



Introduction to Cogeneration

Leonardo Energy Webinar

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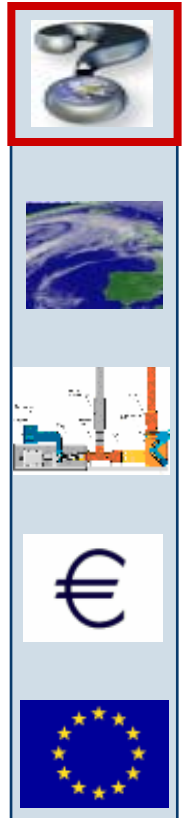
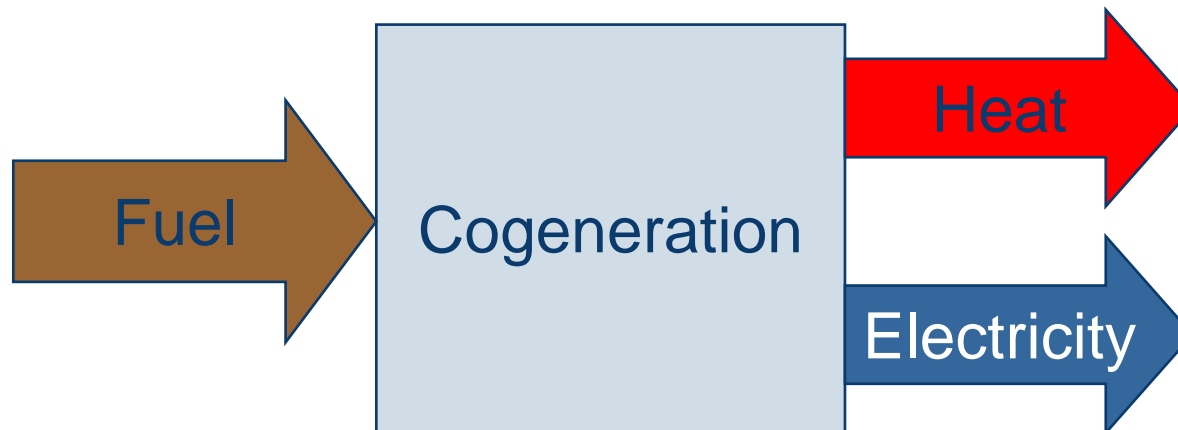
Contents

- What is Cogeneration
- Why Cogeneration
- Application of Cogeneration
- Economics of Cogeneration
- Policy in the EU



What is Cogeneration

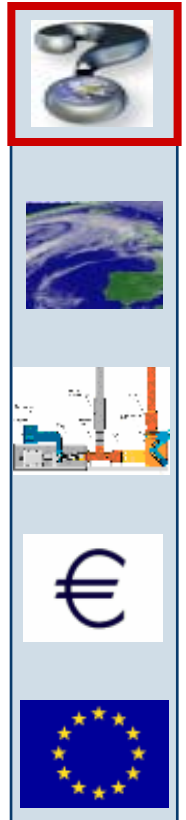
Cogeneration = the simultaneous production of power and heat, with a view to the practical application of both products.



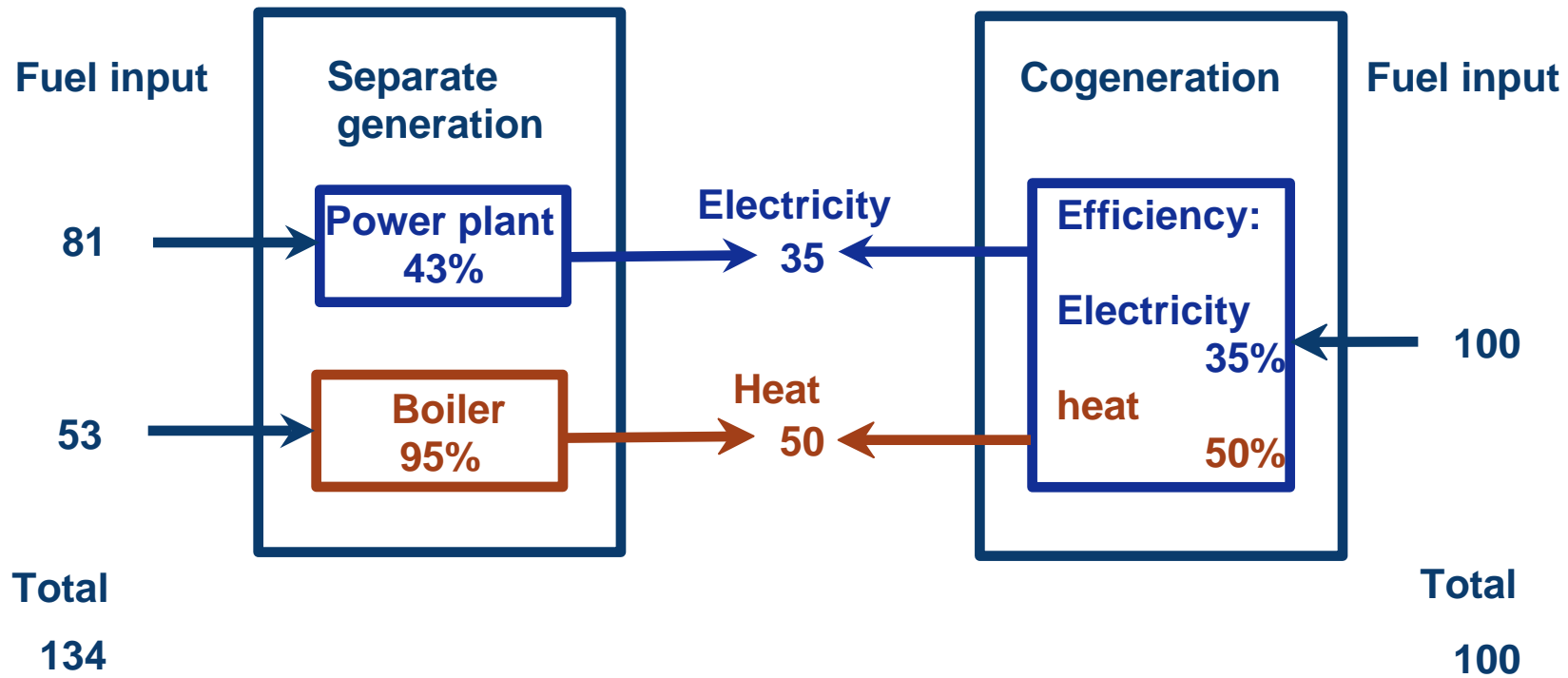
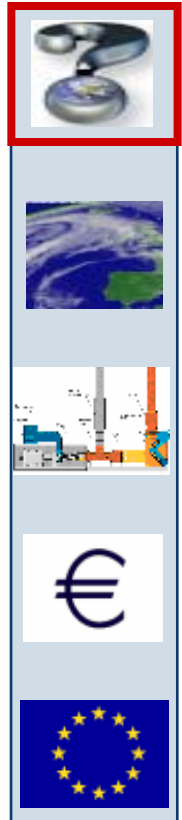
What is Cogeneration

- A way of local energy production
- Used instead of separate production of heat and electricity
- Heat is main product, electricity by-product
- Uses heat that is lost otherwise
- Way to use energy more efficient

- Different area's of application
- Different technologies

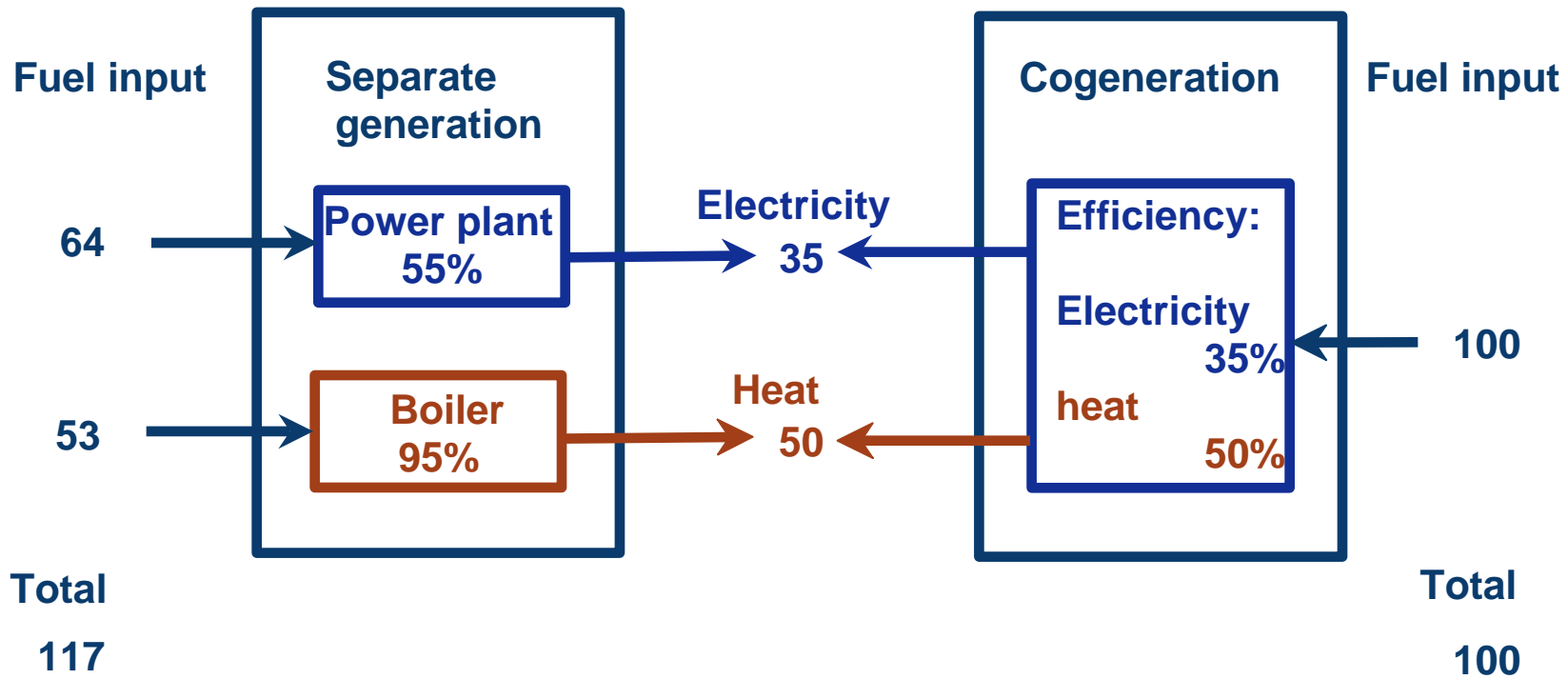


Energy efficiency



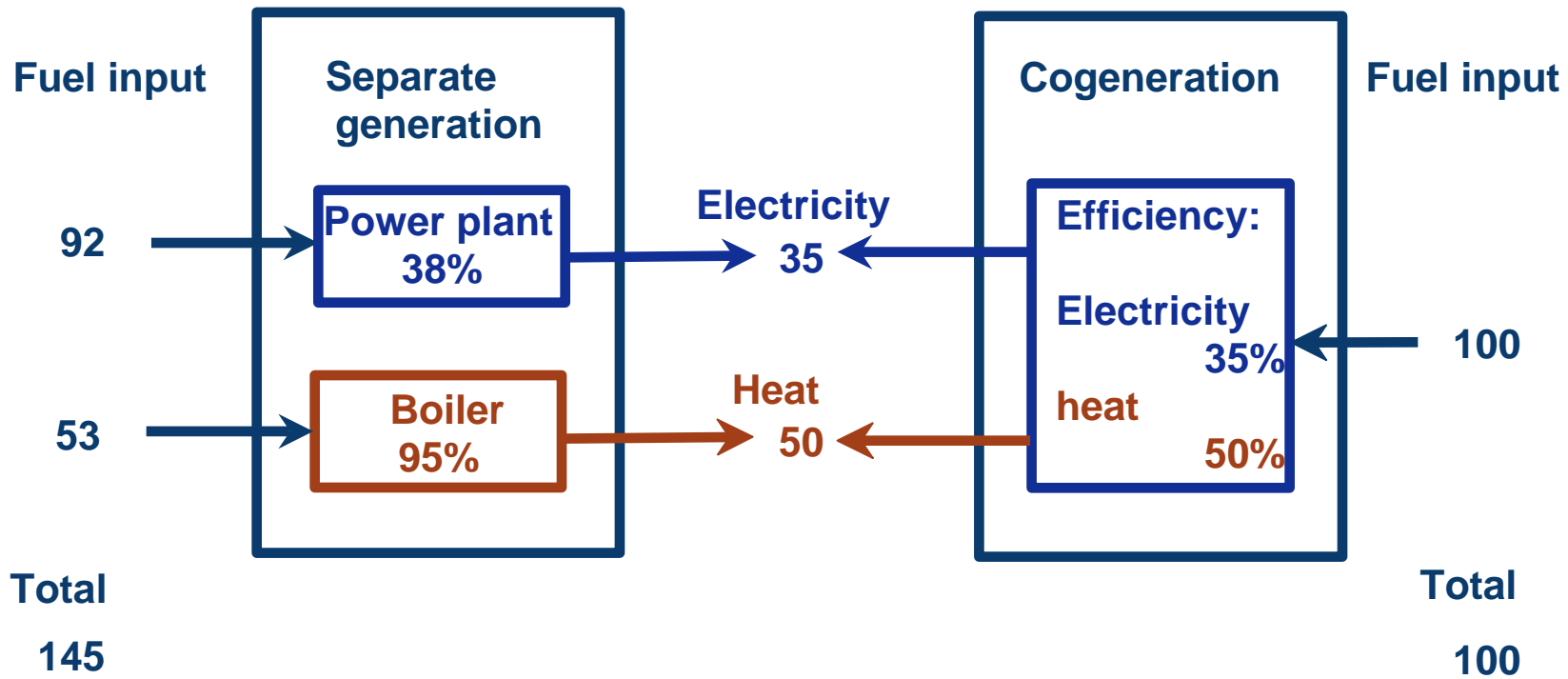
$$\text{Energy conservation} = \frac{(134 - 100)}{134} = 25\%$$

Energy efficiency (II)



$$\text{Energy conservation} = \frac{(117 - 100)}{117} = 15\%$$

Energy efficiency (III)



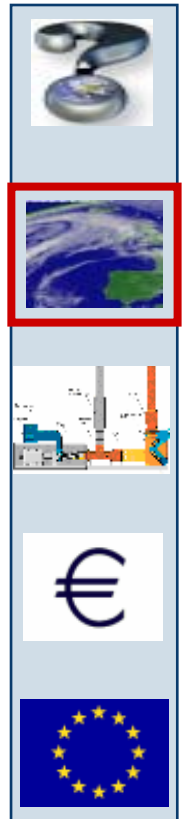
$$\text{Energy conservation} = \frac{(145 - 100)}{145} = 31\%$$

Why Cogeneration

- Improve energy efficiency
- Reduce use of fossil fuel
- Reduce emission of CO₂

Also,

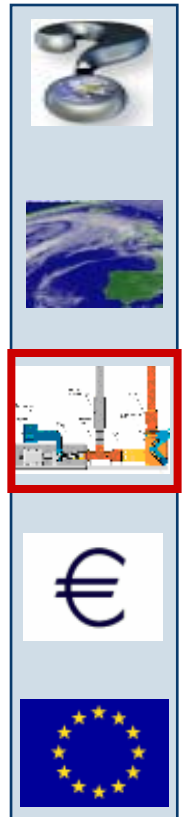
- Reduce cost of energy
- If heat fits demand, cheapest way of electricity production
- Improve security of supply
- Use of organic waste as fuel
- Position on energy market



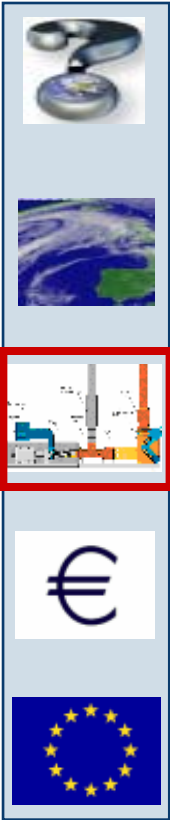
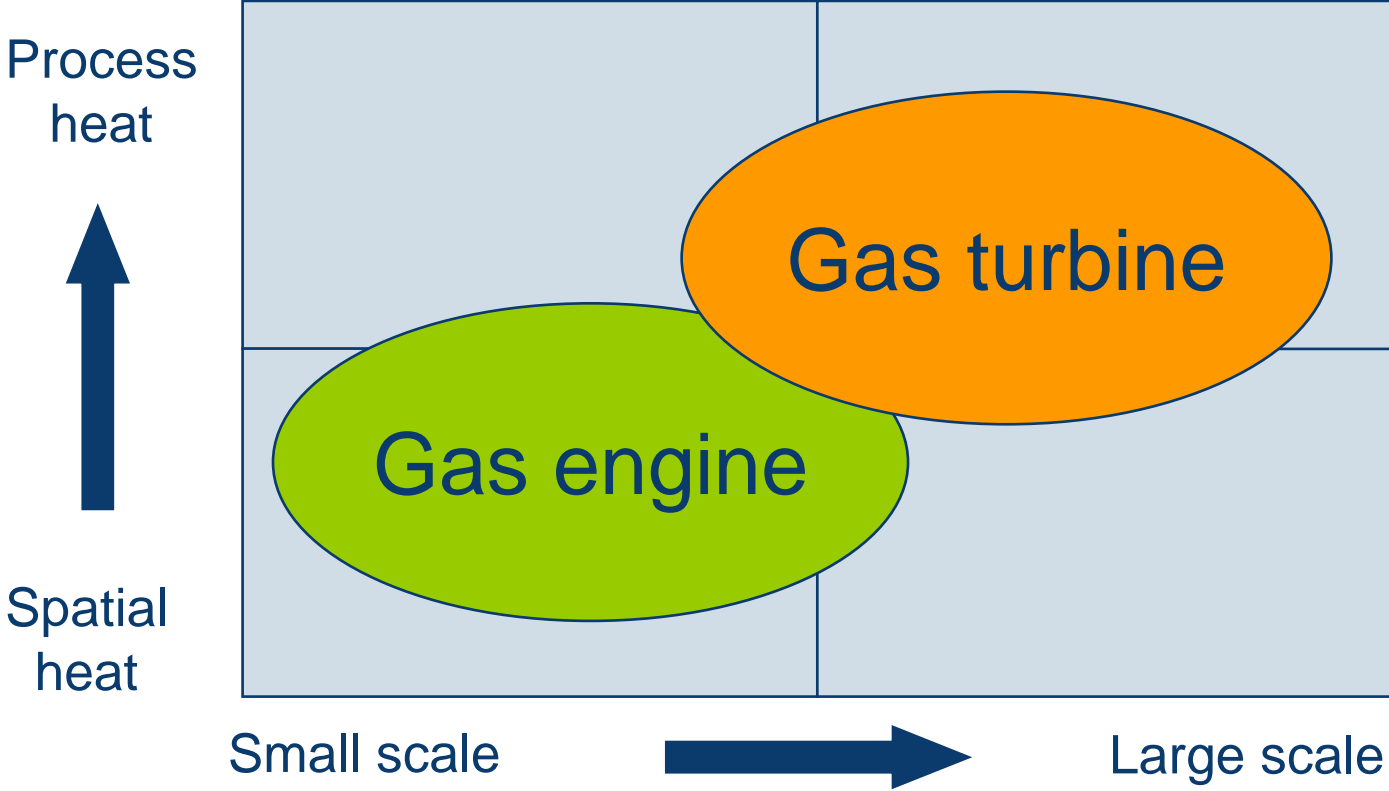
Application of Cogeneration

Classification:

- Scale of application: Large scale – small scale
- Heat usage: Spatial – process
- Technology: Gas turbine – gas engine
- User: One user – more users
- Ownership: User – cooperation

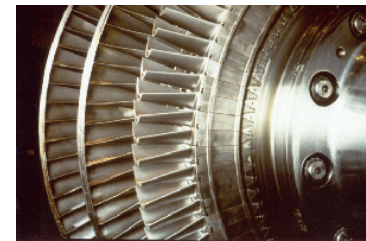
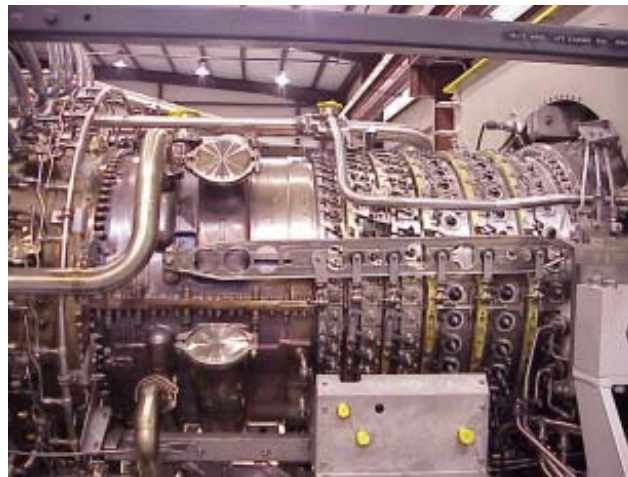


Application of Cogeneration

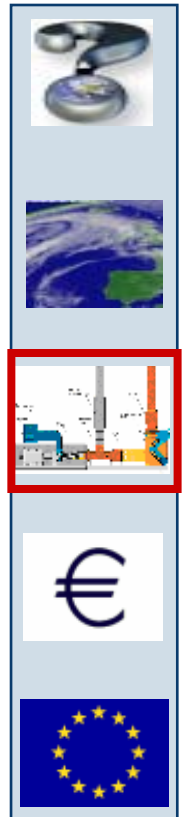


Application of Cogeneration

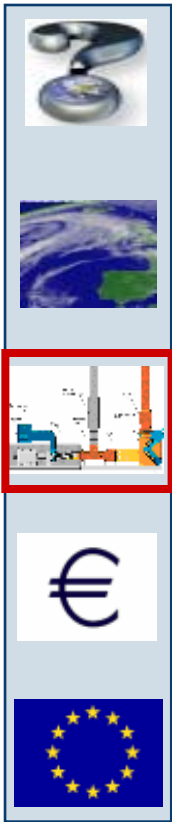
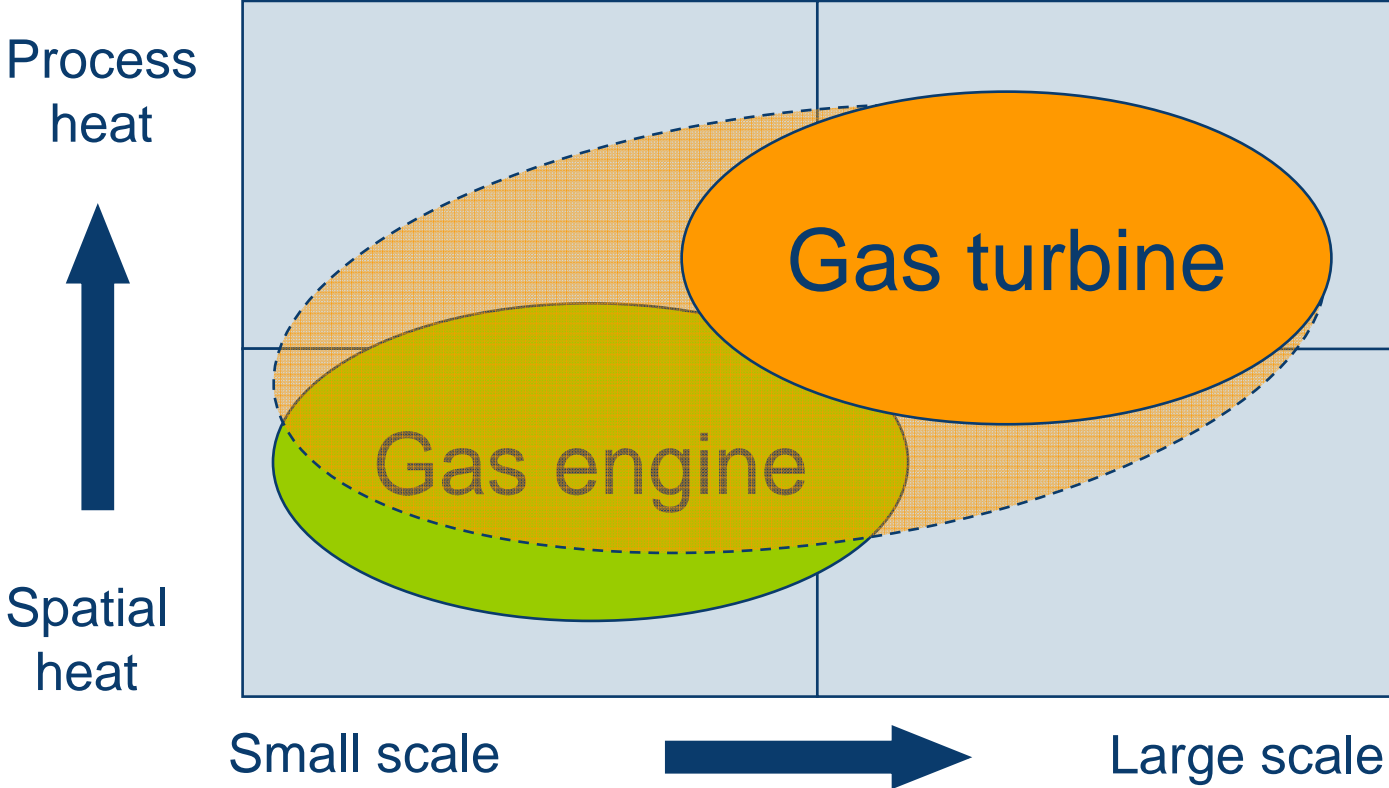
- **Gasturbine**
Burning fuel causes fan blades to rotate



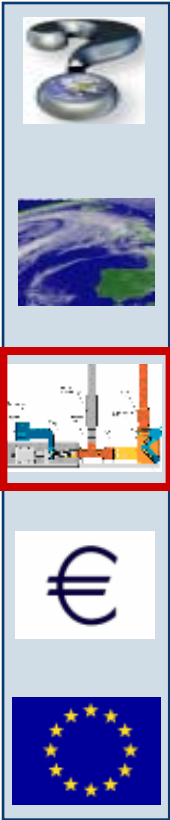
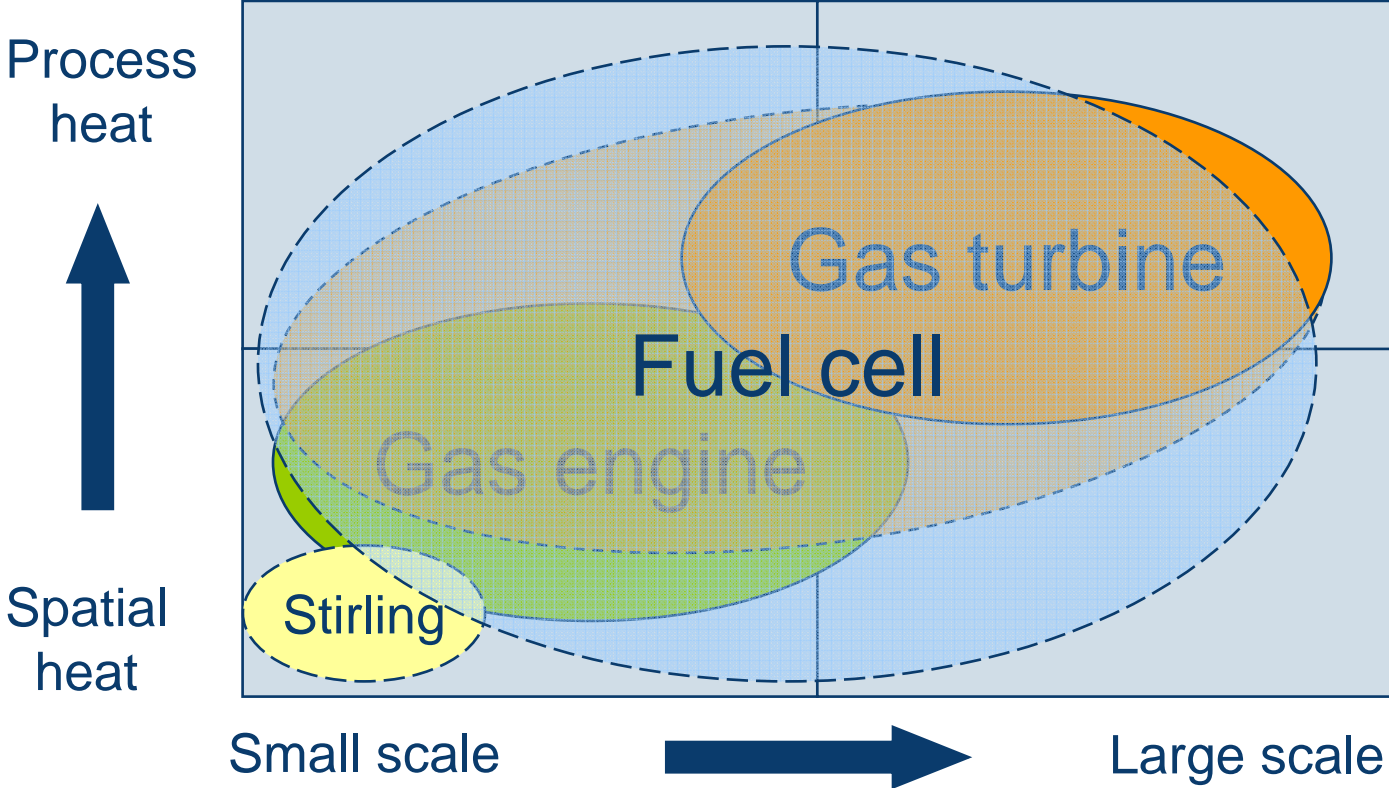
- **Gas engine**
Burning fuel causes reciprocating motion of cylinders



Application of Cogeneration

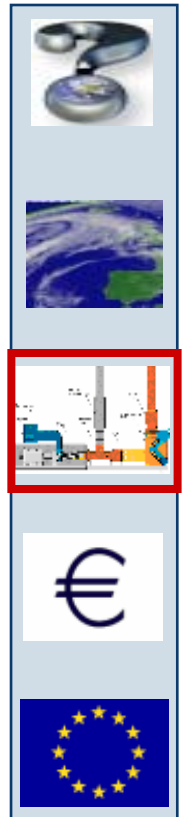


Application of Cogeneration

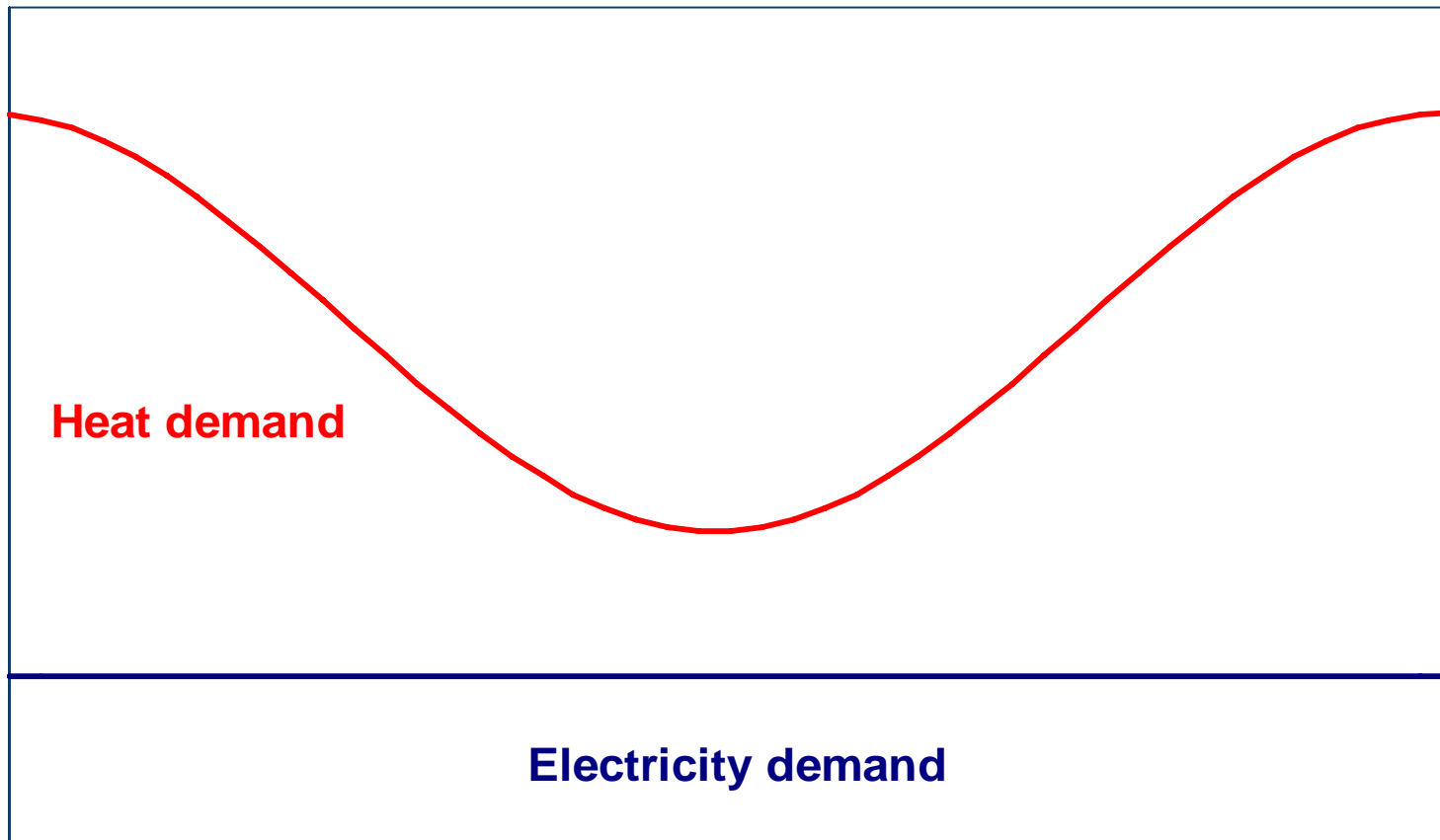


Development towards small scale

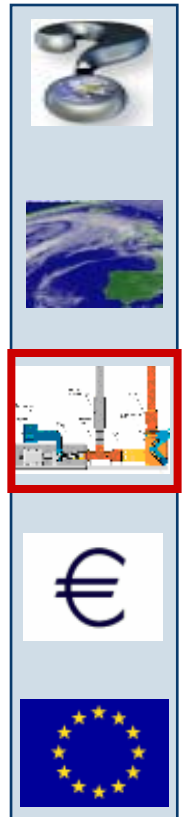
- Industry
- Glasshouse horticulture
- Hospitals
- Office buildings
- Blocks of houses (heat distribution)
- One house



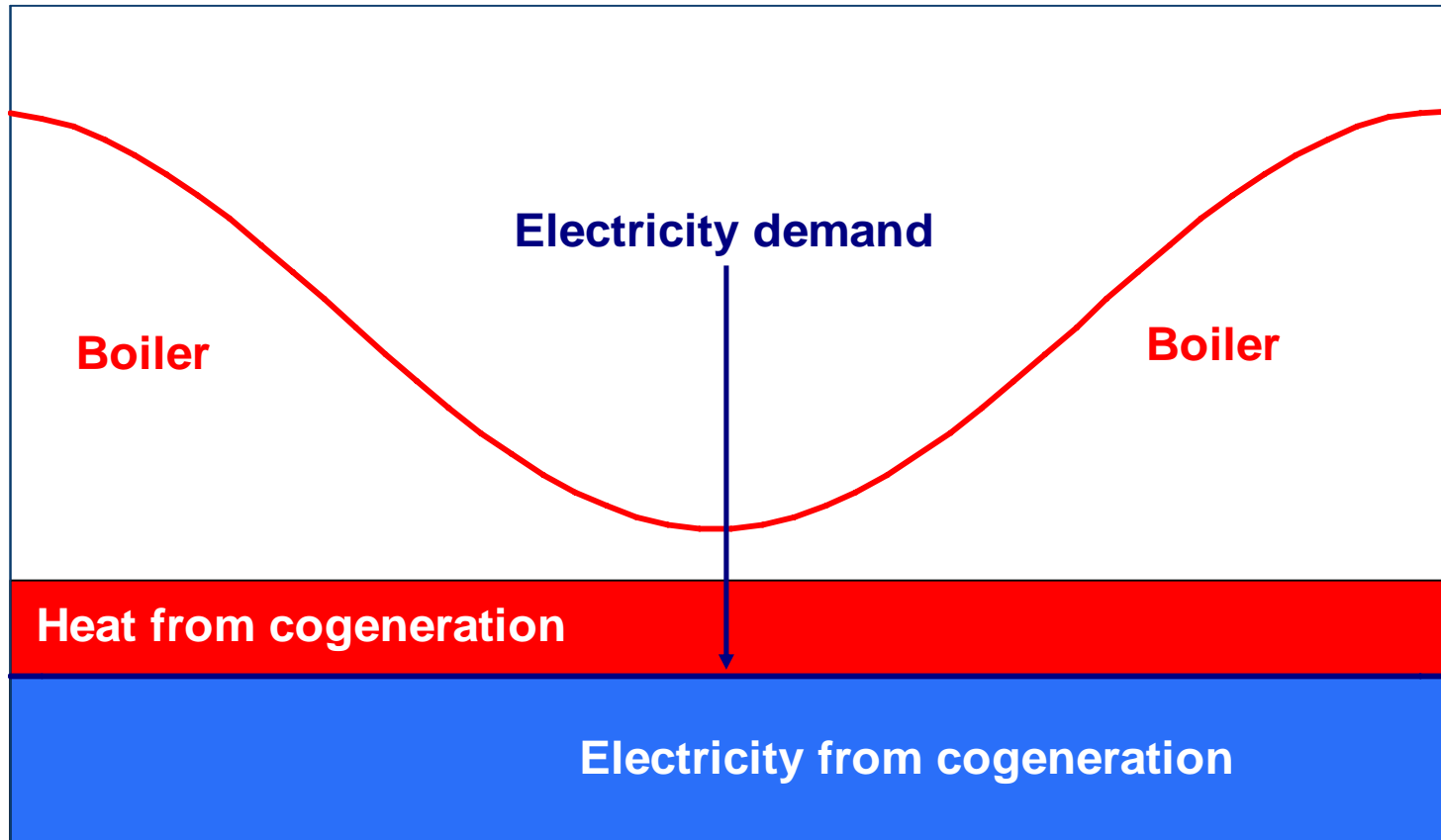
Heat and electricity demand



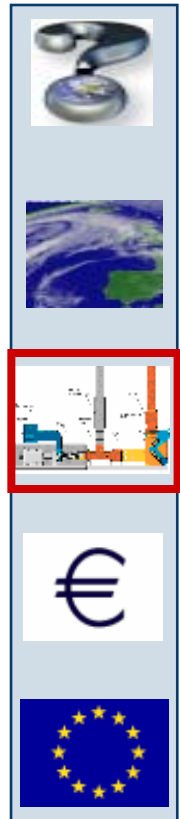
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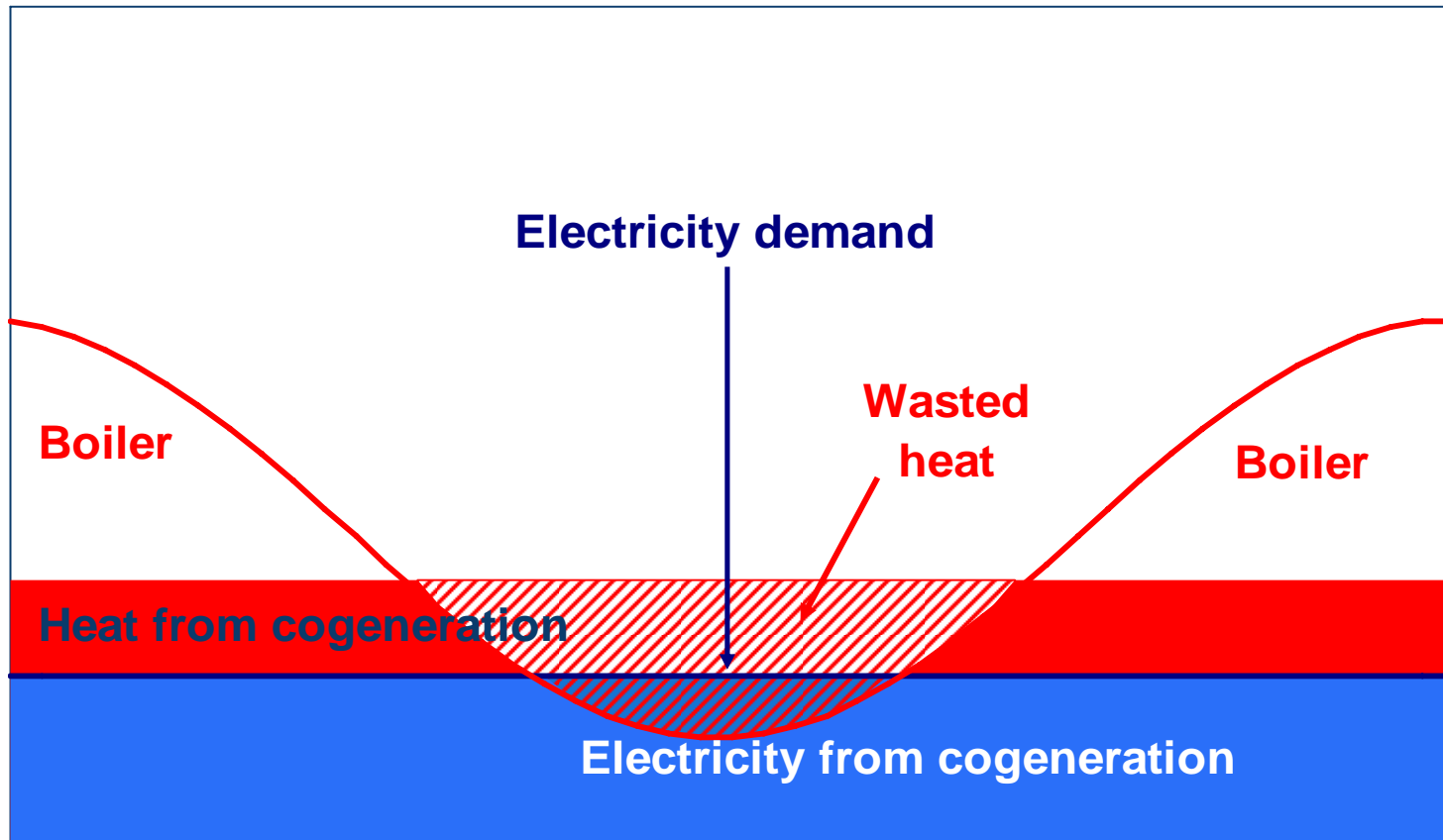
Dimension on electricity demand



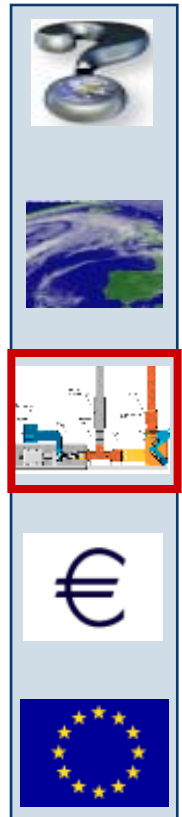
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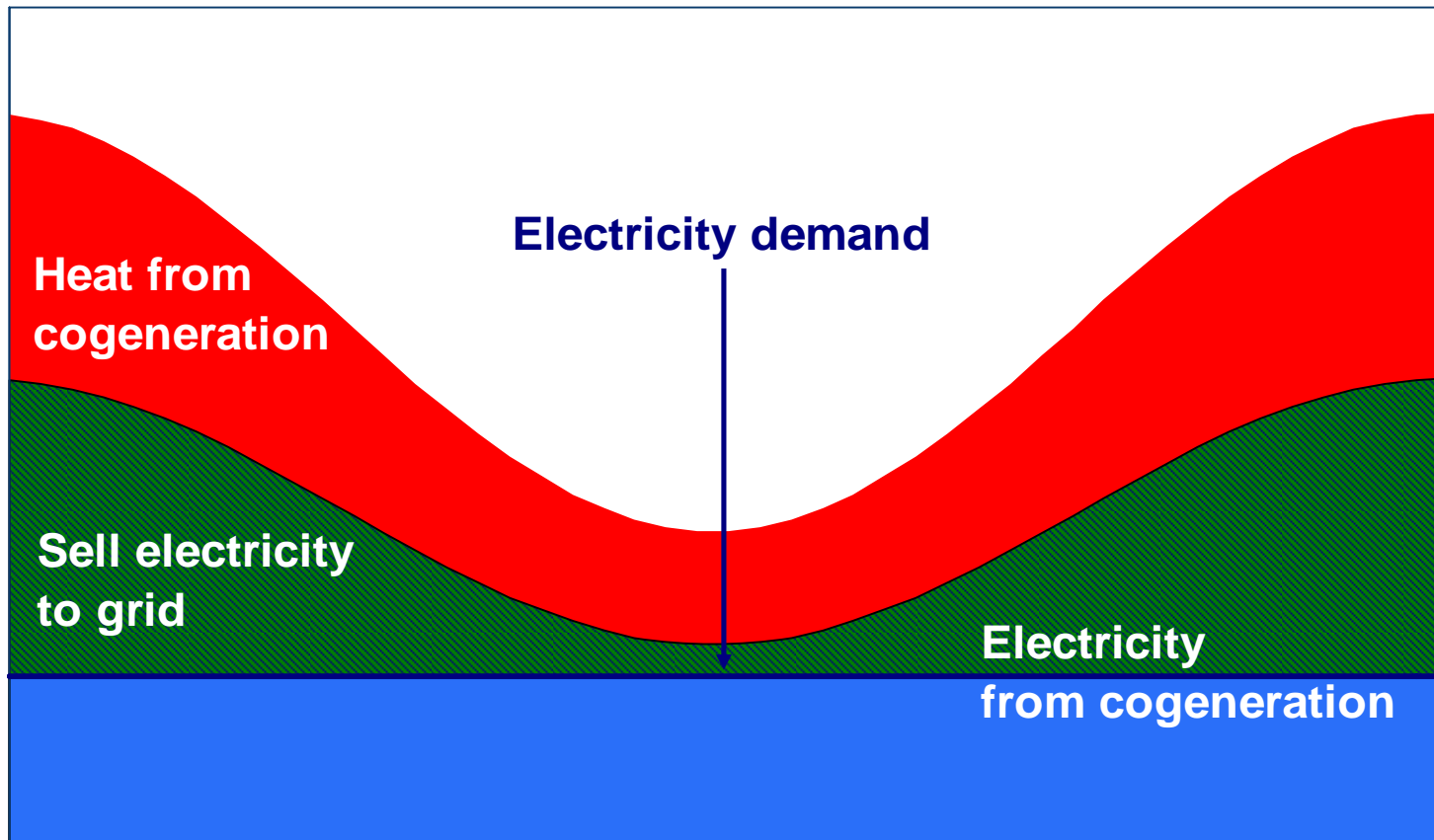
Dimension on electricity demand



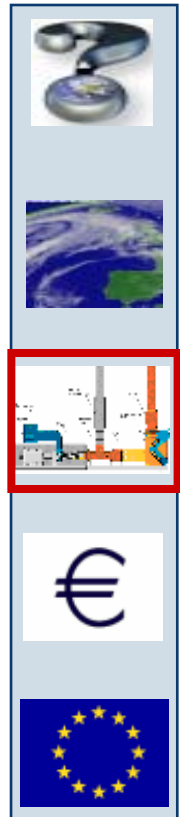
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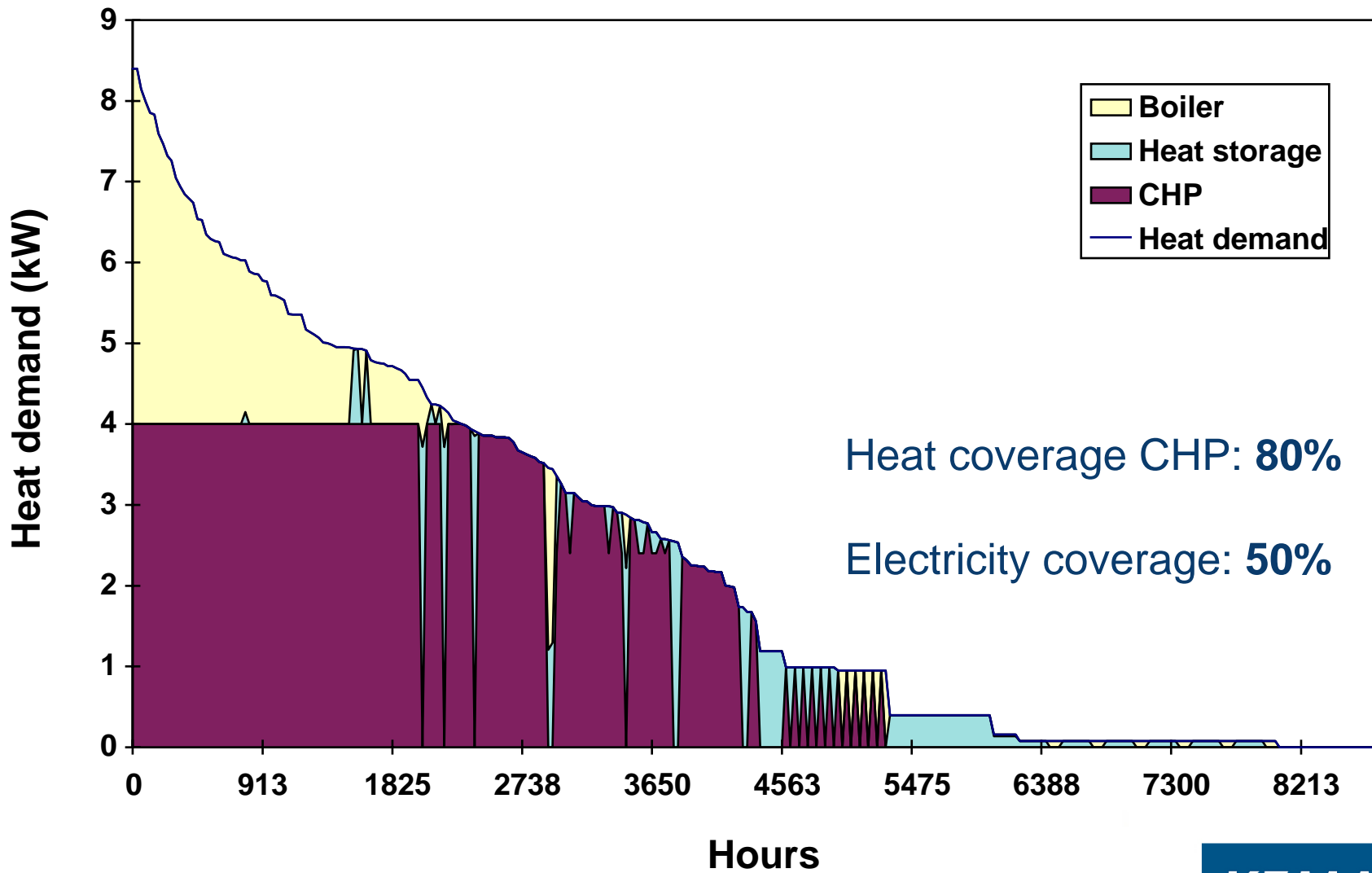
Dimension on heat demand



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Load duration curve



Economics

Costs

Capital

Operation & Maintenance

Fuel

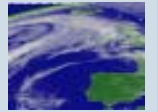
Benefits

Heat

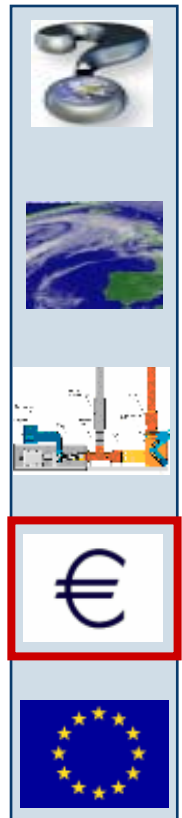
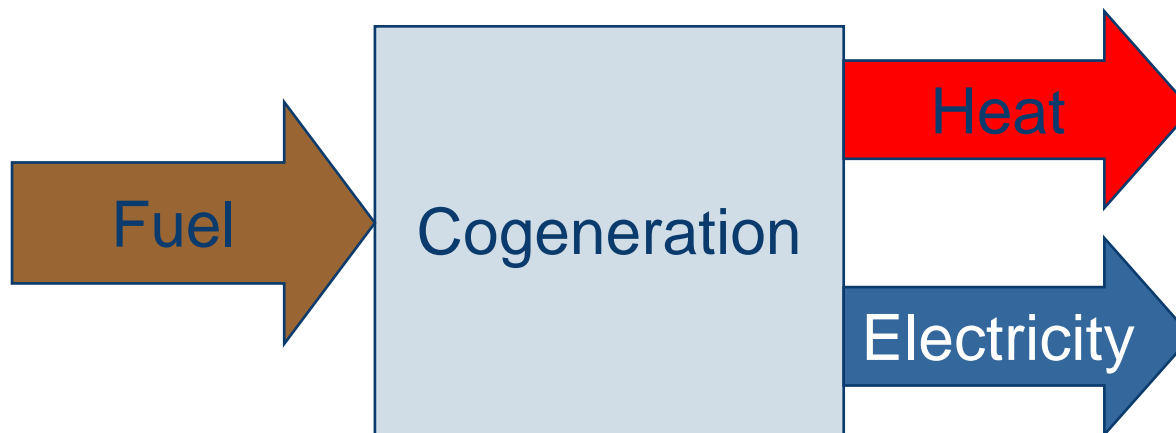
Electricity

- less purchase

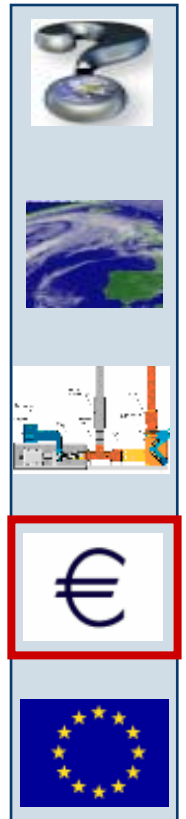
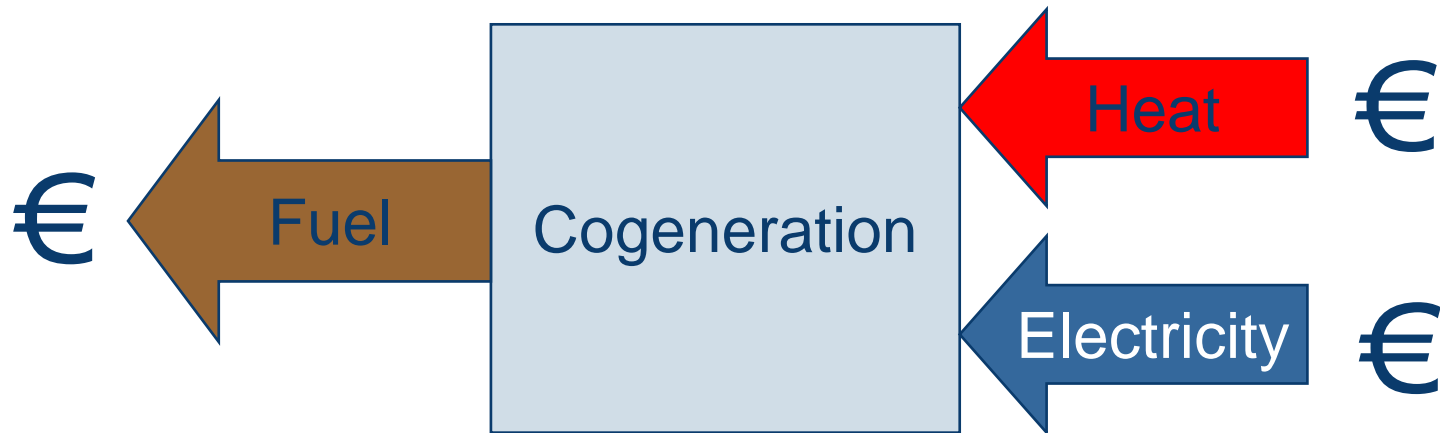
- sell to grid



Energy flows

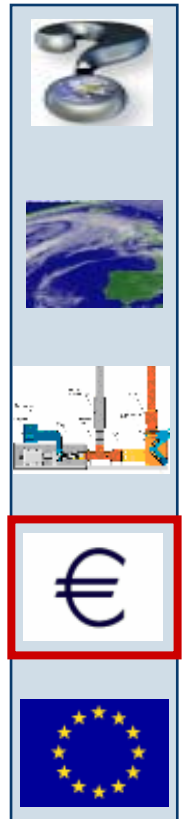


Money flows

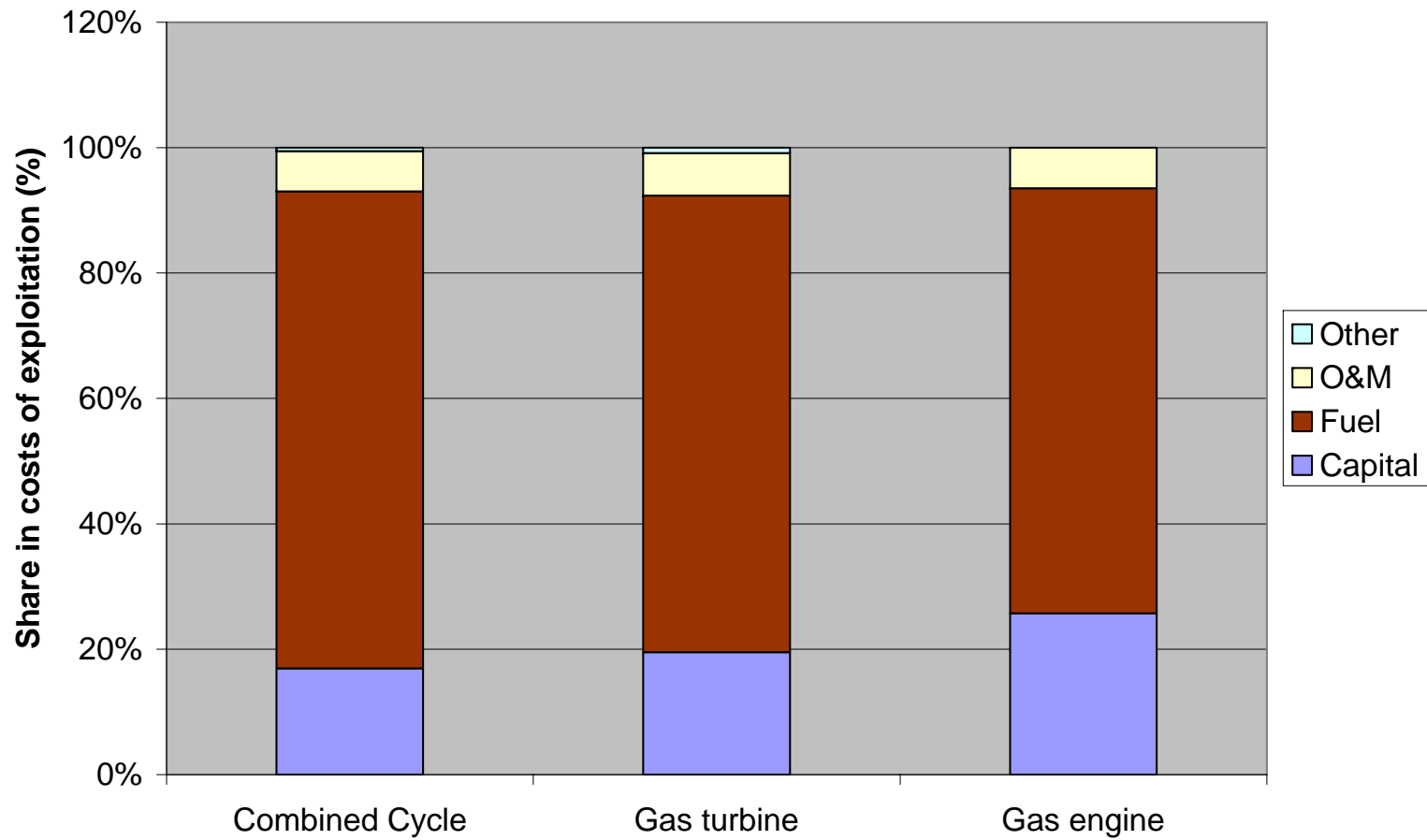


Economic value of cogeneration

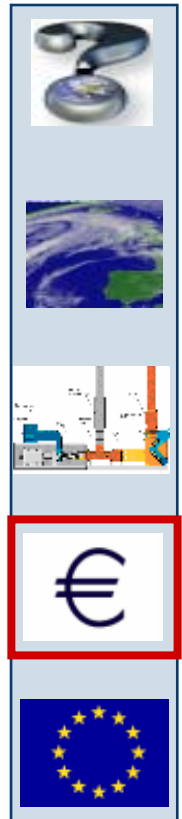
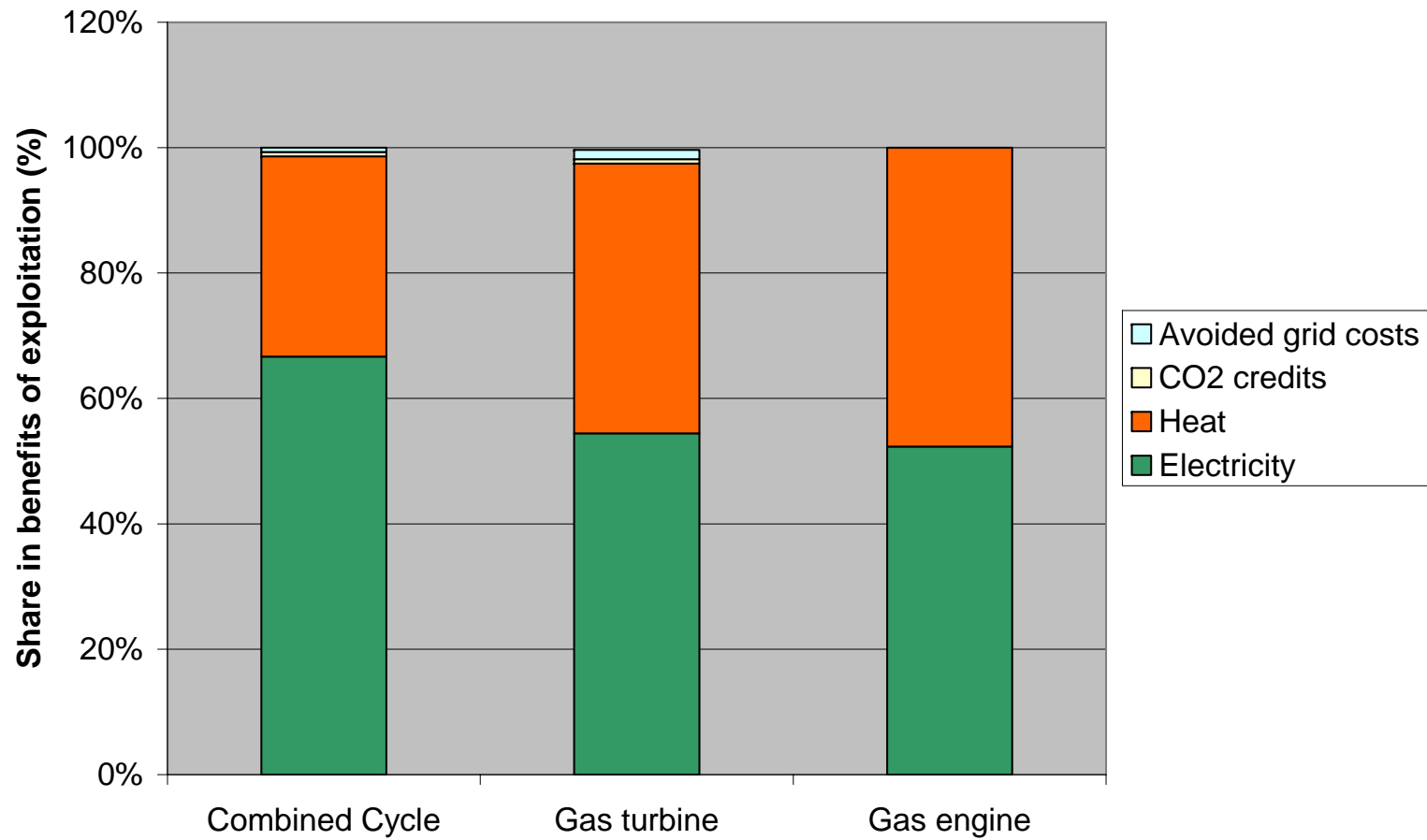
- Depends very much on tariff system
- Heat → avoided cost of separate heat production
- Electricity →
 - 1) less purchase (kWh)
 - 2) sale of surplus electricity
 - 3) Peak shaving (kWe)
- Carbon credits (future)



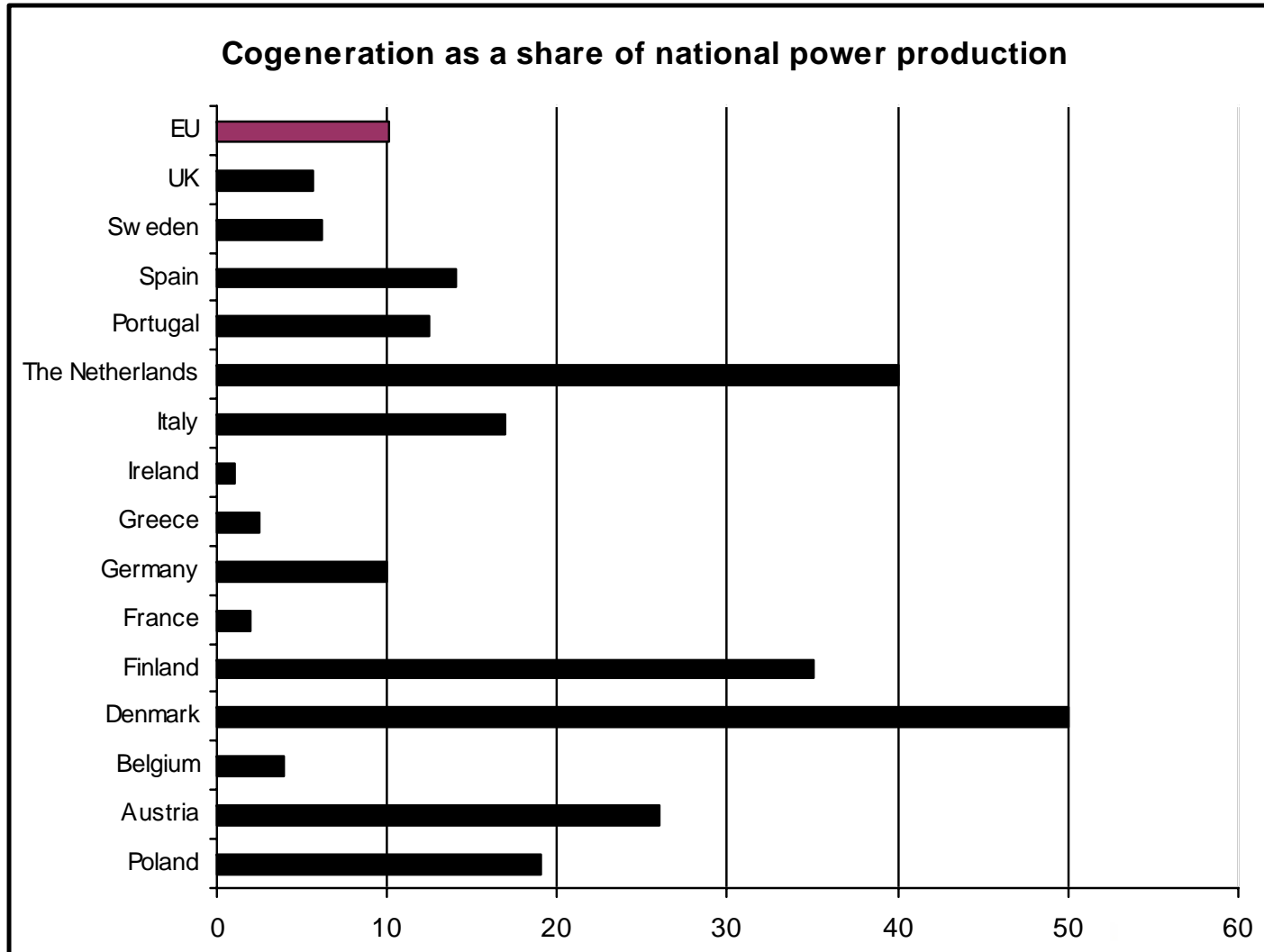
Economics



Economics



Policy in the EU



Source: COGEN Europe



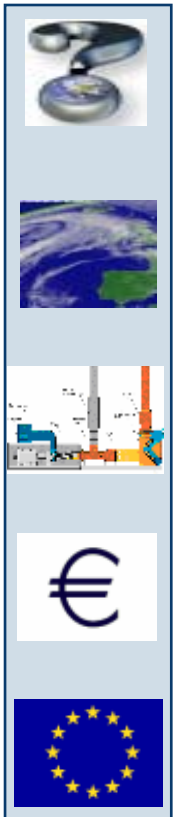
Policy in the EU

- Cogeneration important in meeting EU Kyoto target
- Ambition: 18% Cogeneration in 2010
- Several directives will support cogeneration
- Quality indicators
- Carbon credits



Concluding remarks

- Cogeneration improves energy efficiency.....
-if heat is used in a proper way
- otherwise it is just a bad way of electricity production.
- Right dimensioning is crucial for economic application.
- Economic performance will increase because of environmental policy of EU.





End sheet

Thank you for your attention