



Market Drivers for Combined Heat and Power

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Transformation

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CHP Market Outlook

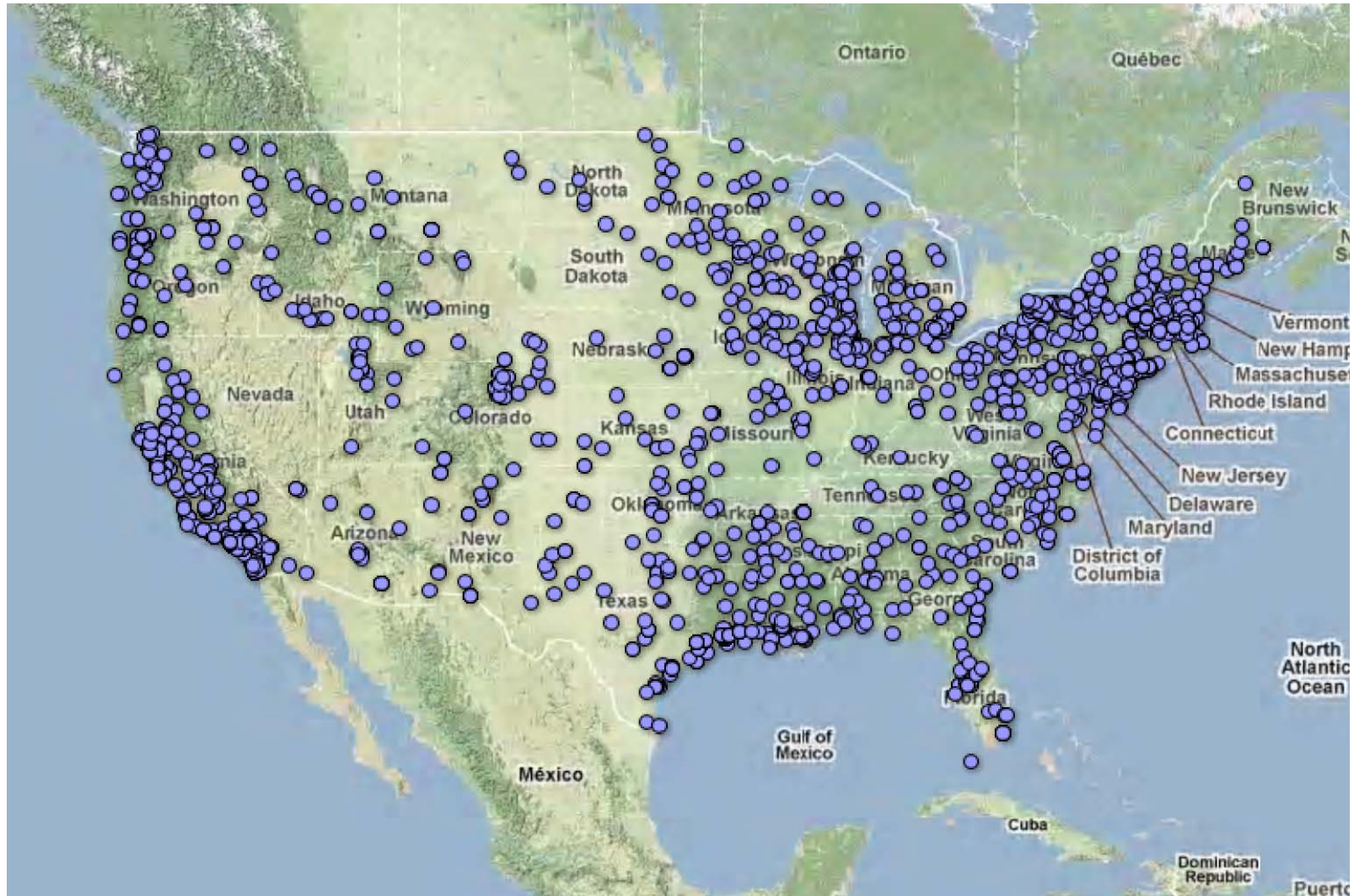
- CHP appears poised for new growth
 - Benefits recognized by policymakers – many states promoting CHP along with renewables
 - Favorable outlook for natural gas supply in North America enhances economics
 - Opportunities created by environmental pressures on the power sector and industrial/institutional users
- Ultimate size and pace of market development depends on economic, regulatory and market environment

CHP's Higher Efficiency Results in Less Energy Used and Fewer Emissions Released

Category	10 MW CHP	10 MW PV	10 MW Wind
Annual Capacity Factor	85%	25%	34%
Annual Electricity	74,446 MWh	19,272 MWh	29,784 MWh
Annual Useful Heat	103,417 MWh _t	None	None
Footprint Required	6,000 sq ft	1,740,000 sq ft	76,000 sq ft
Capital Cost	\$18 million	\$60 million	\$24 million
Annual Energy Savings	316,218 MMBtu	225,640 MMBtu	306,871 MMBtu
Annual CO ₂ Saving	42,506 Tons	20,254 Tons	27,546 Tons

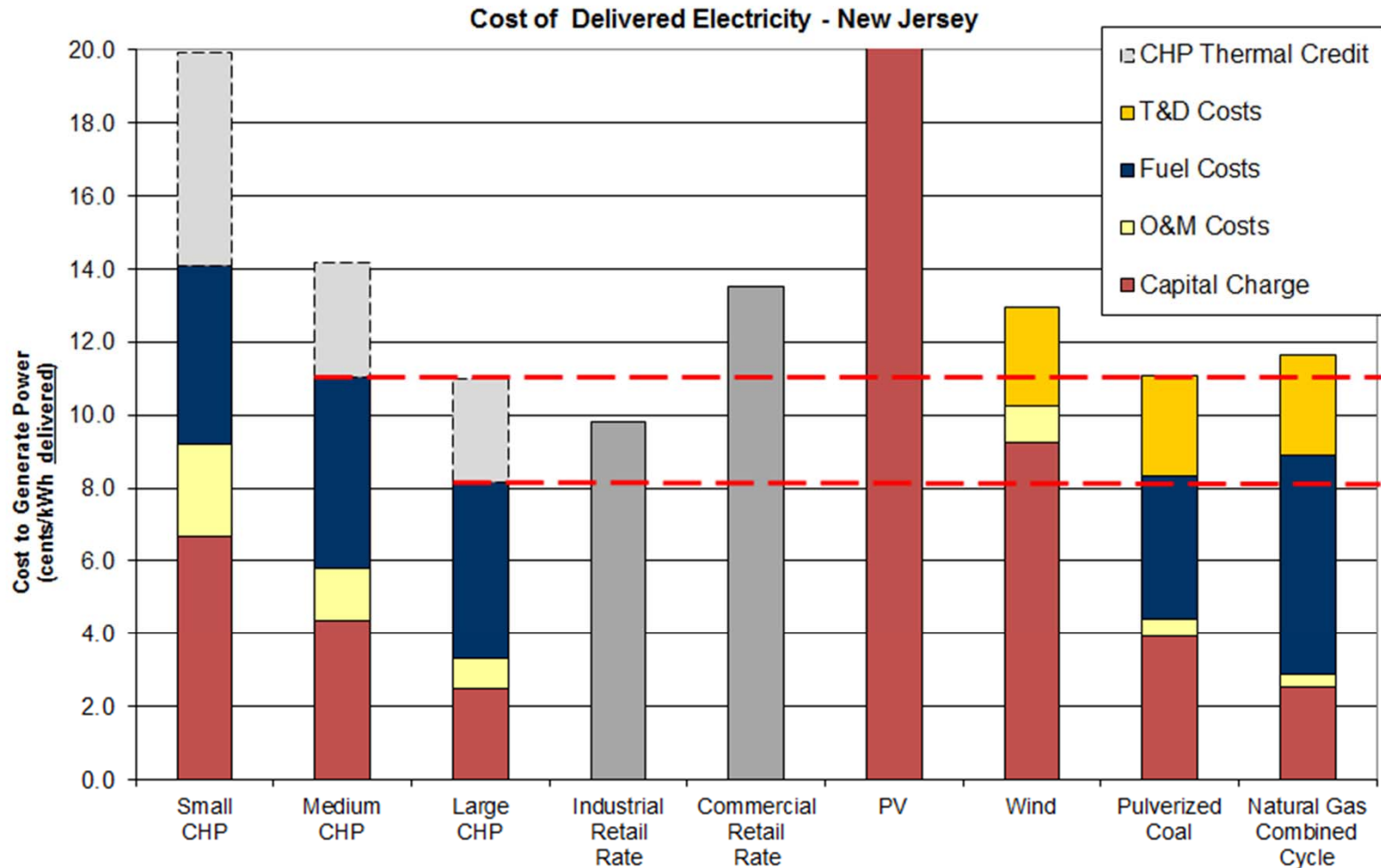
Based on: 10 MW Gas Turbine CHP - 28% electric efficiency, 68% total efficiency
 Displaces National All Fossil Average Generation (eGRID 2010) -
 9,720 Btu/kWh, 1,745 lbs CO₂/MWh, 6% T&D losses

CHP is Used at the Point of Demand



Source: ICF CHP Database

CHP and WHP Can be a Cost-Effective Source of New Power



CHP thermal credit reflects the cost of boiler fuel avoided by capturing and using the waste heat from CHP

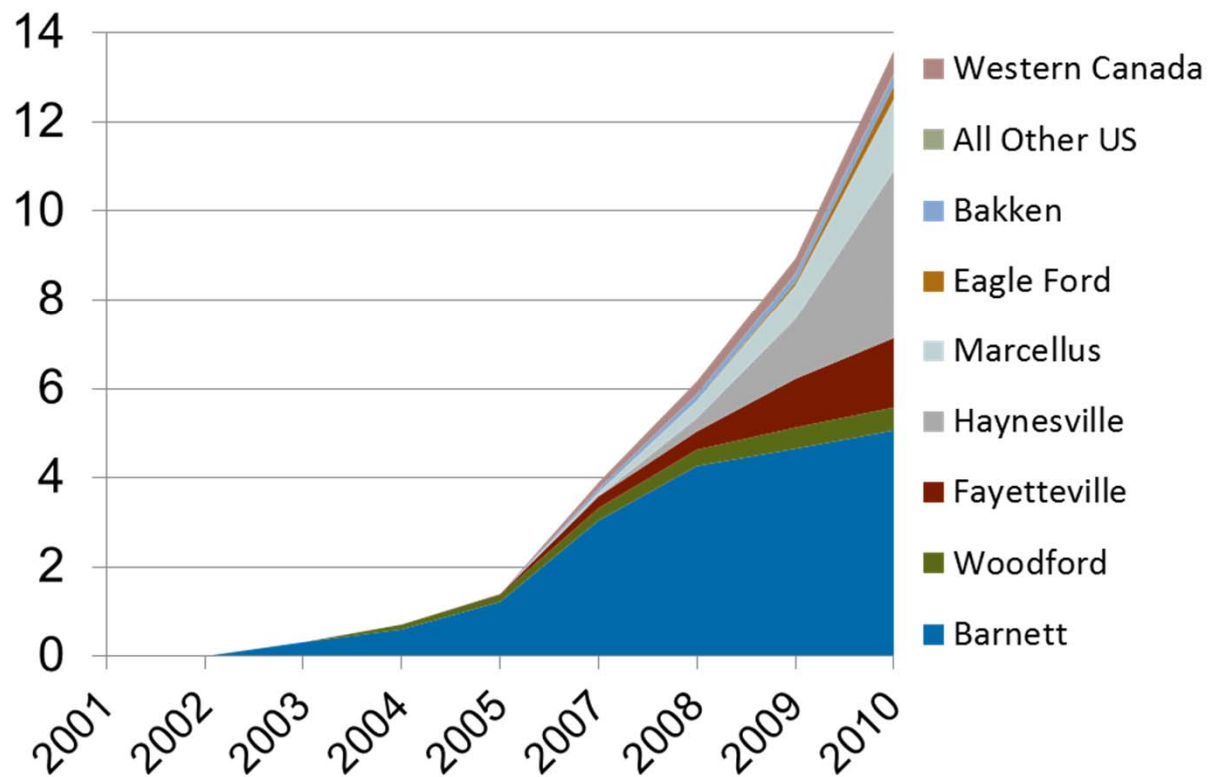
State Support for CHP

- Eighteen states include CHP or waste energy recovery in portfolio standards
- Specific incentives for CHP (tax credits, streamlined permitting, capital incentives)
 - New York
 - California
 - Connecticut
 - Massachusetts
 - New Jersey
 - North Carolina

The Shale Gas Revolution

- Large-scale application of horizontal drilling and hydraulic fracturing techniques in the shale plays began in the early 2000s.
- Barnett was the first big shale play, but production quickly expanded to surrounding shale plays.
- More recently developed plays include Marcellus, Bakken, and Utica.
- Since 2005, shale gas production has been increasing at about 50% per year.

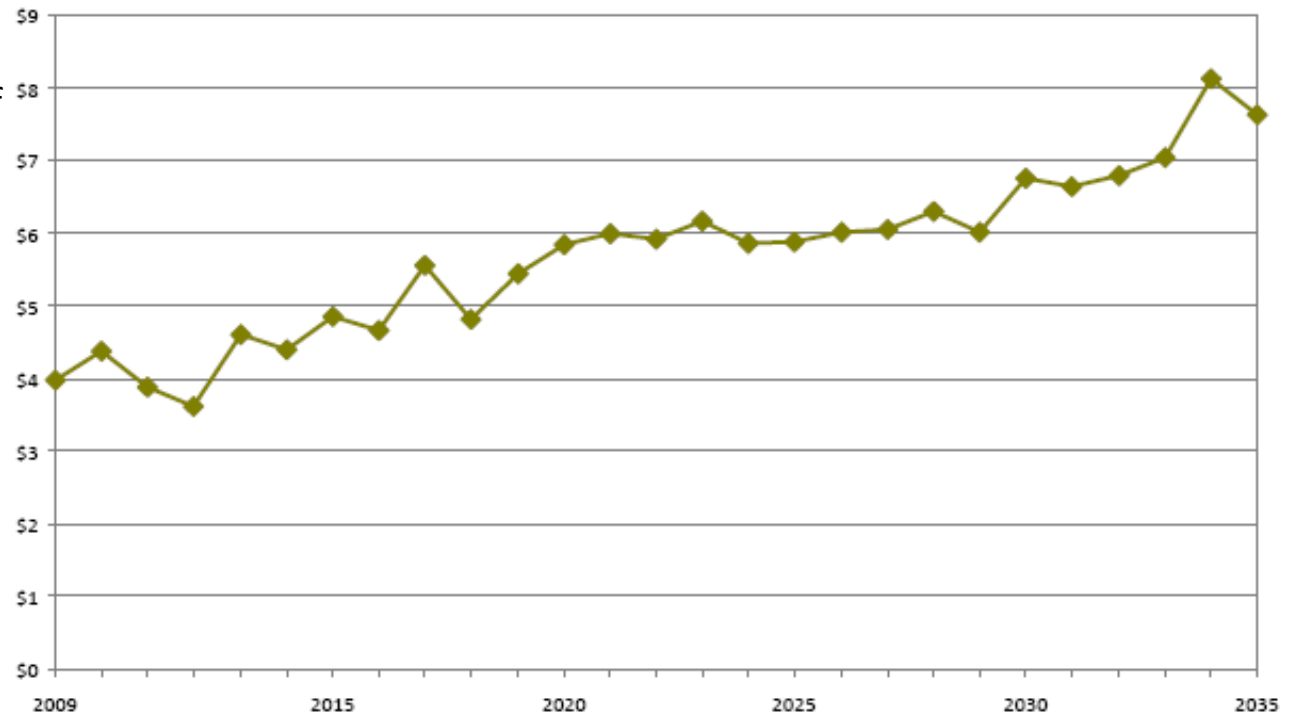
U.S. and Canada Shale Gas Production, Bcf/d



Gas Prices Likely to Remain Between \$5.00 to \$7.00 Into 2030

- Henry Hub natural gas prices are projected to average between \$4 and \$7 per MMBtu throughout much of the projection.
- Robust growth in gas demand will eventually apply upward pressure on gas prices.
- \$5 to \$7 gas prices are sufficient to support the levels of supply development in the projection, but not so high as to discourage market growth.

Gas Prices at Henry Hub (2010\$/MMBtu)



Source: ICF Estimates, 2012

Pending Environmental Regulations

- Utility Regulations
 - Air Emissions
 - **Mercury and Air Toxics Standards (MATS)**
 - **Cross-State Air Pollution Rule (CSAPR)**, formerly “Transport Rule”
 - Water/Solid Waste
 - **Cooling Water Intake Structures (CWIS)**, aka “316b”
 - **Coal Combustion Residuals (CCR)**, aka “ash rule”
- Industrial/Commercial/Institutional (ICI) Boilers
 - **ICI Boiler NESHAPS** (National Emissions Standards for Hazardous Air Pollutants), aka :**Boiler MACT**”