The Re-emergence of Combined Heat and Power (CHP)

PRESENTED TO

NRRI Teleseminar

PRESENTED BY

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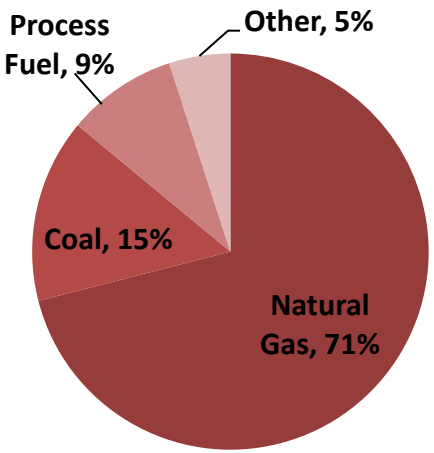
August 27, 2014

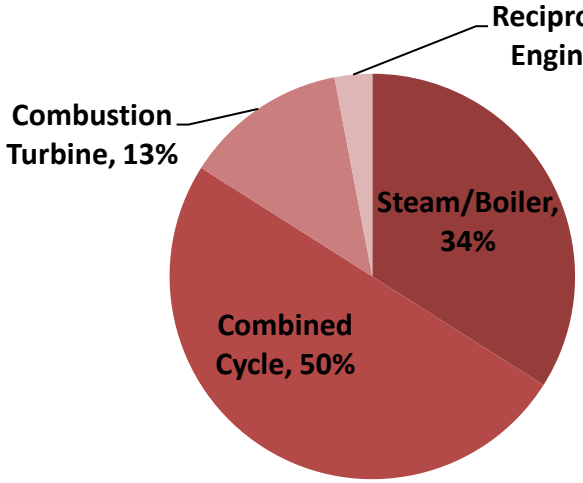
THE Brattle GROUP

CHP accounts for some 8 percent of installed generation capacity in the US

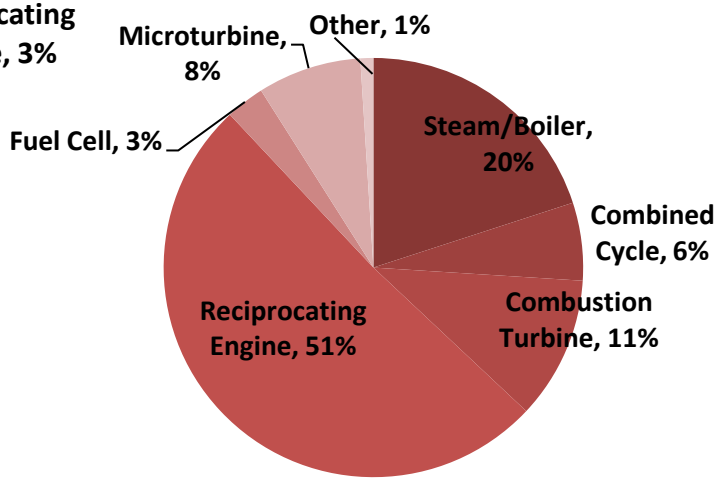
Fuel Inputs



Technology (Capacity)



Technology (Sites)



Average Retail Electricity:	$0.12/kWh
Natural Gas:	$4/MMBtu

Source: EIA, 2014

CHP Capacity:	82 GW
Total Generation:	1,051 GWh

Source: ICF, 2013 and EIA 2011

CHP is experiencing a re-emergence

Largest CHP Users

- Chemicals (24.3 GW, 275 sites)
- Petroleum Refining (15 GW, 108 sites)
- Pulp and Paper (11.3 GW, 232 sites)
- Food Processing (6.2 GW, 247 sites)
- Commercial/Institutional (10.7 GW)

Source: ICF International, 2013

Policy Status

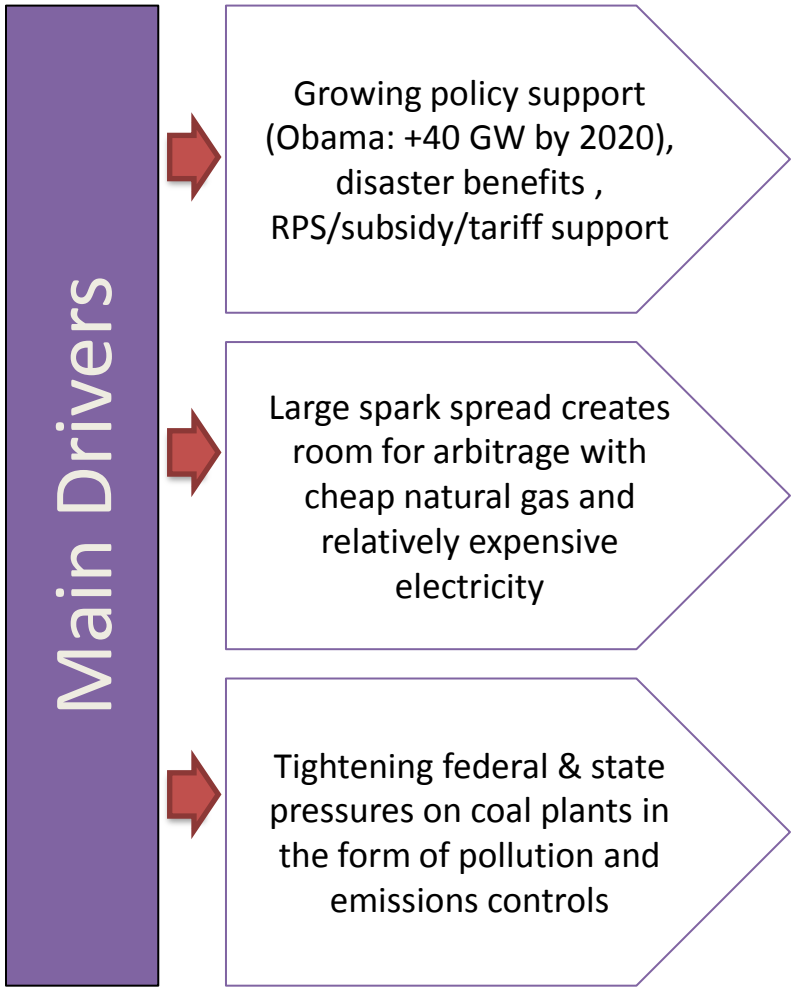
Accelerated depreciation (5 years)

Interconnection standards for projects under 20 MW

10% federal tax credit for CHP < 50 MW

Various state tax credits, grants, loans, renewable requirements, efficiency standards

Source: Database of State Incentives for Renewables & Efficiency, 2014



Source: The International DHC/CHP Collaborative, 2008

Texas leads the nation in CHP

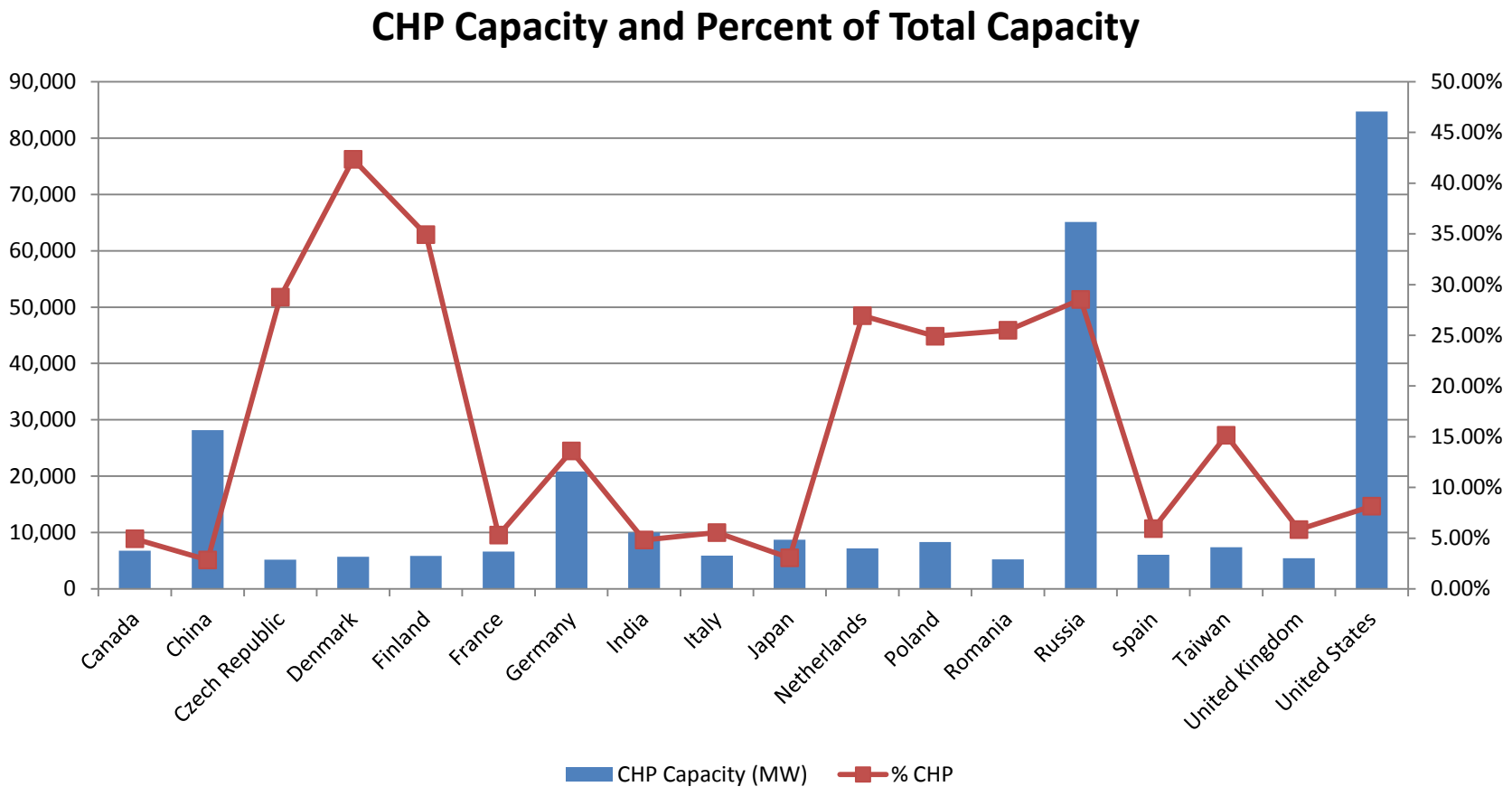
There is some 17.5 GW of capacity in Texas, out of the US total of 82 GW

- The petrochemical industries account for 16.6 GW of the 17.5 GW

In a study for the Mitchell Foundation, Brattle estimated that there is an untapped potential of 11.3 GW in Texas, of which 8.6 GW resides in petrochemicals

- The untapped potential rises to 15.8 GW in 2017and reaches 20.2 GW by 2032

In absolute terms, the US leads the world in CHP capacity but not in percentage terms



Source: IEA, 2005

Source: IEA Country Scorecards, 2007-2011

CHP's importance will rise in the future

The US government has set a goal of raising the installed CHP capacity by 50 percent by 2020

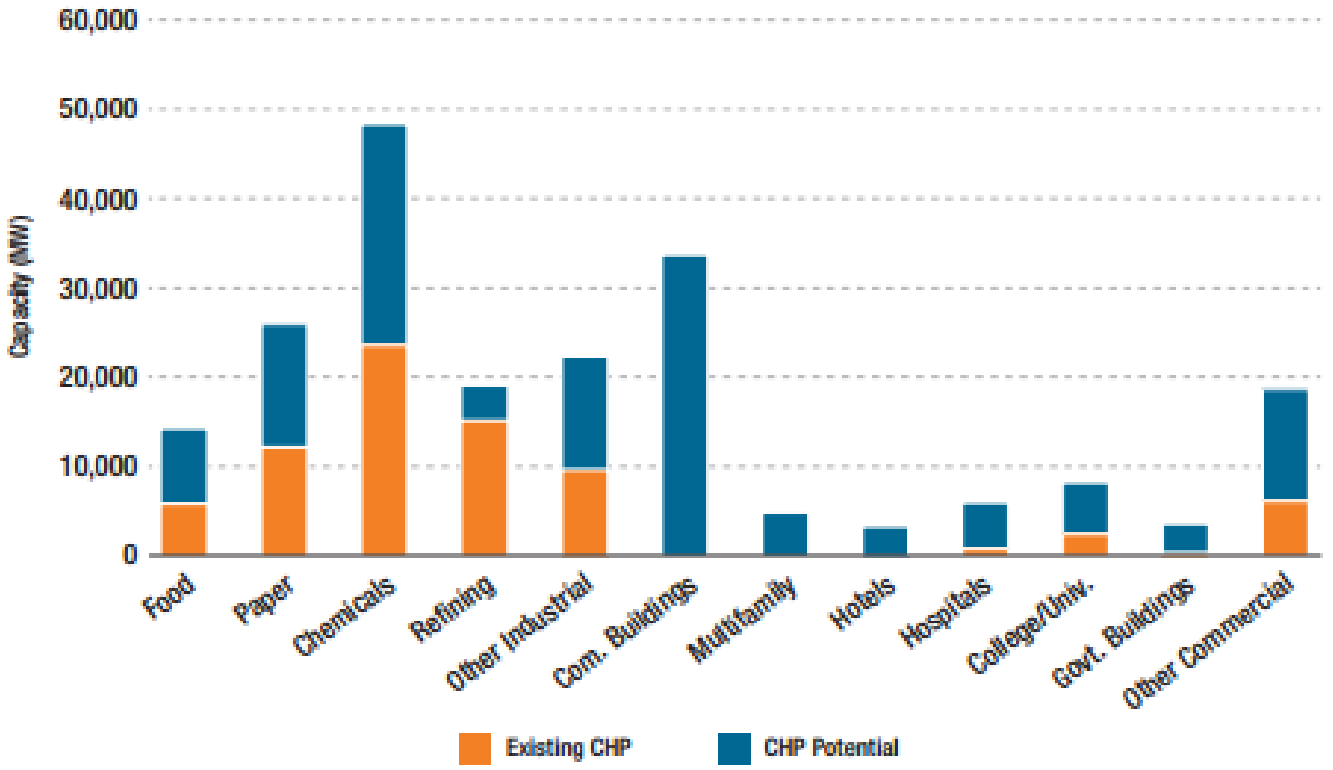
- Studies suggest that CHP's technical potential is about 130 GW and that the economic potential is 50 GW

While it is true that CHP has been around a long time, other kinds of self-generation may arise to augment it

- Incentives for solar PV and push to renewable sources
- Growth of battery technology, micro grids and fuel cells

Much of the technical potential for CHP resides in commercial buildings

FIGURE 7 | Technical Potential for Additional CHP at Existing Industrial and Commercial Facilities[20]



Source: US Department of Energy and US Environmental Protection Agency, *Combined Heat and Power: A Clean Energy Solution*, August 2012

A recent survey revealed differences in the way that utilities are engaging with CHP

Some utilities are wary of CHP because it will erode their customer base and revenues

Other utilities have found ways to accommodate CHP

While some others are seeking ways to turn CHP into an opportunity

Some utilities are wary of CHP

- Utility A: A tariff for high (> 90%) load factor customers discourages CHP
- Utility B: Real time pricing lowers the cost of electricity and makes CHP less attractive
- Utility C: Has ratcheted demand charges and exit fees which act as a disincentive for customers to install CHP
- Utility D: Petroleum Refineries had ‘formally explored’ leaving the grid but exit fees caused them to stay
- Utility E: Sought to deter CHP through a standby tariff but the request was denied by the state commission

Other utilities have found a way to accommodate CHP

- Utility F: >10 MW CHP customer had enough self-generation capacity and negotiated a special rate but stayed on the grid for standby electricity
- Utility G: One customer emphasized that CHP can also be unreliable, needed to be grid-connected
- Utility H: Has an ice storage facility with 1.3 MW of solar capacity but is still reliant on the utility for peak demand
- Utility I: A data center customer substitutes grid power with ‘backup generation’ when prices are high, but stays grid connected for regular usage

While some utilities are seeking to turn CHP into an opportunity

- Utility J: Charge standby rates for customers with CHP that still want to be on the grid
- Utility K: Dispatch CHP during peak times and provide interruptible rates
- Utility L: Buys solar energy from a third party that installed and manages solar panels on site for a customer and sells it back to the customer
- Utility M: Customer installs standby generator for backup but utility pays for fuel, runs and maintains generator
- Utility N: Co-owns CHP plant on customer site; utility sells energy to customer and is able to dispatch generation
- Utility O: Uses CHP to meet its state-mandated energy efficiency goals

Solar PV is part of the future of CHP

- Extensive incentives for solar PV, the decreasing cost of solar panels, green labeling, and (to come, new battery technologies) are increasing the uptake of solar PV
- Utility P:
  - New hospital building with roof designed for solar installation
  - Large retailer interest in power from third-party owned solar panels on roofs
- Utility Q: Manufacturing company installed 3MW wind turbines to allow product to be branded as ‘green’

The full potential of CHP won't be realized without utility engagement

Utilities have begun giving serious consideration to CHP and are asking three questions

- What is the market potential of CHP in my service area?
- Should I modify my tariffs to make CHP an attractive proposition for me and my customers?
- Should I consider investing in customer-located CHP facilities?

Commissions will have to make suitable modifications to the appropriate regulations for CHP to become a win-win opportunity for utilities, consumers and society as a whole

Presenter Information

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Dr. Ahmad Faruqui helps develop customer-focused competitive business and regulatory strategies for utilities. He has testified before a dozen regulatory commissions and legislative bodies and worked for several dozen utilities around the globe. He has also worked for the Alberta Utilities Commission, the California Energy Commission, the Edison Foundation, the Electric Power Research Institute, the Federal Energy Regulatory Commission, the Ontario Energy Board, the Ontario Power Authority and the World Bank. His work has been cited in *The Economist*, *The New York Times*, *Wall Street Journal*, *Washington Post* and *USA Today.* He has appeared on Fox Business News and National Public Radio. The author, co-author or editor of four books and more than 150 articles, he holds a Ph.D. in economics from The University of California at Davis and B.A. (Hons.) and M.A. degrees in economics from The University of Karachi, Pakistan.