

Green Campus Workshop 2023

Rutgers University

Combined Heat and Power (CHP) Integral Role in Decarbonization

May 26, 2023

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U.S. DEPARTMENT OF ENERGY
CHP Technical Assistance Partnerships

Agenda

- DOE CHP TAP Intro
- **CHP Supports Decarbonization**
 - Research Supporting Current CO2 Savings in All States
 - Saving Carbon Now is More Valuable Than CO2 Saved in 5, 7 or 10 Years
 - Low or emissions free alternatives maintain CHPs advantages (and are available)
 - Markedly more equipment and system choices are soon to be available
 - CHP is not technology lock in (several points to re-evaluate operations)
- **CHP Provides Valuable Resiliency Benefits**
 - Certain States and Regions are Facing Increasing Reliability Concerns
 - Ontario IESO's Long Term RFP (LT1): Illustrative Example of New Markets for CHP
- **Financial Drivers including the IRA and the NJ CHP Incentive program**
- **Conclusion: US DOE CHP TAPs wide offering of End-User and Stakeholder Services**



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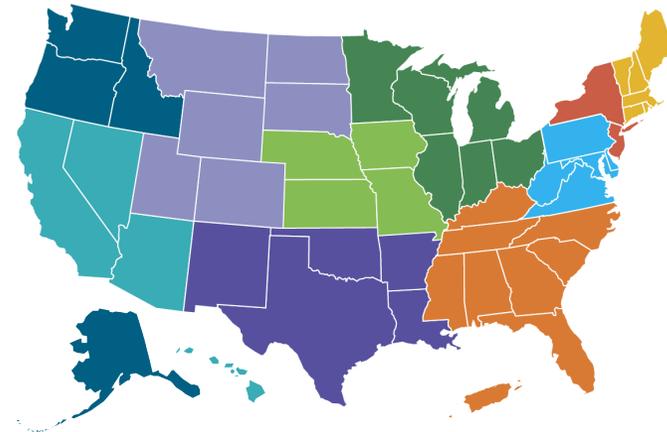
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US DOE CHP Technical Assistance Partnership Services

- **End User Engagement**

Partner with strategic End Users to advance technical solutions using CHP as a cost effective and resilient way to ensure American competitiveness, utilize local fuels and enhance energy security. CHP TAPs offer **fact-based, non-biased engineering support** to manufacturing, commercial, institutional and federal facilities and campuses.

- **Stakeholder Engagement**

Engage with strategic Stakeholders, including regulators, utilities, and policy makers, to identify and **reduce the barriers to using CHP** to advance regional efficiency, promote energy independence and enhance the nation's resilient grid. CHP TAPs provide fact-based, non-biased **education** to advance sound CHP programs and policies.

- **Technical Services**

As leading experts in CHP (as well as microgrids, heat to power, and district energy) the CHP TAPs work with sites to **screen for CHP opportunities** as well as provide advanced services to maximize the economic impact and reduce the risk of CHP from initial CHP screening to installation.



www.energy.gov/chp



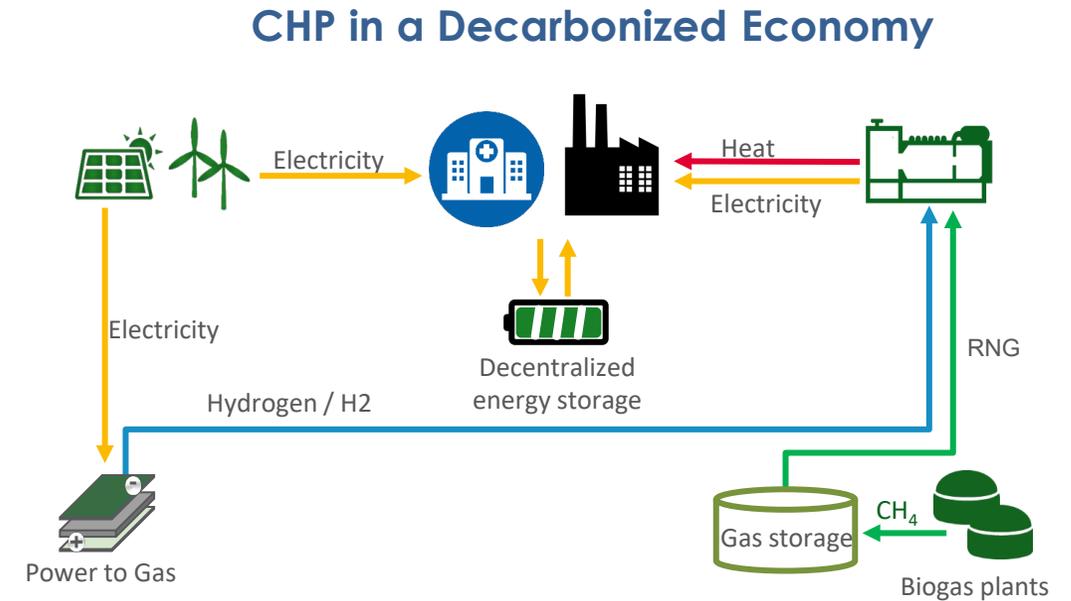
National Manufacturing Day 2019 at the University of Illinois at Chicago



U.S. DEPARTMENT OF ENERGY
CHP Technical Assistance Partnerships

CHP Supports Decarbonization

- CHP is fuel flexible
- CHP is the most efficient way to generate power and thermal energy, and reduces GHG emissions today
- CHP can decarbonize industrial and commercial facilities that are difficult to electrify
- CHP can decarbonize critical facilities that need dispatchable on-site power for long duration resilience
- CHP's high efficiency can extend the supply of renewable, low carbon and hydrogen fuels
- CHP can support the long-run resource adequacy of a highly renewable grid



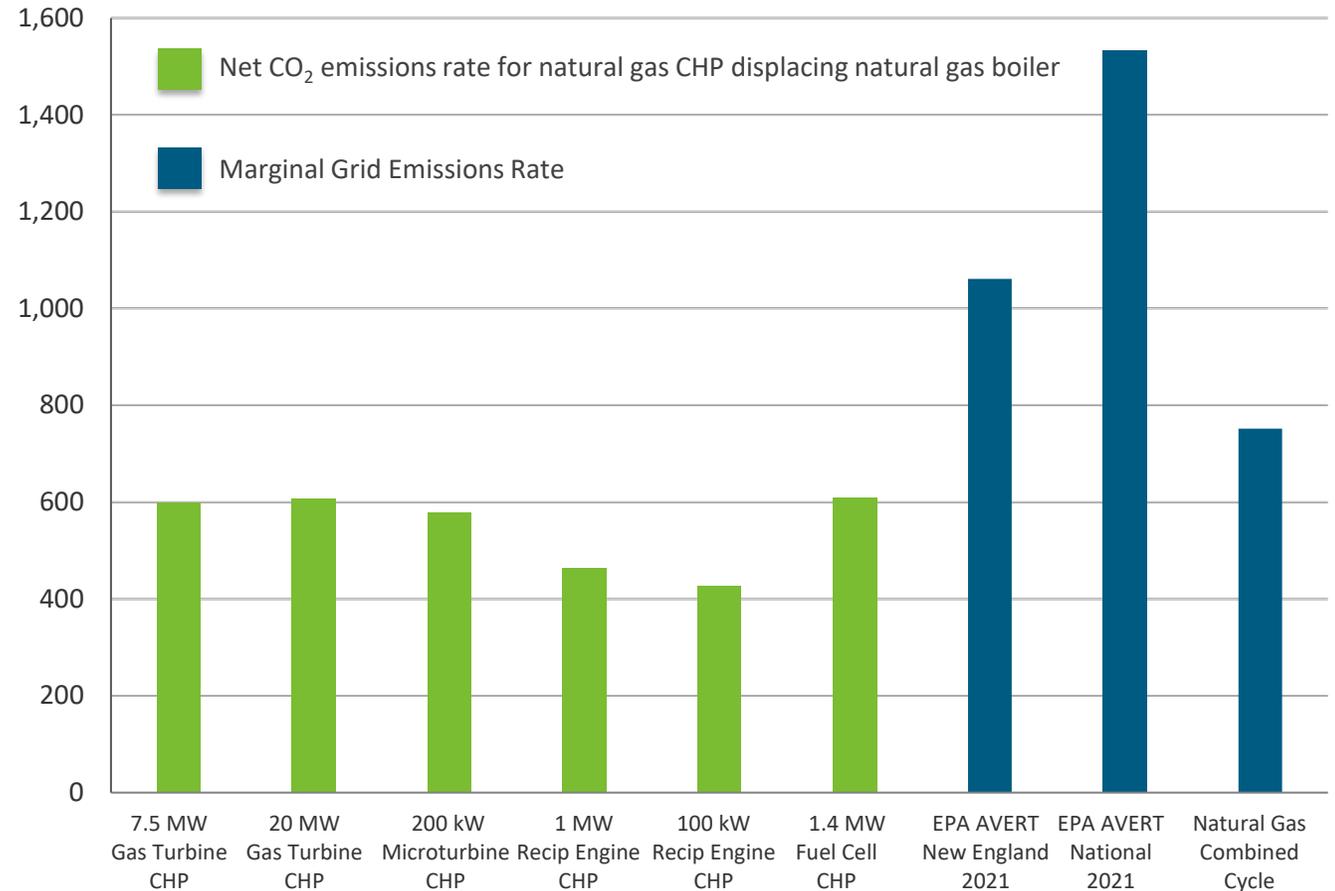
Source: Based on 2G Energy



Natural Gas CHP Emissions vs Marginal Grid Emissions

- Natural Gas CHP systems have lower net GHG emissions in terms of lbs CO₂/MWh than current marginal grid generation
- Natural gas CHP displacing natural gas boilers provides emissions savings as long as the marginal grid emissions rate is greater than 430 to 615 lbs CO₂/MWh
- Current marginal grid emissions factors range from 1,071 lbs CO₂/MWh in New England to 1,925 lbs CO₂/MWh in the Rocky Mountain region based on 2021 EPA AVERT data (1,534 national average)
- Emissions factor for state of the art natural gas combined cycle power generation is 750 lbs CO₂/MWh (including T&D losses)

Net Electric CO₂ Emissions Rate, lbs /MWh



Based on 100% CHP Thermal Utilization

Prepared by: Entropy Research, LLC, 11/1/22

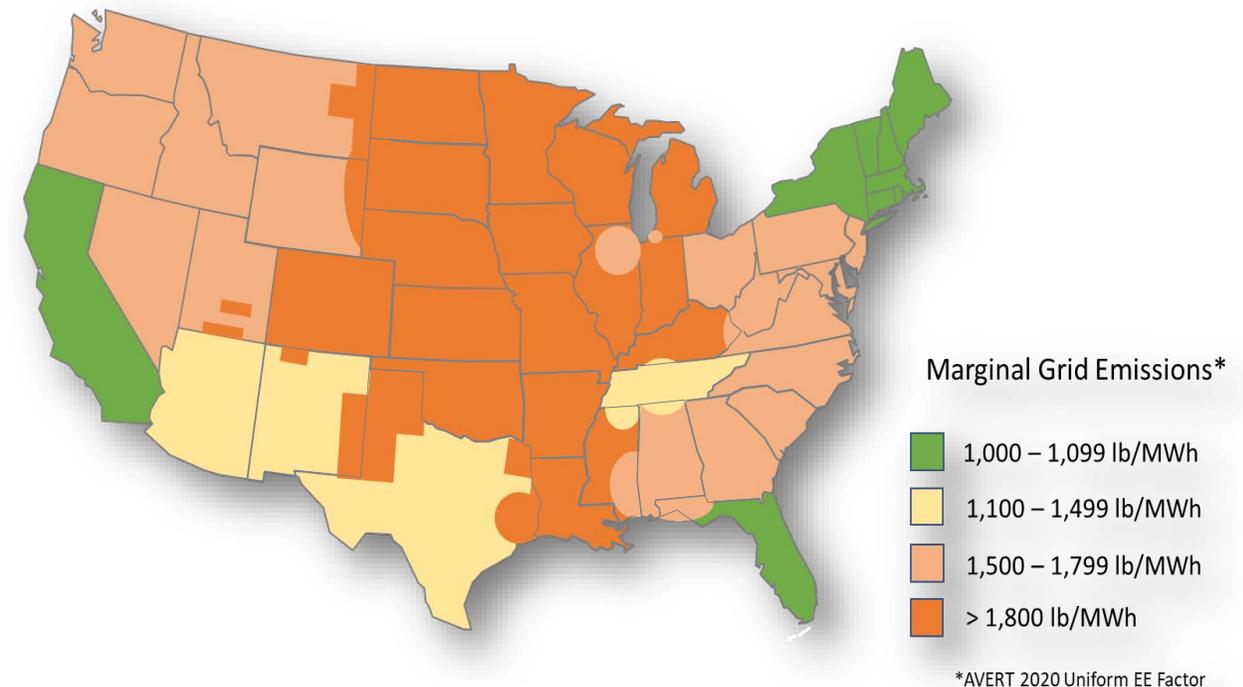


CHP Reduces CO₂ Emissions in All Regions Today

- CHP and renewables displace marginal grid generation (including T&D losses)
- Marginal generation is currently a mix of coal and natural gas in most regions of the US
- CHP's high efficiency and high annual capacity factor currently results in significant annual energy and emissions savings
- *“Because emissions are cumulative and because we have a limited amount of time to reduce them, carbon reductions now have more value than carbon reductions in the future. The next couple of decades are critical.”*

Source: “Time Value of Carbon”, Larry Strain, Carbon Leadership Forum, April 2020

Regional Marginal Grid Emissions Factors
based on EPA AVERT 2021



CHP's High Efficiency Saves CO₂ Emissions Today

- CHP and renewables **displace marginal grid generation (including T&D losses)**
- Marginal generation is **currently a mix of coal and natural gas** in most regions of the US
- **CHP is a low carbon resource**, not a zero-carbon resource like PV & Wind, but it reduces grid carbon by displacing higher marginal emission sources
- **CHP's high operating efficiency and high capacity factor** enables it displace more marginal grid generation and reduce more CO₂ than the same capacity of zero carbon wind or PV

Category	Natural Gas CHP	Utility Solar PV	Utility Wind	Biogas CHP
Capacity, MW	1.1	1.1	1.1	1.1
Annual Capacity Factor	80%	24.3%	34.3%	80%
Annual Electricity, MWh	7,709	2,342	3,305	7,709
Annual Thermal Provided, MWh _{th}	8,831	None	None	8,831
Annual Energy Savings, MMBtu	40,834	21,065	29,733	40,834
Annual CO ₂ Savings, Tons	4,019	1,796	2,677	8,114

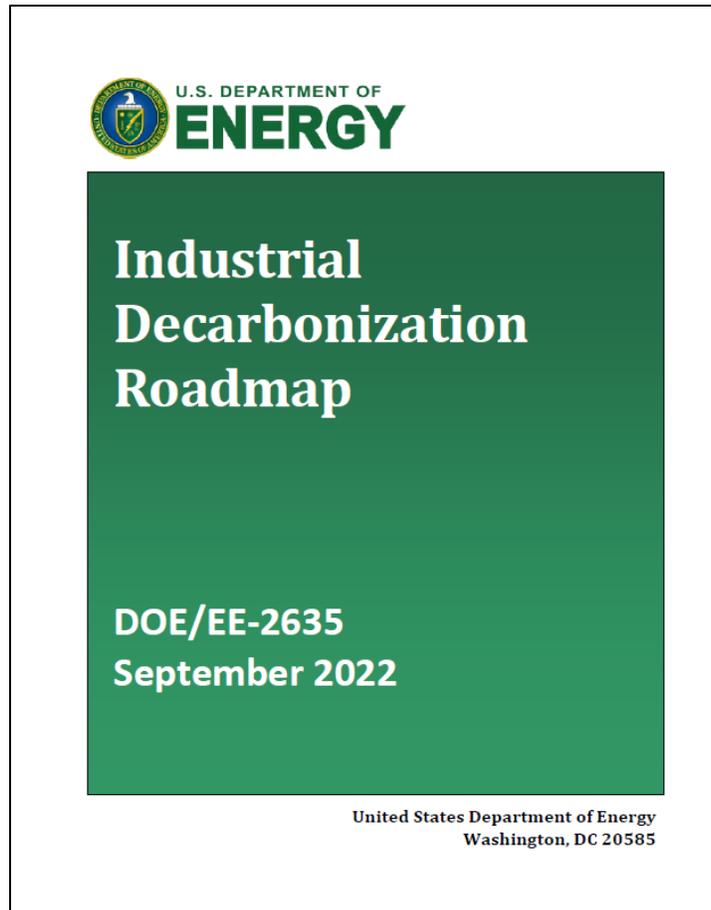
Savings based on EPA AVERT Uniform EE Emissions Factors as a first level estimate of displaced marginal generation

(<https://www.epa.gov/avert>)

Prepared by: Entropy Research, LLC, 7/28/2022



U.S. DOE “Industrial Decarbonization Roadmap”



“The science is clear that significant greenhouse gas (GHG) emissions reductions are needed to moderate the severe impacts of ongoing climate change. **Bold action is needed**, and the Biden Administration has set goals of 100% carbon pollution-free electricity by 2035 and net-zero GHG emissions by 2050.” – *Page 14*

“The U.S. industrial sector is considered a **“difficult-to-decarbonize” sector** of the energy economy, in part because of the diversity of energy inputs that feed into a heterogenous array of industrial processes and operations.” – *Page 14*

Source: <https://www.energy.gov/eere/doi-industrial-decarbonization-roadmap>



Near, Mid-Term and Future Solutions

“Industrial CHP can provide significant GHG emissions reductions in the near- to mid-term as marginal grid emissions continue to be based on a mix of fossil fuels in most areas of the country.”... In the future. RNG and hydrogen fueled CHP systems can be a long-term path to decarbonizing industrial thermal processes resistant to electrification”

Source: US Department of Energy, Industrial Decarbonization Roadmap, Sep. 2022 at 14,

<https://www.energy.gov/sites/default/files/2022-09/Industrial%20Decarbonization%20Roadmap.pdf>



Path to Net-Zero Industrial CO₂ Emissions in U.S. for 5 Carbon-Intensive Industrial Subsectors

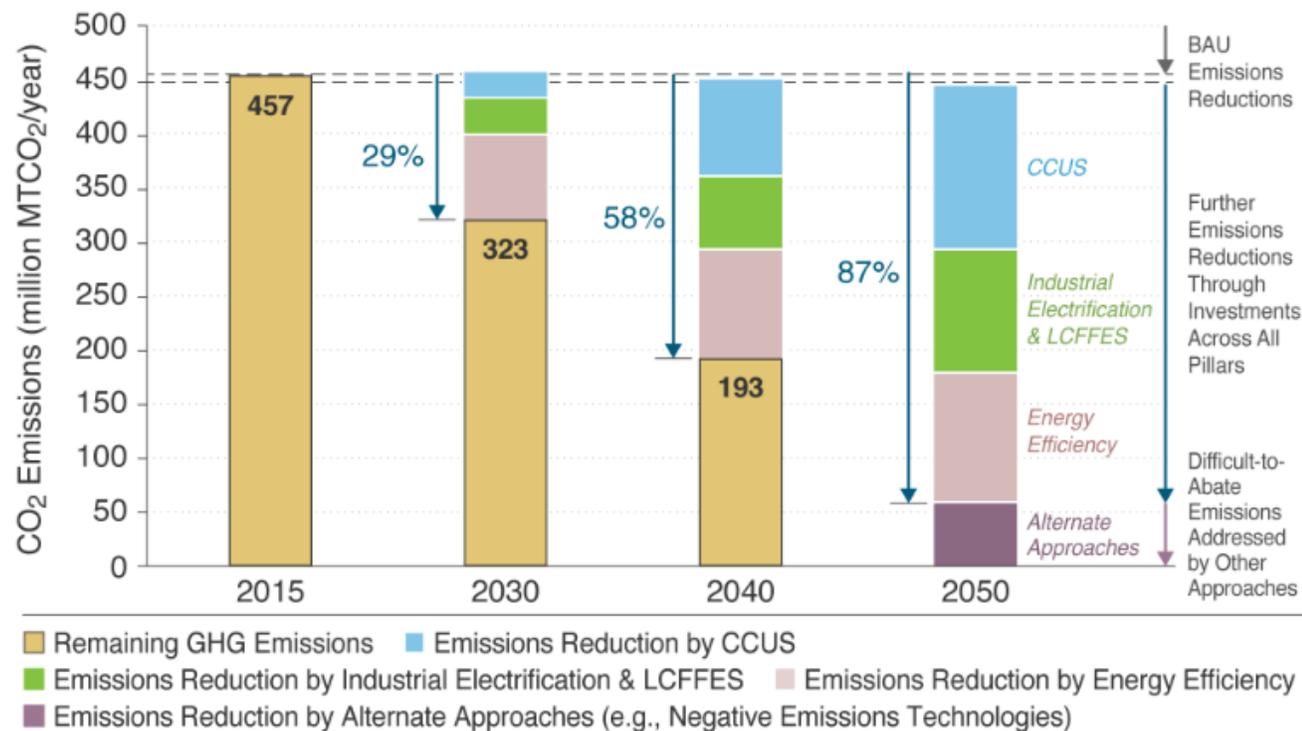


FIGURE ES 1. THE PATH TO NET-ZERO INDUSTRIAL CO₂ EMISSIONS IN THE UNITED STATES FOR FIVE CARBON-INTENSIVE INDUSTRIAL SUBSECTORS, WITH CONTRIBUTIONS FROM EACH DECARBONIZATION PILLAR: ENERGY EFFICIENCY; INDUSTRIAL ELECTRIFICATION; LOW-CARBON FUELS, FEEDSTOCKS, AND ENERGY SOURCES (LCFFES); AND CARBON CAPTURE, UTILIZATION, AND STORAGE (CCUS)). EMISSIONS ARE IN MILLIONS OF METRIC TONS (MT) PER YEAR.

Source: <https://www.energy.gov/eere/doi-industrial-decarbonization-roadmap>



U.S. DEPARTMENT OF ENERGY
CHP Technical Assistance Partnerships

RD&D Needs and Opportunities for the Chemical Industry

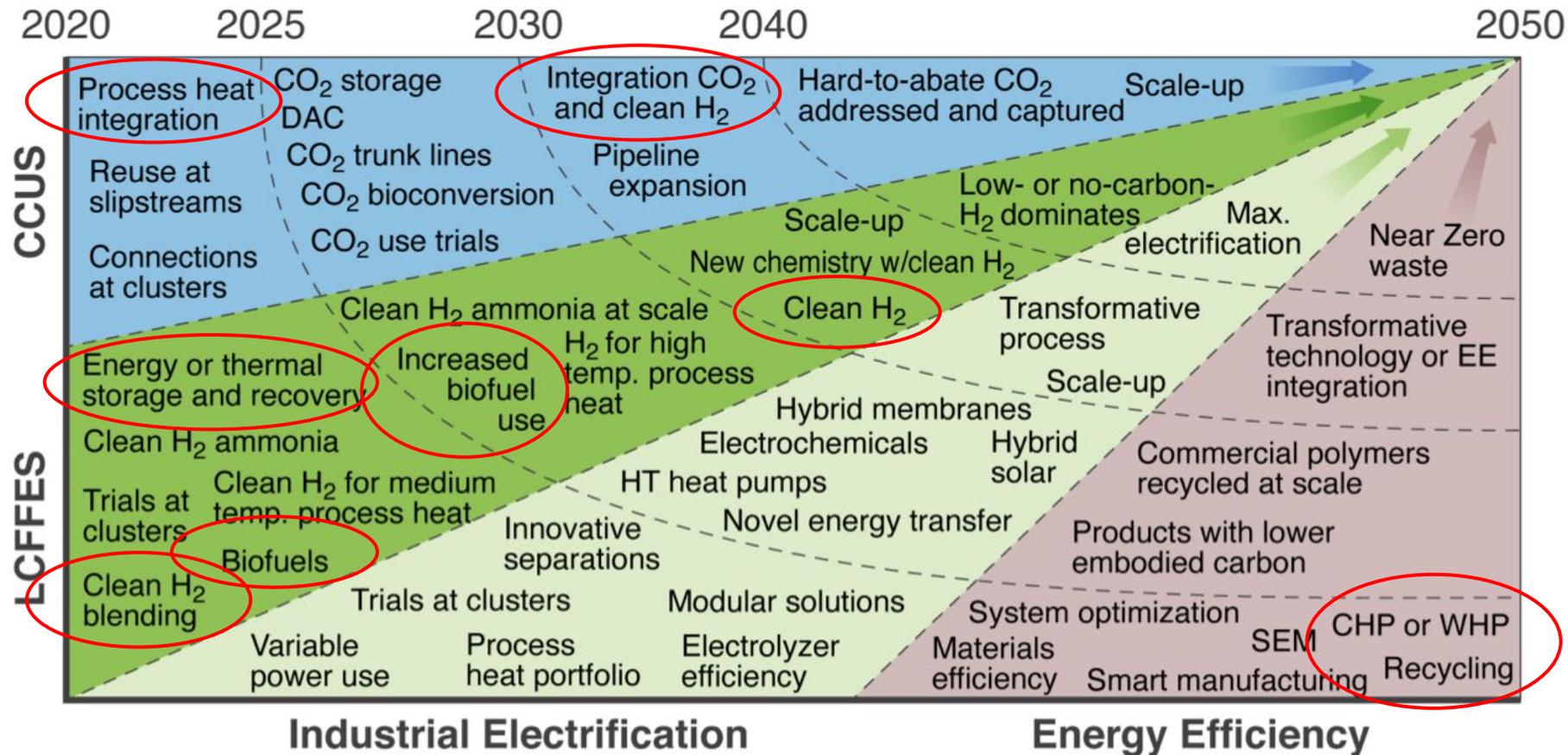


FIGURE 30. LANDSCAPE OF RD&D ADVANCEMENT OPPORTUNITIES BY DECADE AND DECARBONIZATION PILLAR FOR THE U.S. CHEMICAL MANUFACTURING SUBSECTOR NOTED BY ATTENDEES AT THE ROADMAP VIRTUAL SESSIONS.



RD&D Needs and Opportunities for the Food and Beverage Manufacturing

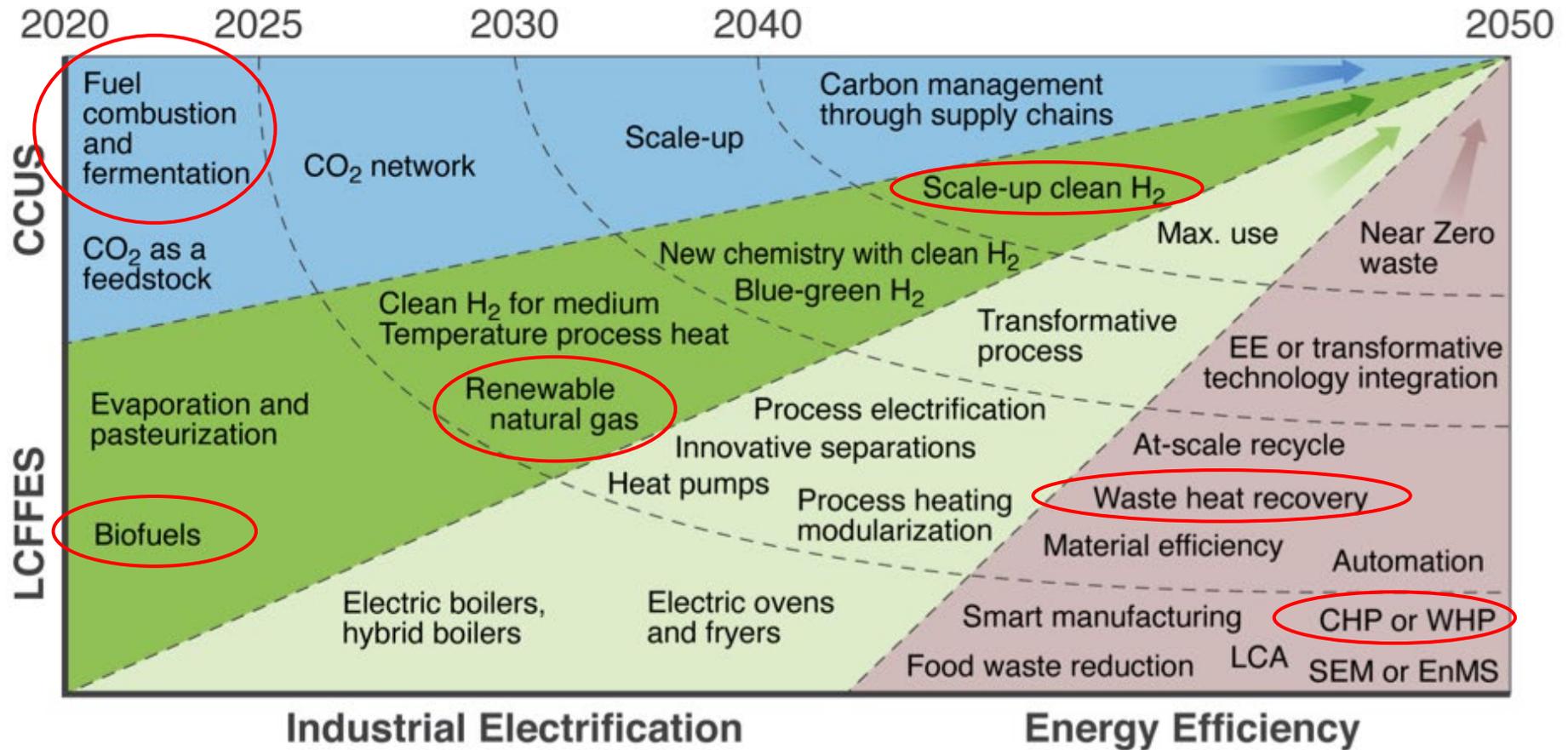


FIGURE 36. LANDSCAPE OF RD&D ADVANCEMENT OPPORTUNITIES BY DECADE AND DECARBONIZATION PILLAR FOR THE U.S. FOOD AND BEVERAGE MANUFACTURING SUBSECTOR NOTED BY ATTENDEES AT THE ROADMAP VIRTUAL SESSIONS.



Landscape of Major RD&D Investment Opportunities for Industrial Decarbonization across All Subsectors by Decade & Decarbonization Pillar

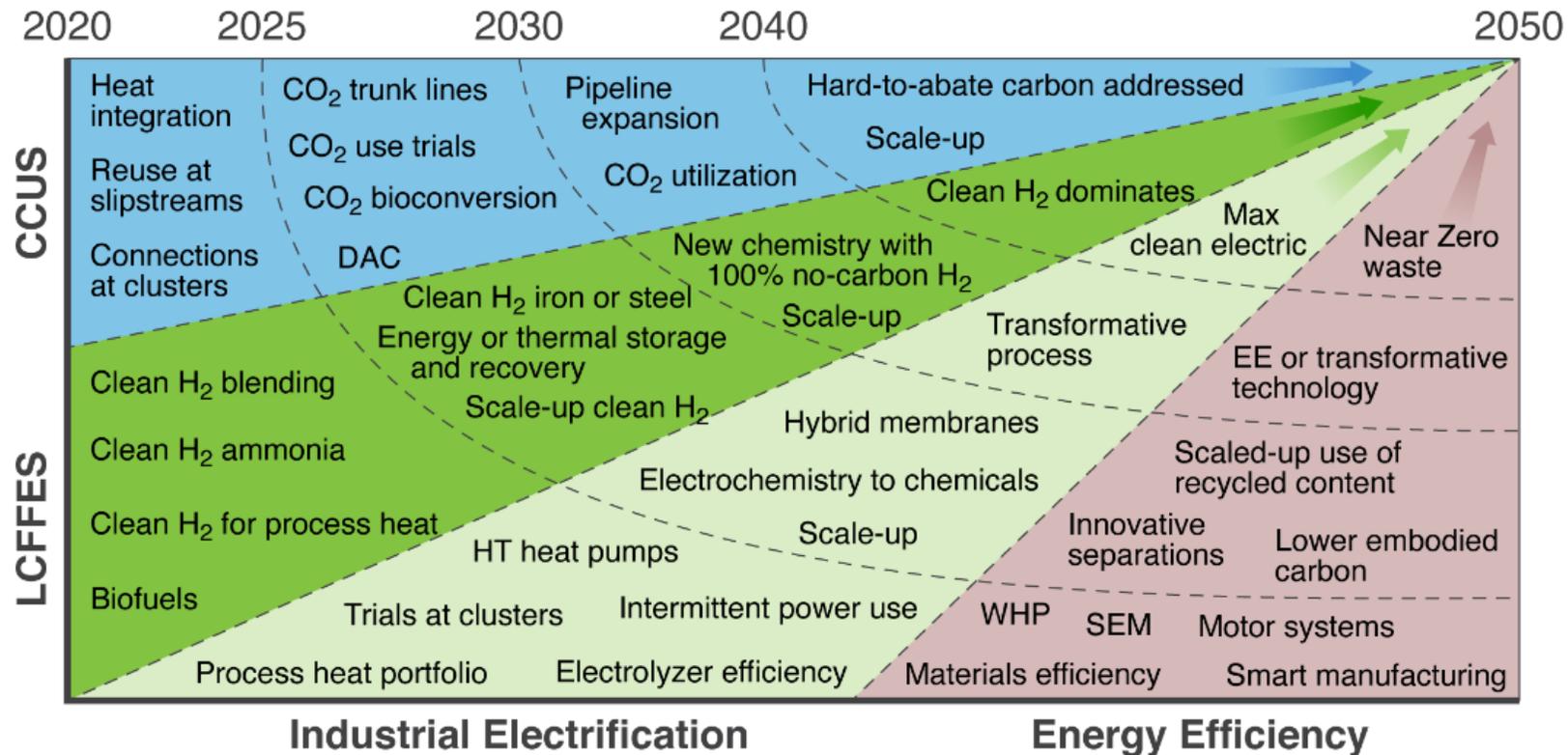


FIGURE 10. LANDSCAPE OF MAJOR RD&D INVESTMENT OPPORTUNITIES FOR INDUSTRIAL DECARBONIZATION ACROSS ALL SUBSECTORS BY DECADE AND DECARBONIZATION PILLAR.

Source: <https://www.energy.gov/eere/doi-industrial-decarbonization-roadmap>



RD&D Needs and Opportunities for the Iron and Steel Industry

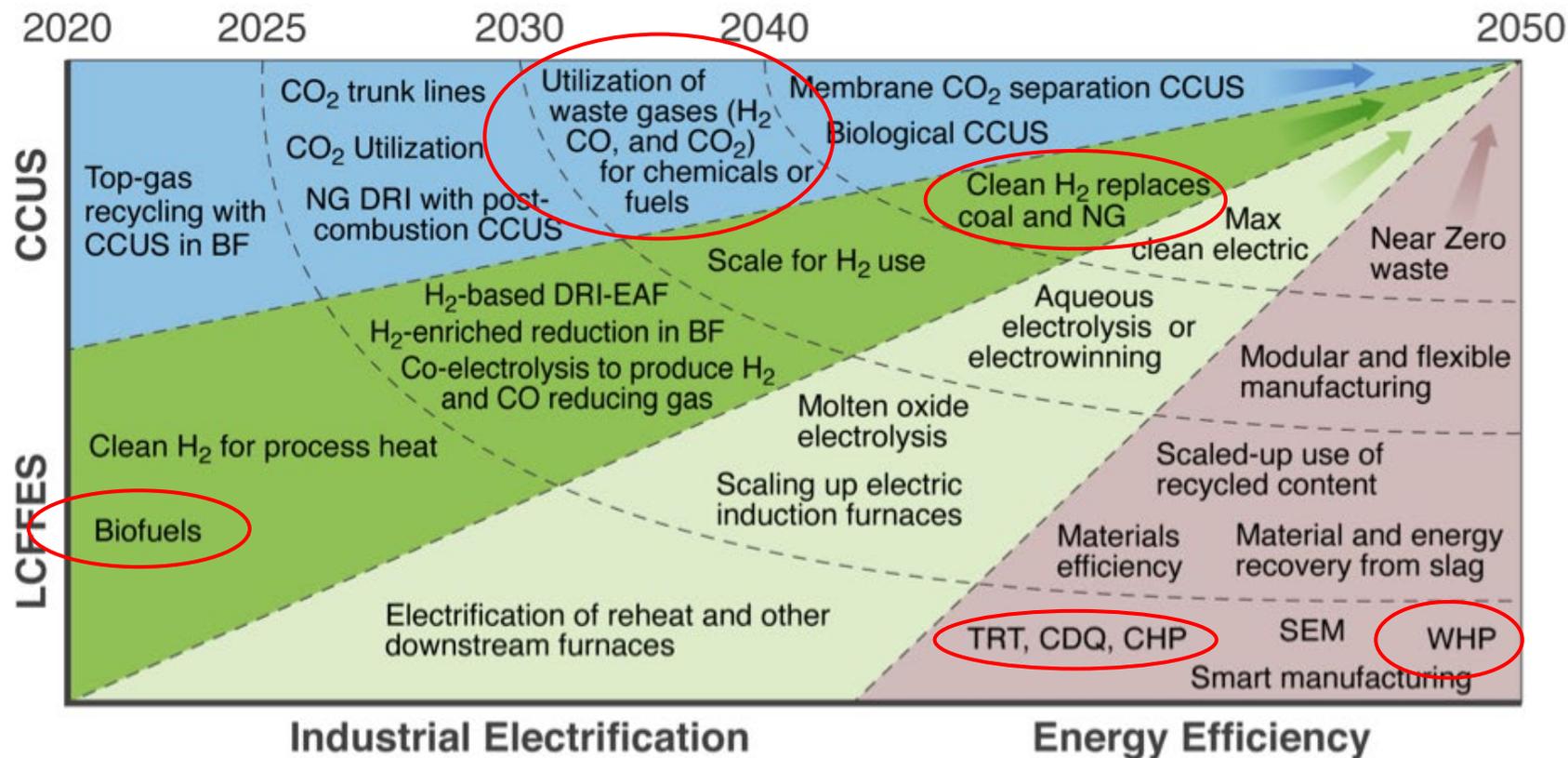
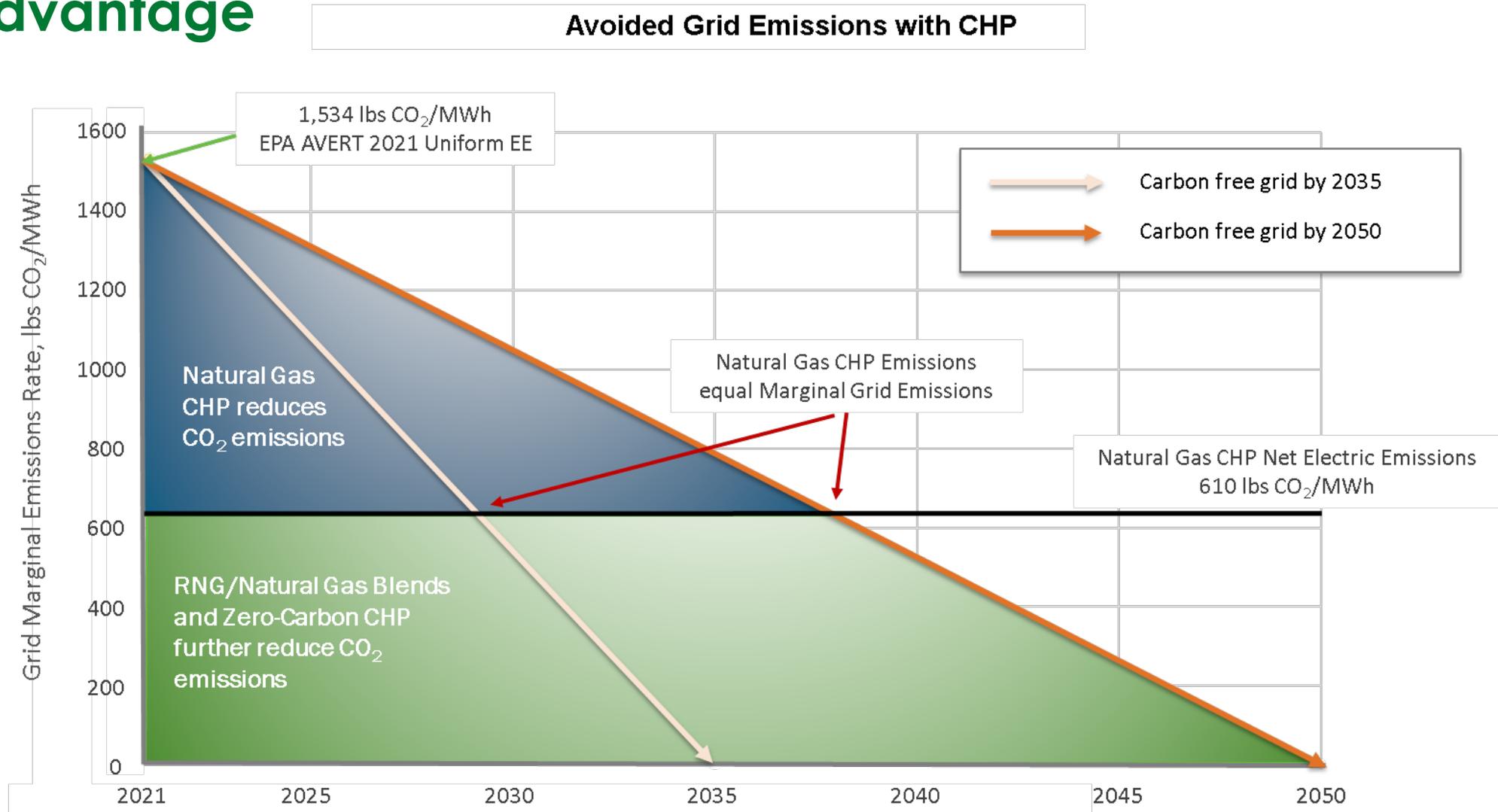


FIGURE 18. LANDSCAPE OF RD&D ADVANCEMENT OPPORTUNITIES BY DECADE AND DECARBONIZATION PILLAR FOR THE U.S. STEEL INDUSTRY



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



A large existing base of renewable based CHP / New options in development

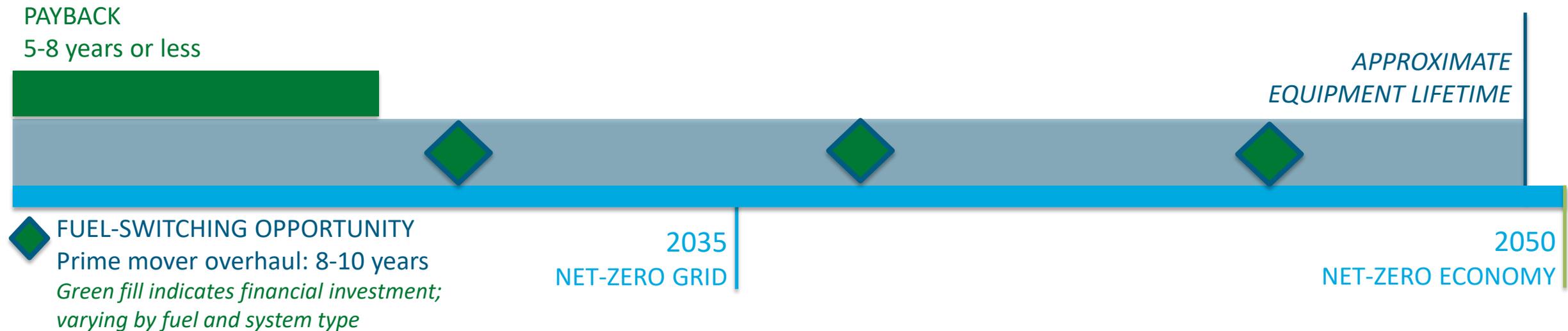
- 46 existing CHP packages capable of running on digester *
- 4 existing CHP packages capable of running on landfill gas *
- 57 existing CHP packages capable of running on a hydrogen blend *
- 5 existing CHP packages that are 100% hydrogen capable *
- most existing turbines and engines sold today can operate on hydrogen/natural gas mixtures ranging from 10 to 40%.
- all major CHP engine & gas turbine manufacturers working on the capability to operate 100% hydrogen systems will have commercially available products by 2030

‘ *’ Source: <https://chp.ecatalog.ornl.gov/search> (2022-03-31)



CHP Life Cycle Offers Multiple Opportunities for Reoptimization

- **Payback periods and regular maintenance schedules offer multiple decision points for reoptimization of emissions reduction measures as the grid evolves and other decarbonization options mature:**
 - **Payback:** Typical payback for CHP installations is between 6–8 years. After the initial equipment and installation costs are recovered, future investment decisions can be based on operating costs only.
 - **Fuel-switching opportunity:** Industrial CHP prime movers require periodic overhauls on an 8 to 10-year cycle (at ~10 to 15% of the original installation cost), which offer at least three opportunities to switch fuel or select an alternate decarbonizing path.



Decarbonization / Energy Markets / Grid Reliability

- Short term reliability margin are “thinning” to 2026 ¹
 - NYC reliability margin narrows to 50 MW in 2025
 - ***“Even the slightest deviations from expected conditions, load forecasts, or project delays could trigger future reliability needs” - NYISO***
- Total Installed Capacity must Triple (95 GWs) to meet the 2040 Goal²
 - New York currently has 37 GWs of generating capacity
 - Roughly 7 years from now, an estimated 20 GW’s of additional renewable generation needed
 - 12.9 GWs of new generation have been developed since 1999

¹ 2022-RNA-Datasheet.Pdf

² NYISO 2021-2040-Outlook-Datasheet.Pdf



Unprecedented Times in Energy Markets

* Roughly 7 years from now, an estimated 20 GW's of additional renewable generation needed

- 12.9 GWs of new generation have been developed since 1999

* Total Installed Capacity must Triple (95 GWs) to meet the 2040 Goal

- New York currently has 37 GWs of generating capacity

* Extensive Transmission Investment is Required

- Unprecedented levels of transmission and generation investment will be necessary to achieve clean energy goals while continuing to meet grid needs

■ *SOURCE: NYISO 2021-2040-Outlook-Datasheet.Pdf*



DEFRs are Critical for a Reliable Grid

- Dispatchable Emission-Free Resources (DEFRs) must be developed and added at scale to reliably serve demand when intermittent generation is unavailable ¹
 - 25 GWs to 42 GWs of DEF Rs required in 2040 Policy Scenarios
 - DEF Rs must be developed and deployed at scale well before 2040
 - *“There will be a great need for DEF Rs to meet the flexibility and energy supply needs of the future system” – NYISO*
- CHP is a proven DEF R when operated on zero (low) carbon fuels.
- CEA’s flexible load characteristics can serve the same purpose as DEF R’s by reducing grid load.

¹ NYISO 2021-2040-Outlook-Datasheet.Pdf



Ontario IESO

- Significant grid congestion in SW Ontario
 - Dense concentration of economic activity with new industry planned
 - Open to variety of dispatchable generation technologies with largest carveout for BESS but portion for CHP
- Program provides reserve payment to participate in program and for response to demand event calls (15-year contracts)
 - Intended to relieve grid congestion
- Existing sites w/ CHP are expanding installed capacity
- New sites are proposed to include CHP and participate in program



Ontario IESO's LT1 RFP

Challenge: Significant grid congestion in SW Ontario due to high concentration of industrial facilities and high energy users. **Ontario requires an additional 4,000 MW of electricity supply between 2025 and 2027.**

Solution: Long term generation procurement (ELT1 / LT1) RFP Released by IESO in 2022.

- Procurement target of 4,000 MW of new efficient, dispatchable, year round resources including hybrid electricity generation and storage facilities > 1 MW that can provide > 4 hrs of continuous output.
- IESO is looking to procure a diverse portfolio: 2,500 MW of storage, contributions from other non-emitting resources such as hybrids and biofuel resources, and up to 1,500 MW of natural gas to relieve grid congestion
- Open to variety of dispatchable generation technologies with largest carveout for BESS with significant portion for CHP
- Program provides reserve payment to participate in program and for response to demand event calls (15-year contracts)

ELT1 and LT1 Programs are resulting in:

- Existing sites w/ CHP expanding installed capacity
- New sites proposing to include CHP and participate in program

LT1: Long Term Request for Proposals; ELT1: Expedited Process for Long Term Request for Proposals



Inflation Reduction Act (IRA)

- Tax credits Before Inflation Reduction Act (IRA)
- Changes made to Investment Tax Credits (ITC)
- Treatment for non-taxpaying entities
- Credits for Renewable CHP and Microgrid

Disclaimer: The CHP TAPs do not provide tax advice. We advise you to reach out to a tax specialist to determine your eligibility.



Pre-IRA Tax Credits for Combined Heat and Power (CHP)

- Before the Inflation Reduction Act (IRA), the ITC granted an energy credit of 10% (sunset 12/31/2021).
- President Biden signed the Inflation Reduction Act (IRA) on August 16, 2022, The IRA provides tax incentives for renewable and qualifying clean energy technologies that begin construction before 2025.
- IRA now extends the ITC under section 48 at the 30% rate for energy property beginning construction after 1/1/2022 and before 2025, and up to 30-40% through 2035.
- IRA extends Section 48 ITC to CHP gas or renewable at the 30% rate.
- It extends Section 45 PTC only available to qualifying renewable CHP and includes energy storage technologies and microgrid controllers (facilitate hybrid CHP).



Major Changes under IRA in Investment Tax Credit (ITC)

Credit Enhancements: There are bonus points to earn “beyond” the 30% ITC and PTC.

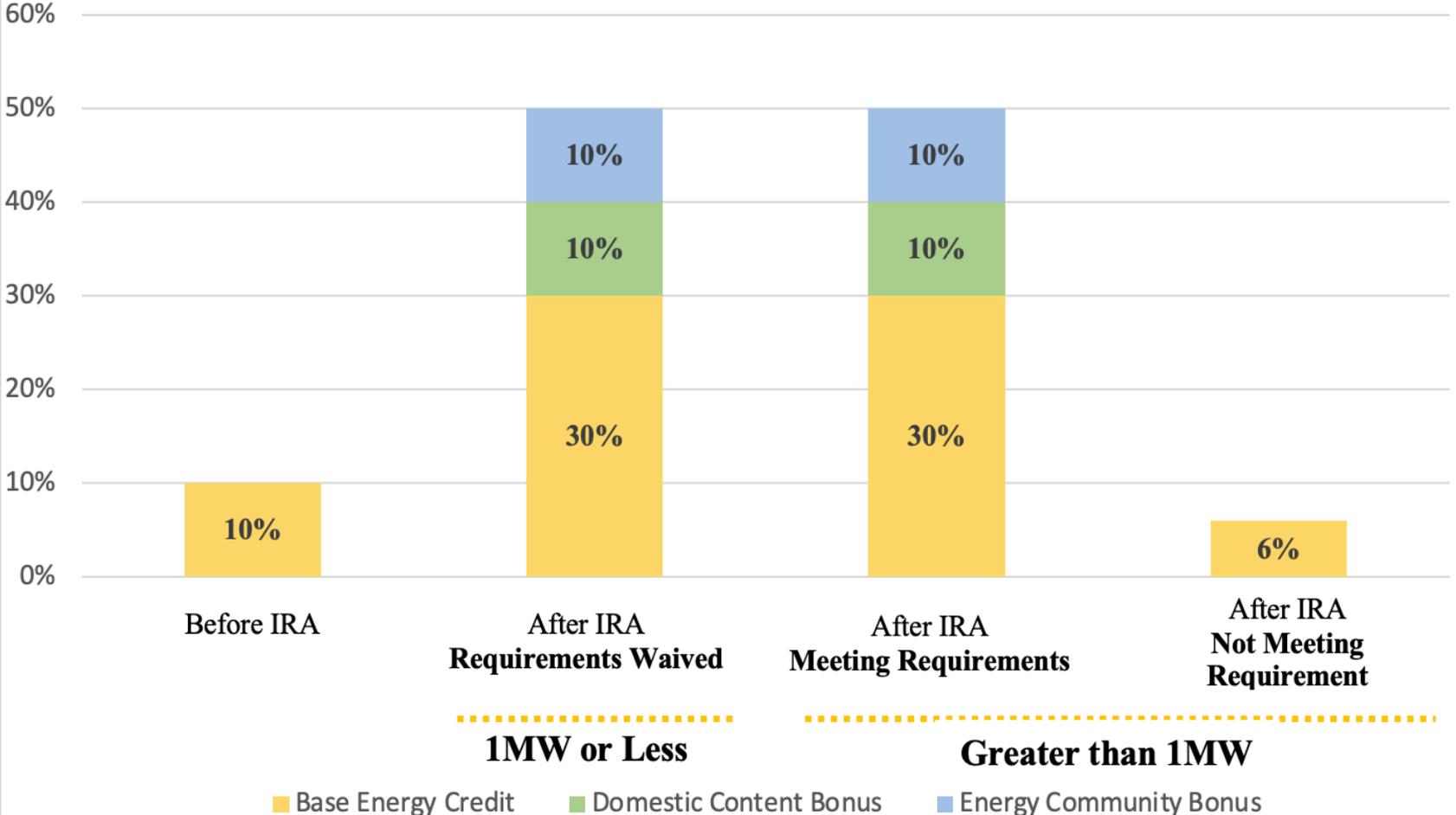
- Domestic Content Bonus: additional 10% credit is rewarded for ITC or PTC if manufactured products that are components (ex: steel, iron) of the completed facility are required to be produced in the U.S.
- Energy Community Bonus: additional 10% credit is awarded for ITC or PTC if a qualified facility is located on brownfields or in an energy community with fossil-electric plant retirements, coal mine closures, or high unemployment rates.
 - Many states offer ITC for brownfields. New York is one of the most lucrative

Limitations: If the project is 1 MW or greater, it must meet the Prevailing Wages Requirement and Apprenticeship requirement to receive 30% ITC. If not, the ITC is subject to 80% reduction (30% ITC reduced to 6%). For projects <1MW, labor requirements are waived.

Cap on System Size: ITC is not eligible for CHP systems greater than 15 MWs. Larger CHP systems (up to a maximum of 50 MW) can qualify for a reduced tax credit equal to the ratio between the actual system capacity and 15MW. For example, a 30 MW system qualifies for a tax credit worth 15/30 of otherwise allowable credit.



Tax Credit Differences Before and After IRA



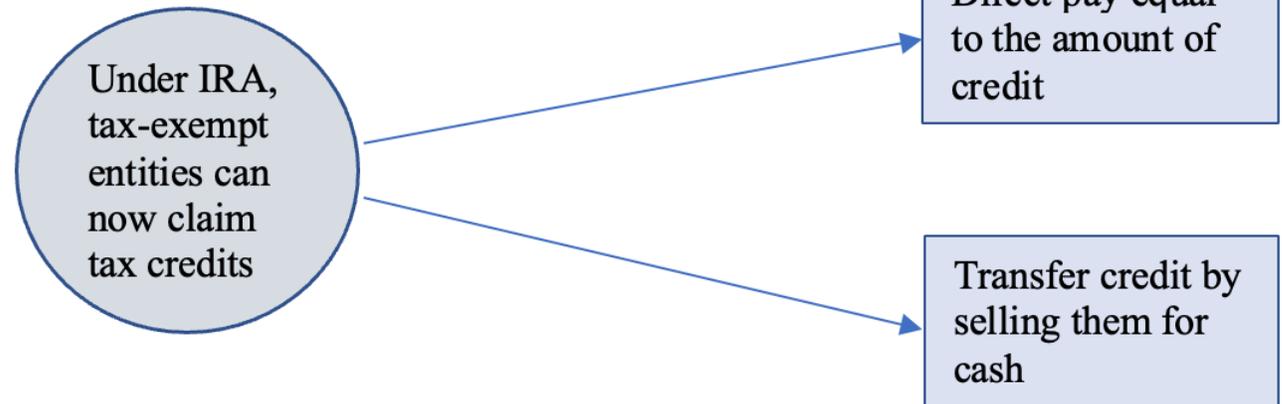
Treatment for Non-Taxpaying Entities

- In an important advancement to note, under the IRA, non-taxpaying entities such as tax-exempt organizations, government, authorities, will be able to monetize tax credits.
- This includes non-profit hospitals, condos, co-ops, government buildings.



Treatment for Non-Taxpaying Entities

- There are two mechanisms for tax-exempt entities to claim credits.
 - Direct Pay: The IRA allows non-taxpaying entities like cities, states, not-for-profit enterprises to take direct pay equal to the amount of the credit, or
 - Transfer: The IRA allows tax-credit exempt entities to sell the credit to an unrelated buyer for cash
 - Section 6417 (Direct Pay Option) and Section 6418 (Transfer of Credits) provide important details regarding applicability, timelines, restrictions, treatment of tax-exempt bond financings.

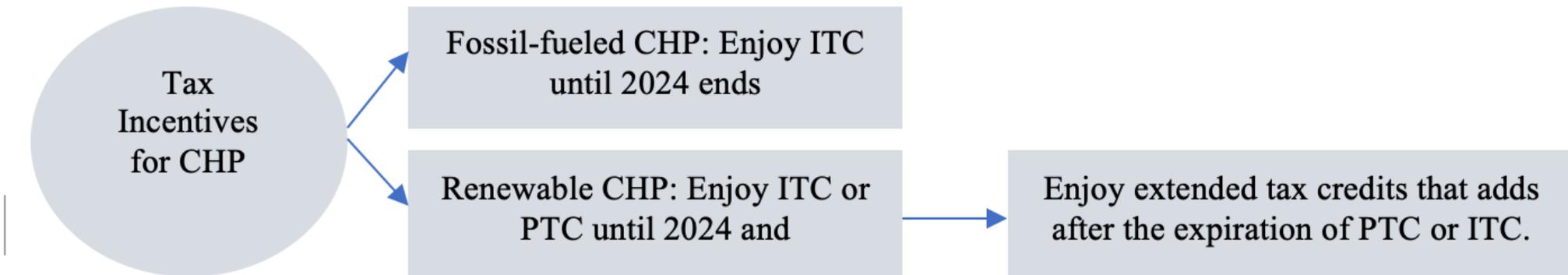


Tax Credits for Renewable CHP and Microgrid

Renewable CHP: Qualifying CHP using renewable sources enjoy greater benefits in the pre and post 2025 period. Public infrastructure using biogas, or organics to power may be opportunities. After the bill, “Renewable” CHP system gets treated differently than “fossil-fueled” CHP system, as IRA adds extension tax credits after the expiration of the PTC and ITC.

Section 45Y, the Clean Energy Production Tax Credit: provides a base PTC of 0.3 cents and a bonus credit of 1.5 cents if prevailing wage and apprenticeship requirements are met

Section 48E, the Clean Electricity Investment Tax Credit: provides a base ITC of 8 percent and a bonus credit of 30 percent if prevailing wage and apprenticeship requirements are met.



Recommended Resources

For an excellent summary, please refer Congressional Research Service. R47202. *Tax Provisions in the Inflation Reduction Act of 2022 (H.R. 5376)*. Updated August 10, 2022.

Authors: Molly F. Sherlock, Anthony A. Cilluffo, Margot L. Crandall-Hollick, Jane G. Gravelle, Donald J. Marples

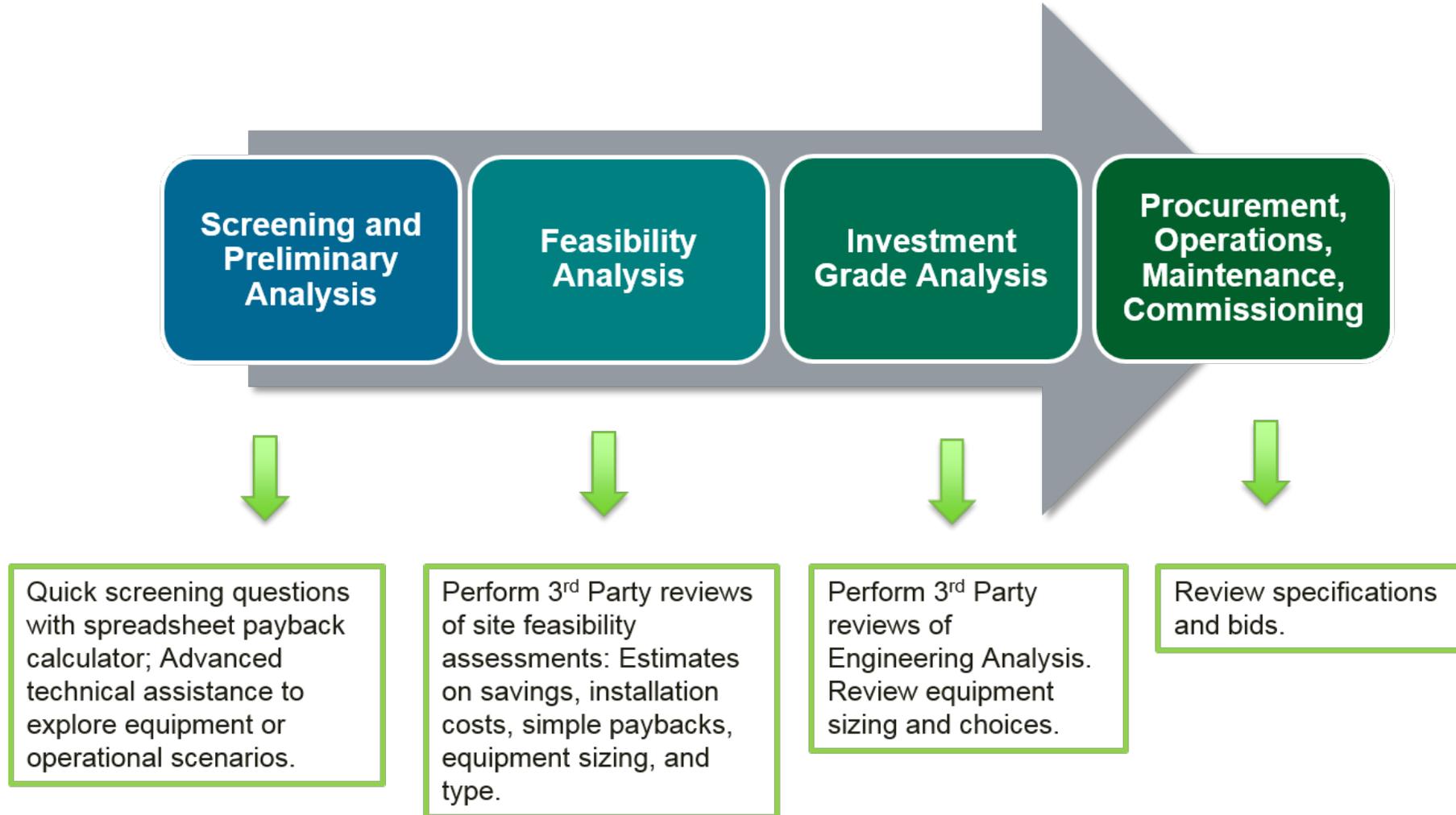
Source: <https://crsreports.congress.gov> enter R47402 in the SEARCH bar

[CRS Search Results \(congress.gov\)](#)

Special thanks to Molly F. Sherlock, Specialist in Public Finance, at Congressional Research Service, who was quite gracious in providing references and information.



We can help you consider CHP in your plant: NY-NJ CHP TAP = Unbiased Technical Assistance. *No Charge*



Resource: CHP Project Profiles

This database includes more than 200 CHP project profiles compiled by DOE's CHP Technical Assistance Partnerships (TAPs). <https://chp.ecatalog.ornl.gov/resources/project-profiles>



Resource: CHP & Microgrid Installation Databases

CHP and Microgrid Installation Databases are data collection efforts sponsored by the U.S. Department of Energy and maintained by ICF Inc.

<https://chp.ecatalog.ornl.gov/resources/databases>



DOE CHP Packaged Systems eCatalog

U.S. DEPARTMENT OF ENERGY | COMBINED HEAT & POWER eCATALOG
RECOGNIZED PACKAGED CHP AND WHP SYSTEMS

PACKAGERS SOLUTION PROVIDERS ENGAGEMENT NETWORK TRADE ALLY NETWORK CHP TAPS BASICS & BENEFITS FINANCING RESOURCES SITE GUIDE

DOE RECOGNIZED CHP PACKAGED SYSTEMS AND SUPPLIERS

The CHP eCatalog is a voluntary public/private partnership designed to increase deployment of CHP in manufacturing plants and commercial, institutional and multi-family buildings. The core of the eCatalog is CHP Packagers who commit to provide pre-engineered and tested Packaged CHP systems that meet or exceed DOE performance requirements and CHP Solution Providers who commit to provide responsible installation, commissioning, maintenance and service of recognized Packaged CHP systems and also provide a single point of project responsibility.

SEARCH THE eCATALOG
340 CHP Packages Available

REGISTER

Create An Account
Anyone may perform a search of the eCatalog without an account. Creating an account allows you to:
• Access advanced eCatalog functions, such as favorites and searches.
• Submit an application as a CHP Packager, Solution Provider or Customer Engagement Network.

CHP eCATALOG PACKAGED CHP SYSTEM PERFORMANCE
Packaged CHP System standardized electrical and thermal performance data* presented for comparison in the eCatalog have been reviewed and recognized as accurate based on engineering data and performance test data submitted by the Packagers. Emissions data presented in the eCatalog are based on either third-party emissions test results when available, or prime mover manufacturer's emissions certification data, both using standard EPA test methodologies or equivalent. When evaluating CHP performance for a particular project, it is important to use final performance data from the Packager or Solution Provider that reflects specific site conditions such as actual fuel characteristics, ambient temperatures and altitude, and thermal load temperatures or pressures. As an example, hot water thermal capacity ratings in the eCatalog are based on a standard hot water supply temperature of 180 F, with packager specified return temperatures for each system. Actual hot water available from a packaged CHP system for a project will depend on the specific temperature requirements of the hot water supply and return at the site, and may vary from data presented in the eCatalog.

CUSTOMER ENGAGEMENT NETWORK: SUPPORTING CHP IN YOUR AREA
An essential element in market success of energy efficient technologies, such as CHP, is a robust customer engagement network to educate end-users and provide assistance through the project development process. States, localities and utilities that are implementing programs and policies to increase the use of CHP in support of key economic, security, efficiency and environmental goals can integrate the eCatalog into their efforts by linking recognized CHP packages offered by Packagers or Solution Providers in their region to their programs. The eCatalog provides a unique platform for connecting recognized CHP equipment and suppliers with state, local and utility market outreach, customer acquisition and incentive programs.

CLICK TO SHARE THIS RESOURCE WITH YOUR PEERS

***PERFORMANCE DATA**

Topping cycle standards:
• 180F hot water supply,
• 125 psig or 15 psig steam supply,
• 44F chilled water supply and 54F return with 85F cooling water,
• 140F or 200F exhaust drying.

Bottoming cycle standards:
• ORC systems- 1,000F, 600F or 300F gas stream with 59F ambient or 85F water sink temperatures
• Back pressure steam turbines- 300 psig to 15 psig saturated steam, or 150 psig to 15 psig saturated steam conditions.

CHP eCatalog is: a national searchable web-based catalog that provides engineers with DOE recognized CHP suppliers and technical data for application of CHP systems to their projects.

CHP eCatalog audience: end-users with engineering staff, consulting engineers, utilities, state energy offices, regulators, federal agencies, and project developers.

Users search for: applicable CHP system characteristics, and get connected to packagers, installers, utilities and state energy programs.

CHP eCatalog allows users: to compare CHP technology options on a common basis.

eCatalog by the Numbers (April 2023)



Almost 600 new users per month

Source: <https://chp.ecatalog.ornl.gov/>



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CHP eCatalog

U.S. DEPARTMENT OF ENERGY | COMBINED HEAT & POWER eCATALOG
RECOGNIZED PACKAGED CHP AND WHP SYSTEMS

SEARCH eCATALOG | SITE GUIDE | BENEFITS | FINANCING | RESOURCES | PACKAGERS | SOLUTION PROVIDERS | TRADE ALLY NETWORK | CUSTOMER ENGAGEMENT NETWORK | CHP TAPS

COMBINED HEAT & POWER eCATALOG OF RECOGNIZED PACKAGED CHP & WHP SYSTEMS
**PACKAGED CHP SYSTEMS:
RIGOROUS RECOGNITION PROCESS**

SEARCH THE eCATALOG
340 CHP Packages Available

Getting Started: REGISTER | SITE GUIDE

The Packaged Combined Heat and Power Catalog (eCatalog) is a voluntary public/private partnership designed to increase deployment of CHP in commercial, institutional and multi-family buildings and manufacturing plants. The core of the eCatalog are CHP Packagers who commit to provide pre-engineered and tested Packaged CHP systems that meet or exceed DOE performance requirements and CHP Solution Providers who commit to provide responsible installation, commissioning, maintenance and service of recognized Packaged CHP systems and also provide a single point of project responsibility.

CUSTOMER ENGAGEMENT NETWORKS: INCENTIVIZING CHP IN YOUR AREA
MAXIMIZE YOUR CHP INVESTMENT WHEN YOU INSTALL RECOGNIZED SYSTEMS

An essential element in market success of energy efficient technologies, such as CHP, is a robust customer engagement network to educate end-users and provide assistance through the project development process. States, localities and utilities that are implementing programs and policies to increase the use of CHP in support of key economic, security, efficiency and environmental goals can integrate the eCatalog

eCatalog by the Numbers (January 2023)

42	340	26	13	18	Almost 500 new users per month
Packagers	Packages	Solution Providers	Trade Allies	Customer Engagement Networks	

New to the CHP eCatalog: Zero Carbon Systems

- 100% Hydrogen CHP Packages (2G and Jenbacher: 108 kW – 1 MW)
- Back Pressure Steam Turbines (NLine Energy: 272 kW)
- Organic Rankine Cycle Systems (Cety : 140 kW)

Contact us for no cost seminar on the CHP eCatalog

Partner News

NLINE ENERGY LISTS FIRST BACK PRESSURE STEAM TURBINE IN THE ECATALOG

NLine Energy, Inc. is an industry leading, US-based, full service, OEM, manufacturer, developer, integrator, and financier of energy recovery and power generation projects.

The Microsteam® turbine is a patented, proven, 275 kW plug-and-play, non-condensing, back pressure turbine system with >30 installations to date. Our assembly facility is located in Cheyenne, WY. ... [more](#)

Partner News

CETY LISTS FIRST ORGANIC RANKINE CYCLE SYSTEM IN THE ECATALOG

Clean Energy Technologies, Inc. (CETY) designs, builds and markets renewable and energy products and solutions. CETY offers a suite of zero emission heat recovery solutions and waste to energy products as well as engineering and manufacturing solutions focused on other energy efficient and environmentally sustainable technologies.

The CETY Integrated Power Module (IPM) is a proven 140 kW magnetic bearing turbine-based

Partner News

2G LISTS FIRST 100% HYDROGEN PACKAGED CHP SYSTEMS IN THE ECATALOG

2G has successfully listed four 100% hydrogen-fueled packaged CHP systems in the CHP eCatalog ranging in size from 108 kW to 348 kW in net electric capacity. Hydrogen is considered an important storage medium for generating green electricity generated from renewable sources, e.g. wind power or solar power, and by means of a combined heat and power system a time-shifted use. With the agentor engines, 2G has succeeded in adapting a tried and tested, highly efficient



DOE CHP Packaged Systems eCatalog (cont.)

42 - Packagers

26 - Solution Providers

18 - Customer Engagement Partners

13 - Trade Allies

340 - Package Offerings

- 272 - Natural Gas Engine Systems
- 46 - Digester Gas Engine Systems
- 4 - Landfill Gas Systems
- 3 - Propane Systems
- 5 - Hydrogen Systems
- 4 - Steam Heat Recovery
- 6 - Low Temperature Heat Recovery (ORC)

FOCUS YOUR RESULTS ⓘ

reset

FOCUS YOUR RESULTS ⓘ

reset

PRIMARY SITE LOCATION

21201

Selected: BALTIMORE, MD

SUPPLIER PRIORITY

- Packagers offering Recognized systems ⓘ
- Solution Providers offering, installing, commissioning and maintaining Recognized systems
- Solution Providers offering Assurance Plans ⓘ
- Solution Providers offering Energy Services and/or Financing ⓘ

POWER OUTPUT (kW)

Help Me Choose ⓘ

kW Size

Consider Multiple Units

*Default includes a max. of 120% of unit size and a min. of 70% of unit size.

OUTDOOR INSTALLATION ⓘ

Required

FUEL TYPE ⓘ

- Natural Gas or Pipeline RNG (272)
- Propane (3)
- Digester Gas (46)
- Landfill Gas (4)
- 100% Hydrogen (5)
- Low Temperature Heat (6)
- Hydrogen Blend Capable (57)

PLEASE ENTER A VALID ZIP CODE TO SEE AVAILABLE CHP PACKAGES

[COMPARE PACKAGES](#)

DISPLAYING: 340 Packages ordered by Relevance

AV Available
SP Solution Provider
AP Assurance Plan
CS Local Support
OD Outdoor Install
FP Within Footprint
H₂ H₂ Blend Capable
I Installed
★ Favorite



NLINE ENERGY

MST-1 IN

- Power Output: 272 kW
- Inlet/Outlet: 300/150 psig
- Fuel: Steam
- Prime Mover: 1x Back Pressure Turbine
- Grid Connection: Parallel Only

AV CE 25

FULL MATCH (100%)



InVerde e+ Tecogenar

INV-E+ 125

- Power Output: 123 kW
- Thermal Output: Hot Water Only
- Fuel: Natural Gas
- Prime Mover: 1x Reciprocating engine
- Grid Connection: Black Start, Auto

AV CE 815

FULL MATCH (100%)



Solar Turbines
A Caterpillar Company

TAURUS 70

- Power Output: 7,918 kW
- Thermal Output: Process Heat Only
- Fuel: Natural Gas
- Prime Mover: 1x Combustion turbines
- Grid Connection: Black Start, Auto

AV CE H₂ 0

FULL MATCH (100%)



CETY

CETY CCII 300 LIQUID A-COND PACKAGED

- Power Output: 140 kW
- Heat Source: 300°F Liquid
- Heat Sink: 59°F Ambient
- System: 1x Organic Rankine Cycle
- Grid Connection: Black Start, Auto

AV CE 0

FULL MATCH (100%)



NORTHERST - WESTERN ENERGY SYSTEMS
Power Systems Specialists

JMC 416

- Power Output: 1,109 kW
- Thermal Output: Hot Water Only
- Fuel: Natural Gas
- Prime Mover: 1x Reciprocating engine
- Grid Connection: Black Start, Auto

AV CE 282

FULL MATCH (100%)



EFG
E-FINITY GG

C1000S-ICHPP HPNG DM MAX EFFICIENCY

- Power Output: 1,000 kW
- Thermal Output: Hot Water Only
- Fuel: Natural Gas
- Prime Mover: 5x Microturbine
- Grid Connection: Black Start, Auto

AV CE 0

FULL MATCH (100%)

Source: <https://chp.ecatalog.ornl.gov/>

U.S. DEPARTMENT OF ENERGY
CHP Technical Assistance Partnerships

No-Cost CHP Resources

EPA dCHPP (CHP Policies and Incentives Database)

Combined Heat and Power (CHP) Partnership

dCHPP (CHP Policies and Incentives Database)

dCHPP (CHP Policies and Incentives Database) is an online database that allows users to search for CHP policies and incentives by state or at the federal level. dCHPP has two primary purposes:

- Policy makers and policy advocates can find useful information on significant state/federal policies and financial incentives affecting CHP.
- CHP project developers and others can easily find information about financial incentives and state/federal policies that influence project development.

The **database** contains definitions for the policy and incentive types included in dCHPP:

Please select one or both of the search filters to return the desired results. To select more than one option in a search filter (e.g., New York and Texas in the "Search by State" filter), hold down the Control key on the keyboard while selecting the options. You can then sort the results by selecting the desired column heading. To start over, select "Reset Filters."

DOE CHP Technologies Fact Sheet Series

ENERGY Combined Heat and Power Technology Fact Sheet Series

Gas Turbines

Gas turbines are internal combustion engines that use a turbine to compress air and heat it to produce power. They are commonly used in power plants, aircraft, and marine propulsion. This fact sheet provides information on the technology, its applications, and its benefits.

Table 1: Summary of Gas Turbine Attributes

Attribute	Description
Efficiency	Gas turbines have high thermal efficiencies, typically ranging from 35% to 50%.
Flexibility	Gas turbines can start up and shut down quickly, making them ideal for peaking power and load following.
Applications	Gas turbines are used in a variety of applications, including power generation, aircraft propulsion, and marine propulsion.

State of CHP Pages

New York CHP by Technology

New York CHP Capacity

Technology	Capacity (MW)
Gas Turbines	1,111
Internal Combustion Engines	2,096
Microturbines	74
Total	3,281

U.S. DOE Combined Heat and Power (CHP) Database

The DOE CHP Database is a comprehensive resource for CHP information. It provides detailed information on CHP projects, including their location, capacity, and technology. The database is available at www.eere.energy.gov/chp.

DOE Combined Heat and Power Partnership Database

Choose a Region

Map showing CHP projects across the United States.

DOE Project Profile Database

PROJECT PROFILE

Gunderson Health System
Onitaska, Wisconsin Campus
1,137 kW Landfill Gas-to-Energy CHP Project

Project Description

The Gunderson Health System in Onitaska, Wisconsin, has installed a 1,137 kW Landfill Gas-to-Energy CHP project. This project is a prime example of how CHP can be used to generate power from a waste stream, reducing greenhouse gas emissions and providing a reliable source of energy for the facility.

Key Facts

- Capacity: 1,137 kW
- Technology: Landfill Gas-to-Energy
- Year Installed: 2008

DOE Policy/Program Profiles

PROJECT PROFILE

CHP Roadmap for Michigan

This roadmap provides a comprehensive overview of the CHP market in Michigan, including current capacity, growth potential, and policy recommendations. It is a valuable resource for policymakers and industry stakeholders.

Key Findings

- Current CHP capacity in Michigan is approximately 1,000 MW.
- There is significant potential for CHP growth in the state, particularly in the industrial and commercial sectors.
- Policy recommendations include streamlining permitting processes and providing financial incentives for CHP projects.

DG for Resilience Planning Guide

Better Buildings DISTRIBUTED GENERATION (DG) FOR RESILIENCE PLANNING GUIDE

INTRODUCTION

The Distributed Generation (DG) for Resilience Planning Guide provides information and resources on how DG can be used to improve the resilience of critical infrastructure. The guide covers topics such as the benefits of DG, the challenges of integrating DG into existing systems, and the steps needed to develop a resilience plan.

CHP Site Screening Tool

The CHP Site Screening Tool is available as either an online or excel-based tool that can provide an individual site screening assessment for CHP based on a variety of user inputs and pre-determined metrics.

Resilience Risk Evaluation Tool

The Resilience Risk Evaluation Tool is an Excel-based tool that can provide a resilience screening assessment for up to 200 individual sites. The tool is based on an evaluation of site resilience factors and does not take account of economics.

CHP Issue Brief Series

ENERGY Combined Heat and Power in Resilience Planning and Policy

Issue Brief

April 2013

This issue brief discusses the role of CHP in resilience planning and policy. It highlights the benefits of CHP for improving the resilience of critical infrastructure and provides recommendations for how to integrate CHP into resilience plans.

Summary

- CHP Saves CO2 now in all 50 States
- Carbon Savings today are more valuable than future savings
- CHP is recognized in the medium to long term as a decarbonization tool low / no emissions fuels and in hard to decarbonize sectors
- Financial incentives including the IRA's ITC are now available to bolster the economic return on CHP investments
- DOE CHP TAP provide no-cost technical assistance to end user sites and a suite education and outreach services.
- Contact us – we know CHP!



Thank you. Questions?



New York/ New Jersey CHP TAP

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For more information about the TAPs:

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

A program sponsored by



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CHP Technical Assistance Partnerships