

CHP a Viable Alternative for Ohio

A Manufacturer's Point of View

by

Chris Lyons

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A Caterpillar Company

Solar Turbines has Extensive CHP Experience

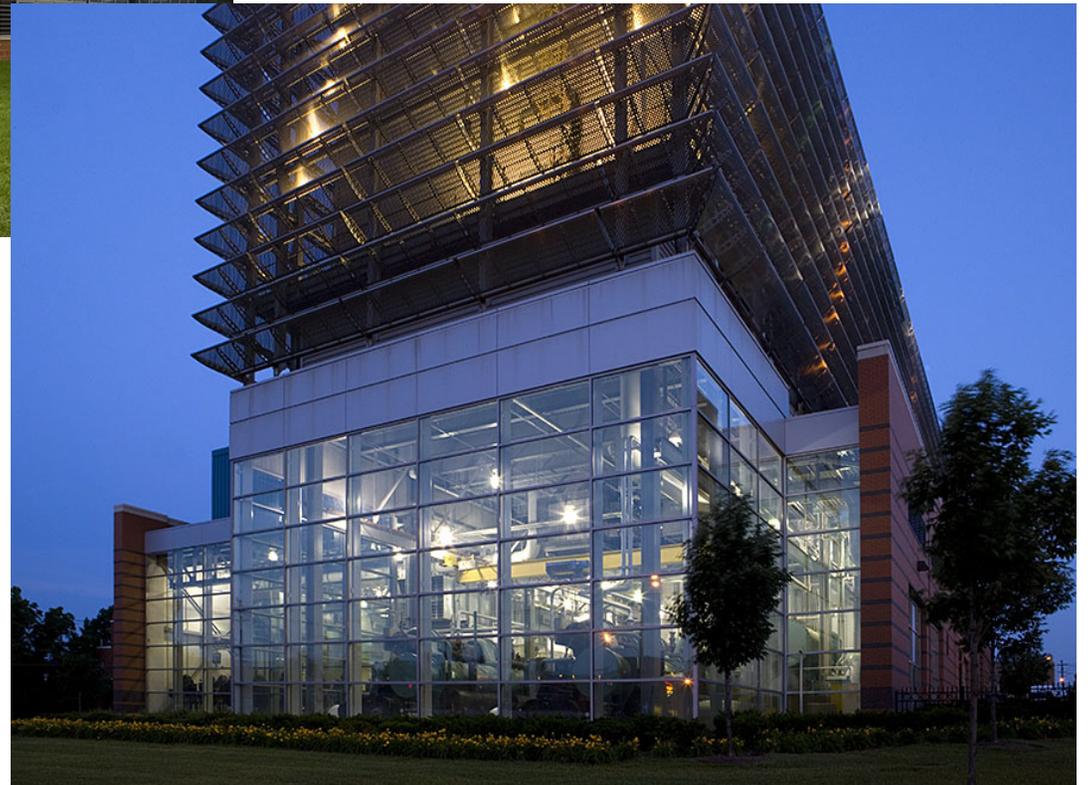


Over 14,000 Units Installed Worldwide
Over 1.4 Billion Operating Hours
Installations in 93 Countries



Kent State University

University of Cincinnati



Kent State University CHP Project



1 x 5 MW GT w/ 100,000 lb/h HRSG

1 x 7 MW GT w/ 32,000 lb/h HRSG

1 x 500 Ton Absorption Chiller

1 x 2000 Ton ST Drive Chiller

Project Drivers: Replace older coal boilers, energy savings and security



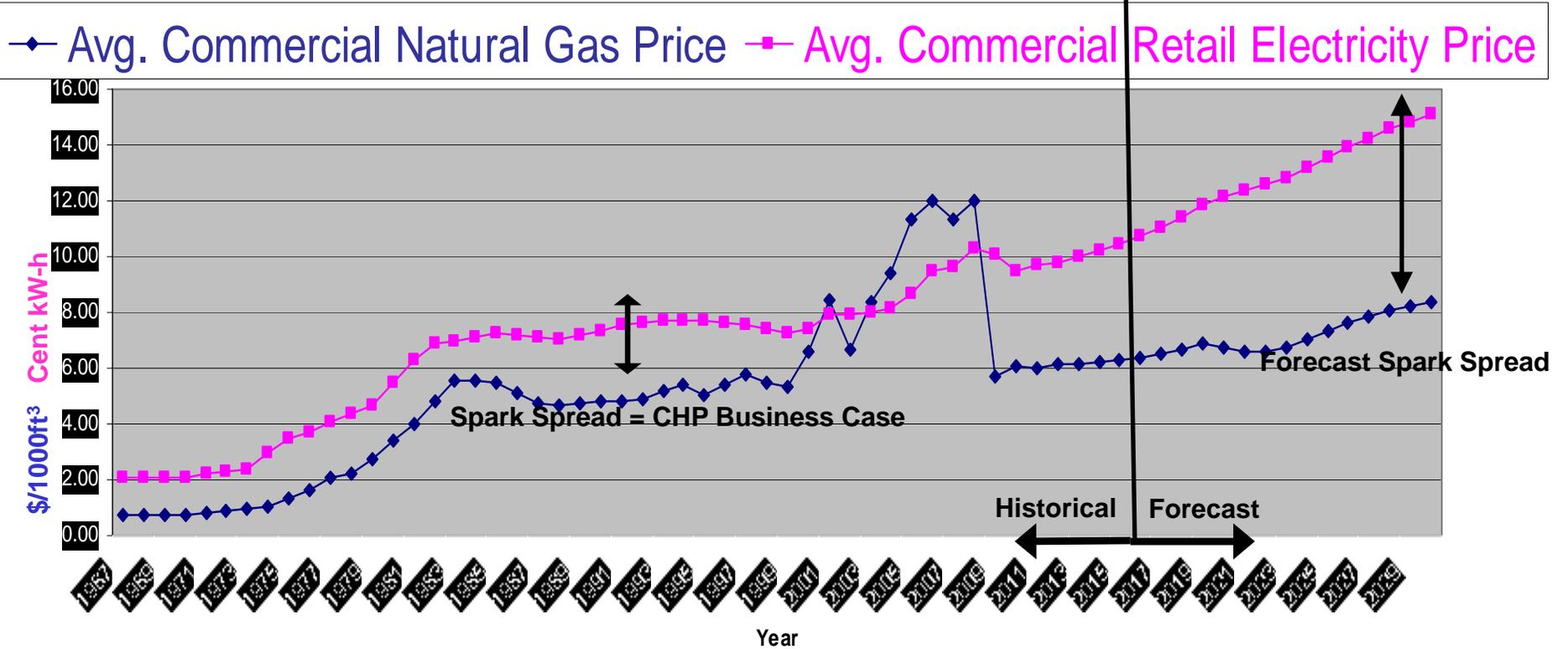


2 x 14 MW GT w/ 70,000 lb/h HRSG

1 x 20 MW ST

Project Drivers: Reliability, cost savings and emissions

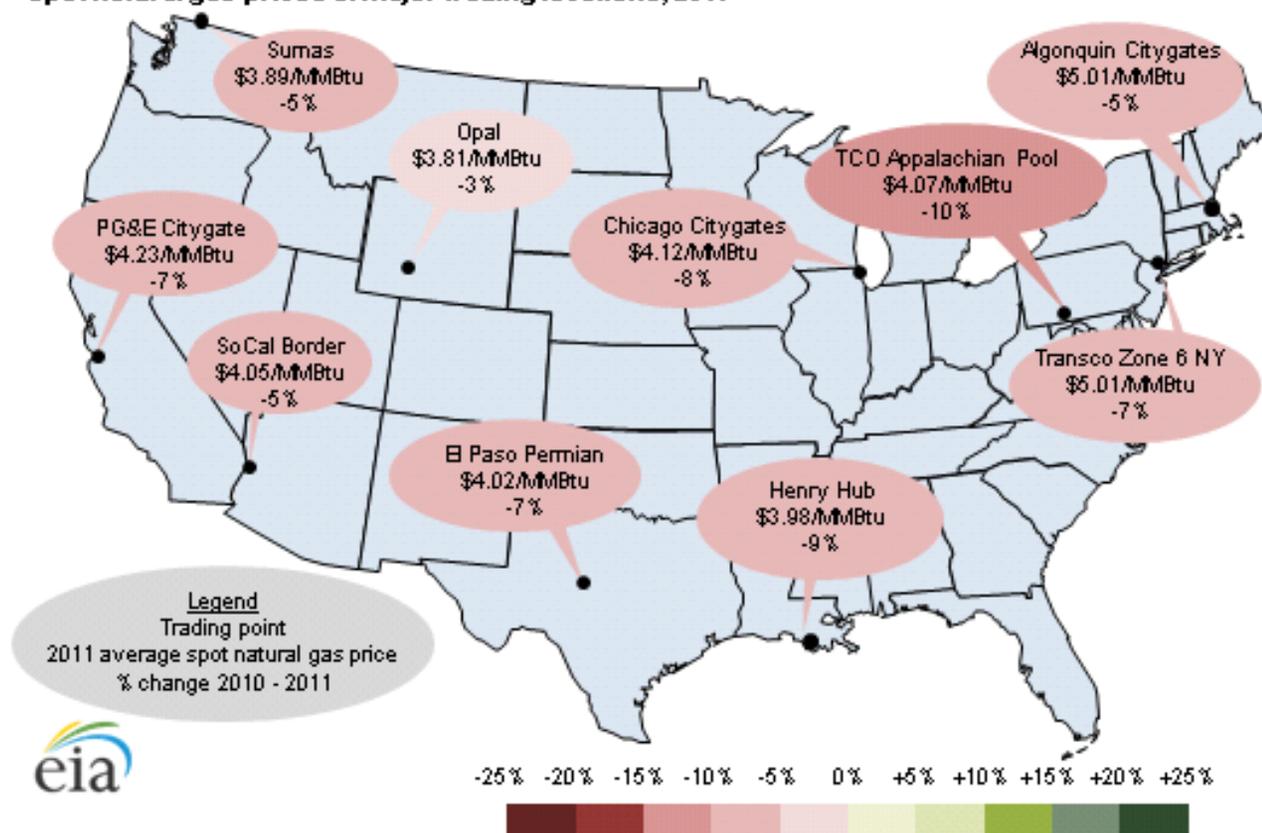




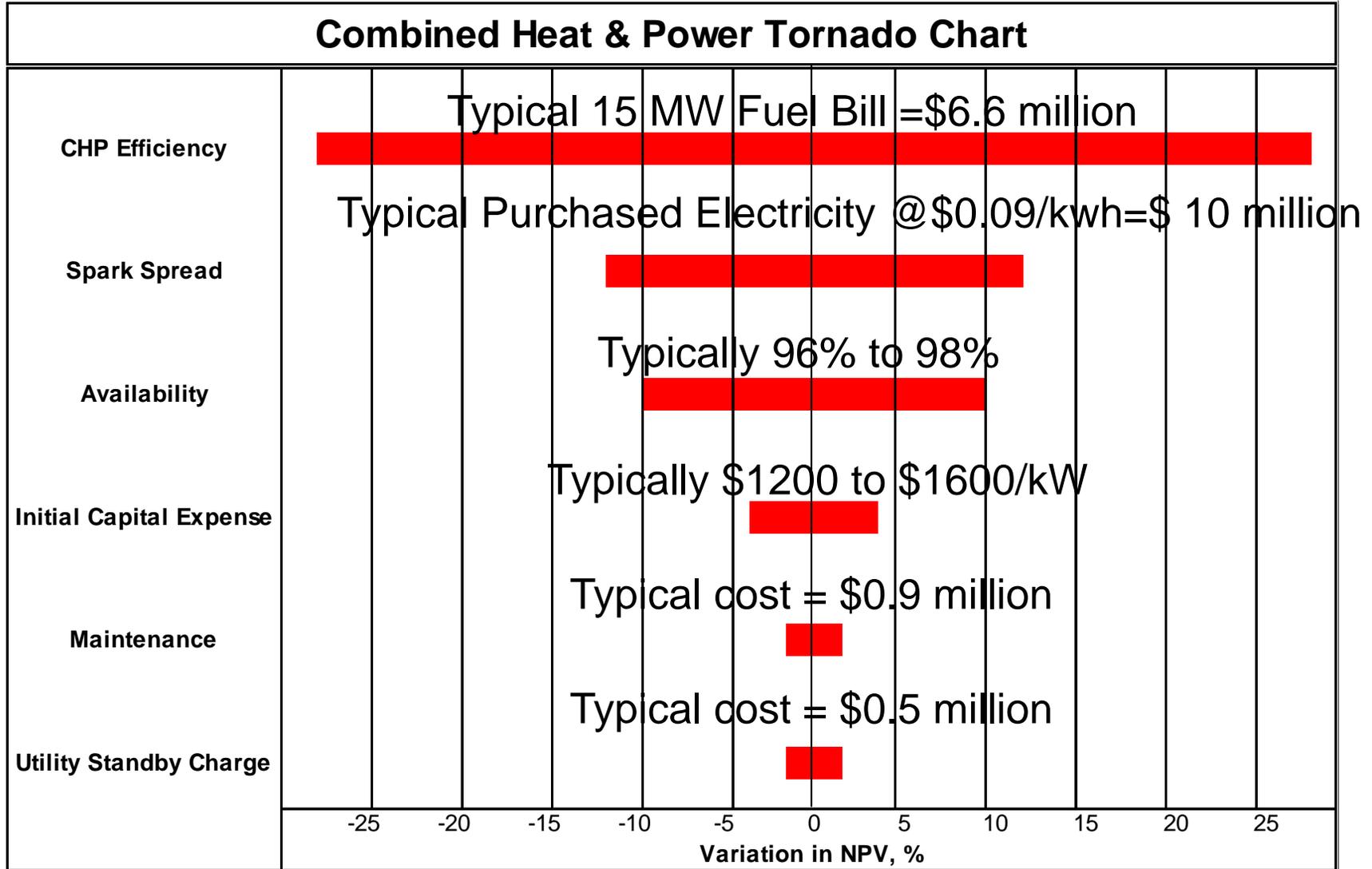
Source = US DOE Energy Information Administration

2011 Brief: Henry Hub natural gas spot prices fell about 9% in 2011

Spot natural gas prices at major trading locations, 2011



Factors that Impact CHP Economics



Note - input parameters were each varied +/- 5%.

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Coke Oven Gas CHP in China

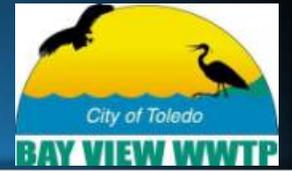




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Toledo Digester & LFG GTCC Plant



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LA County 35 MW Digester Gas Plant

CHP plant that has
been operating for
over 15 years



GenOn plans to deactivate 3140 MW of coal-fired generating capacity by 2015

GenOn expects to deactivate 3,140 MWs of coal-fired generating capacity in PJM between June 2012 and May 2015 because forecasted returns on investments necessary to comply with environmental regulations are insufficient. **February 29, 2012**

Study: Closing Arizona coal plant could cost \$18B

February 29, 2012

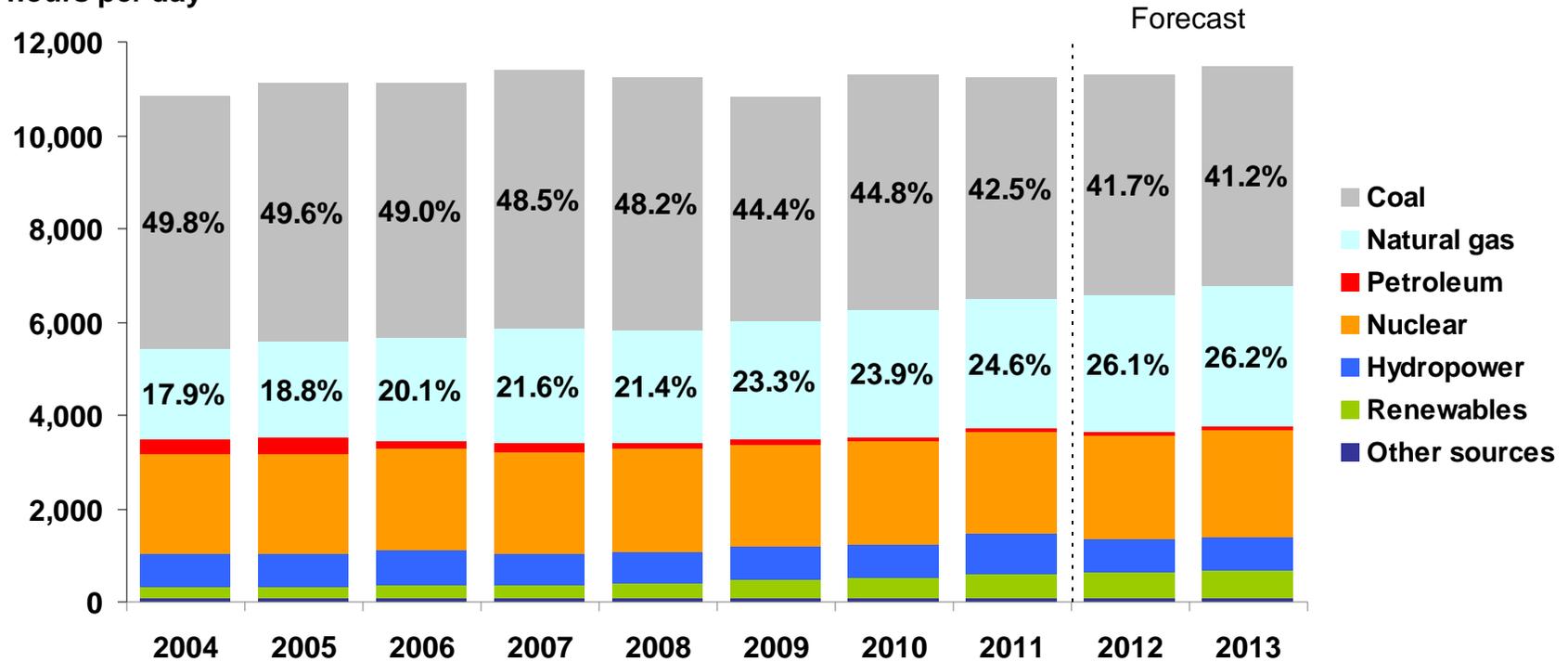
A new study from the Arizona State University L. William Seidman Research Institute projects that the closure of the Navajo Generating Station could have a dramatic economic impact on Arizona, according to the Phoenix Business Journal. The massive 2.25-gigawatt coal-fired power plant is the second-largest power plant in Arizona, behind only the Palo Verde nuclear plant, according to the U.S. Energy Information Administration.

Federal court rejects delay of coal-fired power plant's emissions controls

A federal appeals court has ruled that the owners of the San Juan Generating Station must continue with plans to install emissions controls. The 1,800 MW coal-fired power plant near Farmington, N.M. was ordered by the U.S. Environmental Protection Agency last fall to install strong selective catalytic reduction (SCR) equipment to cut its output of fine particulate matter and other emissions in order to meet federal standards. PNM, which owns about half the San Juan plant, has estimated the cost to retrofit the generating system to be between \$750 million and \$1 billion. The EPA estimates the cost to be much lower — around \$345 million. **March 5, 2012**

U.S. Electricity Generation by Fuel, All Sectors

thousand megawatt-hours per day

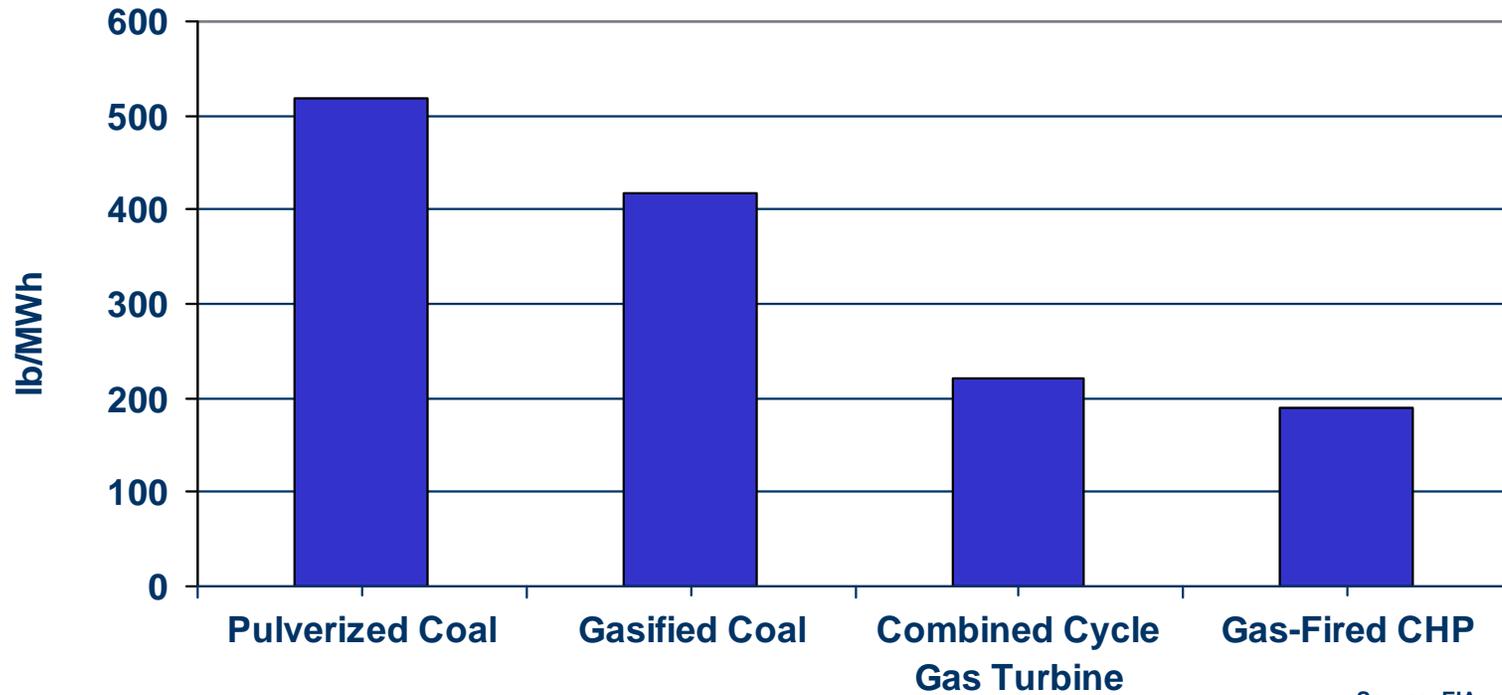


Note: Labels show percentage share of total generation provided by coal and natural gas.

Source: Short-Term Energy Outlook, February 2012

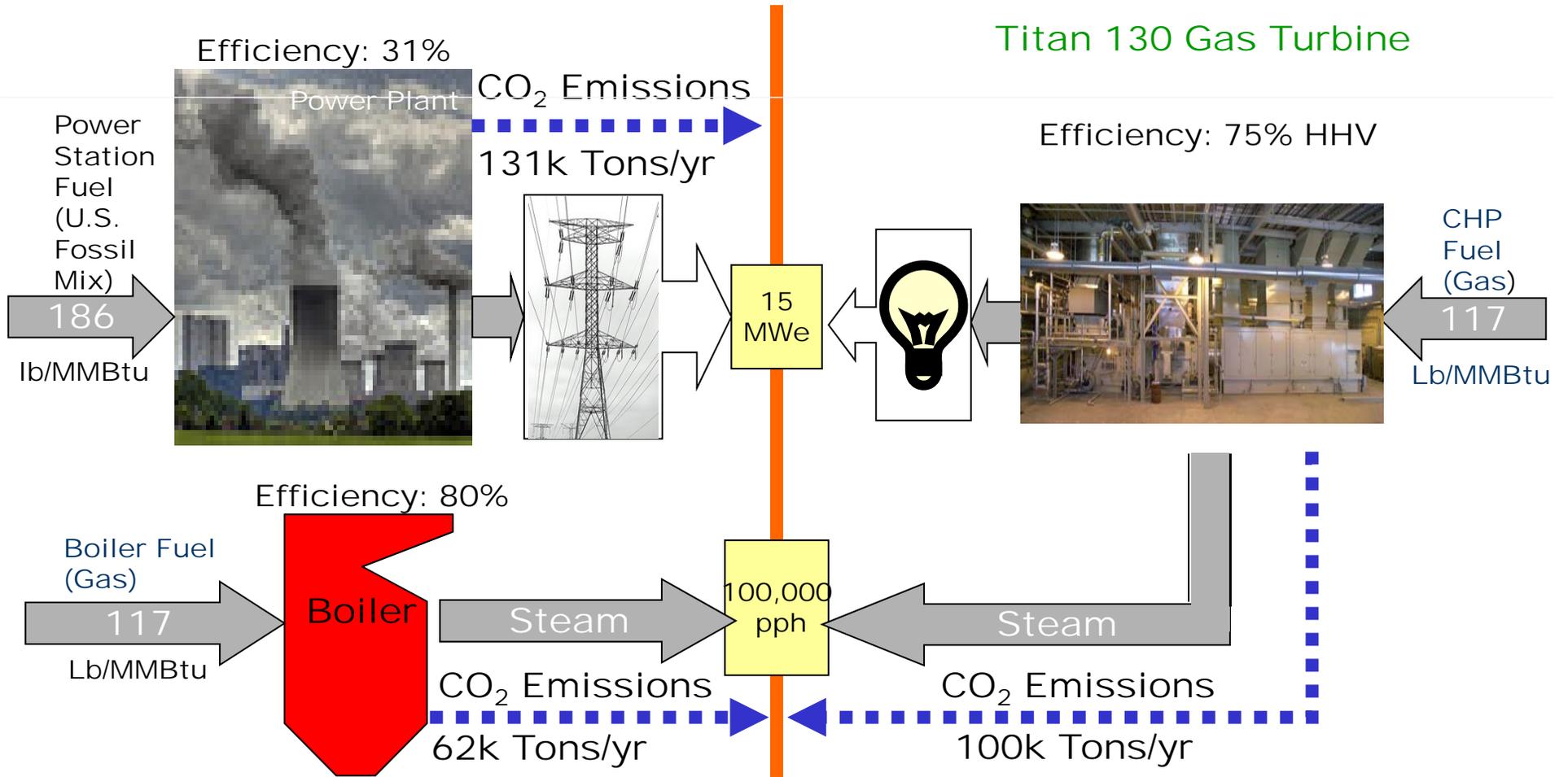
“Natural Gas CHP is the Best Choice for Lowering Carbon Based Emissions”

Carbon Emissions



Conventional Generation

Combined Heat & Power: Titan 130 Gas Turbine



193k Tons

...TOTAL ANNUAL CO₂ EMISSIONS...

100k Tons

93,000 Tons CO₂ Saved/Year

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We Cannot Always Depend on the Grid?



Oregon Storm Jan. 21, 2012



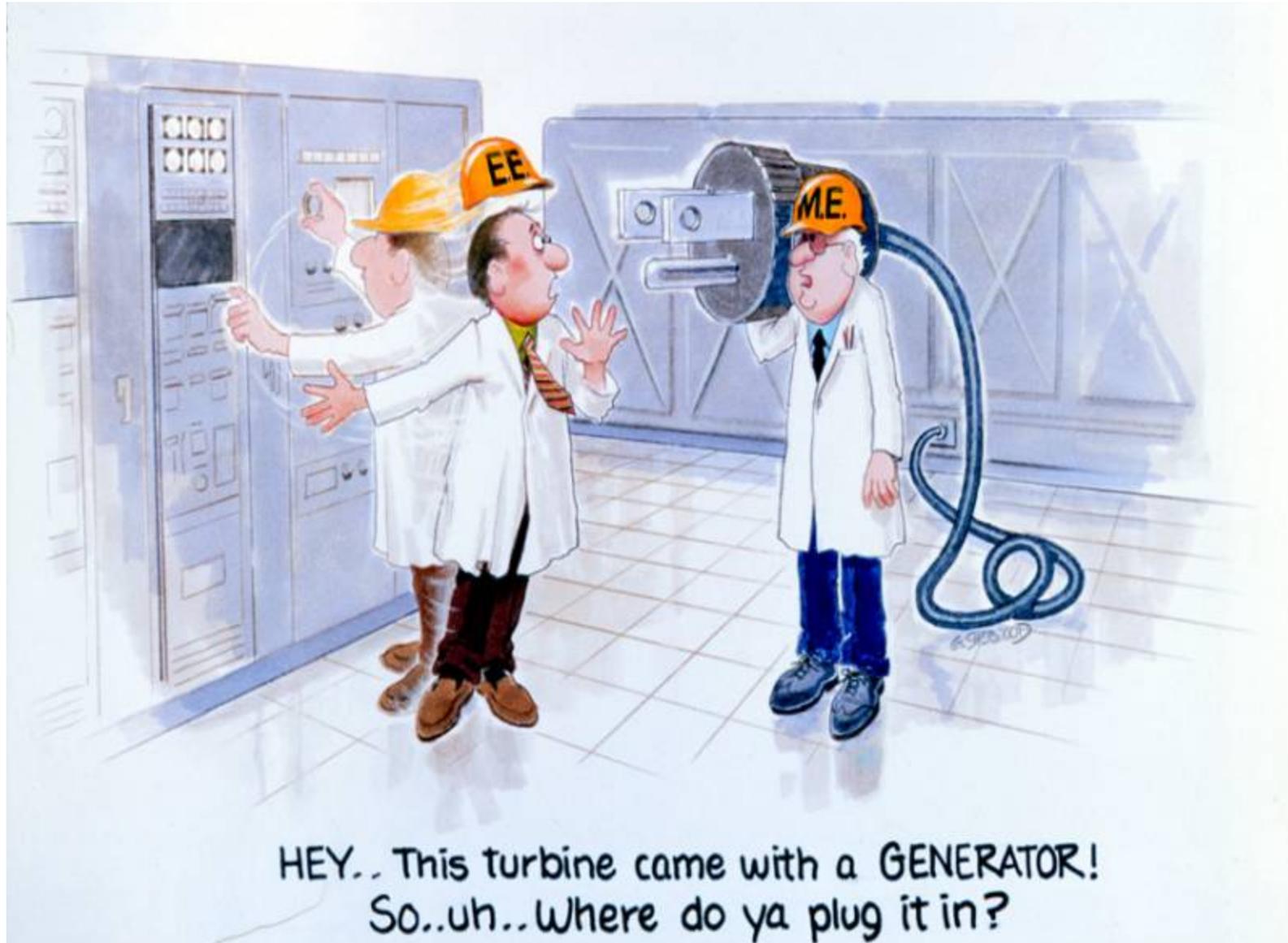
October 2007 Wildfires in San Diego

- **Cost Effective, Clean and Reliable Generation**
 - Support potential customers with evaluation of opportunities
 - Work with utilities to minimize grid interferences and cost
- **State's Effectiveness in Global Economy**
 - Provide sustainable cost effective energy supply options
 - Discuss possible incentives to encourage CHP

Suggested Incentives to Encourage CHP in Ohio

- VAR support recognition
- Credits for efficient generation
- Demand side type incentives for supply side generation
- Tax preferences for capital investments
- More favorable standby charges
- Preferred feed in tariffs for qualifying facilities

Why Can't Electric Utilities Provide CHP?

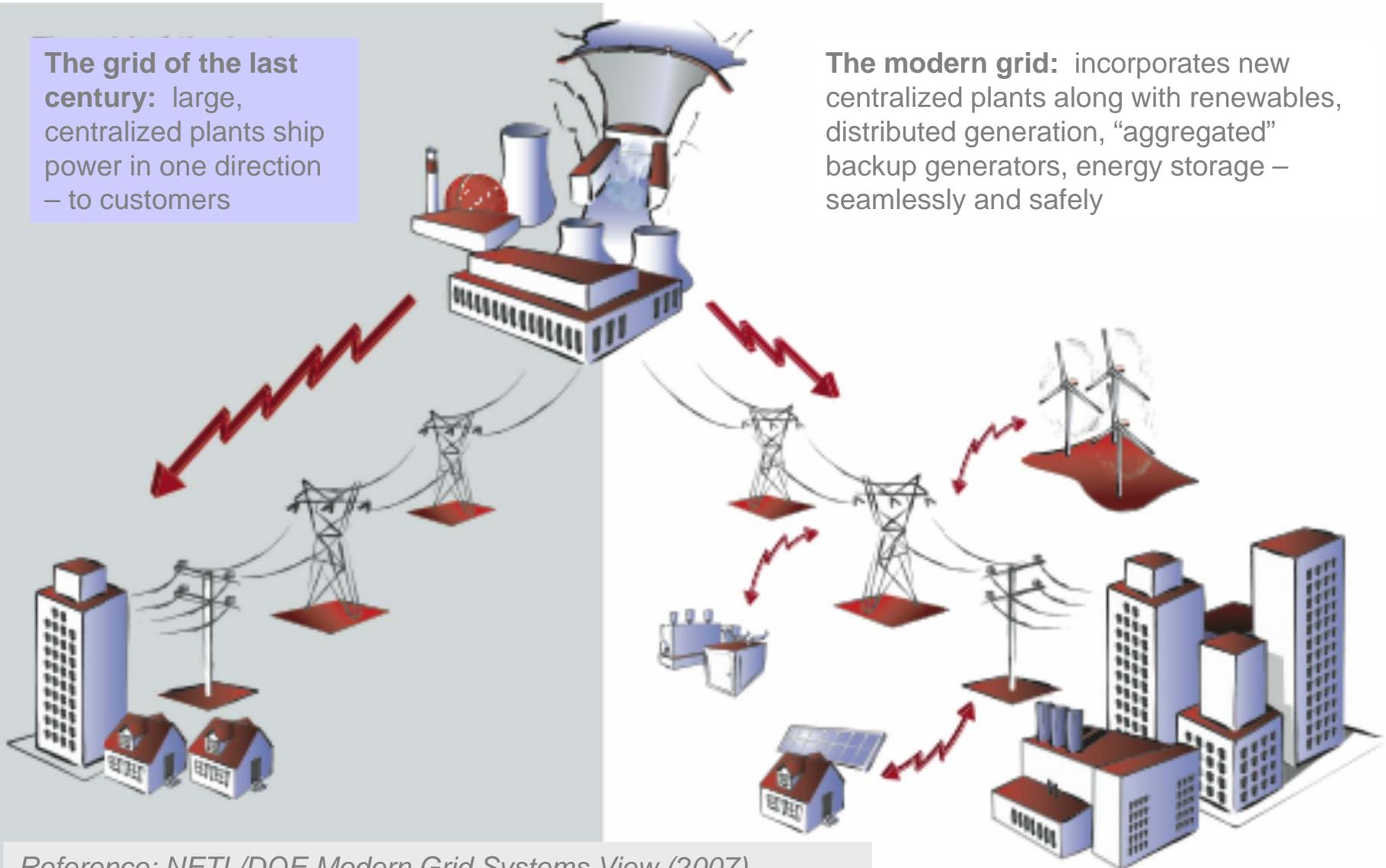


HEY.. This turbine came with a GENERATOR!
So..uh..Where do ya plug it in?

Utilities Need to Consider a New Paradigm

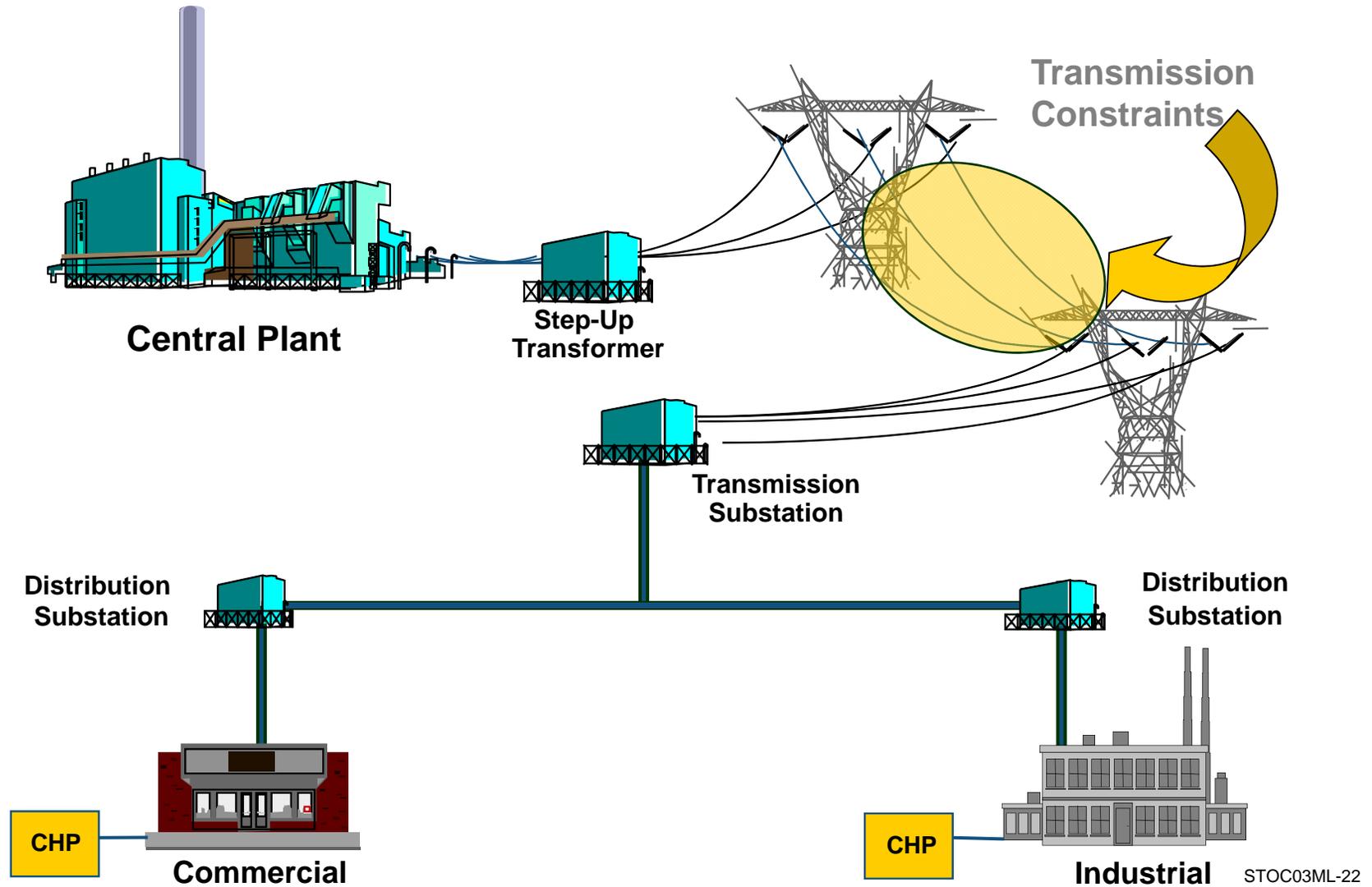
The grid of the last century: large, centralized plants ship power in one direction – to customers

The modern grid: incorporates new centralized plants along with renewables, distributed generation, “aggregated” backup generators, energy storage – seamlessly and safely



Reference: NETL/DOE Modern Grid Systems View (2007)

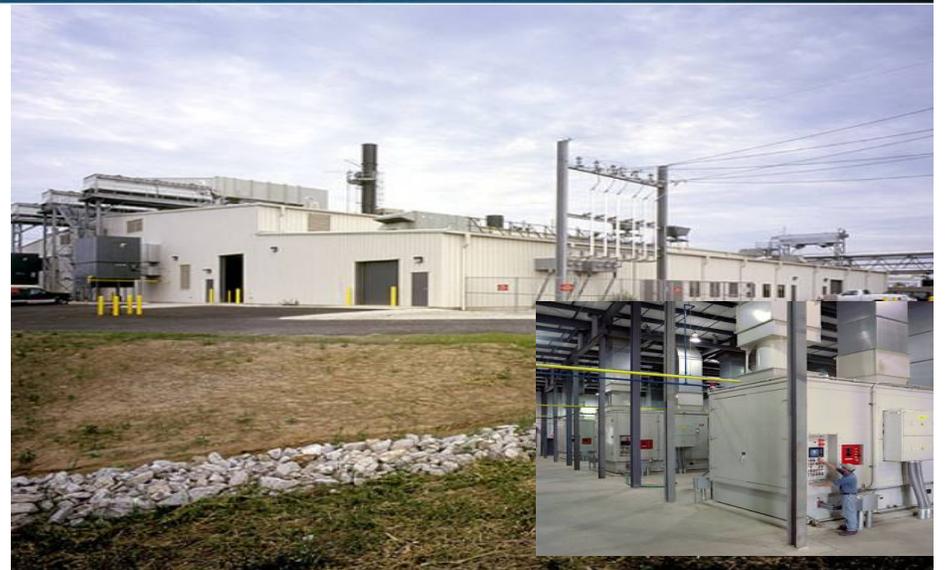
Utility Model Incorporating CHP Can Be Very Effective



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Utility Installed CHP Projects



Questions and Discussion

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