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COGEN Europe Position Paper

In response to European Commission Consultation on "Strategy for long-term EU greenhouse gas emissions reductions"

Brussels, 09/10/2018

In the context of the Paris Agreement, the EU has set ambitious energy and climate change objectives to ensure that it relies on secure, affordable and climate-friendly energy. **The cogeneration sector is committed to the creation of a resilient, decentralised and carbon neutral European energy system by 2050 with cogeneration as its backbone**. Cogeneration empowers European citizens and industry to generate efficiently reliable and affordable clean heat and power locally, thus representing a "no regrets" solution for delivering EU's energy and climate objectives both in the medium and long term.

The EU's 2030 climate and energy framework, which is currently taking shape, has reaffirmed Europe's commitment to implementing energy efficiency first, to putting consumers at the centre and cementing Europe's leadership in renewable energy production and use, all while reducing CO_2 emissions and boosting competitiveness and growth. Moving beyond 2030, the EU's Strategy for long-term EU greenhouse gas emissions reductions should:

- ✓ continue to integrate the **"energy efficiency first" principle** by prioritising primary energy savings across the entire energy value chain and applying it to all energy sources. Energy and climate policy should in a consistent and effective manner ensure **that high efficiency cogeneration is set as the default option over the separate and inefficient production of heat and electricity**;
- ✓ take an **integrated approach to energy systems**, promoting a mix of decarbonisation solutions across the key energy infrastructures (i.e. electricity, heat and gas) and markets. Europe's long-term decarbonisation strategy should avoid taking a costly silo approach (e.g. by only focusing on decarbonisation through electrification) and instead focus on delivering cost-effective carbon reductions for the economy as a whole, optimising and maximising energy efficiency and renewable energy use in gas, heat and electricity, while making first use of the existing infrastructures available. The potential of all types of storage, electric, thermal and seasonal via power-to-gas, should be identified and unlocked;
- ✓ **establish a level-playing between different decarbonising solutions**, fairly promoting technologies like cogeneration that support sectoral integration and provide decarbonisation benefits at systemic level. Because cogeneration competes with both electricity-only and heat-only generation in two separate markets, its system-level decarbonisation benefits are not fully recognised if a siloed policy approach persists. An integrated approach to the energy system should address these inconsistencies;
- ✓ ensure that the policy framework in place promotes a **continuous and cost-effective decarbonisation pathway between now and 2050**. While it is key to set medium- and long-term investor signals and prevent technology lock-in, it is equally important to avoid only adopting today solutions that will not decarbonise until decades later. In this respect, the inefficient and non-renewable electrification of end-use sectors like heating and transport can run counter to our decarbonisation objectives, while also increasing real energy costs.

- ✓ account for **the contribution of different energy consumers to the decarbonisation** of the economy, empowering them to reduce CO_2 emissions at the lowest cost, while ensuring security of their heat and power supply. Special attention should be given to the cost-effective **decarbonisation of heat, accounting for the diverse needs of buildings, SMEs and industry**;
- ✓ develop a framework that **fosters investment security for both solution providers and energy consumers**. In recent years, retroactive changes to support schemes and regulatory frameworks at national level are continuing to delay or even prevent important investments in CHP and other sustainable energy projects, aimed at improving the efficiency and reducing the industry's carbon intensity. A stable and predictable regulatory environment is needed to ensure that necessary investments are encouraged for a long-term and as part of a comprehensive decarbonisation pathway.

Today cogeneration efficiently generates 11% of EU's electricity and 15% of its heat, reducing CO_2 emissions in the EU by more than 200 million tons per year. It is used in many key European industries (i.e. pulp and paper, alumina, chemicals, ceramics, glass, textiles, food & drink). Across Europe, 90 million European households enjoy local electricity and efficient heating & hot water provision thanks to cogeneration, via their district heating networks. Over 100,000 active energy consumers like homes, hospitals and SMEs already self-generate their heat and power with distributed and on-site cogeneration facilities, including via fuel cell micro-cogeneration.

If the cogeneration potential identified by Member States was to be realised by 2030 (equivalent to a doubling of generated electricity from CHP), it would secure an additional reduction of 200-300 million tons of CO_2[1], **contributing up to 23% of EU's 2030 GHG emissions target**.

Beyond 2030, cogeneration should be prioritised for all thermal generation of heat and electricity, helping to avoid any waste of valuable resources. A doubling of cogeneration capacity in the EU energy mix by 2050 will complement and facilitate the increasing share of intermittent renewable energy sources, thus ensuring system efficiency and reliability, as well as consumer empowerment and sustainability goals.

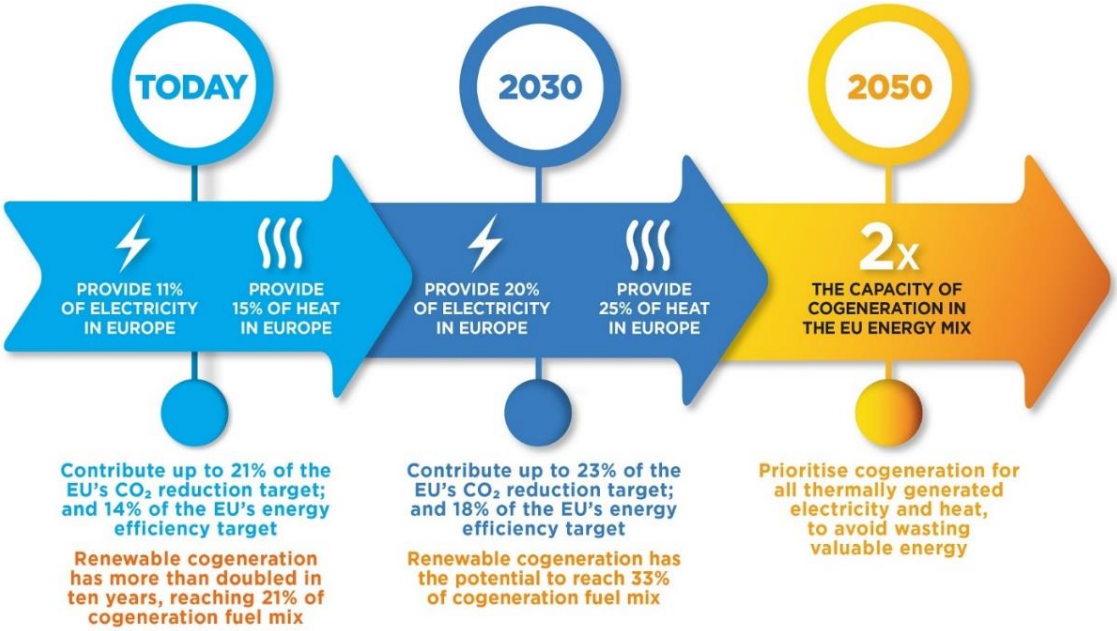

Figure 1 COGEN Europe's vision for a growth pathway and role of cogeneration in the future energy system (Source: COGEN Europe)

[1] COGEN Europe calculations based on Eurostat, CODE2 & Member States' Article 14 EED notifications

Energy efficiency first principle

As the energy system progressively decarbonises, energy efficiency should remain a "no regrets" option. A comprehensive implementation of energy efficiency, across the entire energy value chain and for all energy sources, will be needed for a cost-effective and resource-efficient energy transition

Efficient supply

The most efficient energy production and conversion solutions should be prioritised. High efficiency cogeneration should therefore be promoted over the inefficient separate production of heat and electricity.

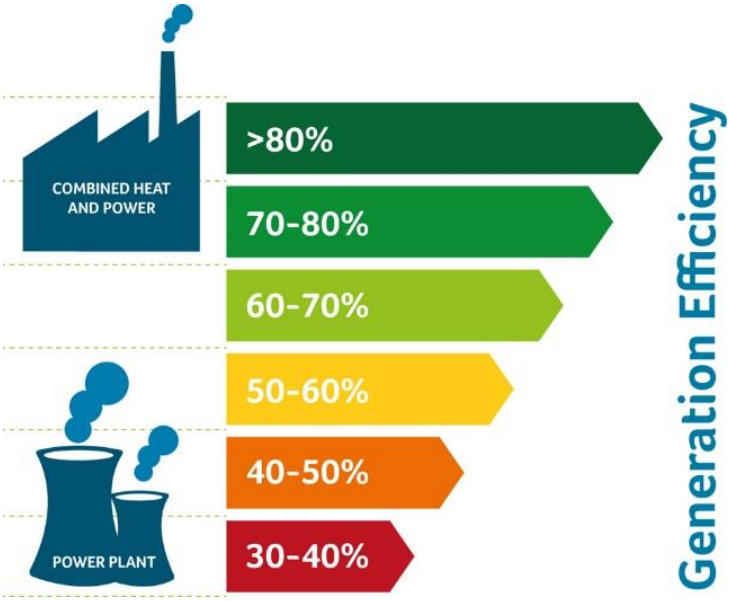

Figure 2 Cogeneration efficiency premium compared to conventional power plants (Source: COGEN Europe)

In practice, this means that high efficiency cogeneration should be promoted as the default option for all thermally based generation of either electricity (instead of power-only plants without heat recovery) or heat (instead of heat-only boilers). This principle should be applied irrespective of the type of fuel used, as there are significant decarbonisation and cost reduction benefits for both conventional and renewable fuels.

COGEN Europe estimates that there is significant energy savings potential associated with a doubling of cogeneration capacity by 2050 compared to today. On the pathway to 2050, the EU project CODE2 estimated that the share of CHP in electricity generation could double from 11% today to 20% by 2030, associated with energy savings equivalent to up to a fifth of the 2030 energy efficiency target[2]. In the shorter term, Member States' Comprehensive Assessments mandated by the Energy Efficiency Directive (EED) confirm that there's further potential for CHP growth: CHP technologies could generate more than 470 TWh by 2020 across EU28[3], 30% more than generated in 2016[4]. Should the additional CHP potential materialise, up to a quarter of the 4% gap[5] in meeting the 2020 energy efficiency target could be achieved through cogeneration.

Reducing primary energy consumption, through cogeneration and other solutions, will be vital for decarbonisation in the short to medium term.

[2] CODE2, 2015. European Cogeneration Roadmap 2030. http://www.code2-project.eu/
[3] JRC, 2018. Synthesis report on the evaluation of national notifications related to Article 14 of the Energy Efficiency Directive
[4] Eurostat, 2018. Statistical pocketbook 2018
[5] Eurostat, 2018. Consumption in the EU above the energy efficiency target

Efficient grids

Decentralised and flexible energy production should be promoted as a way to reduce the need for costly electricity grid infrastructure.

Cogeneration, installed either on-site or close to a point of consumption, will reduce electricity grid losses (of more than 5%), while at the same time reducing or deferring the need to reinforce those grids. Being dispatchable and distributed, cogeneration has the technical capability to balance the grids and provide other ancillary services, thus reducing the increasing costs of the power grids. Cogeneration will produce reliable and low carbon electricity at times of no wind or sun to cover the increasing electricity demand (e.g. from heating and electric vehicles), thus complementing the intermittent renewable electricity solutions.

Available evidence shows that micro-cogeneration installed by small consumers and householders have the potential to improve grid efficiency, **reducing electricity grid costs by between 1,500 EUR to 2,000 EUR/kW of installed electrical micro-cogeneration capacity**. Should the potential of micro-CHP be realised, reaching up to 30 million installations across Europe, would amount to € 62 bn in avoided grid costs, up to 28% of EU's projected grid reinforcements needs[6].

Despite this clear role of cogeneration in reducing electricity grid costs, hardly any Member States account for these benefits in their comprehensive plans for energy efficiency[7]. **Greater consideration of these benefits will mitigate the rise of electricity system costs and reduce consumers' exposure to significant spikes in energy costs. At the same time such an approach will generate opportunities for new revenue streams for flexible and distributed generation, and cogeneration in particular**.

Efficient consumption

Comprehensive local energy planning is necessary to make sure an optimum mix of efficient supply of energy and demand reduction measures - across different sectors (e.g. buildings, industry, transport). In this respect, **trade-offs between efficient generation and increased demand efficiency should be assessed taking into consideration the highest decarbonisation impact as well as optimal cost-efficiency**.

Efficient renewable energy

Renewable energy should be promoted along with (and not instead of) energy efficiency. To ensure a cost-effective decarbonisation trajectory, the increasing share of renewable energy consumption should not preclude its most efficient production, transmission and use, including thermal renewables (e.g. solar, geothermal, biomass, biogas, hydrogen). **Cogeneration applied to bioenergy fuels will ensure the efficient transition to a higher share of renewables in the energy mix.**

[6] Based on ene.field micro-CHP projections in "Benefits of Widespread Deployment of Fuel Cell micro-CHP in Securing and Decarbonising the Future European Electricity System" authored by Imperial College London click here & Imperial College London, NERA Economic Consulting, DNVGL, «Integration of Renewable Energy in Europe», June 2014. Full report is available here.

[7] Idem 4

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Primary vs. final energy savings

Prioritise primary energy savings in addition to final energy reductions: this will help tackle significant energy losses and emissions associated with inefficient combustion of both conventional and renewable fuels.

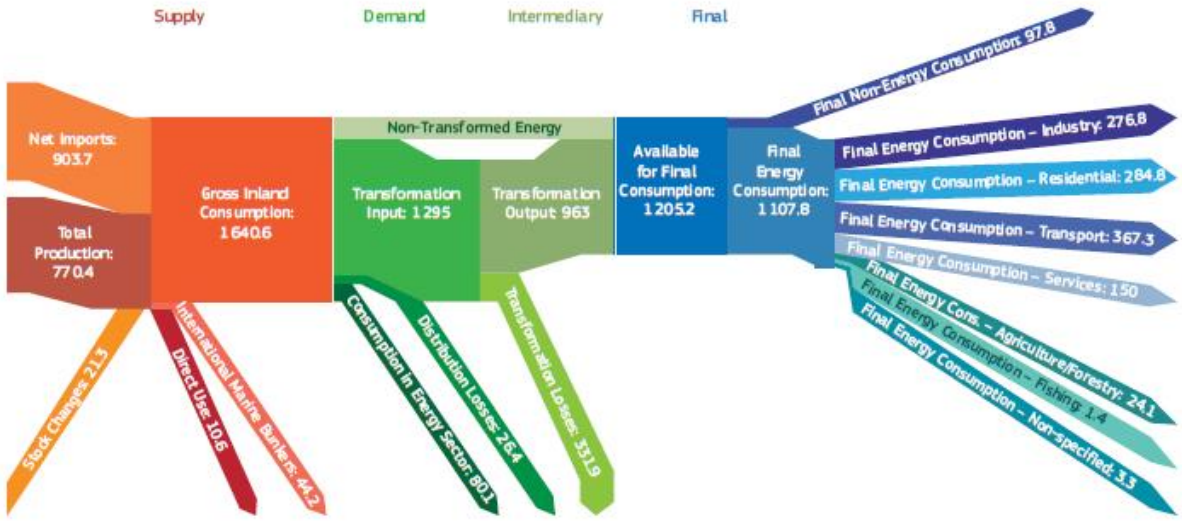

Figure 3 EU-28 Energy Flow in 2016 (Source: Eurostat, 2018)

Electricity sector: Currently up to 50% of electricity comes from non-combustible renewable energy (e.g. wind and solar) or from high efficiency cogeneration. Consequently, the remaining 50% of electricity production comes from power-only thermal plants incurring important energy losses in the form of heat dissipated into the atmosphere. **More than half of the primary energy that is converted to produce electricity by thermal power plants (representing 50% of the generation capacity in Europe) is lost as "waste" heat (i.e. 332 Mtoe of transformation losses in 2016). Instead of wasting this heat, cogeneration can ensure that it is, in part, usedto satisfy the demand for heat in industries, buildings, towns and cities (potential estimated at 500-550 Mtoe), thus achieving significant primary energy savings.**

Heat sector: Looking at primary energy used for heat generation, **only around 20-25% of EU's heat is generated today with highly efficient cogeneration systems (incl. auxiliary boilers) or efficient heat pumps**, leaving the remaining 75% generated in inefficient heat-only boilers for both domestic and industrial use. Applying more stringent efficiency standards on combustion-based generation of either electricity or heat, both using conventional and renewable sources, will help trigger early and continued emission mitigation efforts.

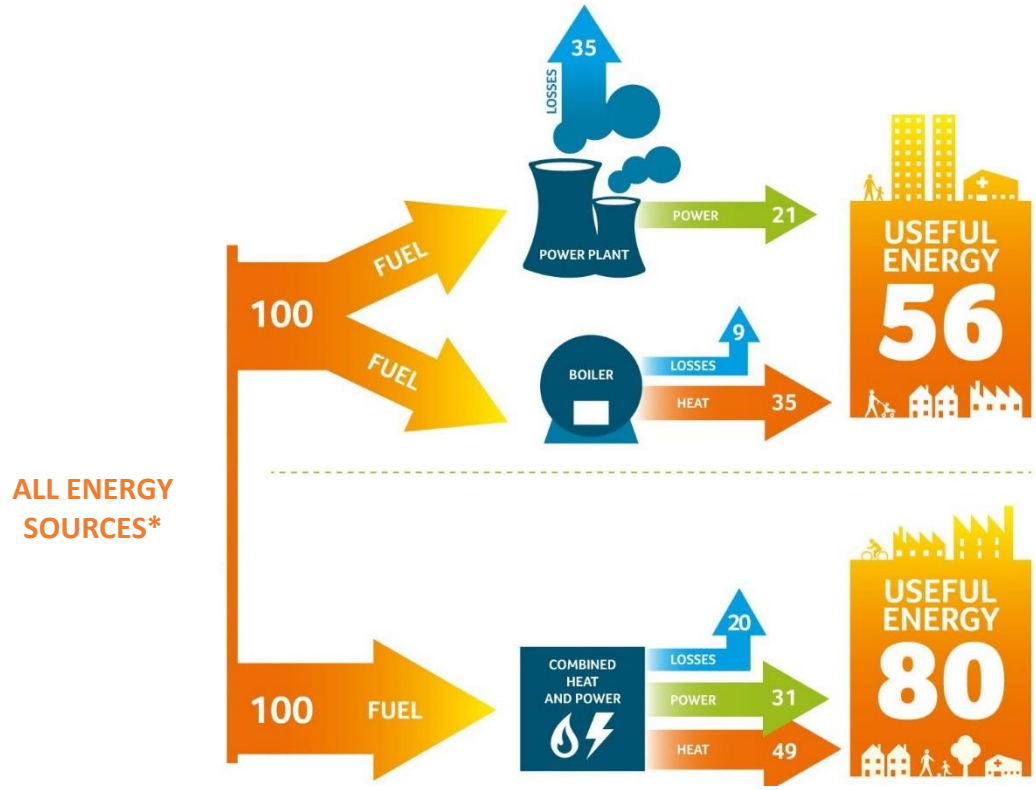

Figure 4 Primary energy savings achieved by cogeneration compared to the separate production of heat & electricity (Source: COGEN Europe)

Taking an integrated approach to the energy systems design and operation

The decarbonisation of the economy will require significant efforts in virtually all sectors, which can only be achieved in a cost-effective way through energy systems integration. The mix of decarbonisation solutions, including energy efficiency options, should be diversified and adapted to local circumstances, as well as optimised across all energy systems, accounting for all energy system costs (e.g. power grid reinforcements, seasonal storage etc.).

COGEN Europe advocates for a comprehensive approach to energy systems integration, looking at energy systems planning, investments, operation and services, and putting all energy systems on an equal footing. This will entail identifying and **unlocking synergies in terms of efficiency, decarbonisation and flexibility** between **all existing and potential energy infrastructures** (i.e. electricity, gas, heat networks), **across sectors** (e.g. industry, residential, agriculture, transport) and **at different levels** (local, regional, national and European).

In a comprehensive review of this concept, Imperial College London[8] highlights that *"Energy Systems Integration (ESI), in general, refers to the connecting and combining of a wide range of energy services and systems in order to maximise energy use and minimise waste and carbon emissions. Building an energy system using ESI could be a potentially cost-effective way to decarbonise the multiple facets of our energy sector, use limited resources in a sustainable way and produce a more resilient system by incorporating greater flexibility and diversifying energy sources".*

[8] https://imperialcollegelondon.app.box.com/s/0sil57fndc5tn9gfy6ypzp8v61qnv3mg

Cogeneration can be a backbone of this transition as it enables a more integrated, decarbonised and reliable future energy system. **By linking essential energy infrastructures and markets (i.e. electricity, gas and heat), cogeneration provides decarbonisation and flexibility at system level, across different energy systems**. However, given that cogeneration competes with both power-only and heat-only generation and in separate/un-integrated markets, not taking an integrated perspective to energy often undermines the above benefits.

Taking an integrated approach to energy systems should ensure a level playing field between technologies, networks and services that deliver decarbonisation and other system benefits in the most cost-effective way.

Figure 5 Cogeneration at the centre of energy systems integration (Source: COGEN Europe)

Benefits of integrated energy systems are widely recognized

Major academia, governments and industry players are recognising and adopting the new integrated systems paradigm[9]. Key evidence shows that integrating renewable energy through **different energy carriers** (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. Studies have estimated these cost savings at: 1) **€1150bn in savings in EU when making use of zero carbon gas** to decarbonise Europe's energy system by 2050[10]; 2) **£300bn savings in the UK from using a mix of energy solutions** to decarbonise heat in the UK, compared to using

[9] https://imperialcollegelondon.app.box.com/s/0sil57fndc5tn9gfy6ypzp8v61qnv3mg
[10] http://www.poyry.com/news/poyry-research-zero-carbon-gas-could-fully-decarbonise-europe-s-energy-system-by-2050-and-save-consumers-eur1-150bn

electrification alone[11]; 3) Another comparison of the different pathways to decarbonise heat in the UK[12] finds that **re-purposing the gas grid provides the lowest cost option, cheaper by more than £100 bn;** 4) 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*"[13]; 5) The **German Energy Agency (dena) also pledges for an ambitious decarbonisation strategy with sectoral integration at its core**, taking advantage of all energy networks and energy resources, including energy efficiency and cogeneration[14].

COGEN Europe supports the broader approach to sectoral integration, putting all resources on an equal footing, as an alternative to the concept of electrification promoted and understood by some stakeholders as the large-scale switch to electricity in key end-use sectors (i.e. heating and transport).

Putting Energy Consumers at the Centre

Energy consumers interact with the energy system as a whole, driven by their specific needs, and do not focus either on the mix and efficiency of generation or demand, nor on the existence of heat, power or gas silos. To actively involve consumers – and make them genuine actors of the energy market - policy should take a comprehensive perspective and break the existing silos between energy conversion, transmission, distribution and consumption, as well as harness synergies between different energy networks (electricity, gas, heat). By doing so, public policies are likely to foster greater awareness and **enable consumers' choice among different sustainable energy solutions**.

In a similar vein, **Europe's decarbonisation strategy 2050 should account for the diverse profiles of energy consumers: domestic, SMEs and industry. Indeed, depending on their specific needs, energy consumers can contribute differently towards a decarbonised energy system.**

Being **user-led**, **cogeneration is also a local and consequently an efficient solution**, with a huge potential to enable an increasingly distributed, integrated and sustainable energy system, while enabling consumers to become active participants. Small scale and micro-cogeneration is particularly suited to also address the specific needs of consumers living remotely and off-grid.

[11] https://policyexchange.org.uk/publication/too-hot-to-handle/
[12] Including electrification, re-purposing the gas grid for green gas & hydrogen, see https://www.nic.org.uk/wp-content/uploads/Element-Energy-and-E4techCost-analysis-of-future-heat-infrastructure-Final.pdf
[13] https://www.sciencedirect.com/science/article/pii/S0360544217312124
[14] https://shop.dena.de/fileadmin/denashop/media/Downloads_Dateien/esd/9261_dena-Leitstudie_Integrierte_Energiewende_lang.pdf

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Accounting for the decarbonisation of heat

Heat consumption represents more than 50% of energy needs across Europe and is responsible for a high share of energy costs for both domestic and commercial consumers. **The decarbonisation of the economy will not be achieved without a comprehensive strategy for heat**. Because heat uses vary, electrification is not a silver bullet solution.

Dedicated approaches should be taken for different types of heat needs:

Heating for domestic and small commercial consumers is seasonal. Even with high insulation rates resulting in more than 50% energy reduction in the building sector, peak heat demand is expected to be twice as high as electricity demand today[15]. Therefore, full electrification of this sector faces a series of challenges, including precisely high seasonality of demand, availability of decarbonised electricity in the medium term, seasonal storage of renewable electricity and cost of reinforcing the grids to sustain a doubling of electricity demand in winter.

Hot water demand, requiring higher temperatures than for space heating, is somewhat **constant throughout the year** and will remain at least at the same levels as today. Because hot water requires higher temperatures than in the case of heating, electrification may not be the most efficient solution.

Steam consumption in industry accounts for approximately 20-30% of energy consumption and is generally subject to high efficiency standards already, with a majority of industry using cogeneration to reliably and efficiently ensure their heat and power demand. At present and future expected electricity prices, electrification of heat would increase industrial steam costs substantially and this would threaten EU industrial competitiveness. Moreover, electrification is not possible practically for high pressure, superheated steam requirements. Therefore, special attention must be given to the cost-effective decarbonisation of heat in industry through all possible means.

Cooling demand is expected to increase dramatically[16] and so it deserves special attention as well.

Heating & cooling is a complex and diverse sector and for this reason it requires a carefully balanced approach. **Tackling the decarbonisation of heat will require enhanced supply side energy efficiency (e.g. industrial cogeneration, micro-cogeneration, cogeneration coupled with district heating) to complement greater demand efficiency (insulation of the building stock where possible), as well as growth of dispatchable renewable or low carbon energy sources**.

In addition, the cost-effective potential of all types of storage solutions should be identified and promoted, including heat storage and the seasonal storage of renewable energy via the gas network.

[15] Idem 14

[16] https://www.iea.org/newsroom/news/2016/august/air-conditioning-demand-set-to-grow-rapidly-over-the-coming-decades.html

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Conclusion

The cogeneration sector is committed to the creation of a resilient, decentralised and carbon neutral European energy system by 2050, with cogeneration as its backbone. As an efficient, consumer-led, fuel-flexible solution, enabling integration of various systems, cogeneration will be key to delivering Europe's long-term decarbonisation objectives.

Europe's long-term climate strategy should aim for the decarbonisation of the economy, providing with growth opportunities for decentralised, efficient and smart energy solutions and taking an integrated approach to energy across electricity, gas and heat networks.

Hence, the forthcoming Decarbonisation Strategy should take into account the undisputable benefits of cogeneration across the different key dimensions highlighted in this paper: increasing energy efficiency in conversion, transmission and distribution, progressive decarbonisation of both electricity and heat, enhanced system reliability and integration, and genuine consumer empowerment.

About COGEN Europe:

COGEN Europe, the European Association for the Promotion of Cogeneration, is the cross-sectoral voice of the cogeneration industry. Its mission is to work with EU institutions and stakeholders to shape better policies and eliminate administrative, regulatory and market barriers to the wider use of cogeneration in Europe.

COGEN Europe is a membership-based association with more than 60 members spanning the entire energy value chain. We all share the vision of a resilient, decentralised, carbon neutral European energy system by 2050, with cogeneration as its backbone.

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