increased availability of natural gas
 - Sharply declining natural gas prices



Key Drivers: Gas and Power Futures – Continued Decline

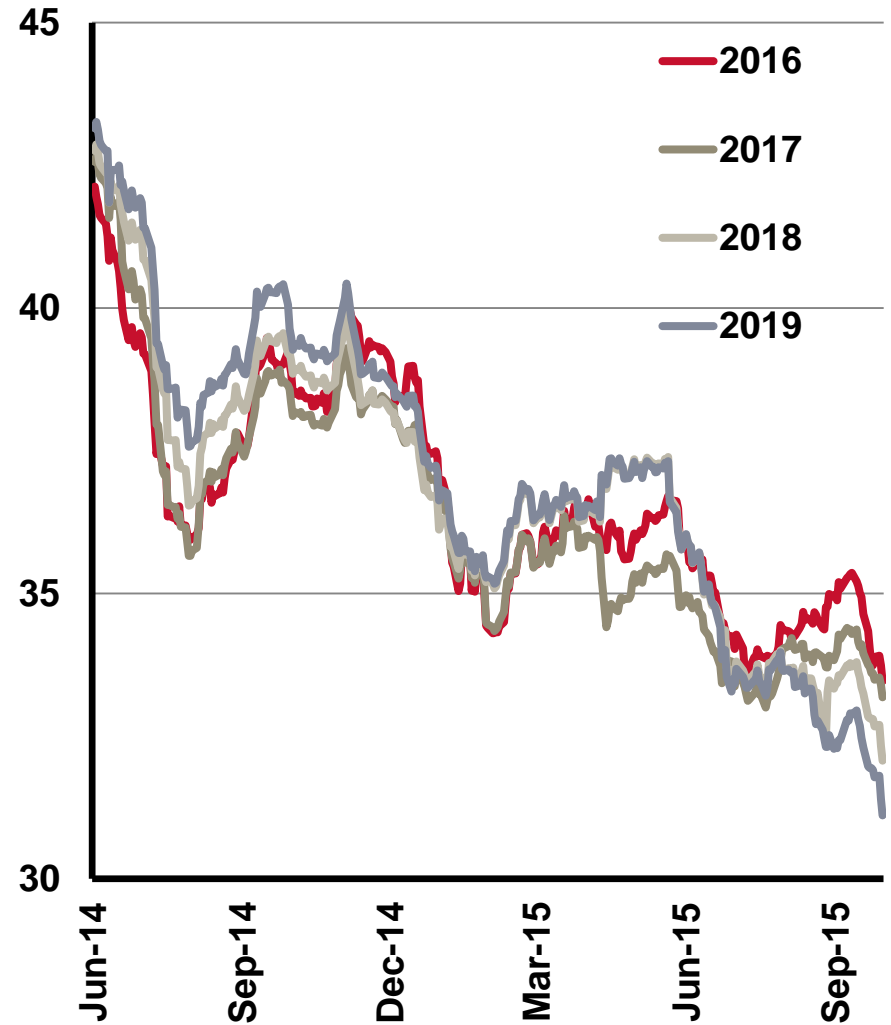
Henry Hub Gas Futures Prices

\$/MMBtu



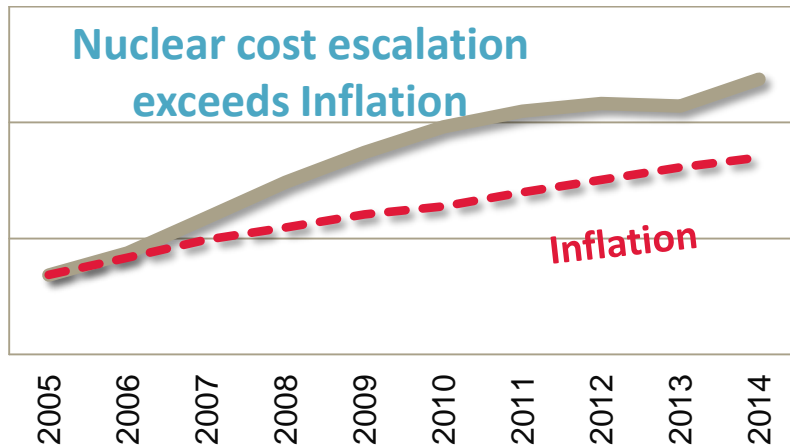
NY Zone A Forward Power Prices

\$/MWh



Key Driver: High Cost Structure for Single Unit Nuclear Sites

Nuclear Cost; \$/MWh



Generating Costs¹ (2013 Average \$/MWh)

First Quartile	\$28
Multi Unit Sites	\$35
U.S. Fleet Average	\$41
Single Unit Sites	\$50

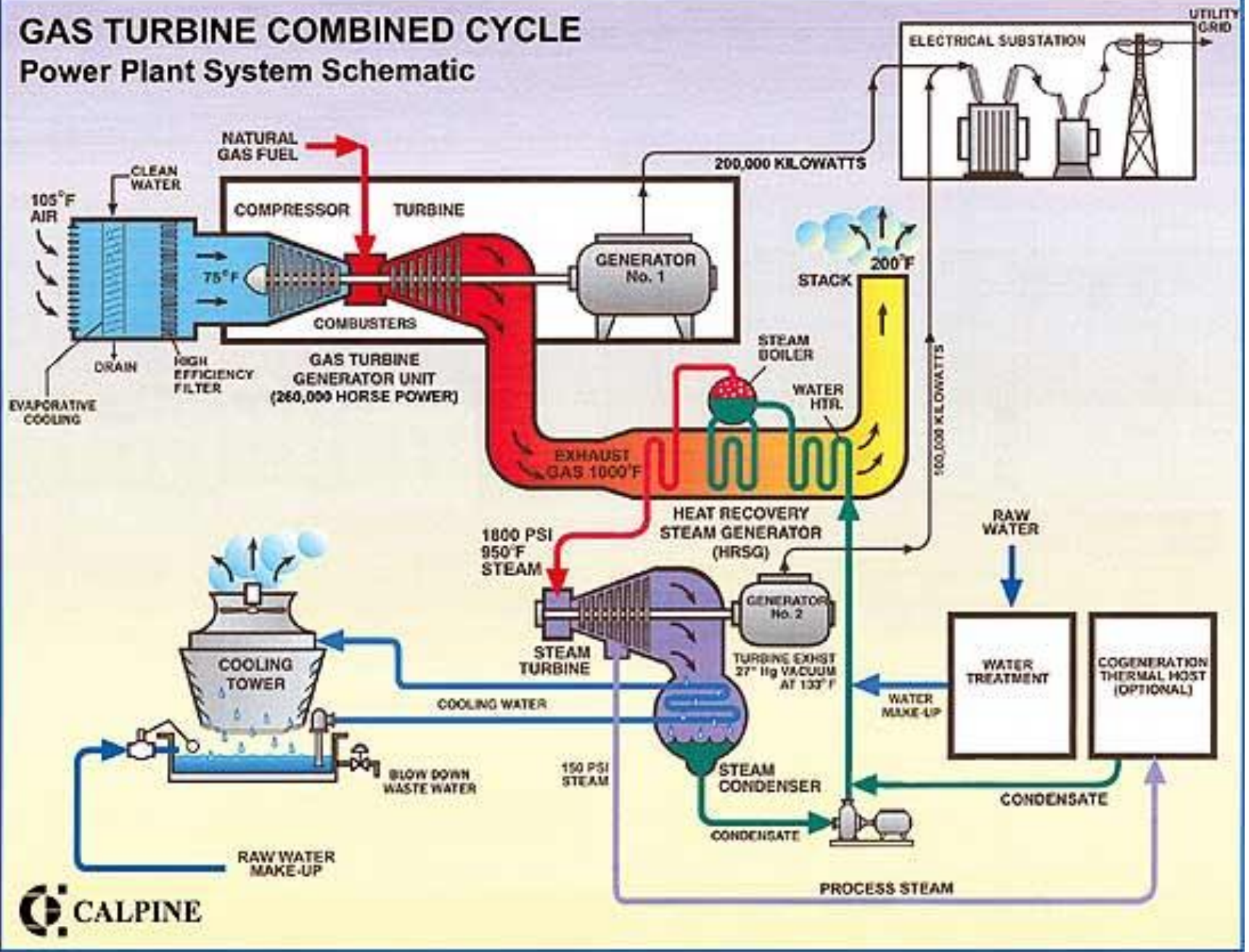
How a Combined-Cycle Power Plant Produces Electricity

- Gas turbine burns fuel.
- Gas turbine compresses air and mixes it with fuel that is heated to a very high temperature.
- The hot air-fuel mixture moves through the gas turbine blades, making them spin.
- The fast-spinning turbine drives a generator.
- A Heat Recovery Steam Generator (HRSG) captures exhaust heat from the gas turbine
- The HRSG creates steam from the gas turbine exhaust heat and delivers it to the steam turbine.
- Steam turbine spins a second generator, delivering additional electricity.

<https://powergen.gepower.com/resources/knowledge-base/combined-cycle-power-plant-how-it-works.html#sthash.rriPRKgy.dpuf>



GAS TURBINE COMBINED CYCLE Power Plant System Schematic

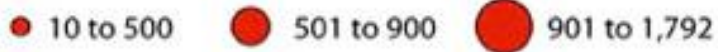


CALPINE

Planned natural gas combined-cycle projects in the US



Planned capacity (MW)



Conclusion

- Primary factor in shutdowns was lower price points.
- Primarily driven by lower natural gas prices
- Rising operational costs also contributed.
- CCGT is major replacement technology.