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The Economics of Biomass Combined Heat & Power

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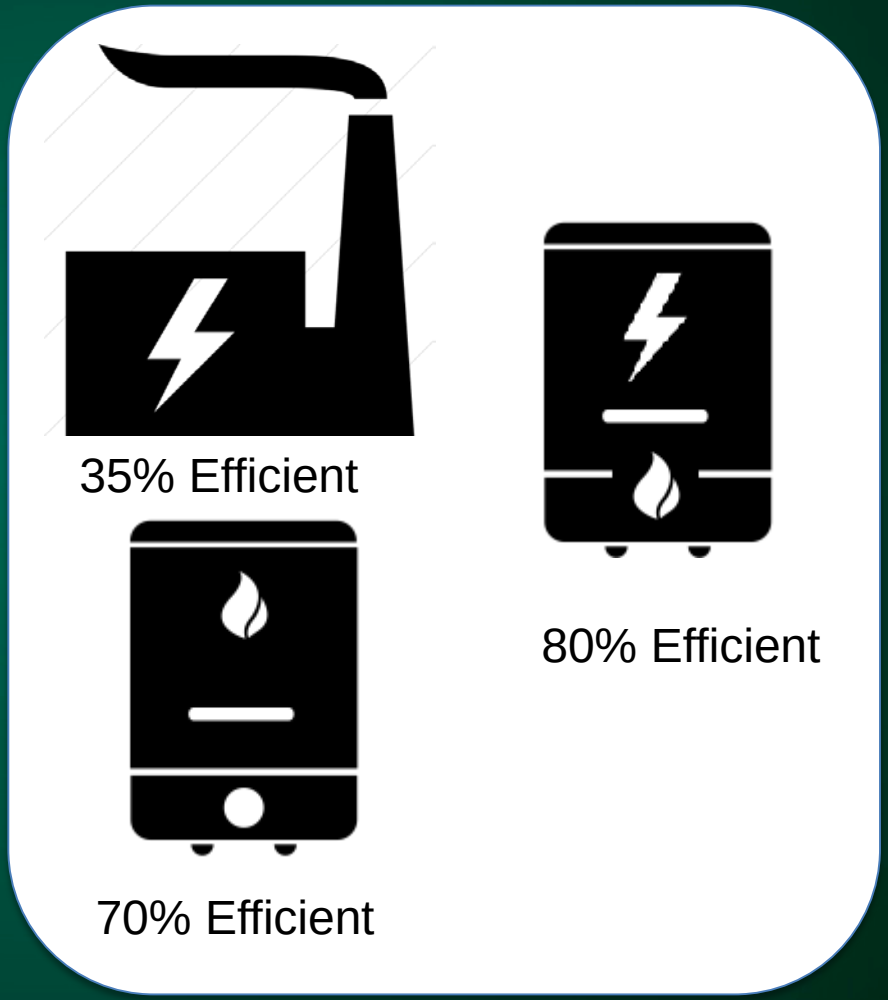
CHP Basics

Generating electric power and useful energy from a single fuel source



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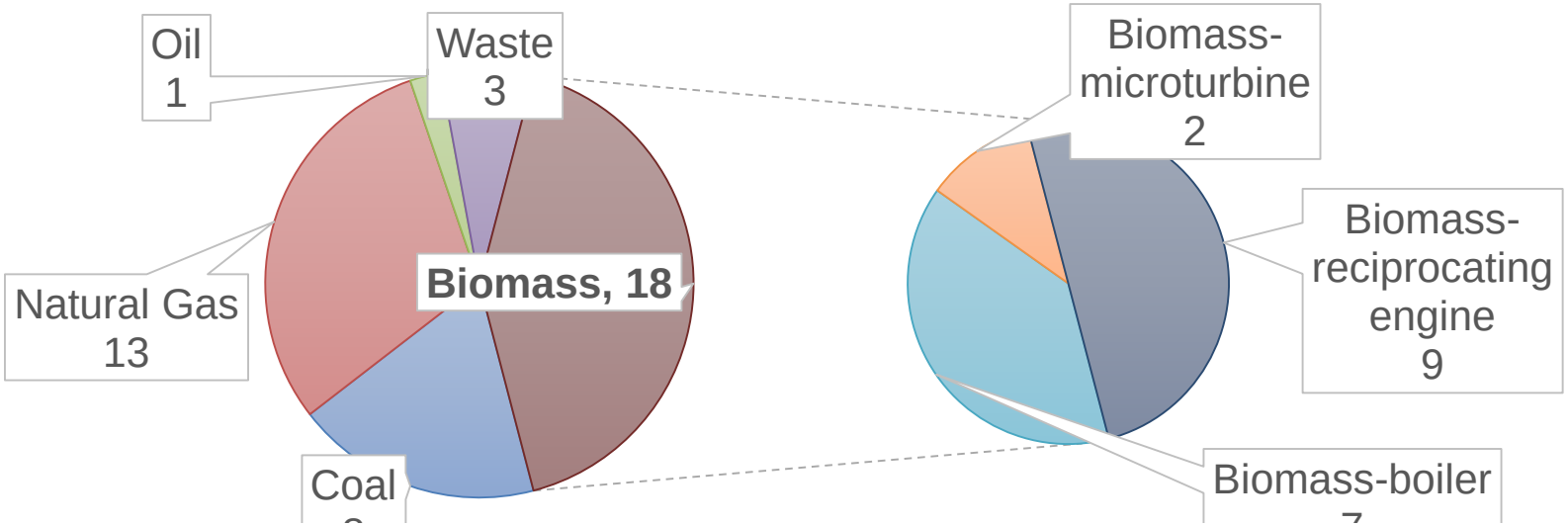
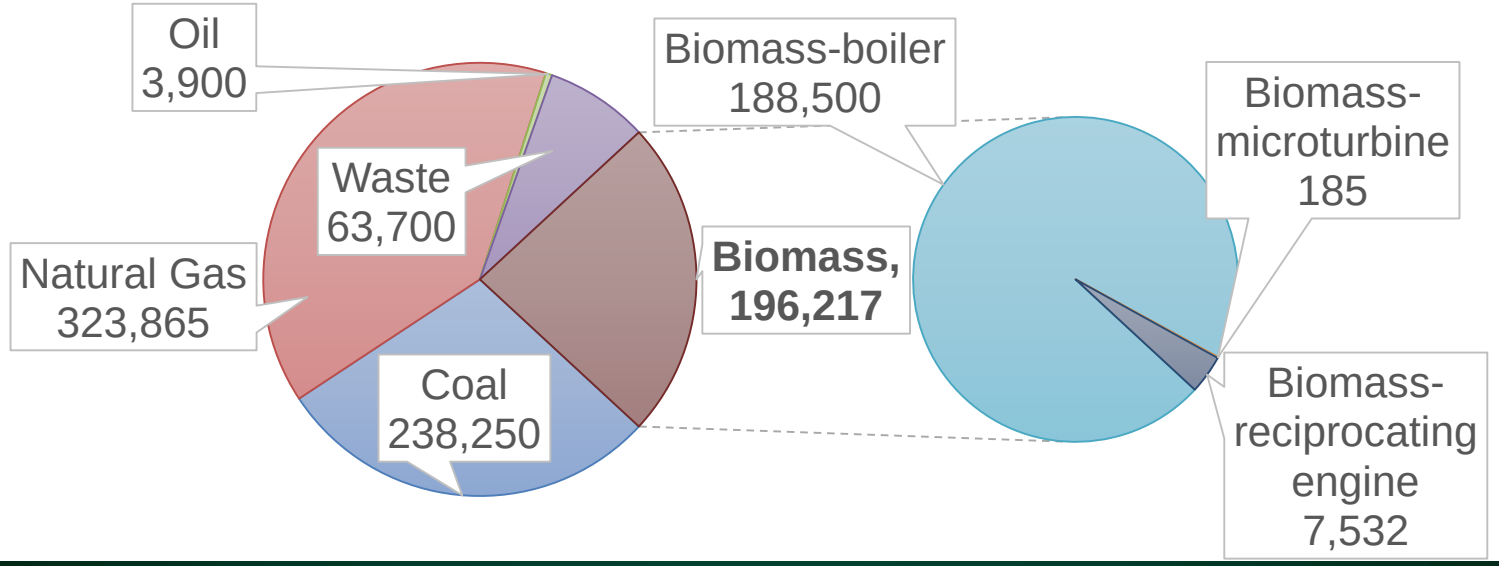
Minnesota CHP Facility Count

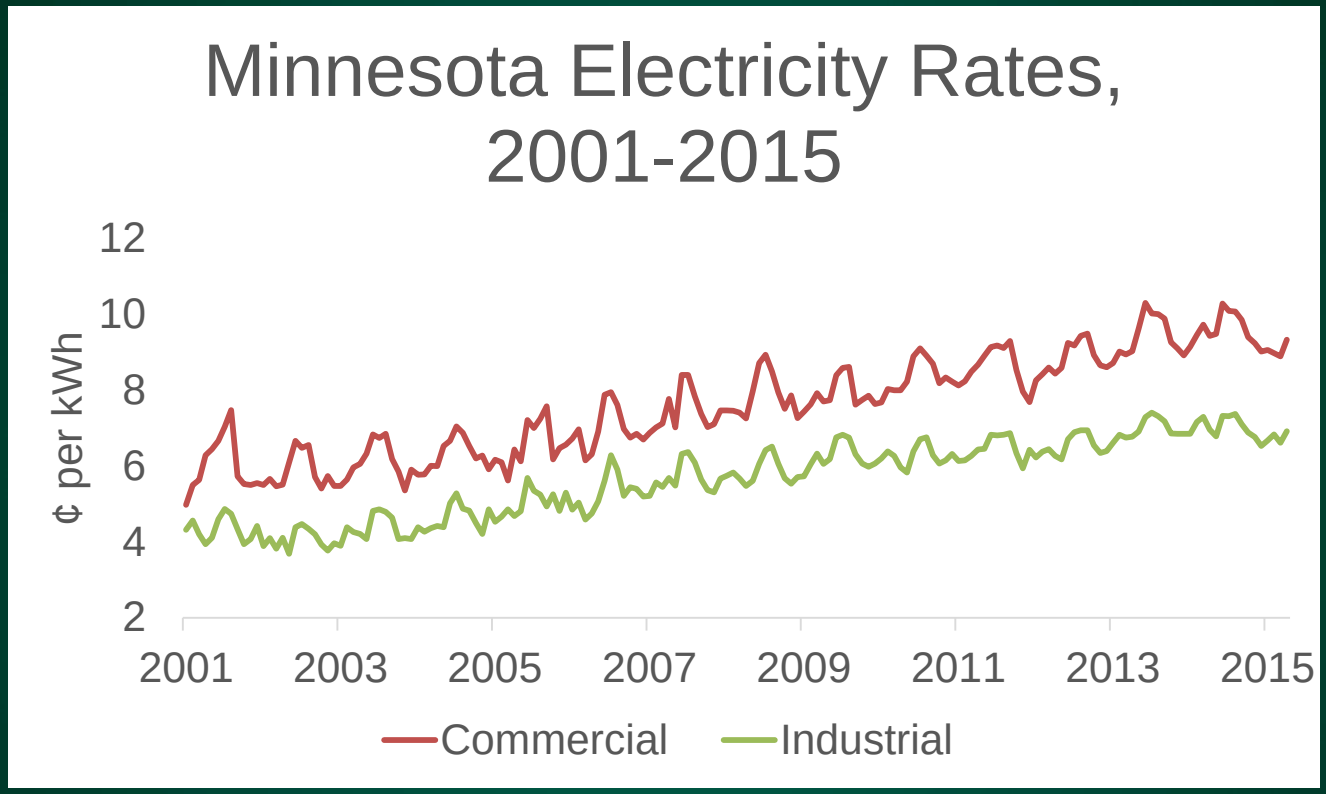


Minnesota CHP Capacity (kW)



Source: ICF CHP Database

CHP Benefits: Economic



Lower cost

Less price variability

Source: Energy Information Administration

CHP Benefits: Efficiency

Recover otherwise wasted thermal energy

Takes place closer to energy consumer- lower losses to transmission & distribution

CHP Benefits: Environmental

More efficient energy use

Lower carbon fuels

→Lower greenhouse gas emissions!

CHP Benefits: Resiliency

For those businesses whose operations depend on reliable power

-Adobe Biogas Fuel Cells

Why Biomass?

Energy cost savings

Greenhouse gas reductions

Local economic development

Reduced supply risk

When does CHP work best?

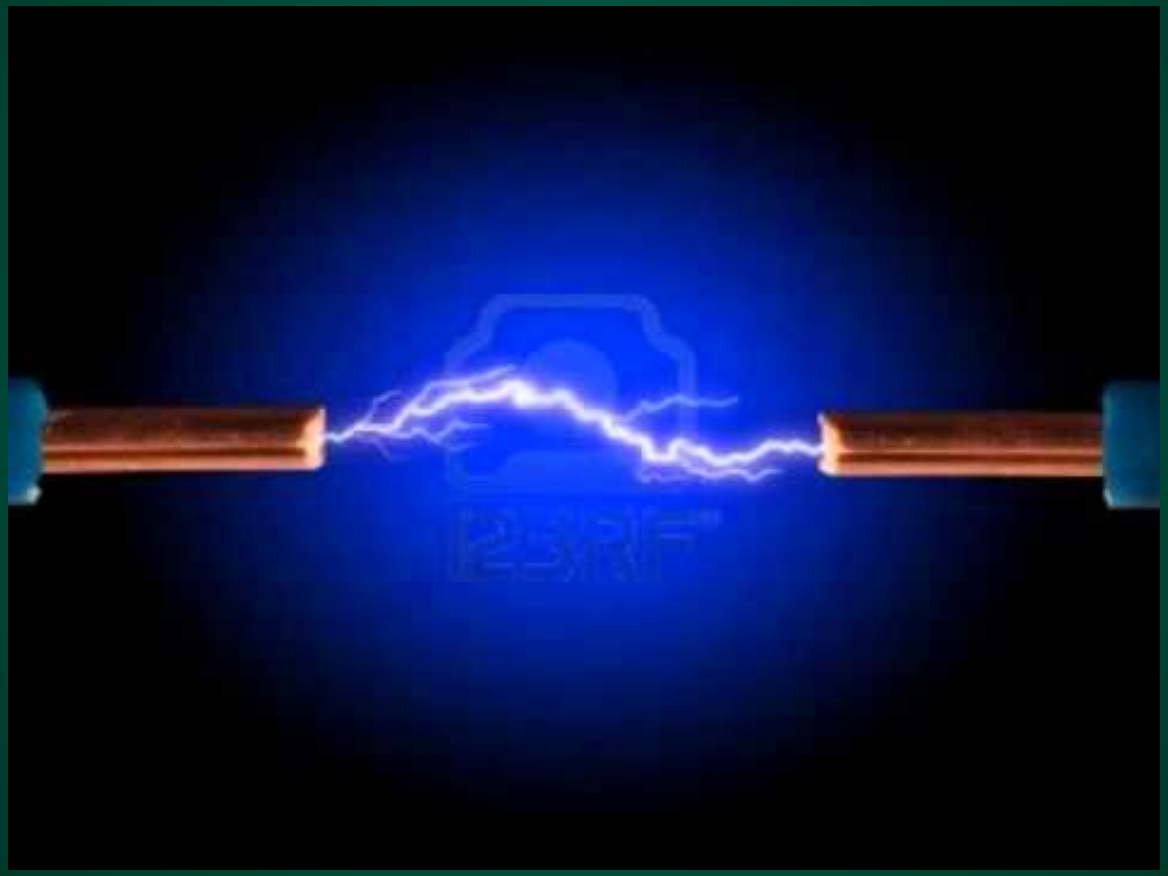
High electricity prices

Deregulated electricity markets

Firms with

- -Regular operations
- -Regular thermal loads
- -Existing central plant
- -Central plant equipment replacement or major construction planned
- -Reliability concerns
- -Environment

Determining Feasibility: The Spark Spread



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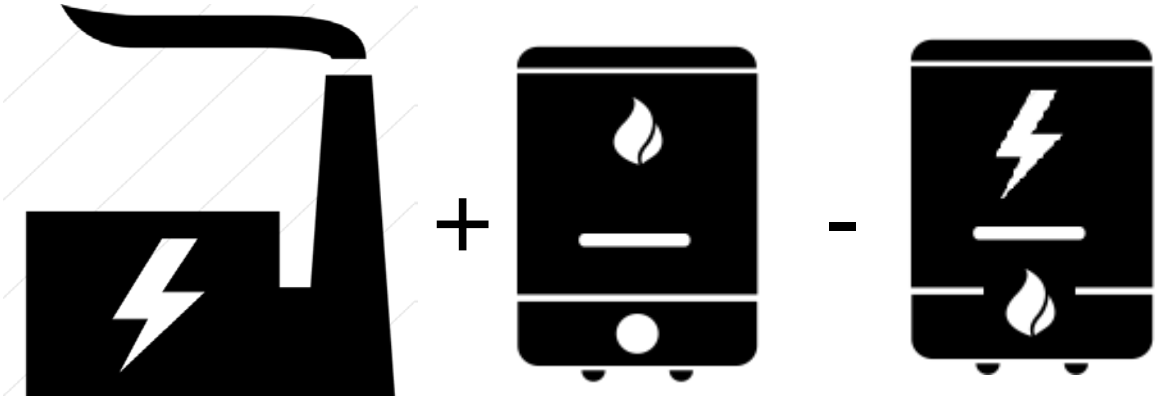
Spark Spread =

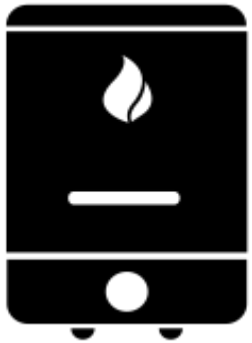


Spark Spread

=

Avoided cost of power ($/kWh)

+



Avoided cost of thermal fuel ($/MMBtu)

÷

Boiler efficiency (%)

÷

Power-to-heat ratio

÷

3,413 MMBtu/kWh

-

CHP fuel price ($/MMBtu)

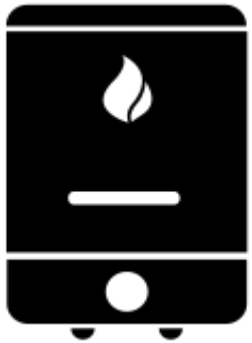
x

CHP heat rate (MMBtu/kWh)

Spark Spread

=

+



-

$.08/kWh

$6/MMBtu

$5/MMBtu

÷

80%

÷

.1

÷

x

.0141 MMBtu/kWh

3,413 MMBtu/kWh

$.03/kWh = $.08/kWh $.02/kWh $.0705/kWh

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You may have a CHP project if

the spark spread is positive

…we didn't account for capital costs and O&M.

Adding the Cost of Capital

Assumptions

- Electric Capacity (MW) 3
- Annual Operating Hours 8,000
- Capital Cost $18,000,000
- Cost of Capital 8%

Calculations

- Cost per kW $6,000
- Cost per kWh $.06

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+ O&M from $.02 to $.10+/kWh

Sensitivity Analysis

Prices: electricity, boiler fuel, CHP fuel, capital, O&M

Technology: boiler efficiency, power to heat ratio, CHP heat rate

Project scale and scope

Alternative fuels

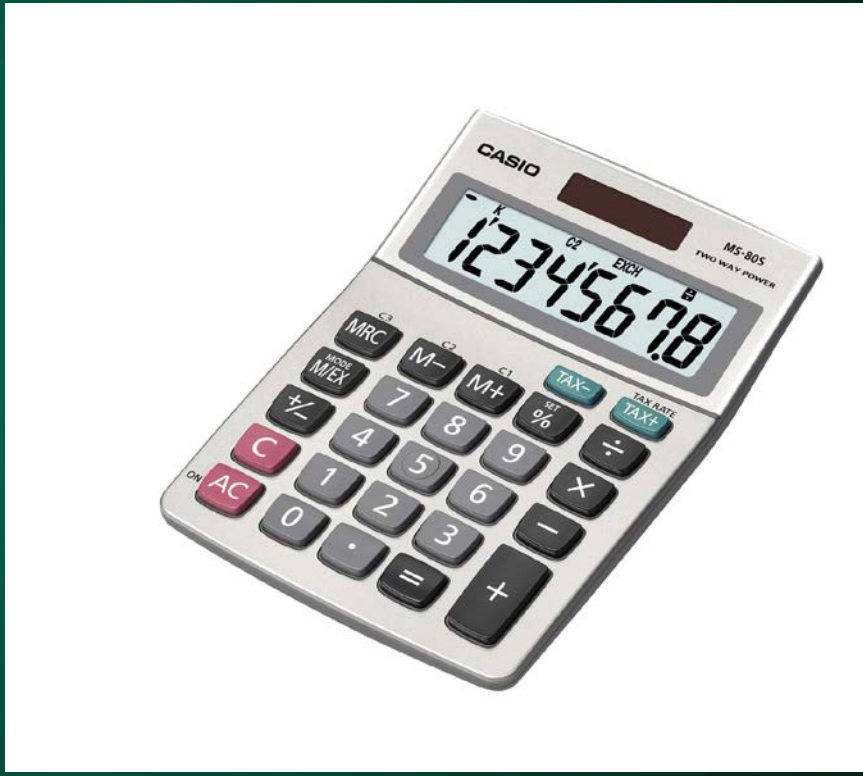
What about risk?

- Price risk
- Supply risk
- Policy risk
- Operating risk

What about emissions?

Calculate the spark spread using carbon instead of financial accounting

Price using a carbon price (eg \$20 MT/CO_2e)

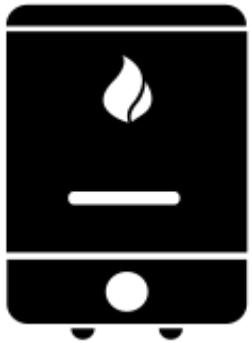


Green Spark Spread

=

Avoided GHG emissions of ~~power~~ (g $CO_{2\,e}$/kWh)

+



Avoided GHG emissions of ~~thermal fuel~~ (g $CO_{2\,e}$/MMBtu)

÷

Boiler efficiency (%)

÷

Power-to-heat ratio

÷

3,413 MMBtu/kWh

-

CHP GHG ~~emissions~~ (g $CO_{2\,e}$/MMBtu)

x

CHP heat rate (MMBtu/kWh)

Someone needs to get EPA better biomass carbon emissions values for their CHP emissions calculator ASAP!

CHP Policy

Federal

- Tax Incentives
- Financing (§ 1703)
- Boiler MACT
- § 111(d)

State

- Next Generation Energy Act (MN)
- RPS
- CIP
- Net metering
- Standby
- Incentives/financing

Summary

Know the basics

Calculate the spark

Follow policy developments

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