

Ready4H2: Europe's Local Hydrogen Distribution Networks

PART 3: A roadmap for local gas distribution networks to become the leading hydrogen distribution infrastructure

March, 2022

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This is part three of the Ready4H₂ reports - <https://www.ready4h2.com>

A roadmap for gas distribution networks to help achieve REPowerEU ambitions and net zero

Societal drive to decarbonise: European and national net zero targets

Now

We have various starting points:

- Over 2 500 DSOs in Europe - supplying a variety of customer groups
- Different gas demand profiles in different countries
- Varying future biomethane availability in different countries

But we share common values:

- Trustworthy and reliable supply, with very few interruptions
- Flexible hubs connecting distributed supply and demand
- Providing seasonal scale to deliver winter heating
- Innovation and digitisation to connect biomethane and prepare for hydrogen

We commit to action in 3 areas

Facilitate hydrogen market development

Offer access to hydrogen for consumers

Offer hydrogen producers a route to market

Build confidence in hydrogen

Transform our networks

Complete network repurposing and undertake targeted new build to ensure capacity

Continue to make our networks digital and smart

Convert our networks to net zero based on detailed roll-out plans

Deliver at scale

Deliver pilots in communities and targeted industry clusters

Attract and retain qualified workforce, upskill for hydrogen

Prepare for additional roles and responsibilities

2045

One achievable goal:

Be the leading hydrogen distribution infrastructure to achieve net-zero across Europe

Enablers that help local gas distribution networks to make the transition

Infrastructure and technology for hydrogen

Supply from H2 backbone, storage and local production

Conversion of existing end users and new end users

Fit for purpose policy & regulatory framework

National hydrogen strategies and enabling regulation

EU policy framework



Policy action is required to deliver emissions savings and jobs from hydrogen transformation

European policy action to enable local gas distribution networks to transition to hydrogen...

A fit for purpose policy and regulatory framework will be needed to enable local gas distribution networks to transition to hydrogen and help achieve REPowerEU goals. This includes:

- Incorporate the role of local gas distribution networks in collecting and distributing hydrogen in the EU's vision for the future hydrogen market.
- Establish a gas DSO entity.
- Allow local gas distribution networks to make investments in hydrogen production until the market becomes mature.
- Establish rules for facilitating connections of local hydrogen production
- Provide a clear and stable regulatory framework for recovering investment in grid repurposing and digitisation.
- Provide unbundling rules which will enable efficient transitions across Europe

...will deliver major emissions savings and employment benefits

European policy can enable the transformation of local gas distribution networks and create a big hydrogen market across our continent, with local hydrogen distribution networks providing the essential connections between producers and consumers. This will have major benefits in a large-scale hydrogen scenario, including:

- Reducing CO2 emissions by over 500 million tonnes a year.
- Creating almost 1 million European jobs.
- Reducing imports of fossil gas and oil substantially and improving security of supply.
- Supporting European manufacturing to decarbonize and thereby remain in Europe.

Introduction

| Local gas distribution networks and the Ready4H₂ initiative

Ready4H₂: Transforming local gas distribution networks and supporting climate neutrality across Europe

- For decades **European local gas distribution networks** have shown the ability to deliver cost-effective, reliable and safe pipeline gas distribution and delivery.
- **The Ready4H₂ alliance** represents 90 European gas distribution companies and aims to combine their hydrogen expertise and experience. The alliance believes that local gas distribution networks, in strong coordination with gas transmission and storage infrastructure, are essential to achieve the huge growth and carbon reduction potential of hydrogen. We will deliver a faster energy transition and deeper emissions reductions to support Europe's decarbonisation ambitions.
- In **Part 3** of this series of three we present **a roadmap** for local gas distribution networks to become the leading hydrogen distribution infrastructure. Hydrogen development will take place at varying speeds, and to varying extents, across Europe, but the key characteristics of the transformation will be similar across regions and countries – together with the actions to get there.

Hydrogen is key to net zero, and local gas distribution networks are crucial to meet Europe's ambitious climate goals.

The Ready4H₂ project consists of three studies:

PART

1

LOCAL GAS NETWORKS ARE GETTING READY TO CONVERT [Link](#)

PART

2

THE VALUE OF LOCAL HYDROGEN NETWORKS IN A DECARBONISED EUROPE [Link](#)

PART

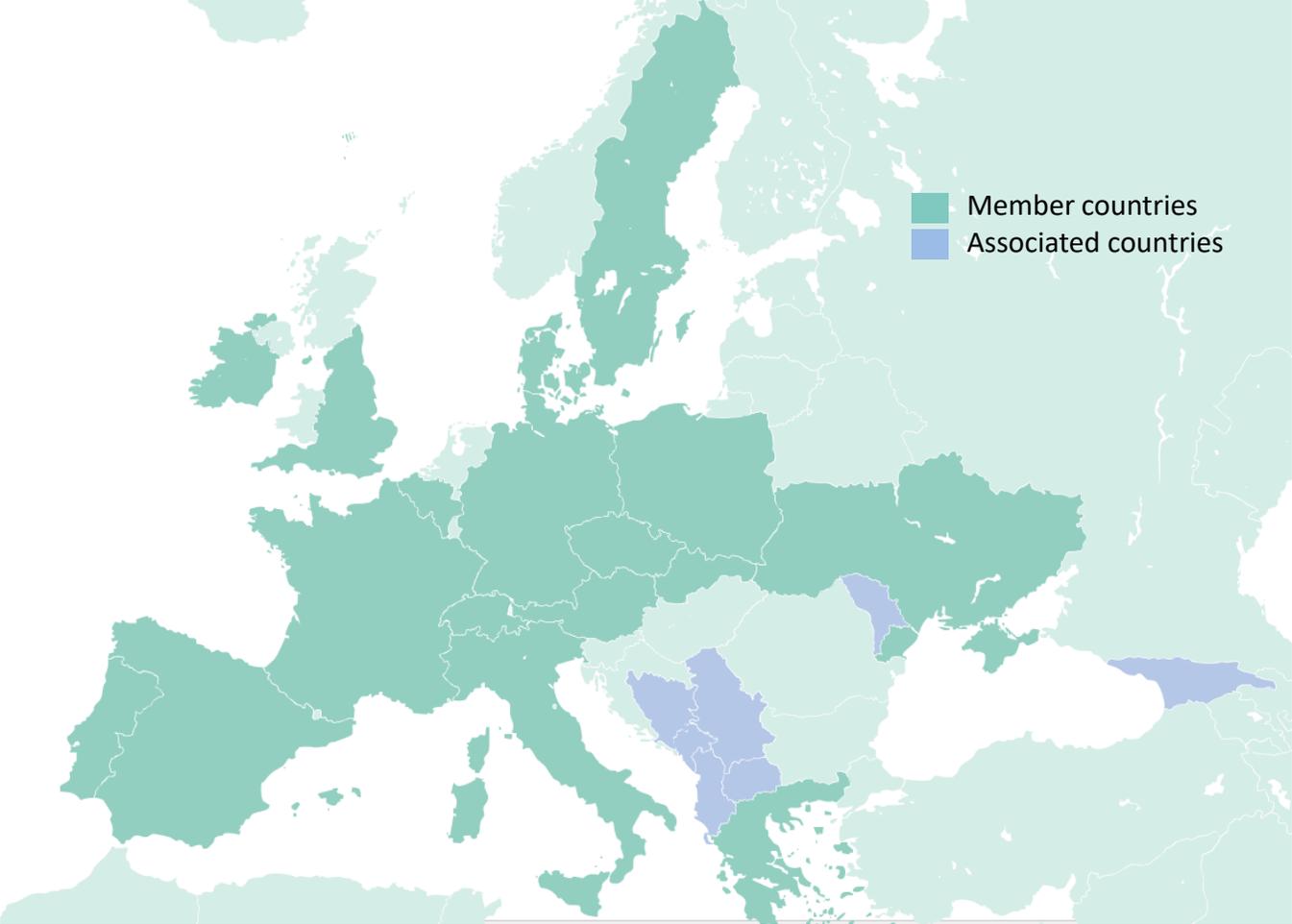
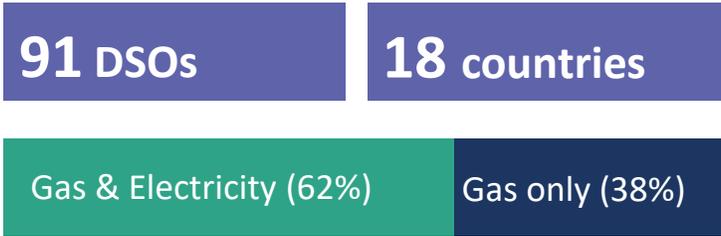
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ROADMAP FOR LOCAL GAS DISTRIBUTION NETWORKS TO BECOME THE LEADING HYDROGEN DISTRIBUTION INFRASTRUCTURE

The Ready4H₂ alliance is growing. As of March 2022, it consists of 91 European gas distribution companies working together to support net zero

Ready4H₂ participating countries:

- Austria
- Belgium
- Czech Republic
- Denmark
- England
- France
- Germany
- Greece
- Ireland
- Italy
- Israel
- Portugal
- Poland
- Switzerland
- Slovakia
- Spain
- Sweden
- Ukraine

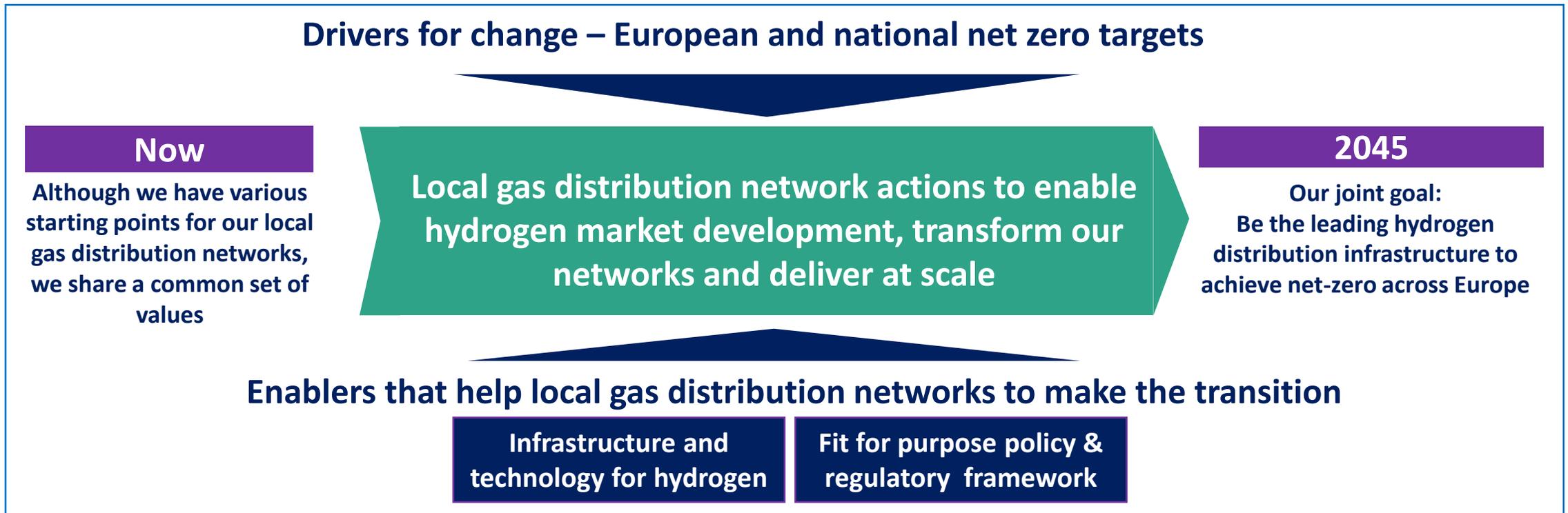


A roadmap for local gas distribution networks to help Europe achieve net zero

| Coming from various starting points to become the leading hydrogen distribution infrastructure

A framework for local gas distribution networks to help Europe achieve net-zero

- The Ready4H₂ hydrogen roadmap shows actions and milestones for European local gas distribution networks from today's various starting points until the common net zero goal in 2045. The drivers at the top and the enablers at the bottom are vital to a successful transition. In the next slides the individual elements will be presented.



Drivers for change

Drivers for change – European and national net zero targets

Improving Europe's energy security in the short term

- On March 8, the EU Commission published a **short-term plan** to reduce the EU's dependence on Russian gas imports, which included a major role for hydrogen and biomethane. Local gas distribution networks can help both hydrogen blending and biomethane to scale up in the short term.
- **Introduce hydrogen blending across Europe:** Hydrogen blending at low percentages (2-5%) can be implemented more widely across Europe within the next two years, displacing natural gas volumes.
- **Scale up biomethane injection:** Local gas distribution networks are already connecting biomethane plants, and can connect as much new biomethane as can be produced. They can handle the injection of significant new biomethane volumes over the next two years.

Achieving net zero in a balanced way that support consumers across Europe

- The European Union aims to decarbonise the energy it consumes to reduce greenhouse gas emissions by at least 55% by 2030 and become climate-neutral by 2050. This will radically transform how energy is generated, transported, stored, distributed and consumed. meeting net zero will require hydrogen and green methane at large scale alongside energy efficiency and electrification.
- Hydrogen and green methane offer a versatile, clean, and flexible energy vector for this ambitious transition. Local gas distribution networks can support households and businesses across Europe to decarbonize with minimal disruption and low upfront cost. For decades local gas distribution networks have provided reliable, secure and affordable energy for consumers, and we will continue to do this through the transition.



We are coming together from various starting points

Different starting points

For decades European local gas distribution network companies have delivered reliable, cost-effective and safe pipeline distribution to millions of customers:

- Our networks include low pressure distribution pipelines connecting millions of buildings and higher-pressure distribution pipelines serving larger energy users.
- We serve a variety of customer groups, including a diverse range of industry, crucial back-up power stations, biomethane refueling stations and commercial and residential buildings.
- We manage very different gas demand profiles, with gas playing a major seasonal heating role in some countries.
- Sustainable biomethane resource potential varies in different countries.

Our common values

- A reliable, trustworthy supply, with very few interruptions.
- Flexible hubs connecting distributed supply and demand.
- Seasonal scale to deliver winter heating.
- Leading innovation to support decarbonization, connecting biomethane and preparing for hydrogen.
- Investing in digitisation, in order to facilitate the operation of multiple gases in the distribution networks. We are able to manage complex projects of gas substitution in our grids.



We are united in our goal to support Europe towards net-zero

Become the leading hydrogen distribution infrastructure to achieve net-zero

- **Infrastructure:** The Ready4H₂ consortium aims to become the leading distribution infrastructure for hydrogen, enabling a substantial hydrogen market which is essential to meet Europe's climate goals and realize REPowerEU targets. We will do this by leveraging and converting existing infrastructure and connecting producers of climate neutral gas with customers in all sectors through flexible distribution structures.
- **Heating, cooking and hot water:** In many areas, the cost-effective and extensive nature of local gas distribution networks is driven by residential sector connections. The hassle-free conversion of current residential customers from natural gas to 100% hydrogen or a blending of hydrogen with green methane will be crucial in many countries.
- **Security of supply:** Using existing storage and distribution infrastructure with decarbonised gas from diversified sources, including local production and hydrogen imports, will improve security of supply.
- **100% hydrogen roadmap:** Hydrogen development will take place at varying speeds across Europe, but the key characteristic is net-zero gas distribution, achieved by 100% hydrogen and blending hydrogen with green methane.
- **Blending:** Blending of hydrogen plays three roles:
 - It can reduce natural gas demand in the short term, helping to improve Europe's energy security.
 - It is a useful stepping-stone on the way to net zero, providing hydrogen producers with a ready source of demand, delivering short term carbon savings, supporting market uptake and hence initial developments, and allowing a digital connection to green hydrogen, as per renewables in the power sector.
 - Given limited green methane resources, it can be used to top up green methane to ensure 100% decarbonised gas without major changes for consumers.

Our commitment to action

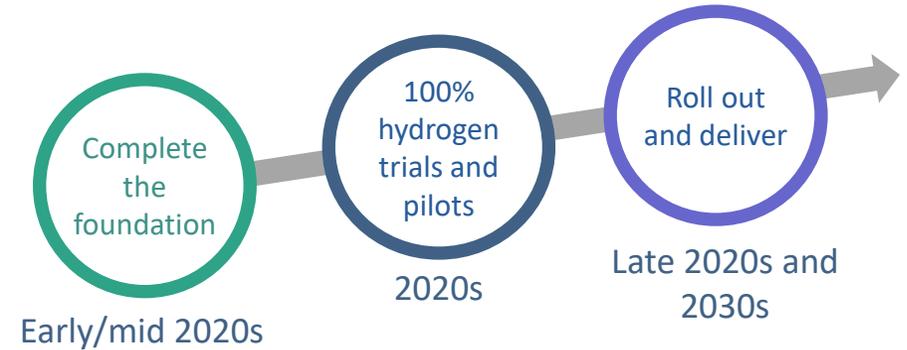
Main stages to transition to net zero by 2045:

Although exact timings will vary between local gas distribution networks and countries, there are three key stages to transition to hydrogen:

- **Complete the foundation:** In the early to mid 2020s, local gas distribution networks will complete the main knowledge elements to prepare for conversion, including 100% hydrogen safety case and new billing arrangements.
- **100% hydrogen trials and pilots:** In the 2020s, we will undertake trials and larger pilots of 100% hydrogen in buildings and industry, and in parallel more hydrogen refuelling stations will open.
- **Roll out and deliver:** From the late 2020s, we will enable the roll out of hydrogen across large parts of our networks, including blending with natural gas as a stepping stone, and blending with green methane in some areas as a net zero solution.

Our actions are on three levels:

- We will work with consumers to build confidence in hydrogen and engage with hydrogen producers to provide them a route to **market**.
- We will transform and repurpose our **networks** by making them intelligent and deliver on detailed plans per region to roll out hydrogen across Europe.
- We will undertake community pilots, attract and retain qualified staff and shape our organisations to **deliver hydrogen at scale** to our customers.



Our commitment to action – Facilitate hydrogen market development

Facilitate hydrogen market development

A big hydrogen market needs to be developed in partnership with consumers, municipalities and producers, with practical demonstrations of safety, efficacy and ease of use.



Offer access to hydrogen for consumers

Plan network transformation based on dialogue with consumers, businesses and municipalities.

Coordinate plans for conversion of areas to ensure necessary resources are mobilised and consumers are sufficiently informed.

Offer hydrogen producers a route to market

Alongside consumer dialogue, plan network transformation based on backbone development and local production to enable market access for suppliers and producers.

Provide connections to and from hydrogen storage facilities to support supply security.

Educate and build confidence in hydrogen

Share information from hydrogen pilots widely to demonstrate that the use of hydrogen is safe and effective.

Involve knowledge institutes to give impartial views and share research findings on hydrogen.

Our commitment to action – Transform our networks

Transform our networks

Our existing networks are the key to a big and cost-effective hydrogen market, and we will complete the preparations to enable them to distribute hydrogen to millions of consumers across Europe.



Complete network repurposing and undertake targeted new build to ensure sufficient capacity

Complete pipeline and network component readiness for hydrogen, focused on repurposing existing infrastructure (which is cheaper than new-build).

Ensure that hydrogen clusters can be effectively connected during the transition through new distribution pipelines.



Continue to make our networks digital and smart

Enable real-time measurement of gas composition to manage gas quality on the network.

Introduce energy content billing for hydrogen and methane blends.



Convert our networks to net zero based on detailed roll-out plans

Deliver area conversions to hydrogen as production and storage become available.

Introduce blending of hydrogen with increasing shares of green methane to achieve net zero in other areas.

Our commitment to action – Deliver at scale

Deliver at scale

We will continue to capture learnings from hydrogen pilots and further equip our innovative workforce for a large-scale roll-out.



Deliver pilots in communities and targeted industry clusters

Carry out pilots of hydrogen in industrial facilities to gain further experience of hydrogen operations in manufacturing

Carry out community pilots of hydrogen in buildings, demonstrating safe and effective operation and sharing knowledge.

Attract and retain qualified workforce, upskill for hydrogen

Provide training for hydrogen blending and 100% hydrogen for gas network engineers and other technicians.

Develop widespread hydrogen training programmes so that it becomes a standard gas safety activity across our networks.

Prepare for additional roles and responsibilities

Strategic planning of the future energy infrastructure of Europe, including working jointly with transmission operators on 10-year national development plans.

Operating pure hydrogen grids alongside methane and blended grids.

Enablers that help local gas distribution networks to make the transition

Infrastructure and technology for hydrogen



Supply from H2 backbone, storage and local production

- Timely realisation of European H2 backbone.
- Hydrogen storage facilities to meet seasonal demand and absorb surplus renewables
- Widespread local hydrogen production fed into local gas distribution networks



Conversion of existing end users and new end users

- H2 Ready appliances available across Europe
- Power to X technologies offering new products to new customers

Fit for purpose policy & regulatory framework



National hydrogen strategies and enabling regulation

- Strategies and regulation supported by public and private actors that build a solid foundation for investment in national hydrogen economies



EU policy framework

- Incorporate the role of local gas distribution networks in collecting and distributing hydrogen in the EU's vision for the future hydrogen market

Summary: A roadmap for local gas distribution networks to help Europe achieve net zero

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Fit for purpose policy and regulation

| Enabling local gas distribution networks to manage the transition to hydrogen

DSOs are crucial to accelerate the hydrogen potentials in REPowerEU and to achieve a future energy independence of Europe – it's time to enable them

Despite the recognized need for green molecules in the European energy mix, the role of distribution networks in the transition continues to be underestimated in its unique ability to connect the production and consumption of hydrogen at the local level

Strict unbundling prevents transition

- DSOs should be able to convert from operators of natural gas grids to hydrogen grids by utilizing their existing organization and workforces. This allows DSOs to adjust flexible to the needs of customers, easing the connection of any local hydrogen and biomethane production to the grid by maximizing cost-efficiency.
- The proposed strict unbundling rules will lead to an enforced separation of operations and ownership for gas and hydrogen in the same grid areas. This is inefficient, raises questions about responsibilities and the complexity will ultimately slow down the transition process to climate neutrality.

Flexibility is needed

- DSOs are enabler of the injection of hydrogen, biomethane and may operate with any combination of gas, and will ensure a route to the hydrogen market to producers, acting as an accelerator of RePowerEU
- This requires the right regulatory EU and national framework incentivizing the operators to ramp up the conversion through ambitious transformation plans supported by strong investments, trained workforces and well coordinated actions with all the relevant stakeholders including customers, producers and suppliers.

Equal representation is crucial

- To successfully work on the foreseen tasks in the field of network codes, TYNDP and methane emissions, Gas DSOs need a fair and strong representation in a dedicated European DSO entity. Due to the strong overlap between gas and hydrogen topics at distribution level the DSO entity has to represent them in combined manner.
- The development of the EU Hydrogen Backbone builds on the successful and speedy transition of the connected distributions grids. A close cooperation between the gas and hydrogen topics of DSOs and TSOs can be ensured through a standing committee.

APPENDIX: Benefits from a large-scale hydrogen transformation

| Our call to action will enable hydrogen at scale with associated benefits

Hydrogen could save over 500 million tonnes of CO2 emissions a year across Europe

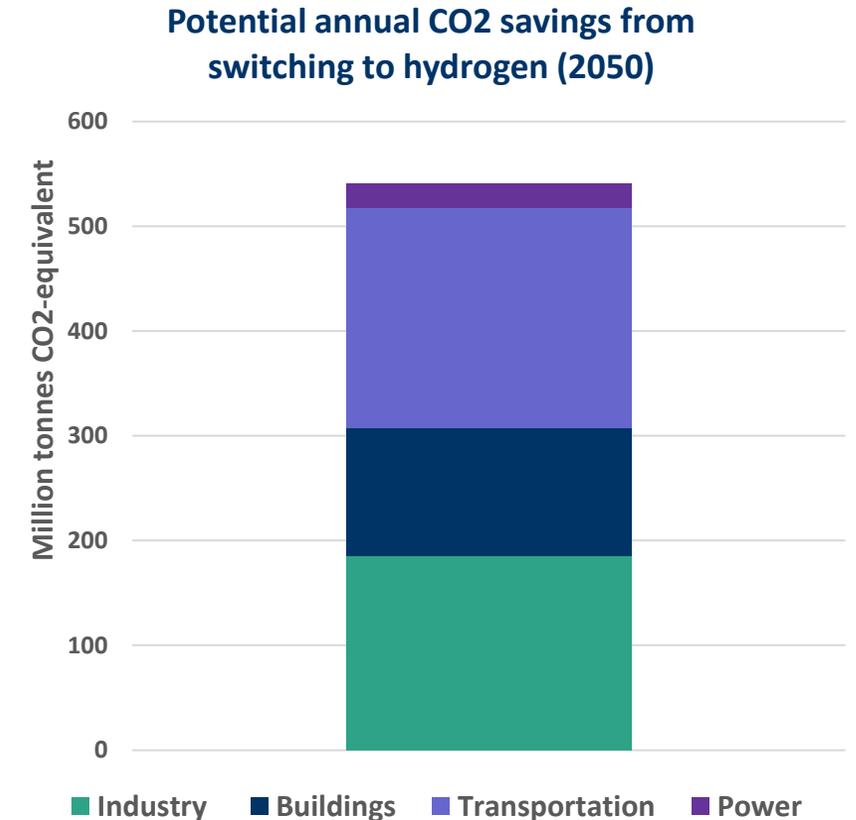
Significant emissions savings

As we showed in Part 1 of this project, converting all the natural gas that Ready4H₂ members distribute to customers to hydrogen or other green gases, would abate over 300 million tonnes of CO₂ emissions a year.

A wider roll-out of hydrogen, including in other sectors such as transport, has the potential to abate 540 million tonnes a year of CO₂ emissions across Europe by 2050. This is based on the Fuel Cell and Hydrogen Joint Undertaking scenario, where hydrogen is widely used in all sectors (including replacing higher carbon transport fuels). This scenario would require local gas distribution networks to convert to hydrogen in many cases.

- For this scenario, we assume that average hydrogen production emissions are 1 kg of CO₂e per kg of hydrogen, higher than lifecycle emissions of hydrogen produced from renewables.
- We also use European average figures for the emissions intensity of natural gas (including natural gas production and transportation) of 240 gCO₂e per kWh, and transport fuel of 341 gCO₂e/kWh.

Other large-scale hydrogen scenarios in Europe (total annual demand of 1 230 – 3 260 TWh) would be associated with emissions savings of 350-889 million tonnes of CO₂ per annum in 2050.



Hydrogen could create nearly 1 million European jobs, and reduce fossil energy imports

Employment

The Ready4H2 alliance members already have a reliable, experienced workforce of many thousands of skilled people, who provide safety to end users and who would be indispensable to any hydrogen conversion.

Switching to hydrogen has the potential to secure and create jobs. Analyses show that, based on a scenario of 1 710 TWh of hydrogen production, the full hydrogen industry (including manufacturing, operations and maintenance) has the potential to create nearly 1 million additional direct and supply chain jobs in Europe by 2050. This includes:

- 290 000 jobs in green hydrogen production;
- 135 000 jobs in operations and maintenance;
- 542 000 jobs in the electricity production required for green hydrogen.

Hydrogen can also support European manufacturing at risk of offshoring, by providing a cost-effective decarbonization pathway. This would protect further jobs.

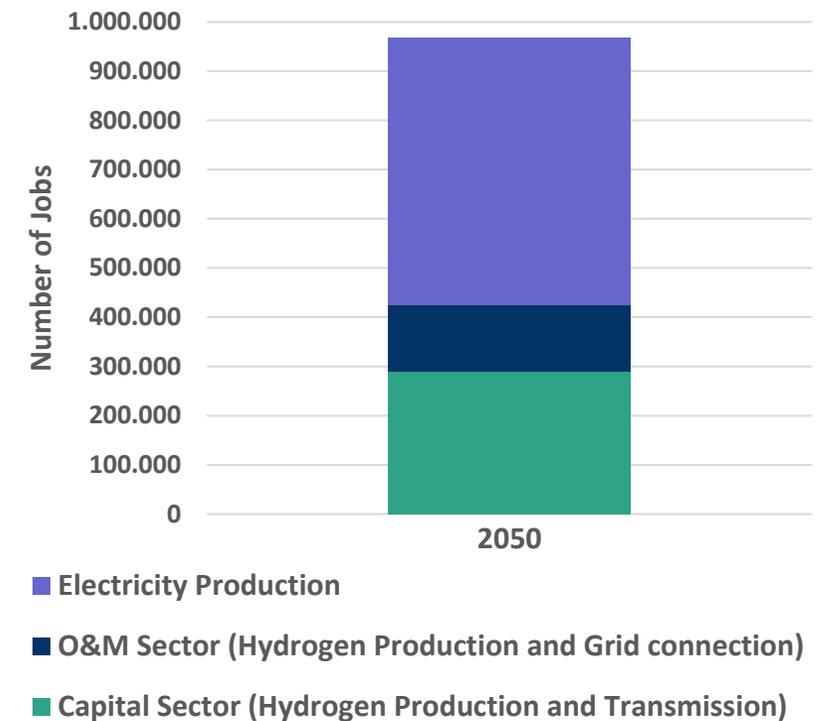
Security of supply

Hydrogen also has the potential to reduce imports of both fossil gas and oil to Europe. In 2019, the EU27 required net imports of oil and gas of around 10 000 TWh, including:

- Almost 4 000 TWh of net imports of gas;
- Around 6 000 TWh of net imports of crude oil and petroleum products.

Therefore, hydrogen production in Europe of around 2 000 TWh would be equivalent to reducing net oil and gas imports to the EU by around 20%.

Potential green hydrogen jobs in 2050



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