

Position Paper

Combining Heat and Power for an Efficient Path to Net-Zero Emissions

November 2024

Setting the Scene

The world is facing numerous challenges, from the current economic slowdown compounded by an unprecedented energy crisis to the long-term effects of climate change. Accelerating our energy transition towards net-zero emissions is now more important than ever, ensuring that economic recovery goes hand in hand with climate protection, empowered consumers, and resilient businesses. In this context, an ambitious global financing framework is needed to foster a predictable investment environment for clean energy solutions.

The 29th United Nations Framework Convention on Climate Change (UNFCCC), which is being held in Baku, Azerbaijan from 11 to 22 November 2024 (COP29), presents a critical opportunity for global leaders to address the urgent need for climate action with a focus on setting a new goal for climate finance. The conference will also be an opportunity for countries to present updated national climate action plans under the Paris agreement, which are due by early 2025.

As world leaders gather in Baku, Azerbaijan, for the 29th Conference of the Parties (COP 29) in Baku, the urgency of addressing climate change has never been more pronounced. The existential threat posed by climate change, exacerbated by extreme weather events, necessitates a robust and immediate global response.

The COGEN World Coalition advocates for:

- 1. An ambitious approach to national climate action plans, which maximize the potential for energy efficiency and aim at accelerating the uptake of all decarbonizing solutions.**
- 2. A firm agreement on climate finance, including setting a new funding target for developed countries to support developing countries in cutting greenhouse gas emissions**

Our vision

Cogeneration has a major role to play in enabling the cost-effective move to increasingly integrated, decarbonised and electrified energy systems across the world. By efficiently and flexibly producing power and heat locally across a range of increasingly renewable and decarbonised energy sources, cogeneration can become the backbone of resilient, efficient and carbon neutral economies around the world.

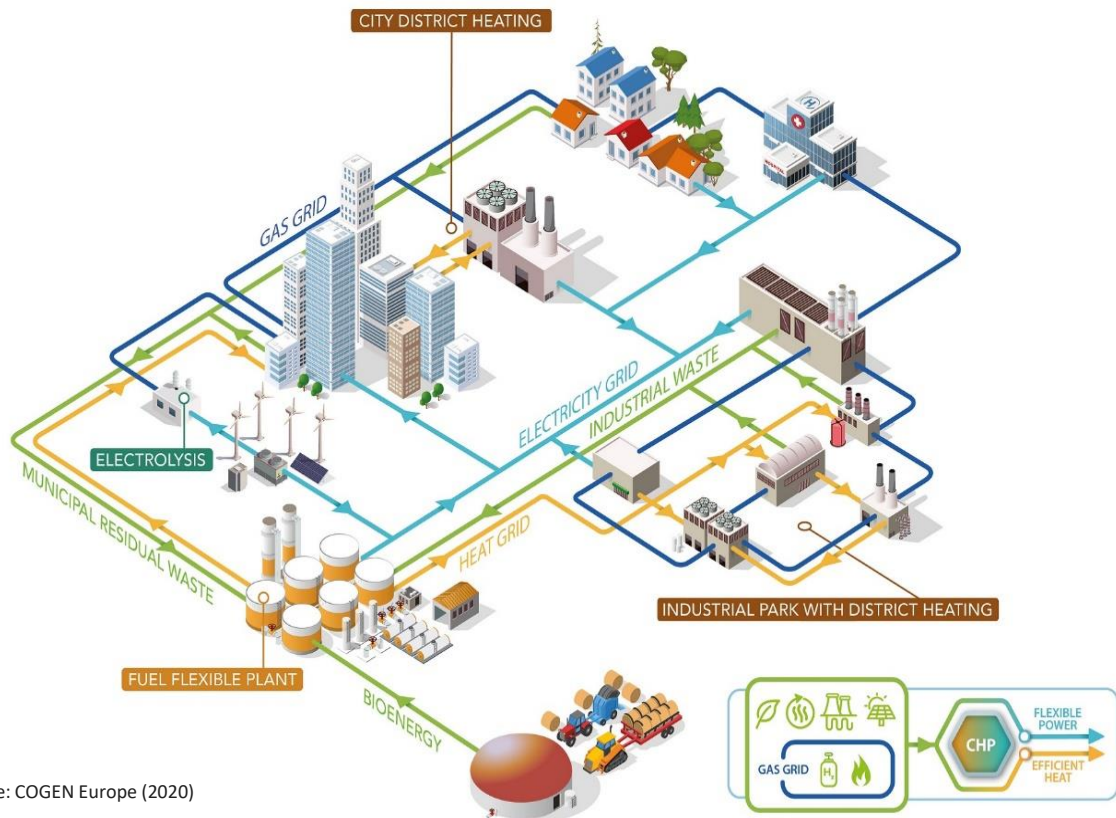
To support an ambitious and speedy path to decarbonisation, the cogeneration sector is committed to the creation of a resilient, decentralised and carbon neutral energy system by 2050 with cogeneration as its backbone, empowering citizens and industry to generate their own efficient, reliable and affordable clean power and utilizing waste heat locally all over the world.

In the context of COP29, the cogeneration sector is committed to delivering on the Paris Agreement ambition, with state-of-the-art solutions that address all dimensions of sustainability: people, planet and the economy.



Achieving this vision will require:

- Taking an integrated approach to the energy system, which brings together electricity, heat and gas systems, to enable the accelerated and efficient uptake of energy from renewable sources.
- Emphasising energy security, flexibility and resiliency, to ensure consumers have access to both electricity and heat when and where they are needed.
- Support measures and dedicated financing tools for clean energy solutions like cogeneration, in order to foster a cost-effective energy transition and affordable energy for all.



What is Cogeneration?

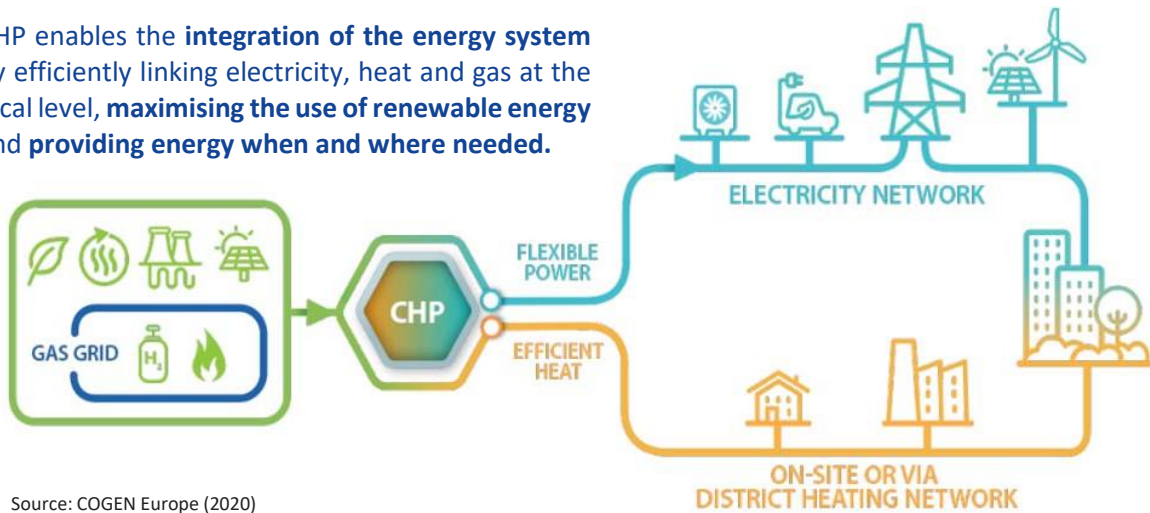
Cogeneration, also known as **Combined Heat and Power (CHP)**, is an energy efficiency solution that generates electricity and captures the heat that would otherwise be wasted. Cogeneration reaches total efficiencies of over 80%, compared to 50% of typical technologies (i.e. conventional electricity generation without waste heat utilization).

Cogeneration uses one input to efficiently produce two outputs – power and heat. The heat can be used for space heating, cooling, domestic hot water and industrial processes. The electricity is produced on-site or near the point of consumption, reducing distribution losses and helping to balance power grids at times of peak demand or insufficient intermittent renewable power.



Cogeneration: backbone of local and integrated energy

CHP enables the **integration of the energy system** by efficiently linking electricity, heat and gas at the local level, **maximising the use of renewable energy** and **providing energy when and where needed**.



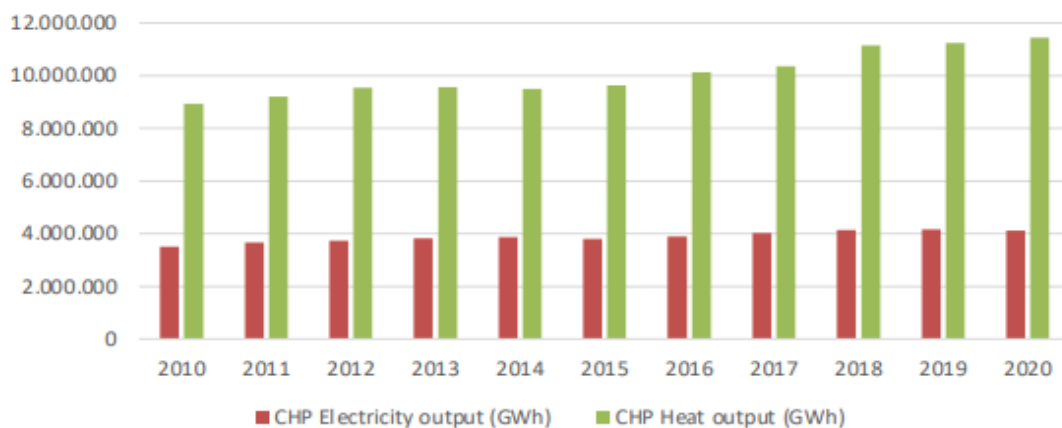
Source: COGEN Europe (2020)

Cogeneration around the world

As governments commit to climate neutrality, accelerating energy efficiency and renewable energy deployment will be critical. In this context, consumers around the world show growing interest in cogeneration for their homes, businesses and cities. The growth of cogeneration across the world is expected to complement the rapid uptake of renewable energy sources and electrification, emerging as a highly efficient, reliable balancing solution to mitigate the intermittency of solar and wind.

In 2022, electricity produced by cogeneration plants amounted to more than 4,000 TWh, covering 15% of the world’s electricity needs. Asia Pacific accounted for a 55.7% share of the CHP market in 2020. Europe and North America have a developed market for cogeneration technologies¹.

10-year overview of CHP electricity and heat generation in the world



Source: [Cogen World Coalition](#) (2023)

¹ IEA (2022).



Growth in India and China is expected due to the industrial expansion, a strong uptake of renewable installations and an increased focus on energy efficiency. The growth in South America, particularly in Brazil, will likely continue. In the EU, more ambitious GHG regulations are expected to advance the phase out of all fossil fuels and accelerate the uptake of renewable-ready, renewable based and flexible CHP. Net-zero scenarios for the EU indicate that CHP will remain important solution for the decarbonisation of district heating, industry, and buildings, with the potential to cover 13-16% of total electricity and 19-27% of heat demand, generating multiple benefits in terms of savings, resiliency and consumer empowerment².

Today, the most widely used cogeneration technologies include gas turbines, steam turbines and gas engines. As we move towards net-zero emissions by 2050, the role of cogeneration will remain important, and it will adapt to the changing needs of energy systems and consumers around the role.

Innovation in the sector aims at renewable fuels integration, increased flexibility and provision of energy system resiliency services, as well as hybridisation.

- Fuel cell cogeneration solutions are now emerging for both domestic and business applications. Larger CHP fuel cells begin to be installed in the US, Japan and South Korea.
- Hydrogen readiness is becoming increasingly available for all cogeneration applications.
- Synergies between cogeneration, power-to-heat, all types of storage and zero-emissions renewables.

Cogeneration remains a consumer-centric solution, delivering competitive power and heat on-site or nearby end-users³. Today industries such as refineries, chemicals, pulp and paper, food and beverages are currently the main end-users of cogeneration. In the future, the sector expects an increase in demand for the commercial and residential CHP installations: CHP as a key technology for city and district level utilities. Cogeneration is also well placed to meet the growing energy demand from data centres worldwide⁴.

These approaches will more rapidly deliver emission reductions, ensuring the lowest cost for energy consumers and a smooth transition to net-zero emissions by 2050.

² Artelys: *Towards an efficient, integrated and cost-effective net-zero energy system in 2050* (2020).

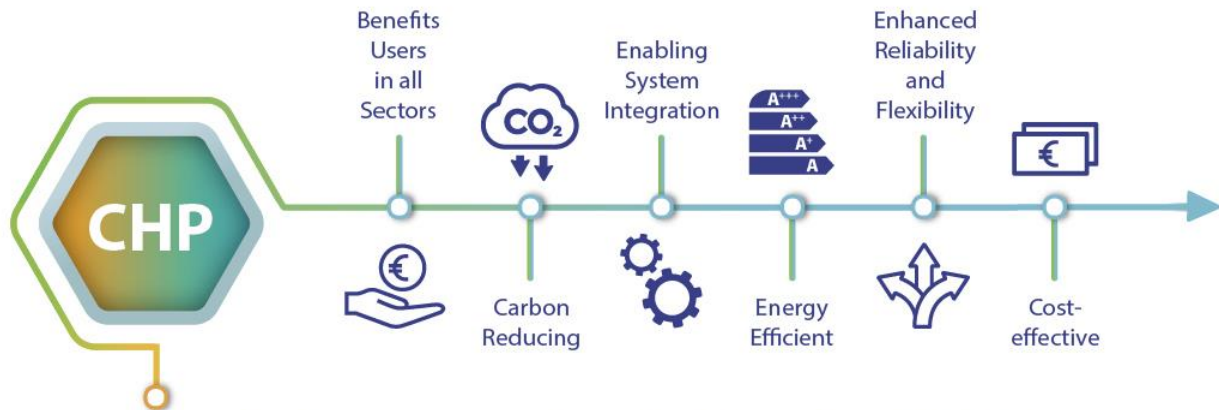
³ Cogen World Coalition. *CHP -360* (2024)

⁴ Cogen World Coalition. *Meeting the energy needs of Data Centres: What role for cogeneration?* (2024)



Benefits of Cogeneration

Cogeneration is a future-proof efficiency solution with multiple benefits for energy consumers and society as a whole.



...a future proof solution for 2050

- **Fosters energy efficiency.** Cogeneration is up to 40% more efficient than the separate generation of heat and power, across a range of increasingly renewable energy sources. Cogeneration achieves more value for consumers by using less energy. This helps reduce the consumption of fossil fuels and ensures the maximum use of renewable energy.
- **Cuts emissions.** As the fuel mix decarbonises, cogeneration reduces emissions cost-effectively by displacing more energy and carbon intensive technologies.
- **Supports renewable energy integration.** As the energy mix decarbonises, CHP will ensure the efficient switch to renewable energy. Cogeneration solutions can run on any renewable fuel, including all gaseous fuels, biomass, geothermal, waste heat, residual waste, solar thermal. State-of-the-art CHP technologies are hydrogen ready, having the flexibility to run on up to 100% hydrogen. Integrated concepts that combine PV, Wind, heat/power storage, heat pumps, district heating and CHP show that higher shares of renewables can be used cost-effectively when cogeneration is added to the mix.
- **Enhances energy system resilience.** Cogeneration can generate electricity and heat when and where needed, especially in the face of increasing disruptions to the grid due to the effects of climate change. This brings flexibility and resilience to an energy system which has to cope with a growing share of intermittent renewables such as solar and wind power. Cogeneration can keep the lights on, ensure electricity heating is delivered and EVs can be charged at times of insufficient supply of wind and solar. By efficiently using renewable hydrogen or synthetic gases, cogeneration closes the loop in delivering system efficiency. Cogeneration also plays a crucial role in hospitals and industry, where the continuous supply of heat and electricity must be ensured at all times.



- **Reduces cost.** By making the most out of available primary energy and reducing grid losses, cogeneration can ensure lowest cost for both the consumer and the society. In the future, as intermittent renewables take centre stage and electrification accelerates, cogeneration can be optimised to deliver lowest cost flexibility while maintaining the highest level of reliability.
- **Empowers consumers.** With cogeneration, consumers can cost-effectively meet their energy, resiliency, competitiveness and environmental objectives. The design and operation of cogeneration systems can be adapted to the needs of a multitude of consumers across all sectors of the economy. Cogeneration is compatible with net-zero emissions scenarios, as it is fuel flexible, cost-effective and complements other clean energy solutions (e.g. wind, solar, heat pumps, electric vehicles).

Call to Action

To tackle climate change, our decarbonisation efforts must be consistent with a net-zero emissions pathway by 2050. Moreover, emissions reductions should accelerate, minimising the total volume of emissions and keeping the world below the allocated carbon budget. This must be achieved cost-effectively, making sure no nation is left behind.

Solving climate change is within our reach and industry is committed to deliver on highly ambitious objectives. For this to be delivered, COP29 represents an opportunity for world leaders to commit to:

- **Set high levels of ambition in national climate action plans under the Paris Agreement**, ensuring a predictable investment environment to cost-effectively reach net-zero emissions in the coming decades across the world.
- **Facilitate massive financing for a range of clean energy solutions**, supporting the highest efficiency and lowest carbon solutions.
- **Plan for and deploy future-proof integrated energy systems**, maximising the use of all clean technologies.
- **Ensure access to reliable, efficient and affordable clean energy**, so that no one is left behind.
- **Empower and provide dedicated OPEX/CAPEX support for energy consumers to produce their own efficient and clean energy**, from local communities to large scale industries, from small businesses to vulnerable consumers, from remote areas to densely populated cities.

