ENTSOG's contribution to "Future climate and energy policy – a Strategy for long-term EU greenhouse gas emissions reductions

The role of ENTSOG (the European Network of Transmission System Operators for Gas) is to facilitate and enhance cooperation between national gas transmission system operators (TSOs) across Europe and to ensure the development of a pan-European transmission system in line with European Union energy goals. Participating in this EC Consultation on ''EU Long-term Strategy for Emissions Reduction'', ENTSOG welcomes the opportunity to discuss the EU vision for a modern, clean economy. ENTSOG commented also the EC technology assumptions for the PRIMES model used to run the EU strategy scenarios.

EC Consultation questionnaire in some places offers only electricity-based answers/solutions, without consideration that a hybrid or gas-based solutions can address the challenge of decarbonization, but such solutions are not presented on a level playing field with electricity solutions. In some parts of the questionnaire, the presented options do not represent enough of complexity and technology neutrality needed for development of the path for a long term emissions reduction.

Successful decarbonization can be reached if none single EU member loses their competitiveness and societies accept the consequences of the transition. Therefore, all technologies, specifically those able to decarbonize non-ETS sector should have the conditions to contribute to reaching overall decarbonization targets.

Gas sector, actively participating in the energy transition, offers: innovative grid optimisation projects, new technologies and business model developments, digitalization of broader sectors of economy, cybersecurity gains, energy system resilience and last-but-not-least: jobs creation. EU global leadership in i.e. electrolysers is only one example of positive technology innovations that can bring even competitive advantage in the longer run. Increasing shares of intermittent RES and the desire for further electrification pose enormous challenges for the electricity system. The EC itself has estimated investment needs to enable a transition to a low carbon economy at more than 1 trillion euro by 2020[1] in its Energy Union Package from 2015.

For achieving the climate targets by 2050, the all electric scenario comes at a total extra cost of EUR 1150 billion compared to the ''Zero Carbon Gas'' pathway (Poyry 2017). Cost efficiency with green gases vs full electrification demonstrated by other studies shows big scale savings: Ecofys ''Gas for Climate'' study 2018 estimates €138 Bn per annum savings; Dena-Leitstudie (pilot study) estimated up to €600Bn total savings in Germany alone assuming a technology-neutral approach instead of high electrification. Therefore Long-term EU competitiveness should not be based on one type of solution (full electrification). *By keeping the technologies basket open for all promising technologies supporting decarbonisation, modern economy not only creates necessary drive for R&D and innovation, but also maximises the synergies between the existing infrastructures and upcoming business models. "Picking-the-winner"/"silver bullet" approach will not be possible – all options for carbonization should be pursued.*

ENTSOG Members, EU gas TSOs, run about 65 pilot/testing projects (full list to be found soon at www.entsog.eu) aiming at scaling solutions for cost effective energy transition. They include usage of the existing gas infrastructure and developing: Power2Gas, biogas, hydrogen and CCS/CCU at the industrial scale. TSOs act under the Gas-For-Climate (https://gasforclimate2050.eu/), Green Gas Initiative (http://www.greengasinitiative.eu/), and within European Power-to-Gas Platform (http://europeanpowertogas.com/). The most advanced projects i.a. are: Amprion/OGE P2G initiative, H21 Leeds City Gate, Gasunie Port of Rotterdam.
ENTSOG members have chosen to work on those projects because they believe that building on both electricity and gas, cross-border energy carriers, can bring more efficient, resilient, sustainable as well as cheaper than an all-electric energy infrastructure, able to decarbonize industry, heating and reduce GHG emissions in the whole economy.

[1] http://eur-lex.europa.eu/resource.html?uri=cellar:1bd46c90-bdd4-11e4-bbe1 01aa75ed71a1.0001.03/DOC_1&format=PDF

*1. **Key messages on gas TSOs input to the EU emissions reduction and future of the energy sector***

- *Europe needs a more holistic view on energy systems based on the capacities of electricity and gas networks, capable to build on optionality, synergy and redundancy offered by the dual system while ensuring the most efficient solutions in terms of cost and timing.*

- *Gas will have to become a low-carbon technology, e.g. through a combination of CCS, CCU and a significant production of hydrogen, synthetic methane and biogas. Increasingly renewable and decarbonised gases will contribute to a cycle-based economy.*

- *"Gas before coal" scenarios are low hanging fruits for a significant reduction of CO2, NOx, SOx emissions and will help to improve air quality as a quick gain affordable for all Member States; more efficient carbon-pricing mechanisms needs to be in place to incentivize the switch from coal to gas.*

- *Gas-fired power generation is a flexible and economically viable partner for the volatile RES-based power generation. The role of the gas infrastructure goes far beyond covering demand from an annual perspective. In particular the gas infrastructure has a key role in ensuring that energy demand can be met whatever the season, including under extreme climatic or supply situations. A proper framework for valuing the peak shaving ability optionality and flexibility offered by the gas infrastructure needs to be in place.*

- *Thanks to the growing maturity of Power-to-Gas technology, gas networks can connect the electricity RES production centres with local consumption centres, specifically important when electricity connections are missing, and their implementation would be too costly or lacking public acceptance. The gas infrastructure offers a significant energy storage potential, either directly through physical gas storages and/or indirectly through storing electricity generated by intermittent RES production in the form of hydrogen, synthetic methane or biogas, ready to bridge "no-wind" / "no-sun" scenarios. In order to capitalize on this, an enhanced cooperation between electricity and TSOs and DSOs is necessary, both regarding planning and operations: physical flows and data exchange.*

- *The gas networks are an asset where the main part of investments have already been done, and which offers substantial optionality, designed to cope with peak volumes and capable to transmit more energy in gaseous form than the electricity grid. The existing gas networks are not influenced by the NIMBY (Not In My Backyard) phenomena - unlike the large-scale development of electricity grids.*

- *There are parts of the economy that to a large extent still need to rely on gas, may it be as hydrogen, synthetic methane or natural gas, as a feedstock for technological processes (e.g. fertilizer production or the steel industry). In both, the medium and the long-term perspective, gas TSOs should be able to cover those needs. Therefore, the deployment of the innovative biogas, hydrogen, P-2-G and CCS/CCU technologies will be important, from the system and industrial user point of view.*

- *In order to avoid massive new investment by end consumers in the residential heating sector, the existing gas infrastructure should be used to the largest extent possible. Gas networks offer solutions and bring immediate social benefits like improved air quality.*

- *To reflect the role of the network operators in the future decarbonised energy system, it is necessary to establish a framework for valuing the necessary investment and enabling innovation, system optimisation and adaptation of all the components of the network services (energy transit, transmission and storage). Certificates for green gases (origination tracking) could be one of the tools for this.*

- *Climate and energy policy have to go hand in hand with foreign policy in order to ensure that the relevant non-EU countries (e.g. major gas producers or countries with high potential for biogas production) contribute to "greening of gas" while trying to maintain a reasonable economic balance between producing and consuming countries.*

2. *Quantification of CO2-reduction potentials by switching from carbon intensive fuels to natural gas in the short term. Development of the decarbonised and renewable gases in mid/long term.*

- ***Power Sector***

  Examples have shown (UK – coal phase out in power generation, US – replacement of coal by gas) that the phase out of coal and heavy fuel oil in power generation and in some heating applications can quickly reduce CO_2 emissions and also significantly improve air quality.

  Given the highly developed, meshed gas grid in most of Europe and the not fully utilized import capacity, in conjunction with a globally well supplied gas market would enable a significant substitution of coal and oil by gas without problems of availability of natural gas or security of supply isssues. Such a set of measures would enable several EU member states to quickly and inexpensively achieve their energy and climate goals.

  *As an illustration, for the 2025 time horizon, ENTSOs TYNDP 2018 Scenarios look at two alternative scenarios with the exact same background except for coal being favoured over gas or alternatively gas being favoured over coal, mostly in the power sector. Within the limits of the TYNDP exercise, this showed that switching one third of coal generation to gas generation would already allow to reduce the overall gas and power sectors CO_2 emissions by 10% (together with increasing gas demand by 500 TWh/y). This also shows that a **total switch of coal generation to gas could theoretically reduce CO_2 emissions by 30%** for the overall gas and power sectors (ca 400 Mt CO2).*[2]

  The existing gas infrastructure can also serve as an efficient flexibility option using Power-to-Gas and hybrid end-user technologies. In general Power-to-Gas (in combination with gas-to-power) and the gas infrastructure itself can be used on the one hand to store surpluses of intermittant renewable electricity until demand exceeds the actual electricity production and on the other hand to stabilize and providing flexibility to the electricity grid itself and thus contribute to a continuous electricity supply. Redispatch costs rose by 75% and reached 1,4 billion EUR only in German in 2017 3. Furthermore, only 11% of a total 7900 km of new power lines designated to accompany new renewable electricity generation have been built so far, mainly due to public opposition. Power-to-Gas and the use of the existing gas infrastructure can reduce dispatch costs as well as power grid expansion needs and therefore increase societal acceptance.

- ***Residential and Tertiary Sector***

  Carbon emissions in the residential and tertiary sector are mainly driven by heat generation. Gas fueled end-user appliances with efficiencies around 98% provide both a low carbon heating solution and low purchasing costs[4] *compared to coal, oil and electric heating. By switching from coal and oil to gas up to*

[2] ENTSOG, based EU statistics and own calculations

[3] https://www.reuters.com/article/germany-energynetworks/german-power-gas-grids-co-operate-on-storage-plans-up-to-2030-idUSL8N1TM2WY

[4] "Technology pathways in decarbonisation scenarios", ASSET, 2018, https://ec.europa.eu/energy/sites/ener/files/documents/2018_06_27_technology_pathways_-_finalreportmain2.pdf

15% of the residential and tertiary sector's total emissions can be saved[5]*.*

ENTSOG also supports the further penetration of hybrid heating solutions such as hybrid heat pumps. Whereas the efficiency of electric air sourced heat pumps depend on the outside temperature and can drop to below 2 at extreme situations, modern gas condensing boilers operate constantly at high efficiencies. The EU gas infrastructure is currently able to offer 33 000 GWh/d (1375 GW) of peak capacity, as the infrastructure is designed to cover an extreme peak demand (1-in-20 year or even stricter depending on countries) and it's is important to consider this security of supply aspect with regard to a highly electrified residential sector.

- ***Industrial Sector***

  The industrial sector's emissions can be reduced by up to 14% immediately by a total switch from coal and oil to natural gas. As for the power sector carbon emissions in industry can be reduced totally by the immediate application of carbon capture and storage/utilisation technologies (CCS and CCU).

- ***Transport***

  Gas as a vehicle fuel is available as compressed natural gas (CNG) and liquefied natural gas (LNG). Using natural gas emissions can be cut by 7% compared to diesel and 23% compared to gasoline in passenger transport, and between 6% and 16% in road freight transport, respectively.[6]

- ***Gas supply***

  In the medium term gas has the potential to be gradually decarbonized by mixing biomethane and other "green gas" volumes produced from e.g. P-2-G or through separation of carbon from natural gas during production or before consumption, combined with CCS or CCU.

  Using these potentials we believe that the average carbon content of gas can be substantially reduced while making full use of the existing gas infrastructure on the transmission, distribution and consumer levels. In combination with the replacement of other, more polluting fossil fuels, gas can play a prominent role in meeting EUs climate goals faster and at affordable cost.

  Biogas is already produced and used in a number of EU member states, but mostly on a small scale. When upgraded to biomethane, it can be injected in the distribution or transmission grid. Between 2011 and 2016, the EU-level production of biomethane has increased by a factor 20 to 1.5 Bcm[7]*.*

  Some studies are showing a possible potential for producing biomethane up to 45 Bcm[8] *by 2030. The potential for producing (only) biomethane by 2050 could reach up to appr. 100 Bcm and more than 120 bcm for all renewable gases per year according to the recent Ecofys Gas for Climate study*[9]*.*

---

[5] ENTSOG, based EU statistics and own calculations

[6] NGVA, https://www.ngva.eu/policy-priorities/decarbonisation/

[7] https://www.entsog.eu/public/uploads/files/publications/Events/2017/tyndp/EBA_Biogas%20and%20biomethane-final.pdf

[8] http://www.geode-eu.org/uploads/GEODE%20Germany/DOCUMENTS%202016/EUSEW%20presentation%20PHL%20.pdf

[9] http://www.snam.it/export/sites/snam-rp/repository/file/Media/Comunicati_stampa/2018/Ecofys_Gas_for_Climate.pdf

3. Additional feedback to survey-questions with limited answer options/characters:

- ***<u>How can opportunities and challenges (in particular related to carbon intensive sectors or regions) be addressed? What key economic transformations should the EU pursue to achieve a low carbon and resilient economy?</u>***

  ENTSOG believes EU economy will benefit from closer cooperation of the two international energy carriers: electricity and gas, to form a dual/Hybrid Energy System building existing and coming infrastructure and through Power2Gas technology and increasingly decarbonised gas deployment in the system.

  When exactly does building on existing gas infrastructure makes sense?

  - *Whenever the flexibility and optionality is needed on the electricity side i.e seasonal fluctuations and emergencies*
  - *In peak demand situations i.e.in no-wind/no-sun & high-demand situations*
  - *To address the need for long term energy storage ex. via P2G as complementary to short-term batteries*
  - *Where heating and mobility cannot come from electricity*

  EU framework should ensure that interaction and synergies between the two systems and application of innovative gases is fully enabled.

- ***<u>What are the biggest opportunities, including for the wider economy? What are the biggest challenges, including as regards public acceptance or the availability of land and natural resources, related to these future developments?</u>***

  By using the two different, existing energy systems / infrastructures (electricity and gas) the resilience of the whole EU economy can be improved, as hybrid energy system will also be more sustainable and less vulnerable on cyberattacks than all-electric system.
  To support the ''EU Long term strategy for GHG emissions reduction'' we propose to take a more holistic and neutral approach. Looking at both EU economy and decarbonisation ambitions, currently challenges in energy sector represent:
  <u>Supply/ Technology related challenges:</u>

  - *Missing/costly large scale short and long-term energy storage technologies,*
  - *The long-term cost and viability of P2G large scale units with and without methanation,*
  - *The degree to which carbon free fuels (gas and liquids) will be produced in Europe or imported from countries with low cost production possibilities*
  - *Pace and economy of electrification or gasification of passenger vehicles including infrastructure,*
  - *Pace and economy of other low carbon options for powering/fuelling heavy-duty vehicles, train and maritime transport,*
  - *Evolving smart grid and decentralisation options,*
  - *Assessing the degree to which efficient electrification of industrial energy use is viable at all.*

  <u>Demand/consumer related</u>

  - *Potential and limits of demand side measures,*
  - *Consumer choices/affordability of decarbonization of the heating sector in general*
  - *Acceptance and ability of end-users to invest in efficiency measures*
  - *Costs, speed and social acceptance of the future electricity grid needed for full electrification (NIMBY phenomenon).*

''Molecules can help electrons'' in addressing both types of challenges for systems and citizens, by contributing to long term energy storage, delivering missing system flexibility, alleviating limitation of electricity to fuel maritime or aviation mobility, improve air quality in general. Cooperation between the technologies will define new types of partnerships between electricity and gas – in electricity generation, mobility and heating. This will require more of joint planning and cooperation between the infrastructure operators, market participants and consumers.

- ***On which cross-sectoral domains should R&D efforts focus in the coming decades? Is there a particular need for large scale deployment of certain innovative technologies? Is there a different role for authorities and private sector in support R&D and Innovation?***

R&D constitutes legitimate cost of the transition. Progressing towards decarbonisation, gas infra operators will face a need for innovation which should be properly recognised and remunerated. Major areas of further R&D needs are:

- *Decarbonised gas technologies:*
  - *Carbon neutral Green Hydrogen from Power-to-Gas (P2G) processes using renewable electricity;*
  - *Carbon neutral Blue Hydrogen produced from natural gas in combination with carbon capture and storage/use;*
  - *Carbon neutral Grey Hydrogen coming from the electrolysis*
  - *Carbon negative Synthetic Methane produced from biogas or P2G;*
  - *Carbon neutral Biogas and biomethane produced from municipal waste, agricultural residues and sewage.*
- *Power2Gas,*

  P2G, in combination with the use of existing gas transport and gas storage infrastructure can offer a reliable and economical way to make up for excess or missing renewable electricity in "grid storage" volumes. It is relevant to launch R&D programs related to scaling up and analysing local potential and the need for Power-to-gas technology potential to absorb excess electricity and long-term storage as well as supplying gas for electricity generation when needed.

- *Decarbonised Gas/Hydrogen as a feedstock and high temperature processes in Industry:*

  In sectors like the steel and chemical industry where currently large amounts of gas and coal are used in the processes themselves, there are a number of R&D projects trying to replace these fossil fuels by H_2, locally produced from RES with the goal of massive CO_2 emission reduction. The gas industry is ideally placed to provide carbon free H_2 (green H_2) on industrial scales to small, medium and large industrial companies. Given the right framework, gas infrastructure can be adapted to store and transport green H_2 to industrial companies of different sizes, enabling them to reduce CO_2 emissions, without massive local investments.

- *Hydrogen in end-user appliances*

  Testing the application of decarbonized and renewable hydrogen to the all types of end-user appliances, for both residential and industrial usage.

- ***Will the sector that you are active in require significant additional investment in the context of a transition to a low carbon economy? For the sector that you are active in, is there a financing gap for making the transition to a low carbon economy?***

  Technically, full decarbonisation of the gas sector is possible. It will depend on economic and regulatory drivers. Renewable and decarbonised types of gas need conditions for industry scale development. This will require proper incentive and support schemes.
  R&D programs, support/financial/regulatory framework and regulated entities'(TSOs/DSOs) roles and responsibilities would need to evolve to ensure full readiness and speed of change in the gas sector.

  Support schemes should promote technology commitment for all viable business models, through combination of the public and private investment.

  Since TSOs are supervised by regulators for energy, there is a need to clarify with the NRAs what is the suitable regulatory treatment of new investments to maximise societal value – inside or outside the Regulated Asset Base of the system operators. To secure the speed of investment projects TSOs/DSOs should be allowed to enter transparent investment schemes for hydrogen, biogas, enabling to experiment, test, own, operate the energy conversion facilities.

- ***Do you have an example that you think is of particular importance to underline the role of such local and private sector actors in supporting the low carbon economy and energy transition?***

  In November 2018, a list of ENTSOG members innovative activities related to decarbonisation of the gas sector will be available at www.entsog.eu. The list will be updated regularly.