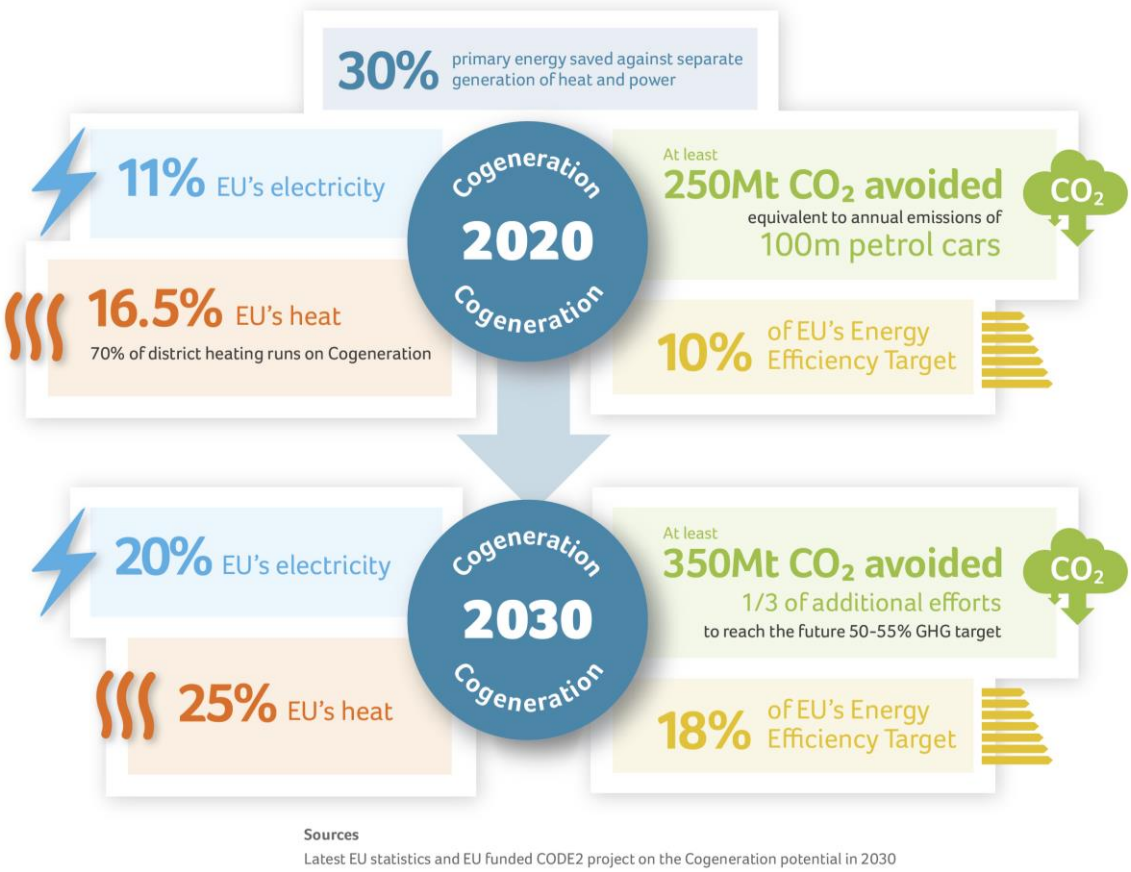
# Position Paper

## An ambitious European Green Deal with cogeneration

COGEN EUROPE

Becoming the first climate neutral continent will require multiple climate-friendly solutions to ensure a cost-effective energy transition, citizens' engagement and economic competitiveness. The cogeneration sector is committed to contribute to achieving climate neutrality by 2050. With cogeneration as its backbone, Europe can build a resilient, decentralised and carbon-neutral European energy system. Millions of households, public buildings and businesses will continue to rely on cogeneration for their heating, cooling and power when and where needed.


Sources

Latest EU statistics and EU funded CODE2 project on the Cogeneration potential in 2030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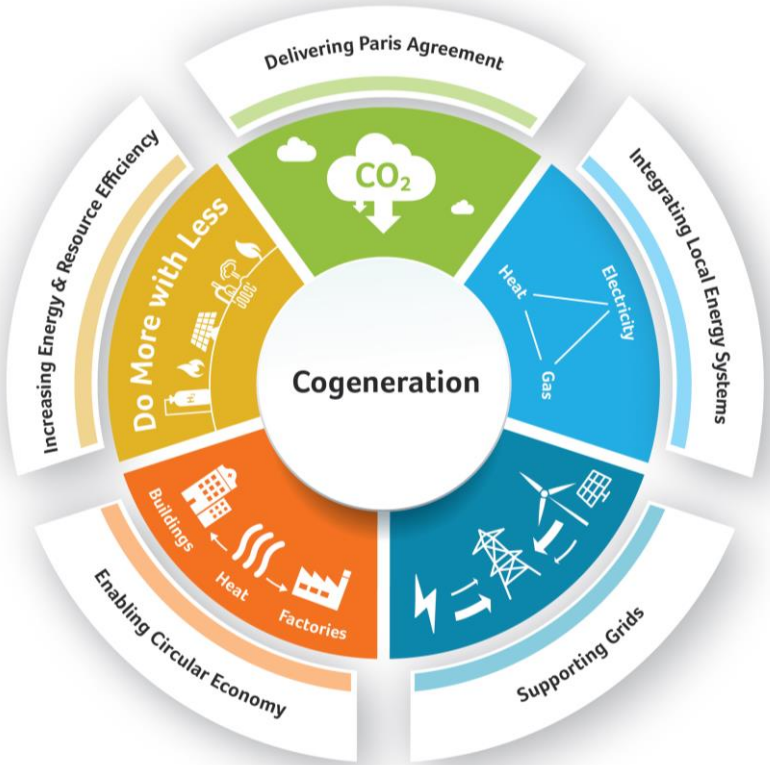
Cogeneration delivers the fundamental dimensions that Europe needs to become carbon-neutral:




- **Delivering the Paris Agreement**: Reducing significantly $CO_2$ emissions already today. Currently, over 70% of cogeneration is low carbon and renewable. In the future, cogeneration will continue displacing more polluting and less efficient generation. Accelerating the uptake of energy sources such as hydrogen and bioenergy will help to fully decarbonise cogeneration.

- **Integrating Energy Systems:** Optimally linking electricity, gas and heat networks and ensuring their most efficient use at local level. This is key to avoid energy waste, foster a more flexible energy system, cost-effectively integrate substantial amounts of renewable energy in the economy.

- **Maximising energy and resource efficiency:** Empowering industry, businesses, cities and citizens to make the most of the valuable primary energy sources available to them and avoid the waste of heat. Cogeneration must be prioritised for the use of low carbon fuels (e.g. natural gas in the transition phase) and fuels of the future like bioenergy and hydrogen, for cost saving purposes and to leave more of them available to decarbonise other sectors.

- **Enabling circular economy**: Recovering waste heat from industry for use on-site or re-use via district heating in nearby factories, businesses and local communities. The latter enjoy affordable and secure heat and the heat supplier gets extra revenues for this service.

- **Supporting power grids**: Supplying efficient and flexible electricity to successfully electrify the economy by meeting electricity demand at times of low wind and sun, as well as reducing pressure on grids during peak demand and needs for costly electricity grid reinforcement.

COGEN Europe has developed comprehensive recommendations on key dimensions of the Green Deal:

- Climate Law & 2030 Target Plan
- New Industrial Strategy for Europe
- Renovation Wave for Buildings
- Energy System Integration Strategy & Hydrogen Strategy

## Cogeneration: key for a more ambition in 2030 and carbon neutrality by 2050

COGEN Europe supports the European Commission's proposal for a European Climate Law setting into law climate neutrality by 2050 as part of a comprehensive, consistent and predictable legislative framework.

To achieve this, the Climate Law and the 2030 Target Plan should consider the following:

### On the road to 2050

- **Offer industry, citizens and investors a clear and stable framework for investing in sustainable energy solutions like cogeneration,** for a smooth and cost-effective transition between now and 2050. Currently, cogeneration is being treated inconsistently. It is supported in EU legislation and by Europe's Climate Bank, the European Investment Bank. Yet in EU ETS, Sustainable Finance, European Regional Development Funds and Cohesion Funds or Just Transition Fund, supporting cogeneration is systematically omitted or faces more stringent and diverging requirements from the already established yet ambitious EU legislation on energy efficiency. This pre-empts much needed investments to modernise existing energy installations and accelerate the uptake of new solutions Only a consistent approach will help unlock the investments that European needs to reach carbon neutrality by 2050.

- **Set a gradual, inclusive and predictable pathway to 2050** for citizens, businesses, investors and energy communities to make the right investments.

  The pathway to 2050 should consider:

  I. cost-effectiveness and economic efficiency, based on the **potential identified at EU, national and local levels**. Examples include: the national Comprehensive Assessments on Heating & Cooling mandated in Article 14 of the Energy Efficiency Directive, relevant EU projects like CODE2, ene.field, PACE;
  II. competitiveness;
  III. best available technologies, **including solutions integrating locally the heat, gas and electricity systems like high efficiency cogeneration**;
  IV. energy efficiency first throughout the entire energy value chain, not only focusing on energy consumption, but also **on efficiency in energy generation, transmission and distribution. This can only be achieved by continuing to target primary energy savings**;
  V. energy affordability and security of supply, looking in particular at **security and continuity of heat supply** in industry;
  VI. gradual progression over time, investment needs and opportunities: This should take into account the **benefits of early reduction of GHG through cost-effective measures**, including a switch from solid fossil fuels to efficient natural gas use, as a transitional phase. This should be complemented by the **uptake of renewable and decarbonised fuels across all energy carriers** (in electricity, heat and gas). This combined approach will ensure a successful decarbonisation strategy for reaching net-zero carbon by 2050, while keeping the overall volumes of emissions below the identified carbon budgets in line with the Paris Agreement.

## A more ambitious 2030 Target Plan with cogeneration

In view of the plans to revise the 2030 GHG target referred to in the Climate Law proposal, COGEN Europe asks the Commission to put in place a robust and inclusive process for defining the target:

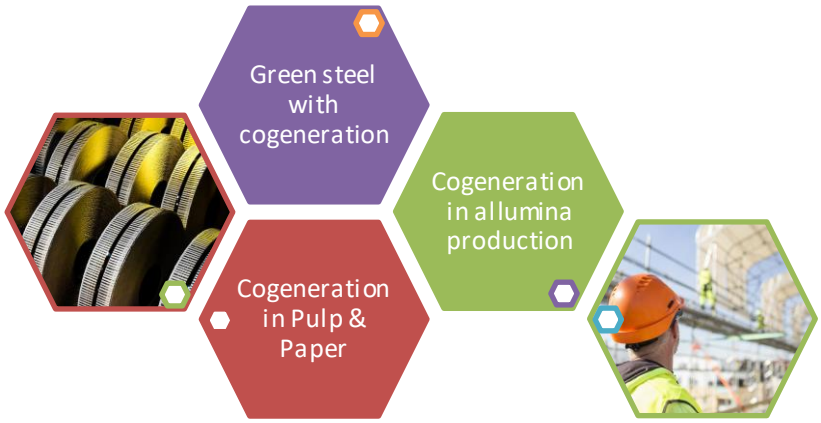
- **Carefully impact assess an increased 2030 GHG emissions reduction target to**:
  I. preserve the competitiveness of existing investments in energy efficiency and emissions reduction solutions, like cogeneration;
  II. identify efforts required to deliver the additional ambition to be based on a robust modelling exercise, which more adequately identifies the benefits of decentralised generation, flexibility, energy efficiency as well as the specificities of the heat sector;
  III. reinforce the existing and propose new legislation to foster the uptake of future-proof solutions, including cogeneration, that can cost-effectively contribute towards the additional carbon reductions required (see CODE2 project for the cost-effective potential for cogeneration by 2030[1]).

- **Ensure a robust and inclusive process for consulting all stakeholders.** The European Industry has a major role to play in delivering the EU ambition and create carbon neutral and circular but also growing economy. Their active involvement through systematic consultation is key to ensure their need for investment certainty and proportionate measures safeguarding their competitiveness in the face of fierce global competition, all the more when faced with the consequences of COVID19-related global economic recession.

[1] EU project CODE2 – European Cogeneration Roadmap

## EU industrial strategy: the chance for a green recovery in Europe

The European Industry has a major role to play in the move to a carbon neutral and circular economy. In this transition, the European industry faces the twin challenge of reducing its emissions while remaining competitive against fierce global competition. Unexpected market disruptions such as the COVID pandemic also call for a more resilient industry in Europe.




Reducing emissions in industry while safeguarding its competitiveness will greatly depend on the streamlining and implementation of the 'energy efficiency first' principle. **A key enabler of this is cogeneration.**

Below are the cogeneration sector's recommendations to build tomorrow's industry, reduce its emissions while preserving its competitiveness.

### Build the industry of tomorrow with cogeneration

**Setting high efficiency cogeneration as default option in industry** over the separate, inefficient and more carbon intensive production of heat and electricity **will help:**

- **Modernise and improve the energy efficiency and environmental performance of existing industrial processes** and ultimately the products we consume in Europe. Currently, cogeneration is being treated inconsistently. It is supported in EU legislation and by Europe's Climate Bank, the European Investment Bank. Yet in Sustainable Finance, European Regional Development Funds and Cohesion Funds or Just Transition Fund, supporting cogeneration is systematically omitted or face more stringent and diverging requirements from the already established yet ambitious EU framework. This pre-empts much needed investments to modernise existing energy installations and accelerate the uptake of new solutions. More support would encourage help create jobs in the European efficiency and renewable technology industry, which is a world-leader and key enabler of decarbonising other industries towards climate neutrality.

- **Decarbonise cost-effectively heat in industry.** An important source of emissions comes from the energy required for industrial processes and heat generation to manufacture products. In Europe, **heat demand in industry amounts to 2,388 TWh – approximately equivalent to the combined**

**electricity produced today in Germany, France and Spain** [2]. This heat is also an essential factor of the industrial competitiveness. But today much of it still also comes from polluting and inefficient sources and in addition it is being largely wasted. Electrifying will be challenging in terms of adding sufficient generation of renewable electricity (i.e. amounting to all power produced today in Germany, France and Spain), building the power grids to accommodate for it, converting industrial sites to use electricity for heat and ensuring the affordability and continuity of supply at all times. Without a serious approach to decarbonise industrial heat, there will be no effective decarbonisation of Europe. Cogeneration is a key solution to tackle this challenge while safeguarding industry's competitiveness.

The following should also be promoted:

- **Foster an enabling framework for waste heat recovery on-site and/or for use in nearby factories, businesses and districting heating networks**, accounting for technological capabilities and economic feasibility in the industry sector. This requires further clarifying the EU definition of waste heat and its potential applications, including but not limited to district heating.

- **Foster the role and integration of industrial players in electricity & heat markets.** Cogeneration used in industry amounts to more than 60 GW of electrical capacity in Europe. This makes industry an energy prosumer of primary importance, also for its potential to deliver flexibility on electricity and heat markets. Authorities must distinguish "must-run" cogeneration, supplying continuous heat and power to industrial sites, versus cogeneration plants that can run more flexibly by virtue of varying industrial process needs. **This calls for better considering industry's demand for heat and electricity in the Heating & Cooling Comprehensive Assessments (EED article 14) and National Energy & Climate Plans (Energy Union Governance Regulation)** by:
  i. Including a breakdown by heat temperature levels in industry (e.g. high, medium and low-grade heat, cooling and refrigeration),
  ii. Establishing support measures to realise the identified cost-effective potential for high efficiency cogeneration and deliver carbon emission reductions in the short to medium term,
  iii. Developing support measures to ensure that decarbonised and renewable gases are used in the most efficient solutions such as high efficiency cogeneration,
  iv. Identifying the potential for cogeneration to deliver system integration benefits including power system adequacy and flexibility, reduction of electricity grid reinforcement costs, reduction in overall energy consumption and imports, supply of heat and/or electricity to neighbouring local communities to avoid waste heat.

For the further development of cogeneration in Europe, it will be necessary to evaluate and tackle the existing barriers in EU legislation that is currently separately covering the heat and electricity markets (e.g. EU ETS, Energy Taxation Directive, EU electricity rules, Energy Efficiency Directive, State Aid rules). Better linking heat and electricity legislation and solutions that deliver on these two markets simultaneously is key to ensure citizens, public authorities and industry can fully rip the benefits of cogeneration.

[2] HeatRoadmap Europe: https://heatroadmap.eu/wp-content/uploads/2019/03/Brochure_Heating-and-Cooling_web.pdf

## Keep European Industry competitive

- **Maintain the security of heat supply in industry.** Many leading European industries [3] need continuous heat supply (often in the form of high temperature steam) for 24h/7 running production lines and minimising costs. Such heat types cannot be electrified for technical or cost reasons. It is important that existing and new investments in cogeneration providing services on both the electricity and heat markets do not face barriers to delivering their primary purpose: supplying heat. To this end, it is crucial to **maintain Priority Dispatch of efficient electricity from cogeneration used industrial installations and reinforce compensation in case this electricity is curtailed.** Priority dispatch helps ensure that efficient and clean electricity is fed onto the grid in priority over less efficient and polluting sources, in line with articles 12 & 13 of EU Electricity Regulation[4] and article 15 of the Energy Efficiency Directive 2012/27/EU (EED). When this electricity is curtailed, this also means that heat supply is interrupted and so are corresponding production lines, resulting in increasing costs and losses for industry.

- **Guarantee grid connection for on-site industrial cogeneration through a predictable and non-discriminatory process and allow for exemption or alleviation from undue regulatory uplifts in the case of self-consumption.** Key industrial sites encounter lengthy and expensive grid connection procedures, despite the requirements in the EED for TSOs/DSOs to foster and facilitate the connection of high efficiency cogeneration. This can delay investments and eventually deter industrial players from considering cogeneration that would have helped improve the environment footprint of their factories.

- **Maintain stable support schemes and regulatory framework to protect existing and upcoming investments in energy efficiency solutions such as cogeneration.** Unstable frameworks and retroactive changes in legislation jeopardise needed investments in modernising existing energy infrastructure in industry, the security of heat supply at all times and ultimately undermine Industry's competitiveness.

- **Develop a roadmap and support measures for the uptake of renewable and decarbonised gases and prioritise their use in the most efficient solutions like cogeneration across all sectors, for cost-saving and resource efficiency purposes.** This will offer a realistic pathway for the cost-effective decarbonisation of the industry but also buildings and district heating networks. Hard to decarbonize industries depend on molecules-based energy to ensure a continuous supply of medium and high temperature heat. In the absence of an imminent plan for renewable and decarbonised gases, investments could stall for a long time, and industry, including decarbonisation technology manufacturers, will move away from Europe. Using these fuels in the most efficient solutions will also offset efficiency losses in the production phase of the renewable and decarbonised fuels. Moreover, a combination of renewable gases, cogeneration and CCS/U may put industry more easily on a path to negative emissions.

- **Scale up investments in research and innovation in the next generation of high efficiency and renewable cogeneration (including biogas, syngases, hydrogen, fuel cells, waste heat recovery, CCS/U)**. Accelerating their commercial application and supporting their rapid scale up is cardinal to secure the supply of the technologies at competitive prices for the industry across Europe. The **European Innovation Council** to be launched in 2021 should focus in particular on these technologies.

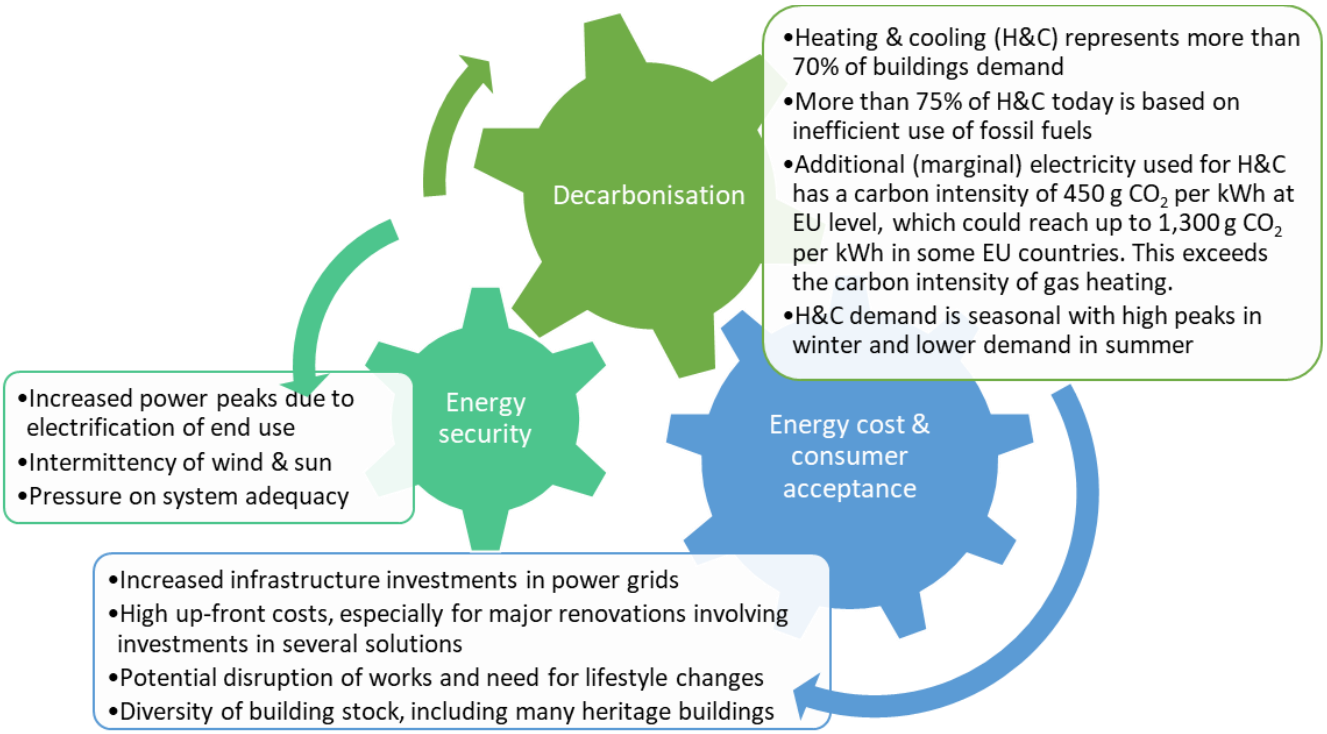
[3] The chemical, food and drink, ceramics, pulp and paper and alumina sectors to name a few.
[4] Regulation (EU) 2019/943 on the internal market for electricity (recast)

## An ambitious Renovation Wave calls for affordable, integrated and efficient energy in buildings

The Buildings will be critical in delivering an ambitious Green Deal while putting Europe on a sustainable recovery path in the context of the current COVID-19 crisis. The Renovation Wave presents significant opportunities to re-launch the EU economy, help Europe meet its Paris Agreement commitments, bring cleaner air to citizens and foster healthier and more comfortable environments to live in.

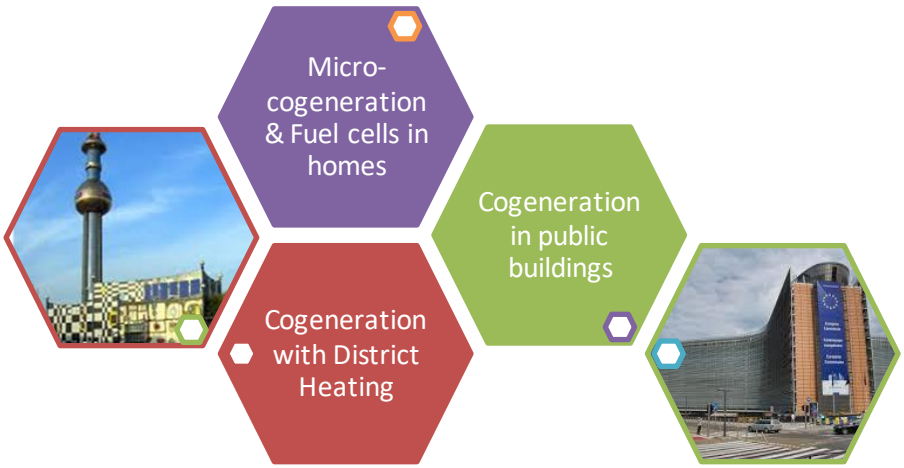
Buildings represent more than 30% of EU's emissions and energy consumption. Heating and cooling, as well as hot water, make up a 80% of energy use in buildings and significantly impact energy affordability and energy poverty. More than 75% of buildings are inefficient, because of a leaky building envelope, the use of old and inefficient heating systems or both. In addition, 90% of the existing building stock will still be standing in 2050.

While there is significant potential in building renovation, the challenges of large-scale building renovation revolve around the cost- energy security - decarbonisation trilemma:




**A holistic approach to buildings renovation must consider both consumer needs and the energy system as a whole, which to deliver a timely and cost-effective transformation of the building stock aligned to the Paris goals.**

**Cogeneration is uniquely positioned to deliver an ambitious renovation wave, as part of a cost-effective and customer-centred mix of buildings solutions**




Cogeneration heat can reach buildings through district heating or can be installed on-site, as micro-cogeneration and stationary fuel cells.

Cogeneration enables systems integration by supplying efficient heat to or in buildings and flexible electricity to support power grids. It smartly and efficiently integrates electricity, heat and gas at local level.

Cogeneration makes better use of energy sources available locally to consumers, buildings and districts. This includes low carbon and renewable fuels like the various gases in and off-grid (H2, (bio)methane, e-gases), biomass, geothermal, solar thermal and waste heat.

Cogeneration reduces the energy bills for the consumer.

Cogeneration reduces overall energy system costs. It minimises the operating costs of electricity grids because electricity is produced and consumed locally. In addition, it helps avoid grid reinforcements, by providing firm capacity.

## Recommendations for an encompassing, cost-effective and ambitious Renovation Wave

### Put energy efficiency first

- Apply energy efficiency across the entire energy value change, complementing demand reduction with uptake of efficient energy solutions. Reinforce primary energy savings as the key measure of efficiency in buildings across EU legislation. Apply energy efficiency to all energy sources used in buildings, including renewable energy and electricity.
- In the heating and cooling sector, the Renovation Wave should prioritise the replacement of inefficient boilers, as well as the modernisation of existing DHC infrastructure. The Renovation Wave should set the framework for further support for the uptake of efficient heating systems, including micro-cogeneration. Supporting the gradually increasing the uptake of renewable energy sources and their efficient use in the energy carriers accessible to consumers across electricity, gas and heat will ensure customer choice and affordability of energy.
- The efficient use of unavoidable waste heat, including as a fuel to in cogeneration, is a key efficiency measure to complement district heating uptake and modernisation. Policymakers should also identify and promote measures to minimise the waste of heat through high efficiency cogeneration.

### Set a level playing field

- Develop robust and consistent criteria, methods and standards for building efficiency and decarbonisation at lowest cost via energy labelling, eco-design, energy taxation, electricity grid tariffs and building codes.
- Ensure that financing and support schemes are directed towards the uptake of efficient solutions like cogeneration, including micro-cogeneration in buildings or cogeneration with district heating, in line with identified potentials at EU, national and local levels.
- Set a level playing field between different energy carriers accessible to buildings, including electricity, heat and gas. In doing so, distinguish between the fuels used (solid fossil fuels, natural gas, various renewables), the energy carriers using them (gas networks, electricity, district heating) and the end use solutions (e.g. heat pumps, boilers, micro-cogeneration).
- Accurately assess the impacts of end-use electrification, accounting for heat seasonality and marginal impacts on power systems, requiring the ramp up of fossil fuel peaking plants to meet the additional demand on the grids, in terms of operational costs and grids investments.

### Empower consumers and local actors

- Promote a diverse mix of integrated, efficient and renewable buildings technologies.
- Customise and optimise renovation solutions at local, district and building levels.
- Strengthen the role of local actors to ensure planning at local level to design customised solutions that offer the best value and comfort for the end-user, while maximizing system level benefits in terms of carbon efficiency.

### Take an energy systems approach

- Synchronise Energy Systems Integration and Hydrogen Strategies with the Renovation Wave, in particular when it comes to district heating and gas applications in buildings.
- Support Member States to deliver ambitious Comprehensive Assessments for heating and cooling, which effectively identify potentials for district heating, cogeneration, renewable/decarbonised gases and other buildings solutions. Ensure that the potentials identified are accompanied by adequate policy and financing measures.
- Develop a roadmap and associated measures for the uptake of renewable and decarbonised gases, and their efficient use, in the building sector.
- Identify and promote synergies between different building solutions, including complementarity between cogeneration and end-use electrification of heat.

### Support EU industry to deliver a green recovery

- Target public and private funding towards the faster uptake and industrialisation of state-of-the-art European building solutions, like micro-cogeneration and fuel cells.
- Remove barriers to innovative business models by energy service providers in the building sector. This could include enabling self-consumers to get extra revenues by providing grid services (e.g. demand response, peak shaving).
- Steer investments towards local job creation, including the up-skilling of building professionals.
- Encourage EU industry to share their know-how and show leadership globally.

## Energy Systems Integration Happens at Local Level

A successful strategy for energy systems integration requires:

- a definition for systems integration, covering the key energy infrastructure and markets;
- putting energy efficiency first at centre of this integration process, across the electricity, heat and gas networks as well as covering generation, transmission, distribution and use of energy;
- fostering the uptake of integration solutions, like cogeneration, by removing existing barriers and better assessing their multi-dimensional benefits;
- developing platforms for the relevant actors to collaborate in identifying and implementing integration projects across different sectors and energy systems;
- ensure energy consumers are at the centre through adequate information and strategic planning at local level.

### What is Local Energy Systems Integration?

> *Energy systems integration involves combining a wide range of energy solutions for an ambitious decarbonisation pathway at lowest cost and highest security of supply for all consumers and communities. This involves:*
>
> ***Maximising benefits:*** *Identifying and unlocking synergies to maximise energy and resource efficiency, renewables, decarbonisation and flexibility among electricity, gas, heat networks.*
>
> ***Minimising cost:*** *Accounting for local circumstances, i.e. existing infrastructure, access to energy sources, climate zones, customer profiles.*
>
> ***Integrating infrastructure:*** *Long term strategic planning will be needed to direct investments towards the efficient integration of gas, electricity and heat infrastructure at local level.*
>
> ***Integrating markets:*** *Gas, heat and electricity markets should be better linked through price signals and grid tariffs accounting for system efficiency and flexibility needs at local level*
>
> ***Cross-sectoral:*** *leveraging synergies across the industry, building, agriculture, transport sectors*
>
> ***Multi-level governance:*** *Coordinating among the local, regional, national and European levels*
>
> ***Mix of complementing future proof solutions:*** *identifying synergies between complementary generation, transmission, distribution and end-use solutions, including all types of storage, and aiming for system-level benefits.*
>
> ***Keeping consumers at the centre:*** *Allocating the benefits of systems integration to the consumers and investors that choose integration solutions.*

## Cogeneration: a key local integration solution

- ✓ From blacksmith to fuel cell cogeneration
- ✓ Cogeneration keeps Belgian Senators warm
- ✓ Reliable and affordable energy for hospitals
- ✓ Nice Smart Valley/Interflex
- ✓ Tesla running on fuel cells with green gas

**Cogeneration with District Heating**

**Cogeneration in industry**

- ✓ Producing biogas with cogeneration
- ✓ Integrated Steel, cogeneration & district heating with waste heat

- ✓ Stadtwerke Hassfurt DHC goes for H2 cogeneration
- ✓ Flexible cogeneration for District Heating in Kiel
- ✓ Vienna using waste heat from cogeneration for its district heating
- ✓ Cogeneration Battery – Warm up with cold wind (concept)

Cogeneration is one of the most efficient integration solutions, flexibly linking electricity, heat and gas, outperforming the separate power and heat generation operating in un-integrated markets.

Cogeneration supports a diversity of system integration applications by supplying efficient and increasingly renewable heat to or in buildings and industry, thus cost effectively linking heat and gas sectors. It can also efficiently convert waste heat from industry into electricity and heat for cities to use.

Cogeneration enables efficient systems integration, by supplying flexible and efficient electricity when the grids need it, at times of high peak demand of low wind and sun supply. Complements electrification by ensuring electricity supply to end use sectors is always available and efficient.

Cogeneration makes better use of energy sources available locally to industry, cities and domestic consumers. This includes low carbon and new gases (H2, (bio)methane, e-gases), as well as biomass, geothermal, solar thermal and waste heat.

Cogeneration reduces overall system costs, by generating energy locally and thus saving power grid operation and investment costs. It is also reduces the energy bills of end consumers, including industry, householders and cities.

## Recommendations for the efficient integration of local energy systems

**Not taking an integrated perspective to energy means less cogeneration, as its benefits are scattered and ignored across energy silos. This will in turn lead to a costlier, less efficient and less flexible energy system.**

To address these barriers, COGEN Europe recommends the following:

- **Implement energy efficiency first or system level efficiency through greater focus on primary energy savings**. Applying energy efficiency through primary energy reduction ensures significant carbon cuts and a cost-effective allocation of efforts among generation, transmission, distribution and end use of energy across different energy carriers. This is particularly important for efficient systems integration, as efficiency measures in a certain sector or linked to a certain carrier may lead to rebound effects in other sectors or at system level.

- **Promote efficient and renewable electrification as part of systems integration.** While electrification of different end-use sectors may integrate energy systems, it does not in and by itself improve efficiency or trigger more renewables uptake. **Criteria for additionality of renewables and efficiency** should be developed to ensure that electrification of end-use does not end up increasing cost and emissions (e.g. as suggested in Article 27.3 of the Renewable Energy Directive 2018/2001). In addition, electrification in and of itself only solves half the problem. Although decarbonised electricity is becoming easier and easier to produce (*and the associated costs are steadily decreasing*), it is still exceedingly difficult (and expensive) to consume. Electrified industrial processes for example, tend to require an extremely steady and uninterrupted supply of electricity that makes it very difficult and expensive to cover exclusively using renewable electricity generation[5] (which is more variable and unpredictable). Therefore, the barriers that are limiting electro-intensive consumers' ability to decarbonise their electricity supply must be addressed suggesting specific measures that can help industrial consumers effectively decarbonize their electricity supply.

    I. Instead, **efficient and increasingly renewable electricity supply must be promoted in combination with electrification**

    II. For example, the **benefits of developing heat pumps or EV in conjunction with cogeneration** (at both aggregate/district level or on-site[6]) should be identified and recognised, unless it can be shown that the additional electricity comes from PV/Wind + Battery.

- **Develop <u>appropriate methods to measure environmental benefits</u> (energy efficiency, renewable energy and decarbonisation) across integrated and more dynamic energy systems.** The **benefits of integration solutions should be fairly assessed, as they will be scattered across the various energy systems** (see this FfE study). Parameters like the **primary energy factor or carbon emissions factors** should more consistently across EU legislation (i.e. in Energy Efficiency Directive, building codes, energy labelling) include **marginal effects/additionality and seasonality principles** (as reflected in Annex (1) (b) of the 2018 Revision of EPBD). For example, the PEF for cogeneration should reflect the grid losses it helps avoid and then actual electricity mix it displaces. This way, cogeneration systems will be incentivised to supply electricity during high peak demand.

[5] Institute for European Studies (IES), 2019. Metals for a Climate Neutral Europe: A 2050 Blueprint.
[6] Cogeneration and heat pumps: win-win

- More fairly **allocate system benefits of integration solutions to the owner/operator**. This is particularly the case for cogeneration, where we recommend:

    I. **Develop fit-for-purpose methodologies for cogeneration to fairly allocate emissions, fuels and energy savings to electricity and heat in order to fully accounts for its benefits**. When comparing cogeneration with power-only or heat-only solutions, the adequate energy mix must be fully accounted to reflect the efficiency or emissions of the solutions displaced by cogeneration. For example, the Primary Energy Factor for cogeneration (in the EED and Ecodesing/Energy Labelling) must better reflect the benefits of this technology. This should be the case for Sustainable Finance, where cogeneration should be prioritised as sustainability criterion.

    II. **Account for the grid reinforcement and grid operation costs avoided thanks to cogeneration.** These key benefits are often omitted and a methodology to account for them should be provided for DSOs, TSOs and regulators to provide incentives for investments in generation and/or grids, where deemed appropriate. The Energy Efficiency Directive (Article 15 & associated annexes) outline very helpful principles for **dynamic grid tariffs and assessments on grid efficiency** both on optimal operation and on strategic planning of networks in an efficient way. The Harmonised Reference Values Regulation 2015/2402 indicates **grid loss avoidance rates for cogeneration**, which may be used in other contexts.

    III. **Integrate the heat and electricity markets by dispatching in priority efficient and clean electricity from cogeneration onto grids, supplying simultaneously efficient and clean heat in homes, district heating and industry.** Priority dispatch of electricity from renewables and high efficiency cogeneration installations is already granted in EU legislation[7]. It should be maintained and extended to all existing and new cogeneration installations to integrate the maximum amount of electricity onto girds and deliver heat to buildings and facilities in all sectors. Such a provision will ensure the security of heat supply in industry at all times, fundamental to safeguard its competitiveness. It is crucial to reinforce compensation in case this electricity is curtailed, for this also means that heat supply is interrupted and so are the production lines, resulting in increasing costs and losses for industry.

    IV. **Incentivise the use of heat storage** that allows decoupling heat and electricity supply. This way cogeneration can produce electricity at times of low wind or sun and turn down production at times when variable renewables are generating, while storing the heat for later use.

- **Develop a roadmap, for the cost-effective, efficient and timely uptake of renewable and decarbonised gases, including hydrogen**. In this context, the most efficient use of these gases with cogeneration in different sectors (industry, buildings, district heating) must be prioritised to ensure higher system efficiency, reduced costs and more flexible power grids.

    I. **Foster the uptake of all applications of renewable and decarbonised gases, including their efficient use in buildings.** Prioritisation of energy carriers and energy sources for specific sectors (e.g. H2 in industry) is still premature. In particular, the benefits of futureproofing gas infrastructure for decarbonising buildings should be considered for its cost, social acceptance and security of supply benefits. In implementing the strategy it must be considered that cogeneration solutions, including stationary fuel cells, have similar efficiencies to heat pumps, can run on hydrogen and are key to mitigating electricity peak demand that heat pumps contribute to increase.

[7] In articles 12 & 13 of EU Electricity Regulation and article 15 of the Energy Efficiency Directive 2012/27/EU.

- Systems integration should foster **resiliency, flexibility and energy diversity at local level,** so that **communities can design their own transition models**. In this context, tools like the **Comprehensive Assessments for Efficient and Renewable Heating & Cooling** (Article 14/Annex VIII of the Energy Efficiency Directive) and the National Energy & Climate plants should more actively involve local actors and take a more bottom-up approach.

### Integrating energy systems: widely recognised benefit

Major academia, governments and industry players are recognising and adopting the new integrated systems paradigm[8].

Key evidence shows that integrating energy systems across different infrastructure, **energy carriers** and sectors (e.g. power-to-X, incl. green gas & hydrogen), via **cross-energy vector technologies** (high efficiency cogeneration) and through **smart operation and aggregation solutions** (demand response, all types of storage), will provide for a significantly less costly energy transition.

An overview of key findings on systems integration is outlined below:

- **€1150bn in savings in EU when making use of zero carbon gas** to decarbonise Europe's energy system by 2050[9];

- **£300bn savings in the UK from using a mix of energy solutions** to decarbonise heat in the UK, compared to using electrification alone[10];

- Another comparison of the different pathways to decarbonise heat in the UK[11] finds that **re-purposing the gas grid provides the lowest cost option, cheaper by more than £100 bn;**

- EU project Heat Roadmap Europe found that "*increased electrification of heating and cooling could potentially redefine the electricity sector: even when using heat pumps the* ***annual electricity demand could double and the peak electricity demand could triple if all heating and cooling is electrified****. […]* ***key challenges and potential limitations related to electrification****, since it is highly* ***unlikely that the electric grid could be expanded rapidly enough in Europe*** *over the coming decades to accommodate such a large growth*"[12].

- ene.field project[13] found that the accelerated deployment of micro-cogeneration across the EU could ***reduce the need for grid reinforcements by €2,000-2,500 per kWel installed between now and 2030, as well as more than €1,500 per kWel installed between 2030 and 2050***. Depending on the level of micro-CHP uptake, this would amount to as much as 30% of required reinforcements at EU level by 2030.

[8] Imperial College London, Unlocking the potential of Energy Systems Integration
[9] Poyry, 2018. Fully Decarbonising Europe's Energy System by 2050
[10] Policy Exchange, 2016. Too hot to handle? How to decarbonise domestic heating
[11] Element Energy, 2018. Cost analysis of future heat infrastructure options
[12] D. Connolly, 2017. Heat Roadmap Europe: Quantitative comparison between the electricity, heating, and cooling sectors for different European countries
[13] Ene.field/Imperial College London, 2017. Benefits of Widespread Deployment of Fuel Cell Micro CHP in Securing and Decarbonising the Future European Electricity System