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# Sector coupling and future roles of different low-carbon and renewable gases

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# *What do we mean when we talk about sector coupling?*

- Electrification: with renewable energy sources, of end-user sectors such as heating and transport (demand side integration).
- Power to X refers to production of other energy vectors such as heat and liquids.
- Power to gas: integration of power and gas sectors (supply side) – decarbonization of the industry, heating and transport with increased us of hydrogen, biomass, biomethane and CCS.
- Sector coupling also includes the use of synthetic fuels which can be used in long-distance shipping and aviation.

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# *Why do we need it?*

- Objective: deliver net zero carbon economy by 2050
- *Benefits:*
- Cost: surplus electricity could be used to produce these sources and existing gas infrastructure can be used to transport them instead of investing in expanding the electricity transmission network.
- Enhanced flexibility: the ability of renewable and decarbonised gases to balance fluctuations in renewable production:
  - Existing gas storage can also be put in use to provide short-term flexibility and
  - Gas fired power plants or fuel cells can provide backup capacity.

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# *Biogas & Biomethane*

- Biogas: produced by making use of biomass, such as manure, waste and other products or landfill and silt gas. Biogas has historically been used in electricity production, heating and cooking and recently as a replacement to natural gas.
- Biomethane: purified and upgraded biogas to natural gas quality for safe injection of biomethane into the existing natural gas system.
- Many biogas and small-scale biomethane plants are already operating. Gas turbines can be adapted to biogas, biomethane, hydrogen and Combined Heat and Power could produce renewable heat and electricity efficiently.
- That being said, biogas could not replace current gas demand as feedstock, waste and agriculture sources are limited.

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# *Green (Renewable) Hydrogen*

- Green Hydrogen: produced via electrolysis by using renewable energy. Hydrogen can be used for several synthetic fuels such as methane, dimethyl ether and diesel jet fuel.
- One can produce renewable energy only for hydrogen but the economics are still not there (as fuel costs are high + insufficient competition between decarbonised gases and natural gas).
- Not every region in the EU has excess electricity. Most suitable for instance in Denmark and other coastal countries with ample wind potential.
- Refurbishment of existing infrastructure and new infrastructure may be needed.

# *Blue (low-carbon) & Grey Hydrogen*

- Grey hydrogen: Steam Methane Reformation (SMR) of natural gas or coal gasification which generates significant carbon emissions (but still the cheapest and mainly used in aluminum and steel production).
- Blue Hydrogen:
  - CCS is added to the SMR process to capture and prevent release of the Co2 (the process can be considered as low carbon)
  - Thermal Methane Pyrolysis: natural gas and a low-temperature, high-pressure reaction with no oxygen present to produce hydrogen and solid carbon.

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# *Carbon dioxide ($CO_2$) capture and storage (CCS)*

- CCS is a process consisting of the separation of $CO_2$ from industrial and energy-related sources, transport to a storage location and long-term isolation from the atmosphere.
- The capture of $CO_2$ could take place pre- or post-combustion. If it occurs after electricity is produced for instance this would be post-combustion. Pre-combustion capture takes place in the process of gas treatment, and it can also be as oxyfuel via the steel industry.
- Additionally, there is bio-CCS, the concept of Bioenergy with CCS. Biomass with CCS would also result in negative emissions.
- Methane Cracking is another method to store $CO_2$ as black carbon.
- The abatement success of CCS is highest in gas and chemicals.

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# *Can it be done on time and at scale?*

- Hydrogen is already commonly used in some industrial processes (ammonia production, low-carbon methanol, other chemicals & in the iron & steel industry).
- Equinor is working on liquid hydrogen: the Magnum Project (production by 2028).
- Cadent Gas and Leeds H21 projects in the UK, standardisation by CEN and Marcogaz conclusion on H2 injection.
- Other technologies: use of synthetic fuels in heavy duty vehicles, shipping and aviation.
- Europe is leading the industrial production of anaerobic digestors and electrolysers, with the development of renewable gas and decarbonised gas being perceived as good for growth and jobs.

# *Can it be done? Cont'd…*

- Investment in large scale CCS is actually still very modest, however there are also some promising developments:
- In 2017 and 2018 many $CO_2$ projects were considered as a PCI (Northern Lights, Rotterdam, Sapling, Teesside, ERVIA and Athos and TransPorts).
- Larger scale projects in the EU include H-vision in Rotterdam, a Blue Hydrogen project with participant including leading European energy companies such as BP, EBN, Engie, Equinor, Gasunie, GasTerra and Shell among others.
- In Port of Rotterdam, Gasunie and EBN are jointly preparing a new project, Porthos, in which $CO_2$ generated by industry in Rotterdam's port area is captured and stored in empty gas fields deep under the North Sea seabed. The first $CO_2$ injection is planned for 2023.
- A similar project is underway in the Port of Amsterdam, called Athos, which is close to big gas fields.

# What do we need: 2020 Gas Package

- Impact study for how much hydrogen can be transported via existing pipelines & need for new infrastructure i.e. for biomethane, oxyfuel or hydrogen.
- Introduction of an EU target for renewable and decarbonised gases
- Taxonomy of gas to demonstrate climate credentials.
- Blueprint for guarantees of origin for hydrogen.
- Market design to enable renewable and decarbonised gases to reach maturity and development at scale and to be integrated in the wholesale market.
- Sector coupling: access tariff methodologies to enable competition between power to gas, gas from storage, LNG or electricity storage
- Reflect the importance of the DSO system as gas grids become more local
- Research and innovation funds to be more available and accessible for competitive carbon neutral industrial solutions.

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# *Where are we now?*

- ACER public consultation on the future legislative action:
- Approval power or to develop guidelines on TYNDP so that competition could be introduced for decarbonised gases as the TSOs have a natural monopoly element and this may result in a barrier to the integration of renewable gases or other not-network based solutions.
- Develop TYNDP cost benefit methodology or guidelines so that it can reflect decarbonisation and give consideration to the development of a pure hydrogen network (third party access rules etc.)
- TYNDP 2020 scenarios: ENTSOG is working with ENTSO-E for an interlinked approach to the assessment of the gas and electricity infrastructure to facilitate synergies to create hybrid energy carries as a necessary condition to achieve the climate and energy targets for 2050 in a competitive and secure way.

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# *What can the Energy Charter offer?*

- Model Agreements for cross-border trade of renewable and low-carbon gases
- Investment protection
- Facilitate technology & knowledge transfer
- Awareness raising & training

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# *Definition of investment protected under the ECT*

- The notion of investment under the ECT is defined broadly: When read together with the Annexes which are integral part of the Treaty, investment that can be protected and promoted under the ECT must be "*associated with economic activity in the energy sector*".
- An economic activity in the energy sector means: exploration, extraction, refining, production, storage, land transport, transmission, distribution, trade, marketing, or sale of Energy Materials and Products, or concerning the distribution of heat to multiple premises.
- The travaux, commentary and case law all indicate that the terms "associated with" is drafted to broaden the scope of the ECT coverage rather than restrict it.

# *Energy Materials and Products*

- Energy Materials and Products (EMP) are defined in three broad but exhaustive categories: nuclear energy; coal, natural gas, petroleum and petroleum products, electrical energy; and other energy.
- […..] *petroleum gases and other gaseous hydrocarbons*.
- […..] *coal gas, water gas, producer gas and similar gases, other than petroleum gases and other gaseous hydrocarbons.*

# *Modernisation of the Energy Charter Treaty*

- In November 2017, the Energy Charter Conference confirmed in Ashgabat the launching of a discussion on the potential modernization of the Treaty.
- *In July 2019, the EU Council has given a mandate to the European Commission to begin negotiations on the modernisation of the ECT. It also adopted corresponding negotiating directives*
- The negotiating mandate is expected during 2019.
- The process could take at least 2 years of negotiations.

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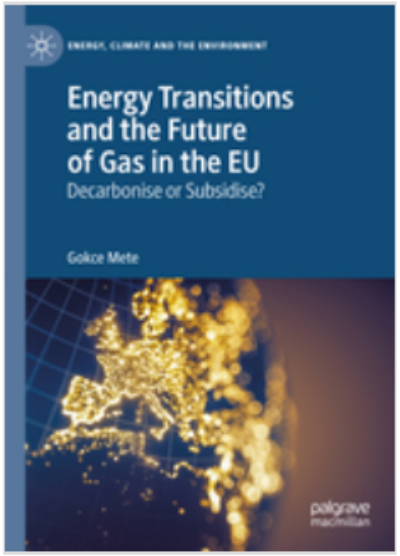




## Energy Transitions and the Future of Gas in the EU

### Decarbonise or subsidise?

Authors: **Mete**, Gokce

Provides an overview of the ongoing revision of EU regulations on natural gas, renewable energy, electricity market and the energy transitions

Engages in the important debate on the cost of EU energy

Offers new approaches to shift the current EU energy security paradigm that enables subsidies for fossil fuels

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