

MoSEP Stakeholder Meeting

Northern Region – October 13, 2021

Combined Heat & Power: A Key Part of Missouri's Energy Future

presented by Jane Epperson

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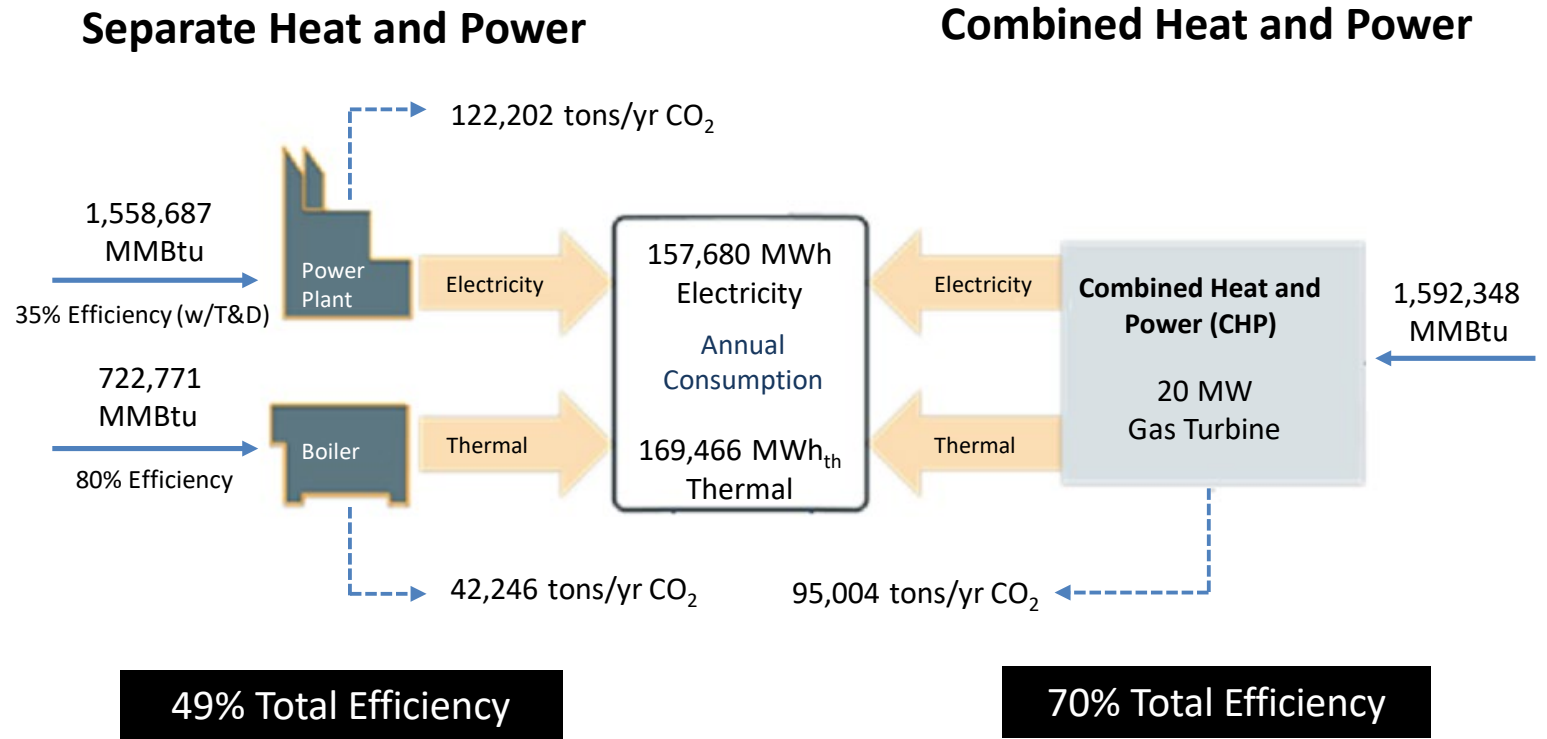
CHP Technical Assistance Partnerships

CENTRAL

CHP Provides both Energy and CO₂ Emissions Savings

20 MW Gas Turbine CHP System

- Natural gas fuel
- 90% load factor (7,884 hours)
- 33.8% electric efficiency
- 73.3 MMBtu/hr steam output
- 100% thermal utilization
- Displaces 80% efficient natural gas boiler
- Displaces EPA AVERT Uniform EE as estimate of marginal emissions



Energy savings: 689,110 MMBtu/yr
 CO₂ Savings: 71,375 tons/yr

CHP directly supports the Core Values of MoSEP planning process

1. Assure secure, **reliable and resilient** energy infrastructure and supplies.
2. Enhance Missouri's **competitive** position in business retention, expansion and attraction through affordable rates and **renewable** energy options.
3. Develop **diverse** in-state energy resources.
4. Create opportunities for energy-related **technological innovation** and workforce development.
5. Ensure affordability and **equity** in access to energy resources, services and programs.
6. Promote the **efficient and environmentally sound** use of energy.

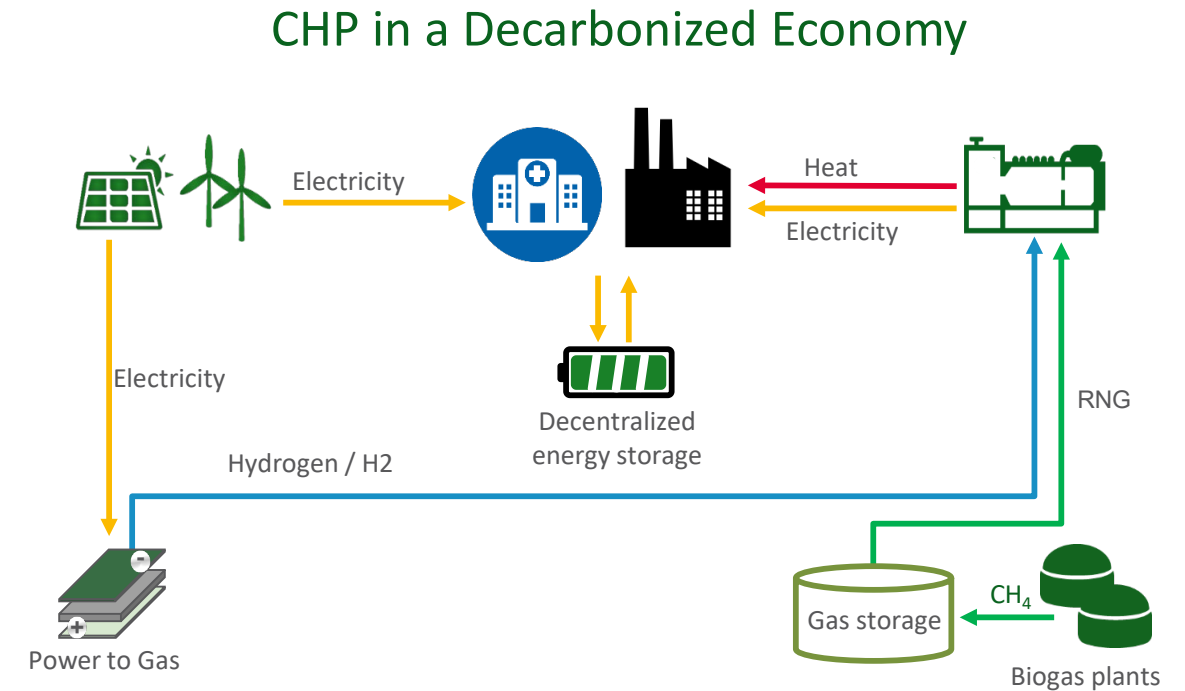
[Summary and Action Report](#)

CHP Benefits the Six Core Values of the MoSEP Process

- CHP is 25 – 35% overall more energy efficient than separate generation of electricity and heating/cooling (2,6)
- NG-fueled CHP reduces pollutant emissions by 50% compared to coal-fueled electric generation (2,4,5,6)
- CHP technology is highly reliable (85-99% available) (1,2,5)
- CHP provides resiliency as a DER and can serve as the heart of microgrid (1,2,4,5,6)
- CHP enables renewable energy growth by serving as baseload (2,3,4,5,6)
- CHP technology is fueled by biogas NOW (2,3,4,5,6)

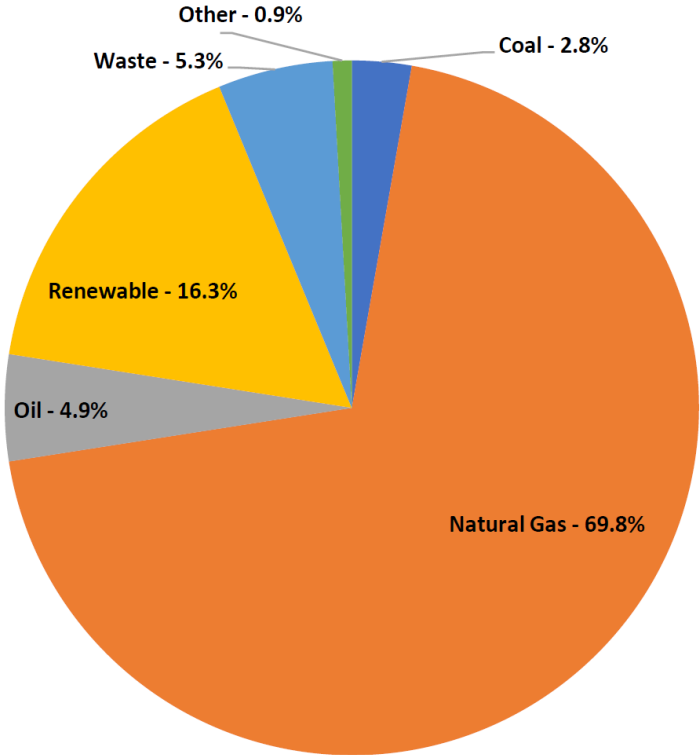
Fuel Flexibility: CHP and Decarbonization

- CHP is fuel flexible - CHP currently uses renewable fuels, low carbon waste fuels, and hydrogen where available, and **will be ready to use higher levels of biogas, renewable natural gas (RNG) and hydrogen as they become available**
- CHP is the **most efficient way to generate power and thermal energy**, and can reduce CO₂ emissions now and in the future
- Renewable/hydrogen fueled CHP can **decarbonize thermal end-uses in industrial and commercial facilities that are difficult to electrify**
- Renewable/hydrogen fueled CHP can **decarbonize critical facilities that need dispatchable on-site power for long duration resilience and operational reliability**
- CHP's high efficiency can **extend the supply of renewable, low carbon and hydrogen fuels**

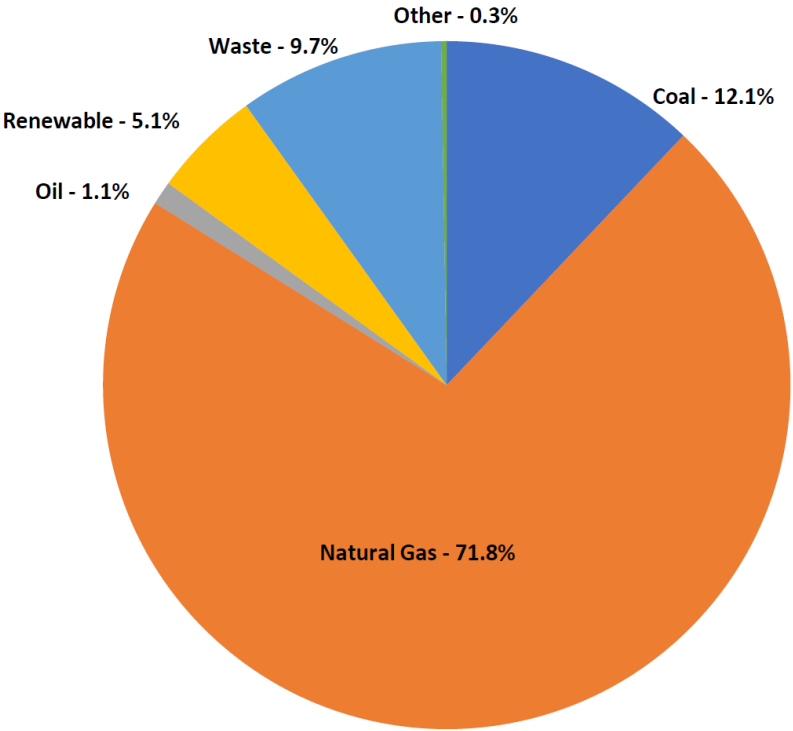


CHP is Fuel Flexible

4,733 Sites



81.6 GW of Capacity



Source: DOE CHP Installation Database (U.S. installations as of August 31, 2021)

CHP, Zero Carbon Fuels and Long Term Decarbonization

Low/Zero Carbon Fuel Feedstocks

- Current CHP products routinely operate on biogas and hydrogen blends, and **all major manufacturers are developing 100% hydrogen capability**
- Renewable/hydrogen fueled CHP can **decarbonize thermal end-uses in industrial and commercial facilities that are difficult to electrify**
- Renewable/hydrogen fueled CHP can **decarbonize critical facilities that need on-site power for long duration resilience and operational reliability**
- CHP's high efficiency can **extend the supply of renewable and low carbon fuels**



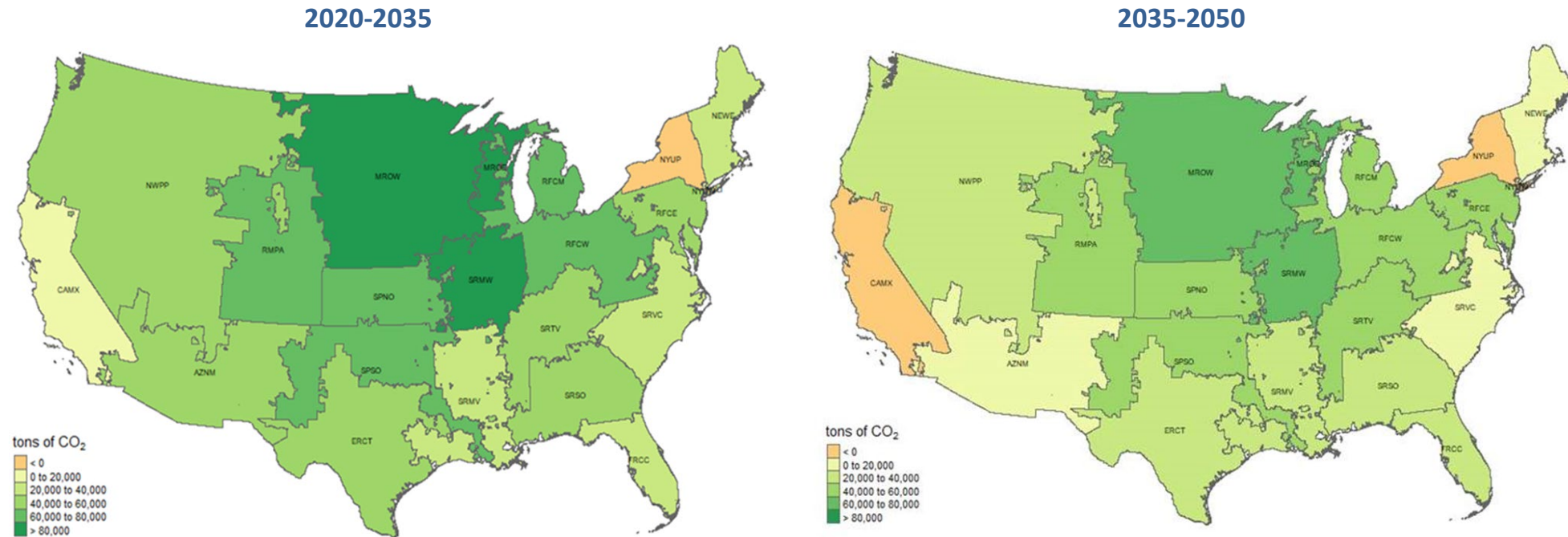
- *Food Waste*
- *Animal manure*
- *Wastewater Treatment (WWTP)*
- *Landfill gas (LFG)*

- *Agricultural residue*
- *Forestry and forest product residue*
- *Energy crops*
- *Municipal solid waste (MSW)*

- *Green Hydrogen from renewable electricity*
- *Blue Hydrogen from natural gas with carbon capture*

Source: AGA Foundation, Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment, 2019

CHP Will Continue to Reduce Emissions in Most Regions of the Country

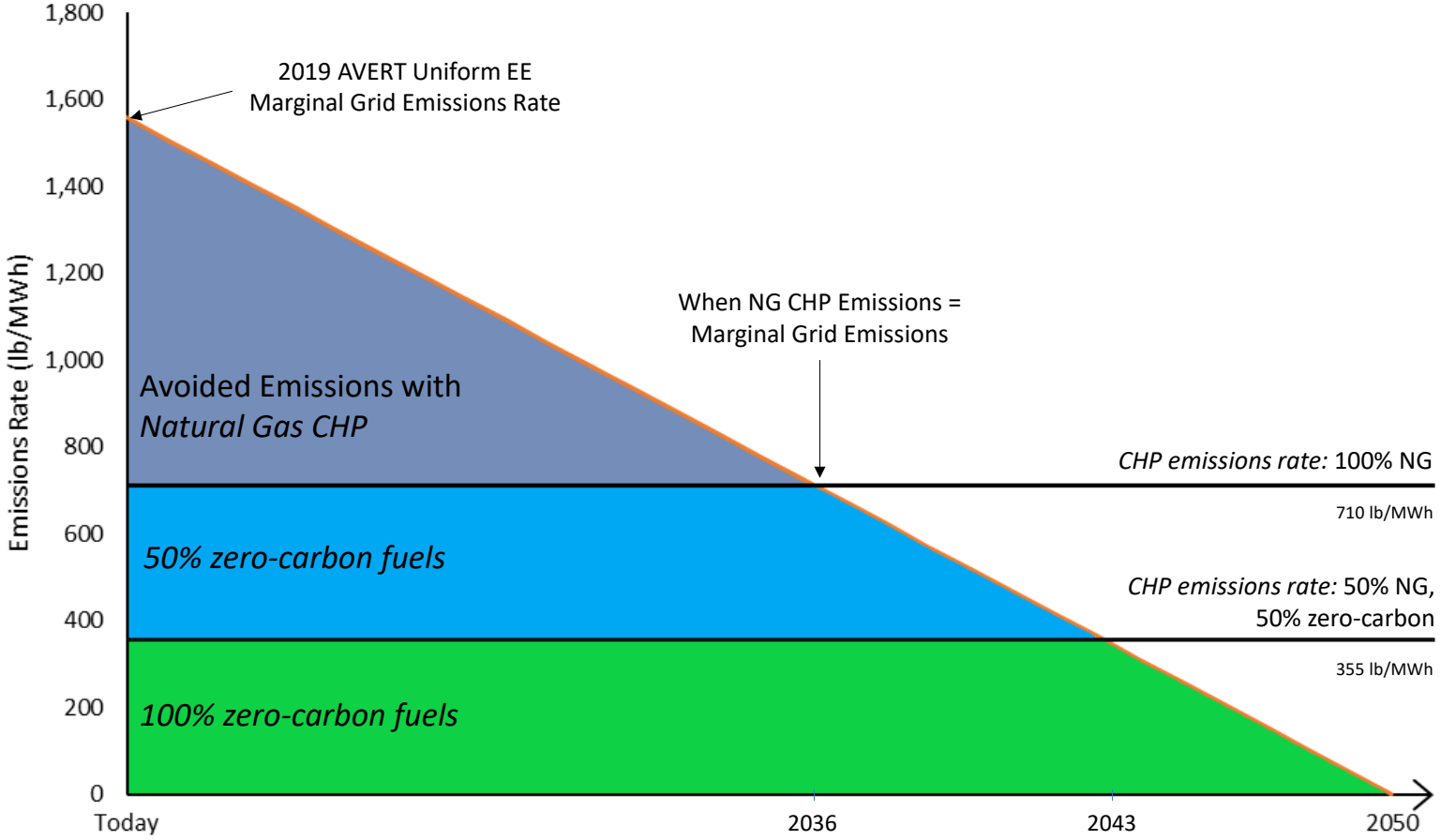


- CHP will continue to reduce emissions in most U.S. locations through 2050
- Emission reduction potential depends on location and timing
- For states with 100% clean/renewable energy mandates, natural gas CHP eventually becomes a net emitter as the grid goes green, but *timing is uncertain*

Source: “Combined Heat and Power Potential for Carbon Emission Reductions”, ICF for Energy Solution Center, July 2020

Renewable and Net-Zero Carbon Fuels Maintain CHP's Advantage

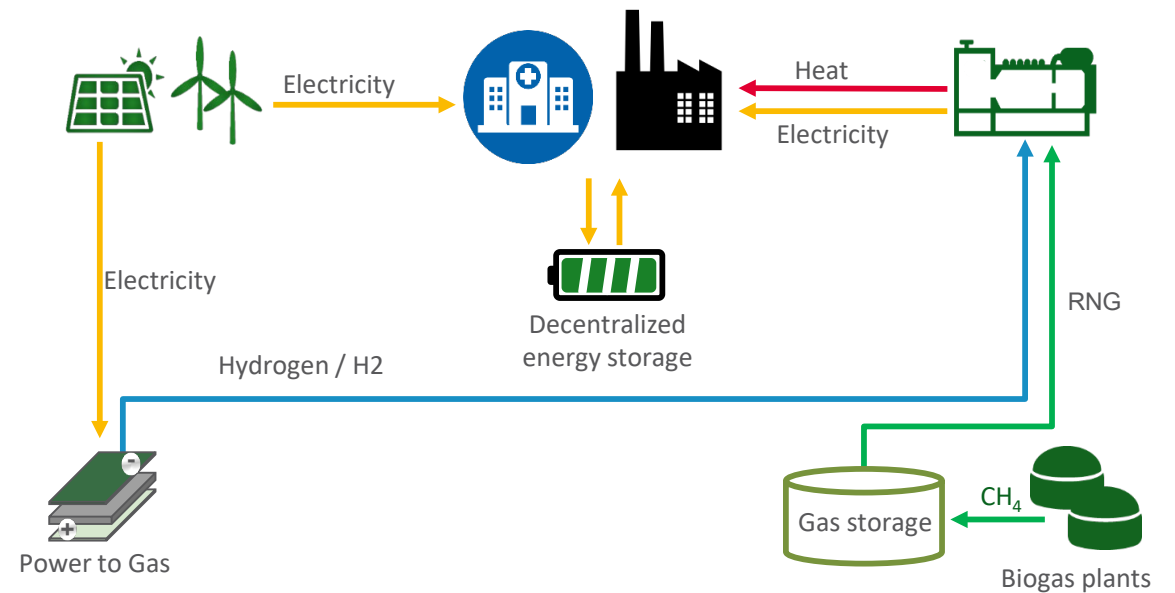
Avoided Emissions with CHP – Now and Into The Future



CHP and Decarbonization

- CHP is fuel flexible - CHP currently uses renewable fuels, low carbon waste fuels, and hydrogen where available, and **will be ready to use higher levels of biogas, renewable natural gas (RNG) and hydrogen in the future**
- CHP is the **most efficient way to generate power and thermal energy**, and can reduce CO₂ emissions now and in the future
- Renewable/hydrogen fueled CHP can **decarbonize thermal end-uses in industrial and commercial facilities that are difficult to electrify**
- Renewable/hydrogen fueled CHP can **decarbonize critical facilities that need on-site power for long duration resilience and operational reliability**
- Renewable/hydrogen fueled CHP offers an **alternative to expensive process conversions to electric technologies**
- CHP's high efficiency can **extend the supply of renewable, low carbon and hydrogen fuels**

CHP in a Decarbonized Economy



Thank You

Jane Epperson

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<https://betterbuildingsolutioncenter.energy.gov/chp/chp-taps>

www.energy.gov/chp



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