



Suggested Treatment of CHP in an EERS Context

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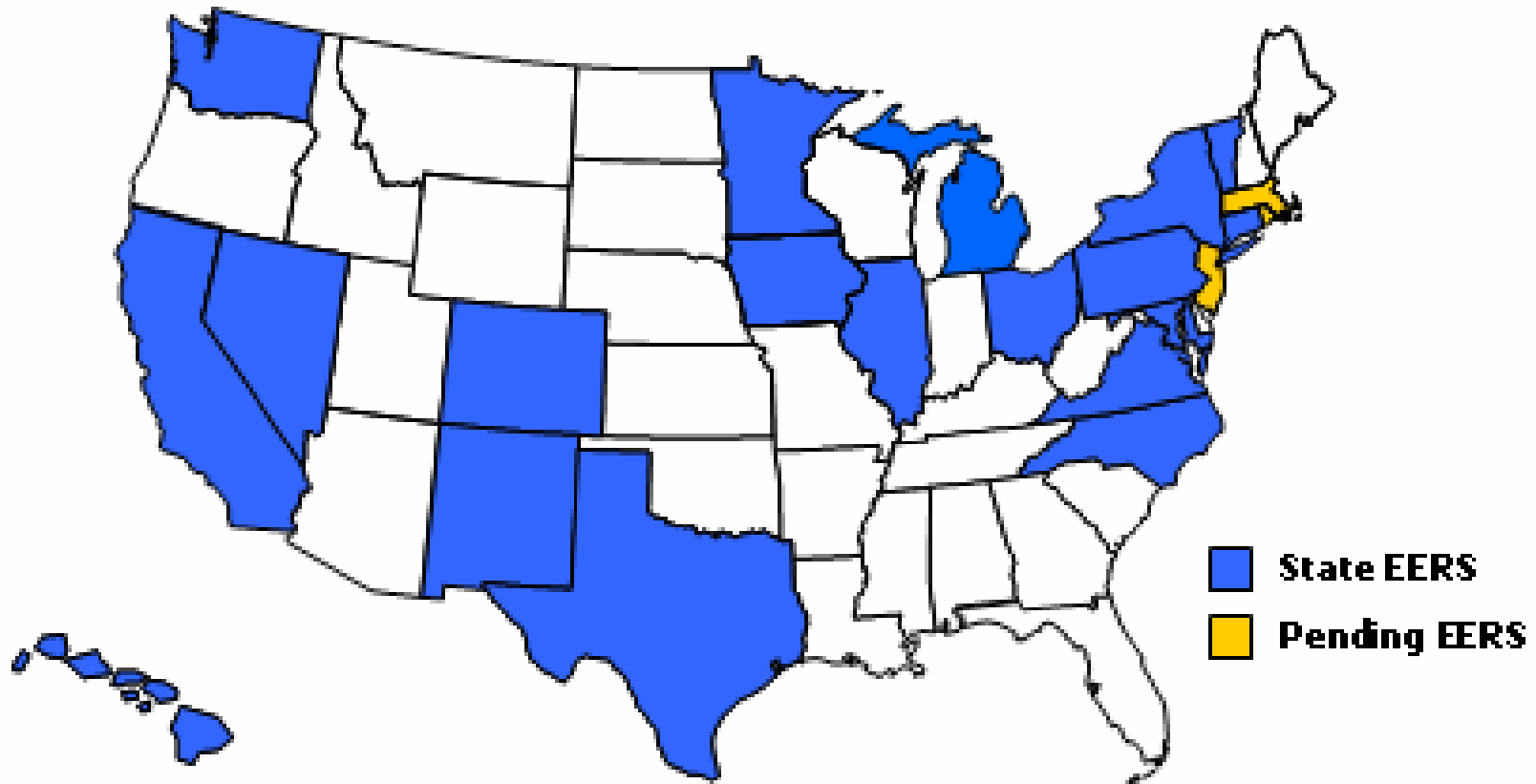
New Orleans, LA

What is an EERS and why do we care?

Energy Efficiency Resource Standard (EERS):

- Sets targets for utilities to achieve more electric and natural gas efficiency
- Can be found in 19 states / 3 pending
- Could possibly be enacted on a federal level (ACEEE recommends 15% electric and 10% natural gas targets met by 2020)
- Brings benefits of energy efficiency (cost and emissions reductions) to all states

State EERS Activity



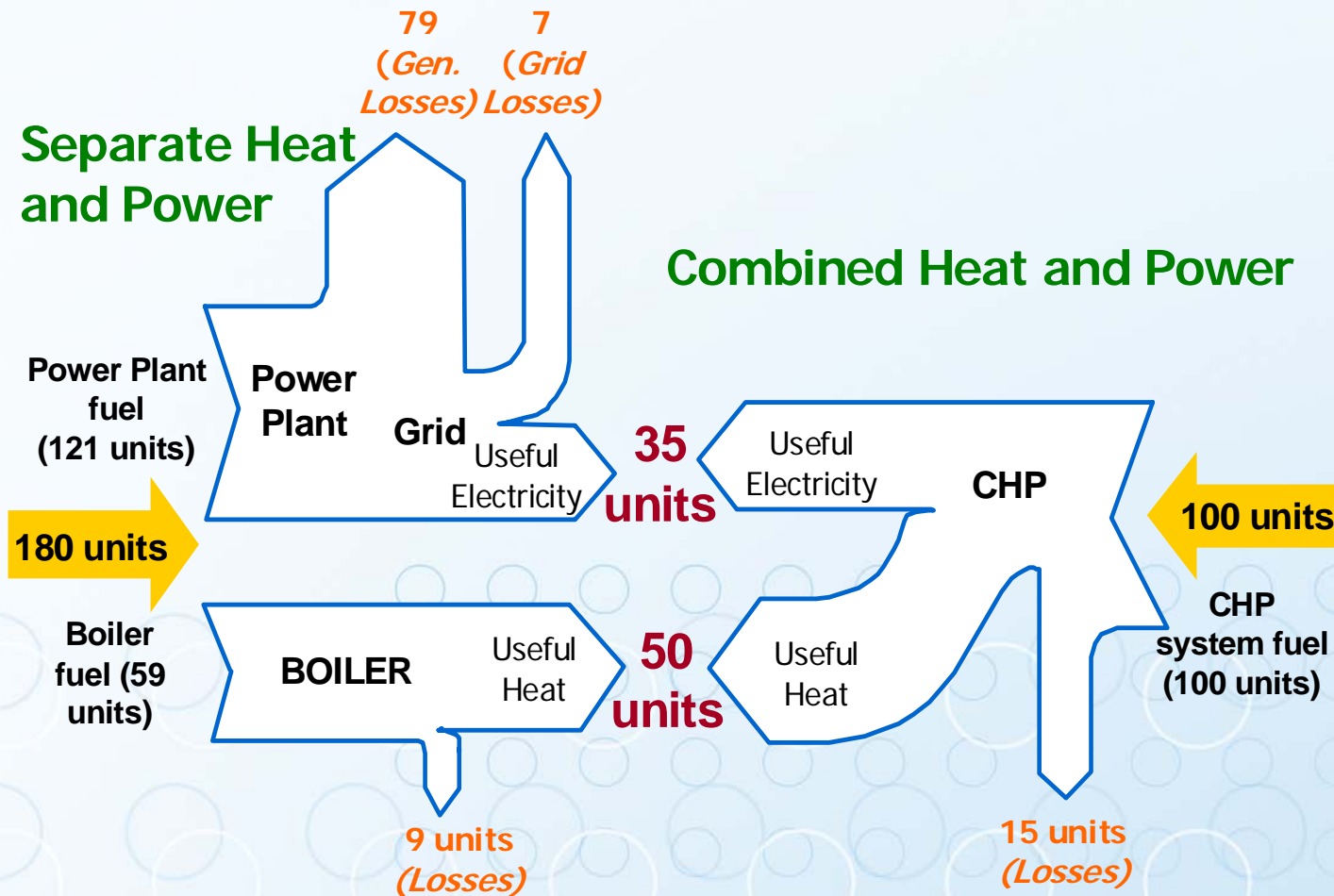
CHP's role in an EERS

- EERS savings: primarily end-use
- Must be quantifiable: what is impact?
 - Utilities and policymakers consider future savings in system and environmental plans
 - Valuation mechanism depends on accurate estimates
 - Most savings estimates: straight-forward
 - CHP savings impacts: nuanced and arcane

What makes CHP different?

- Savings accrue at point of centralized generation – *not* at point of use
- Multiple entities involved; who gets savings?
- Not all CHP systems are created equal
- Not all centralized generation is created equal
- If CHP didn't exist, onsite thermal generation would likely have existed regardless
- Offers considerable cost-effective savings

Considerations with CHP



Source: Elliott and Hedman 2001

Considerations with CHP

- Net decrease in total fuel input, compared to separate generation
- Reduced transmission/distribution losses
- Wholesale power generators excluded
- Cannot simply credit absolute output of system – distorts and misrepresents “true” CHP savings

Necessity for a new methodology

- Previous CHP incentives and policies: looked to set a single efficiency threshold
 - Adequate for just encouraging CHP deployment
 - But by producing 1kWh, is a CHP system directly displacing 1kWh from being created by the centralized grid?
 - In a word: No
 - So must scale credits accordingly
- Because an EERS confers calculable benefits to measures that save energy, measures must be comparable and tradable (if applicable)

Underlying assumptions of ACEEE methodology

- Not all CHP systems created equal
- Not all centralized generation equally efficient/clean
- Natural gas-fired CHP systems will participate in *one* EERS market, and it will be the electric market
- Other CHP systems will generally only participate in one EERS market as well
 - Onsite systems would exist regardless of CHP
 - Trying to capture benefit to electric market in particular
- EERS methodology should be directly applicable to future greenhouse gas crediting/trading systems

Proposed calculation

Credited savings = energy no longer consumed due to the presence of CHP

- For ease of discussion, we use fuel (expressed as BTUs) as basic unit
- Will convert back to creditable kWh later

$$S_{\text{FUEL}} = F_{\text{GRID,POWER}} - F_{\text{CHP,POWER}}$$

Proposed calculation

$$S_{\text{FUEL}} = F_{\text{GRID,POWER}} - F_{\text{CHP, POWER}}$$

S_{FUEL} = Total (creditable) net fuel savings from CHP system

$F_{\text{GRID,POWER}}$ = Fuel that *would have been used* by the power pool to create onsite electricity

$F_{\text{CHP, POWER}}$ = Fuel that is used by the CHP system to produce onsite electricity

Proposed calculation – input fuel

$$S_{\text{FUEL}} = F_{\text{GRID,POWER}} - F_{\text{CHP, POWER}}$$

Working on the last term of the equation...

$F_{\text{CHP, POWER}}$ = Fuel that is used by the CHP system to produce onsite electricity

- Net out: fuel that would have otherwise satisfied onsite thermal load (reference quant.)
- Justification: what is benefit to *this* market?
We only credit fuel attributable to the electricity

Proposed calculation – input fuel

$$S_{\text{FUEL}} = F_{\text{GRID,POWER}} - F_{\text{CHP, POWER}}$$

Working on the last term of the equation...

$$F_{\text{CHP, POWER}} = F_{\text{CHP, TOTAL}} - F_{\text{CHP, THERMAL}}$$

Where

$F_{\text{CHP, TOTAL}}$ = Absolute fuel input of CHP system

$F_{\text{CHP, THERMAL}}$ = CHP fuel input that would have been required to produce the same thermal energy as an onsite thermal system

Proposed calculation – grid fuel

$$S_{\text{FUEL}} = F_{\text{GRID,POWER}} - F_{\text{CHP,POWER}}$$

Working on the second term of the equation...

$F_{\text{GRID,POWER}}$ = Fuel that would have been used by the power pool to generate the now-onsite electricity

- Consider: rate at which power pool converts fuel to electricity on average + T&D losses
 - AKA: Average heat rate of power pool (BTU/kWh, would include T&D rate)
- Justification: What does saving 1 kWh mean *here*?
Need to know fuel reductions, emissions reductions

Proposed calculation – grid fuel

$$S_{\text{FUEL}} = F_{\text{GRID,POWER}} - F_{\text{CHP, POWER}}$$

Working on the second term of the equation...

$$F_{\text{GRID, POWER}} = E_{\text{CHP}} * H_{\text{GRID}}$$

Where

E_{CHP} = Avg. annual output of CHP system in kWh

H_{GRID} = Average heat rate of the corresponding power pool expressed as BTU/kWh

Proposed calculation – saved fuel

$$S_{\text{FUEL}} = F_{\text{GRID,POWER}} - F_{\text{CHP, POWER}}$$

S_{FUEL} = Creditable fuel savings that occur *at the point of generation*, in BTUs.

- Problem: we need to know what that means in terms of saved, comparable, creditable kWh for purposes of the EERS!
 - Solution: Revisit the grid's average heat rate

Proposed calculation - **New term!**

$$S_{\text{CHP,ELEC}} = \text{CHP savings (in kWh) creditable to an EERS}$$

$$S_{\text{CHP, ELECTRIC}} = S_{\text{FUEL}} / H_{\text{GRID}}$$

Where

S_{FUEL} = Saved fuel (in BTUs) from previous calculation

H_{GRID} = Average heat rate for power pool (same rate used in previous calculation)

Proposed calculation

$$S_{\text{CHP, ELECTRIC}} = \frac{[(E_{\text{CHP}} * H_{\text{GRID}}) - (F_{\text{CHP, TOTAL}} - F_{\text{CHP, THERMAL}})]}{H_{\text{GRID}}}$$

$$S_{\text{CHP, ELECTRIC}} = S_{\text{FUEL}} / H_{\text{GRID}}$$

$$S_{\text{FUEL}} = F_{\text{GRID, POWER}} - F_{\text{CHP, POWER}}$$

$$F_{\text{GRID, POWER}} = E_{\text{CHP}} * H_{\text{GRID}}$$

$$F_{\text{CHP, POWER}} = F_{\text{CHP, TOTAL}} - F_{\text{CHP, THERMAL}}$$

Proposed calculation

$$S_{\text{CHP, ELECTRIC}} = \frac{[(E_{\text{CHP}} * H_{\text{GRID}}) - (F_{\text{CHP, TOTAL}} - F_{\text{CHP, THERMAL}})]}{H_{\text{GRID}}}$$

Expressing the above in general form yields:

$$S_{\text{CHP, ELECTRIC}} = E_{\text{CHP}} \left[1 - \frac{F_{\text{CHP, TOTAL}} - F_{\text{CHP, THERMAL}}}{E_{\text{CHP}} * H_{\text{GRID}}} \right]$$

Proposed calculation

$$S_{\text{CHP, ELECTRIC}} = E_{\text{CHP}} \left[1 - \frac{F_{\text{CHP, TOTAL}} - F_{\text{CHP, THERMAL}}}{E_{\text{CHP}} * H_{\text{GRID}}} \right]$$

S_{CHP, ELECTRIC}	CHP savings (in kWh) creditable to an EERS
E_{CHP}	Annual electric output (in kWh) of CHP system, in kWh
F_{CHP, TOTAL}	Total fuel input (in BTUs) of the CHP system
F_{CHP, THERMAL}	Fuel (in BTUs) that would have been required to produce same amount of thermal energy as CHP system in onsite thermal-only system
H_{GRID}	Average heat rate (in BTU/kWh) at which the corresponding power pool generates and delivers electricity

Questions?

Thank you!

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