COGEN EUROPE

Biomass CHP in the clean energy transition

COGEN EUROPE

07 December 2021

Our Mission

Cross-sectoral voice of the cogeneration industry

Work with EU Institutions and stakeholders to shape better policies by:

- Building a robust evidence-base demonstrating the benefits of cogeneration.
- Using the expertise of our membership.
- Establishing strong coalitions and partnerships.

Members

National Associations

Corporate Members

Our Vision

Resilient, decentralised and carbon neutral European energy system with cogeneration as its backbone

2050

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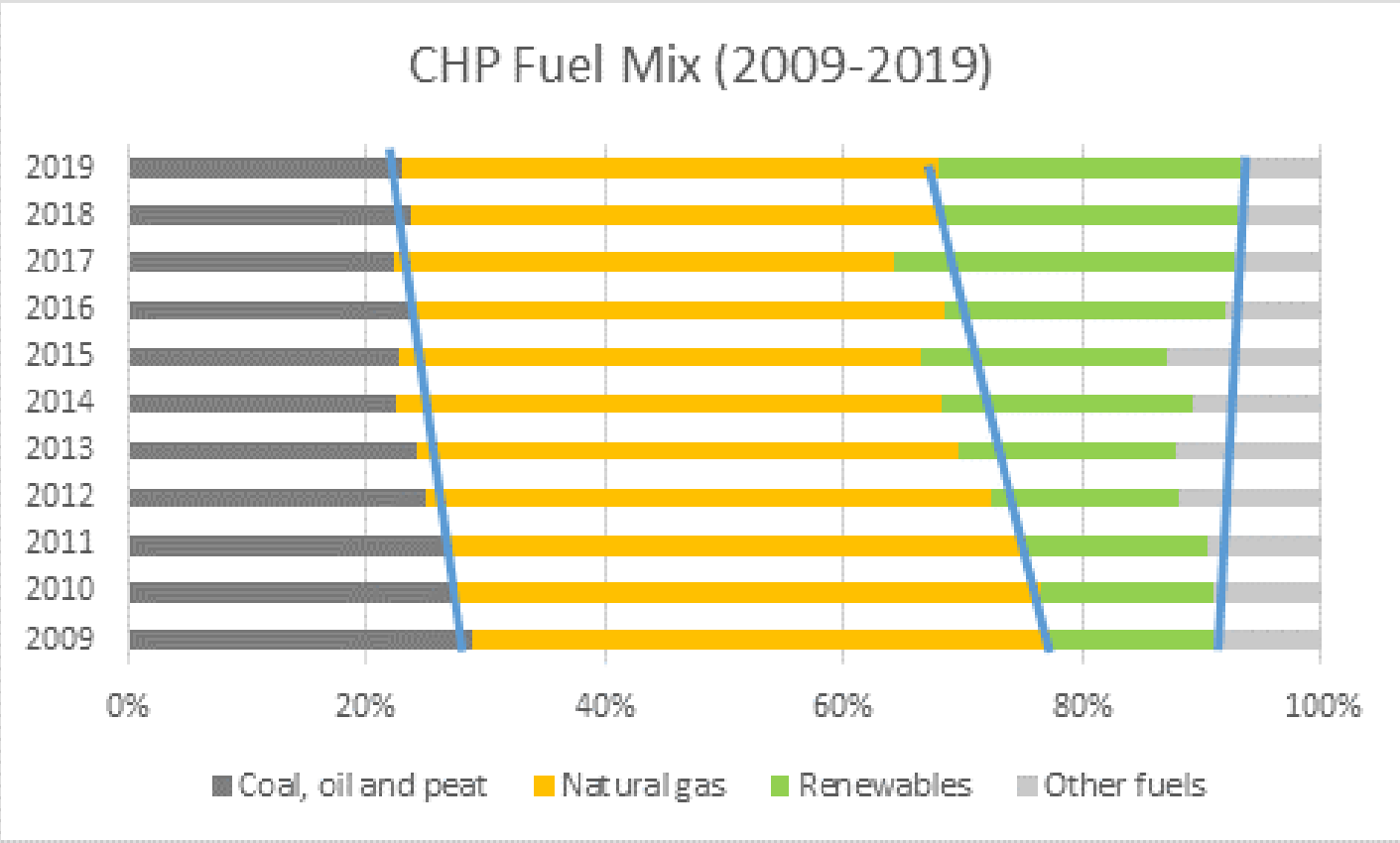
Cogeneration Fuel Mix

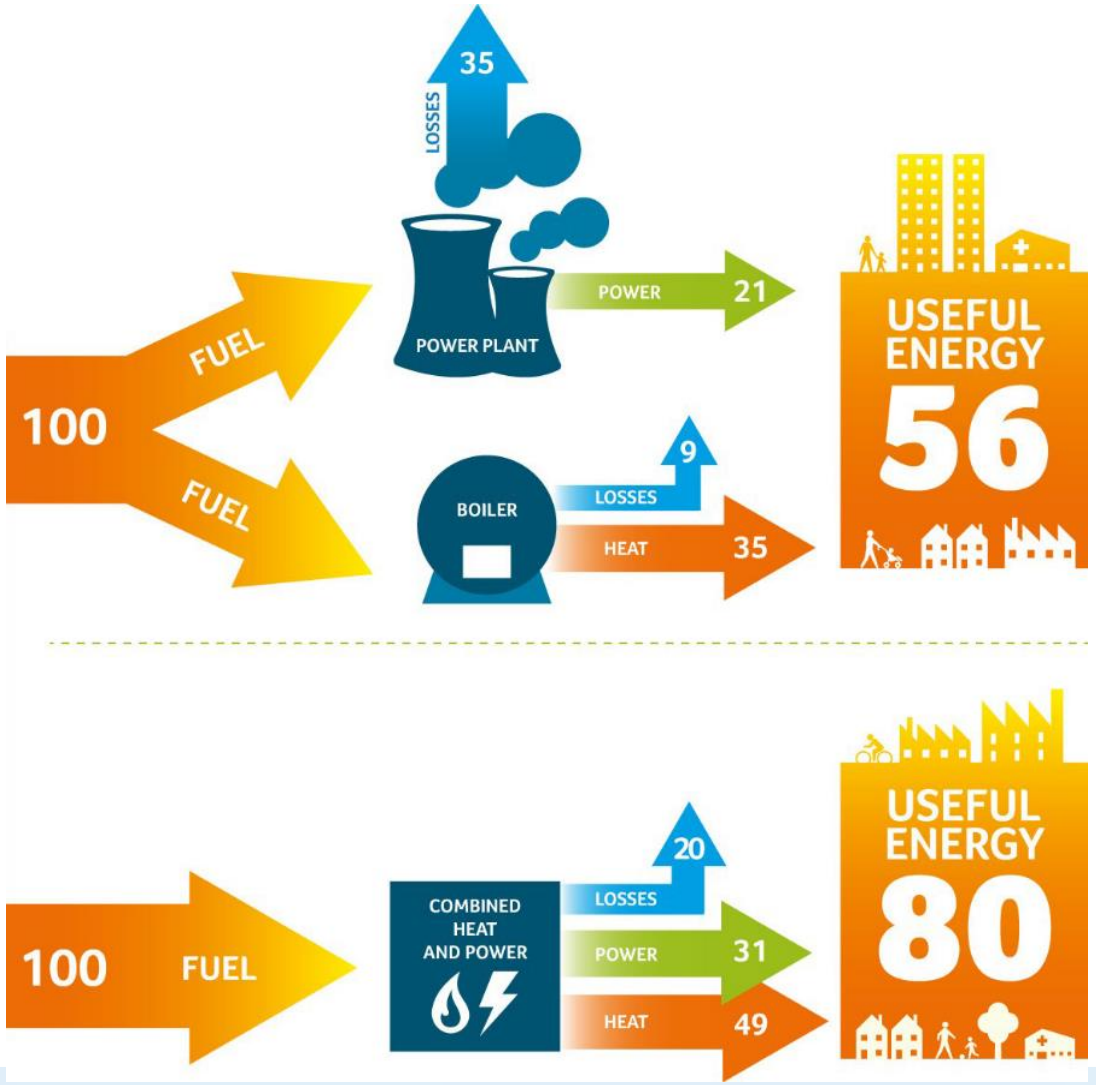


Source: Eurostat (2021)

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

- Steady decline in solid fossil fuels and oil use in CHP.
- Rapid increase of RES, reaching close to 25% in 2019 (from 13% in 2009). Most of CHP RES today is bioenergy based.
- EU markets with high shares of biomass CHP: Denmark, Estonia, Lithuania, Latvia, Austria, Finland

CHP Benefits: Efficiency



- **Transforms more than 80% of the energy into useful heat and electricity** for factories, offices, public buildings and homes.
- **Saves up to 40% energy compared to the separate supply of electricity and heat** from conventional power stations and boilers.

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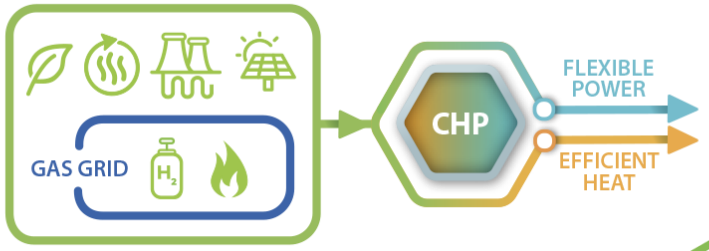
CHP Benefits: System Integration

Cogeneration:

backbone of local and integrated energy



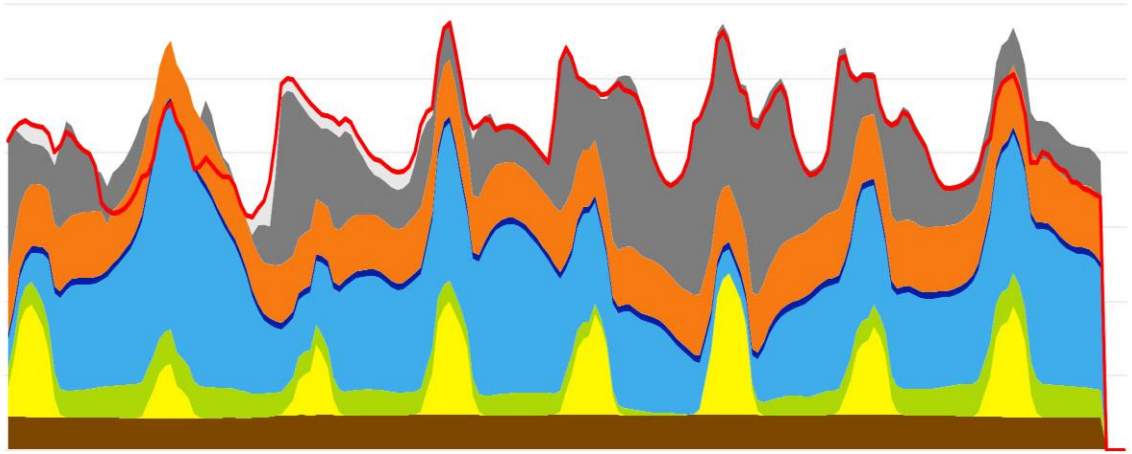
CHP enables the **integration of the energy system** by efficiently linking electricity, heat and gas at the local level and **providing energy when and where needed.**

CHP Benefits: Flexibility

The dynamic operational management of CHPs is simulated with Artelys Crystal Super Grid. CHPs adopt a virtuous behaviour by only generating when it is cost-effective for the joint electricity and heat system.

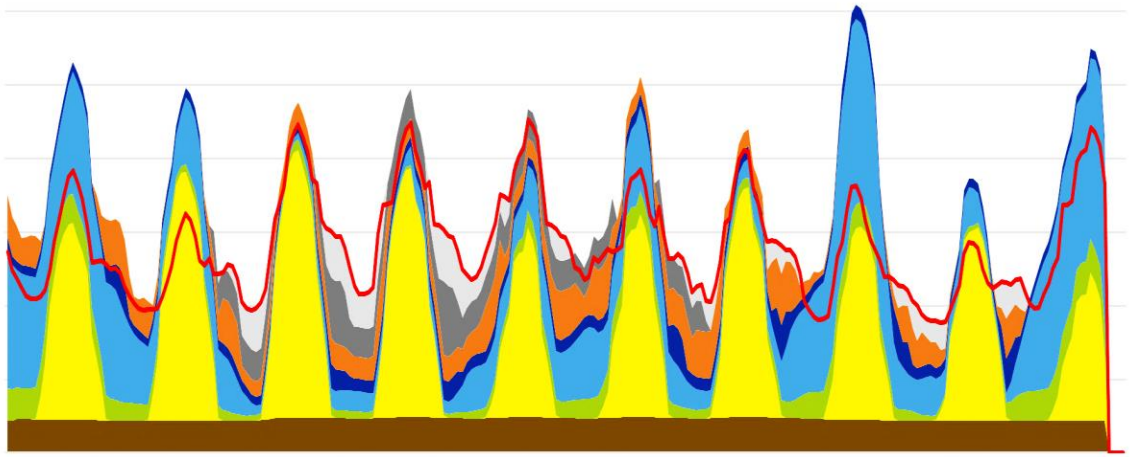
In particular, CHPs, with a flexible price-driven operational mode, do not compete with, but **complements** variable renewable generation to meet seasonal peak demand due to high shares of electrified heat.

WINTER



CHPs (orange) run as base load during low wind and sun periods, covering a high share of the peak demand.

SUMMER



CHP stops producing when variable renewable generation is sufficient to cover demand, and covers evening peaks.

RES baseload | PV | Wind offshore | Wind onshore | Hydro | CHP | Demand | Peakers | Batteries | Transmissions | Loss of load

Towards an efficient, integrated and cost-effective net-zero energy system in 2050

Artelys
OPTIMIZATION SOLUTIONS

STUDY ON THE ROLE
OF COGENERATION

Achieving Carbon Neutrality by 2050

Cogeneration or Combined Heat and Power (CHP) is a key enabler to achieve carbon neutrality in Europe by 2050.

Prioritising cogeneration for thermally generated heat and power in all sectors will maximise energy efficiency and the integration of the European energy system at the lowest cost.

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.

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Solution of Choice

Our 26 Partners

Cogeneration enjoys widespread industry support across EU and beyond: **Technology manufacturers, utilities, industrial players, energy service companies and national associations.**

Introduction

BACKGROUND

Energy efficiency first and energy systems integration are key dimensions of carbon neutrality in 2050.

So far, EU policymaking and scenarios have not fully captured the benefits of efficiently combining heat and power as enabling solution to move to a net-zero integrated energy system.

Artelys
OPTIMIZATION SOLUTIONS

European-wide modelling of integrated gas, heat and power scenarios with Artelys Crystal Super Grid, capturing key aspects of the energy transition and in particular smart sector integration strategies.

STUDY OBJECTIVES

1. **Explore the potential of further integrating Europe's energy system in an efficient way to reach carbon-neutral economy at least cost.**
   - Assess the role of cogeneration building on the EC's Long-Term Decarbonisation Strategy (LTS).
2. **Provide recommendations to better reap the benefits of efficient and local system integration solutions in policy making & modelling.**

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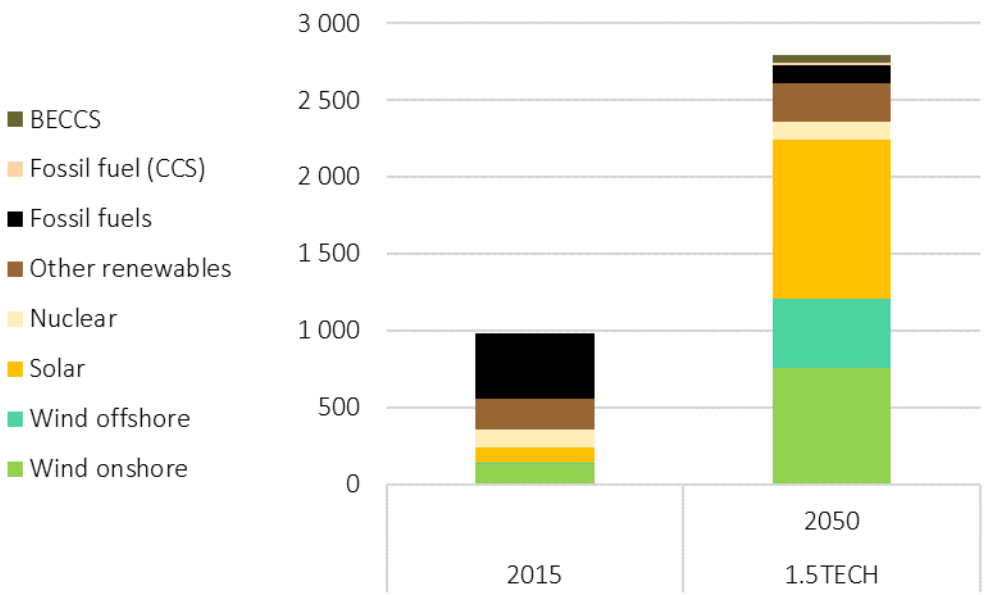
Biomass CHP Potential 1/2

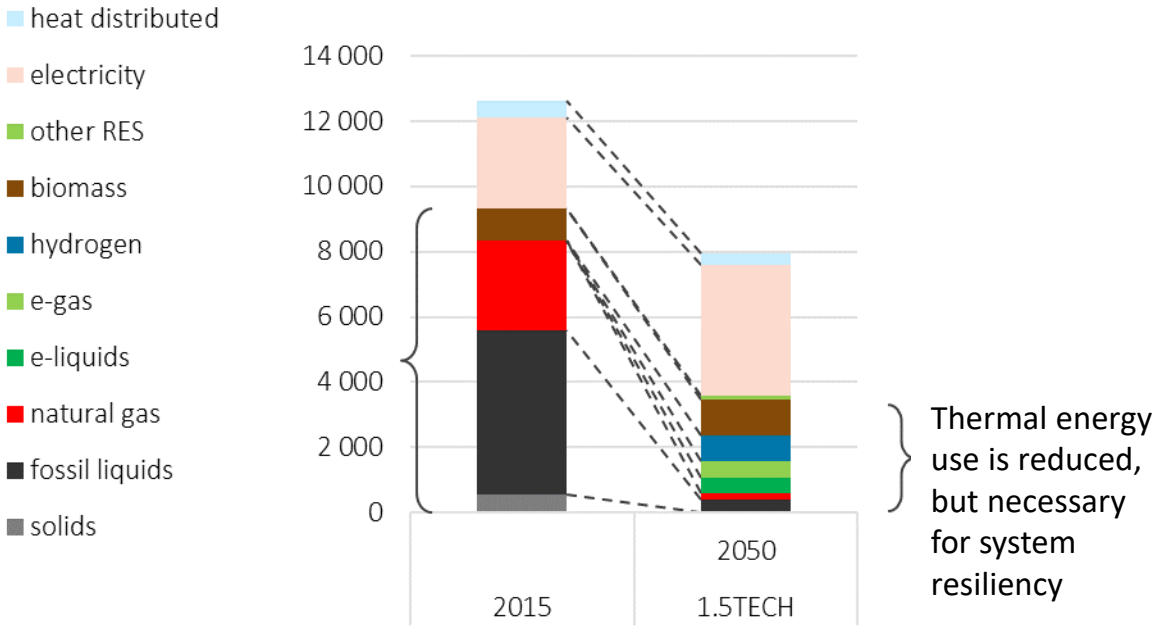
1.5TECH* relies on publicly available assumptions of the 1.5TECH scenario of the EC Long-Term Strategy (LTS)

- Between 2015 and 2050, the fossil fuel consumption reduces drastically as the role of electricity increases and bioenergy and e-fuels develop.
- The 1.5TECH scenario considers an **important system electrification**, especially of transport and heat, and **significant energy efficiency efforts** (high number of renovations, important technological improvements)

Power capacity mix - EU28 (GW)



Final energy consumption by energy carrier - EU28 (TWh)



Thermal energy use is reduced, but necessary for system resiliency

Source: EU Long Term Strategy

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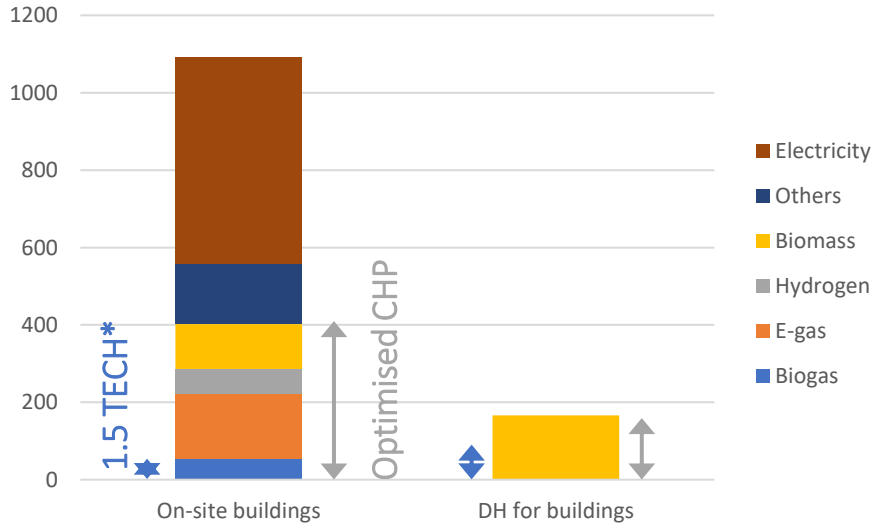
Biomass CHP Potential 2/2

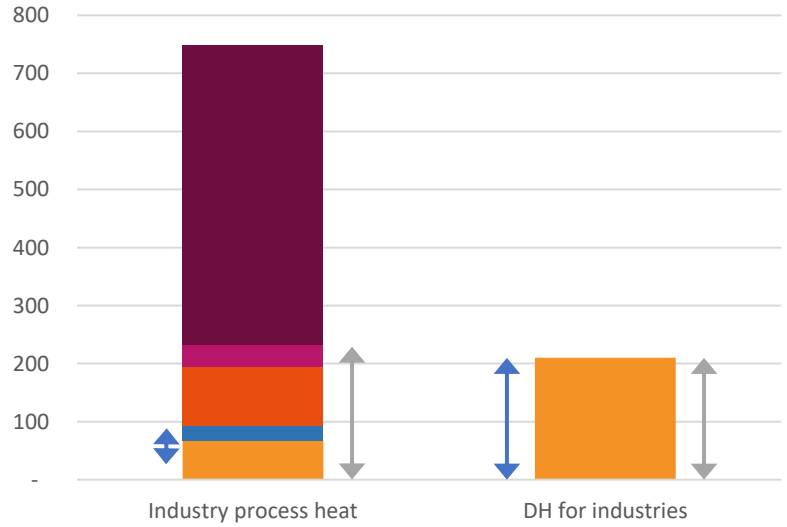
The heating sector is modelled jointly with the electricity system:

- 4 sectors are modelled: 1. district heating for industries, 2. district heating for buildings (residential/tertiary), 3. on-site heat generation for industries, 4. on-site heat generation in buildings (collective heat or individual heat)
- The share of each energy source in each sector is an input from the 1.5TECH scenario
- The generation of heat in each sector is optimized between CHP and separated heat generation with a limitation on the maximal share for CHP*.
- Waste heat recovery on industrial furnaces for electricity generation is also optimised.

Final energy demand for space heating in buildings per energy (TWh)



Final energy demand for industrial heat (TWh)



Maximal heat demand that can be provided by CHP

Source : LTS 1.5TECH scenario & FORECAST Model

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* We consider that in any case, the separated heat generation remains in the heat generation mix. CHP is installed only if its energy savings (in both systems) offsets its additional investment costs.

CHP's Multiple Benefits in 2050

€4-8 Bn

↓ cost for energy system

150–220 TWh

↑ energy savings across energy system

~20%

↓ remaining CO_2 emissions

13-16%*
of total electricity

and **~30-36% of flexible thermally generated power** at times of low wind & sun and to cover peak demand

19-27%**
of total heat

and **52-100%*** of thermal heat** in buildings, industry & district heating

* excluding off-grid RES for P2X generation.
** excluding furnaces.
*** excluding furnaces; DHC for industry is 100% CHP.

Cost Savings for CHP Users

Family Home (hydrogen fuel cell)	Hospital	District Heating (DHC)	Industry (high-temperature)	Industry (medium-temperature)	Industry and City DHC (using residual and industrial waste and biomass)
up to 800 €* for 10 MWh	6 - 52k € for 8 GWh	0.4 - 3M € for 500 GWh	3 - 10M € for 684 GWh	1.5 - 7.1M € for 500 GWh	0.9 - 16 M €** for 700 GWh

*Based on retail power prices including taxes, levies and grid costs, self-consumed electricity and hydrogen retail price of 80-100 €/MWh. All other user cases assume cogenerated electricity is sold to market at wholesale electricity prices, excluding taxes.
**Based on biomass price of 40-60 €/MWh.

CHP: Beneficial to Consumers in All Sectors

CHP enables the **most energy-efficient** & **cost-effective** pathways to decarbonisation in a **consumer-empowering** way.

220 TWH

OF PRIMARY ENERGY SAVINGS

OR **2.5 x annual electricity consumption of Belgium***

5.5 MT

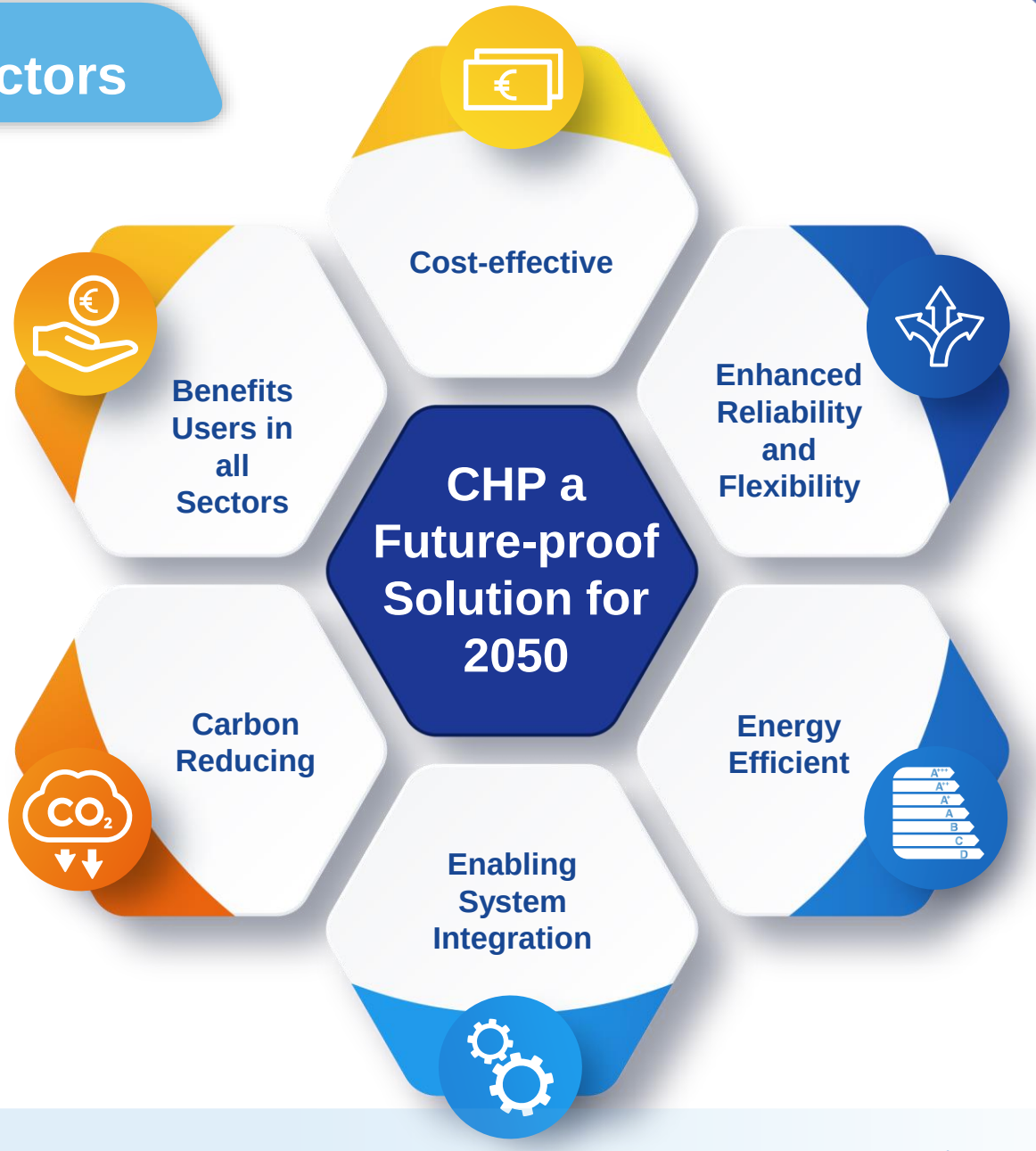
OF REMAINING CO_2 EMISSIONS AVOIDED

OR **Annual CO_2 emissions of 3 million petrol cars**

8.2 BN €

SAVED YEARLY

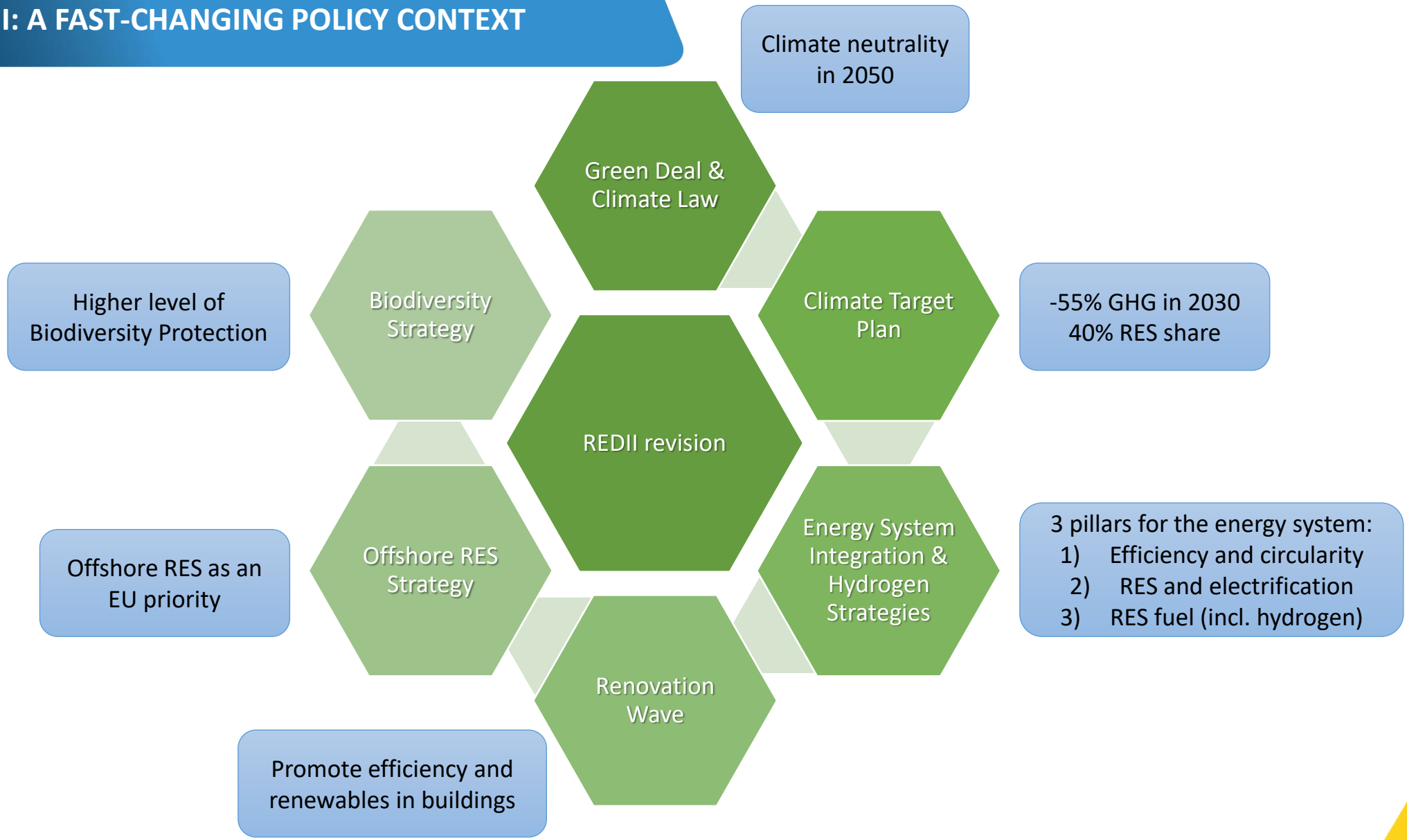
OR **9.5 x of LIFE Climate Action funding**



** IEA 2019*

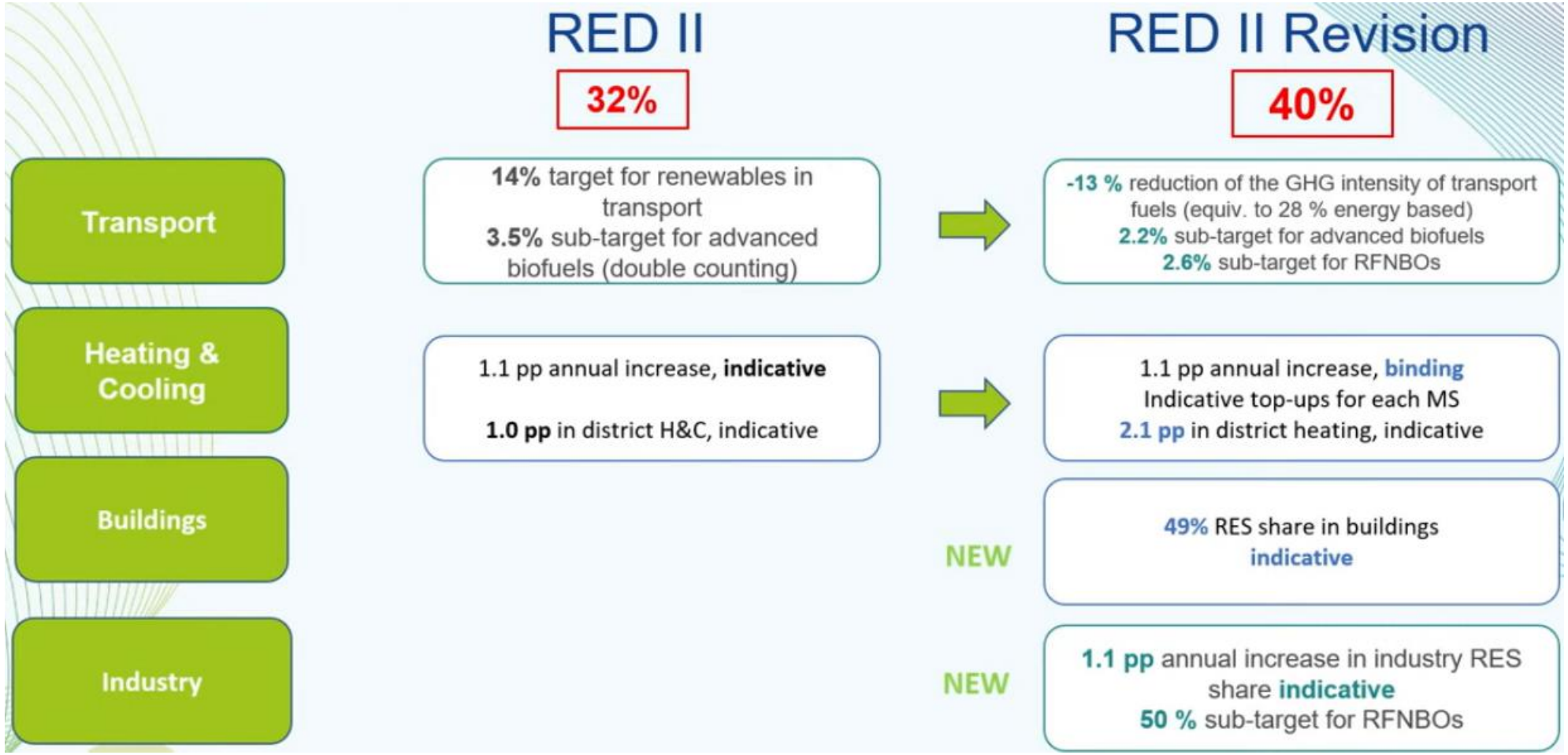
An ambitious Fit for 55 framework with Cogeneration!

RED III: A FAST-CHANGING POLICY CONTEXT



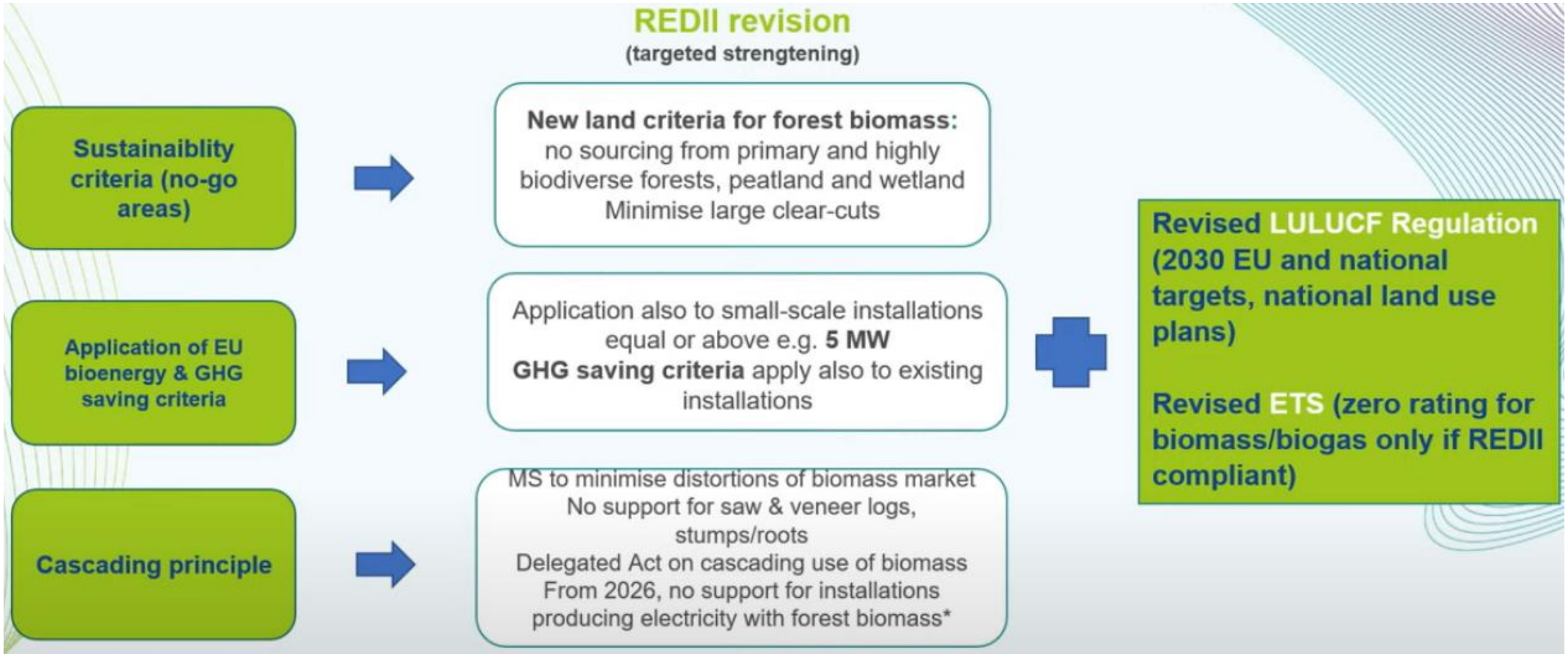
Source: The European Commission

RED III: SECTORAL TARGETS



Source: The European Commission

RED III: BIOENERGY CRITERIA



Source: The European Commission

RED III: IMPACT ON CHP

- ✓ **Energy efficiency first:** Authorisation criteria for renewable energy linked to **EE1st may favour the use of CHP**
- ✓ **Biomass:** Reinforced bioenergy sustainability criteria may impact CHP differently:
  1) **CHP may be preferred to power-only** to ensure forest biomass is accounted
  2) **Too strict requirements may limit the availability** of biomass/biogas/biomethane for CHP operation
- ✓ **RES H2 & gases:** **Recognition for RES gases,** including hydrogen, at the point of consumption favourable for CHP
- ✓ **Waste heat:** The promotion of waste heat appears to take precedence over natural gas based CHP, despite the definition of waste heat, requiring CHP to be prioritised.
- ✓ **DHC:** **Mixed impact on CHP,** given the focus on prioritising RES and waste heat use in DHC. **Updated efficient DHC definition in Energy Efficiency Directive implicitly covers all high efficiency CHP until 2035.**
- ✓ **Buildings:** Indicative RES share in buildings objective can be achieved among others through **renewable electricity and heating and cooling in combination with CHP**
- ✓ **Heating and cooling**: RES in heating and cooling could be achieved through integration of renewable gases and the use of efficient renewable heating and cooling technologies; **RES CHP is implicitly covered**

COGEN EUROPE HIGH POLICY ASKS

Support the efficient switch to renewable energy in electricity, heat and gas: prioritise high efficiency CHP for the efficient use of thermal renewable sources, including bioenergy, biomass, biogases, hydrogen and waste heat.

Promote efficient district heating and cooling (DHC) for an increasingly renewable energy system: reinforce CHP as a best available solution for district heating and cooling, complementing waste heat, thermal renewable sources and renewable electricity.

Promote local energy system integration to maximise renewable energy use: take an integrated approach to energy systems to maximise share of renewable energy across all energy carriers at lowest cost for consumers.

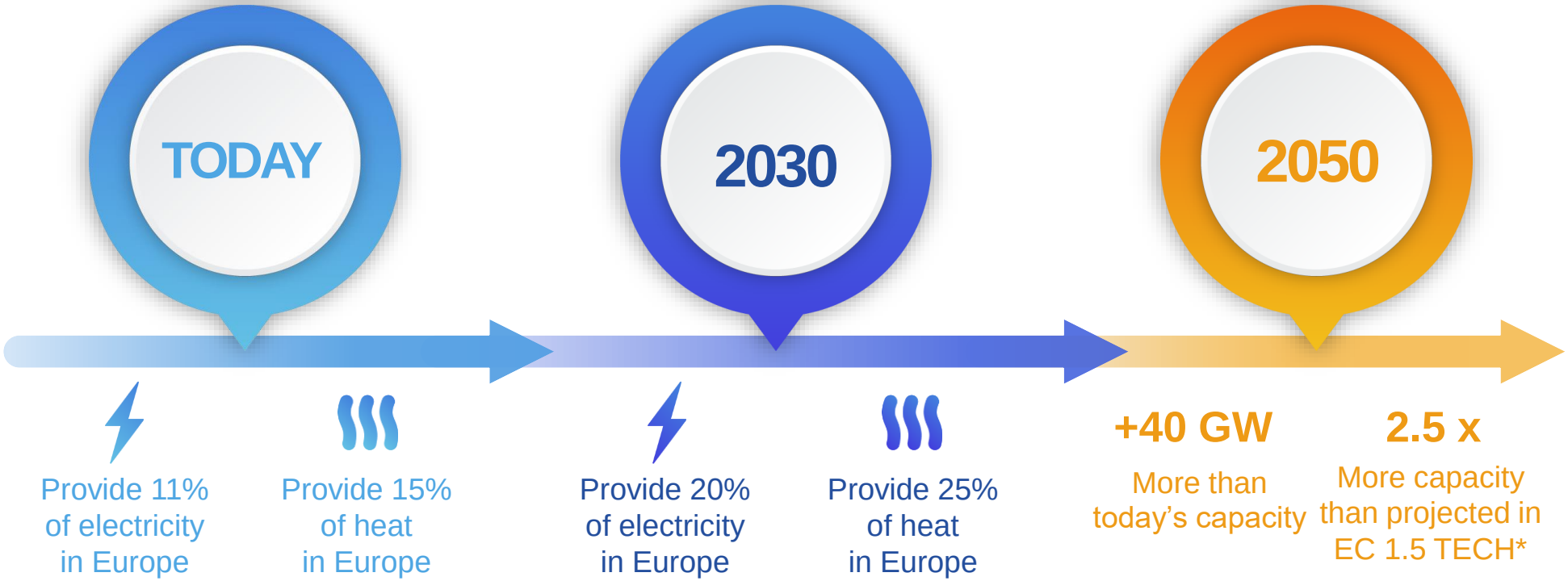
Enable efficient and renewable electrification of heat: Ensuring that electrification is delivered cost-effectively through renewable electricity and complemented by efficient dispatchable generation.

Foster a robust, ambitious and predictable framework for renewable energy: Support the availability and affordability of renewable energy sources for all end consumers through ambitious yet stable and predictable rules.

Our Call to Action

An **ambitious and predictable regulatory framework** must be set in place to fully reap the benefits of cogeneration for citizens, businesses and the energy system between now and 2050.

Prioristise cogeneration for all thermally generated heat and power, to avoid wasting valuable energy.



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