ELECTRICITY AND GAS SECTOR COUPLING

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DISE ENERGY

SECTOR COUPLING AS AN UN'S PARTIES DEAL

The electrification of transport, buildings and industry could enable these sectors to shift away from dependence on fossil fuels in line with 13. sustainable goal of Agenda 2030.

- common access to affordable, reliable and innovative energy services
- development of infrastructure and modernisation of technologies enabling access to innovative and sustainable energy services

- strengthening adaptive ability and resilience to climate threats
- promoting mechanisms that increase the ability to effectively plan for and manage climate change

SECTOR COUPLING DEFINITION

„Sector coupling focuses on combining at least two of the different sectors of energy demand and production (i.e. electricity, heating, cooling, transport and industrial processes)” – IRENA (2022)

„Electrify as many areas of the economy as possible – by directly switching them to electric power, and/or fueling them from green hydrogen (produced by electrolysis) or other fuels produced from power” – Bloomberg (2020)

International Renewable Energy Agency, *Sector Coupling. A key concept for accelerating the Energy transformation*, 2022.
Bloomberg, *Sector Coupling in Europe: Powering Decarbonization*, 2020

SECTOR COUPLING DIRECTIONS

- Direct electrification as wide as possible and indirect electrification for hard-to-decarbonise sectors
- Decentralisation and primacy of dispersed energy system (including engaging micro networks)
- Smart management in energy system with using digital instruments

International Renewable Energy Agency, *Sector Coupling. A key concept for accelerating the Energy transformation*, 2022

SECTOR COUPLING VISION

Energy system integration – the coordinated planning and operation of the energy system 'as a whole', across multiple energy carriers, infrastructures, and consumption sectors

UN AGENDA 2030

2015

Innovative energy system as a key factor for climate protection

EUROPEAN GREEN DEAL

2019

Multifunctional and green electricity energy system as a condition to achieve climate neutrality

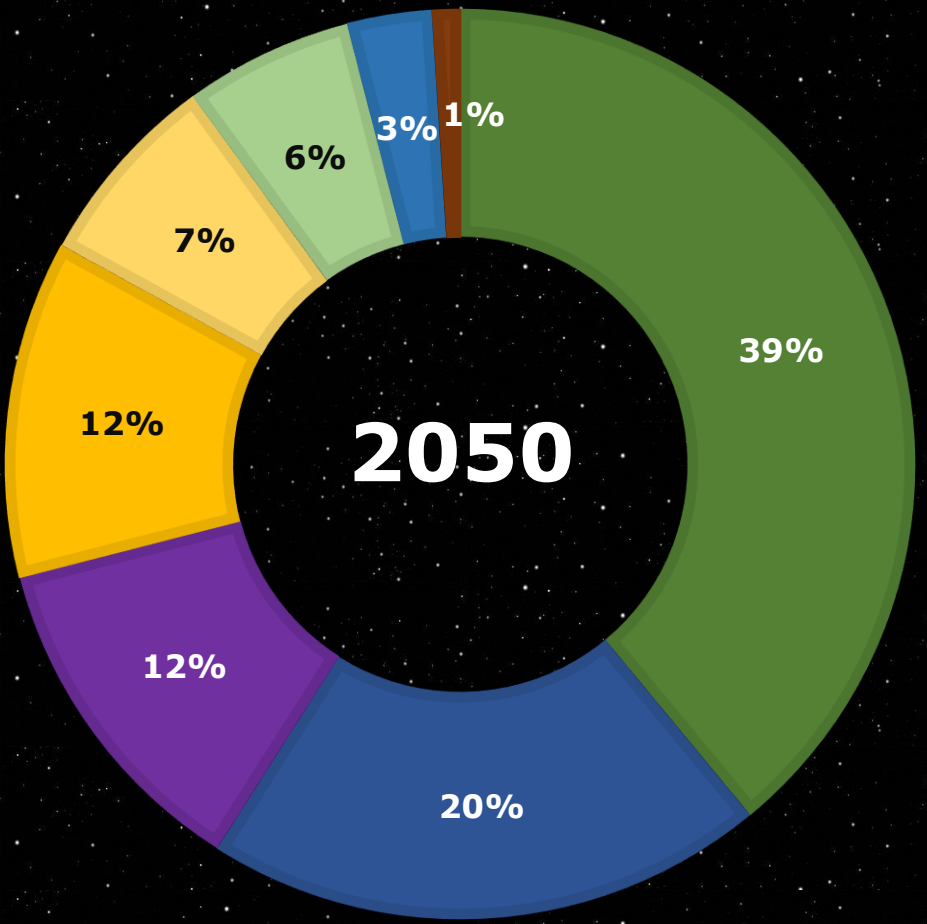
EU SECTOR COUPLING STRATEGY

2020

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Powering a climate-neutral economy: An EU Strategy for Energy System Integration of 8 July 2020 (COM(2020) 299 final)

DISE ENERGY

ELECTRICITY FOR NET ZERO



- Onshore wind
- Offshore wind
- Nuclear
- PV farms
- PV in households
- Biomass CCS
- Hydro
- CCGT
- Biomass
- Geothermal

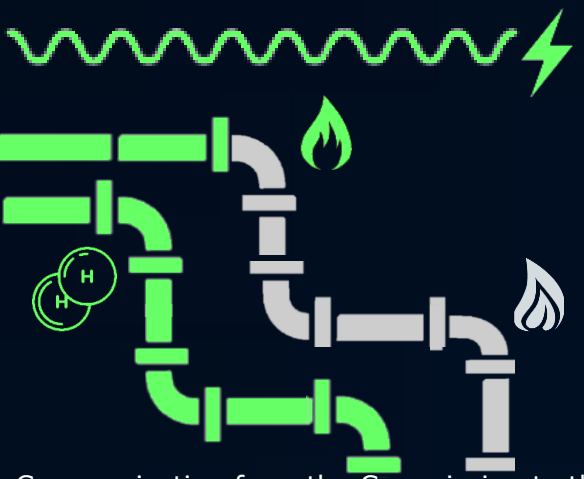
min. 81% of RES until 2050 through the deep electrification the energy system
– one of possible energy transition scenario by Center on Regulation in Europe

Center on Regulation in Europe, *Reaching net-Zero: Scenarios and Regulation to Rethink Sector Coupling*, 2021, p. 10

EU SECTOR COUPLING VISION

Whats means integrated energy system according to sector coupling strategy?

- Replacing the linear system with an integrated system
- Flexible use of resources instead of their rigrid assignment
- Circular energy – reusing waste heat and electrifying of end uses
- More active participants in power and heat generation



Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Powering a climate-neutral economy: An EU Strategy for Energy System Integration of 8 July 2020 (COM(2020) 299 final)

DISE ENERGY

EU SECTOR COUPLING VISION

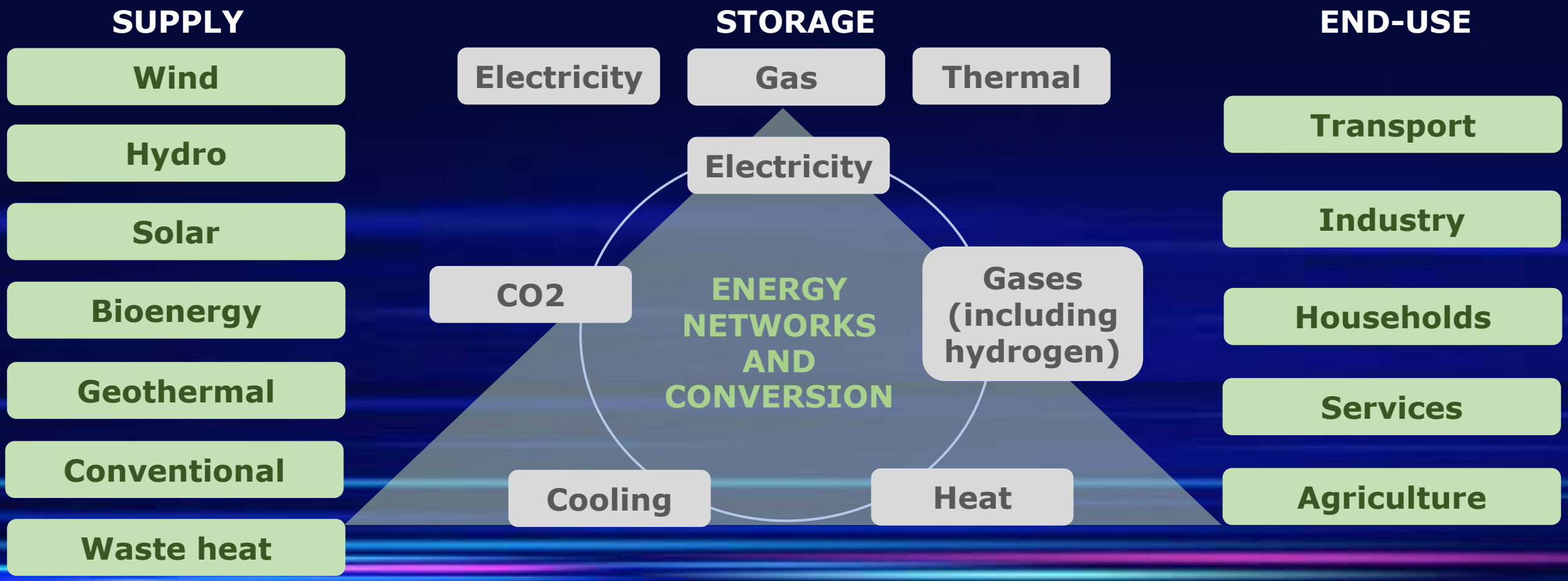
1.1. REPLACING THE LINEAR SYSTEM WITH AN INTEGRATED SYSTEM

CURRENT LINEAR ENERGY SYSTEM

FUTURE INTEGRATED ENERGY SYSTEM

EU SECTOR COUPLING VISION

1.2. THE PROPOSED NEW MODEL OF INTEGRATED ENERGY SYSTEM



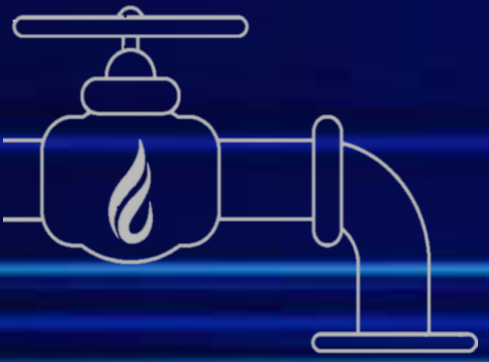
European Parliament, *Sector coupling: how can it be enhanced in the EU to foster grid stability and decarbonise?*, 2018, p. 9

SECTOR COUPLING VISION

2.1. FLEXIBLE USE OF RESOURCES INSTEAD OF THEIR RIGRID ASSIGNMENT

AT PRESENT

- separated electricity and natural gas networks



IN THE FUTURE

- **blending of natural gas and hydrogen** is just allowed in Poland (currently with a maximum 10% share of hydrogen)
- proceeding are regulations for the introduction of **direct energy transmission lines** and **direct hydrogen pipelines**
- the proceed Polish law (Energy law amendment) does not predict on the first stage of developing hydrogen market, the gas and hydrogen operators unbundling, but at the same time hydrogen is developing as a multifunctional source

Regulation of the Minister of Economy of 2 July 2010 on detailed conditions for the operation of the gas system (Polish Journal of Law of 2018 item 1158)
Proceeding Energy law amendment (UD382)

SECTOR COUPLING VISION

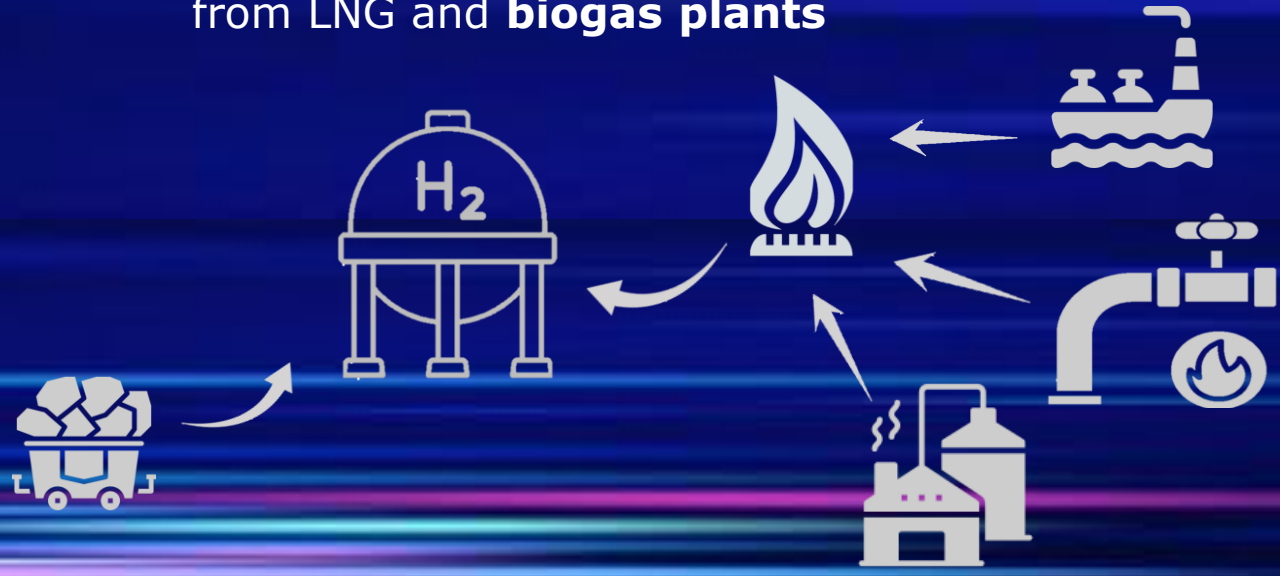
2.2. FLEXIBLE USE OF RESOURCES INSTEAD OF THEIR RIGRID ASSIGNMENT

AT PRESENT

- use coal and natural gas mainly to produce electricity and heating

IN THE FUTURE

- **coal** will in the short term be used to produce conventional hydrogen and then used in other sectors such as cosmetology, while **natural gas** will for a long time be a transition fuel in the green transition and will enable the production of low-carbon hydrogen
- gas supply will be multi-directional, including from LNG and **biogas plants**



SECTOR COUPLING VISION

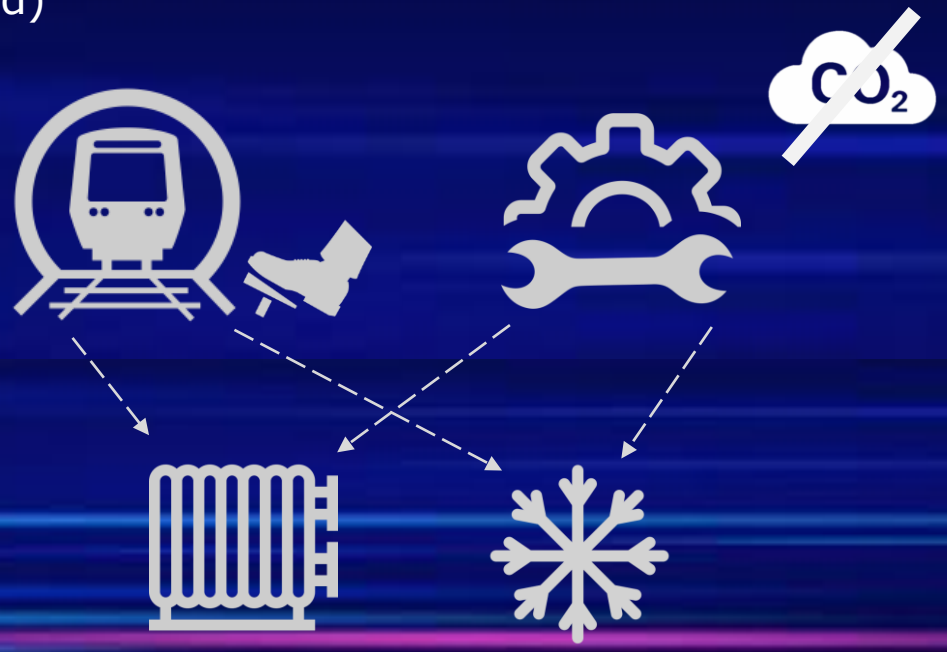
3. CIRCULAR ENERGY – REUSING WASTE HEAT AND ELECTRYFING OF END USES

AT PRESENT

- electricity and heat from industrial processes are not fully used

IN THE FUTURE

- it is necessary to prevent electricity and heat from being wasted through re-use in other processes (e.g. use of heat from underground braking, heat storage or combined heat and cold)



SECTOR COUPLING VISION

4. MORE ACTIVE PARTICIPANTS IN POWER AND HEAT GENERATION

UNTIL RECENTLY

- until recently, only large partnerships were actively involved in the energy market in the area of mining, generation, transmission distribution and trading of energy

FROM RECENTLY

- there are already new players on the energy market, such as prosumers, collective prosumers and virtual prosumers, but the new regulations also foresee, i.a. the emergence of **tenant prosumer** and **new hydrogen operators**
- new activities are already present on the energy market, such as energy clusters and energy cooperatives, but **hydrogen valleys**, **hydrogen and electrolytic conversion companies**, among others, will also emerge

POLISH SECTOR COUPLING STRATEGIC ACTIONS

- Deepening the integration of European gas connections (Poland-Lithuania, Poland-Norway and Poland-Slovakia – interconnectors launched in 2022) and expanding the LNG terminal

- Enabling blending renewable gases (biomethane, hydrogen) with natural gas in the gas network

- Integration of RES as a result of adopting proceeding cable pooling legal regulations

- Coexistence of gas, hydrogen and electricity networks with direct hydrogen pipelines and direct lines

Resolution No 149 of the Council of Ministers of 2 November 2021 on the adoption of the Polish Hydrogen Strategy until 2030 with an outlook until 2040 (Polish Monitor of 2021 item 1138).

Proposal for a Directive of the European parliament and of the Council on common rules for the internal markets in renewable and natural gases and in hydrogen (COM/2021/803 final)

CONSLUSIONS

- The EU integrated energy system will allow the introduction of new low- and zero-carbon technologies, whose multifunctionality means efficiency and environmental and climate acceptability;
- New reality of copupled sectors will create some challenges and need for an adequate regulatory framework
- Flexibility in the use of energy sources will allow the matching of supply and demand, increase market competition and expand end-user rights;
- Coal will remain a stabilizer of the energy system in the short term, including marginal use in the production of conventional hydrogen, and then coal will find use in other sectors of the economy, while as for natural gas, new directions of supply will emerge and gas will also be an important source for building a low-carbon economy in the energy transition period (including use in the production of hydrogen);
- The emergence of new actors in the energy market and new energy generation activities means the decentralisation of the energy market and with it the dominance of dispersed generation;
- Energy sources used should be adapted to local needs and energy generation should aim for the shortest possible supply chains (*local content*).

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