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Current and Future Challenges to Energy Security
The role of cogeneration & hydrogen

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POINTS

WHAT IS COGENERATION

REASON WHY FOR COGENERATION IN ENERGY SECURITY ISSUE

FUELING COGENERATION: EVOLUTION TOWARDS HYDROGEN

VISION

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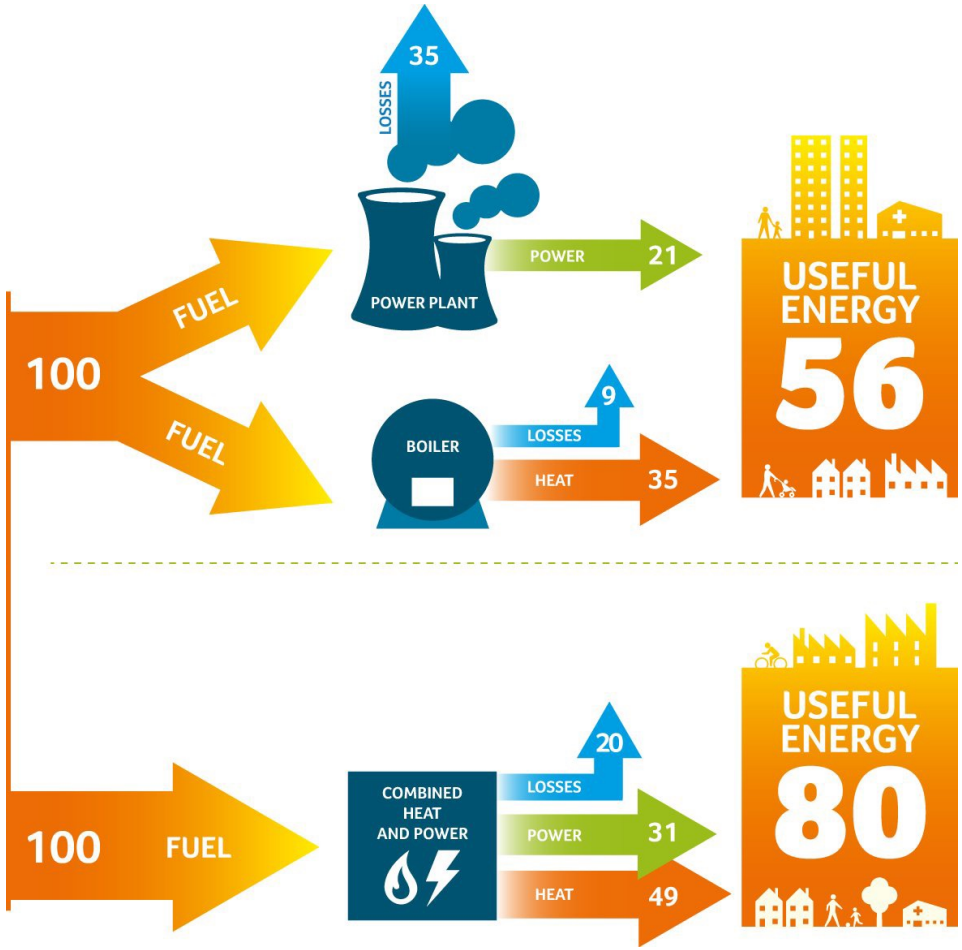
What is cogeneration

Cogeneration

Single Input **Two Outputs**

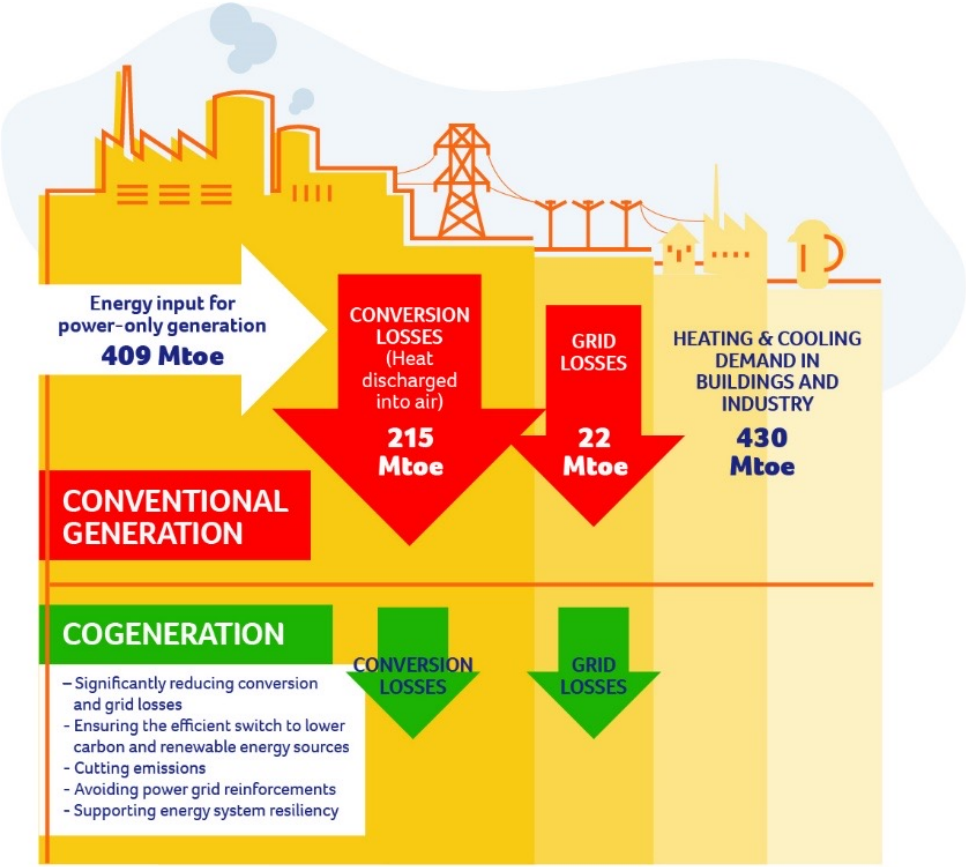
Cogeneration transforms 90% of the energy into useful heat and electricity for factories, offices, public buildings and homes.

EXPLAINED
Cogeneration: A Key Efficiency Principle



- **CHP generates 40% more productive energy** than **average** heat-only and power-only & **CHP saves at least 10%** of primary energy compared to **best-in-class** generation.
- **CHP avoids the waste of heat** by thermal power generation, increasing fuel efficiency from 30-50% to 75-95%.
- **Distributed CHP production reduces electricity grids losses** and the need for grid reinforcements, complementing electrification.

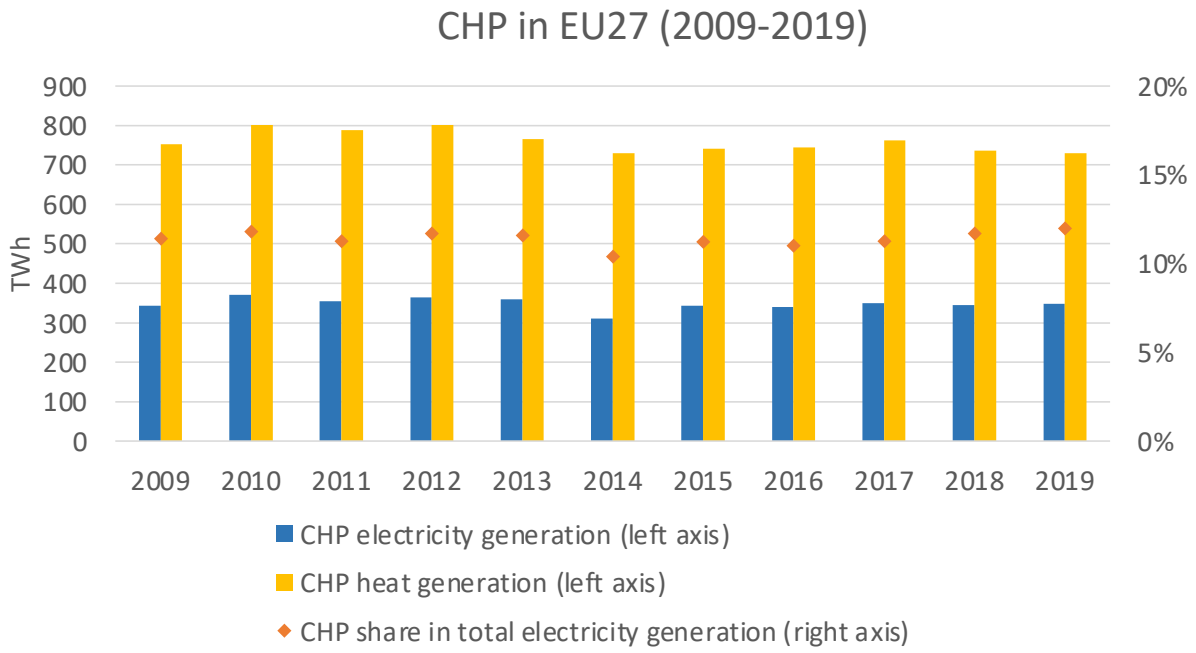
“Efficiency” of the Power System



Overview of CHP in Europe

CHP in Europe - Overview

- 113 GWe of high efficiency CHP installed in 2019
- CHP represents 12% of total electricity and ~14% of the heat in EU27, with potential for it to double by 2030
- CHP across the EU reduces up to 150 Mt of CO2 & ~30 Mtoe of primary energy today (equivalent to the emissions of ~90 million cars)

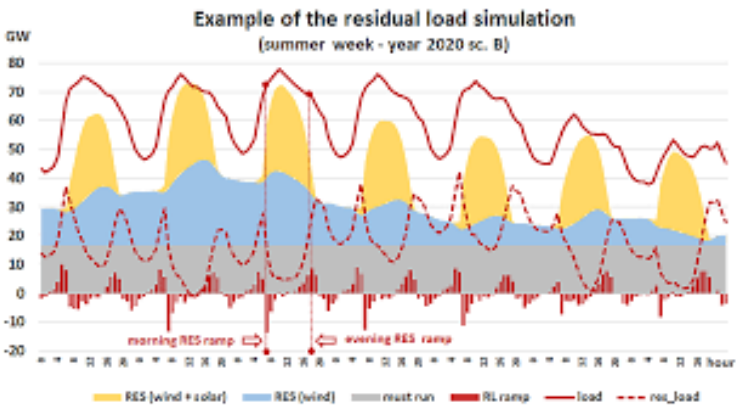


Source: Eurostat (2021)

REASON WHY FOR COEGENERATION IN ENERGY SECURITY ISSUE

Residual load – Inertia & integration issues

- Residual load is the load not covered from (non programmable) renewable generation



- Inertia in power systems refers to the energy stored in large rotating generators and some industrial motors, which gives them the tendency to remain rotating. This stored energy can be particularly valuable when a large power plant fails, or generally in abrupt changes in the load. This temporary response—which is typically available for a few seconds—allows the systems to react without damages in supply

- Increasing penetrations of inverter-based resources—e.g., wind, solar photovoltaics (PV), and battery storage—do not inherently provide inertia

- CHP is a programmable generation (also through aggregation of more CHP small plants controlled in a coordinated way)

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Role of CHP in Fit for 55 & REpowerEU

Energy Supply

- 12% of electricity
- 16% of heat

Empowering Consumers

- 60 GWe installed on-site in key industries*
- Ensuring 70% of DHC heat
- >100.000 micro-CHP units installed in buildings

Energy Efficiency

- 85-95% of CHP qualifies as high efficiency CHP
- ~1300 PJ of energy savings, eq to 30-40 bcm
- > 15 bcm of direct gas savings (~10-15% of REPowerEU objective)

Renewable Energy

- 30% of CHP is renewable & growing
- Gas based CHP is RES/H2 ready
- Coal/fuel oil CHPs rapidly declining

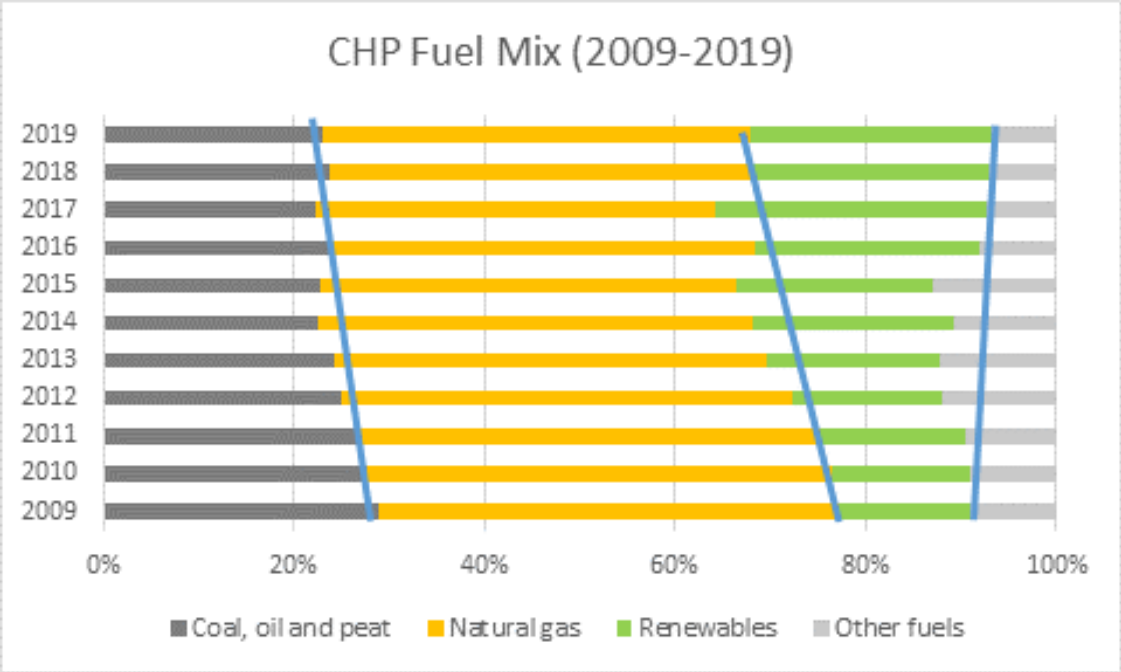
Energy Resiliency

- Cleanest source of dispatchable electricity
- Flexible CHP in DHC will complement intermittent RES & electrification
- Industrial CHP is key to support continuous supply of heat

* Chemical, pulp & paper, alumina, ceramics, primary food processors, hospitality, health and agriculture.

FUELING COGENERATION & THE HYDROGEN ISSUE

Cogeneration Fuel Mix



Source: Eurostat (2021)

CHP fuel mix influenced by fuel price dynamics, support schemes and availability of renewable fuels at local level.

- Stable share of natural gas use in CHP.
- Rapid increase of RES, reaching close to 26% in 2019 (from 13% in 2009).
- Steady decline in solid fossil fuels and oil use in CHP.

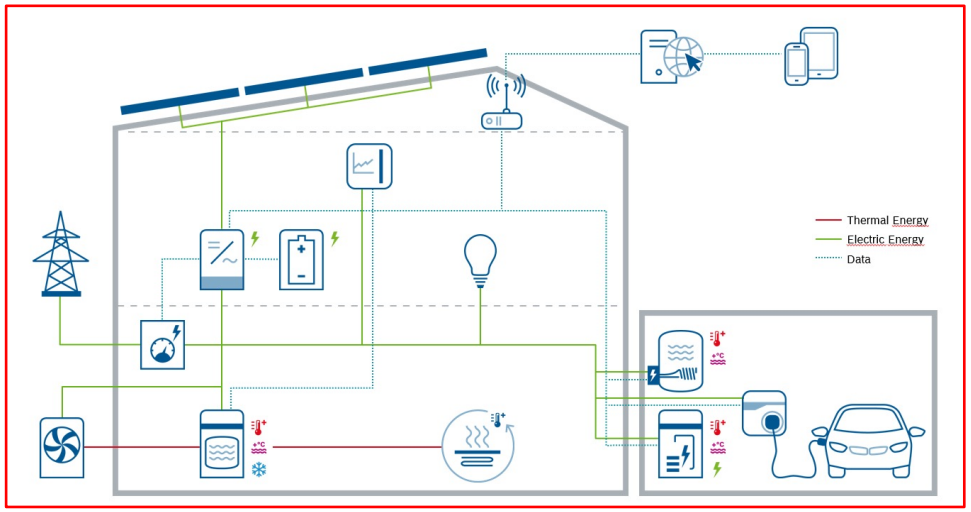
Role of fuel cells

Heating and Powering your home

Fuel Cell micro-Cogeneration is a highly efficient home energy system that simultaneously produces heat and electricity

With the possibility of hydrogen use

- **Empowers consumers**
- **Supports the European energy transition**
- **Provides greater flexibility for the energy system**
- **Fosters innovation and high-value jobs**



Role of engines

CHP ready to use solution for hydrogen

Exixsting plants (mixture)

New plants (mixture – full hydrogen)

CHP is a ready hydrogen solution

Electrical Power Output (kWel)	0 1,000 2,000 3,000 4,000 5,000 [...] 10,000	H_2 in Pipe-line Gas <5% (vol)	H_2 in Pipe-line Gas <20% (vol)[2]	Gas[1]/H_2 Engine 0-100% (vol)	Gas[1]/H_2 Engine 100%
Type 9	J920 FleXtra	✓	✓	25	2025+
Type 6	J612, J616, J620, J624	✓	✓	60	2025+
Type 4	J412, J416, J420	✓	✓	100	✓
Type 3	J312, J316, J320	✓	✓	60	2025+
Type 2	J208	✓	✓	60	2025+

VISION

Our Vision

The cogeneration sector is committed to creating a resilient, decentralised, carbon neutral European energy system by 2050, with cogeneration as its backbone:

- **empowering European citizens and industry to generate their own efficient, reliable and affordable clean heat and power locally**
- **bringing together heat, electricity and gas networks, allowing the efficient integration of substantial amounts of renewable energy and providing energy when and where needed**
- **enabling an integrated energy system and a cost-effective transition towards a sustainable future**

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