Co-funded by the European Union

EU4ENERGY PHASE II

Autumn Digital EU4Energy Week for EaP Universities, 2-6 October 2023

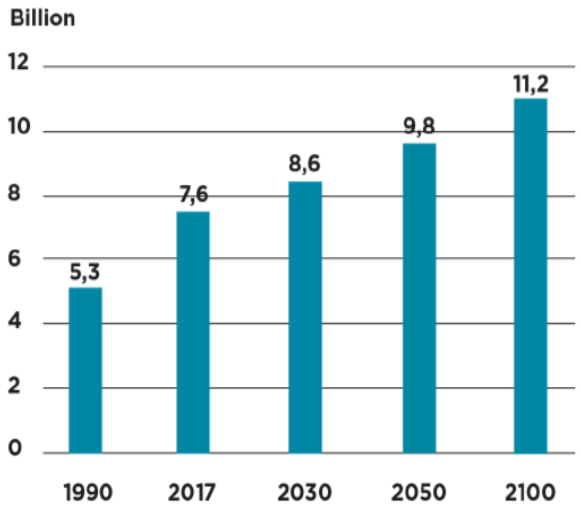
GREENING THE GASES

Karolina Čegir, Senior Gas Expert, Energy Community Secretariat

Co-funded by the European Union

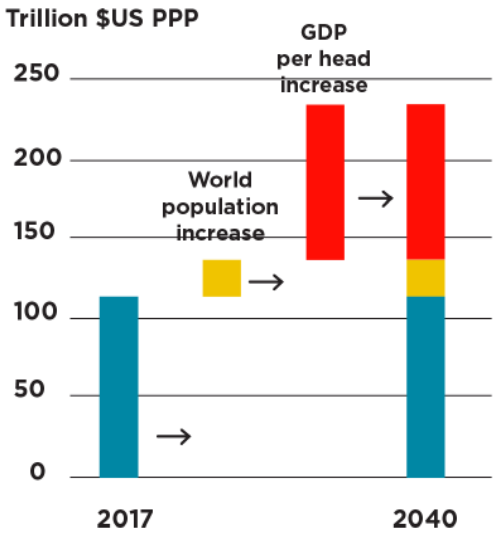
All about energy starts with....

World population



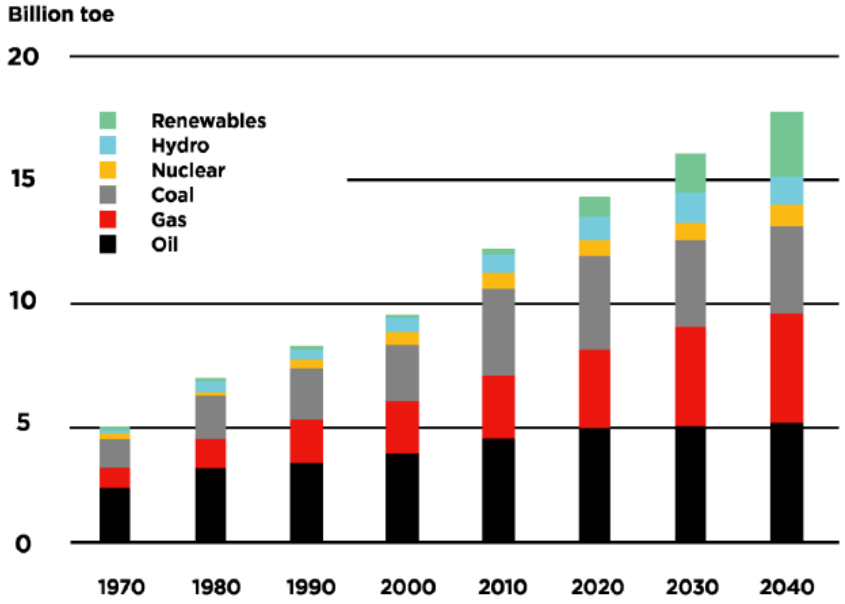
Source: United Nations, World Population Prospects 2019

Increase in global GDP



Source: BP Energy Outlook, 2019 Edition

Primary energy demand – fuel



Source: BP Energy Outlook, 2019 Edition

Energy Community

IEA

CEER
Council of European Energy Regulators

Co-funded by the European Union

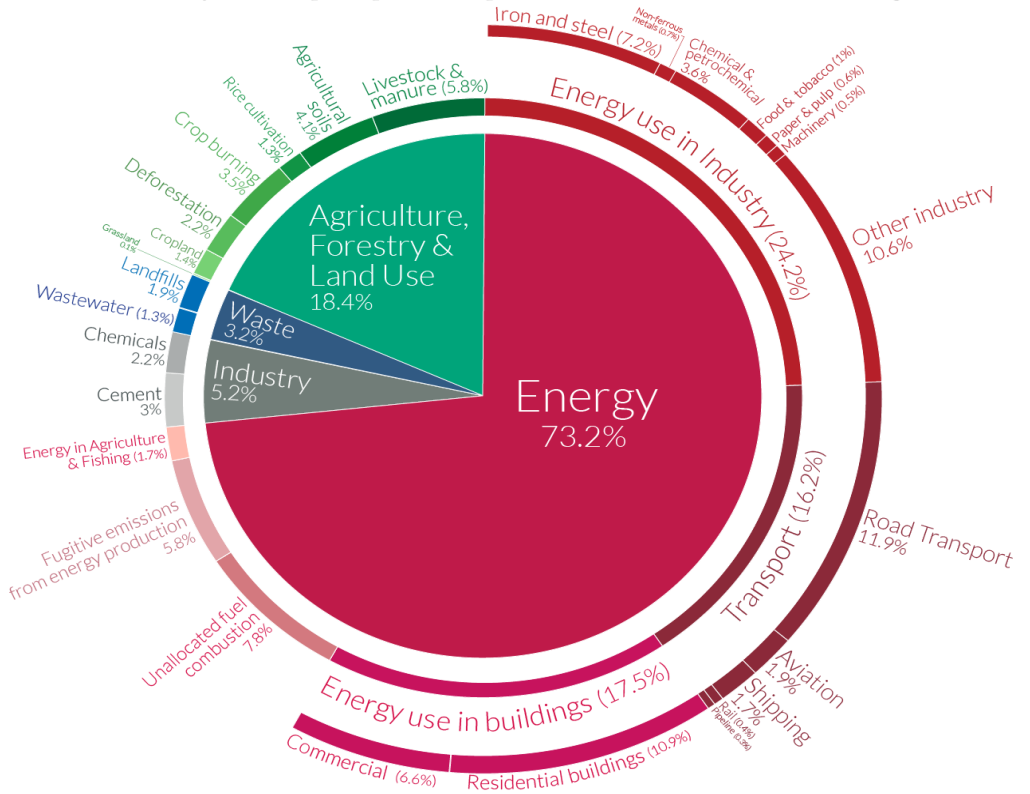
Usage of fossil fuels =► GHG emissions

$C + O_2 = CO_2$

Global greenhouse gas emissions by sector

Our World in Data

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO_2eq.

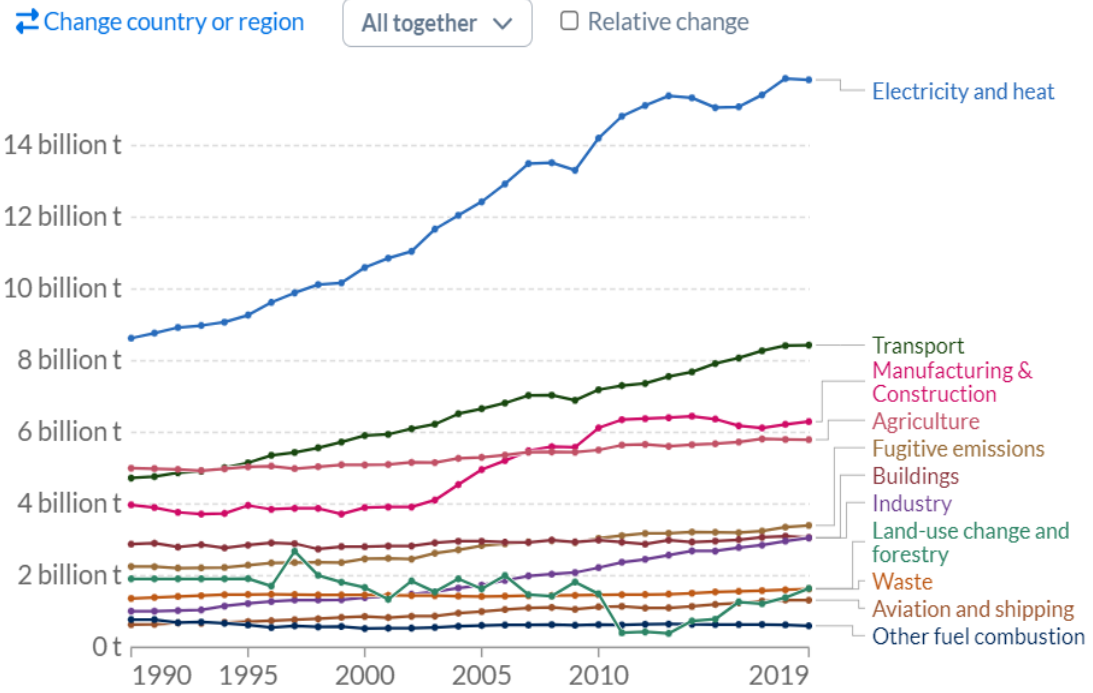


OurWorldinData.org – Research and data to make progress against the world's largest problems.
Source: Climate Watch, the World Resources Institute (2020). Licensed under CC-BY by the author Hannah Ritchie (2020).

Greenhouse gas emissions by sector, World

Our World in Data

Emissions are measured in carbon dioxide equivalents (CO2eq). This means non-CO2 gases are weighted by the amount of warming they cause over a 100-year timescale.



Source: Our World in Data based on Climate Analysis Indicators Tool (CAIT).
OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

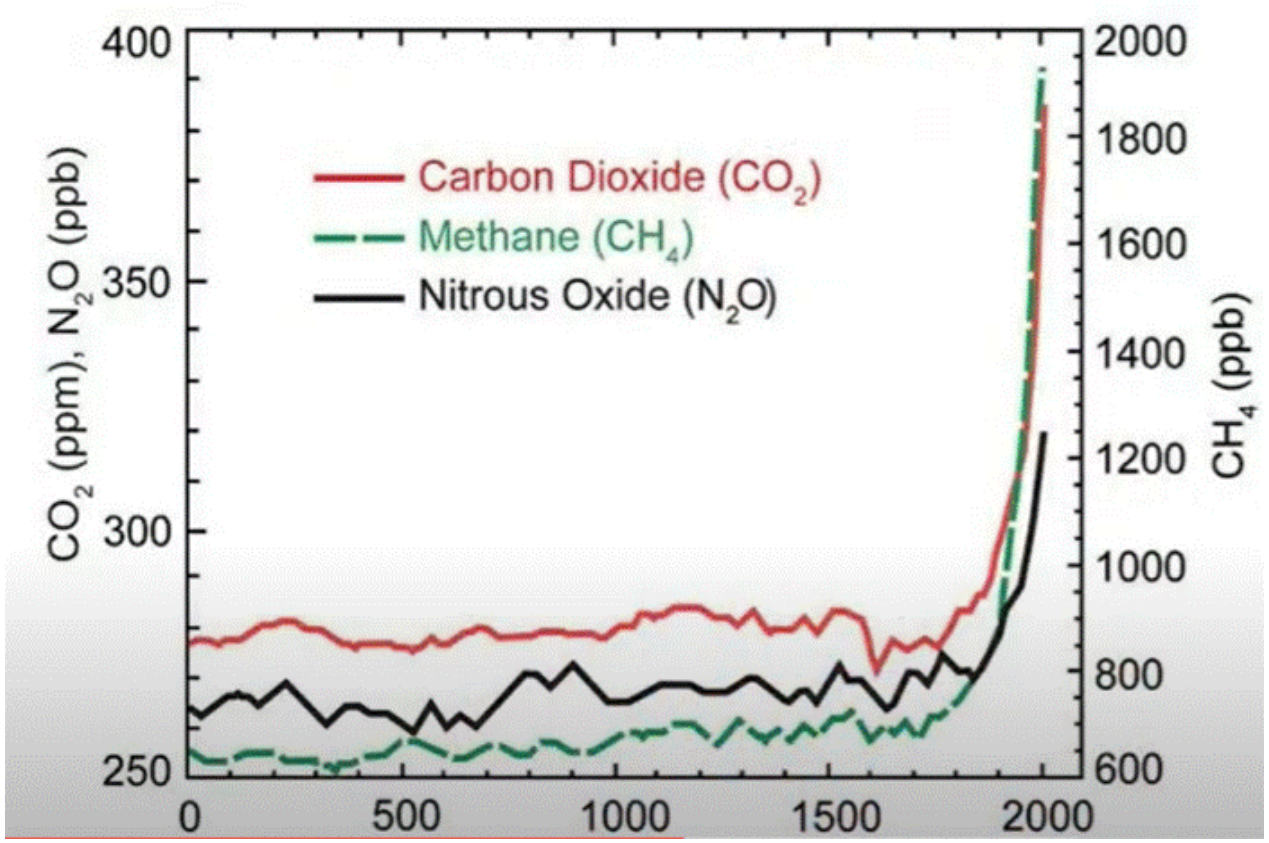
Energy Community

IEA

CEER
Council of European Energy Regulators

Co-funded by the European Union

GHG emissions - climate change mitigation – Paris Agreement



Mitigation: reducing emissions

Governments agreed

- a long-term goal of keeping the increase in global average temperature to **well below 2°C** above pre-industrial levels;
- to aim to limit the increase to **1.5°C**, since this would significantly reduce risks and the impacts of climate change;
- on the need for **global emissions to peak as soon as possible**, recognising that this will take longer for developing countries;
- to undertake **rapid reductions thereafter** in accordance with the best available science, so as to achieve a balance between emissions and removals in the second half of the century.

Energy Community

iea

CEER Council of European Energy Regulators

Co-funded by the European Union

Role of methane in GHG emissions

GHG	Symbol	Lifetime (years)	GWP_{20} (Over 20 years)	GWP_{100} (Over 100 years)	Total emissions (2018)
Carbon Dioxide	CO_2	100-1000	1	1	81%
Methane	CH_4	12	84	28	10%
Nitrous Oxide	N_2O	121	264	265	7%
Tetrafluoroethane	HFC-134a	13	3710	1300	2%
Trichlorofluoromethane	CFC-11	45	6900	4660	
Carbon Tetrafluoride	CF_4	50,000	4880	6630	

In Contracting Parties:
CO_2 68-78%
CH_4 13-20%

CO_2 is the biggest GHG, but

CH_4 defines the speed of warming

The need to act in **the next decades**, not in the next century

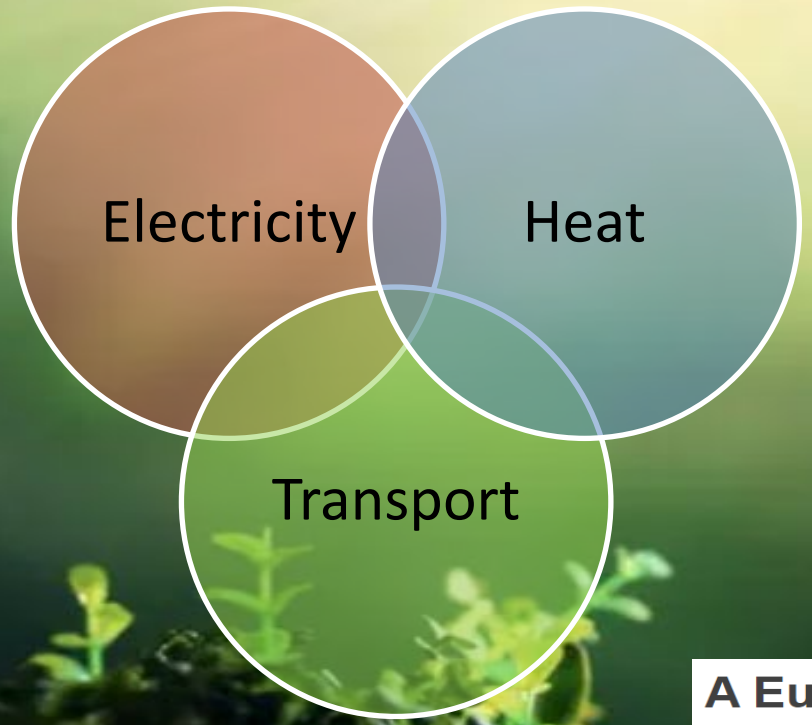
Energy Community

IEA

CEER
Council of European Energy Regulators

Co-funded by the European Union

Replacement of fossil fuels =► Reduction of GHG emissions [1]



Renewable energy sources

Energy efficiency

Electrification

Decarbonization by 2050

Energy and Climate Plans

Methane strategy

……..

A European Green Deal

The first climate-neutral continent
by 2050

At least 55% less
net greenhouse gas emissions by 2030, compared to 1990 levels

3 billion
additional trees to be planted in the EU by 2030

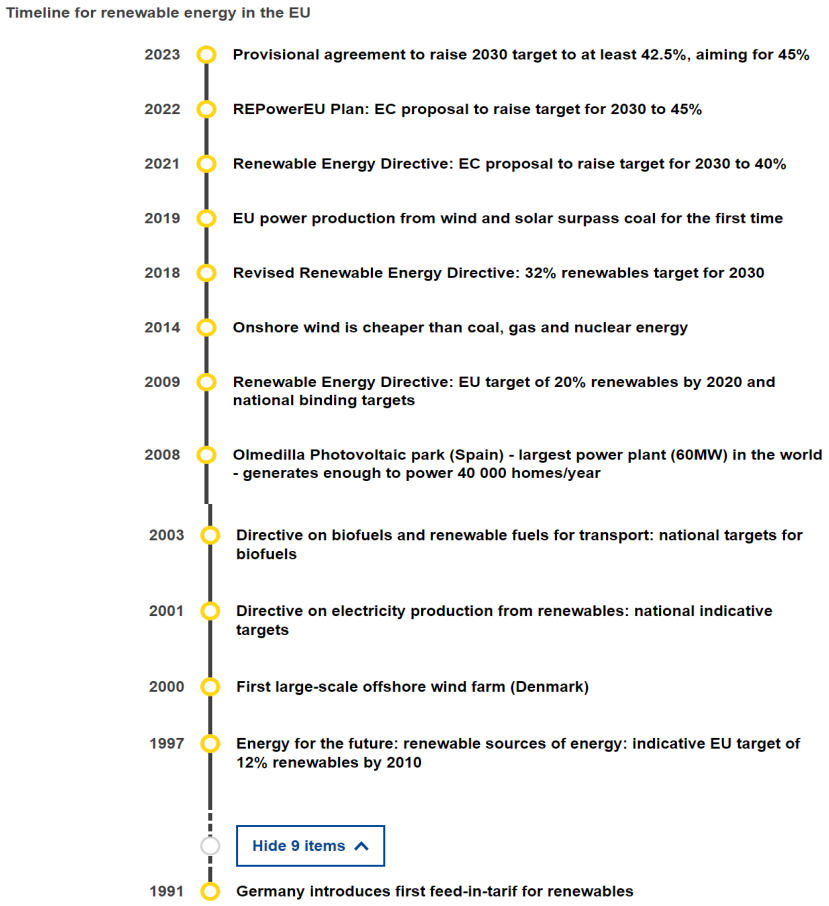
Energy Community

iea

CEER
Council of European Energy Regulators

Co-funded by the European Union

Replacement of fossil fuels =► Reduction of GHG emissions [2]



Role for renewable gases:
Biogas, biomethane, hydrogen, synthetic gases

Feedstock criteria / sustainability has to be verified

Wide range of usage:
Transport, heat & electricity production, industry

Different ways of transportation and storage

Development of production and application technologies

Energy Community

iea

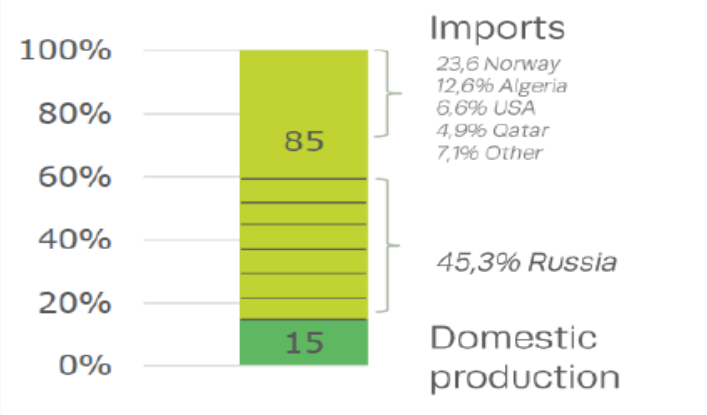
CEER
Council of European Energy Regulators

Co-funded by the European Union

Biomethane – why now? [1]

- **EU 2020 Strategy on methane emissions** - more biomethane in use = fewer emissions to the atmosphere from agriculture and waste
- **Fit for 55** - more renewable energy in the heating & cooling and the transport sector = more gases from RE origins
- **RePowerEU** – substitution of Russian gas by biomethane

EU dependency on natural gas 2021



Cost of biomethane vs natural gas

- Cost of **biomethane**: **From €55/MWh** to €120/MWh
- Expected cost of **natural gas** to remain high throughout 2022 and 2023
- Cost of **green hydrogen** today **€180/MWh**

Energy Community

IEA

CEER Council of European Energy Regulators

Co-funded by the European Union

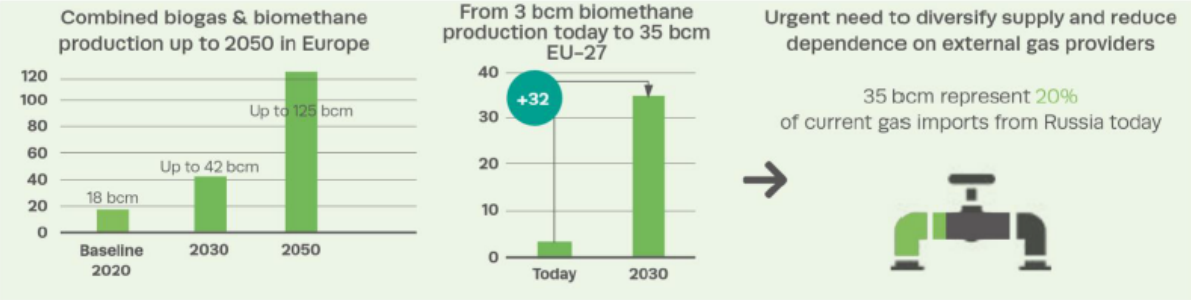
Biomethane – why now? [2]

Before REPowerEU

- The European Commission sets strong decarbonization targets (-55% of GHG by 2030) while leaving each Member State defining its own strategy regarding the development of biomethane 1G/2G and e-methane.

After REPowerEU

- European ambition: production of 35 bcm of biomethane by 2030



- European Commission's Executive Vice-President, Frans Timmermans, and the Commissioner for Energy, Kadri Simson, have launched the Biomethane Industrial Partnership (BIP, public-private partnership) in September 2022

First step: Gas for Energy Security

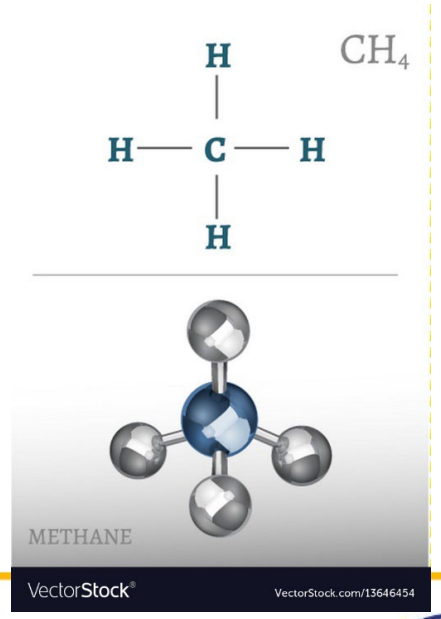
- Import of LNG/CNG from non-Russian origin
- Import and promotion of biomethane and RFNBO
- renewable hydrogen to decarbonise the industry
- significant increase of biomethane production: ~ 35 bcm until 2030
  - old target: 17 bcm
  - production 2021: 3 bcm

Energy Community · IEA · CEER Council of European Energy Regulators

Co-funded by the European Union

Biogas ? Biomethane?

- Biomethane = methane with biological origins
- Result of natural processes (agriculture, waste) or technological processes (in controlled conditions)
- Same gas as fossil methane **BUT**



Terminology' confusion:

natural gas ≈ methane [typically in Europe $CH_4 \geq 85\%$]

biomethane ≠ biogas [CH_4 50-75%; CO_2 25-50%]

► **biomethane = natural gas**

Energy Community

iea

CEER Council of European Energy Regulators

Co-funded by the European Union

Biogas & biomethane production

Current production

Europe was producing end of 2020 **18 bcm** (15 bcm of biogas and 3 bcm of biomethane) from **19,654** plants.

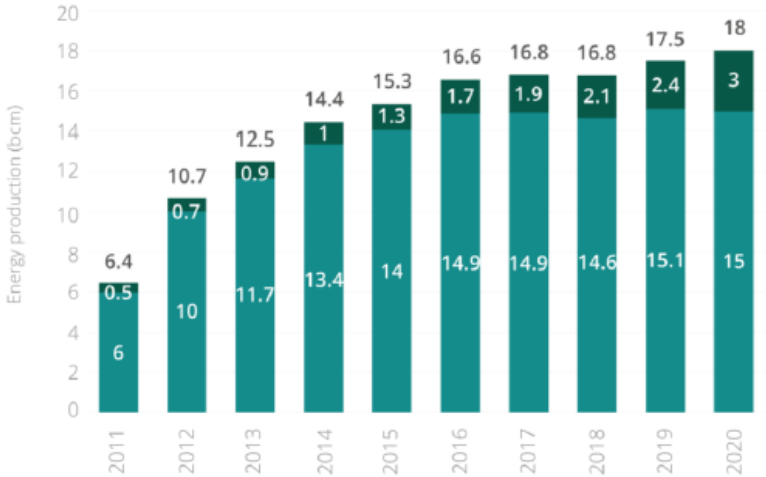


Figure 2.2: Combined biomethane and biogas production in Europe (bcm)

Relative to gas consumption

4.6% of EU gas consumption = Close to entire natural gas consumption of Belgium

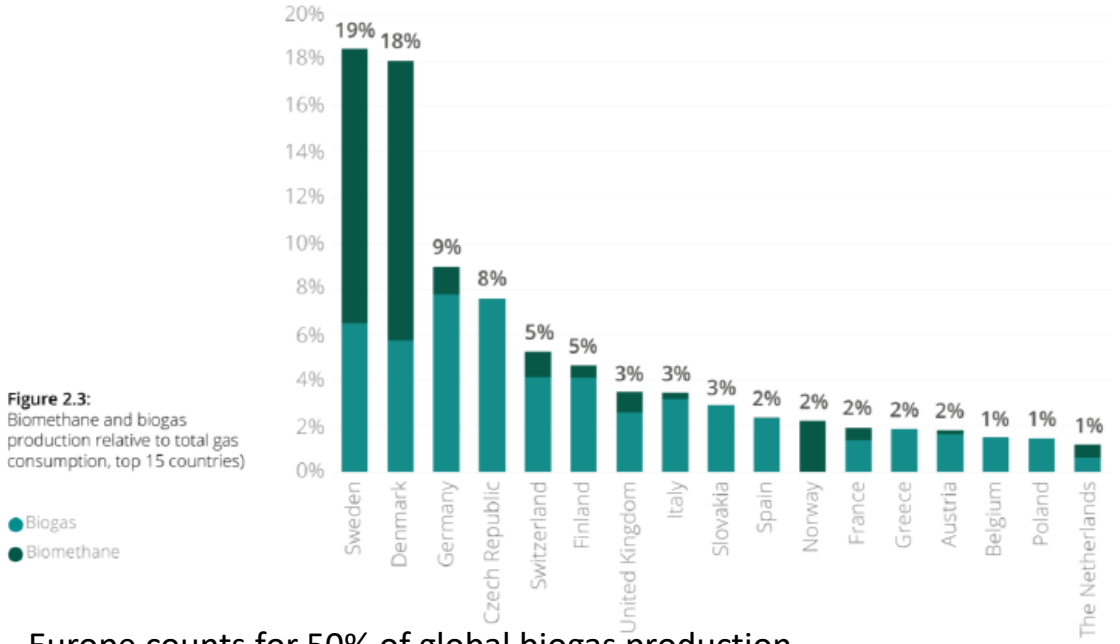


Figure 2.3: Biomethane and biogas production relative to total gas consumption, top 15 countries)

Source: EBA, BiogasPowerON 2022

Europe counts for 50% of global biogas production

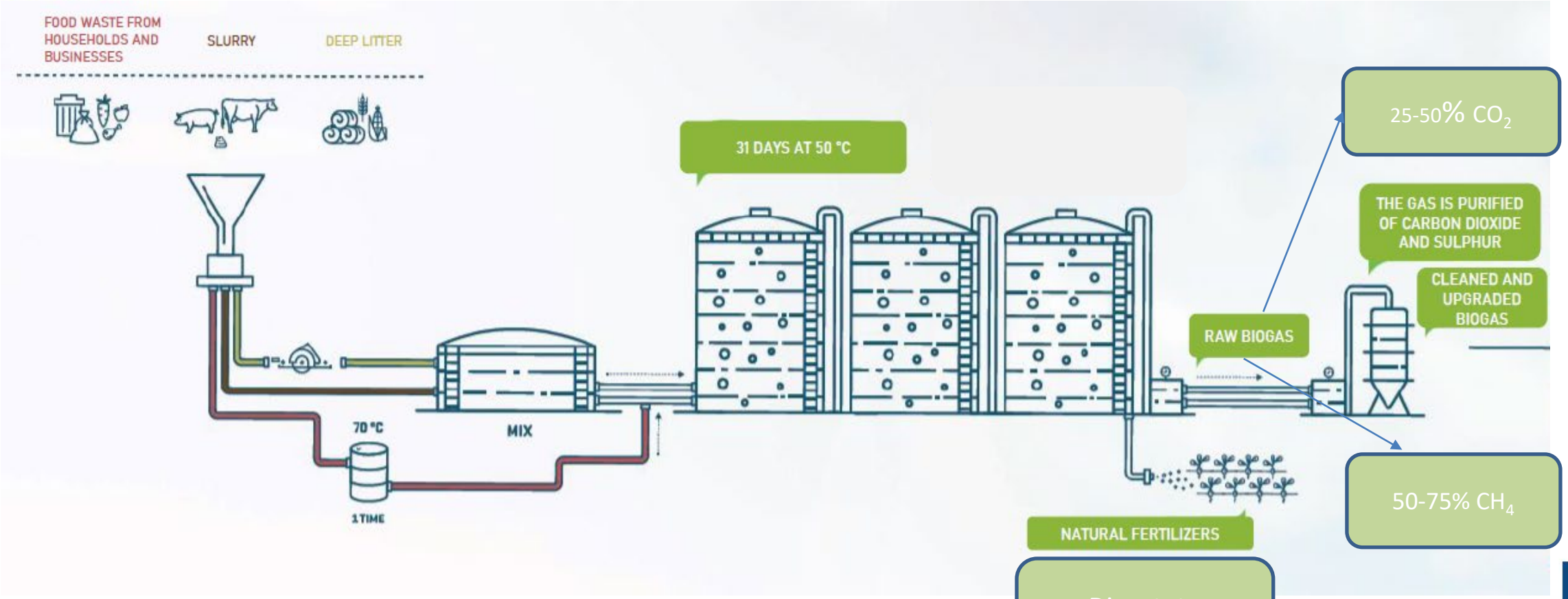
Energy Community

iea

CEER Council of European Energy Regulators

Co-funded by the European Union

Biogas production



Energy Community

CEER Council of European Energy Regulators

Co-funded by the European Union

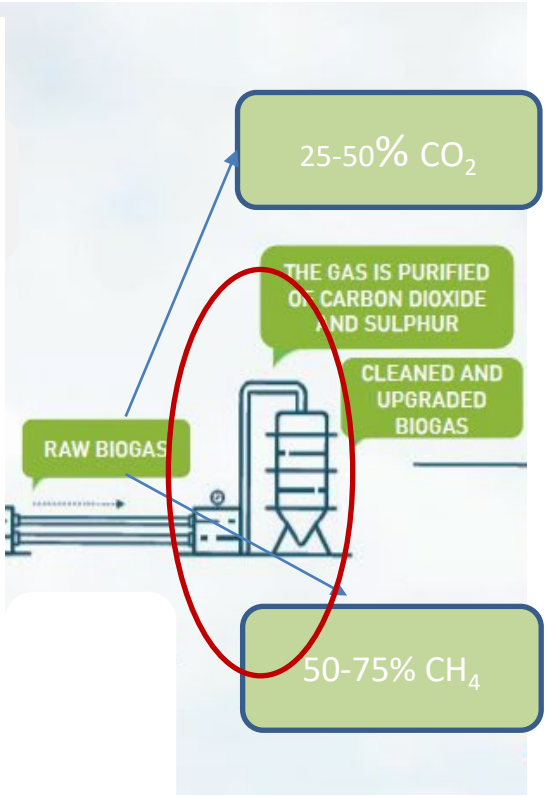
Biomethane production

✓Separation of CH_4 and CO_2

- Pressure Swing Adsorption (PSA)
- Water scrubbing
- Organic physical scrubbing
- Chemical scrubbing
- Membranes

✓Cleaning

- H_2O
- H_2S
- O_2, N_2
- Ammonia
- Siloxanes
- Particles



Energy Community

CEER
Council of European Energy Regulators

Co-funded by the European Union

Hydrogen = fuel of the future?

Trigger No 1:
Electricity is not easy to be stored, but easy to electrolyse water and make H_2

Issue No 1:
Not all electricity renewable

Trigger No 2:
No C (and CO_2) produced by using H_2

Issue No 2:
Is there enough water?

Trigger No 3:
Wide scope of application H_2

Issue No 3:
$\mathbf{H_2}$ is gas, with own characteristics

Issue No 4:
Low production and usage of $\mathbf{H_2}$ currently

Energy Community

iea

CEER
Council of European Energy Regulators

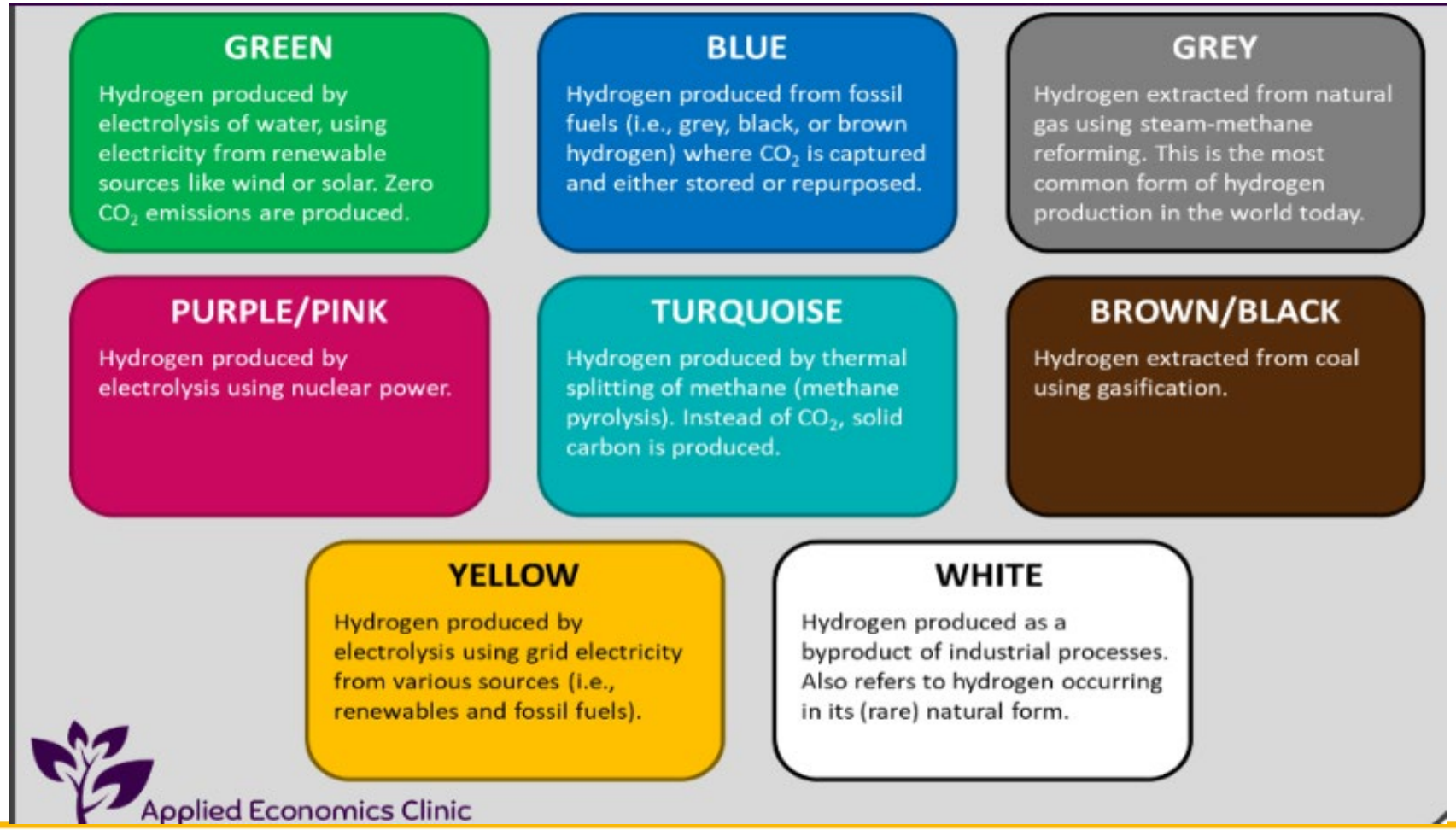
Co-funded by the European Union

Hydrogen current production

- Hydrogen is produced on a commercial basis today from natural gas
- It is used as a feedstock in the chemical industry and in refineries, as part of a mix of gases in steel production, and in heat and power generation
- Global production stands at around 75 MtH2/yr as pure hydrogen and an additional 45 MtH2/yr as part of a mix of gases
- This is equivalent to 3% of global final energy demand and similar to the annual energy consumption of Germany

Co-funded by the European Union

All colours of Hydrogen



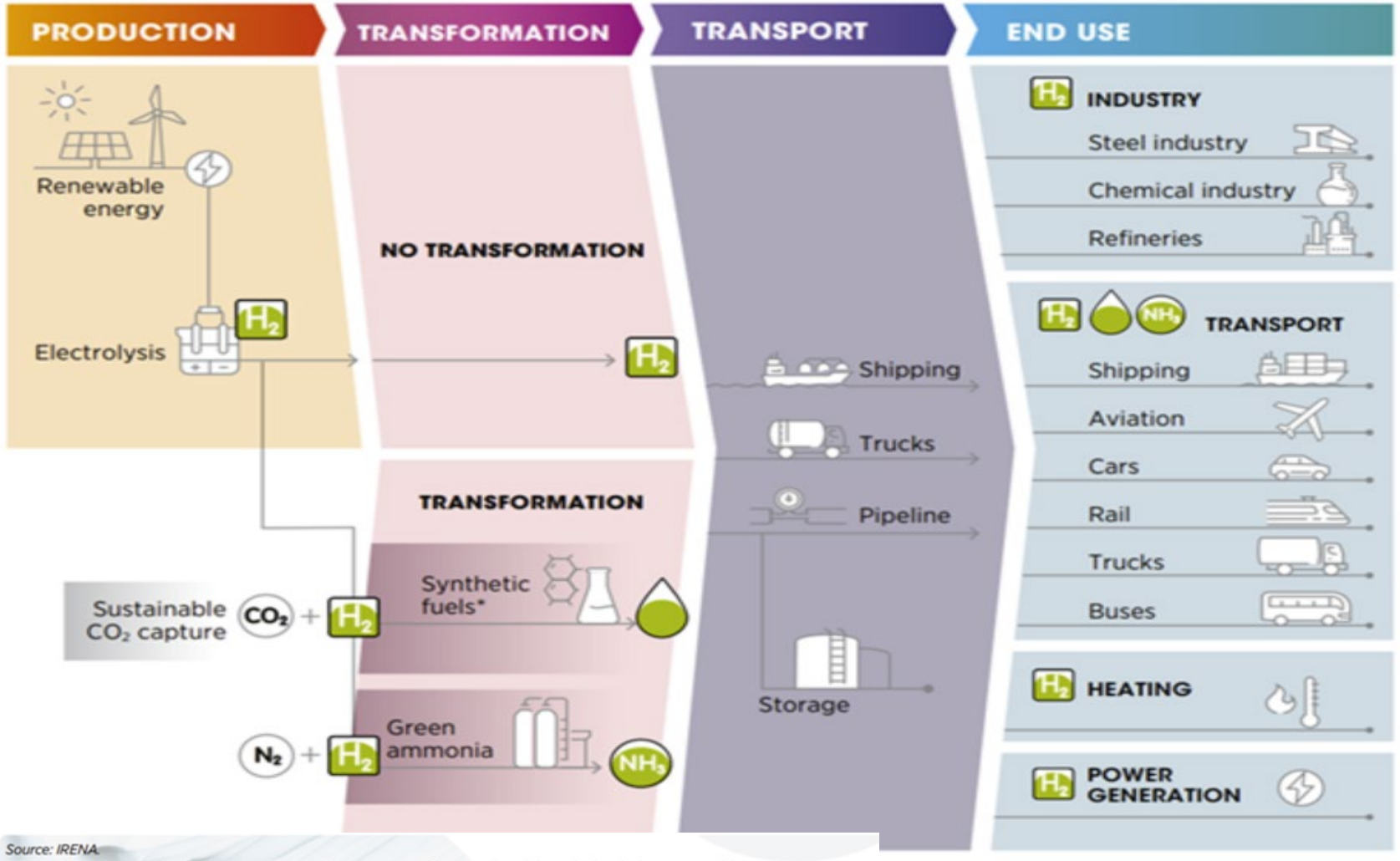
Issue No 5:
Could be enough **green H_2** produced?

Energy Community

CEER
Council of European Energy Regulators

Co-funded by the European Union

Hydrogen planed application



Source: IRENA.

* The term synthetic fuels refers here to a range of hydrogen-based fuels produced through chemical processes with a carbon source (CO and CO_2 captured from emission streams, biogenic sources or directly from the air). They include methanol, jet fuels, methane and other hydrocarbons. The main advantage of these fuels is that they can be used to replace their fossil fuel-based counterparts and in many cases be used as direct replacements – that is, as drop-in fuels. Synthetic fuels produce carbon emissions when combusted, but if their production process consumes the same amount of CO_2 in principle it allows them to have net-zero carbon emissions.

Issue No 6:
Transfer of H_2

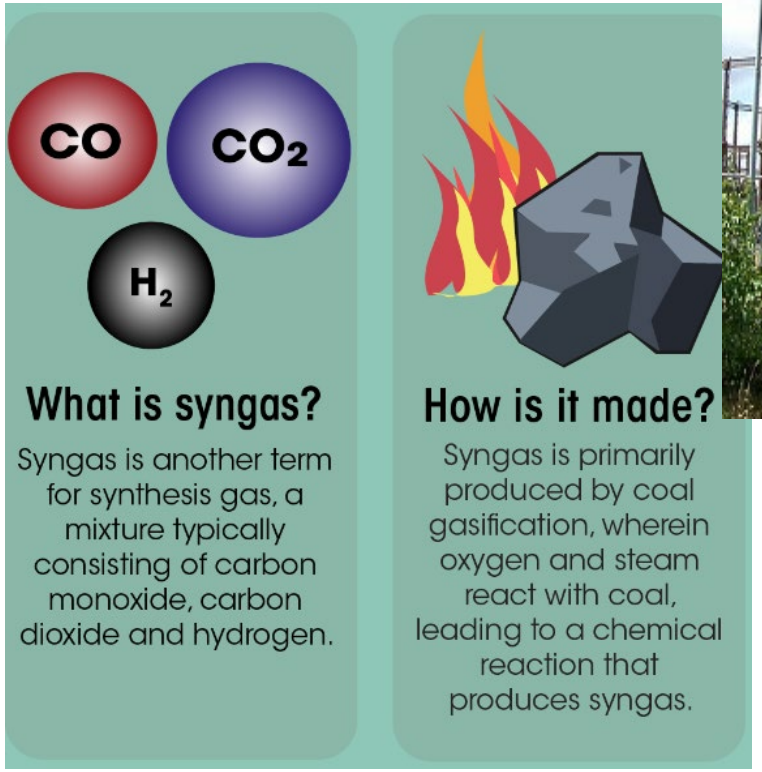
Energy Community

CEER
Council of European Energy Regulators

Synthetic gases

Co-funded by the European Union

As they used to be….

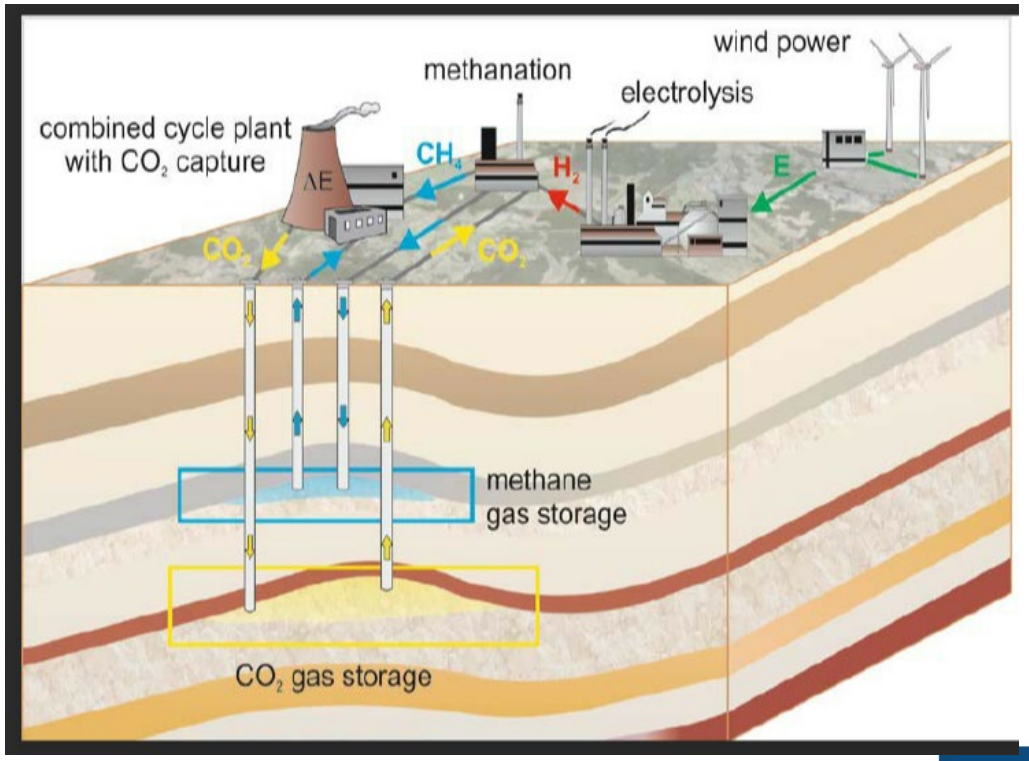


SNG

stands for

Synthetic Natural Gas

As they might come….



Energy Community

IEA

CEER
Council of European Energy Regulators

Co-funded by the European Union

New EU acquis to come soon

EU Methane Regulation

- Based on the Strategy on reducing methane emissions in the energy, agriculture and waste sectors, as these areas account for almost the entirety of anthropogenic methane emissions
- Establishment of **I**nternational **M**ethane **E**missions **O**bservatory
- Cross-sectoral approach
- Cross – border requirements
- Regulation in energy sector: OGMP 2.0 reporting, LDAR, ban on venting & flaring
- In waste sector: production of **biogas & biomethane**

https://energy.ec.europa.eu/topics/oil-gas-and-coal/methane-emissions_en#eu-methane-strategy

Gas Package amendments

- Based on the Hydrogen Strategy and Energy Systems Integration Strategy
- **Hydrogen** in gas networks
- Enabling the market to decarbonise gas consumption
- Put forward policy measures required for supporting the creation of optimum and dedicated infrastructure, as well as efficient markets.
- To remove barriers to decarbonisation and create the conditions for a more cost-effective energy transition

https://energy.ec.europa.eu/topics/markets-and-consumers/market-legislation/hydrogen-and-decarbonised-gas-market-package_en

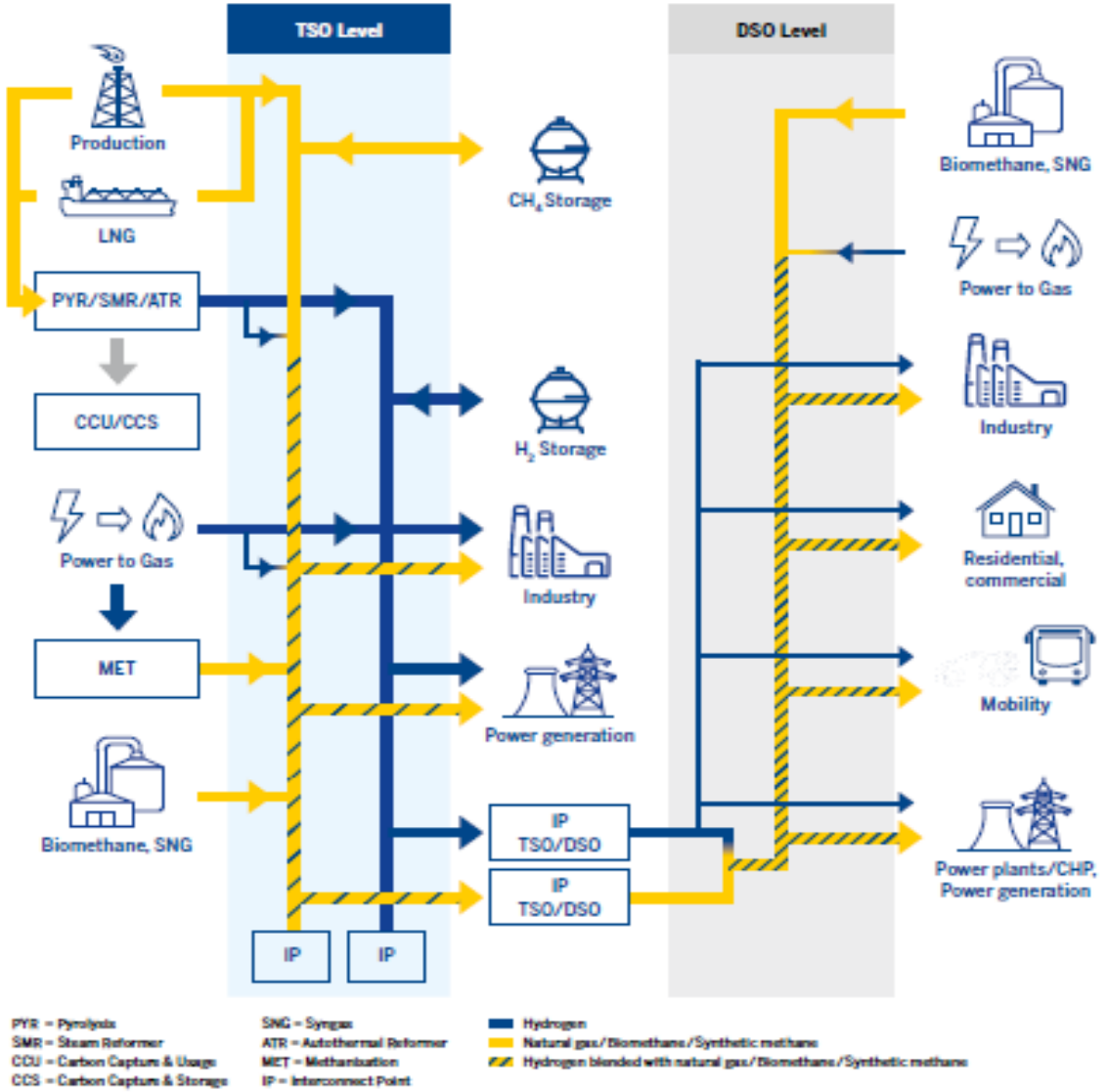
Energy Community

iea

CEER Council of European Energy Regulators

Co-funded by
the European Union

Future gas systems



Energy Community

iea

CEER
Council of European Energy Regulators

THANK YOU
FOR YOUR ATTENTION

karolina.cegir@energy–community.org

GET IN TOUCH

www.energy-community.org
Ener_Community
/company/energy-community
/Ener.Community
/EnergyCommunityTV

EU4ENERGY PHASE II