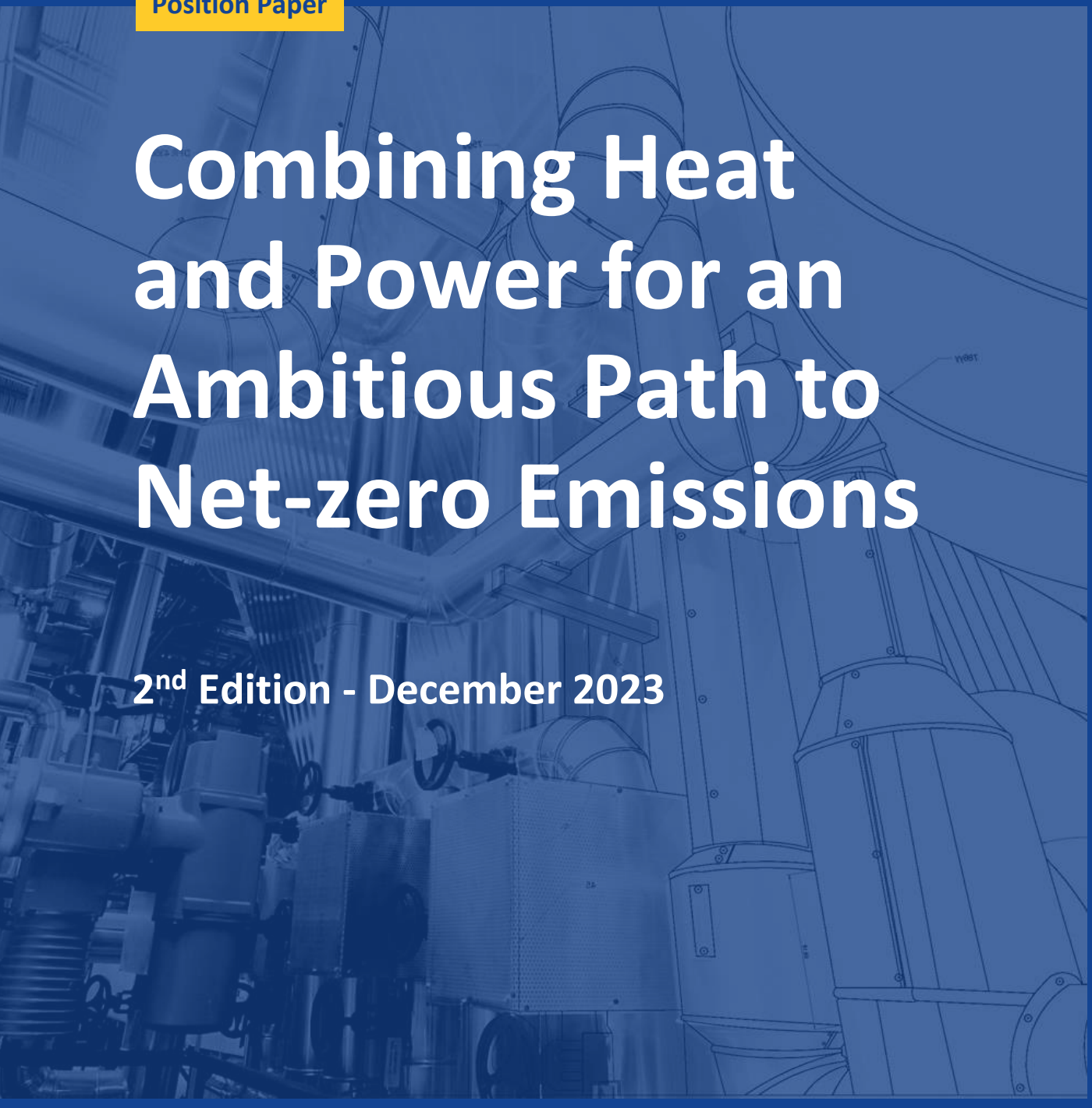
COGEN WORLD COALITION

Position Paper

Combining Heat and Power for an Ambitious Path to Net-zero Emissions



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Setting the Scene

The last two years have seen remarkable progress in developing and deploying key clean energy technologies. However, energy sector carbon dioxide emissions have continued to rise, reaching a new record in 2022. Doubling the global pace of energy efficiency progress is key in reaching net zero emissions and ensuring that economic recovery goes hand in hand with climate protection, empowered consumers, and resilient businesses.

The fast tracking of the energy transition and reducing emissions before 2030 to limit global warming to 1.5° C above pre-industrial levels will be one of the main focus areas of the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP28). Leaders will also work on setting the framework for a new deal on climate finance to make it affordable, available, and accessible to developing countries; and on ensuring that decisions, discussions, and solutions are inclusive and done in collaboration with Indigenous Peoples and local communities.

According to the most recent projections by the Intergovernmental Panel on Climate Change (IPCC) there is a more than 50% chance that global temperature rise will reach or surpass 1.5°C between 2021 and 2040. Changing course to limit global warming to 1.5°C will instead require deep greenhouse gas emissions reductions in the near-term. The world must rapidly shift away from burning fossil fuels — the number one cause of the climate crisis.[1]

In its 'Net Zero by 2050' Roadmap, the International Energy Agency (IEA) set out a narrow but feasible pathway for the global energy sector to contribute to the Paris Agreement's goal of limiting the rise in global temperatures. An update of the report, issued in 2023, shows that greater ambition and implementation, supported by stronger international cooperation, will be critical to reach climate goals. Limiting global warming to 1.5 °C remains possible due to the record growth of key clean energy technologies, though momentum needs to increase rapidly in many areas.[2]

Given that carbon dioxide emissions have a cumulative effect, rapidly eliminating the most polluting forms of generation must be prioritised while increasing energy efficiency. In this respect the rapid transition to efficient generation based on low carbon and increasingly renewable energy sources will be a win-win. Prioritising energy efficiency will also enhance security of supply and energy system resiliency, whilst limiting the negative impacts of increasing energy costs.

The cogeneration sector is committed to delivering on this ambition, with state-of-the-art solutions that address all dimensions of sustainability: people, planet and the economy.

[1] IPCC (2023).
[2] IEA (2023).

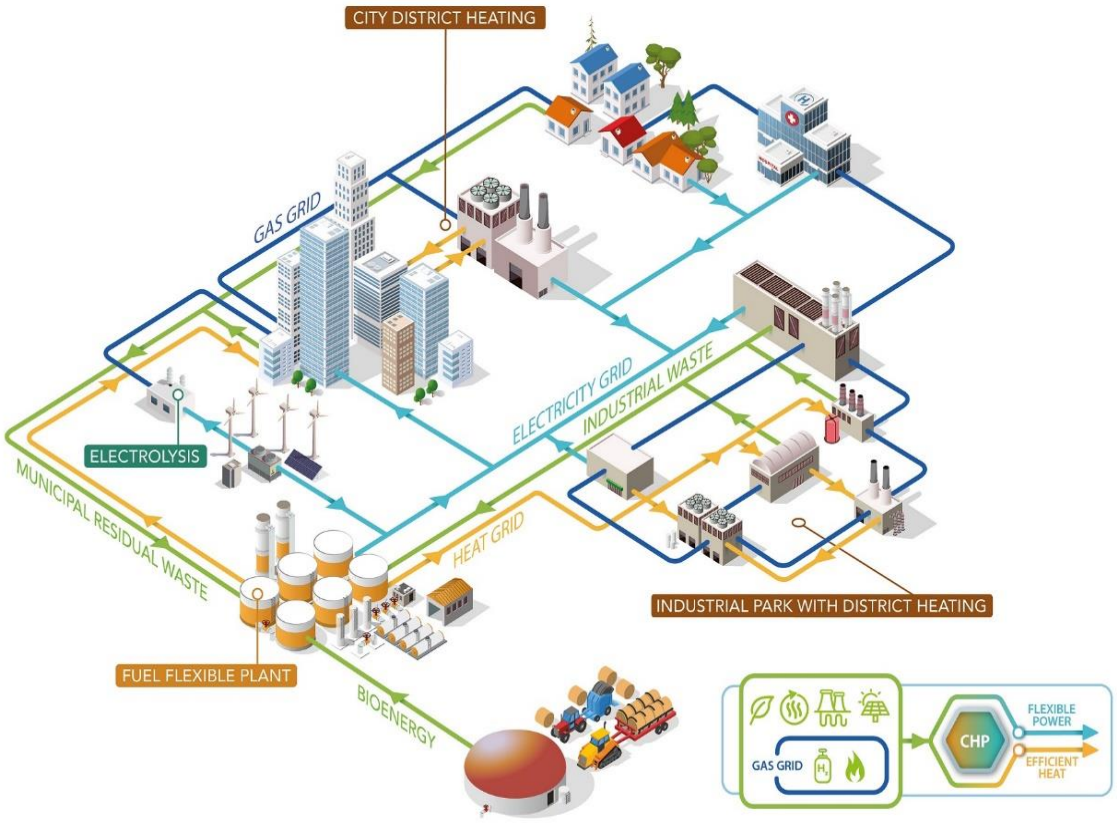
Our vision

Cogeneration has a major role to play in enabling the cost-effective transition 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 rapid path to decarbonisation, the cogeneration sector is committed to the creation of a resilient, decentralised and carbon neutral energy system by 2050 with cogeneration playing a central role, empowering citizens and industry to generate their own efficient, reliable and affordable clean heat and power locally all over the world.

Achieving this vision will require:

- bringing together electricity, heat and gas networks, to enable the efficient integration of substantial amounts of renewable energy;
- emphasising energy security, flexibility and resiliency, to ensure consumers have access to energy when and where it is needed;
- supporting measures for efficient energy solutions like cogeneration, to foster a cost-effective energy transition and affordable energy for all.



Source: COGEN Europe (2020).

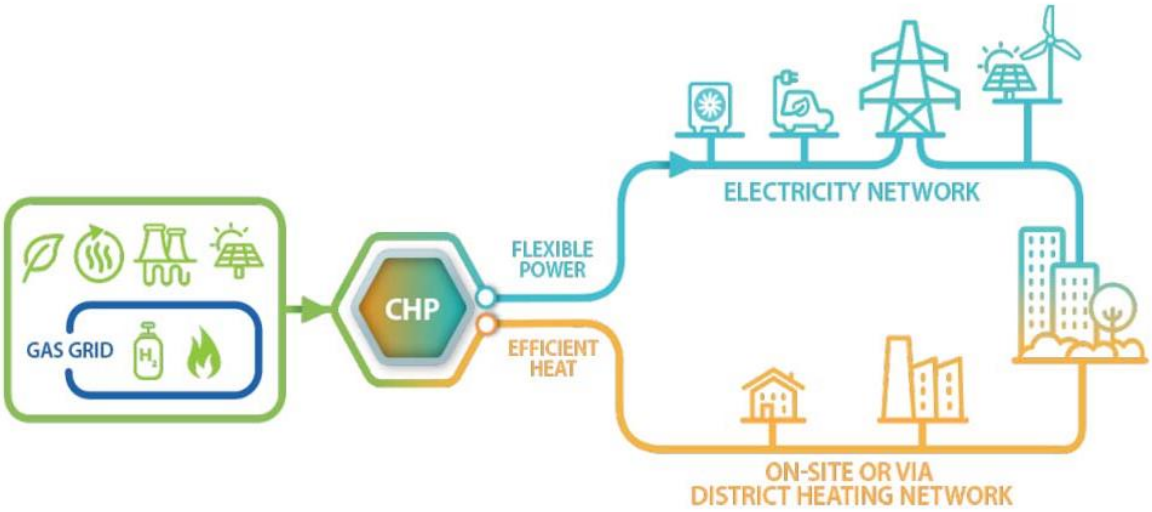
What is cogeneration?

Cogeneration, also known as Combined Heat and Power (CHP), refers to a range of technologies that generate electricity whilst also capturing the heat that would otherwise be wasted. Cogeneration technologies can reach total efficiencies of over 80%, compared to 50% for other technologies (e.g. 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/or 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 when power from intermittent renewables (like PV and wind) is insufficient.

Cogeneration: backbone of local and integrated energy systems

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.**

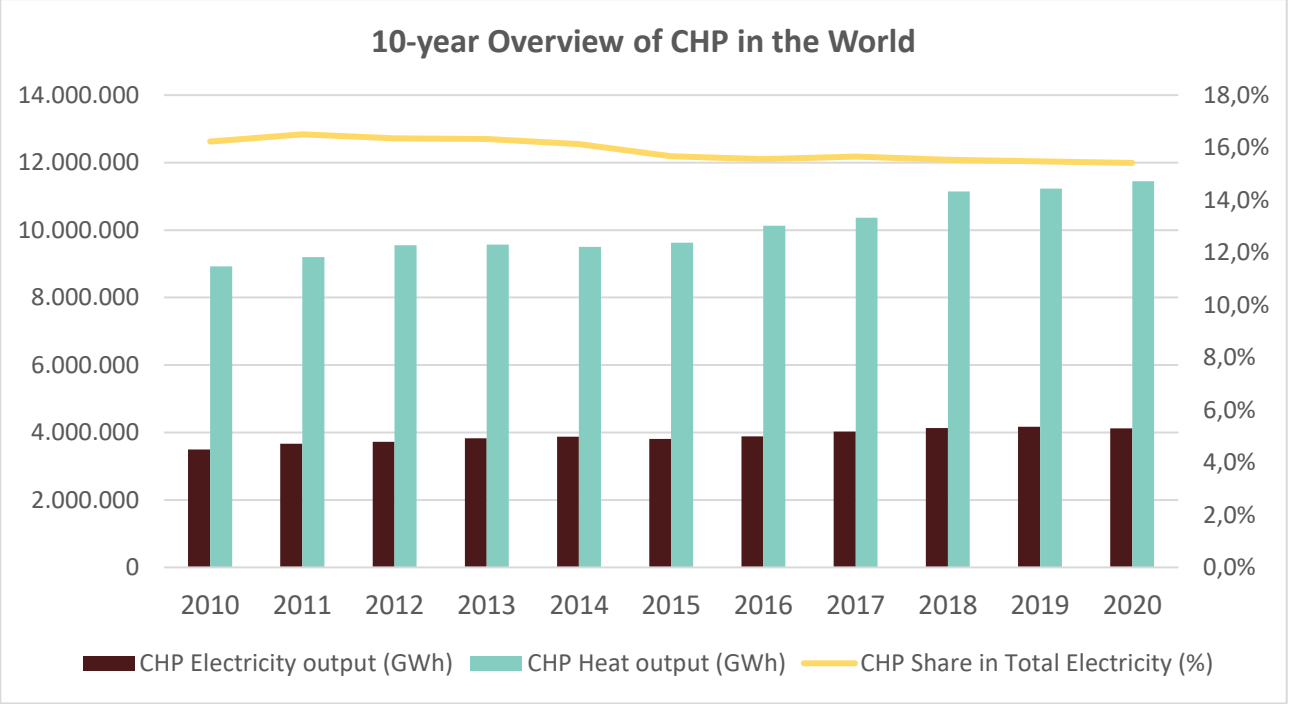


Source: COGEN Europe (2020).

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 CHP for their homes, businesses and communities. The growth of CHP 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 (PV) and wind.

In 2020, electricity produced by CHP plants amounted to more than 4,000 TWh, covering 15% of the world's electricity needs, while the heat output from CHP plants amounted to nearly 11,500 TWh. The Asia Pacific Region accounted for a 55.7% share of the CHP market in 2020. Europe and North America also have well-developed CHP markets[3].



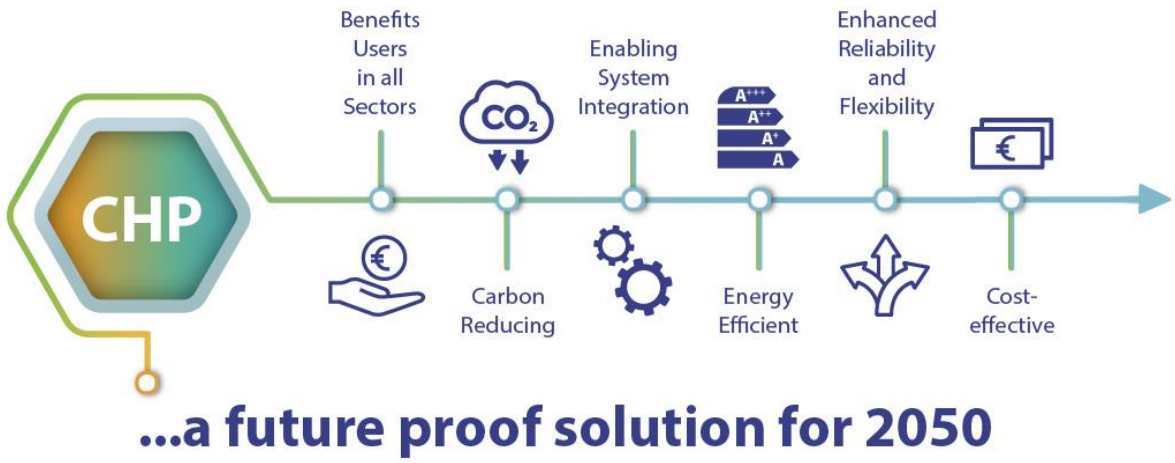
Growth in India and China is expected due to industrial expansion, a strong uptake of renewable installations and an increased focus on energy efficiency. The growth in South America, particularly in Brazil, will likely continue. In the EU, more ambitious regulations relating to greenhouse gas emissions are expected to advance the phase-out of all fossil fuels and accelerate the uptake of renewable-ready, renewable-based and flexible CHP systems. Net-zero scenarios for the EU indicate that cogeneration will remain an 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 empowerment[4].

[3] IEA (2022).
[4] Artelys: Towards an efficient, integrated and cost-effective net-zero energy system in 2050 (2020).

Today, the most widely used cogeneration technologies include gas turbines, steam turbines and gas engines. Innovations in the sector aim at the integration of renewable fuels and the adaptation towards greater flexibility and resiliency. Fuel cell cogeneration solutions are now emerging for both residential and business applications. Meanwhile, cogeneration applications are increasingly hydrogen-ready.

Benefits of cogeneration

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



- **Enhances energy system resilience.** Cogeneration can generate electricity and heat when and where they are needed, which is especially valuable in the context of increasing disruptions to the electricity grid due to the effects of climate change (flooding, hurricanes, wildfires, etc.). This brings flexibility and resilience to an energy system which also has to integrate a growing share of intermittent renewables such as solar and wind power. CHP can keep the lights on, ensure that electricity and heating is available and electric vehicles (EVs) can be charged at times of insufficient supplies of wind and solar power. By efficiently using renewable gases or clean hydrogen, CHP closes the loop in ensuring system efficiency. CHP also plays a crucial role in hospitals and industry, where the continuous supply of heat and electricity must be ensured at all times. CHP is flexible and dispatchable, making it an essential market for the technology in the future. Combining CHP into gas peaking stations, which are largely electricity-only at present, and integrating CHP into district energy schemes could be a key lobbying point for local deployment.

- **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 most efficient use of renewable energy.

- **Cuts emissions.** As the fuel mix decarbonises, cogeneration reduces emissions cost-effectively by displacing more energy-intensive and carbon-intensive technologies.
- **Supports renewable energy integration.** As the energy mix decarbonises, CHP will ensure the efficient switch to renewable energy. Cogeneration systems can run on any renewable fuel, including all gaseous fuels, biomass, residual waste, waste heat, solar thermal or geothermal. State-of-the-art CHP technologies are hydrogen ready, having the flexibility to run on up to 100% hydrogen. Integrated systems that combine PV, wind, heat/power storage, heat pumps, district heating and cogeneration show that CHP enables higher shares of renewables to be used cost-effectively.
- **Reduces cost.** By making the most out of available primary energy and reducing grid losses, cogeneration can reduce costs for both the consumer and the society. In the future, as intermittent renewables take centre stage and electrification accelerates, CHP can be optimised to ensure flexibility and reliability whilst also maintaining affordability.
- **Empowers consumers.** With cogeneration, energy consumers can cost-effectively meet their resiliency, competitiveness and environmental objectives. CHP design and operation can be adapted to meet the needs of a wide variety of end-users across all sectors of the economy. The widespread use of cogeneration is compatible with net-zero emissions scenarios, as it is fuel flexible, cost-effective and complements other clean energy solutions.

The untapped potential of cogeneration

Cogeneration is fundamental for cross-industry decarbonisation. Several aspects of its potential are still yet to be explored and utilised:

- **Potential of CHP to eliminate short-lived climate pollutants most notably in synergy with sustainable waste management**. There is a huge amount of unabated methane emissions from landfill sites and other locations, particularly in the developing world.[5]
- **Potential of CHP to help convert waste gases from industrial processes to useful energy**, notably from furnaces, chemical processes, and flare gas sites.
- **Potential of localised carbon capture to increase the carbon benefits of cogeneration**. CHP carbon emissions from natural gas can be brought close to zero. CHP carbon emissions from biogas carry the potential to have a net atmospheric carbon reducing system.
- **Potential of CHP to act as an anchor to support decarbonisation in other sectors**.
    - Power generation from biogas is not the only benefit of anaerobic digestion, but also the production of sustainable fertiliser and sustainable treatment of organic wastes.
    - Potential for CHP to contribute to electrification of transport. The e-RIN in the US is a proposed route to have credits for electricity generation dedicated to charging electric vehicles with a stated carbon benefit equivalent to biomethane injection to the grid.

[5] UNEP

Call to action

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

Avoiding the worst impacts of climate change is within our reach and industry is committed to deliver on highly ambitious objectives. For this to be achieved, world leaders must commit to:

- Accelerate and step-up ambition to reach net-zero emissions as quickly and cost-effectively as possible;
- Facilitate financing on a massive scale for the most efficient and least emitting solutions;
- Support the development of future-proof, integrated and decentralised energy systems, maximising the use of all clean and efficient technologies;
- Ensure access to reliable, efficient and affordable clean energy for all households and businesses, so that no one is left behind; and
- Empower energy consumers to produce their own clean power and heat, from individual homes to large buildings, from small businesses to major industries, from remote areas to densely populated cities.

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