

Combined Heat and Power (CHP) and the US DOE CHP Technical Assistance Partnerships (CHP TAPs)

Midwest Governors Association
Maximizing Bioenergy Resources in the Midwest
Panel Discussion: Electrical Generation from Biomass

Coralville, IA
October 11-12, 2017



U.S. DEPARTMENT OF ENERGY

CHP Technical Assistance Partnerships

MIDWEST

Agenda

- US DOE CHP Technical Assistance Partnerships (CHP TAPs)
- Biomass/Biogas CHP Technologies
- Example Utilities Incorporating CHP into Utility Energy Efficiency Programs

DOE CHP Technical Assistance Partnerships (CHP TAPs)

DOE's CHP TAPs promote and assist in transforming the market for CHP, waste heat to power, and district energy or microgrid with CHP throughout the United States. Key services include:

- **Market Opportunity Analysis**

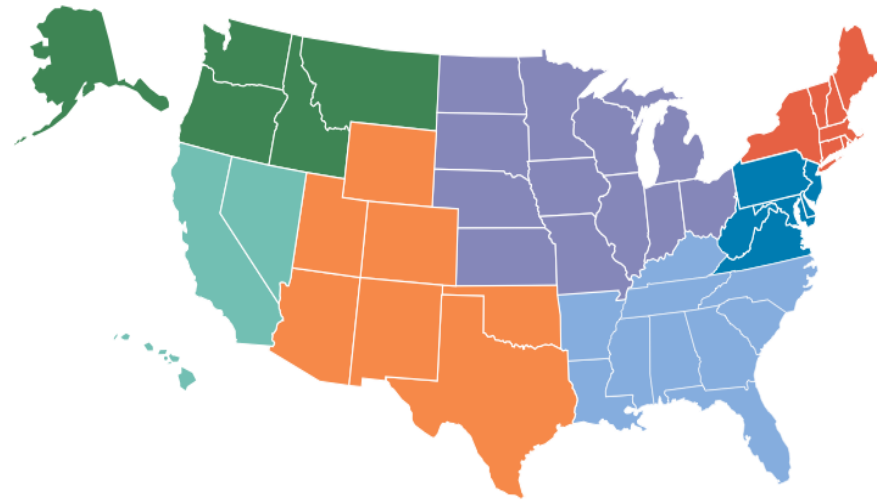
Supporting analyses of CHP market opportunities in diverse markets including industrial, federal, institutional, and commercial sectors

- **Education and Outreach**

Providing information on the energy and non-energy benefits and applications of CHP to state and local policy makers, regulators, end users, trade associations, and others.

- **Technical Assistance**

Providing technical assistance to end-users and stakeholders to help them consider CHP, waste heat to power, and/or district energy or microgrid with CHP in their facility and to help them through the development process from initial CHP screening to installation.



www.energy.gov/chp

DOE CHP Technical Assistance Partnerships (CHP TAPs)

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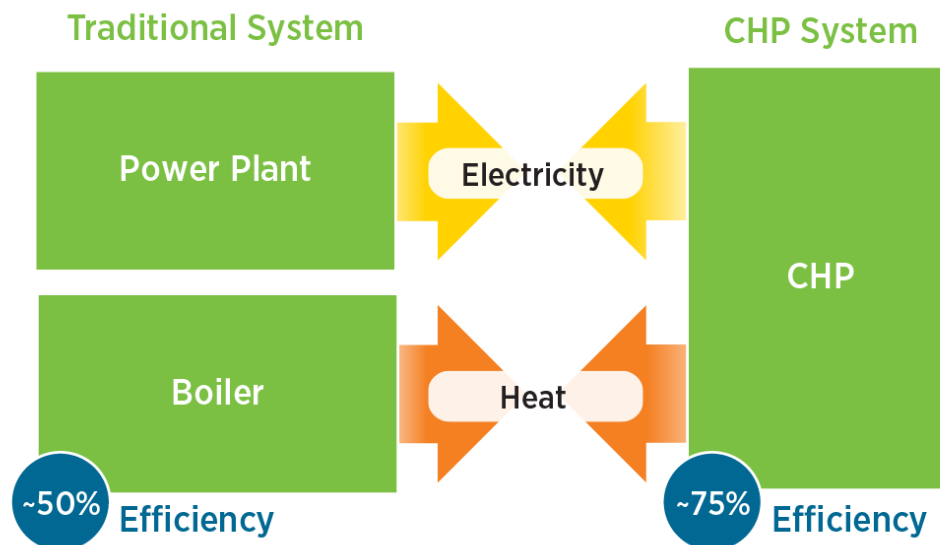
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CHP: A Key Part of Our Energy Future

- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building / facility
- Provides at least a portion of the electrical load and
- Uses thermal energy for:
 - Space Heating / Cooling
 - Process Heating / Cooling
 - Dehumidification



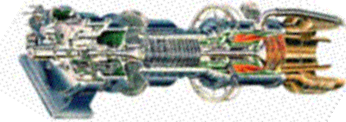
CHP provides efficient, clean, reliable, affordable energy – today and for the future.

Common CHP Technologies and Generating Capacity Ranges



Microturbines

Gas/Steam Turbines



Reciprocating Engines



Fuel Cells



50 kW

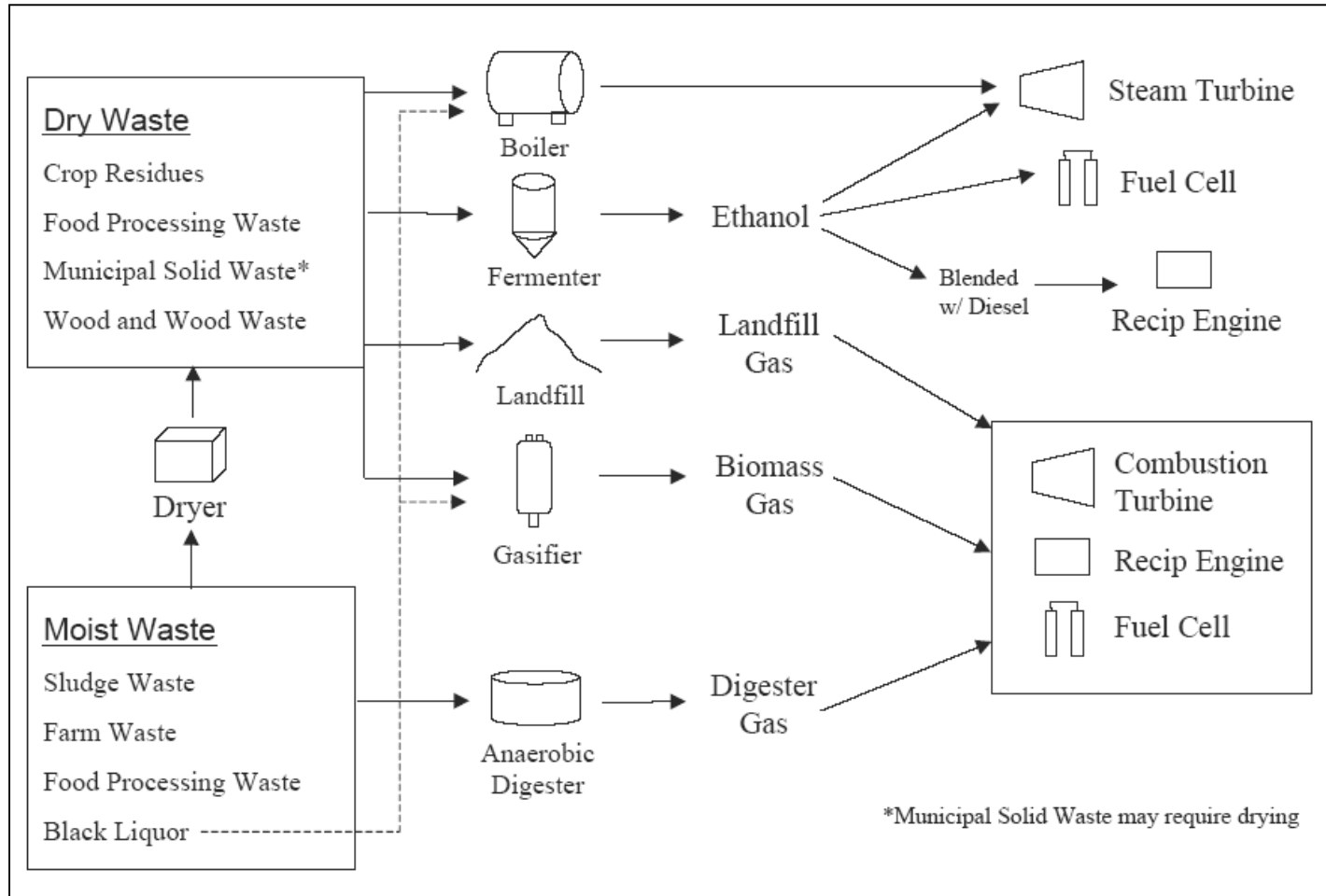
100 kW

1 MW

10 MW

20 MW

Flowchart of Biomass Fuels for CHP Applications



Example Biomass/Biogas CHP Projects

Market Sector	Site	State	CHP Capacity (kW)	Prime Mover	Fuel	Year Installed
Wastewater	Glenbard Wastewater Authority	IL	760	Recip Engine	Biogas	2016
Wastewater	Des Moines Metropolitan Wastewater Reclamation Authority	IA	4,600	Recip Engine	Biogas	1991
Wastewater	Plymouth Utilities' Wastewater Treatment Plant	WI	130	Microturbine	Biogas	2015
Wastewater	Lima Wastewater Treatment Plant	OH	130	Microturbine	Biogas	2012
Agriculture	Sievers Family Farms	IA	1,000	Recip Engine	Biogas	2013
Agriculture	Amana Farms	IA	2,600	Recip Engine	Biogas	2008
Institutional	Gundersen Health	WI	500	Boiler / Steam Turbine	Wood Biomass	2013
Institutional	Gundersen Health – LaCrosse County Landfill	WI	1,137	Recip Engine	Landfill Gas	2012
Institutional	Battle Creek VA Medical Center	MI	2,000	Boiler / Steam Turbine	Wood Biomass	2014
Industrial	Campbell Soup	OH	2,800	Recip Engine	Biogas	2013
Industrial	Fort Wayne Assembly Plant	IN	14,000	Recip Engine	Landfill Gas	2014

CHP in Clean Portfolio Standards

- **Renewable Portfolio Standard (RPS)**
 - Traditionally focused on wind, solar, biomass projects
 - Often market based – qualifying projects may receive tradable credits (RECs)
 - CHP utilizing biogas/biomass usually qualify (sometimes WHP)
- **Energy Efficiency Resource Standards (EERS)**
 - Utilities to meet mandated or voluntary annual targets (reduce energy use)
 - Some states include CHP and other efficient DG technologies
 - Sometimes CHP is restricted due to fuel switching issue
- **Alternative Energy Portfolio Standard (AEPS)**
 - Annual targets for percentage of supplier's capacity from alternative or advanced energy sources
 - Example Technologies: CHP, Coal with Carbon Capture and Storage (CCS), coal co-fired w/biomass, or MSW

Source: SEE Action (<https://www4.eere.energy.gov/seeaction/topic-category/combined-heat-and-power>)

Example Midwest Utility CHP Programs



Illinois – ComEd Energy Efficiency Program – CHP

- 50% of feasibility assessment cost up to \$25,000
- 50% of interconnection fee up to \$25,000
- Production Incentive: \$0.07 per eligible kWh based on review of 12 months of metered data and capped at \$2,000,000 per project

[https://www.comed.com/SiteCollectionDocuments/WaysToSave/Business/PY9 CHP flyer v03.pdf](https://www.comed.com/SiteCollectionDocuments/WaysToSave/Business/PY9_CHP_flyer_v03.pdf)



Illinois – Nicor Gas energySMART CHP Program

- Available under C&I Custom Incentive Program:
- \$1.00/therm based on TRM calculations and verification
- Cap of \$500,000, requires pre-approval
- 25% of feasibility assessment cost up to \$12,500

<https://www.nicorgasrebates.com/your-business/custom-incentive/Combined-Heat-and-Power>
<https://www.comed.com/WaysToSave/ForYourBusiness/Documents/AssessmentsServiceProvidersList.pdf>

Illinois – DCEO Public Sector CHP Pilot Program (2014-2016)

- Up to \$2M per project (capped at 50% of project cost)
- Design Incentive: \$75/kW capacity
- Constructive Incentive: \$175/kW capacity
- Production Incentive: \$0.08/kWh ($\eta \geq 70\%$ HHV) OR \$0.06/kWh ($60\% \leq \eta < 70\%$ HHV) of “useful electric energy” produced (after 12 months of operation)

<https://www.illinois.gov/dceo/whyillinois/TargetIndustries/Energy/Pages/CHPprogram.aspx>



Illinois
Department of Commerce
& Economic Opportunity

Example Midwest Utility CHP Programs (cont.)



Ohio – Dayton Power & Light CHP Rebates

- Up to \$10,000 towards CHP feasibility study
- Generation incentive: \$100 per kW capacity and \$0.08 per kWh generated over 12 months (capped at 50% of total installed cost and capped at \$500,000 per project)

<https://www.dpandl.com/save-money/business-government/custom-rebates/chp-rebates/>



Ohio – AEP Ohio's Combined Heat and Power and Waste Energy Recovery Program

- The minimum total system efficiency required is 60% with a minimum 20% useful thermal energy. Incentives:
 - Up to \$0.035/kWh for systems > 1000 kW
 - \$0.05 per kWh for systems <= 1000 kW
 - Based on measured production of kWh recovered by the project
 - Payment of the incentive may occur over a period of 1 to 5 years

<https://www.aepohio.com/save/business/programs/CombinedHeatandPower.aspx>

CHP Project Snapshot:

Hauled Waste Yields Significant Savings

Des Moines Wastewater
Reclamation Authority

Des Moines, IA



Application/Industry: Wastewater Treatment

Capacity (MW): 4.6 MW

Prime Mover: 5 Reciprocating Engines

Fuel Type: Biogas

Thermal Use: Heat for the Digestion Process,
Building Heat

Testimonial: DMWRA hauls in high strength waste, enough to account for 40% of their organic loading. This gas helps the facility produce around 1.6 million cu. ft. of biogas daily, which is enough to fuel 5 reciprocating engines with some supply leftover to sell to a neighboring manufacturing facility.



600 kW Engine. Source: Iowa Environmental Council



1.4 MW Engine. Source: Iowa Environmental Council

Project Snapshot:

Targeting Net-Zero

Participated in Illinois DCEO EE Program

Downers Grove Sanitary District

Downers Grove, IL

Application/Industry:

Wastewater Treatment

Capacity (MW): 655 kW

Prime Mover: Reciprocating Engines

Fuel Type: Biomass

Thermal Use: Heat for Digestion Process

Installation Year: 2014, 2017

Highlights: In 2014, DGSG installed a 280 kW engine-driven generator with heat recovery, along with a gas conditioning system. The plant began processing waste grease from nearby restaurants within the digester system to increase gas production. To fully utilize this resource, it installed an additional 375 kW engine and generator in 2017 with incentives from utility ratepayer Energy Efficiency Portfolio Funds.

Downers Grove

Sanitary District



Project Snapshot:

Participating in Illinois DCEO EE Program

Glenbard Wastewater Authority

Glen Ellyn, Illinois

Application/Industry: Wastewater Treatment

Capacity (MW): 750 kW (2 x 375 kW)

Prime Mover: Reciprocating Engines

Fuel Type: Biogas & Natural Gas

Thermal Use: Heating Digesters

Installation Years: 2016

Highlights: The Glenbard Wastewater Authority received energy efficiency incentives through the Illinois Department of Commerce and Economic Opportunity's (DCEO) Public Sector CHP Pilot Program, which is part of the Illinois Energy Now Public Sector Program. To boost biogas production, the Glenbard Wastewater Authority also receives food waste and fats, oils, and greases (FOG).



Project Snapshot:

Opportunity Fuels

Lima Wastewater Treatment Plant

Lima, OH

Application/Industry:
Wastewater Treatment

Capacity (MW): 130 kW

Prime Mover: 2 Microturbines

Fuel Type: Biogas

Thermal Use: Heat for the
Digestion Process

Installation Year: 2012

Highlight: The CHP project was
determined to provide:

- Best avenue for reductions of V.O.C.'s
- Best return of electrical energy
- Best capture of the heat for use in the WWTP



Project Snapshot:

Dairy Farm Cogeneration

Sievers Family Farm

Stockton, IA

Application/Industry: Dairy Farm

Capacity (MW): 1 MW

Prime Mover: Reciprocating Engine

Fuel Type: Biomass

Thermal Use: Heating the Digesters

Installation Year: 2013

Energy Savings: Unknown

Testimonial: The 1 MW engine at Sievers Family Farm was awarded a \$500,000 USDA REAP grant, a \$250,000 NRCS EQIP grant, and a \$200,000 Alliant Energy grant. After the farm's electric needs are met, the remainder of the power is sold to Interstate Light and Power (Alliant Energy).



(L to R) Bryan Sievers, Paul Owen (CAT Financial), Jon Sievers, David Harris (Altorfer)



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Source: <http://www.americanbiogascouncil.org/projectProfiles/stocktonIA.pdf>

Project Snapshot:

Food Processing Plant

Campbell Soup Company

Napoleon, OH

Application/Industry: Food Processing

Capacity (MW): 2.8 MW

Prime Mover: Reciprocating Engines

Fuel Type: Biogas

Thermal Use: Heating Digesters

Installation Years: 2013

Testimonial: “This new biogas technology will improve Campbell’s Napoleon recycling rate to approximately 95%, reaching the company’s 2020 destination goal for the site early. The use of biogas energy will reduce greenhouse gas emissions associated with the use of electricity in this facility by approximately 16,000 metric tons per year, or the equivalent of 3,000 cars.”

- Dave Stangis, Vice President of Public Affairs and Corporate Responsibility, Campbell Soup Company

Campbell's



Source: <http://americanbiogascouncil.org/pdf/toretta.pdf>
<http://www.bnbrenewables.com/napoleon-biogas/>

Project Snapshot:

Public-Private Partnership

Gundersen Health System: Onalaska Campus
Onalaska, WI

Application/Industry: Healthcare

Capacity: 1.137 MW

Prime Mover: Reciprocating engine

Fuel Type: Landfill gas

Thermal Use: Space heating and hot water

Installation Year: 2012

Energy Savings: \$400,000

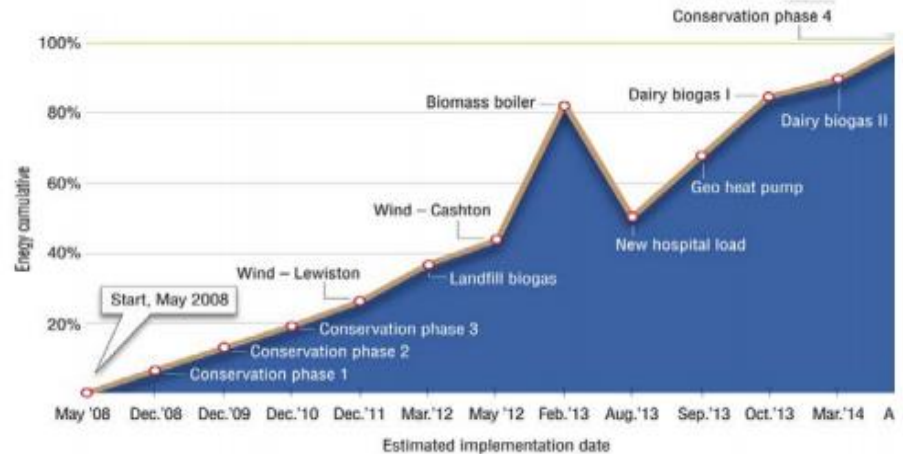
Testimonials: *“The project should pay back quite nicely because it’s offsetting a big portion of our electricity bill as well as our natural gas bill and we’re providing a revenue stream for the county.”* - Jeff Rich, Executive Director, GL Envision, Gundersen Health System

“This is a great use of a previously unused natural resource and it is an excellent example of what a public-private partnership can achieve in our community.”

- Hank Koch, Solid Waste Director, La Crosse County

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HEALTH SYSTEM®

Where Caring Meets Excellence



Source:

<http://www.midwestchptap.org/profiles/ProjectProfiles/GundersenLutheranOnalaska.pdf>

Project Snapshot:

100% Energy Independence

Gundersen Health System

La Crosse, WI

Application/Industry: Hospital

Capacity (MW): 500 kW

Prime Mover: Boiler/Steam Turbine

Fuel Type: Biomass

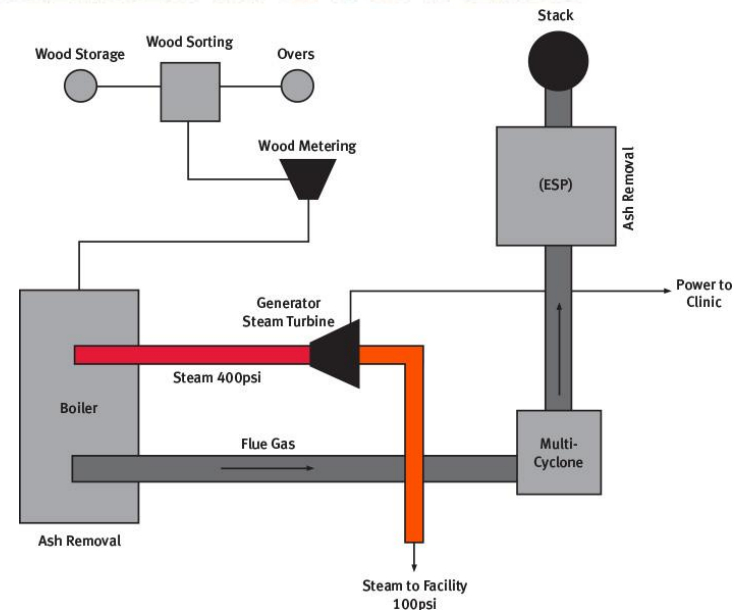
Thermal Use: Heating, Hot Water, Sterilizing Needs

Installation Year: 2013

Energy Savings: \$500,000/year

Testimonial: Gundersen Health System received a \$225,000 grant from the U.S. Forest Service through the Wisconsin Dept. of Administration for the biomass CHP system at their La Crosse campus. Gundersen Health system reached 100% energy independence in 2014 thanks to their 4 CHP systems at their campuses.

GUNDERSEN HEALTH SYSTEM®



Source: <http://www.gundersenhealth.org/news/gundersen-powers-up-biomass-boiler>,
http://lacrossetribune.com/news/local/gundersen-s-new-wood-chip-boiler-taps-region-s-resources/article_79024da6-b2c7-11e2-8d3a-0019bb2963f4.html
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Project Snapshot:

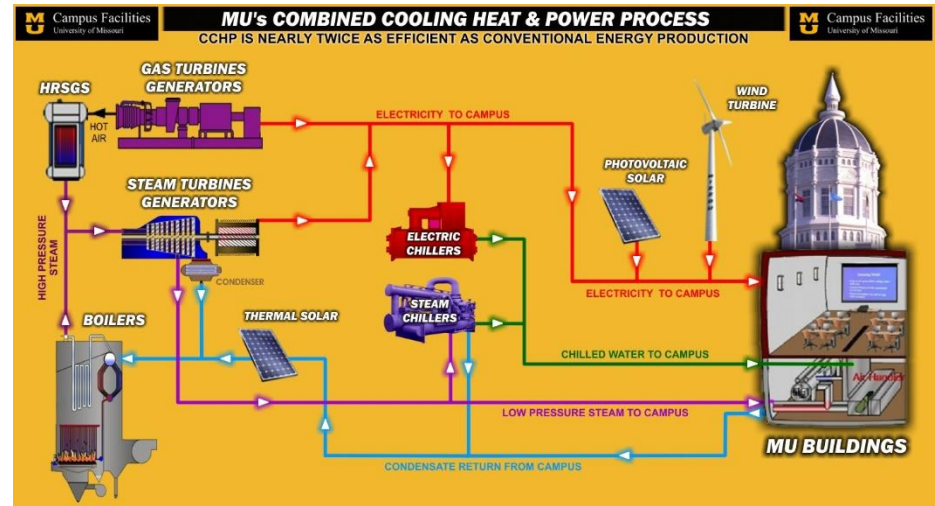
Green University Campus



University of Missouri
Columbia, MO

Application/Industry: University Campus
Capacity: 99.5 MW
Prime Mover: Steam turbines, gas turbines
Fuel Type: Biomass
Thermal Use: Steam, heating, cooling
Installation Year: 1961

Highlights: MU has been producing energy using various forms of CHP since 1892. The plant serves a wide variety of campus buildings and facilities, including two hospitals, a veterinary teaching hospital, a research reactor, numerous research facilities and laboratories, as well as classroom buildings, residence halls, dining facilities, athletic facilities, computer centers, and administrative buildings. The university recently replaced one of its coal-fired boilers with a 100% biomass-fired boiler integrated with the existing steam turbines, reducing coal use by 54%.



Source:
www.energy.gov/chp-installs
www.epa.gov/chp/our-partners
www.cf.missouri.edu/cf/em/eff

Project Snapshot:

Green University Campus

University of Iowa

Iowa City, IA

Application/Industry: University Campus

Capacity: 25.5 MW

Prime Mover: Steam turbines

Fuel Type: Coal, Oat Hulls, Wood Chips, Miscanthus

Thermal Use: Steam, heating, cooling

Installation Year: 1947

Testimonial: “The University of Iowa Hospital and Clinics’ research and residential services require continuous, uninterrupted supplies of steam. The new plant will not only ensure continuity of services to our most critical health and research facilities, but also provide back-up service to both sides of campus while providing the most flexibility in fuel sources.”

- Glen Mowery, Director of Utilities and Energy Management (comments on future system)



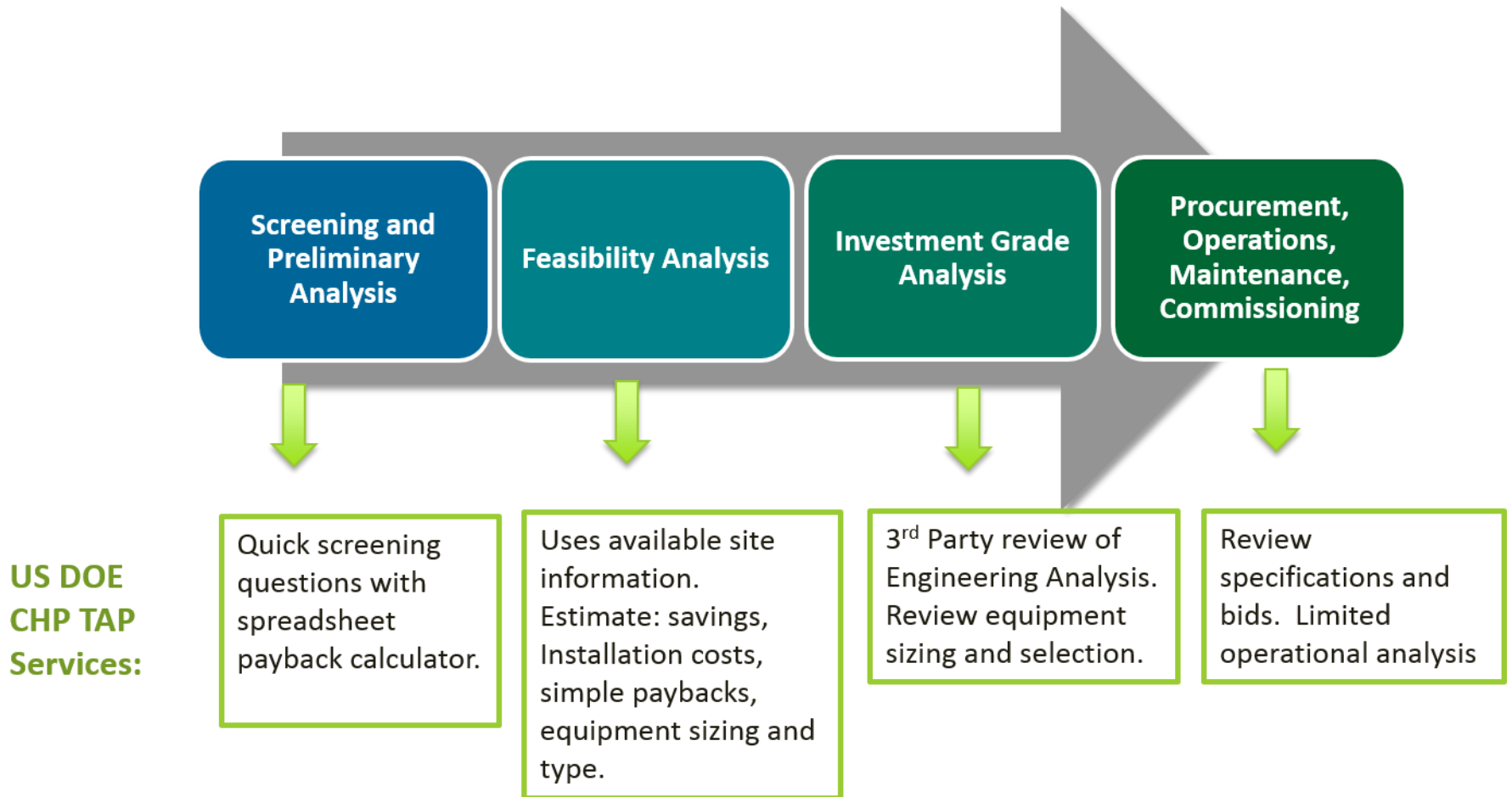
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CHP Project Development Steps

CHP TAP Technical Assistance



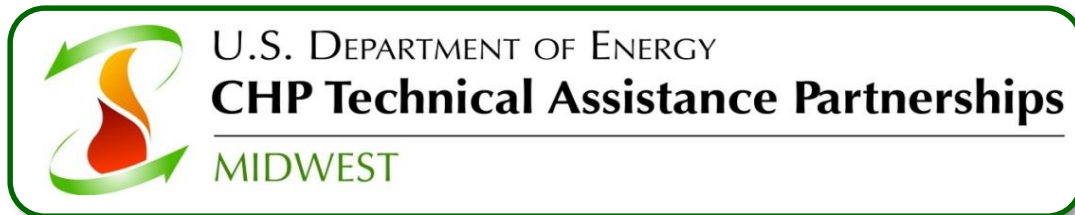
Summary and Next Steps

- CHP is a proven technology providing energy savings, reduced emissions, and opportunities for resiliency
- Emerging drivers are continuing to create new opportunities to evaluate CHP today including utilities finding economic value in CHP
- DOE CHP TAP resources are available to assist in developing CHP projects and providing education on CHP concepts and technologies

Thank You

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www.MidwestCHPTAP.org