

BUILDING A WORLD OF DIFFERENCE

4 March 2016

**CHP FOR WWTF
RELIABLE, RESILIENT AND EFFICIENT
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AGENDA

CHP and Market Landscape

CHP Outlook for WWTF

Evolving Distributed Generation

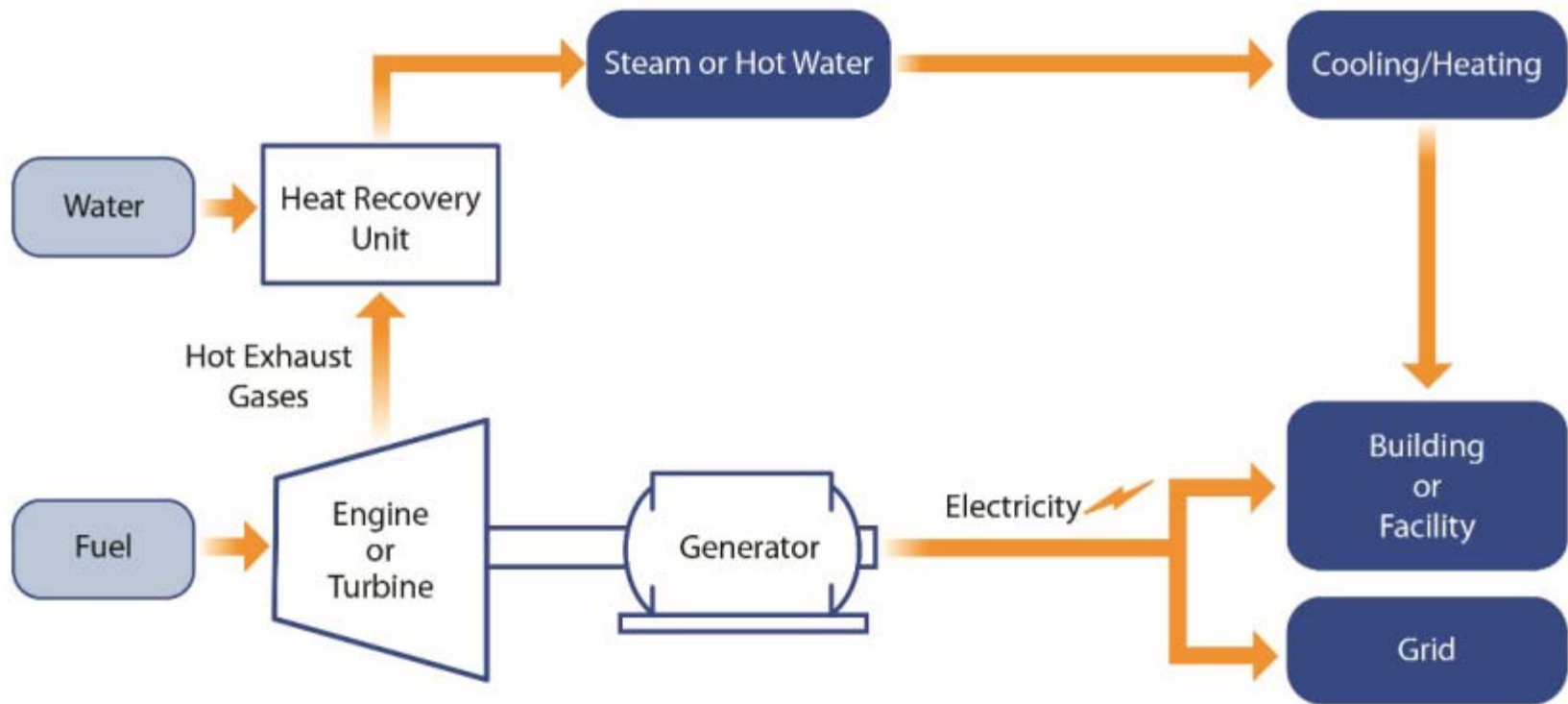
Electric Utility Involved DG

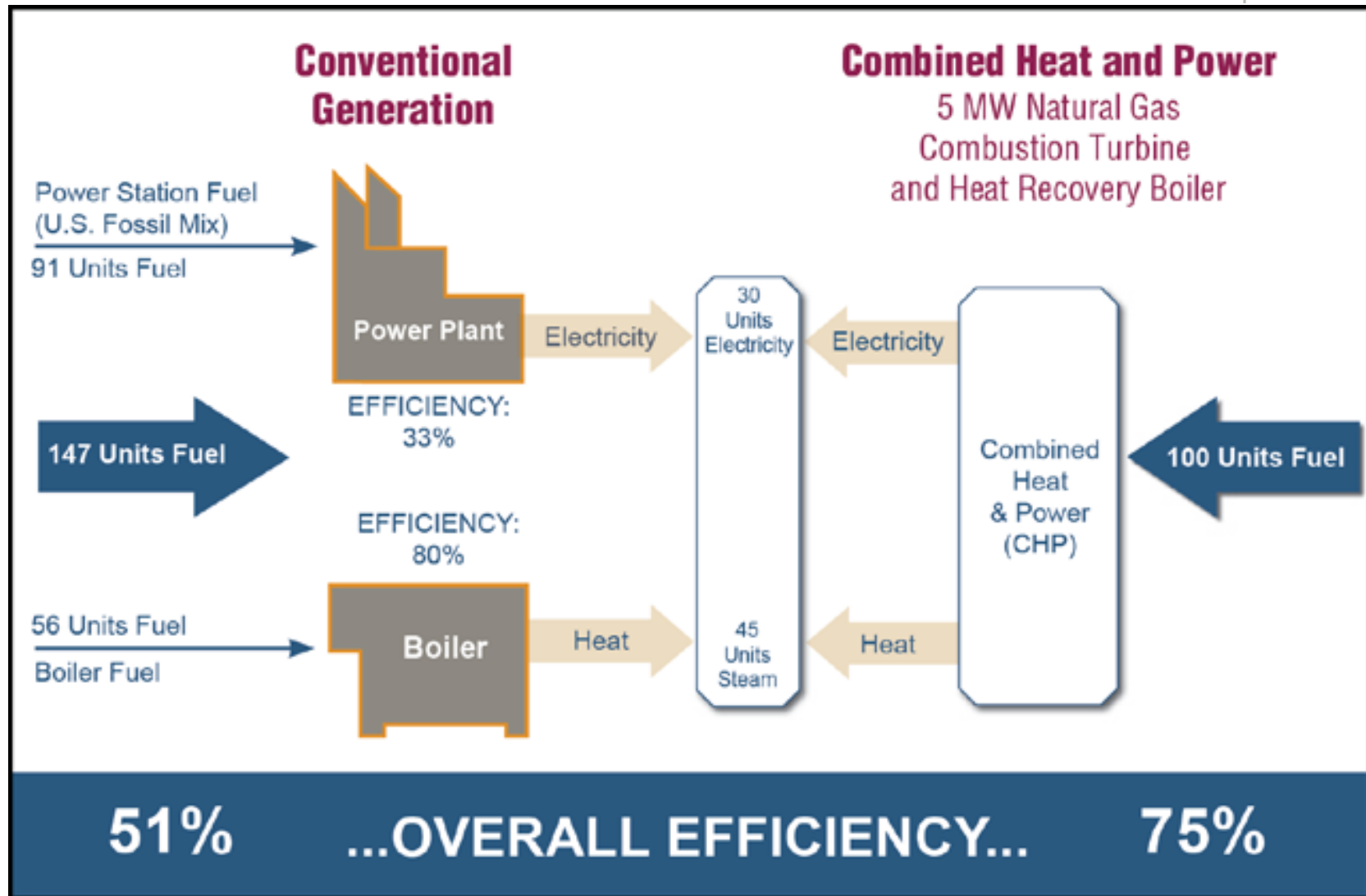


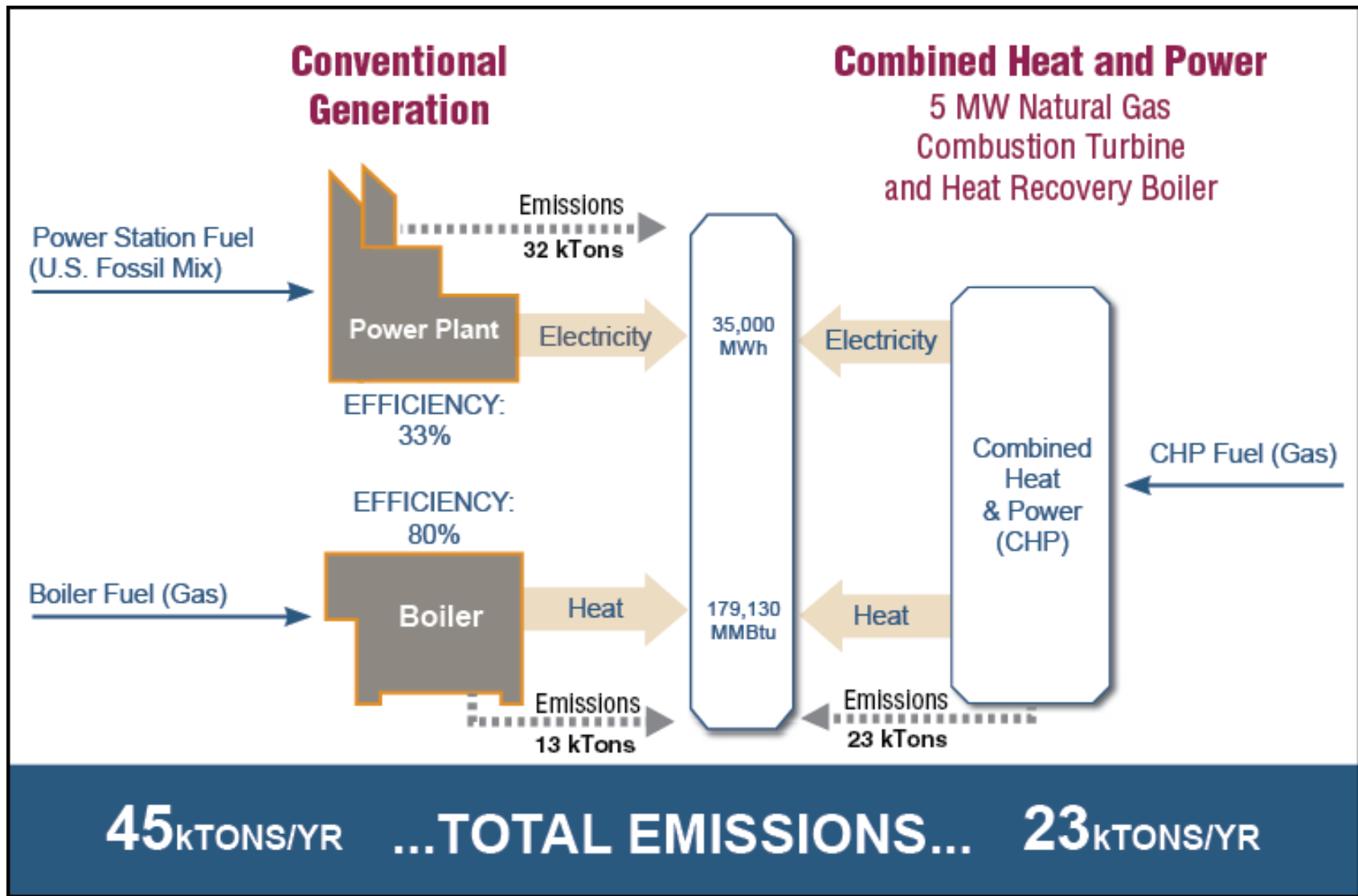
CHP AND MARKET LANDSCAPE



Figure 1: Typical Reciprocating Engine/Gas Turbine CHP Configuration (Topping Cycle)





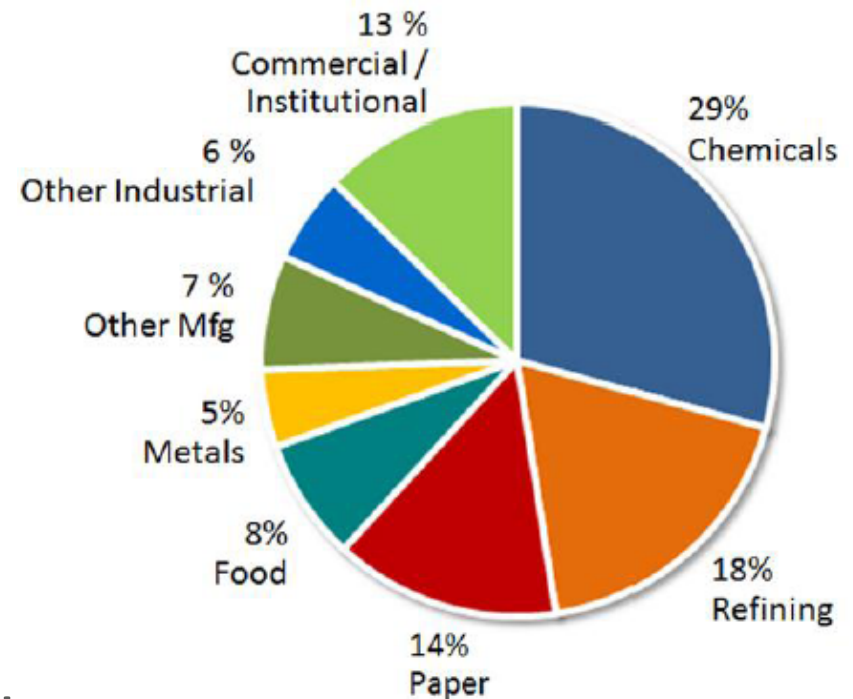


CHP Partnership

- <https://www.epa.gov/chp>
 - Calculating CHP Emissions Reductions
 - CHP Emissions Calculator(xls)

CHP CURRENT LANDSCAPE

- Most CHP owned by non-utility sector
- 82 GW of CHP capacity at more than 4,100 industrial and commercial facilities
- Approximately 8% of current U.S. generating capacity and more than 12% of total MWh generated annually
- According to IDEA, District energy CHP systems in cities and university campuses represent approximately 5 GW of installed CHP



Source: "CHP Installation Database." ICF International. www.eea-inc.com/chpdata/index.html.

2012 Presidential Executive Order: National Goal of 40 GW of new CHP installed by 2020



CHP OUTLOOK FOR WWTF

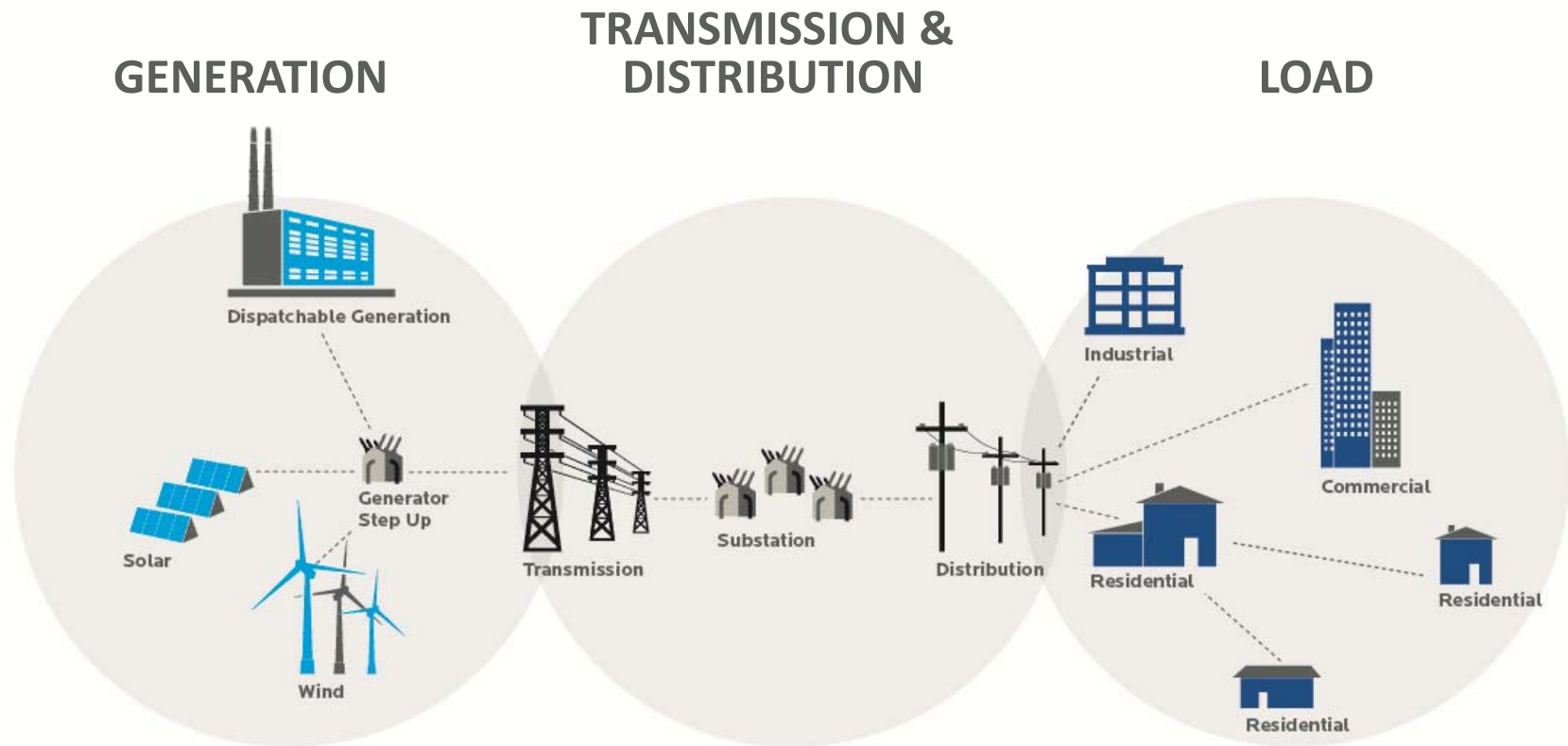
- 1 MGD Influent = 26 kW & 2.4 mmBtu/day (if Digestion associated with Facility)
- US WWTF Potential
 - 1,351 WWTFs w/anaerobic digesters
 - 15,795 MGD influent
 - 411 MW
 - 37,908 mmBtu/day (with CHP option)
 - @ 100% Utilization, 2.3 MTY of GHG emissions reduction



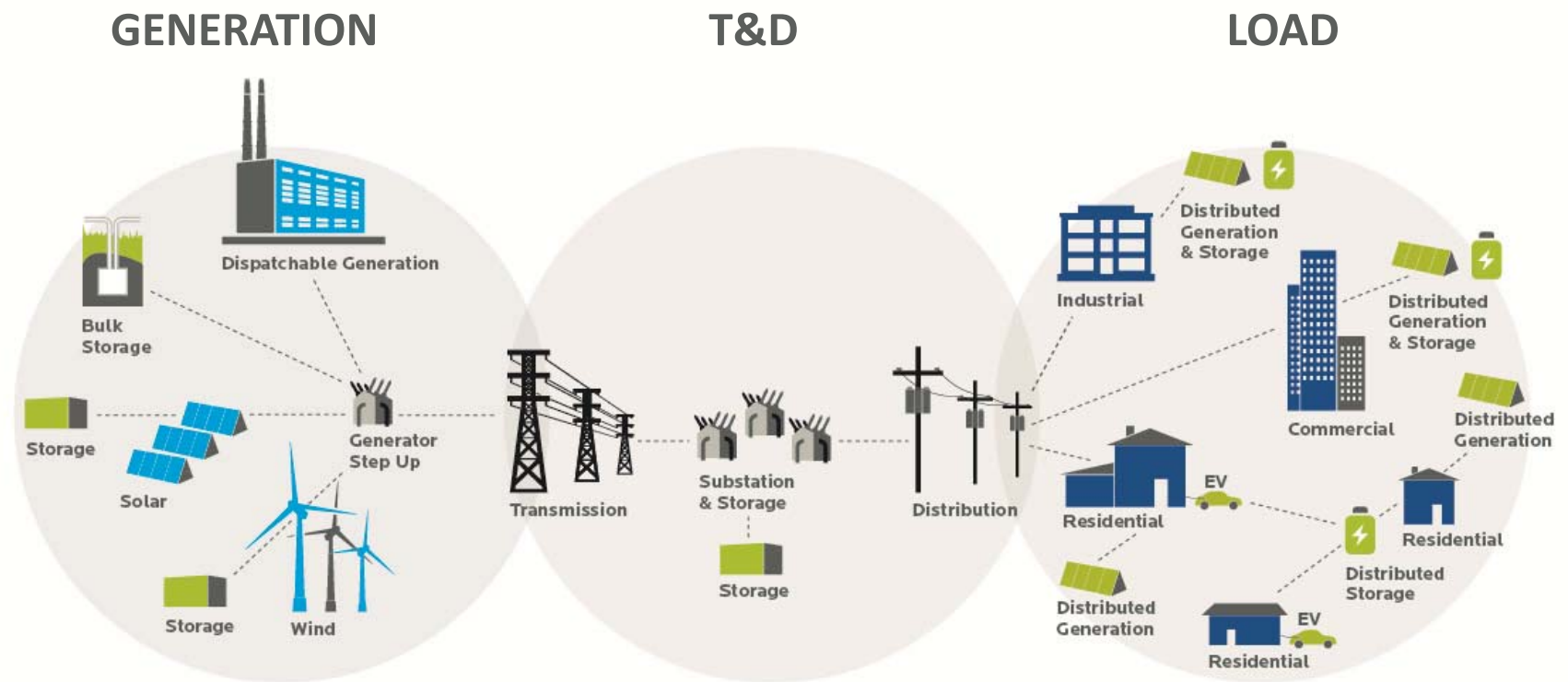
OUR ELECTRICAL UTILITY MODEL IS CHANGING



CONVENTIONAL

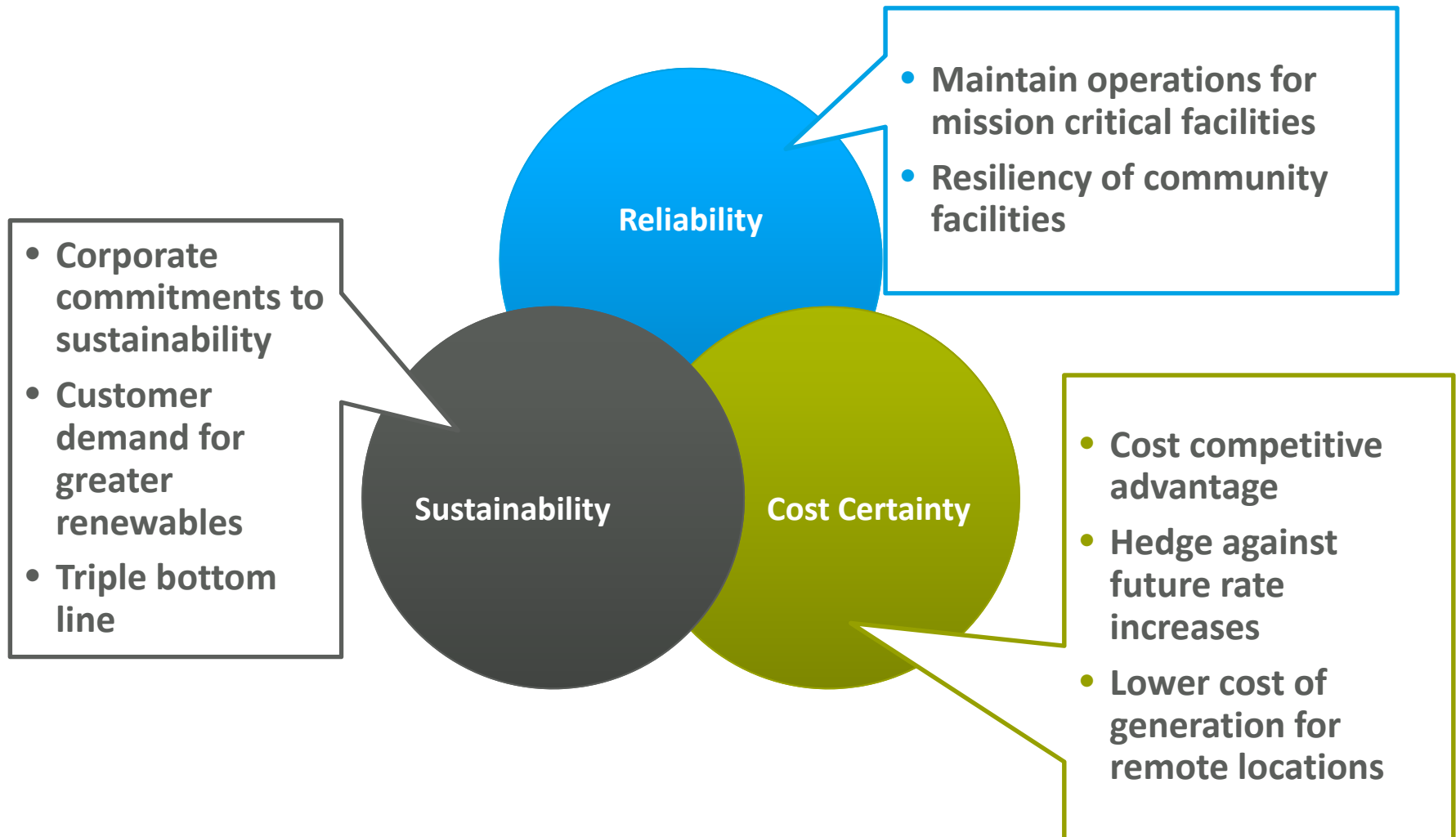


EVOLVING



Convergence of infrastructure, communications and data

CONSUMER DRIVERS



Confluence of Low cost NG, sustainability and reliability



WORLD HQ MICROGRID RENEWABLES – WE BELIEVE IN THEM



Battery Energy Storage System



Rooftop Solar Photovoltaic (PV)



Microturbines



Microgrid Energy Management Application



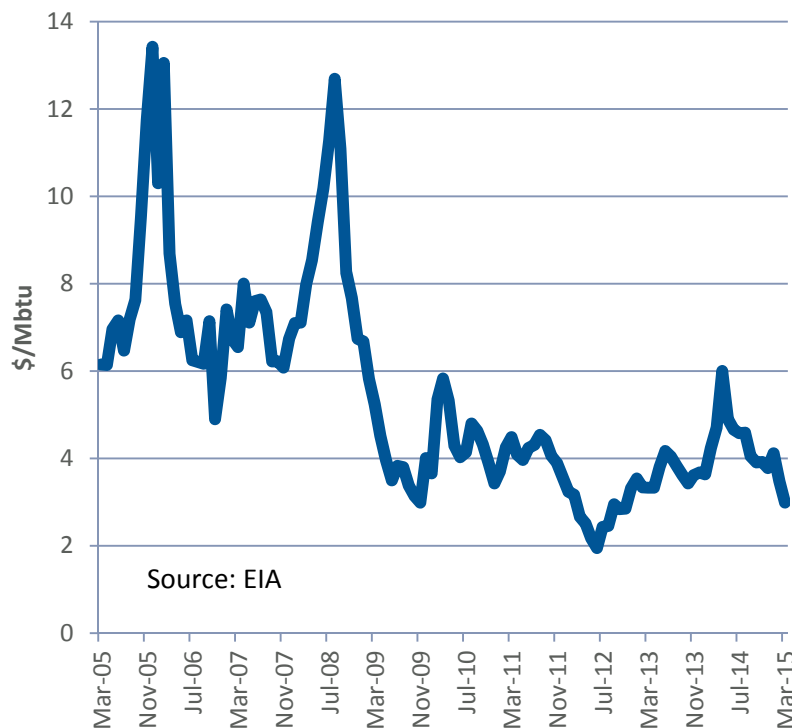
Geothermal



Electric Vehicle Charging Stations



NATURAL GAS PRICES ARE HISTORICALLY LOW AND PROJECTED TO STAY LOW FOR THE LONG-TERM – DRIVER FOR CHP



- **Economic Advantage**
 - CHP projects succeed because of low gas prices
 - High total system efficiency
- **Sustainability Advantage**
 - Lower carbon footprint and CPP ERCs
 - Improved public perception
- **Reliability Advantage**
 - Islanding and microgrids
 - Relieve grid congestion

ELECTRIC UTILITY INVOLVED DISTRIBUTED GENERATION – A SECOND POTENTIAL PATH

- Utility owned / facilitated distributed generation assets, (including CHP) on-site
- Utility brings power generation expertise
- Trusted/Reliable Brand (Partnering)
- High customer satisfaction through reduction in cost and increase in service
- Reliability and resiliency benefits
- Access to Investment Grade Credit – Low Cost of Capital

Growing interest from utilities nationwide



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Together



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