ENTSOG 2050 ROADMAP

ACTION PLAN

OCTOBER 2020

ABOUT ENTSOG

The European Network of Transmission System Operators for Gas (ENTSOG) is composed of 44 gas Transmission System Operators (TSOs), 3 Associated Partners from all over EU and 9 Observers from beyond EU.

ENTSOG was established on 1 December 2009 and was given legal mandates by the EU's Third Legislative Package for the Internal Energy Market, which aims to further liberalise the gas and electricity markets in the EU.

With new challenges ahead to meet EU Climate and Energy goals, ENTSOG with the expertise of its members and in dialogue with European Commission (EC), Agency for the Cooperation of Energy Regulators (ACER), industry and other stakeholders will collaborate to achieve the decarbonisation of the gas grids.

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RATIONALE AND SCOPE OF THE ACTION PLAN

RATIONALE AND SCOPE

In December 2019, ENTSOG launched its 2050 Roadmap for Gas Grids, which set out its vision and concrete actions on how gas grids can play an essential role in helping Member States to achieve net-zero emissions by 2050. ENTSOG Roadmap proposed three parallel – and co-existing – pathways for decarbonising the European gas infrastructure – the Methane Pathway, the Blending Pathway and the Hydrogen Pathway.

The guiding principle of the ENTSOG Roadmap is that the future European energy infrastructure will build on both electrons/cables and molecules/pipelines and that the gas infrastructure will provide substantial contributions to a faster and more cost-efficient transition of the European energy sector, towards carbon neutrality. The ENTSOG 2050 Roadmap outlined seven areas of recommendations for the future framework for decarbonising the gas infrastructure:

Figure 1: ENTSOG Recommendations, ENTSOG, 2019.

The Roadmap publication was followed by extensive dialogues with stakeholders through ENTSOG Public workshops held in Q1 and Q2 of 2020, numerous other events and many bilateral meetings with electricity, hydrogen, gas and industry associations.

On 8 July 2020, the European Commission published its Strategies on Hydrogen and Energy System Integration respectively and the intention is to follow-up on these strategies with legislative proposals in 2021. Recommendations of ENTSOG 2050 Roadmap for Gas Grids have broadly been reflected in the EC strategies.

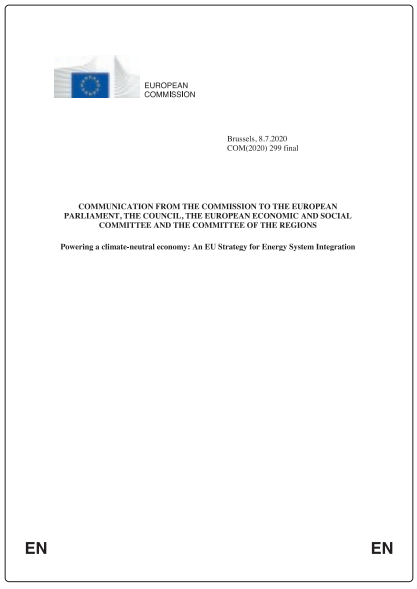
ENTSOG RESPONSE TO EC STRATEGIES

The EU's Energy System Integration and Hydrogen Strategies mark a new stage in the EU's thinking on some aspects, leading ENTSOG to update its actions plans for the delivery of ENTSOG's 2050 Roadmap. ENTSOG decided to respond in a pragmatic and constructive way, as both Strategies foresee hydrogen to be one of the central pillars of the EU's long-term energy system, that will be especially important for heating, for hard-to-electrify sectors such as energy-intensive industry, and heavy-duty transport1.

The debate on achieving cost-efficient decarbonisation is moving very quickly at the EU level. ENTSOG has therefore reviewed the recommendations contained in its initial 2050 Roadmap, which basically remain valid. However, more pragmatic and quicker actions are needed, to correctly prepare the first (IPCEI, SET, Recovery) projects in practice and develop concrete input to the regulatory framework (TEN-E, MRR, REDII, ETS, Sustainable Finance, Gas Directive and Regulation). In the context of **the Energy System Integration, all these agendas will require an organised and coordinated response of hydrogen, gas and electricity**.

Upon review of the EC strategies, it was decided to hereby propose this Action Plan, with practical actions and contributions that ENTSOG and its members can provide. **Building on accumulated expertise of gas TSOs, existing TSOs' land use rights, we believe that quicker and more cost-efficient energy transformation is in a direct reach within the timescales proposed by EC's strategies.**

ENTSOG took part in the public consultations leading up to the Hydrogen Strategy and Energy System Integration Communications. The EC strategy papers reflect a clear support for promoting hydrogen R&D, markets, and infrastructure - including a growing understanding of the vital role that gas grids will play to deliver the hydrogen economy.

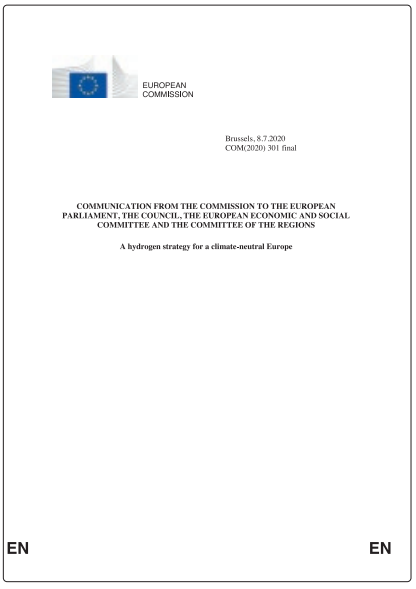

EUROPEAN COMMISSION

Brussels, 8.7.2020
COM(2020) 299 final

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

EN EN


EUROPEAN COMMISSION

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COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

A hydrogen strategy for a climate-neutral Europe

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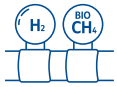
1 Analysts estimate that clean hydrogen could meet 24% of energy world demand by 2050, with annual sales in the range of € 630 billion". It also states that "In its strategic vision for a climate-neutral EU published in November 2018, the share of hydrogen in Europe's energy mix is projected to grow from the current less than 2% to 13 -14% by 2050". In 2018, natural gas provided 21.9 % of the EU's gross inland energy consumption.

KEY ENTSOG POSITION ELEMENTS

Markets

This ENTSOG Action plan acknowledges that hydrogen valleys/clusters will emerge in regional demand centers throughout Europe. It is vital that **these clusters are linked through a dedicated hydrogen system**, that allows for diverse supply sources and thereby enables a competitive hydrogen market to develop.

Infrastructure



A coordinated planning of such **a European hydrogen backbone should start now** and should go hand-in-hand with the development of such hydrogen clusters. Furthermore, the positive results achieved for gas markets in terms of price convergence, availability, accessibility, security of supply and virtualisation of gas markets' operations can be brought to the emerging hydrogen clusters faster and more efficiently with a combination of **gas infrastructure repurposing** and dedicated new.

TSOs role

The TSO experience of infrastructure assessment, market framework organisation and services (balancing, flows and quality management, conversions, etc.) **can support the speed and efficiency of this market development**, especially in its early stages.

Therefore, we believe that regulatory and standardisation activities will be required in parallel to hydrogen production development to provide these benefits at the right time. This ENTSOG Roadmap Action Plan is therefore focusing on the following elements:

ALL THREE PATHWAYS (METHANE, BLENDING AND HYDROGEN) WILL COEXIST, AND BE INEVITABLY AND INCREASINGLY INTERLINKED

All three pathways from the existing Roadmap remain important to efficiently support the transition towards complete climate neutrality. **ENTSOG will continue to work with those 3 pathways, based on Member States and markets choices**, bearing in mind that the EU Strategies call for coordinated sector integration, in order to bring hydrogen into the EU's energy system. The existing Roadmap fully takes into account the fact that, under the methane pathway today, natural gas will continue to play a significant and important part, supporting the EU economy in its transition from coal or nuclear energy to low carbon and renewable solutions. However, to achieve climate targets in 2050, methane will mainly be composed of biomethane and synthetic methane as well as natural gas combined with CCUS technologies will be part of this pathway. Therefore, the **hydrogen pathway and elements of the blending pathway are a key focus of this Roadmap Action Plan, as in those pathways we see the challenges which require more planning** in this transition.

THE STRATEGIC TASK OF RETROFITTING AND REPURPOSING OF GAS GRIDS

Under a joint gas and hydrogen value chains process there is a need to map the demand and supply patterns and remove regulatory uncertainty.

In order to achieve a competitive hydrogen market in the EU, the first hydrogen clusters should achieve liquidity and attain optimal access to multiple sources of hydrogen production or imports. This implies the European-wide linkage of H_2 production facilities (electrolysis, SMR, pyrolysis), imports, major industries, distribution grids and storages. That is why it is crucial that hydrogen production sites will be physically connected, with demand centres via repurposed gas transmission grids established as soon as possible.

Retrofitting and repurposing of existing gas grids provides an opportunity for a more cost-effective energy transition in combination with (relatively limited) newly built hydrogen dedicated infrastructure.[2] **Between 2023 and 2030, the development of a first phase 'no regrets' backbone'[3] should be completed.** This will be essential to partner the foreseen 80 GW of renewable hydrogen production inside and outside of EU and connecting the existing fragments of hydrogen grids by 2030, as identified in the EC's Hydrogen Strategy.

Creating connected network systems for hydrogen at the present time, in parallel to the first elements of the emergence of the hydrogen market (i. e., IPCEI projects) and connecting the first European clusters, will drive innovation and efficiency which avoids the development of monopolistic supply positions, right from the beginning.

Another strong dimension of the Hydrogen Strategy is the international planning of future hydrogen import routes: an important task, which includes building on the outcomes of the EU dialogue with future import countries. ENTSOG members have experience of conducting the dialogue with suppliers from outside the EU (Norway, Russia, Northern African) and well-established Energy Community outreach.

The industrial gas consumers have signaled their willingness to engage in the emerging hydrogen economy, and to work actively towards the best ways to transition to climate neutrality (i. e., from methane to biogas and hydrogen markets). Therefore, ENTSOG foresees that a parallel and inter-linked development of hydrogen clusters and backbones must start already in the Ten Year Network Development Plan 2022[4], under the reformed TEN-E Regulation. Such development will require extensive planning and coordination with all parts of the value chains involved.

THE IMPORTANCE OF TECHNOLOGY NEUTRALITY: FACT-BASED AND INCLUSIVE CLEAN HYDROGEN DEFINITION

The majority of academic, inwstitutional and industry studies indicate that decarbonised and low carbon hydrogen produced from natural gas will be cheaper than renewable hydrogen until 2040, and perhaps beyond. To achieve the cost and price reductions of renewable hydrogen, industrial scale of production, transportation and consumption should be successfully achieved – a process which cannot be completed quickly. Building only on a more expensive technology option for now and in the mid-term – i. e., renewable hydrogen – will result in a slower phase-in of hydrogen than including clean hydrogen produced from natural gas with abatement, as well as slower replacement of fossil fuels by clean hydrogen in industry and transport. **Relying on renewable hydrogen alone will therefore most likely lead to (i) a more expensive EU energy transition and (ii) a slower overall greenhouse gas reduction.** Therefore, mid-term hydrogen demand should be stimulated and secured with decarbonised and low carbon hydrogen, combined with CCUS technologies.

2 Converting existing gas pipelines to hydrogen is cheaper (10 % - 33 %) than building new dedicated hydrogen pipelines. See Trinomics study on Sector integration - Regulatory framework for Hydrogen.

3 Numerous examples of a possible backbone and studies emerge on the shape of the backbone, for example: European Hydrogen Backbone, Gas for Climate, June 2020, https://gasforclimate2050.eu/publications/

4 TYNDP is prepared under an iterative process held by ENTSOG every 2 years, with significant joint work with ENTSOE and involving stakeholders, supervised by ACER and approved by the European Commission.

ENTSOG will therefore promote a fact-based, technology-neutral and responsible approach to GHG emissions along the value chain of hydrogen production (including pyrolysis and renewable hydrogen from biogas and low carbon hydrogen without bias on CCUS efficiency). **Full life cycle analysis of all the sources and vectors of energy can provide an objective framework for Guarantees of Origin and energy certificates to determine energy value, both on the gas and electricity side as well as cross-border.**

THE TSOs AS SYSTEM INTEGRATORS

Coordinated dialogue with the value chain stakeholders supports that gas TSOs can play a role of integrators, not only on downstream and upstream gas markets, but equally as a key player in Energy System Integration, linking the gas, hydrogen and electricity markets of the future.

- **of the gas and hydrogen system:** Since the current legal framework at EU level does allow for hydrogen to be blended into existing gas infrastructure, and energy consumers are currently assessing their decarbonisation options, it is important that European gas TSOs play a key role in contributing to the 'hydrogen agenda'. First - by offering TSOs services to complement and support an efficient and cost-effective development of the EU hydrogen backbone; next – by integrating the existing gas grids within hydrogen backbone to connect first clusters; and also – by operating the hydrogen girds.
- **of the gas and hydrogen markets:** Multiple new services inherently linked to grid management will be required: gas quality handling, digitalisation and data sharing, hydrogen connections and balancing, dual capacity management, and conversion services – between gas compositions (methane-hydrogen) and energy carriers (molecules and electrons).
- **for the Energy System Integration:** In the sector coupling context, gas TSOs cooperating with electricity TSOs can serve the transition well when building on their accumulated technical, operational, market organisation expertise.

THE ROLE OF ENTSOG AND GAS TSOs IN FACILITATING THE TRANSITION PROCESS FOR THE GAS SECTOR

This **Action Plan for 2050 Roadmap** marks the next stage in the engagement of ENTSOG and its members and provides additional transparency on how 2050 Roadmap Recommendations should be delivered in practice and reflected in forthcoming EU legislation and policy actions. To support this, **ENTSOG has joined the European Clean Hydrogen Alliance to contribute to a constructive and pragmatic approach to this development.**

ENTSOG and its members have played a key role in developing the current gas network codes i. e., the network codes on capacity management, balancing, tariffs, interoperability and data exchange rules, including close cooperation with stakeholders through 'Prime Mover' groups. This concept has successfully enabled discussion and in-depth consultation with all relevant actors during the development phase of the gas network codes and has been recognised as a valuable mechanism to ensure transparent, open and inclusive process.

ENTSOG's key role will be to facilitate the dialogue and look for effective solutions, building on the technical expertise of gas TSOs, hand-in-hand with industry stakeholders, policy makers, and regulators. We propose to integrate new stakeholders in already functioning processes (TYNDP scenario building, Network Codes co-creation, Prime Mover with EU-wide representation) and to allow for an incremental transformation of the gas system from primarily methane towards decarbonised and renewable gases. Full transparency regarding ENTSOG and its members' approach will be provided. This 2050 Roadmap Action Plan identifies ENTSOG's forthcoming priorities and actions to highlight the roles of stakeholders in its work and to ensure that the 2050 Roadmap continues to deliver on its objectives.

AREAS WITHIN ACTION PLAN

- **FUTURE GRIDS CONFIGURATIONS – THE AGENDA FOR GAS NETWORKS**
- **MARKET DESIGN CONSEQUENCES – THE AGENDA FOR THE MARKETS**
- **THE AGENDA FOR THE ROLE OF TSOs AS INTEGRATORS**

ENTSOG **strongly supports a coordinated and cooperative stakeholders' process** related to the gas and hydrogen value chain and believes that such approach will bring benefits to the EU gas and hydrogen consumers, and to the wider delivery of the European Green Deal.

As specified by the EC Hydrogen Strategy, the investment plan for hydrogen clusters and backbones will need to be delivered in the time frame between 2020 and 2030 in order to perform well after 2040.

Figure 2: ENTSOG Engagement activities, ENTSOG, 2020.

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FUTURE GRIDS CONFIGURATIONS – AGENDA FOR THE GAS NETWORKS

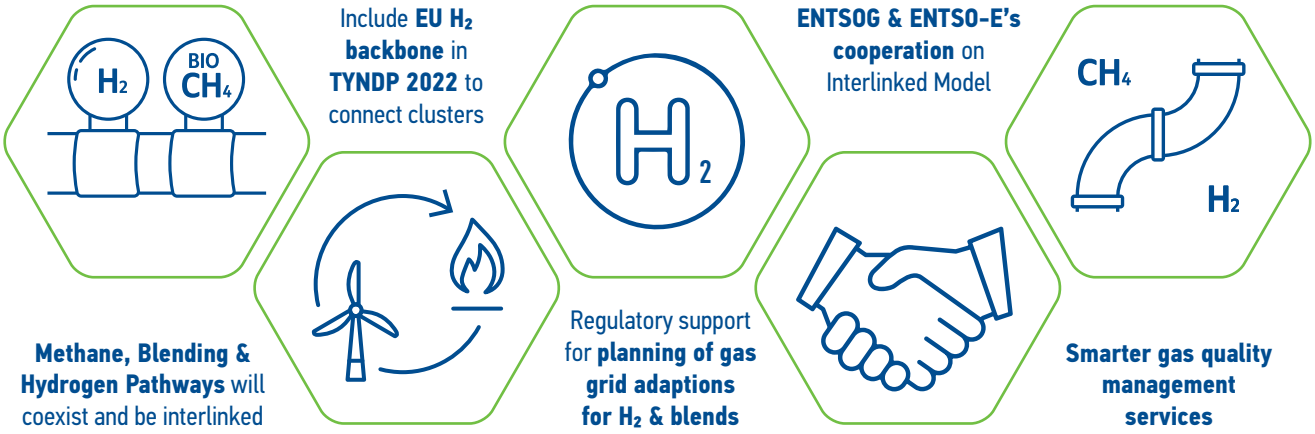


Figure 3: Agenda for the gas networks, ENTSOG, 2020.

As identified in the 2050 Roadmap, there are different possible pathways for future gas grids, which will develop in parallel, inherently interlinked, and which will progressively converge. As the ultimate result of delivering this agenda:

AGENDA FOR THE GAS NETWORKS:

Under the Hydrogen Pathway: an agreed hydrogen backbone is identified. H2 infrastructure should be developed in the framework of the TYNDP (considering the interlinkage with electricity sector) in support of sector integration approach. Possibility and legal framework for gas grid operators to repurpose their networks for H_2 transportation are in place.

Under the Blending Pathway: clear, geographically localised consumer needs for blending to be identified and the alignment of uses across the EU to be promoted are achieved. Smart tools for gas quality handling services to be developed and solutions for cross-border trade where blending occurs to be identified, and smarter, digitalised system design are agreed.

In terms of stakeholder dialogue: ENTSOG builds its active participation in the EU Clean Hydrogen Alliance. To ensure a leading voice that fully reflects the views and needs of gas (and hydrogen) grid users, ENTSOG will establish an Advisory Panel for Future Gas Grids, a TYNDP Joint Advisory Panel (with ENTSO-E) and Prime Mover Groups for Gas Quality Handling and Hydrogen and encompass respectively electricity/gas/hydrogen value chains and prepares a coordinated input.

1.1 RATIONALE FOR ROADMAP UPDATE

The EU's Energy System Integration and Hydrogen Strategies mark a new stage in the EU's thinking, leading ENTSOG to update actions plan for delivery of ENTSOG's 2050 Roadmap.

The Hydrogen Strategy recognises the need for "**full integration of hydrogen infrastructure** in infrastructure planning, through revision of TEN-E and TYNDPs, taking into account also the planning of a network of refueling stations."[5] The Strategy also confirms that to "enable repurposing of existing assets, its technical suitability must be assessed as well as a **review of regulatory framework for competitive decarbonized gas market** should allow such financing and operation with an overall energy system perspective in mind."[6]

On existing point-to-point pipelines, the Hydrogen Strategy states that the **"existing rules for so-called closed distribution systems, direct lines or exemptions** in the gas and electricity markets may provide guidance on how to address this."[7] It also develops the initial rules that will be needed for the efficient operation of emerging hydrogen grids, stating that "Hydrogen infrastructure should be accessible to all on a non-discriminatory basis. In order not to distort the level playing field for market-based activities, **network operators to remain neutral.** Third-party access rules, clear rules on connecting electrolysers to the grid and streamlining of permitting and administrative hurdles will need to be developed."[8] The strategy underlines international dimension and future import of hydrogen.

The Energy System Integration Strategy also identifies that a dedicated infrastructure for H2, going beyond point-to-point pipelines may be needed. It does also propose a role for CCUS technologies and calls for further reflection on **CO_2-dedicated infrastructure. ESI Strategy** also calls for TYNDPs to consider the need for the joint planning of gas and electricity networks and systems, heating and cooling networks, consistency with climate and energy targets, and to ensure full alignment with NECPs. The Energy System Integration Strategy expects the revised **TEN-E Regulation** to provide climate neutrality, cost-effective integration, and integrate digital and transport sectors with energy.

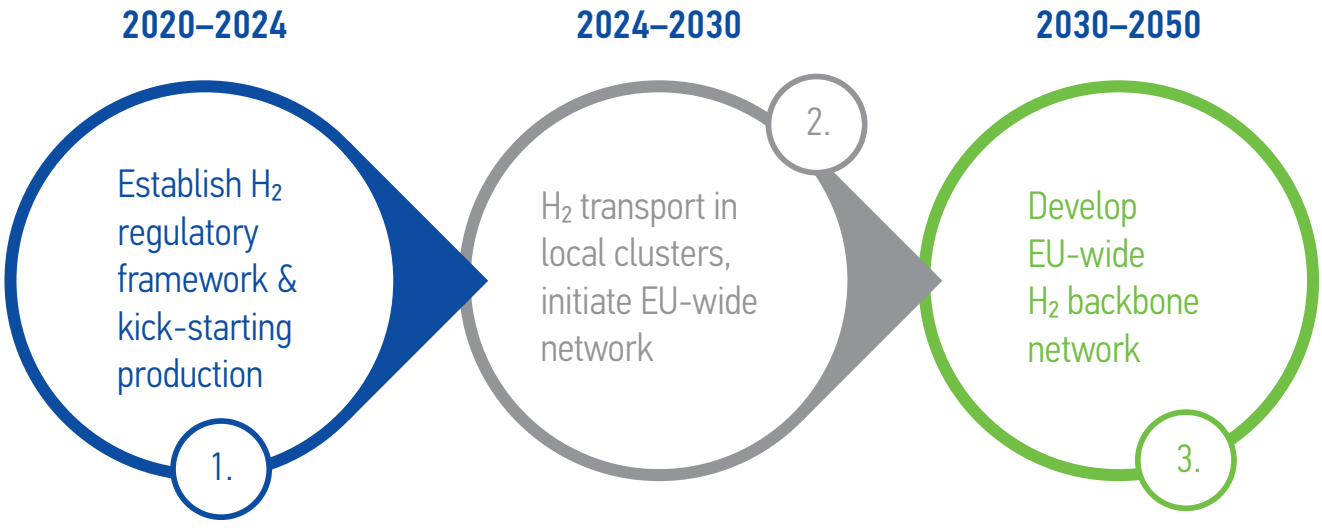


Figure 4: ENTSOG Approach to the European Hydrogen Economy, ENTSOG, 2020.

5 European Commission, EU Hydrogen Strategy, p.15.

6 Ibid, p.15.

7 Ibid, p.14-15.

8 Ibid, p.16.

1.2 ENTSOG RECOMMENDATIONS FOR NETWORKS

1.2.1 ENSURE THE PARALLEL AND INTER-LINKED DEVELOPMENT OF HYDROGEN CLUSTERS AND BACKBONES

To facilitate the efficient, secure and cost-effective development of the hydrogen market is it necessary to ensure the parallel and interlinked development of hydrogen clusters and backbones. In its Hydrogen Strategy, the EC envisages the step-by-step development of the low and then zero gas grid[9], with the initial development of the hydrogen market through a 'clusters' approach, focusing hydrogen demand around major consumers such as fertilisers and steel companies. ENTSOG agrees that this is the most likely short-term scenario. In developing the 'cluster' approach, ENTSOG therefore underlines the **importance of open access to infrastructure.** However, **the exclusive cluster approach alone holds a risk of fragmentation, therefore will need to be complemented by connected backbone infrastructure to meet growing demand,** to assure the development of well-functioning markets and for security of supply at the same time. Decarbonising the transport sector with hydrogen the economy,[10] will especially need the re-fuelling infrastructure preferably localised along the transmission and distribution routes.

1.2.2 REFORM LEGAL FRAMEWORK FOR FUTURE-PROOF GRIDS DEVELOPMENT

The EC Hydrogen Strategy recognises the need to remove the barriers for efficient H_2 infrastructure development (e.g. via repurposing), ensuring access to liquid markets for H2 producers and consumers, and the integrity of the internal gas market through review of the gas legislation (by 2021). To deliver an efficient, secure and cost-effective energy transition for the benefit of EU citizens, the legal framework under revision should aim to **catalyse investment** in the new hydrogen grid and the progressive evolution of the existing grid to a carbon-free future, as well as ensuring the long term security of gas supply.

To achieve this, first, the EU **Sustainable Finance taxonomy should** clarify and **recognise hydrogen transportation as positively contributing to GHG reduction,** by classifying the transportation of hydrogen and the construction of hydrogen pipelines as sustainable activity.

Next, the **upcoming revision of TEN-E** should recognise the need for the development of a hydrogen backbone in the short-term inter alia to connect clusters, thereby fostering a well-functioning, secure and competitive EU wide hydrogen market.

The TEN-E should also ensure that TSO investments, **necessary for retrofitting and repurposing existing infrastructure** and progressively ensuring that the system is 'hydrogen ready', are fully recognised by regulators across Member States as an integral part of TSO's regulated activities.

Also, **the reform of the existing gas legislation** should be aligned with the TEN-E objectives and ensure that **TSOs efforts and costs of such transition to prepare the grids for hydrogen are effectively addressed.**

The **European Recovery Plan** represents a unique opportunity to finance the backbone, and to future-proof the first stage of the development of the EU's hydrogen economy, via **Resilience & Recovery, SET Plan and IPCEI.** Such development will require extensive planning and coordination with all parts of the value chain involved, both under Clean Hydrogen Alliance actions and within TYNDP framework, where geography of first demand and supply patterns will need to match with grids adaptations.

9 Footnote with the quote on H_2 production levels as of 2023, 2030 and post 2040

10 Transport sector accounted for 25 % of EU GHG emissions in 2018, https://ec.europa.eu/eurostat/statistics-explained/pdfscache/1180.pdf

1.2.3 UPDATE THE TEN-E REGULATION USING THE SUCCESSFUL AND PROVEN TYNDP PROCESS

To achieve a speedy and successful process of the IPCEI projects, there is insufficient time and financial means for a "test and try" process for the development of the European hydrogen grids. It should be considered that it took 10–15 years to integrate most of the European gas network and that substantial financial means will have to be devoted to the electricity sector (offshore wind, new infrastructure developments, etc.). Development of a sub-optimal system or stranded costs should be avoided, and therefore the whole EU picture should be observed from the beginning, when developing infrastructure for hydrogen.

The existing TYNDP process is a well-tried and tested mechanism for grid planning and development, and ENTSOG believes that it should support the hydrogen 'backbone' planning. However, it will need to be updated to take account of the new market realities. **The TEN-E should also recognise that the TYNDP process remains the foundation for future network planning at EU level,** not least given the increasing inter-linkage between sectors which is the foundation of Energy Sector Integration, including for both gas and hydrogen networks.

ENTSOG believes that to achieve this in a timely manner, the TYNDP 2022 should already be developed to deliver on the Hydrogen and Energy System Integration strategies. To fully update the TYNDP process, in the light of the new network challenges, **a change to the existing TYNDP process, Project of Common Interest (PCI) criteria and the underlying cost-benefit analysis (CBA) methodology will be required in 2021.** The CBA criteria should be revised to clearly reflect the goals on sustainability, sector integration and energy efficiency. The updated criteria should also be able to consider projects including the retrofitting and repurposing of gas systems, gas conversion and upgrading facilities, digitalisation of measurement equipment and data handling.

1.3 ENTSOG ACTIONS

1.3.1 ENSURE FULL INPUT OF ALL RELEVANT ACTORS IN THE TYNDP PROCESS AND WITHIN CLEAN HYDROGEN ALLIANCE

To efficiently coordinate the development of an EU Hydrogen backbone and to promote transparent and organised stakeholder involvement in these processes, ENTSOG suggests to establish the following stakeholder panels, and prime mover group:

1. TYNDP JOINT ADVISORY PANEL

a joint ENTSO-E/ENTSOG body between gas and electricity TSOs related to the regulatory tasks under TEN-E, including TYNDP scenarios.

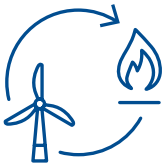
2. ADVISORY PANEL FOR FUTURE GAS GRIDS

focused on the gas and hydrogen value chains to deliver on decarbonisation in general and on the European hydrogen backbone and the future role of existing gas infrastructure in the development of the hydrogen market (including blending) and CO_2 transport.

3. PRIME MOVER GROUP ON GAS QUALITY AND HYDROGEN HANDLING

for gas, hydrogen and industry experts, TSOs and DSOs on interoperability, handling of hydrogen/natural gas blends, security and operations. The aim of these groups is to ensure transparent expert dialogues amongst all relevant stakeholders.

1.3.2 ENTSOG PROPOSES A ENTSO-E/ENTSOG TYNDP JOINT ADVISORY PANEL



A TYNDP Joint Advisory Panel should cover both electricity and gas. It should have a broad composition, including cross-sectoral representation (NGOs, Industry representatives, DSOs, EC, ACER) and be an effective approach to ensure a full, more structured and formalised involvement of all relevant parties in TYNDP planning of an integrated energy system. The panel would be tasked to explore the assumptions for TYNDP scenarios and make key recommendations. It would build on the top of current ENTSOG and ENTSO-E stakeholder engagement processes (webinars, workshops, cooperation with environmental NGOs), regarding TYNDP scenarios and the assessment of relevant electricity, gas and hydrogen planning proposals. The governance and set-up of the Panel is to be agreed with ENTSO-E and EC.

AGENDA FOR THE TYNDP JOINT ADVISORY PANEL

1. Establish dialogue on future scenarios - simulation models and assumptions.
2. Further progress the Interlinked Model developed jointly by ENTSOG and ENTSO-E, applying combined electricity and gas CBA methodology, and benefit from both associations applying same network modelling tool.
3. The TYNDP 2022 should consider the Hydrogen and ESI strategies – including the first core elements of a hydrogen backbone.
4. Transparency would be the foundation of success for the Panel; modelling and projects' assessment would be ensured and shared by ENTSOG with stakeholders.

1.3.3 ENTSOG TO ESTABLISH THE ADVISORY PANEL FOR FUTURE GAS GRIDS

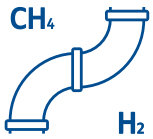
To ensure transparency and coordination on the gas side, the Advisory Panel for Future Gas Grids would support gas TSOs and stakeholders in identifying the practical challenges and solutions of gas grids in relation to the three identified pathways (methane, blending and hydrogen), including the development of a EU hydrogen backbone, via retrofitting and repurposing of the existing infrastructure and building of dedicated hydrogen infrastructure. It will also analyse the role of blending in different regions and will work on an EU-wide approach for CO2 infrastructure. Governance and set up to be discussed with the stakeholders and EC.

The role of the panel would be to enable current gas grid shippers/traders, gas consumers and the entire value chain to coordinate the transition towards a hydrogen economy and a decarbonised gas system. It would cover infrastructure, technical, regulatory and organisational aspects of such transition. The works of the panel would lead to efficient representation of the agreed and coordinated input to Clean Hydrogen Alliance, to the Madrid Forum and would be shared with the European Commission and ACER.

AGENDA FOR THE ADVISORY PANEL FOR FUTURE GAS GRIDS (GROSS LIST)

1. Coordinate with gas end consumers and industry their gas quality handling and future infrastructure needs. Create policy-oriented principles for cross-border and regional gas quality handling that are coordinated with gas end consumers and industry needs (either via blending or by dedicated hydrogen backbone).
2. Inform on the practical experience of gas TSOs in terms of grid adaptation i.e. compressor capacities and timing/costs of adaptation. Assess tolerance and safety thresholds for different levels of hydrogen concentration where blending occurs.
3. Discuss the attribution of costs and benefits from the infrastructure between gas, hydrogen and electricity consumers. Address legal gaps for TSOs' conversion services and their remuneration. Establish principles for cost recovery mechanisms for gas quality handling, digitalisation, repurposing etc.
4. Develop an EU-wide approach for CO_2 infrastructure, including TPA, the role of gas TSOs, transmission charges and liabilities. Include CCUS activities in planning NECPs, TYNDP.
5. Establish a dialogue with the national regulators/ACER on addressing the regulatory principles for infrastructure retrofitting, re-purposing of gas infrastructure, gas quality handling, and digitalisation, etc. to enable emerging transport of hydrogen.
6. Update of the existing TYNDP criteria and CBA methodology to prepare for the evaluation of decarbonisation benefits, which will be needed already in 2021 – including retrofitting and repurposing of gas systems, conversion/upgrading facilities, digitalisation of measuring and data handling, etc., as well as including energy storage and flexibility from all technologies
7. Exchange with Member States on the initial national H_2 Strategies (existing: German, Dutch, Portuguese, upcoming: French, Polish, Czech, Spanish, etc.) Discuss with Member States to consider developing and reporting on the planned and pilot infrastructure projects, upgrades of gas networks as well as electricity and sector integration projects in their NDPs (National Development Plans) for all types of hydrogen production.
8. Establish coordination with Hydrogen Europe and Gas for Climate, GIE, gas DSOs, regulators, etc. Provide input and feedback to Clean Hydrogen Alliance, agreed with gas and hydrogen stakeholders.

1.3.4 ENTSOG LAUNCHED 'PRIME MOVER' GROUPS ON GAS QUALITY AND HYDROGEN HANDLING



The EC Hydrogen Strategy underlines that in order to ensure interoperability of markets for hydrogen, common quality standards and cross-border operational rules are needed. **Current gas quality standards** (national & CEN) would therefore need to be **updated.**

The Hydrogen Strategy finds that the **technical feasibility of adjusting the quality & cost** of handling the differences in gas quality, need to be assessed. EC also calls for checking efficiency of blending, its effects on the value of hydrogen injected into the gas grids and consequences for market integrity. ENTSOG members are in dialogue with their respective stakeholders and can see that blending enables **decentralised** hydrogen production in local networks during the transitional phase, using the natural gas as a gaseous hydrogen carrier to transport and store hydrogen, whilst also enabling the **decarbonisation** of the gas system.[11] In light of this, the reinforcement of instruments may be needed to **secure cross-border coordination and system interoperability** for an unhindered flow of gases across Member States.

In July 2020, ENTSOG, together with DSO organisations (Eurogas, Geode, CEDEC, GD4S) invited key industry and institutional experts from multiple associations from gas, hydrogen, standardisation, and digitalisation industries, including producers and consumers, as well as the EC to a new Prime Mover Group for Gas Quality and Hydrogen Handling. Tangible work is planned to start in September 2020. The objective of such expert work is to deliver solid and concrete principles for gas quality management to meet the needs of the consumers.

AGENDA FOR THE PRIME MOVER GROUP ON GAS QUALITY AND HYDROGEN HANDLING

1. Promote a fact-based, technology-neutral, and fair discussion on the possibilities of blending and de-blending services for gas quality management.
2. Coordinate with gas end consumers and industry their gas quality handling needs and access to the product they require.
3. Elaborate on how gas TSOs can facilitate the cost-effective conversion principles and gas quality management services while ensuring market integrity and the diversification of supplies.
4. Facilitate discussion and cooperation with DSOs and TSOs for an appropriate distribution of injection points, injection possibilities (considering the different readiness levels of the grids) and for improving gas quality data exchange (especially in cases with bidirectional flows).
5. Facilitate the development of innovative and feasible ways to handle gas quality in fluctuating blends as well as pure hydrogen grids in the future gas system, by addressing the main technical challenges, including end-user safety, in close cooperation with stakeholders. Promote research on de-blending technologies (e.g., membrane technology)
6. Assess the need for new or upgraded tools to ensure system interoperability, security of supply and end-user safety for each possible network configuration (hydrogen, methane and blending pathway).

11 Blending can also be seen as a way to prepare access to the networks for synthetic gases (produced by pyro-gasification or hydrothermal gasification), not only a last resort outlet for hydrogen. That way, valorisation of waste to produce synthetic gases is made more cost efficient. Also, from the point of view of hydrogen value: for a consumer who is only interested in thermal power, there is no difference between consuming pure hydrogen or hydrogen as a share of the gas supply. This consumer only cares about energy consumed, not about the purity of the hydrogen consumed. Chemical properties of hydrogen are key to a limited number of consumers

2

GAS MARKET DESIGN CONSEQUENCES – AGENDA FOR THE MARKETS

2.1 RATIONALE FOR ROADMAP UPDATE

ENTSOG CONSIDERS THAT THE MARKET DESIGN FOR HYDROGEN SHOULD INCLUDE THE FOLLOWING PRINCIPLES:

— All types of hydrogen must be able to compete on an objective basis taking account of their externalities (notably GHG) at the relevant moment of transition from first clusters to an integrated market.

— The establishment of a standardised GO framework, with GOs and certificates being easily transferable and compatible with EU ETS

— Both gas and hydrogen markets being integrated and based on the same underlying regulatory framework.

The EC Hydrogen Strategy foresees that the 'hydrogen economy' (encompassing supply, demand, markets and infrastructure) is likely to develop over the period 2020 towards 2050 in the three stages:

Phase 1 - 2020 up to 2024 consists of laying down the regulatory framework and kick-starting production. The EU develops the market framework and the financial toolkit to catalyse the first production clusters. In particular, this will require common low-carbon thresholds/standards for H2 production and ETS benchmarks based on GHG performance, carbon Contracts for Difference and competitive tenders, and, possibly, quotas for renewable hydrogen). Infrastructure needs will remain limited in the very short term as demand will be met initially by production close to demand, or on-site.

Phase 2 – from 2025 to 2030: hydrogen will be primarily transported over short distances through local hydrogen cluster/valleys, although the need for an EU-wide network will also emerge.

Phase 3 - from 2030 – 2050: This phase will see the development of a pan-EU hydrogen backbone network.

In Phase 1 the EC Strategy underlines the need to place CO_2 avoidance and/or content as a 'currency', that would be the foundation of the mechanism to express the tradable value of hydrogen. Integral here is the discussion on the relevant threshold for H_2 distinguished between renewable or low-carbon gases and the work being undertaken on methane emissions. The EC work on a common low-carbon threshold/standard for the promotion of hydrogen production installations based on their full life-cycle GHG performance by June 2021 will be central to achieving this objective, as well as a comprehensive terminology for certification of hydrogen being developed. In preparation for phase 2 and 3, the Hydrogen Strategy foresees that existing rules developed for the gas markets should form the foundations for a hydrogen market. This would lead to the review of gas legislation for competitive decarbonised gas markets. The requisite principles in this respect are clear: Hydrogen infrastructure should provide third party access on a non-discriminatory basis; network operators must remain neutral; an open and competitive EU market with prices based on competition, cost-based transportation/infrastructure, carbon costs, and external costs and benefits; The concept of virtual blending[12] could be explored.

12 Virtual blending' refers to a share of hydrogen in the overall volume of gaseous energy carriers (i.e. methane) regardless as to whether these gases are blended physically in the same infrastructure or in separate, dedicated infrastructures. Source: European Commission, EU Hydrogen Strategy, 2020, p.11

2.2 ENTSOG RECOMMENDATIONS FOR MARKETS

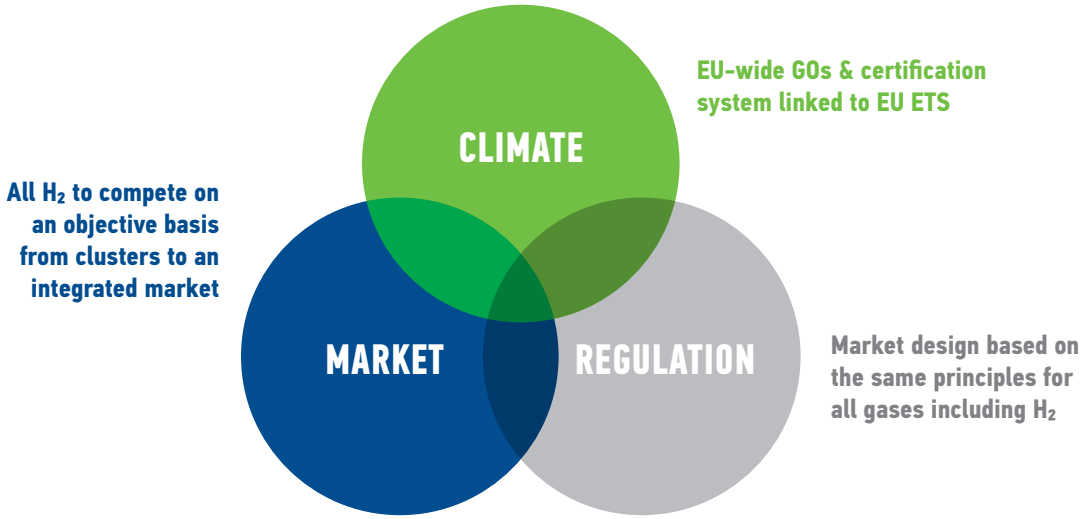


Figure 5: ENTSOG Agenda for the Markets, ENTSOG, 2020.

2.2.1 THE HYDROGEN MARKET SHOULD ADHERE TO THE PRINCIPLES AND TECHNICAL RULES THAT UNDERPIN THE EXISTING INTERNAL ENERGY MARKET FOR GAS, ADAPTED WHERE NECESSARY

The ENTSOG 2050 Roadmap recommends that all renewable and decarbonised gases should be integrated as much as possible with the gas market to deliver common or at least similar price signals for gaseous energy, similar to H-gas and L-gas zones that are currently commercially integrated in some EU countries via virtual trading points. Gas TSOs are committed to facilitate non-discriminatory access to hydrogen infrastructure, not least to prevent potential problems of the development of uncompetitive and dominant market structures for the supply of H_2.

However, given the current costs and scalability of hydrogen production, integrated price signals will only develop over time. ENTSOG finds that **whilst the longer-term objective of an integrated market would deliver significant benefits for both consumers and producers of gas, there might be a need to take a stepwise approach** and start with a number of clusters/markets with sometimes simplified trading arrangements. The Internal Market rules currently applicable to the gas market are designed for a mature, integrated and large market and not all rules will initially be appropriate for the emerging hydrogen market. Thus, the Internal Market rules will need to be applied in a proportionate and progressive manner, according to the degree of maturity of the hydrogen market and be carefully tailored, according to the stage of market development in a given region/Member State.

At minimum, the technical aspects of trading hydrogen should be broadly identical with gas trading, to make best use of the accumulated experience with trading gas for the future hydrogen market – i. e., trading in energy units, VTPs, separate handling of commodity and capacity, comparable transparency rules-REMIT.

ENTSOG proposes to screen the existing network codes for gas to identify and evaluate which measures could apply at each stage of development of the hydrogen market.

2.2.2 EFFICIENT USE OF (VIRTUAL) BLENDING CAN FACILITATE THE DEVELOPMENT OF THE HYDROGEN MARKET

In certain cases, it may not be cost-effective to construct dedicated infrastructure, especially where it is not situated in a 'cluster' together with other consumers. In these circumstances, via GOs and possibly (de-)blending, the consumer will nonetheless be able to 'virtually' consume low/zero carbon hydrogen, with the resultant CO_2 savings elsewhere in the physical chain, but the cost supported by the remote consumer. Such an approach will be important in developing the market.

Blending can also facilitate the integration of synthetic gases produced from waste and be a technical solution to imbalances in emerging hydrogen markets, providing an important flexibility tool. For example, an electrolyser may produce hydrogen from 'peak' renewable electricity supply to avoid curtailment, but not have an immediate market for it. A flexible solution would be the use of blending, either to consume or to store this 'excess' hydrogen. Blending/network injection facilitates keeping the electrolyser in charge (hot) and so to seize opportunities on the electric market. As mentioned earlier, blending can also be a way to facilitate the integration of synthetic gases produced from waste.

Therefore, the **framework should allow Member States to use the blending (flexibility) option on a national or regional basis, in particular where hydrogen clusters or hydrogen backbones are not yet economically viable**. Tools for correctly accounting for the reduction of GHG emissions achieved as a result of blending gas need to be developed.

ENTSOG assumes that the same principles implemented successfully for gas (TPA, operator neutrality, and transparent tariffs) should apply for hydrogen.

(MARKET-RELATED) AGENDA FOR THE ADVISORY PANEL FOR FUTURE GAS GRIDS:

1. Based on the Gas Directive and Regulation, discuss and agree on the market arrangements relevant for hydrogen infrastructure and promote consistent application of these arrangements throughout the EU. Discuss how the existing gas network codes rules could be helpful in development of the hydrogen market
2. Process for developing the Hydrogen market arrangements, to align with process that was adopted for the creation of the gas network codes,
3. Technical aspects of trading hydrogen should broadly mirror the gas trading arrangements (trading in energy units, VTPs, separate handling of commodity and capacity, comparable transparency rules (REMIT), etc.)
4. Assess 'virtual blending' as a market tool under certain conditions to link hydrogen and natural gas systems.

2.2.3 GHG PERFORMANCE OF HYDROGEN SHOULD BE BASED ON TECHNOLOGY NEUTRAL FULL LIFE-CYCLE ANALYSIS

Based on discussions with consumers, ENTSOG understands that initial industrial demand will partly be covered by hydrogen produced from natural gas reforming. Allowing low-carbon hydrogen to kick-start the market will help to tap early decarbonisation gains and create the dispatchable baseload for first hydrogen industrial application, ensure liquidity and security of supplies. Therefore, in the debate on carbon content as a currency to express the value of hydrogen, it is important to keep an inclusive approach to all production technologies.

In implementing this practically, GHG externalities must be determined on an objective basis and be applicable to all energy sources to enable consumers to make objective decisions regarding energy choices. The EC work on common **low-carbon threshold/standard** for the promotion of hydrogen production installations based on their **full life-cycle GHG performance** (by June 2021) and should, for example, consider objective information on CCUS performance and include pyrolysis and hydrothermal gasification in the equation.

TO ENABLE THIS, THE FOLLOWING ELEMENTS ARE NEEDED:

— Promote a fact-based, technology-neutral and responsible approach to GHG emissions along the value chain of hydrogen production, as well as natural gas production and all other sources of energy.

— Establish clear definitions on hydrogen considering life-cycle emissions, e.g., defining hydrogen from biogas or biomass as a renewable source.

— Establish a harmonised, EU-wide accountable GO and certification system based on life cycle analysis for all energy carriers and technologies.

2.2.4 ENTSOG AND GIE WILL CONTINUE THE PRIME MOVER GROUP ON GOs AND CERTIFICATES

GIE and ENTSOG have been chairing the Prime Mover group on GOs and Certificates since 2018. The group has successfully developed recommendations on the optimal ways of addressing the development and transferability of GOs under the existing and future legal framework. The results of this work represent the coordinated position of participating members and can be found here.

AGENDA FOR PRIME MOVER GROUP FOR GOS AND CERTIFICATES

1. Work for a harmonised EU Certification scheme based on life cycle analysis for all energy carriers and that a standardised GO framework is implemented throughout the EU:
   - GOs for all energy carriers should reflect externalities (including GHGs emissions and compliance with the sustainability criteria, where relevant) determined on a life cycle basis.
   - GOs in its final form should be capable of being easily transferable between energy carriers and across borders.
   - GOs in its final form should be compatible with EU ETS;
2. Support and convert the legislation off all hydrogen production pathways in the upcoming review of the gas legislative framework (Regulation & Directive): RED II, MRR Include under definition of "renewable" all hydrogen produced from renewable sources including biogas.
3. With the CEN Standard 16325 for GOs, a quick set-up, effective functioning and interoperability of the different national GO schemes should be secured. ENTSOG and its Members stand ready to facilitate this cooperation between national GOs and Certificates registers.
4. Continue cooperation on CO_2 transportation and storage with relevant stakeholders.
5. Be active in EU programming of R&D activities (including on CCUS/pyrolysis) via the Clean Hydrogen Partnership under Horizon Europe.

3

AGENDA FOR TSOs AS INTEGRATORS

3.1 RATIONALE FOR ROADMAP UPDATE

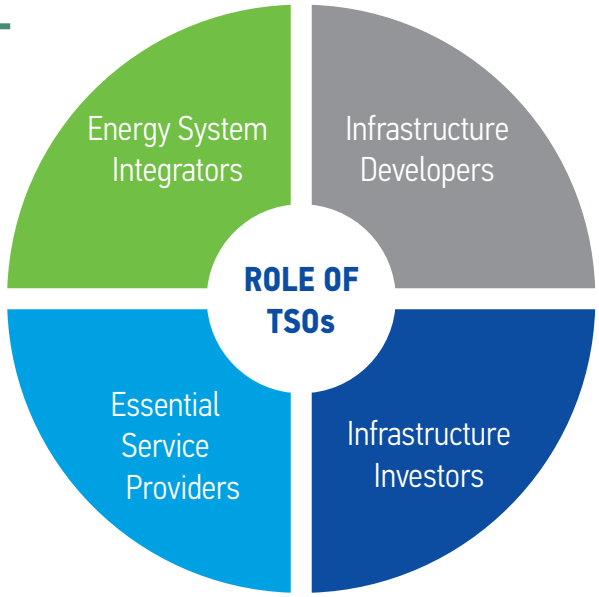


Figure 6: Key actions and commitments for TSOs, ENTSOG, 2020.

The strategy sets out the EU's aims under a number of broad headings: investment; boosting demand and scaling-up production; design framework – support schemes, market rules and infrastructure; and promoting research and innovation.

The EC Strategy states that to "facilitate the deployment of hydrogen and develop a market where also new producers have access to **customers, hydrogen infrastructure should be accessible to all on a non-discriminatory basis.** In order not to distort the level playing field for market-based activities, **network operators must remain neutral."**[13] In addition, the Energy System Integration Strategy sets the ambition to develop an integrated energy system that has **"coordinated planning and operation of the energy system 'as a whole', across multiple energy carriers, infrastructures, and consumption sectors."**[14] To positively contribute to these objectives, ENTSOG will continue to develop the position of TSOs and concentrate on the role of TSOs as hydrogen network developers and 'system integrators'.

AS THE ULTIMATE RESULT OF THIS AGENDA:

— TSOs can play a role as integrators for natural gas, biogas and hydrogen – facilitating as smooth handling of the various gas qualities as possible

— Already at the cluster stage TSOs services can efficiently support consumers transitioning from methane to smart hydrogen economy (industry ports, airports, fuelling stations)

— Ensure timely development of the H_2 backbone to connect clusters and promote market development

13 European Commission, EU Hydrogen Strategy, 2020, p.16.

14 European Commission, Energy System Integration, 2020, p.1.

3.2 ENTSOG RECOMMENDATIONS

3.2.1 GAS TSOs WILL PLAY AN IMPORTANT ROLE AS 'SYSTEM INTEGRATORS'

At least until 2050, the system will need to carry hydrogen, biogas and natural gas. For the market to function efficiently during the transition phase, blending will take place at least in some regions. These developments will give rise to issues such as the need for technical standards, interoperability, and trading arrangements as well as cost-sharing between systems.

Facilitating the efficient handling of the various types of gases and ensuring the operation of the technical interfaces to gas/hydrogen suppliers and to consumers will be vital. An important aspect of this role will be digitalisation – measuring and handling data on energy content and gas quality, including dynamic sharing of data to the parts of the gas value chain. Therefore, the revised TEN-E Regulation and revised Gas Directive and Regulation should include tasks related to this 'system integrator' role. Suitable provisions will need to be made to ensure that these issues are adequately covered in the future regulatory framework, thus ensuring the recognition of these tasks by national regulatory authorities and reasonable remuneration.

3.2.2 TSOs AS ESSENTIAL SERVICE PROVIDERS

The essential task of TSOs in this respect will be to enable the maximisation of injection levels of renewable and low carbon gas, to facilitate the different injected gases and ensure that the different injected gases affect the cross-border trading on the Internal Energy market as little as possible. In particular:

- TSOs will manage the diversity of gas compositions and facilitate cross-border trade, liquidity and price convergence
- TSOs will facilitate the interoperability and security of supply, in particular for emergency situations.
- With more diverse gas compositions, TSOs will have to control gas quality, focussing particularly on end-user sensitivity.
- TSOs will play a vital role in the transfer of energy between energy carriers (electrons to molecules)
- TSOs will continue to play a key role in planning future infrastructure, crucially as the use of hydrogen and an integrated energy system develops, which should be eflected in TEN-E Regulation.
- TSOs will use their expertise as market facilitators to work with stakeholders to develop suitable future market arrangements to accommodate the diversity of gases and increased interactions with energy carriers.
- TSOs will take any necessary actions that support the establishment and efficient operation of a GO system in the gas market.
- TSOs will promote and foster research and innovation and play a primary role in cross-sectoral infrastructure planning.

3.2.3 TSOs AS INFRASTRUCTURE OWNERS AND DEVELOPERS

Given the interlinkage between hydrogen networks and the gas grid, and that much of the future hydrogen grid will be based on repurposed existing gas infrastructure, it will be logical that such networks would be operated by existing gas TSOs – owning already the network and having the technical and commercial experience to facilitate the required investment and their efficient operation.

It should be clarified and allowed for the gas TSOs to own, plan, build and operate dedicated hydrogen networks both at EU level and in the Member States – including repurposing of existing gas infrastructure to ensure the cost-effective development of a hydrogen backbone. A similar provision should be made for gas DSOs and the operators of gas storage facilities and LNG terminals, to ensure their full participation in the developing hydrogen economy.

With respect to the limited hydrogen grids already in existence, used largely to supply natural gas-based hydrogen as a feed stock, a case-by-case solution will be needed to ensure their effective integration into the wider emerging grid.

Carbon capture and storage technology is expected to grow, serving both industrial plants that use CCS to decarbonise production facilities, and producers of natural gas based low-carbon hydrogen. CO_2 networks can also be expected to develop over time, particularly close to storage sites, for example in the North Sea. The question whether such grids should be owned by existing gas TSOs or specific CO_2 system operators is one that should be decided by each Member State, depending on specific national circumstances. However, provisions should be made at EU level to confirm that gas TSOs can legally undertake such activities, thereby creating a level playing field for all market participants.

3.2.4 TSOs AS INVESTORS

In addition to the "System Integrator" concept, TSOs (and/or their related undertakings within the same corporation where the TSO is located) can also bring benefits in terms of a cost-effective and speedy energy transition, if they are allowed to get involved in decarbonisation facilities. For this to happen, a clear business model would need to be developed, fully compliant with the future regulatory framework. Special rules or exemptions might also be needed for specific and new infrastructure equipment (e.g., quality conversion units, blending units, gas filling stations, CO_2 transport systems, etc.) With regards to TSO involvement in the development, ownership and operation of decarbonisation facilities, ENTSOG takes a pragmatic view that work should continue to identify business models that are compliant with relevant legislation and the EU's Green Deal objectives.

This approach has been an integral part of the Internal Market to-date, permitting derogations from unbundling and Third-Party Access (TPA) requirements when fully justified, and e. g. indeed permitting electricity TSOs to invest in electricity storage under certain conditions in the context of the Clean Energy Package. Similarly, gas TSOs could be allowed to invest into selected new infrastructure pieces (e.g., gas quality management, blending facilities, storages for system operations, conversion facilities, etc.) on the condition that **this is in the public interest and does not distort the market.** On this basis, **TSOs could play a role in the initial stages of the emerging hydrogen market** to kick-start its development, in the circumstance of the public interest, given the need to make rapid progress in delivering the Green Deal and the European Recovery Plan.

The development of national hydrogen industries is currently under way in Member States, notably regarding R&D and how to kick-start the market in an efficient and cost-effective manner. Appropriate flexibility regarding the potential of TSOs to assist in the early stage of market development is important, as a 'one size fits all' is not appropriate given the state of market development and the diversity of approaches and markets in the different Member States. **National Regulatory 'sandboxes'**, balancing the need during the initial 'market take-off' phase and the importance of retaining and catalysing a competitive non-distorted market will provide the necessary flexibility and relevant input once supervised by the regulators.

3.3 ENTSOG ACTIONS

3.3.1 ENTSOG'S ACTIVE PARTICIPATION IN CLEAN HYDROGEN ALLIANCE

In August 2020, ENTSOG among many other organisations has been admitted joining the Clean Hydrogen Alliance for its expertise on managing the existing gas grids. Within Clean Hydrogen Alliance, ENTSOG will contribute to two types of discussions: on the best hydrogen investment support and on the needs for regulatory improvements. Therefore, we decide to present the following ENTSOG ambition in Clean Hydrogen Alliance.

ENTSOG AMBITION – INVESTMENT SUPPORT:

1. Achieve recognition of the need for timely development of the hydrogen backbone to connect clusters and for gas grids readiness/adaptation to facilitate repurposing/blending as appropriate.
2. Agree common understanding of key demand-supply developments and (based on the revised TEN-E criteria, updated to reflect the climate priorities in the EC strategies) include in network planning:
   a. Focus on geography of hydrogen production from all feedstocks, storage, transport, distribution and key components for priority end-uses of clean hydrogen at competitive price.
   b. Launch of 100 MW electrolyser and a Green Airports and Ports call for proposals as part of the European Green Deal call under Horizon 2020 (Q3 2020).[15]
   c. Propose viable framework for hydrogen in the future EU Strategy on Clean Steel.[16]
   d. Facilitate the use of hydrogen in transport sector, heating, industry - as back-up for electricity.
   e. Accelerate the deployment of hydrogen vehicles, vessels and resulting hydrogen infrastructure in revision of the Alternative Fuel Infrastructure Directive and TEN-T.
3. Understand and share knowledge on the EU financing programs: LIFE, Horizon Europe, InvestEU Program, Cohesion Policy, CEF, Innovation Fund, etc.

15 Reference: 13 EU Hydrogen Strategy, 2020, p22.

16 Reference: 14 EU Industrial Strategy, 2020, p9.

REGULATORY IMPROVEMENTS NEEDED:

1. Achieve regulatory acceptance of repurposing and retrofitting of the existing infrastructure in national planning: within national grids plans and NECPs.
2. Facilitate dialogue with ACER on addressing the regulatory principles to enable emerging transport of hydrogen.
3. TSOs to contribute to connecting clusters via backbones, allowed to own and operate hydrogen networks and to provide services related to integrating the various pathways to decarbonisation.
4. Where blending occurs: Gas TSOs can provide services in relation to H_2 transportation/handling as well as 'system integrators' – ensuring that different types of gases are handled as seamlessly and safely as possible/ as necessary. These services should be remunerated.
5. Support, where applicable, the same principles of the EU gas regulation into the EU regulatory framework for hydrogen, preferably (for its accuracy, timeliness and efficiency) by incorporating hydrogen into the existing gas regulation. Seek the exemptions or flexibility within the hydrogen regulatory framework to ensure the progressive development of the hydrogen market through to maturity.
6. Include TSOs' role as 'system integrators' able to offer services already for clusters (balancing, operations, market organisation) and for backbone (planning and operation with Third Party Access).
7. Find solutions for existing hydrogen grids – ensuring balance between developing viable business cases and open, transparent, andnon-discriminatory access to the grids, supporting markets and security of supply.

3.3.2 ENTSOG'S ACTIVE PARTICIPATION IN STRATEGIC ENERGY TECHNOLOGY (SET) PLAN

ENTSOG has been invited to join the European Commission's SET Plan activities related to Energy Efficiency in Industry (IWG6) in May 2020 and joined on 25 June 2020. The SET Plan provides a framework to accelerate the development and deployment of cost-effective low carbon technologies. The IW6 brings together the industry, Member States, and the EC in risk-sharing, public-private partnerships aimed at the rapid development of these technologies at EU level. This key priority is highlighted in the EU Hydrogen Strategy, which includes several key actions on the promotion of R&D to steer the development of pilot projects that support H_2 value chains in coordination with SET Plan from 2020 onwards.

ENTSOG AMBITION WITHIN THIS FRAMEWORK INCLUDES:

1. Provide ENTSOG know-how and expertise on network management on how best to utilise existing gas grids efficiently to transition to Hydrogen Economy.
2. Highlight current and proposed innovative gas TSO pilot projects on technologies, partnerships and business models (hydrogen, P2G, CCS, etc) as examples in debates under thematic group on Systems on horizontal issues related to energy system integration.

GLOSSARY

ACER	Agency for the Cooperation of Energy Regulators
CAN Europe	Climate Action Network Europe
CEN	European Committee for Standardisation
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilisation and Storage
DSO	Distribution System Operator
EC	European Commission
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSOG	European Network of Transmission System Operators for Gas
ESI	Energy System Integration Strategy
EU ETS	EU Emissions Trading System
EU	European Union
GHG	Greenhouse gases
GIE	Gas Infrastructure Europe
GO	Guarantee of Origin
GW	Gigawatt
H-gas	High-calorific gas
IPCEI	Important Project of Common European Interest
L-gas	Low-calorific gas
LNG	Liquefied Natural Gas
MRR	Monitoring and Reporting Regulation
MW	Megawatt
NDP	National Development Plan
NECP	National Energy and Climate Plan
NGO	Non-profit Organisation
PCI	Project of Common Interest
P2G	Power to Gas
RED	Renewable Energy Directive
REMIT	EU Regulation on Energy Market Integrity and Transparency
RGI	Renewables Grid Initiative
R&D	Research and Development
SET Plan	Strategic Energy Technology Plan
SMR	Steam Methane Reforming
TEN-E	Trans-European Networks – Energy Regulation
TPA	Third-Party Access
TSO	Transmission System Operator
TYNDP	Ten-Year Network Development Plan
VTP	Virtual Trading Point

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Additional Note:

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