



Searching for new roles for district heating in a sustainable society

Danica Djurić Ilić – Linköping University, Sweden,
Louise Ödlund - Linköping University, Sweden



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Aim:



Can DH contribute to a sustainable development of other energy systems?

Sustainable development?

”...development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

G. Brundland (1987)



Basic principles for sustainability:

In a sustainable society, nature is not subject to systematically increasing...

- 1)...concentrations of substances extracted from the Earth's crust,
- 2)...concentrations of substances produced by society,
- 3)...degradation by physical means

and, in that society...

- 5-8)...people are not subject to conditions that systematically undermine their capacity to meet their needs.”

The research questions:



1. Can the following business strategies ensure profitable DH production and contribute to DH having an important role towards and in a future sustainable energy system?

- introduction of biofuel production into DHSs
- integration of DH-driven absorption cooling technology in DHSs
- delivering industrial waste heat (from biofuel production industry) to DHSs
- increasing DH use in industrial processes.

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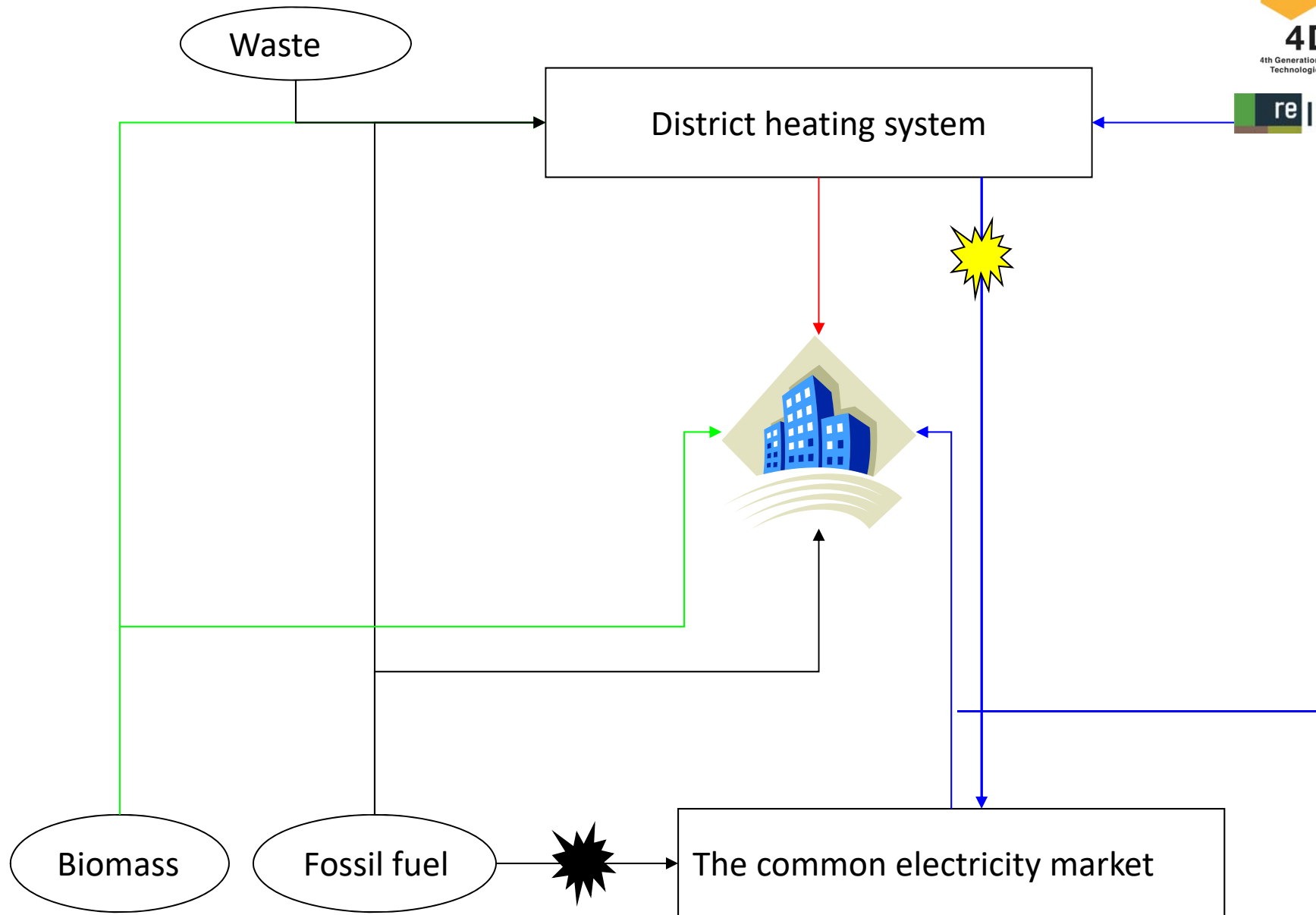


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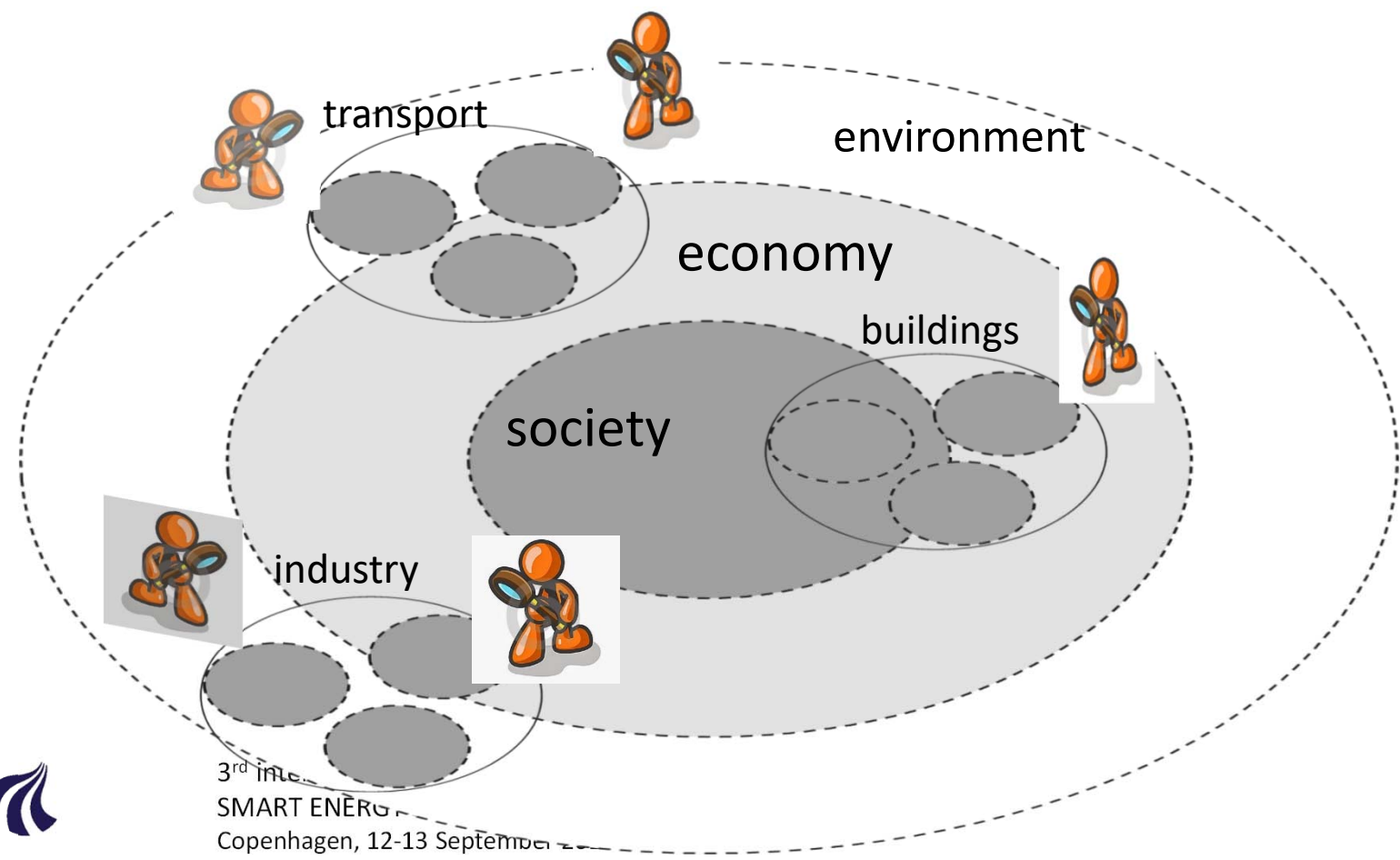
- introduction of biofuel production into DHSs
- integration of DH-driven absorption cooling technology in DHSs
- delivering industrial waste heat (from biofuel production industry) to DHSs
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2. How can heat production in DHSs contribute to reduction of global fossil fuel consumption and global GHG emissions?

The fundamental idea of district heating



You can not see the forest for the trees!

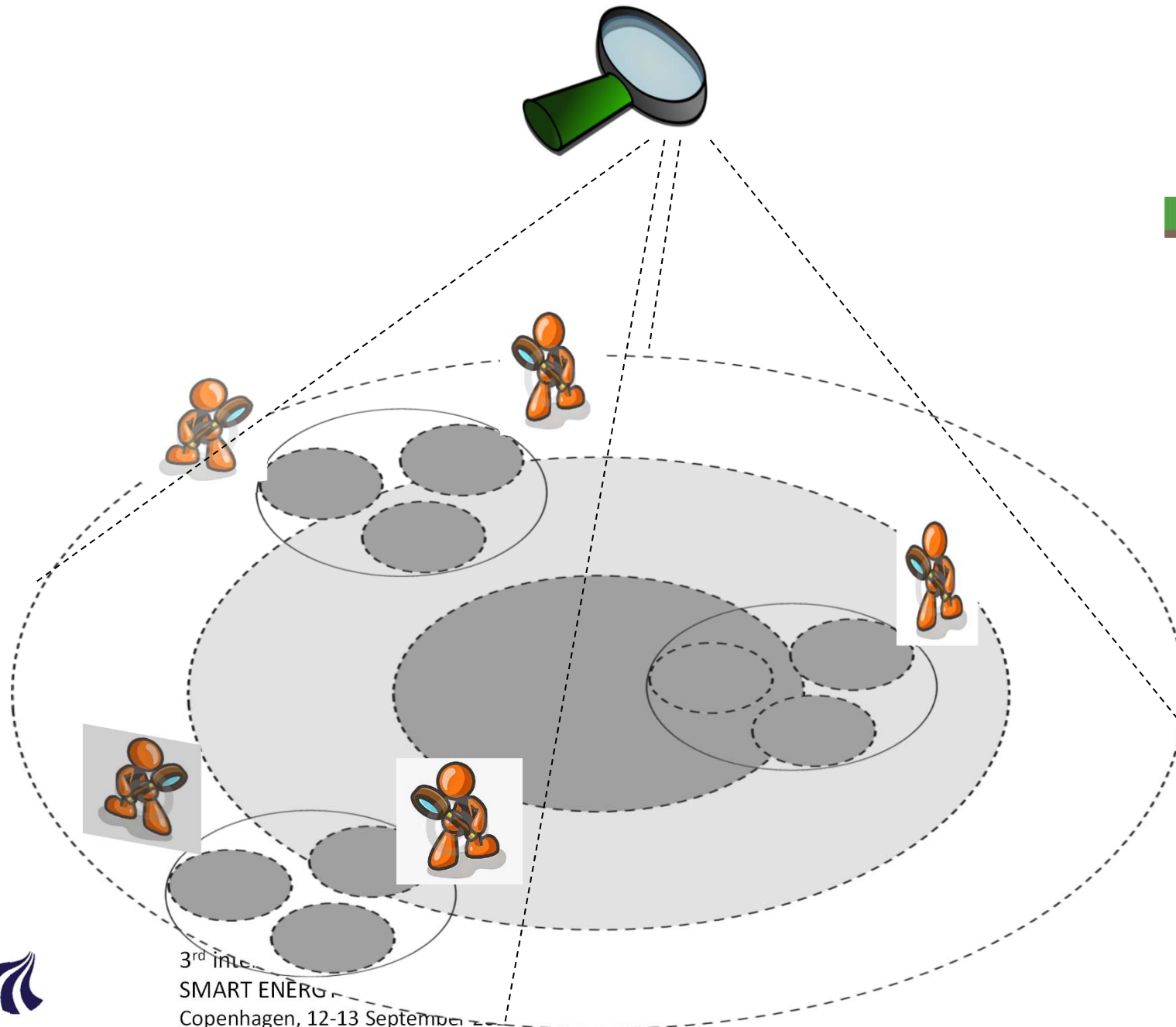




4DH

4th Generation District Heating
Technologies and Systems

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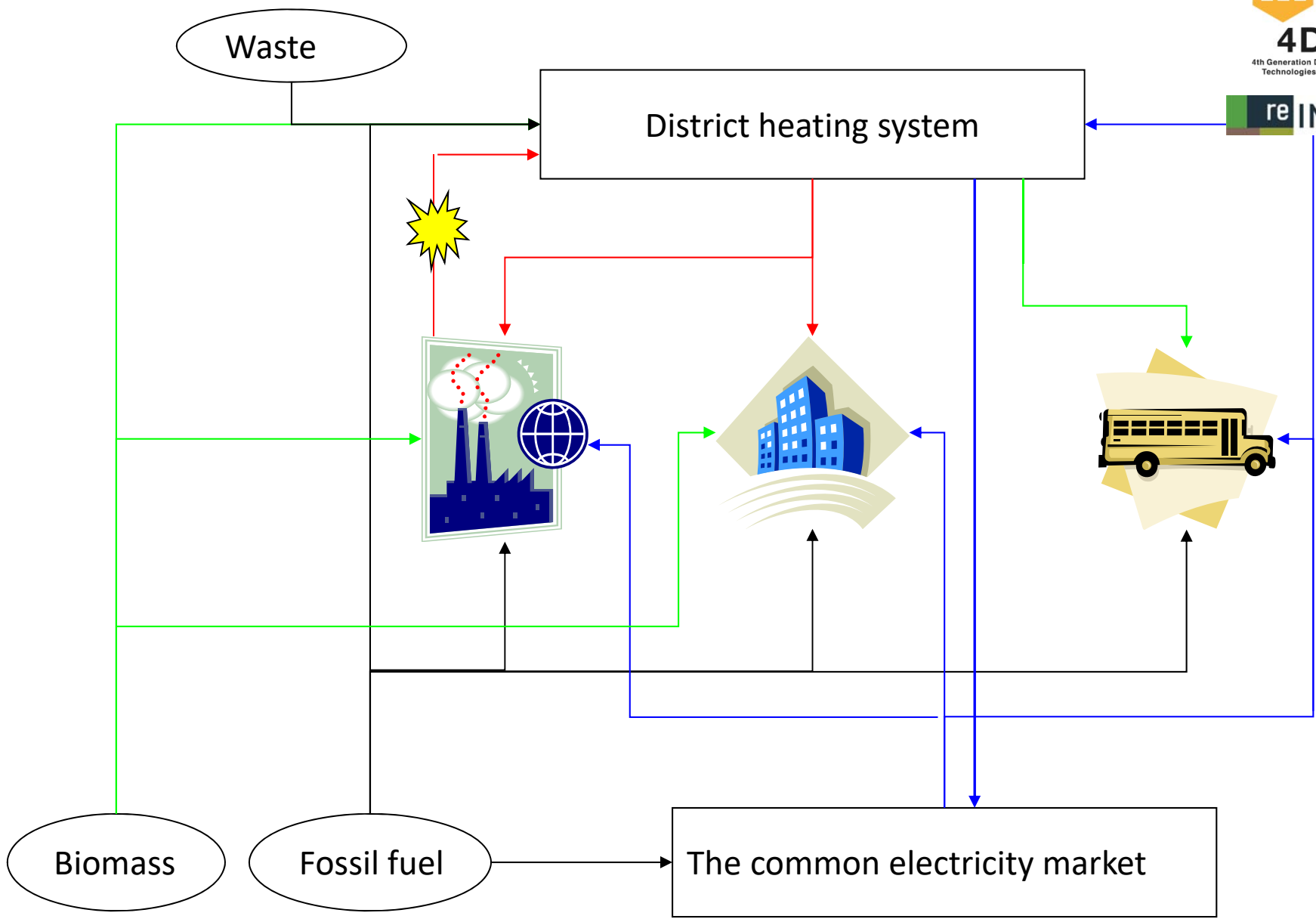
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Sectors of interest	TS, DHS	IS, DHS	IS, DHS	IS, BS, DHS
Suggested business strategy	Biofuel by-production	Excess heat recovery from biofuel production industry	Use of DH in industrial processes	Absorption cooling production
Geographical case studied	Stockholm	-	Västra Götaland, Östergötland, Jönköping	Stockholm
Time frame applied	Long-term; (2030-2040)	Long-term; (2030-2040)	Long-term; (2030-2040)	Long-term; (2030-2040)
EMSs applied	EMS _{levels} , EMS _{WWF} , EMS _{WEO}	EMS _{WEO}	EMS _{WEO}	EMS _{WEO}
Model framework and tool applied	MODEST	Excel	MeHLA	MODEST
Viewpoint (perspective)	From DH producers	From IS	From IS	(From DH producers)
GHGs included in the study	CO ₂ +CH ₄ +N ₂ O	-	CO ₂ +CH ₄ +N ₂ O	CO ₂ +CH ₄ +N ₂ O



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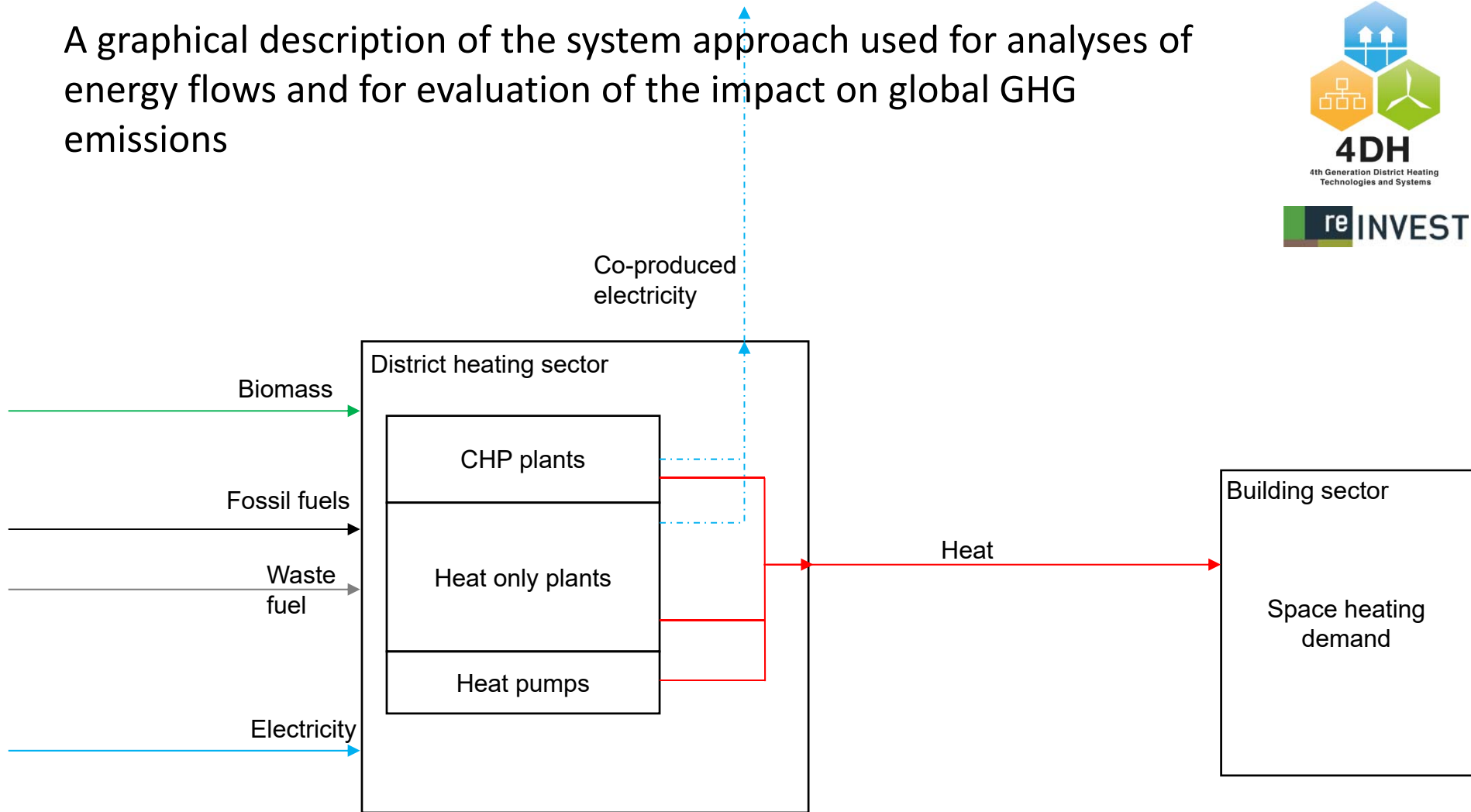
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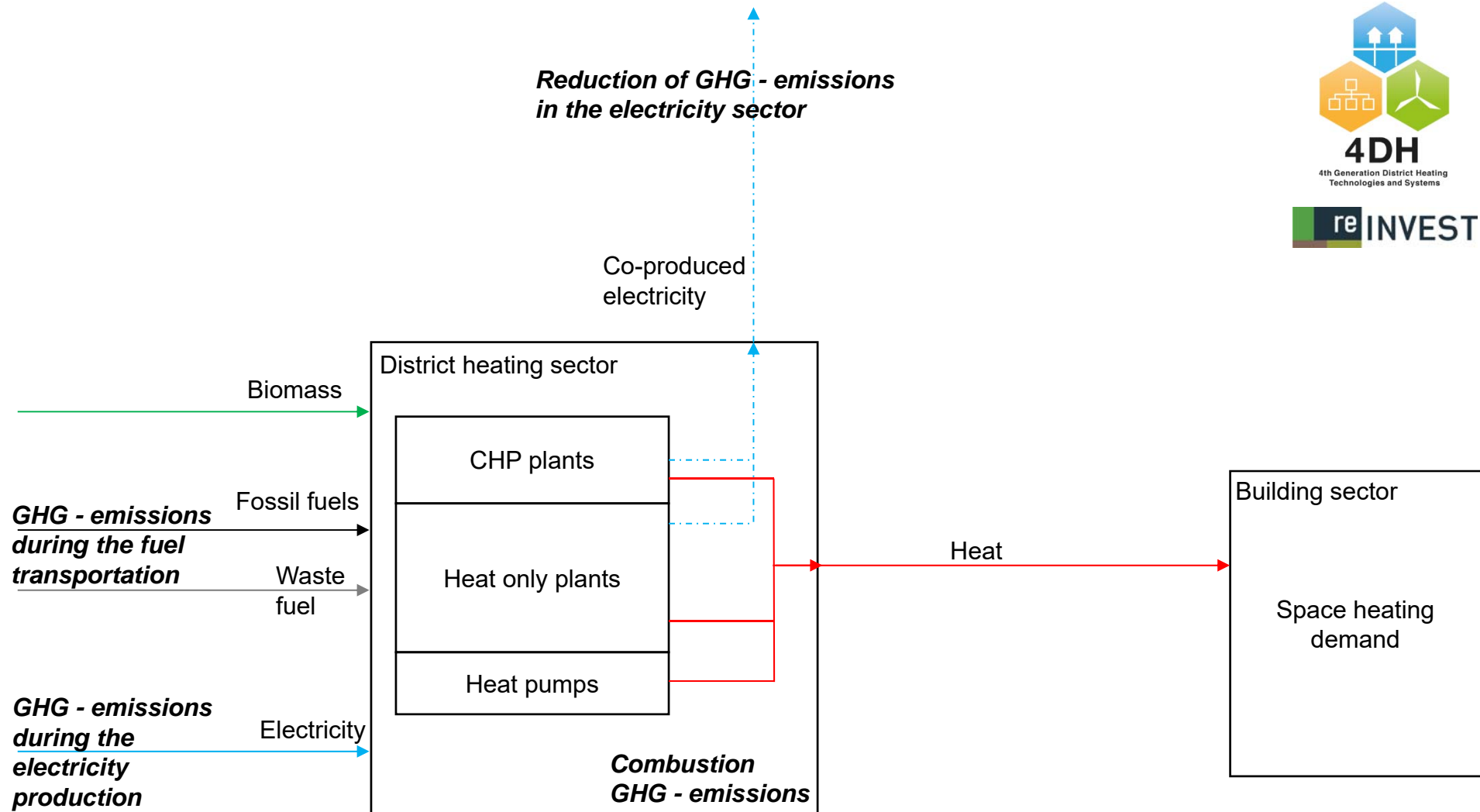
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A graphical description of the system approach used for analyses of energy flows and for evaluation of the impact on global GHG emissions





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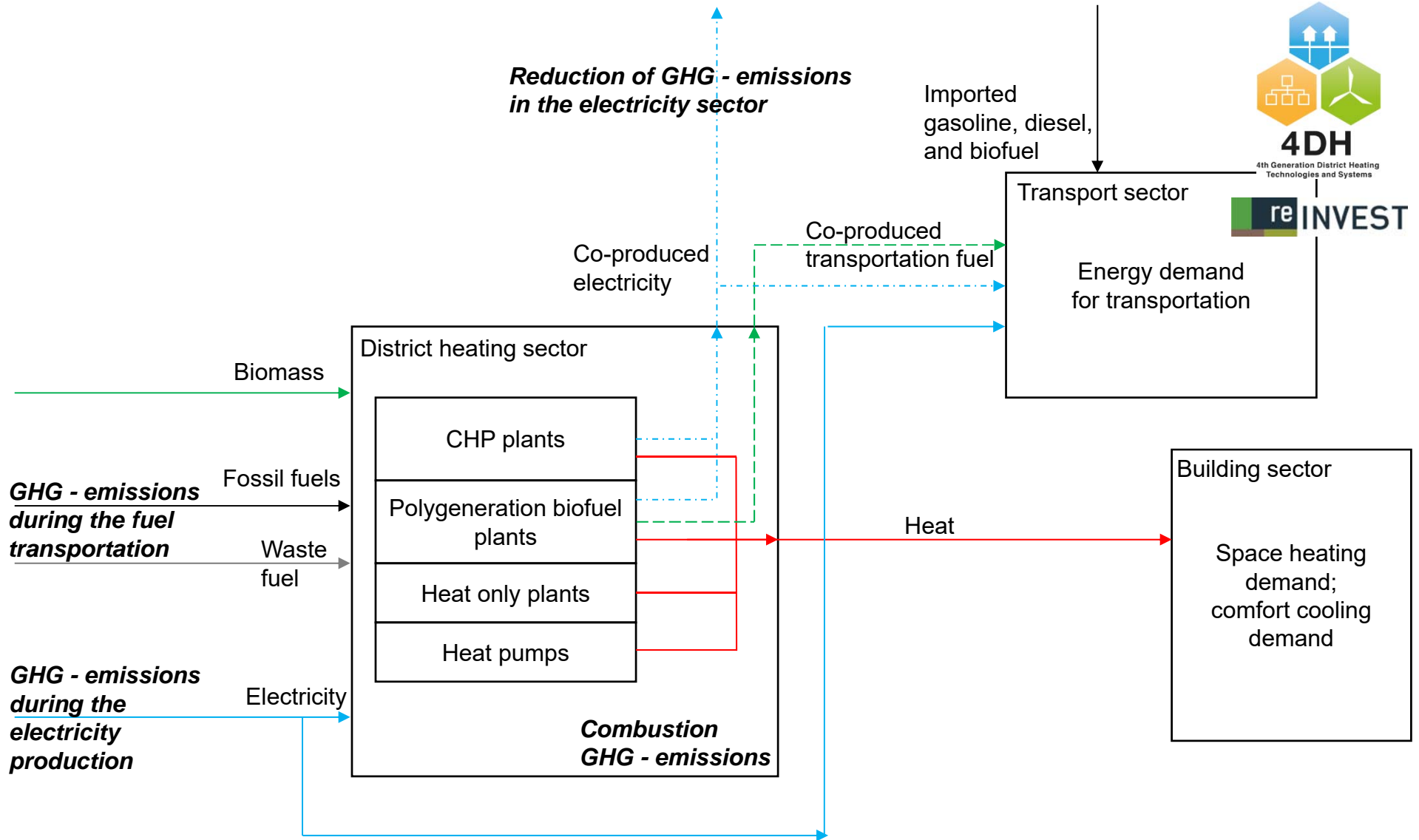
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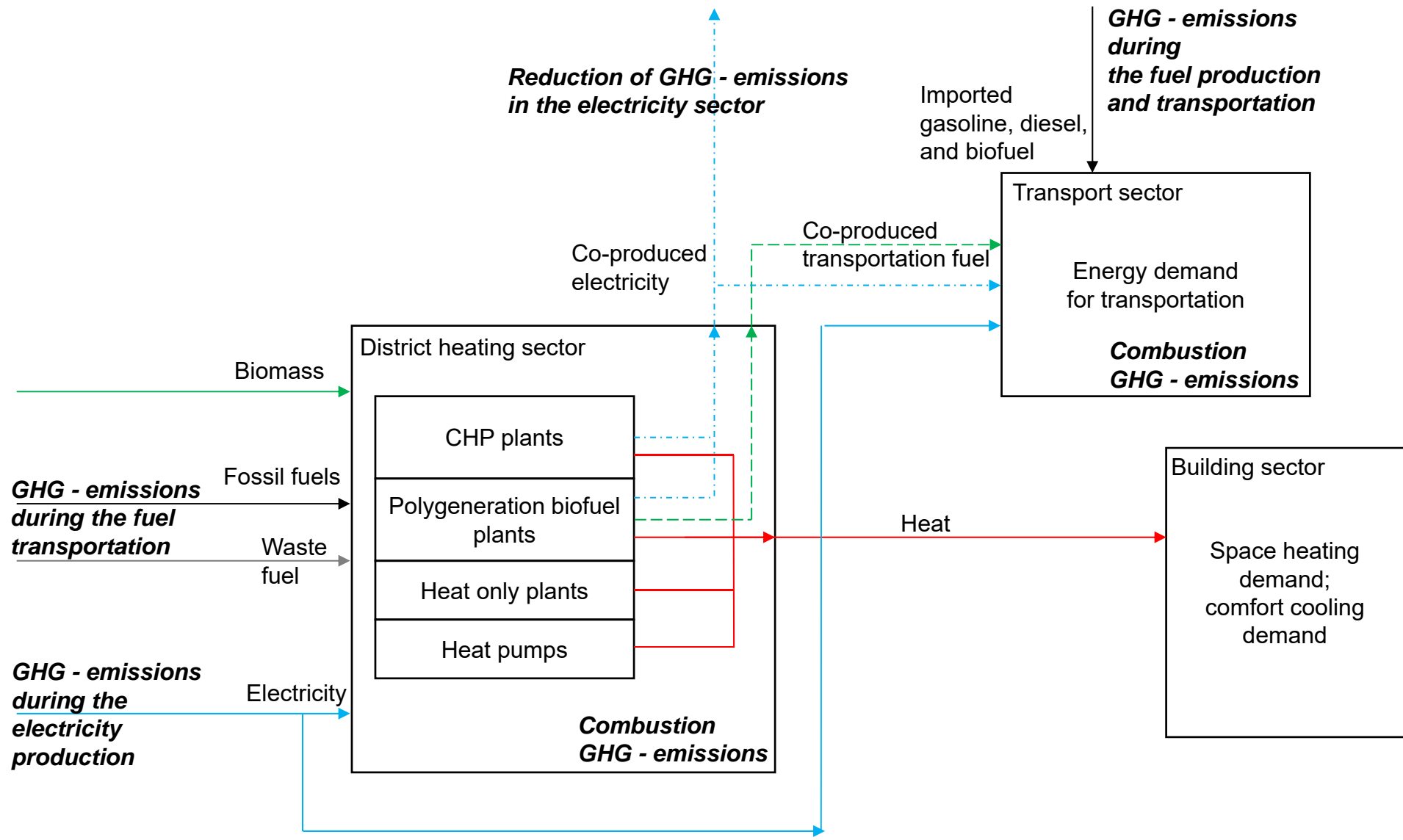
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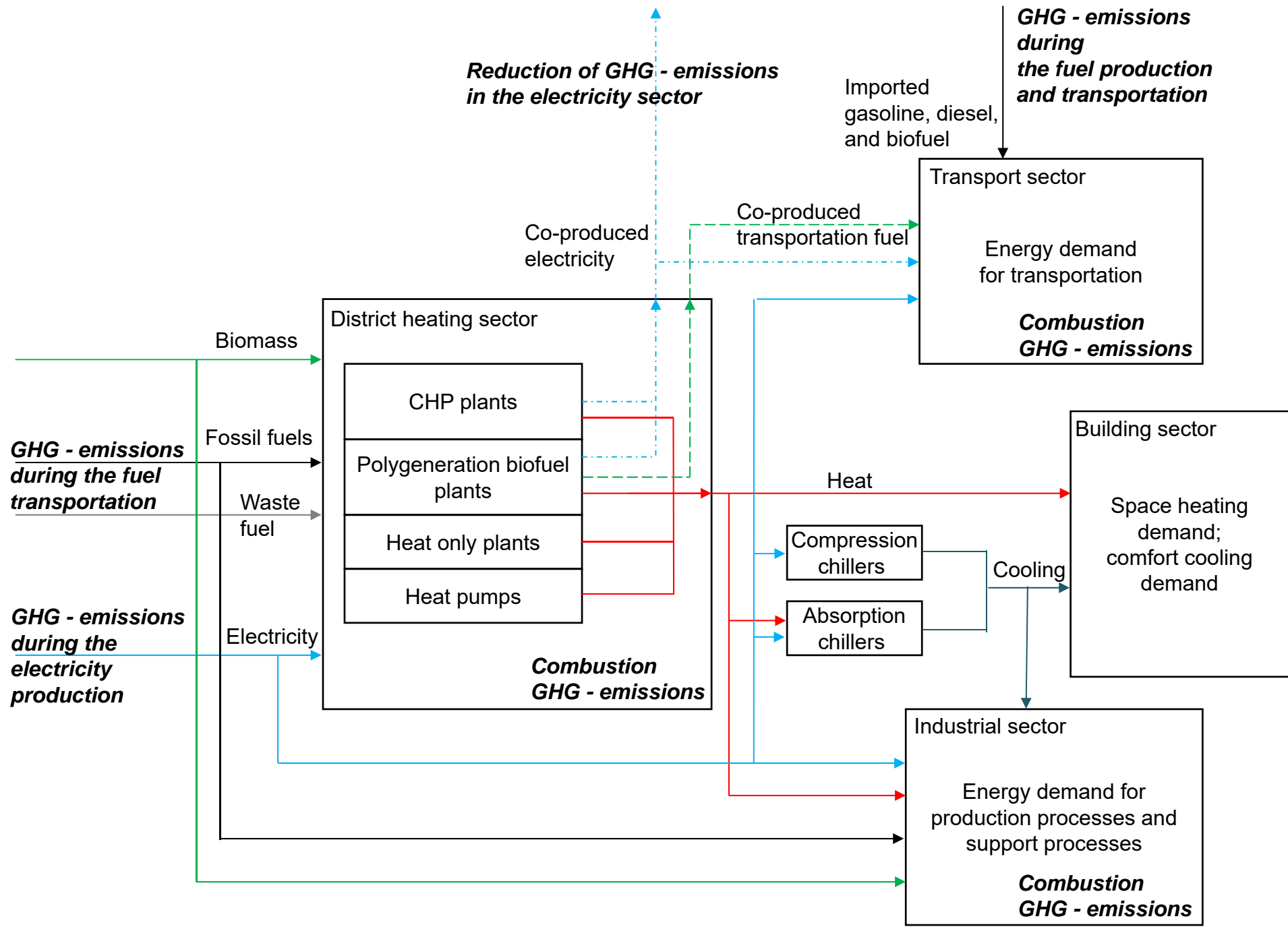
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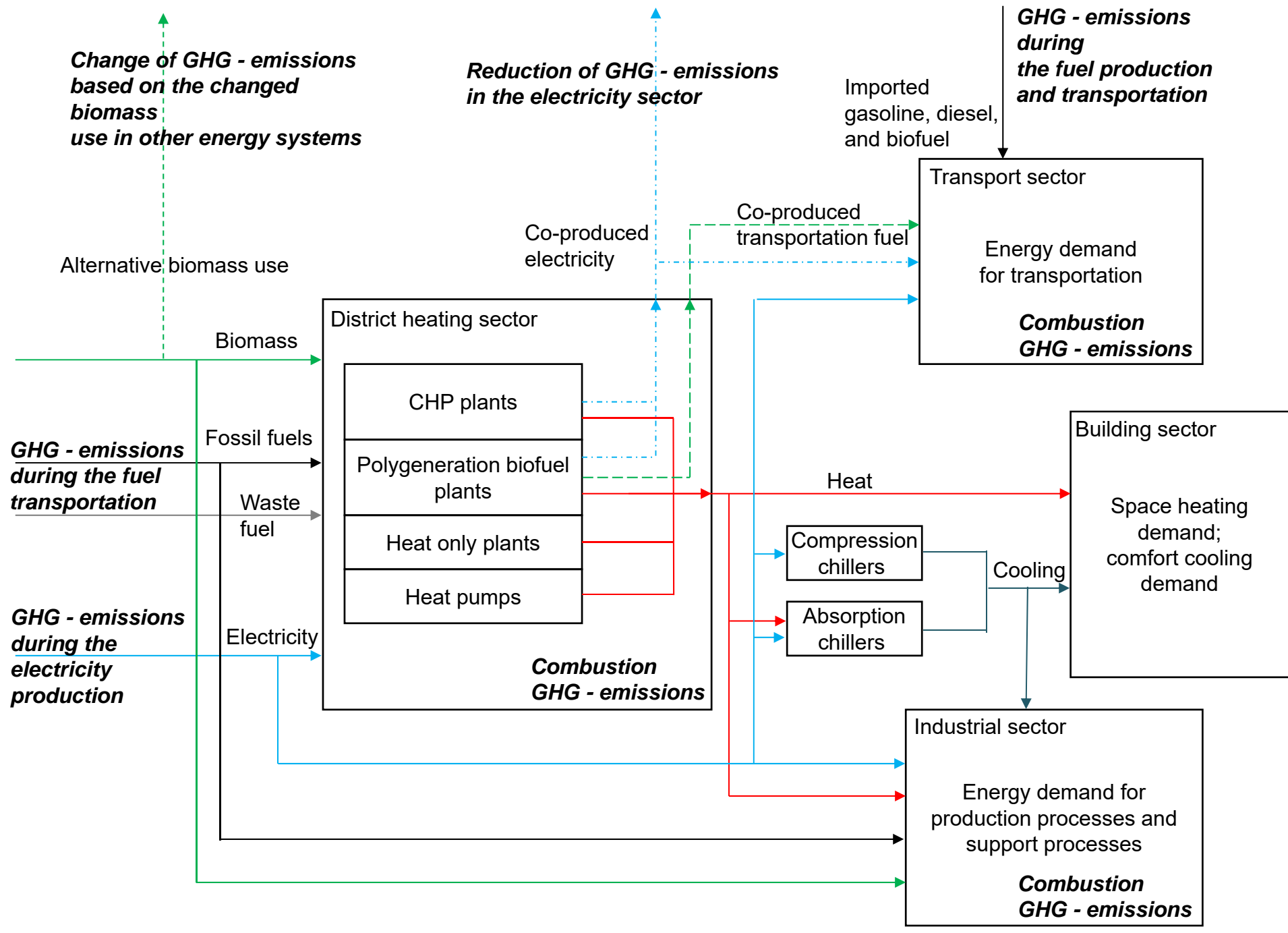
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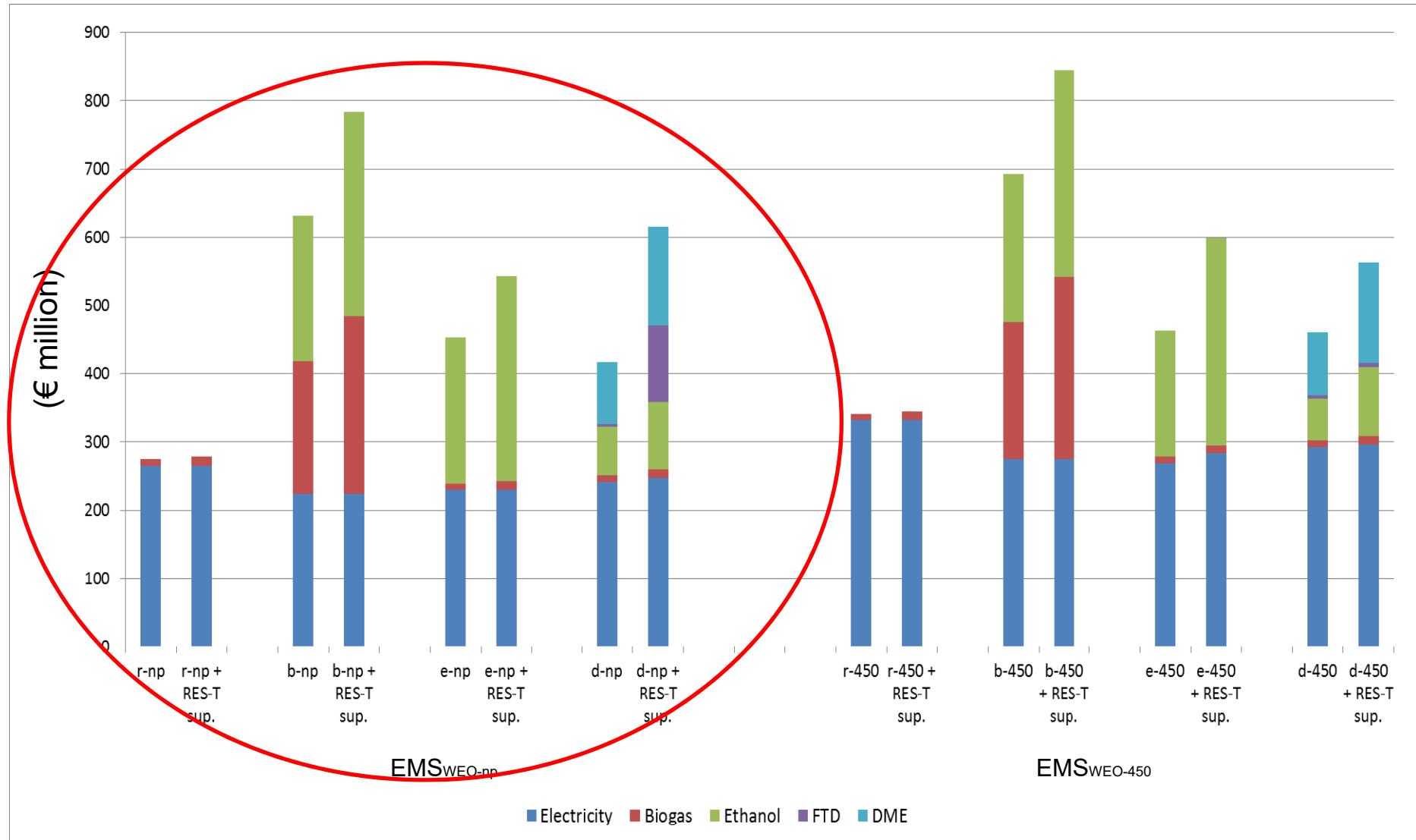
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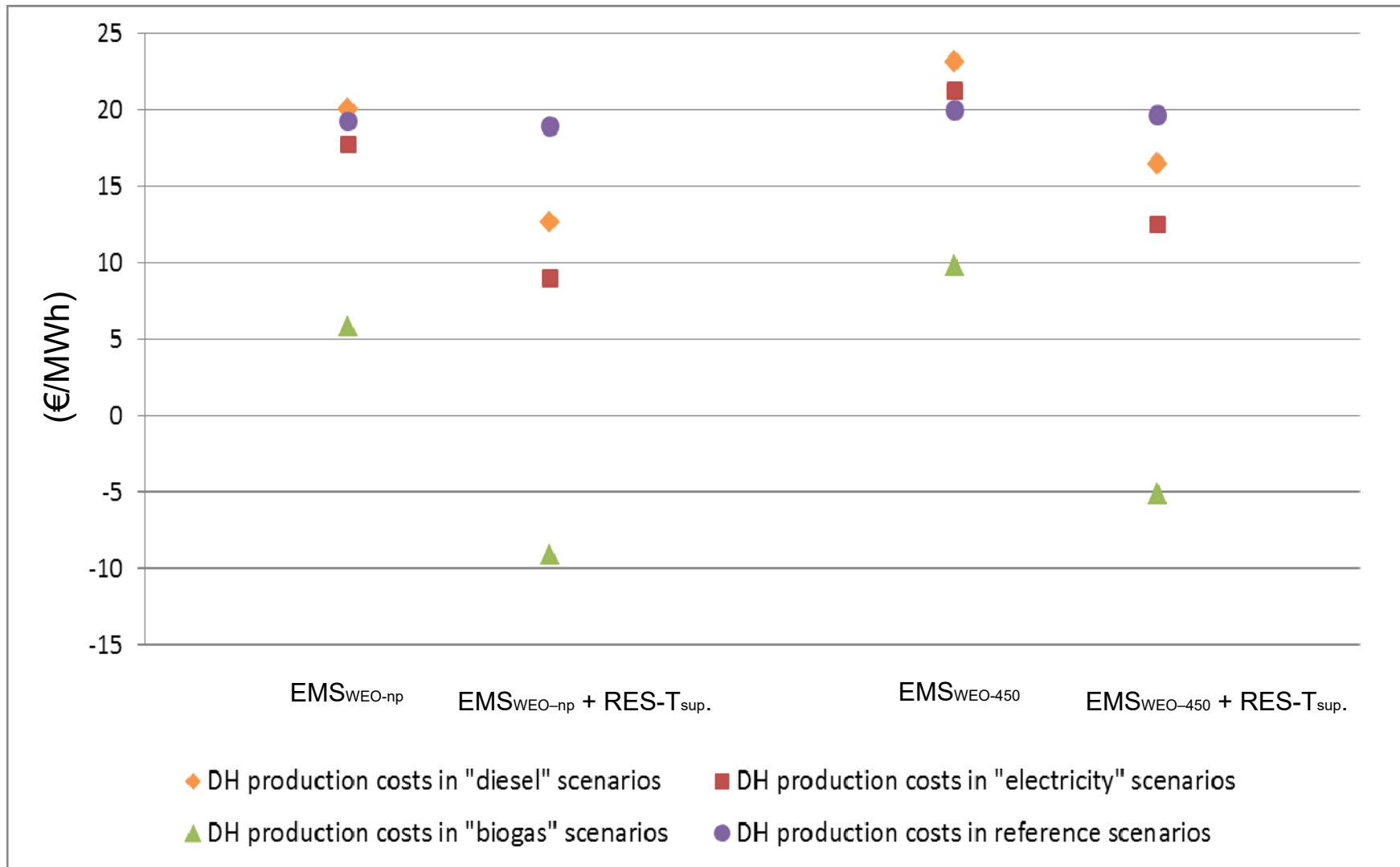
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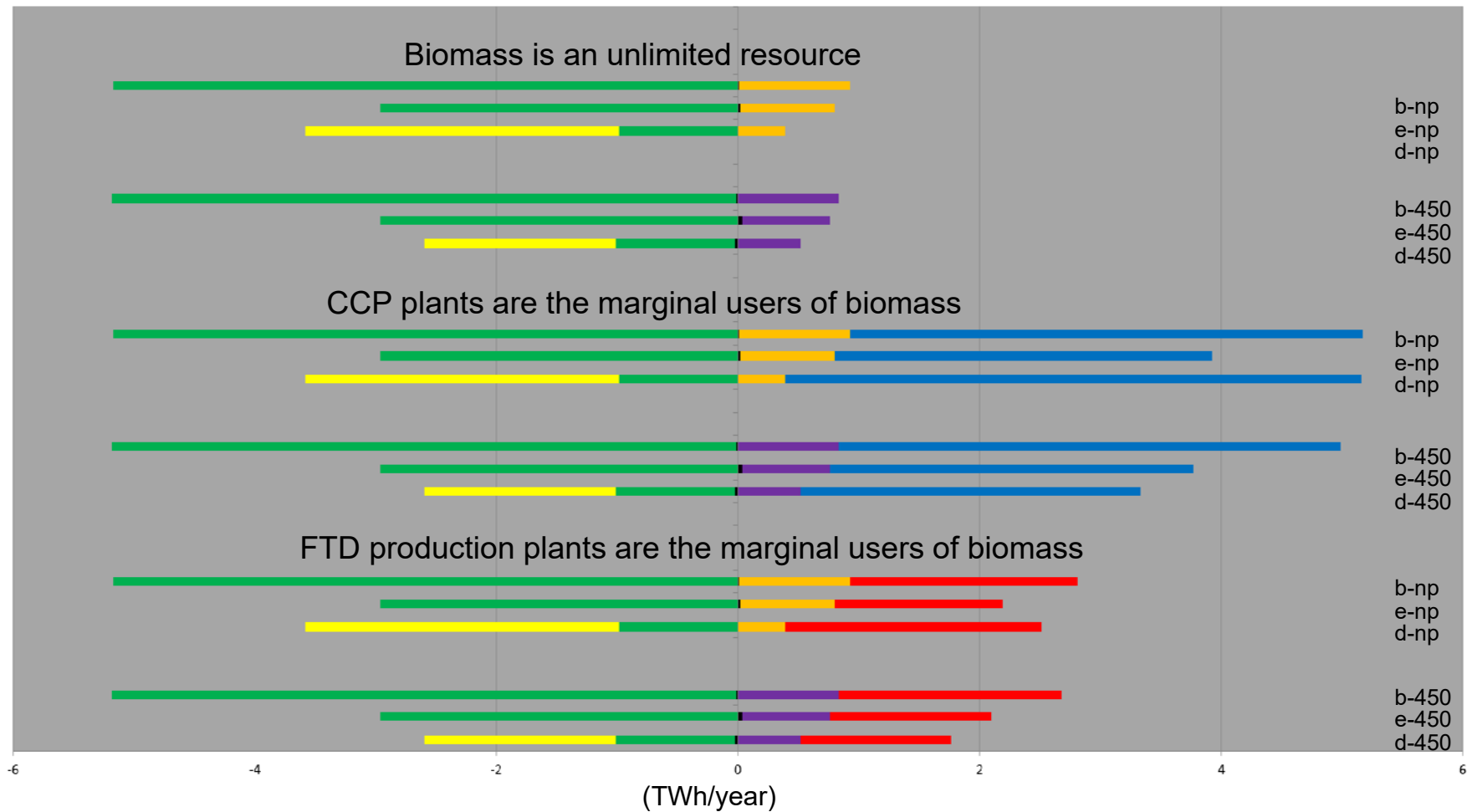
Revenues from the sale of by-products in different scenarios considering different EM conditions.



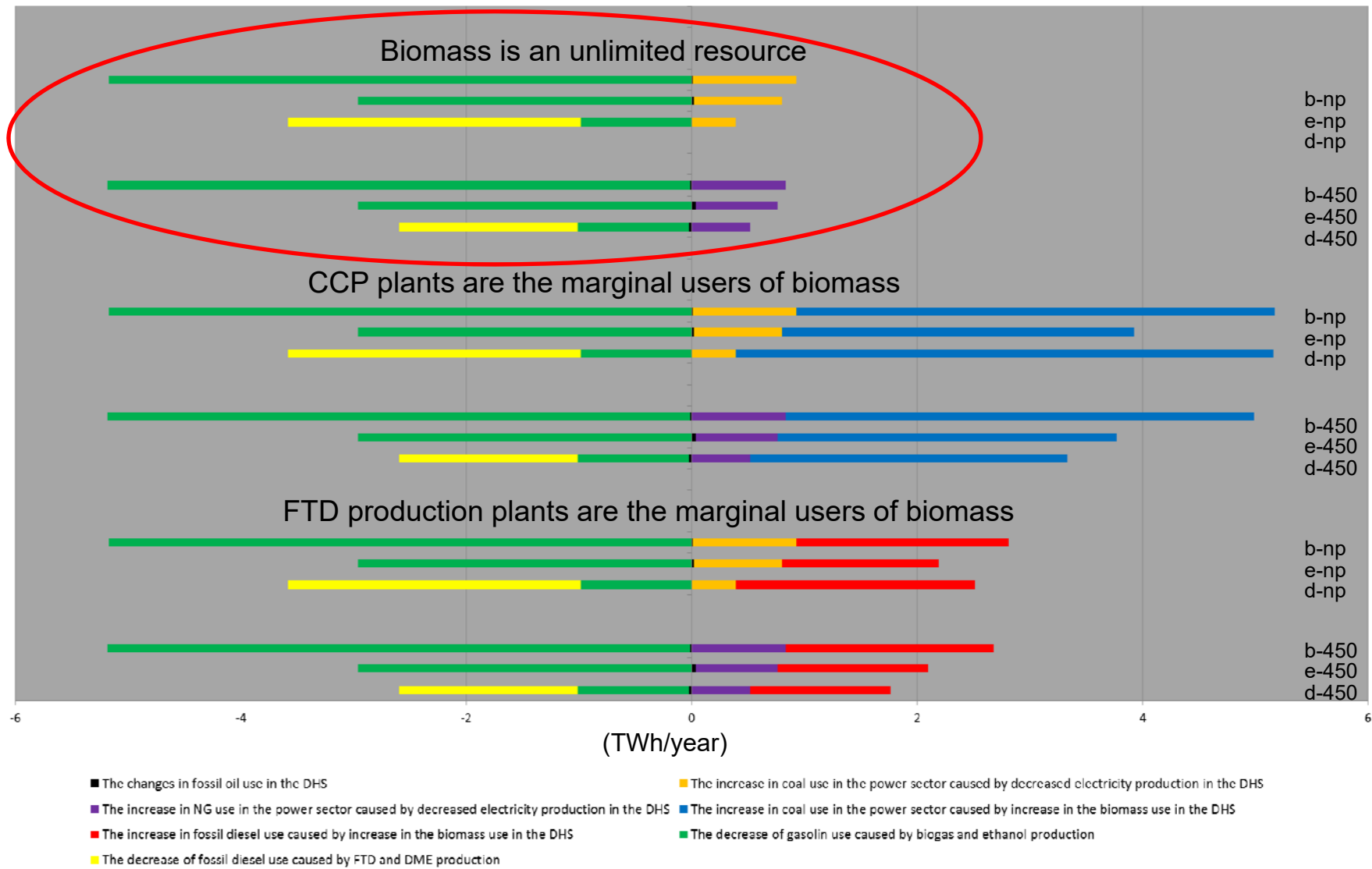
Annual average DH production costs in different scenarios considering different EM conditions when the discount rate is 6%



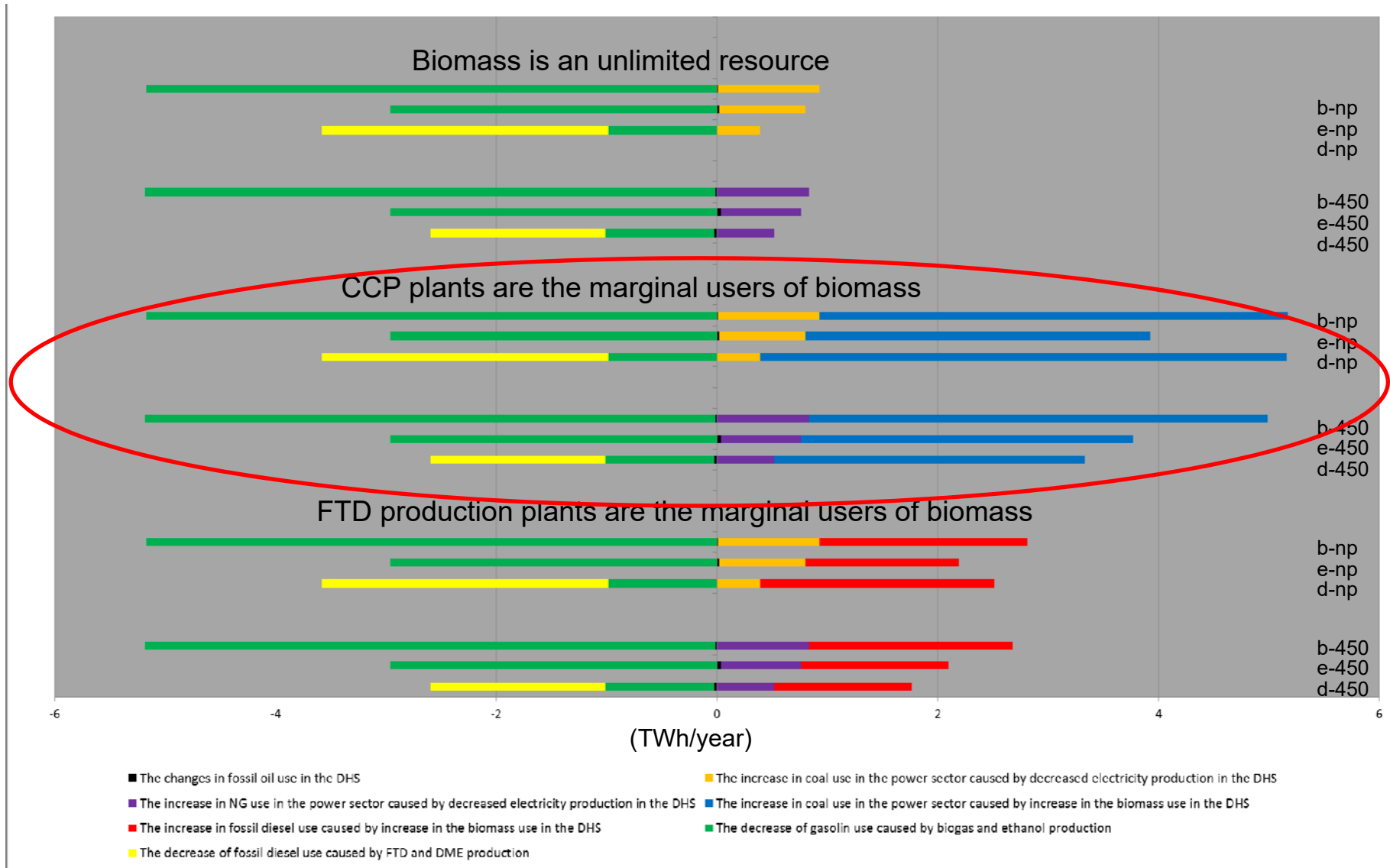
The changes of global fossil fuel consumption when the scenarios with large-scale biofuel production are compared with the reference scenarios where the investments are made in CHP production



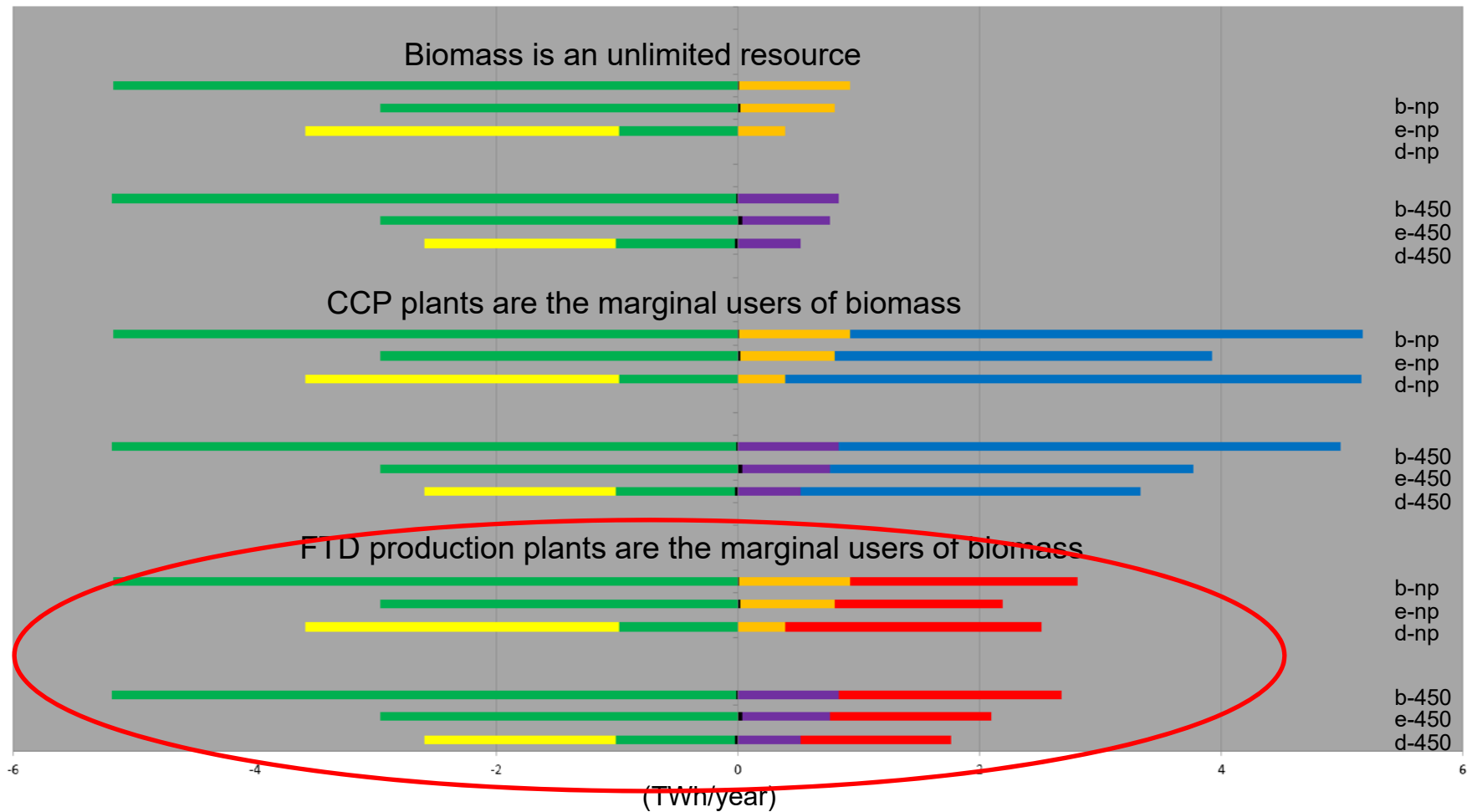
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- The changes in fossil oil use in the DHS
- The increase in coal use in the power sector caused by decreased electricity production in the DHS
- The increase in fossil diesel use caused by increase in the biomass use in the DHS
- The decrease of fossil diesel use caused by FTD and DME production
- The increase in NG use in the power sector caused by decreased electricity production in the DHS
- The increase in coal use in the power sector caused by increase in the biomass use in the DHS
- The decrease of gasolin use caused by biogas and ethanol production

DH can benefit the future sustainable development of the transport sector



- enables ***development of local biofuel supply chains*** (facilitate the introduction of biofuel in the local transport sectors)
- ***promote development of biofuel production technologies*** which are not yet commercial



Thank you!



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DH can contribute to the sustainable development of the industrial sector



- ***can make industrial sector less dependent on fossil fuels and fossil fuel-based electricity*** by converting industrial processes to DH.
- ***increase energy efficiency of the industrial sector and reduce production costs*** by buying excess heat from industrial processes.

DH can benefit the sustainable development of the power sector



- DH has a possibility to ***reduce fossil fuel consumption and subsequently GHG emissions in the power sector*** by producing electricity in biomass- or waste-fuelled CHP plants.

Further work



- Pellets co-production
- Including small CHP plants and HP in order to increasing the share of supply-driven renewable electricity in the power sector



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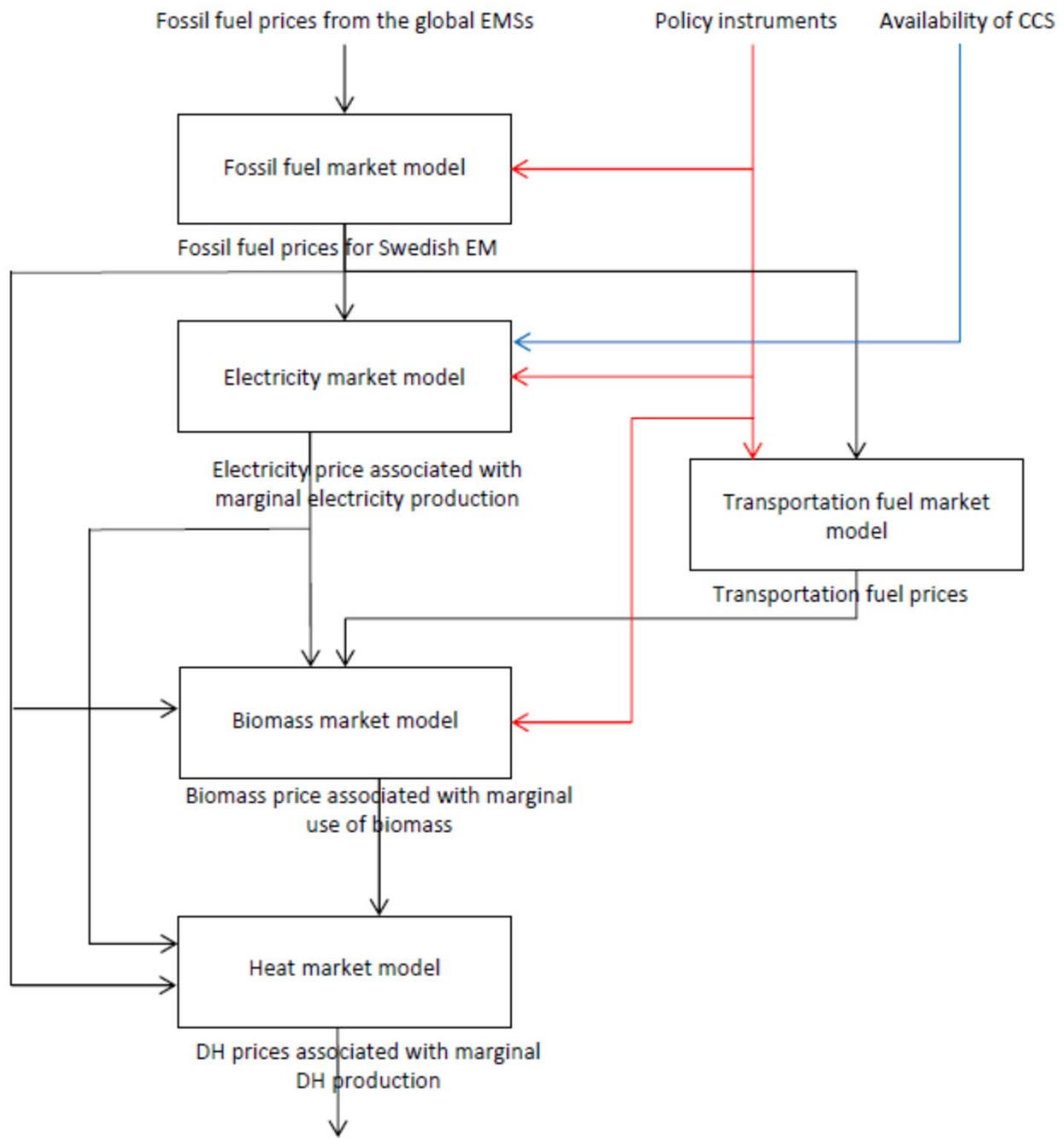


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Combined heat and power plant

Coal condensing power plant

