



Indirect Emissions  
District Heating, Cogeneration, District Cooling



# Cogeneration Facilities and Indirect Emissions

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- What does the law say about “indirect” emissions?
- What are “indirect” emissions?
- How to calculate indirect emissions.



## RCW 70.94.151(5)

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If owner or operator's direct emissions meet the reporting threshold...

Then must report....

their total annual emissions of greenhouse gases.

With Total Annual Emissions defined as...

all direct emissions plus all indirect emissions.



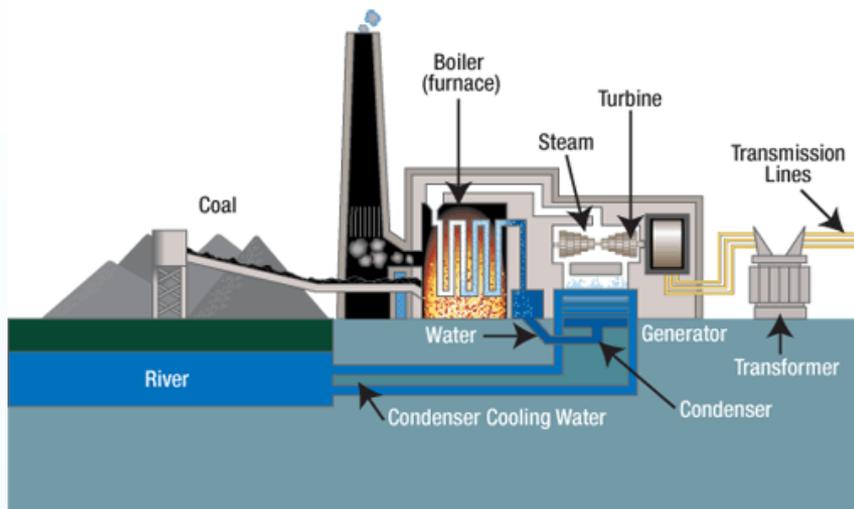
# Definition – Indirect Emissions

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- "Indirect emissions" means emissions of greenhouse gases associated with the purchase of electricity, heating, cooling, or steam.



# Indirect Emissions – Steam, Heat or Cooling



Cogeneration or District Heating or cooling plant produces GHG emissions ( direct emissions )

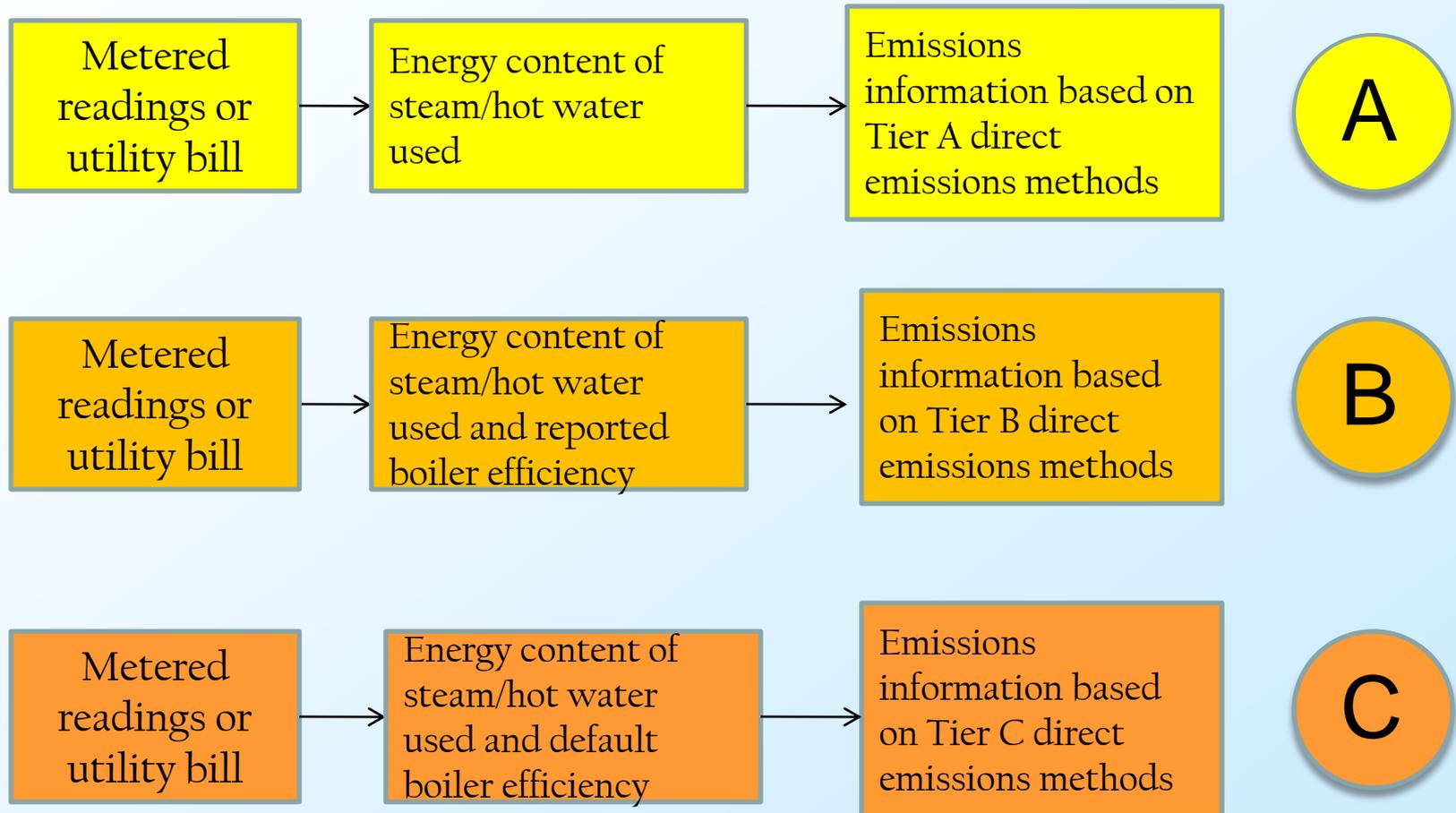


The steam or ‘waste’ heat or cooling is purchased by the reporter.

(indirect emissions)



# Data Quality Tiers





# General Process

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- Determine your annual heating/cooling energy use
- Gather information from the supplier
- Select the appropriate emission factors
  - Site specific factors supplied by the steam generator
  - ‘Generic’ factors based on the characteristics of the facility generating the heating/cooling energy
- Calculate annual emissions



# Steam/Heat Energy Used

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- Based on energy used in the heating application. Usual units are MMBtu or megaJoules per hour or year
- Determined from:
  - steam quality as received and returned to district heating or cogeneration facility (temperature, pressure, saturation)
  - Total quantity of steam (i.e. lb or kg steam per hour or year)
- Energy consumption based on difference in enthalpy between steam supplied and condensate returned
- Hot water energy use can be determined by a similar method



# Determine direct emissions from boiler

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- Calculate quantity of fuel consumed
  - Using energy content of steam produced and boiler efficiency, calculate MMBtu of fuel consumed /hour
- Calculate emissions of CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub> in lb or kg/MMBtu
  - Use fuel consumption and emission factors to calculate emissions
- Calculate CO<sub>2e</sub> in lb or kg/MMBtu
  - Convert to CO<sub>2e</sub> and sum



# Calculate emissions

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## ● Method 1

- Use the emission factors for the boiler (lb /MMBtu of steam)
- Multiply by the steam usage in MMBtu/hr or year
- Convert to annual indirect emissions

## ● Method 2

- Determine annual emissions from the boiler
- Take your % of the annual total steam production and multiply with the boiler emissions
- This is your annual indirect emissions



# Considerations when Steam/Heat is from a Cogeneration Plant

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- Must apportion heat input between electrical and heat production.
  - Need to know boiler efficiency, electrical conversion efficiency, other useful work performed by the cogeneration unit.
  - Determine MMBtu attributable to all uses and convert to common units such as MW or MMBtu (see Gail's discussion on indirect electrical emissions from cogeneration)
  - Apply emission factor for emissions attributable to the steam production to your steam purchases.
- Easily done for topping cycle cogeneration facilities, bottoming cycle cogeneration must be evaluated carefully



# District Heating/Cooling versus Cogeneration

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## ● Methods Similar

- Determine your energy usage,
- Determine emission factor per unit of heat used,
- Calculate indirect emissions

## ● Exceptions

- Cogeneration also needs to account for energy used for electrical production
- District cooling needs to account for how cooling is achieved – fuel combustion or electric motors



# Cogeneration Considerations

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- Determine total emissions attributable to total power and heat energy
- Determine net heat and power production in terms of a common energy unit (MWh, MMBtu/hr, etc)
- Calculate emissions attributable to your portion of the heat and electricity energy produced by the facility



# Cogeneration Electrical Considerations

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- Determine how much of the emissions are attributable to the electrical production
- Determine your share of the electrical production (% of total)
- Determine the total GHG emissions attributable to your share of the total electrical production



# Cogeneration Steam Usage Considerations

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- Determine how much of the emissions are attributable to the steam production/heat production
- Determine your share of the total heat production (% of total)
- Determine the total GHG emissions attributable to your share of the heat energy produced



# District Cooling Systems

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- Similar to the heating examples, you need to determine the total emissions for the cooling system and your share of the total cooling system output to determine emissions
- District cooling can be accomplished by combustion methods or electrical processes.



*Climate Change*  
*global warming*

Questions?