MONNOYEUR

08 JUNE 2023

Sustainable CHP Solutions

Erik DEVIS

PRESENTATION PLANNING

CHP version 2.0

01 **Preview**
Some notes about energy

02 **CHP**
What, where, why, how much

03 **Evolution on the grid**
Why there is a duck

04 **CHP and sustainibility**
CO2

05 **Conclusions**
2 of a kind…

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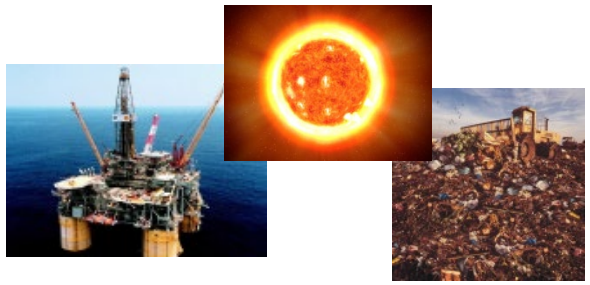
Preview

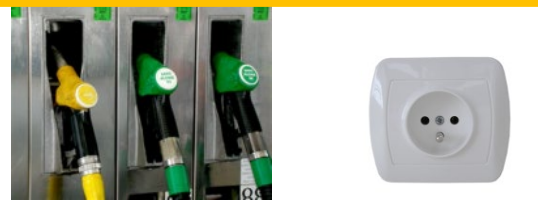
Level 1
Primary and Secondary Energy



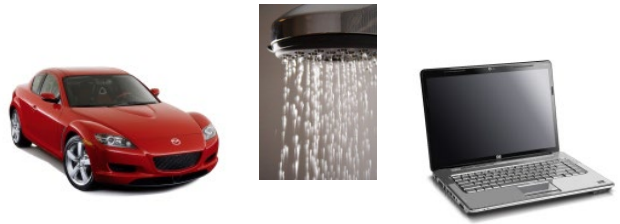
Level 2
Transformation

CHP

Level 3
Energy for End use



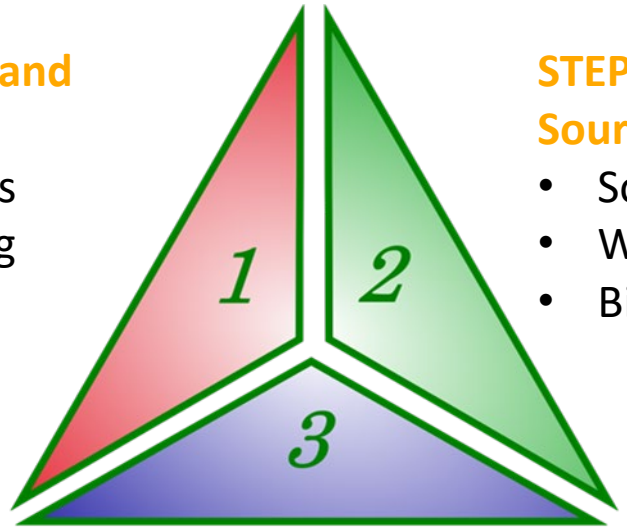
Level 4
Products & Services



- Source : CogenVlaanderen

- Sustainable Energy Policy -> Trias Energetica

STEP 1: Limit Energy Demand
- Insulation
- Energy-efficient devices
- Energy-efficient lighting



STEP 2: Usage of Sustainable Energy Sources
- Solar
- Wind
- Biomass

STEP 3: Use energy resources efficiently
- Efficient transformation processes

→ **CHP**

- Source : CogenVlaanderen

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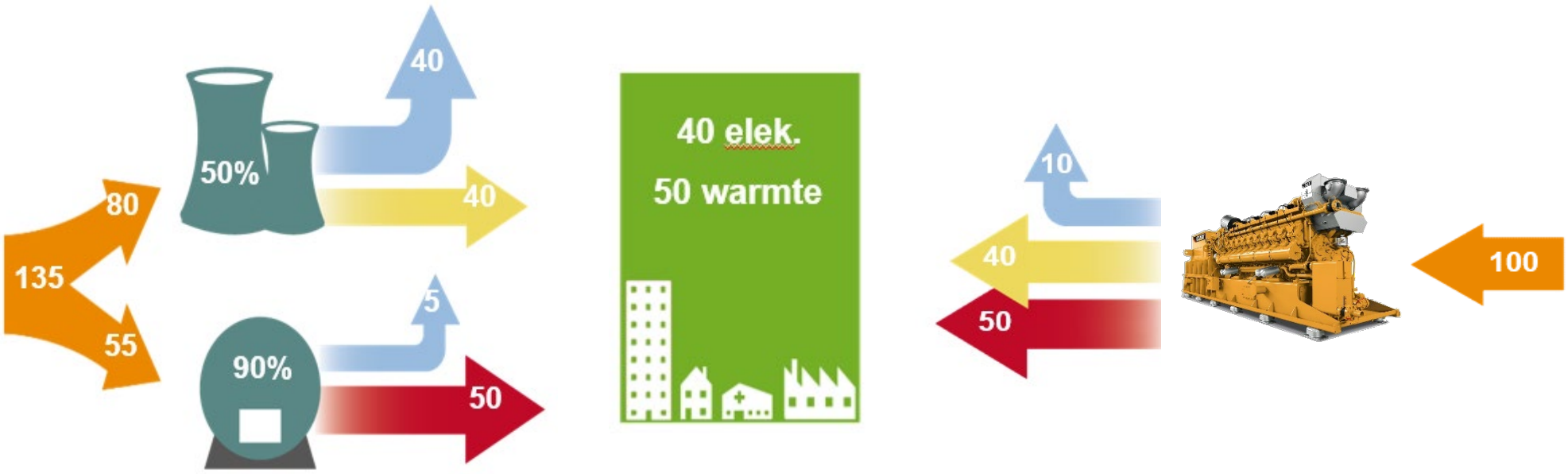
What, where, why, how much…

- CHP is an efficient way for combined heat and power production which can save primary energy versus separate production



Primary energy savings: 35/135 = 26 %

- Source : CogenVlaanderen

What, where, why, how much…

Offices
Appartments
Sportcomplexes

Hospitals
Swimming Pools

Greenhouses

50 kW

1 MW

10 MW

Micro-CHP

Small scale CHP

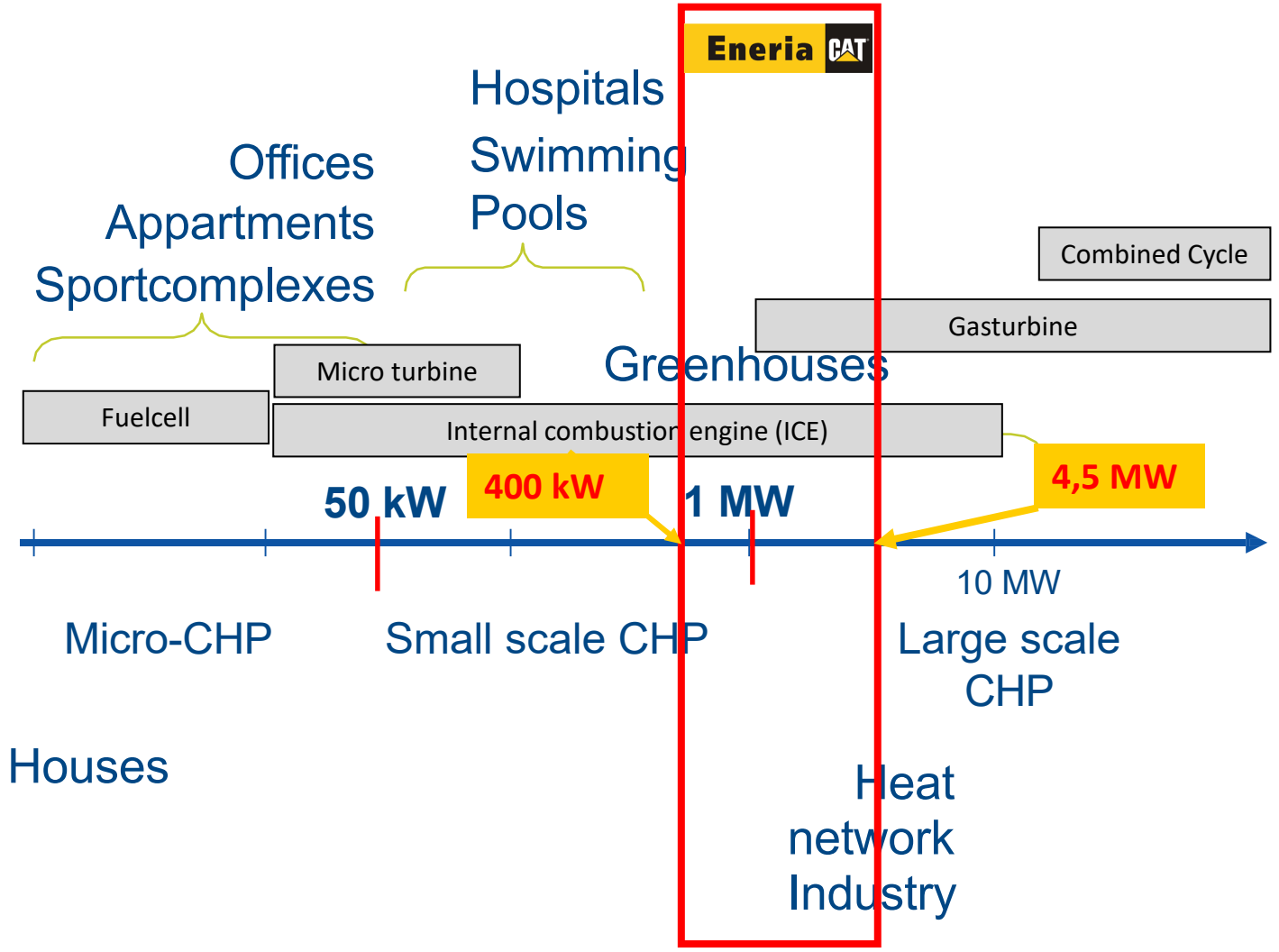
Large scale CHP

Houses

Heat network
Industry

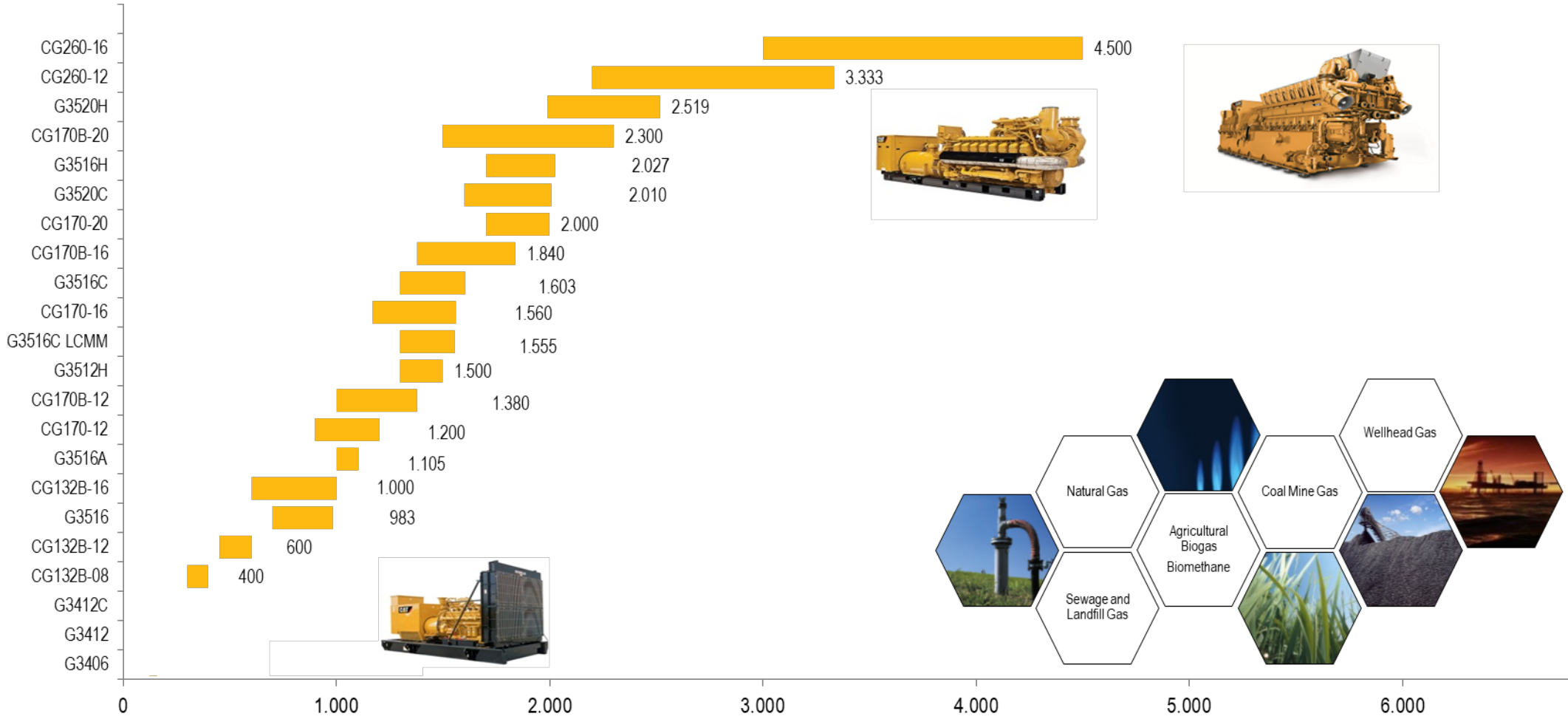
- Source : CogenVlaanderen

What, where, why, how much…



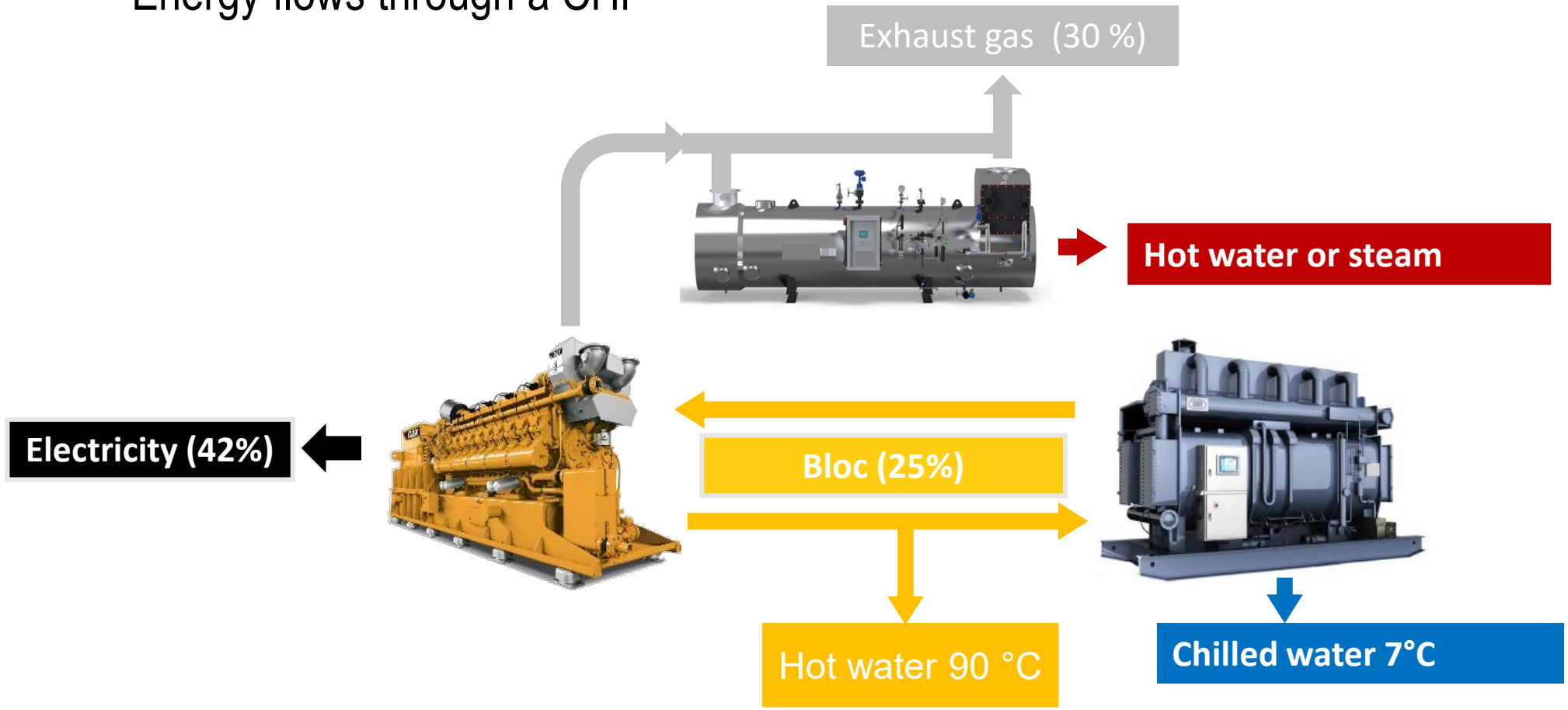
- Source : CogenVlaanderen

What, where, why, how much…

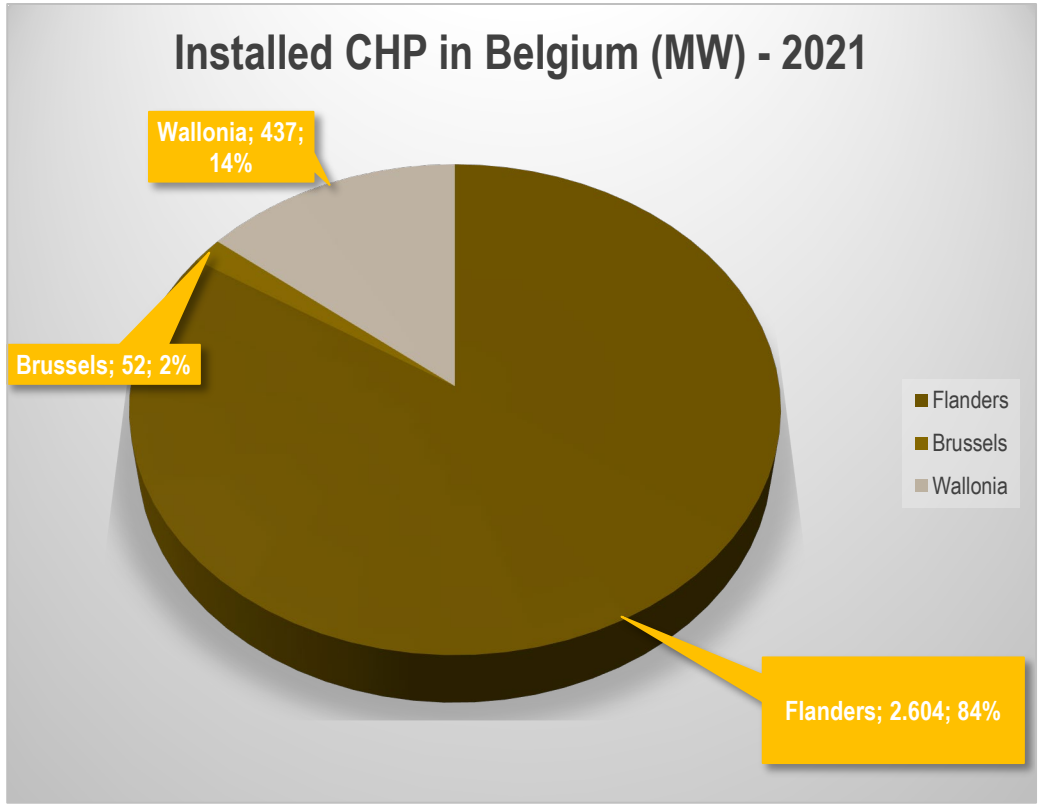


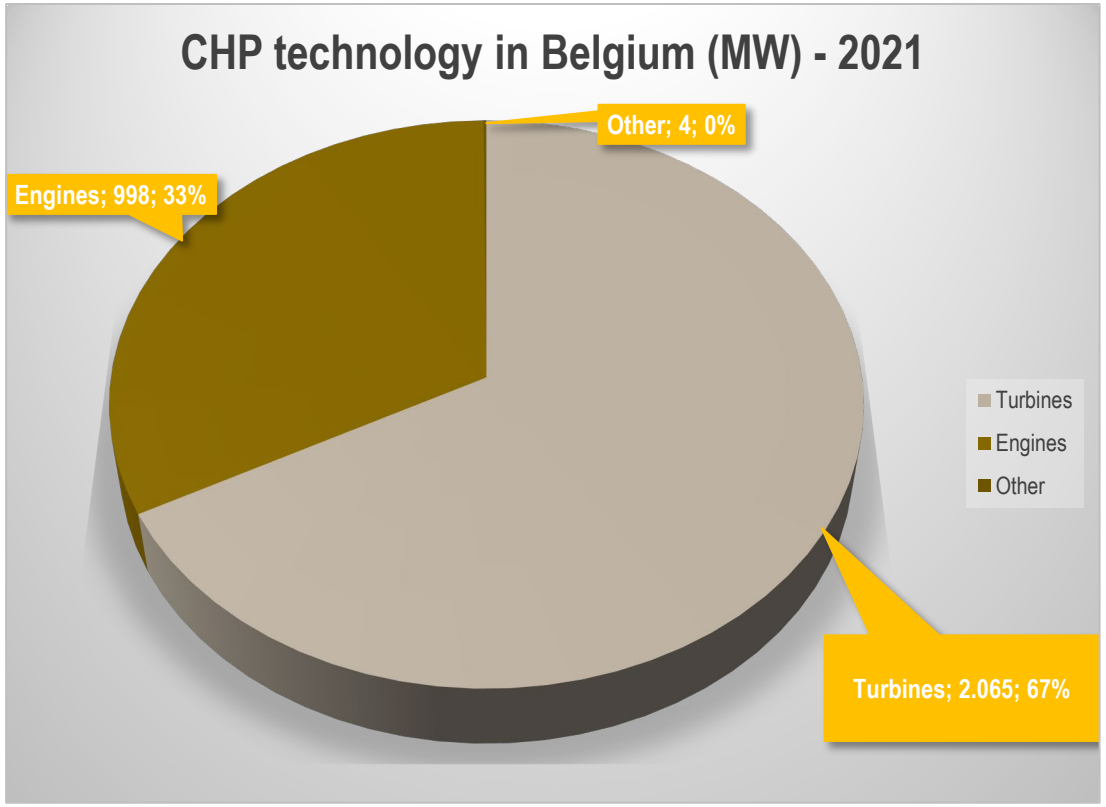
What, where, why, how much…

- Energy flows through a CHP



What, where, why, how much…





- Source : CogenVlaanderen

- Comparison with other forms of electricity generation
  - Nuclear: 8,760 operating hours per year
  - Turbines: 8,760 operating hours per year
  - CHP ICE : 5000 operating hours per year
  - Wind turbine on shore : < 2000 full load hours per year
  - PV : 1000 full load hours per year

-> an average 2 MW CHP generates yearly as much electricity as +/- 30.000 PV panels, which needs 60.000 m² of free surface

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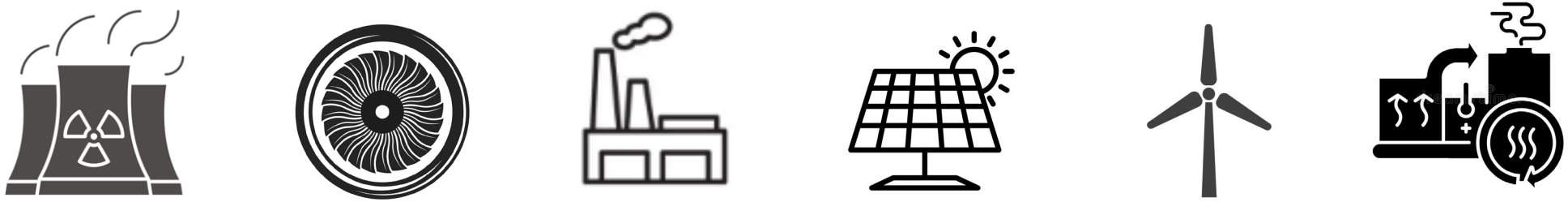
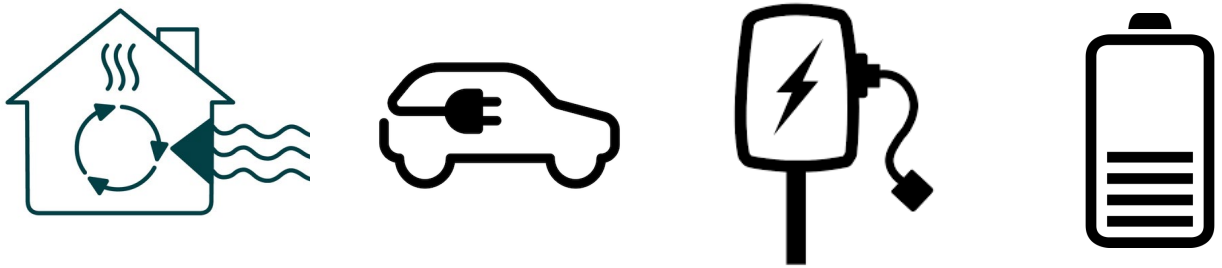
Evolution on the grid

- Evolution at Producer side



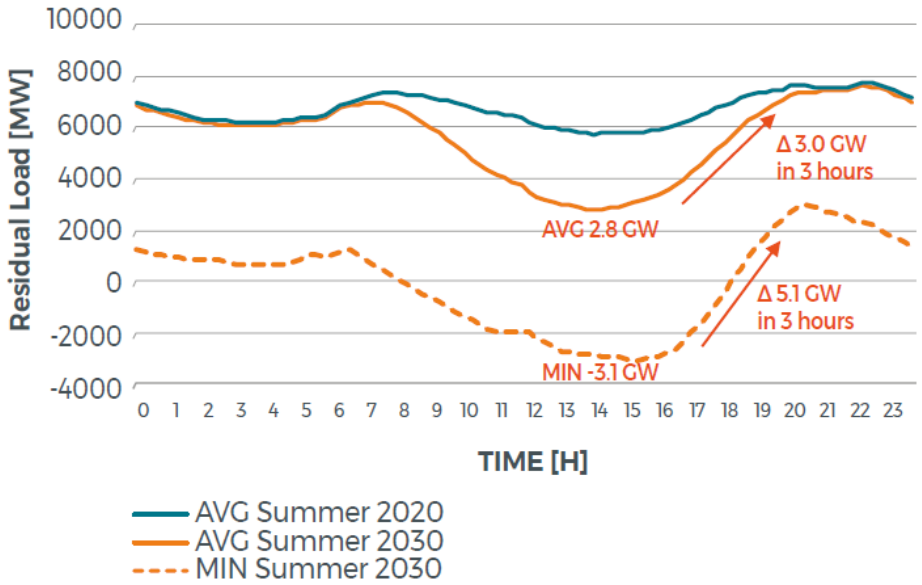
- Evolution at Consumer-side



Evolution on the grid

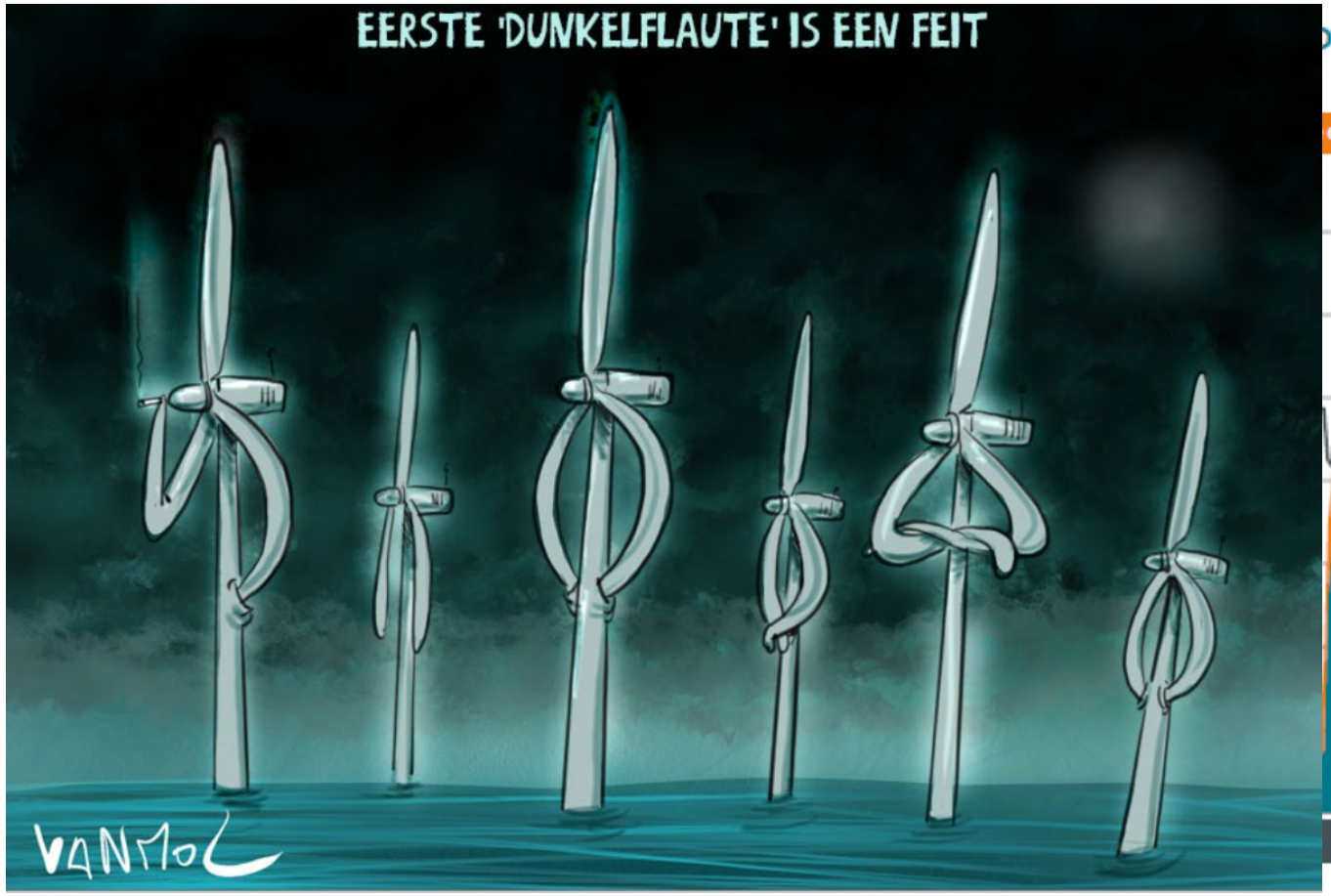
- Load profile = electricity demand
- Residual load profile =

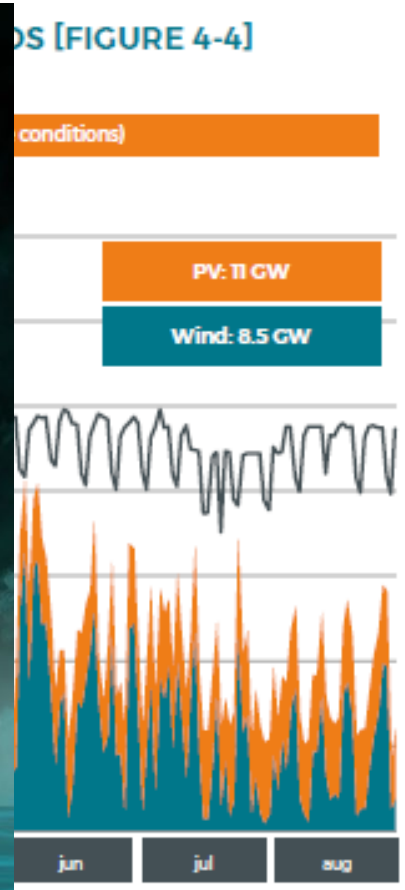
  the electricity demand minus generation from variable renewable energy sources (PV, wind, hydro-electric, …) and, other 'must run' decentral generation



- Source : Elia

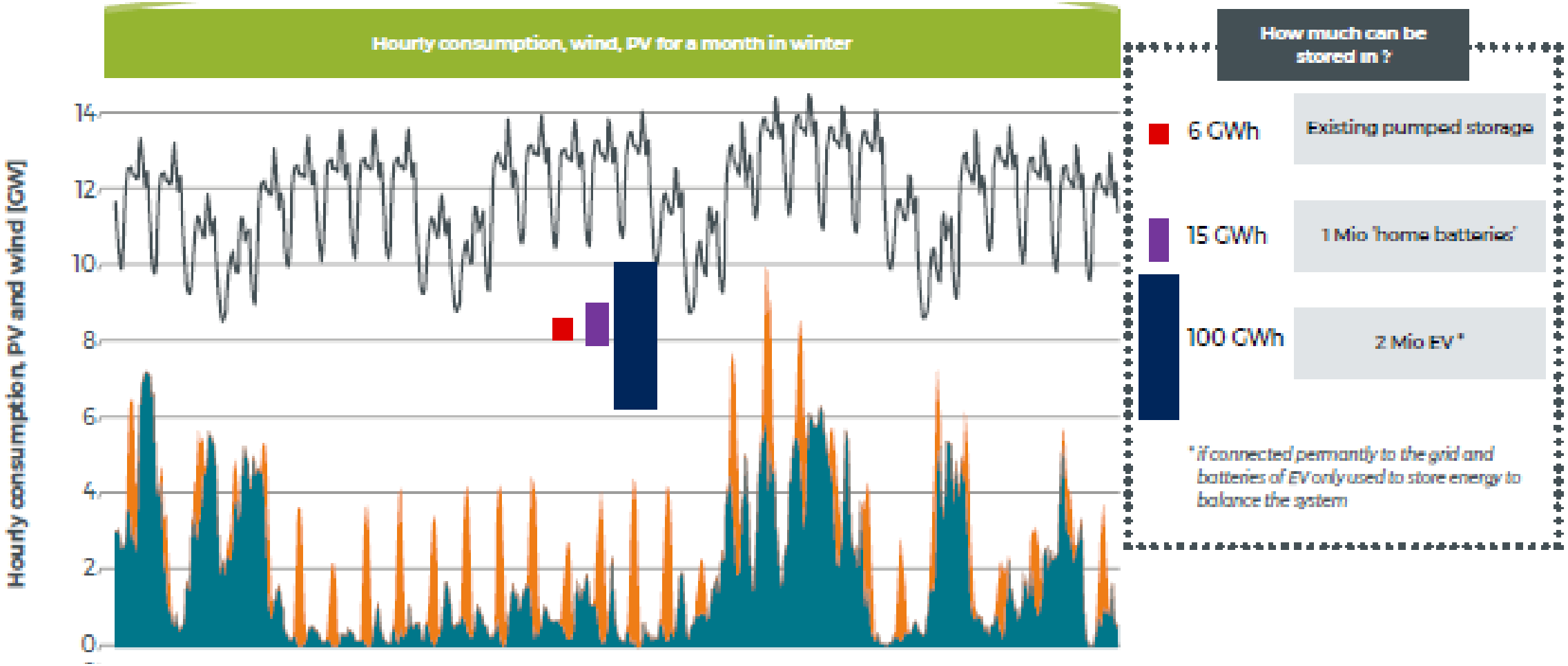
Evolution on the grid





- Source : Elia

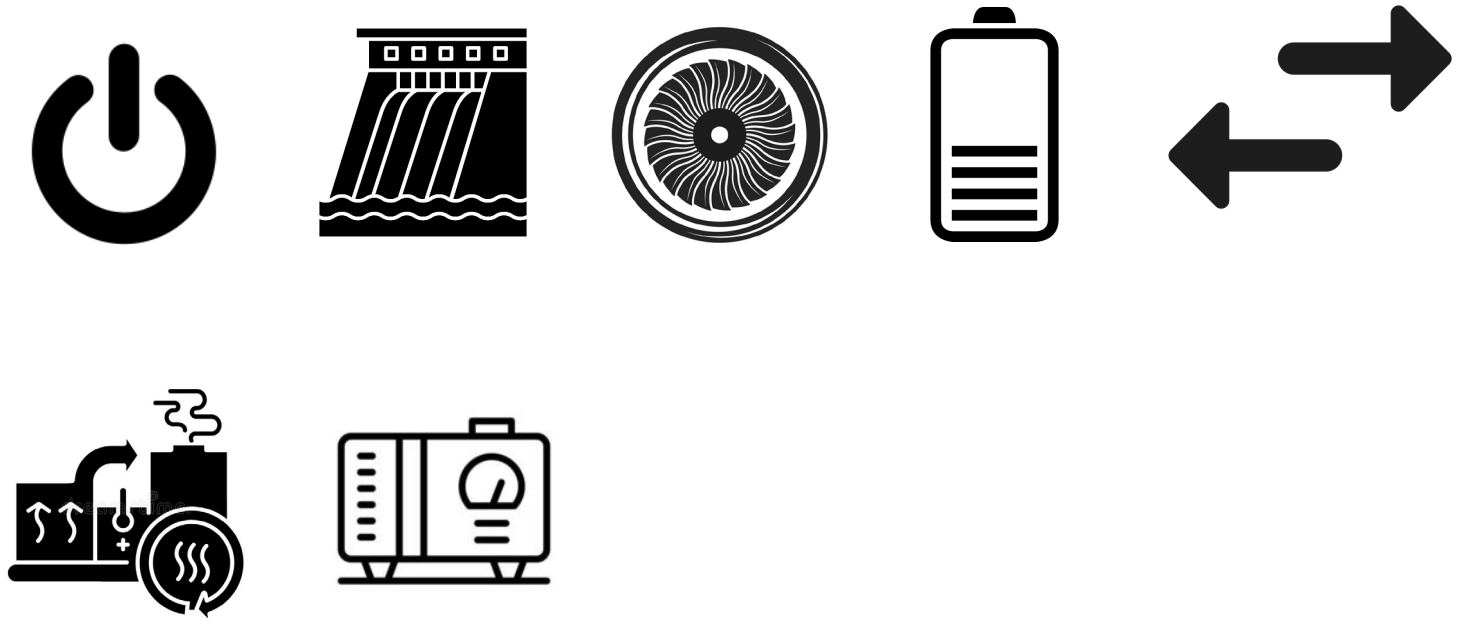
03 Evolution on the grid



- Source : Elia

Evolution on the grid

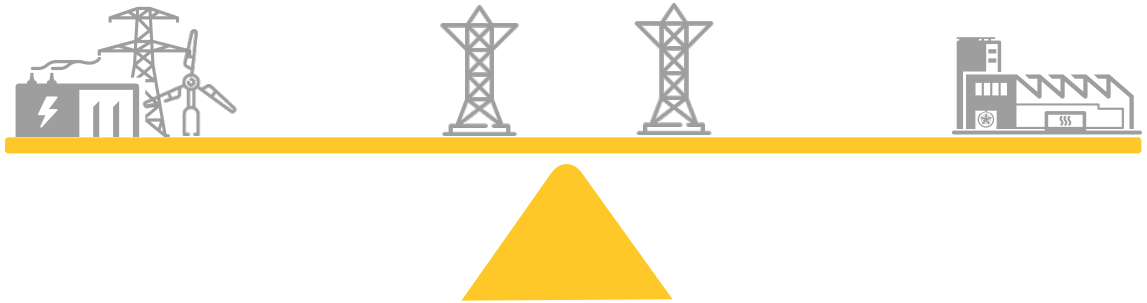
- What solutions will cover this evolution ?



- Source : Elia

Evolution on the grid

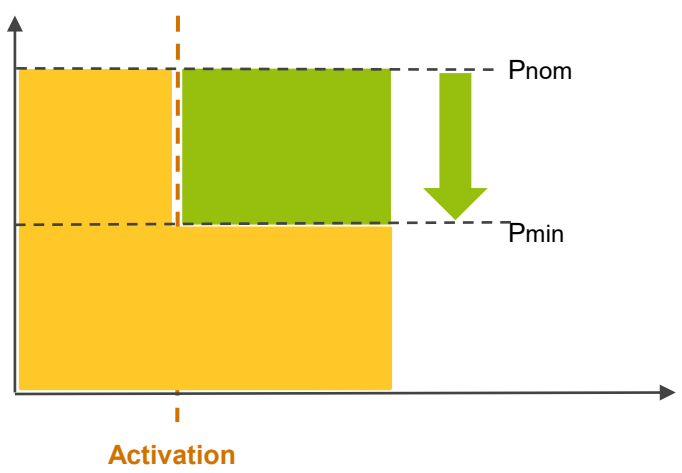
- Elia is responsible to keep the grid in balance.
- Different markets developed by Elia :
  - reserve mechanisms (f)
  - CRM (P)



Evolution on the grid

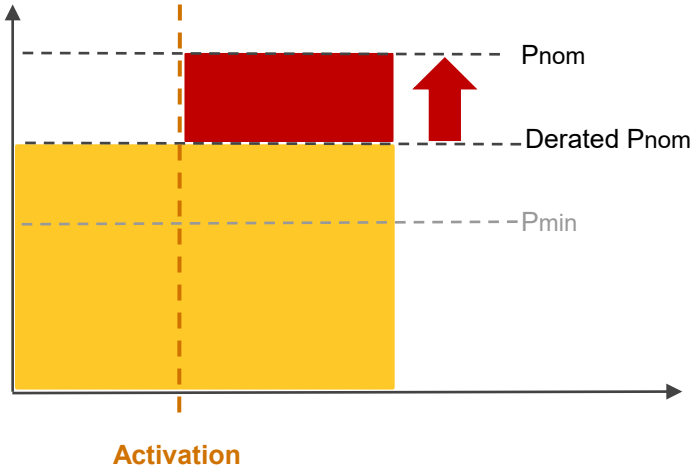
- Flexibility market through an aggregator
  - CHP can participate in the flexibility market in the following segments:

aFRR (R2) DOWN



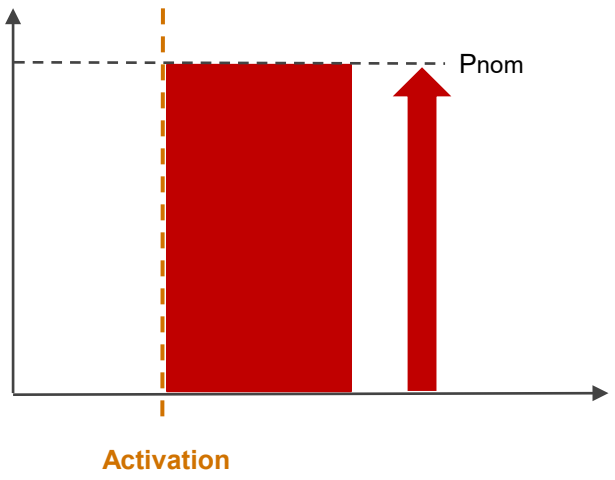
Reduce production
Increase consumption

aFRR (R2) UP



Increase production
Reduce consumption

mFRR (R3)

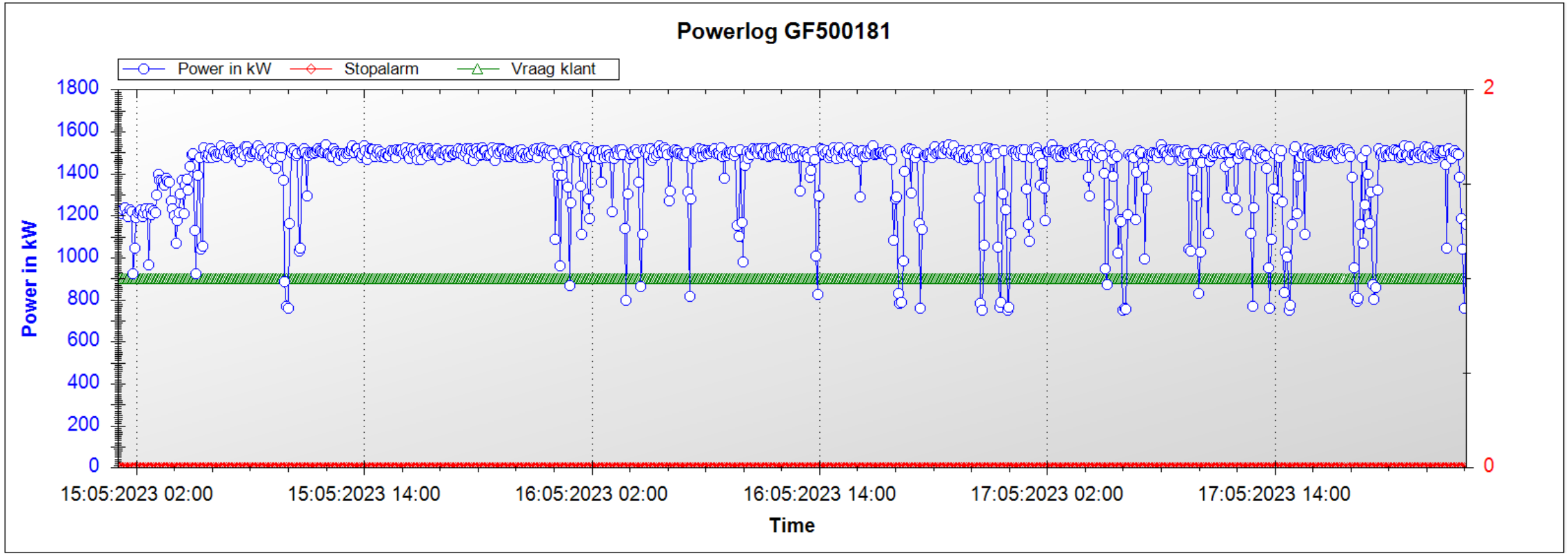


Increase production
Reduce consumption

- Source : Flexcity

Evolution on the grid

- Example of a CHP of 1500 kW in R2 down



https://www.wattshappening.be

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CHP and sustainibility

- CHP mostly on natural gas
  - Fossil fuel, greenhouse gasses …not sustainable

- How can we increase sustainability?
  - Input
    - Biogas
    - Hydrogen
    - Bio-propane
  - Output
    - CO2-capture

- Current status at Caterpillar
  - Full range : admixture up to 10%, 100%P
  - With retrofit kit : mixing up to 25%, 100%P
  - G3516H gas engine can operate 100% on H2 with an output of 1250 kW (compared to 2000 kW on natural gas)

- Biopropaan (C3H8)
  - Chemical same as conventional propane

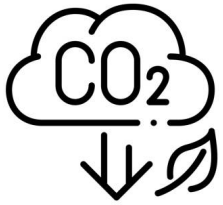
Bio propane = Conventional Propane

  - By-product of HVO (per ton of HVO, 50 kg of propane)
  - renewable and sustainable (min 50% reduction)
  - No connection to the natural gas network required
  - Low methane number (MN33) :reduced power compared to natural gas
  - Same maintenance schedule for the gas engine

CHP and sustainibility

- CO2…
  - ICE have a contribution to CO_2 emissions
  - Project ENERglik

    https://www.grensregio.eu/projecten/energlik
  - Capturing and purifying CO2 from flue gases in order to achieve storage and thus dose at the right time, with the aim of reducing CO2 emissions
  - First results : 2024



- Source : Herman Mariën @ Thomas Moore

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Conclusion 1

2 of a kind…

- CHP continues to guarantee primary energy savings. It still remains BAT to produce electricity and heat simultaneously
- CHP will certainly play an important role in supporting the grid.
- Developments in greener fuels will have a positive impact on the sustainability of CHP
- Eneria will support you in this changing energy landscape

Conclusion 2

2 of a kind…

ChatGPT

As of my last knowledge update in September 2021, combined heat and power (CHP), also known as cogeneration, has been recognized as an important energy efficiency measure in Belgium. CHP systems simultaneously produce electricity and useful heat from a single energy source, resulting in higher overall energy efficiency compared to separate generation of heat and power.
The future for CHP in Belgium is expected to remain positive due to several factors:

1. **Energy Efficiency Goals**: Belgium has been actively working towards achieving its energy efficiency targets. CHP plays a crucial role in reducing greenhouse gas emissions and increasing overall energy efficiency, which aligns with the country's environmental goals.
2. **Regulatory Support**: The Belgian government has implemented various policies and support mechanisms to promote CHP installations. These include financial incentives, feed-in tariffs, and grants to encourage the deployment of CHP systems across different sectors.
3. **District Heating Networks**: Belgium has a well-developed district heating infrastructure, especially in urban areas. CHP systems can be integrated into these networks, providing a reliable and efficient supply of electricity and heat to residential, commercial, and industrial consumers.
4. **Decentralized Energy Generation**: The shift towards decentralized energy generation is gaining momentum in Belgium. CHP systems are well-suited for decentralized energy production, allowing for localized energy supply, increased grid resilience, and reduced transmission losses.
5. **Renewable Energy Integration**: CHP systems can be combined with renewable energy sources, such as biomass or biogas, to further enhance their environmental benefits. Belgium has been actively promoting the use of renewable energy, and the integration of renewables into CHP can help achieve a more sustainable energy mix.

While I cannot provide precise predictions beyond September 2021, it is reasonable to assume that the future for CHP in Belgium will continue to be promising, driven by the country's commitment to energy efficiency, regulatory support, district heating networks, decentralized energy generation, and renewable energy integration. It is recommended to consult up-to-date sources or official publications for the latest developments and policies regarding CHP in Belgium.

Useful links

- https://www.grensregio.eu/projecten/energlik
- https://www.cogenvlaanderen.be/
- https://www.elia.be
- https://www.wattshappening.be