Stimuli for the next German Government

Gas infrastructure: for a secure energy system and efficient climate protection

September 2021

About FNB Gas:

The Berlin-based association Vereinigung der Fernleitungsnetzbetreiber Gas e.V. (FNB Gas) was founded in 2012 by the German gas transmission system operators (TSOs), i.e. the network companies operating the major supra-regional and cross-border gas transmission pipelines. One key focus of the association's activities is the Gas Network Development Plan, which has been drawn up annually by the TSOs since 2012. The association also acts as a central point of contact for policymakers, the media and the general public on behalf of its members.

The members of the association are: bayernets GmbH, Ferngas Netzgesellschaft mbH, Fluxys TENP GmbH, GASCADE Gastransport GmbH, Gastransport Nord GmbH, Gasunie Deutschland Transport Services GmbH, GRTgaz Deutschland GmbH, Nowega GmbH, ONTRAS Gastransport GmbH, Open Grid Europe GmbH, terranets bw GmbH and Thyssengas GmbH. Between them they operate a pipeline network totalling some 40,000 kilometres in length.

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Ambitious climate protection targets unachievable without molecules

Germany has set itself ambitious climate targets, aiming to reduce its CO2 emissions by 65% by 2030 compared to 1990 levels. The goal is to be climate neutral by 2045 and have negative emissions from 2050 onwards. Around 40% was achieved in 2020. This means that transformation of the German (energy) industry will have be much quicker than it has been thus far. In order to achieve climate neutrality, it is not only necessary to expand renewable generation capacity, but also to convert and expand the existing energy infrastructure and the application technologies used by the end consumer. The energy transition is not a "greenfield" project but must be implemented as efficiently and expediently as possible on the basis of the existing conditions. In reality, full electrification is neither financially viable nor practical. The key point is to make rapid and sustainable reductions in CO2 emissions. These can only be achieved in an economically efficient manner by using a mix of technologies and green energy in the form of electrons and molecules.

It is crucial for acceptance of the energy transition and for Germany as a business location that the energy system is successfully transformed without any serious structural disruptions. The gas infrastructure can make a decisive difference here, as it can be used for all gaseous energy sources. In certain industries (e.g. steel, chemical, refinery), the use of gaseous energy sources (such as hydrogen) is essential to decarbonise processes. In areas such as the heating market where molecules currently account for around 70% of the energy consumed the (continued) use of gaseous energy sources is a prerequisite for a cost-effective and secure energy supply. Natural gas, the energy carrier transported in the current gas infrastructure, is gradually being replaced by green gases such as hydrogen, biomethane or SNG. This will make it possible to provide a climate-neutral gas supply to all connected consumers.

Gas infrastructure as a guarantor of flexibility, storage and transport for renewable energies

Alongside the expansion of electricity networks, the conversion and expansion of the existing gas infrastructure will be crucial. The existing gas network already transports nearly twice as much energy as the electricity grid. It was also designed as a transit and import network. Due to its comparatively high overall capacity, energy transmission via the gas network is more cost-effective than via the electricity grid.

Also in terms of energy storage, the gas network offers important prerequisites for the success of the energy transition. Due to the volatility of generation from wind turbines and photovoltaic systems, intermediate storage of electricity is essential, if Germany's potential for renewable power generation is to be fully exploited. On the electricity side, there is no foreseeable prospect of significant long-term storage potential. On the other hand, with the help of the gas infrastructure, the energy required to meet a significant proportion of Germany's annual electricity demand can be stored long-term in German gas storage facilities alone and be made available again at any location as and when required. This avoids shutdowns of production plants and unnecessary outage costs while also creating flexibility within the power grid.

In addition, the urgently needed expansion of the transmission networks is progressing very slowly. This is due, among other things, to a high level of public concern about power line construction projects. With

the tightening of climate protection targets and the associated expansion targets for renewables, the electricity transmission situation is becoming even more critical. Transporting the renewably generated electricity as hydrogen via a hydrogen infrastructure is therefore a cost-effective and necessary complement. One medium-sized hydrogen pipeline is equivalent to approximately four HVDC lines. This allows faster expansion and more widespread use of renewable energy. The gas infrastructure can serve the permanent energy needs of industry throughout Germany, irrespective of location, relieve the electricity system around the seasonal winter peaks in the heating market and at the same time supply gas-fired power plants and CHP plants in order to ensure constant security of supply, e.g. when there is no wind and no sun. The gas infrastructure is therefore an important factor in ensuring a secure energy supply at all times.

Development of a hydrogen infrastructure as the backbone of a hydrogen economy

The German government has recognised that climate protection targets cannot be achieved solely through renewable electricity in end-use applications. It has therefore proposed measures in its national hydrogen strategy to encourage the development of a hydrogen economy. These include both building up capacities of large-scale power-to-gas plants for the production of hydrogen from renewable electricity and the import of hydrogen from third countries, as well as the development of a hydrogen infrastructure. The supraregional connection of numerous domestic and foreign hydrogen production sites with the centres of industrial consumption on the one hand, but also the provision of hydrogen countrywide creates the conditions for a secure hydrogen supply in Germany. Gas transmission system operators (TSOs) can develop the necessary hydrogen infrastructure as the backbone of a competitive hydrogen economy in an economically efficient manner, largely by converting today's natural gas network. However, this requires a reliable regulatory framework that treats the hydrogen network and the natural gas network as one single unit in regulatory, financial and network planning terms, and avoids any unnecessary and obstructive demarcations. Such a unified regulatory framework would ensure the gradual, demand-driven and efficient conversion of the existing gas infrastructure.

Importance of hydrogen and other green gases in difficult-to-decarbonise sectors such as the heating market

Particularly in sectors that are difficult to decarbonise, such as industry and heavy goods transport as well as the heating market, the use of hydrogen is a crucial prerequisite for achieving the ambitious climate protection targets.

Given the heterogeneity of the building stock and the preconditions that are necessary – but not always present – for the efficient use of electric heat pumps, there is much to be said for keeping further technological options open. Apart from biomethane, another realistic option is to use hydrogen to provide heating for existing buildings, as this would allow existing, cheap and tried and tested technologies (such as condensing boilers, combined heat and power generation, e.g. small-scale CHP units) to be used. In the short term, blending renewable hydrogen into gas distribution networks can make an initial contribution to climate protection. An even greater contribution could be achieved through the mandatory use of green gases, such as biomethane. The introduction of a (virtual) green gas quota for traders would be an effective market instrument here. In future, the gas supply could also potentially be 100% hydrogen. There are various technological options promoting competition among technology providers and affordability

for consumers, which is also especially important in the heating market from a socio-political perspective. Focusing solely on electrification would be inefficient and expensive and also require historically unprecedented rates of modernisation.

Another argument for the use of gas-based heating systems in existing buildings is the available network capacity. While the provision of energy via gas pipelines can be guaranteed in the long term, even at low outside temperatures, electricity distribution grids would require significant expansion. Studies show that the capacity requirements to be met at any one time by the German gas network for heat generation at an outside temperature of -14°C[1] is approximately 230 GW for the heating market. Even in an optimistic all-electric scenario with a high proportion of heat pumps and highly ambitious renovation rates, the peak electrical demand in the building sector would roughly amount to an additional 80 GW[2], which is about the current maximum peak load in the power grid.

Hence, rapid and socially acceptable decarbonisation of the building sector will not be possible without the use of hydrogen and other green gases in the heating market.

Restructuring the energy system requires integrated network development planning

Transformation of the energy system as the basis for a decarbonised economy also places new demands on network planning. In future, this will have to be cross-sectoral, with much more integration between the different energy carriers electricity and gas, including hydrogen. This is the only way to couple the energy infrastructures in an economically advantageous way, while taking account of energy and climate policy objectives.

Conclusions

- → **Green gases pave the way for decarbonisation: We need hydrogen and other green gases in all sectors. The climate protection targets cannot be achieved solely through the use of renewable electricity in end-use applications.**
- → **Hydrogen offers significant potential for decarbonising the heating market: To make climate protection affordable for consumers, it is sensible to establish the energy supply in the building sector on a broad technological base. Various options for decarbonisation, e.g. the use of hydrogen, can be opened up via the gas infrastructure.**
- → **The gas infrastructure is essential for the success of the energy transition: The gas infrastructure per se is not fossil-based. It is merely the link between energy producer and consumer. The energy it transports, which today is still mainly of fossil origin, will gradually become climate-neutral (hydrogen and other green gases). As such, the gas infrastructure remains a central component of the future energy system.**
- → **A unified regulatory framework for hydrogen networks is needed: The development of a national and European hydrogen infrastructure is a prerequisite for a competitive hydrogen economy. Developing such an infrastructure from the existing natural gas infrastructure provides a cost-effective and comparatively rapid implementation pathway.**

[1] Infrastructure-related design case for the gas network according to KOV.
[2] This 80 GW includes the replacement of heating oil as an energy source.

→ **Integrated network development planning is necessary for transformation of the energy system**

Recommended actions

Green gases: paving the way for decarbonisation

Gas is a key component of the energy system. With an energy consumption of 954 TWh (2019), gas is the second largest energy supplier in Germany, ahead of electricity at 507 TWh (2019). In the heating sector, gas accounts for almost two thirds (620 TWh) of the energy consumed. It is also indispensable in transport and especially in industry.

In future, hydrogen and other green gases will pave the way for the transformation to a carbon-neutral energy world. Fossil natural gas will gradually be replaced by biomethane, green as well as initially blue or turquoise hydrogen and synthetic methane.

Today, climate-neutral gases are already helping to reduce greenhouse gas emissions and will do so much more in the future. Together with the associated infrastructure, they will be an ideal partner for renewable electricity by compensating for the shortcomings of electrification.

For example, gas-fired power plants, which will potentially run on hydrogen in the future, offer flexible backup for electricity generation at times when the wind is not blowing and the sun is not shining. Gas transmission pipelines and storage facilities offer a much greater geographical and seasonal capacities than the electricity system. Thus, climate-neutral gases, in conjunction with the gas infrastructure, ensure that business and consumers can continue to rely 100% on the security of energy supply in Germany in the future.

Climate-neutral gases also make it possible to decarbonise in areas where it would otherwise be difficult or very costly to achieve. This applies, for example, to production processes in energy-intensive industries or the transport of heavy loads over longer distances (heavy goods transport). Climate-neutral gases will also make an important contribution to climate protection by heating buildings where alternatives such as heat pumps are not a realistic option, either for technical or financial reasons.

Recommended action: to increase the use of decarbonised and green gases by introducing a quota

The introduction of a quota for climate-neutral gases would effectively support the achievement of ambitious climate protection targets. With the help of a binding quota, the reduction of CO2 emissions can be clearly planned and specifically controlled. The obligation for gas suppliers to comply with quotas should start in 2022 with a virtual share of 1% (approx. 6.7 TWh) of final energy consumption and increase to 10% by 2030 to facilitate decarbonisation of the gas industry by 2045. Depending on the mix of different climate-neutral gases, FNB Gas calculates that CO2 emissions could be reduced by up to 70 million in the period from 2022 to 2030.

Heating market: hydrogen offers considerable potential for decarbonisation

The climate protection targets are ambitious. The amended Climate Protection Act requires the building sector to emit no more than 67 million tonnes of CO2 in 2030. According to the Federal Environment Agency, the sector contributed 120 million tons of CO2 emissions in 2020, so emissions will have to be reduced by 43% over the next ten years. Given that only 8% savings were achieved in the period from 2010 to 2020, it therefore seems rather unlikely from a current perspective that the 2030 target will be met, unless other measures are initiated in the short term to supplement the promotion of electric heat pumps and energy efficiency measures.

The existing technology mix of electricity and gas applications in the heating market demonstrates a number of key advantages that will be of central importance in a future energy system: high resilience and security of supply, high acceptance, low economic costs, and a high level of social compatibility. Against this background, the greatest possible electrification of the heating market does not make sense. Rather, solutions that do not favour any particular technology (including gas-based solutions) as well as the use of hydrogen can contribute successfully and in a socially acceptable way to decarbonisation and secure supply in the heating market.

Hydrogen as a socially acceptable option for decarbonising the heating market

The gas infrastructure can open the way to various decarbonisation options. Today, with a figure of around 1,300 TWh/a, the heating market accounts for more than 50 per cent of final energy demand in Germany. Currently, about two-thirds of this is provided by molecules. The figures make it clear that the challenge of decarbonising the heating market is immense. The task is rendered even more difficult by the heterogeneous building stock (existing/new-build – detached houses/apartment blocks/commercial) and the multitude of stakeholders with individual decisions for their properties. If the transformation process in the energy sector is to be successfully designed, it will be necessary to find a suitable solution for each stakeholder. Hydrogen is an indispensable option here. It is able to provide solutions where electricity-based solutions lead to high investment and social distortions or are not immediately feasible for technical or time-related reasons.

While new buildings are already highly energy-efficient, this cannot be said for most of Germany's unrenovated or only partly modernised building stock (which accounts for 87% of all buildings). Before electricity-based solutions can sensibly be used in existing buildings, building envelopes will have to undergo costly renovation. Moreover, the heating system in the entire building has to be converted to underfloor heating or panel radiators. These high investments represent a significant obstacle to decarbonisation and can result in social distortions. In contrast, using hydrogen for space heating does not require high levels of investment on the part of the property owner, so the barrier to decarbonisation is relatively low. The investment required to upgrade the building envelope is especially high where the building structure is particularly old and has undergone little renovation. In such cases, high investments would lead to rent increases, thereby burdening the population in these neighbourhoods. Here again, the use of hydrogen would allow socially acceptable conversion of the heating market.

In terms of economic efficiency, there is much to be said for an energy transition based on climate-neutral gases. Decarbonisation with a focus on molecules, i.e. via the gas network, is cheaper overall and more socially acceptable.

Hydrogen as an energy storage and transport medium for the heating market

The heating market is characterised by a high degree of seasonality due to the weather so that in the natural gas system, for example, the capacity peak differs between summer and winter by a factor of 4.5. Today, the natural gas system alone provides the heating market with a peak heating capacity of 230 GW while the installed oil heating systems provide another 100 GW. The historical peak load in the entire electricity system is just under 80 GW. For a heating supply based on renewable energies, it is therefore essential to store energy in phases of oversupply (e.g. in the summer months) to allow these energy quantities to be used during the heating season. The only feasible long-term storage option for these very large amounts of energy is to generate hydrogen and downstream derivatives and store them in underground storage facilities like those currently used for natural gas storage.

Since there is limited land available in Germany for generating electricity from renewables, there is a consensus that we will have to continue to import a large proportion of our energy. In addition, electricity from renewable energy sources can be generated in other countries at significantly lower costs, due to their prevailing climatic conditions. Transmission of large amounts of energy over long distances in the form of molecules can be carried out comparatively inexpensively via pipelines, and the transported hydrogen can be used directly.

Hydrogen as a contribution to efficient power grid expansion

Especially at very low temperatures, the efficiency of air-to-water heat pumps drops sharply, so that a large amount of electricity would then have to be transported. This energy must be available at all times, even on extreme winter days. If the heating market were to become “all-electric”, the historical electricity peak load of 80 GW would more than double through the use of heat pumps – even if the renovation of buildings is accelerated. The study "The value of hydrogen in the heat market" (August 2021) by Frontier Economics concludes that in the event of full electrification in the heat market, the additional peak electricity load in 2045 would more than double to 86 - 124 GW compared to today. In addition, there would be further increases in electricity demand in the course of electrification, e.g. in the transport sector for e-mobility. Especially in inner-city areas, the power grids are not currently designed for these capacity requirements. This would result in high costs for the expansion of the electricity grids, especially the distribution grids. Using a hydrogen infrastructure developed from the existing natural gas network would lead to significantly lower transportation costs and there would probably be much greater acceptance for repurposing the existing infrastructure.

Recommended actions:

- Energy supply in the heating sector should be placed on a broad technological footing to achieve security of supply and climate protection. The use of hydrogen is a socially acceptable decarbonisation option for the heating market.
- Existing gas infrastructure should continue to be used to minimise additional power grid expansion and keep the various decarbonisation options open.
- Today's gas customer is tomorrow's hydrogen customer. This is particularly true in the heating market. Therefore, joint regulation of hydrogen and natural gas networks should be introduced to make the infrastructure transformation process efficient and affordable for all customer groups.

Successful energy transition: only achievable with gas infrastructure

In order to protect the climate, the greenhouse gas reductions needed have to be implemented quickly and sustainably. Incorporating carbon-neutral gases into the energy system can make a significant, immediate and cost-effective contribution to reducing CO2 emissions in all consumer sectors, while at the same time maintaining security of supply. The basis for this is an infrastructure that links up supply and demand and, for the first time, makes it possible for climate-neutral gases to be incorporated into the energy system. In this way, the gas infrastructure can make an important contribution to meeting climate policy targets. Making the best possible use of existing gas infrastructure assets for the energy transition is therefore a "no regret" strategy for the energy transition.

Using gas infrastructure for the future energy system avoids lock-in effects

It is important when developing the sustainable energy system of the future to set the course very soon in order to avoid any adverse lock-in effects. Just from looking at current energy consumption (507 TWh of electricity and 954 TWh of gas in 2019), it is clear that – even with major gains in energy efficiency – we will only be able to meet future energy needs if we rely on renewable electricity and gaseous energy sources. It is not the infrastructure that is fossil-based, but the gas that is currently still predominantly in the pipes. However, what is certain is that, in order to achieve climate protection targets, today's fossil gas will have to be successively replaced by climate-neutral gases, especially hydrogen, but also other green gases (biomethane and synthetic methane). Therefore, rather than being a commitment to the (continued) use of fossil fuels, the continued use of gas infrastructure instead paves the way to decarbonisation.

Leveraging gas infrastructure for an affordable energy transition, security of supply, and greater system efficiency

It is economically efficient to use existing infrastructure where possible, thereby avoiding the expense of building new energy networks. Besides, the urgently needed expansion of the power grid is already coming up against major acceptance problems. These would be further aggravated, if it were also planned to build extensive new infrastructural facilities, despite there already being well-developed gas infrastructure in place, ready to transport large amounts of energy.

Together with the gas storage facilities, the existing, internationally interconnected gas infrastructures are an important pillar of security of supply in the German energy system. When it comes to the long-term storage of large amounts of energy, there are no viable alternatives to gaseous energy carriers. At the same time, the available conversion technologies tap into a current gas storage volume of several months (around 260 TWh) in Germany, compared to an electricity storage volume of well under an hour (around 0.04 TWh). Seasonally fluctuating load profiles and dark doldrums can therefore be managed.

A good combination of electricity and gas networks can offer the spatial and temporal flexibility of energy sources needed for the energy transition and thus ensure security of supply at all times. It can also provide cost-efficient generation and transportation options. However, this requires existing energy systems to

be integrated by intelligently linking sectors and infrastructures. Today, gas networks transport more than twice as much energy as electricity grids and are designed to meet the high peak load demands in the heating market. A sensible linkage, for example via power-to-gas plants, can significantly increase the efficiency of the overall energy system.

Even in its function as a bridge to a decarbonised energy system, gas infrastructure also plays an important role in quickly and significantly reducing CO2 emissions. Numerous industrial companies and utilities will initially switch their energy source from coal, which they currently use, to natural gas. Only in this way is it possible to halve average CO2 emissions per kWh. In parallel, gas TSOs are preparing the next "fuel switch" from natural gas to hydrogen.

The gas infrastructure is ready for hydrogen

The gradual replacement of methane by hydrogen and other green gases is a particularly big plus for the energy transition. In contrast to a switch from gas to electricity applications, it does not require any large-scale replacement of end-use appliances. The hydrogen infrastructure can grow organically from the gas network and be developed as needed from Germany's and Europe's extensive gas network. This makes technical and financial sense, since it takes much less time and money to convert a network than to build a new one. According to the gas TSOs' calculations to date, the future hydrogen network in Germany can be largely (around 90%) created from the existing natural gas network. 70% of the European Hydrogen Backbone (2021) is made up of the existing natural gas network.

Recommended action:

Develop the existing natural gas infrastructure to create a sustainable gas infrastructure consisting of hydrogen and methane networks to ensure the secure supply of climate-neutral gases (hydrogen and other green gases). This will require an appropriate regulatory and network planning framework to be created.

Regulatory framework: a unified approach to hydrogen and gas networks is needed

With the amendment of the Energy Industry Act (EnWG), the German government has introduced regulation for hydrogen networks in Germany for the first time. The Act defines hydrogen as an energy carrier alongside electricity and gas. Moreover, it creates a legal basis for the conversion of existing natural gas pipelines to hydrogen and for the construction of new hydrogen pipelines. Hence it is now possible, from a legal point of view, for gas TSOs and other market players to implement the first projects for developing a hydrogen infrastructure, provided that the financial framework can be clarified very soon. The gas TSOs see this Act as a first step towards a comprehensive regulatory framework that will allow a competitive hydrogen market ramp-up. The legislator and the German government have already acknowledged that the separate hydrogen regulation introduced will only be suitable for a transitional period. Given the upcoming amendments to the hydrogen and gas market decarbonisation package at the European level, a revision of the regulatory provisions is already provided for in the EnWG. However, further steps will have to follow straight after the federal election in Germany.

Investment security

The next step is to clarify the unresolved issues in the transitional regulation introduced by the EnWG amendment. The separation of costs and charges for natural gas and hydrogen infrastructure envisaged for the transitional regulation does not create adequate investment security for network operators and network customers. So far, the German government's answer to the question of funding is that so-called IPCEI funding will be available to kick-start the hydrogen infrastructure. However, such project-based investment funding does not provide an adequate basis for building a cohesive infrastructure. Infrastructure measures are based on long-term cycles (depreciation of up to 55 years), which are subject to considerable operational risks, especially in the ramp-up phase. These need to be adequately addressed for the transition phase by imposing appropriate network charge regulation, so that no prohibitively high charges arise for network customers and no investment-inhibiting risks arise for network operators.

Stable unified regulatory framework for gas and hydrogen networks needed

In the long term, however, the development of the hydrogen infrastructure cannot be based on government funding. Therefore, following on from the transitional regulation, joint financing of natural gas and hydrogen networks should be introduced to create lasting investment security for network operators and network users. In addition, the transitional regulation must be refined to create a unified regulation for hydrogen networks along the lines of the tried and tested gas regulation. Such a regulation would also address market issues related to the use of hydrogen infrastructure, such as capacity marketing. In addition, the German government should enact suitable measures to allow a competitive hydrogen market ramp-up.

Integrated planning of natural gas and hydrogen infrastructures

The unified approach to gas and hydrogen networks must also be anchored in network planning. It is technically possible, and above all economically efficient, to develop the major part of future hydrogen networks from the existing natural gas network. At the same time, the transport of methane will still be necessary for a secure energy supply. This natural gas will gradually be replaced by hydrogen, biomethane or synthetic methane. Because of this link between the current methane system and the future hydrogen system, it would be neither efficient nor expedient to separate them for network planning purposes. Such an artificial separation also contradicts the politically intended goal of integrated planning and a holistic view of all infrastructures in the energy system. The gas TSOs are therefore already working on concepts to integrate the planning of the two infrastructures and to use the instrument of the Gas Network Development Plan and the tried and tested network planning processes for the hydrogen infrastructure as well.

Joint regulation for natural gas and hydrogen at European level

The European Commission is currently developing the hydrogen and gas market decarbonisation package. An initial legislative proposal has been announced for Q4 2021. This is expected, inter alia, to create a regulatory framework for hydrogen networks at the European level. The Bundestag has called upon the German government to take an active role in this process and advocate the introduction of joint regulation for natural gas and hydrogen infrastructure at the European level in order to ensure that the development of a coherent hydrogen infrastructure gets off to a quick start in Germany as well, thereby facilitating the ramp-up of a competitive hydrogen market. In this way, the above-mentioned uncertainties of separate regulation could be eliminated at an early stage. It is also particularly important for Germany to adopt a strong position in Brussels, because many other European countries are already actively promoting their national interests, and in many cases these are incompatible with the goal of establishing a regulated hydrogen infrastructure as a prerequisite for a competitive hydrogen economy in Germany and Europe.

Recommended actions:

- Rapidly create security for investments
- Refine the transitional regulation to create joint regulation and funding of gas and hydrogen networks to establish a unified framework that is stable in the long term
- Introduce integrated planning of natural gas and hydrogen infrastructures
- Enforce a common regulation for natural gas and hydrogen at the European level

Integrated network development planning: a prerequisite for the transformation of the energy system

Against the backdrop of the energy transition, an integrated, coordinated process for the network development plans for electricity and gas, including hydrogen, is essential for future network planning. The key forecasts and energy scenarios for the development of the energy transition should be jointly developed as part of a cross-sector process. In order to achieve more integrated network planning between the energy carriers electricity and gas in the future, it is necessary, inter alia, to make adjustments to the existing network planning processes.

Infrastructure paves the way for the energy transition

A cross-sector system development plan preceding the network development planning processes (Scenario Framework and NDP) would be a consistent and reliable framework to define the guidelines for efficient and economically beneficial coupling of energy infrastructures, taking account of energy and climate policy goals. This would create a common basis for planning by identifying different, coherent future scenarios, which form the basis for electricity and gas network development planning and ensure that energy transport is considered in an integrated manner as part of the established infrastructure planning processes.

As well as the demand-driven approach for short-term network modelling, the transformation of the energy system requires long-term and scenario-based modelling of infrastructures. Such an approach to electricity and gas network planning based on consistent metrics of cross-sector energy scenarios calls for unified planning horizons and synchronous handling of the planning processes per se.

The development of a competitive hydrogen economy requires a growing hydrogen infrastructure connecting the generation centres at home and abroad with the storage facilities and consumers in Germany. The development of this hydrogen infrastructure must be fully integrated into the gas network planning process as large parts of the existing gas network can be used for this purpose, with only a few new pipeline sections needed to close gaps in the network and some additional pipelines having to be built. The conversion of natural gas pipelines requires integrated and iterative modelling of the networks as part of the Gas NDP. Not least because, in parallel to the hydrogen ramp-up, it will also be necessary to secure the supply and transit of natural gas and in future also the supply of biomethane and synthetic methane for several decades to come. A separate network development plan for hydrogen is therefore not expedient. As part of the H2 report pursuant to section 28q of the Energy Industry Act (2021), the gas TSOs will develop a corresponding concept for integrated network planning in order to continue to use the synergies that exist with the tried and tested processes in the Gas Network Development Plan.

Recommended actions:

- A prerequisite for an integrated process is the synchronisation of the network development plans for electricity and gas, which would not only harmonise the planning horizons but also allow the processes for electricity and gas to be carried out in parallel. This is the only way that electricity and gas TSOs can carry out their planning work in a coordinated manner.
- In the interests of efficient energy infrastructure planning, a regulatory framework for hydrogen must be created as part of natural gas regulation and the course must be set for the development of a hydrogen economy in Germany.
- An economical and demand-oriented gas infrastructure can only be developed through joint natural gas and hydrogen network planning. Since the hydrogen network will predominantly develop from the natural gas network, synergies and efficiencies (based on the established Gas Network Development Plan) will have to be used for network modelling and development.