ENERGINET

LONG-TERM DEVELOPMENT NEEDS IN THE DANISH GAS SYSTEM

Energinet's long-term development plan 2022 – Needs analysis

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LONG-TERM DEVELOPMENT NEEDS IN THE GAS SYSTEM

This report presents a likely scenario for the new initiatives that will be needed in the gas system towards the year 2040.

The aim is to obtain a clear picture of the planning activities, as a starting point for dialogue about the solutions that will be studied and ultimately selected, paving the way for an effective green transition.

NEEDS ANALYSIS: THE GREEN TRANSITION REQUIRES NEW INITIATIVES AND DIALOGUE

This report presents a likely outcome for the **initiatives that will be needed in the Danish gas system towards the year 2040** in order to maintain a high security of supply throughout the green transition. Along with the report on possible solutions, the needs analysis must contribute to making the green transition as cost-effective as possible.

Big changes are taking place in our energy landscape, which will look very different in the coming decades – driven by the green transition and the Danish climate target to reduce CO_2 emissions by 70 percent by 2030 and to achieve climate neutrality by 2050. Considerably more natural gas is expected to flow through the Danish gas system, when Baltic Pipe is commissioned and the Tyra-complex is back in operation with supplying gas from Danish offshore.

With increasing electrification and renewable energy production, gas consumption is generally forecasted to decrease towards 2040, when renewable gas is expected to be able to cover the total gas consumption. Developments are very difficult to predict, with many unknowns. In particular, it is uncertain where in Denmark the development will take place – and how quickly. A new technology called Power-to-X might become very important for the gas system, although the direction the technology will take is still uncertain. Large-scale Power-to-X could end up being a game changer for the gas system.

The needs analysis aims to form a basis for dialogue and effective solutions

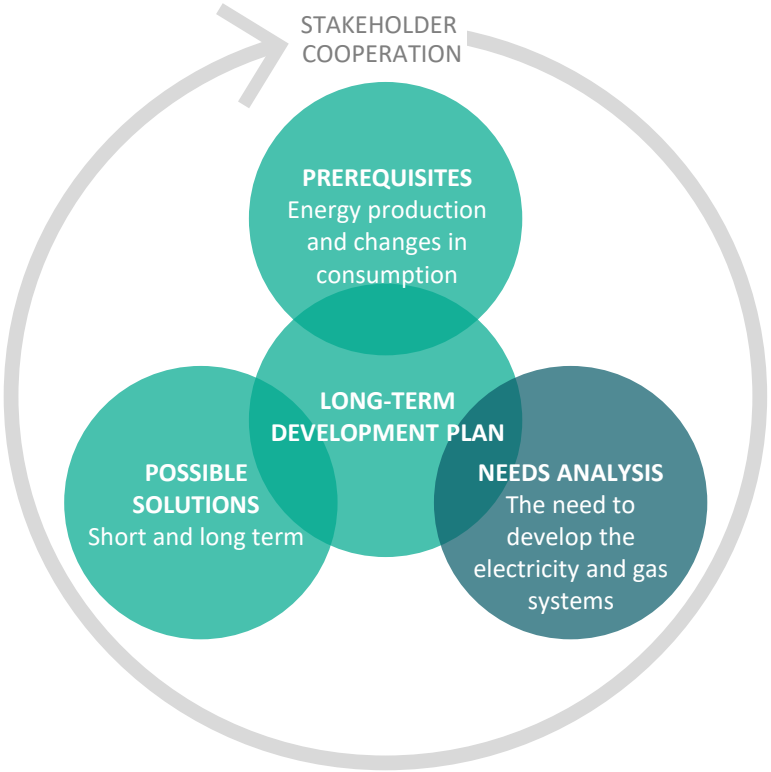
Close dialogue across society and with stakeholders is vital if we are to succeed in combining security of supply with an effective green transition of our energy system. This needs analysis therefore seeks to establish a qualified basis for the dialogue that will help us to find effective and future-proof solutions.

How did we do our calculations?

Our models for calculation and analysis are based on the Danish Energy Agency's Analysis Assumptions for Energinet from 2020 (AF20). The Analysis Assumptions provide a likely scenario for developments in the consumption and production of gas and electricity, which are aligned with the political objectives.

Where can you find out more?

- See the background material for the needs analysis: www.energinet.dk/gas-baggrund2021 (Danish)
- The needs analysis forms the basis for possible future solutions which are set out here: www.en.energinet.dk/gas-solutions2021



An important part of the bigger picture: Energinet's long-term development plan

In line with the assumptions used, the needs analysis forms a basis for investment decisions and thus for the solutions which are intended to guarantee a high degree of security of supply now and in the future. There are many unknowns and therefore the process is iterative, meaning that we revise and update our plan as we go if the assumptions change and new needs arise.

THE NEEDS OF SOCIETY AT THE HEART OF THE GREEN TRANSITION

At Energinet, we are working to transform the electricity and gas systems so they supply green energy, while maintaining a high degree of security of supply and ensuring that this is all affordable for consumers and society. This is called the energy trilemma and is what concerns us overall.

The needs analysis will help us keep up with developments and continue to put the needs of society in front and centre as we plan and make investment decisions. Our work is affected by three things in particular: rapid pace, green energy and existing systems.

Rapid pace

With ambitious political climate goals and a development which is increasingly driven by market forces, it is clear that the green transition is set to speed up in the coming years.

The market-based development is characterised by greater unpredictability. Where will technologies such as biomethane and solar power do particularly well, and where will the systems need to be developed? This unpredictability influences Energinet's planning.

Effective solutions require timely planning because the processes involved are complex – and it will be necessary to take calculated risks so that Energinet is not left behind in terms of development needs. We are dependant on dialogue with the outside world in order to succeed.

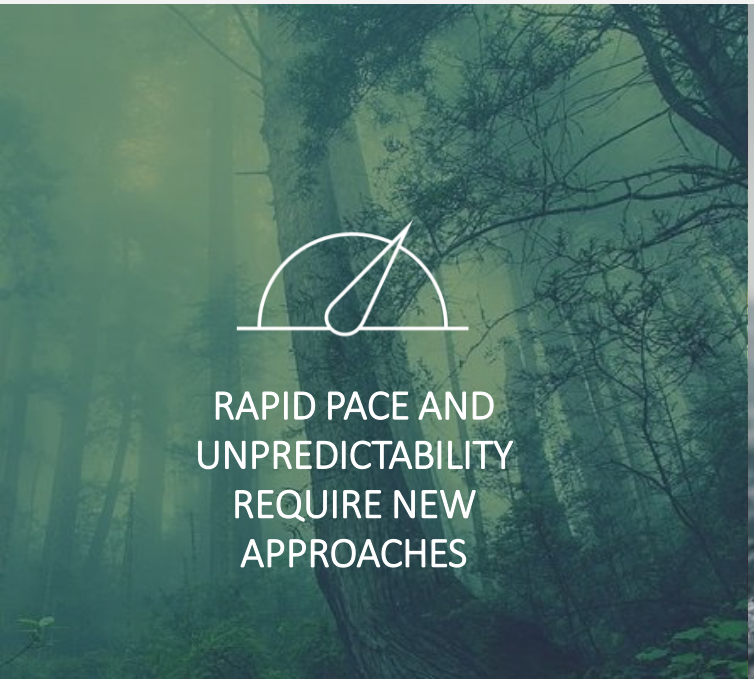
Green energy

The production and consumption of renewable energy will grow significantly as we move towards a climate-neutral society. This presents new challenges for the electricity and gas systems. The new green consumption will need to be linked to green production, as the two are often separated by great distances. Meanwhile we must maintain the existing high degree of security of supply.

Developments in Power-to-X technologies opens more possibilities for the electricity and gas systems to support each other in the green transition.

Existing systems

Alongside the development of the electricity and gas grids necessitated by the green transition, the existing systems will also be adapted and maintained so they continue to meet the needs of society and our customers. This could include reducing the visual impact of an installation, or replacing components at the end of their service life. Or modifying the gas infrastructure to allow for other developments benefiting society, for example when a new railway is built.



WHY IS THERE A NEED TO DEVELOP THE GAS SYSTEM?

The green transition requires development, and ultimately we need to rethink the gas system we are familiar with today. With increasing electrification, less gas will flow through the pipelines and the gas that does flow must be green. The journey towards 100 percent green gas started years ago – for example the quantity of biomethane increased from 1.5 percent in 2015 to 17 percent in 2020. And the upward trend shows no sign of stopping. The development in Power-to-X and hydrogen, too, could have a big impact on the future gas infrastructure. Three factors will particular influence on our work.

RAPID PACE

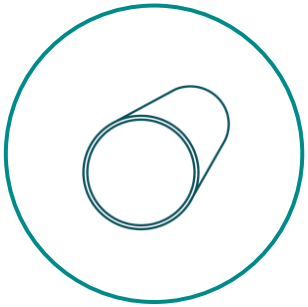
Political ambitions are accelerating the phase-out of gas for heating meaning that gas consumption in the future will mainly be driven by industries. The gas which is left in the system is to become greener.

Procurement regimes encouraging the production of green gas have stimulated a lot of interest in connecting biogas plants to the gas grid. This will speed up the development, and will test Energinet's ability to plan and implement measures to ensure that the infrastructure is ready in time for the new green gas to be integrated.

GREEN ENERGY

The rapid pace of development means that our efforts must be focused on the effective integration of green gas in the system. The green transition may create local congestion if biomethane production cannot be utilised locally due to low consumption. Development and adaptation will be necessary so that biomethane production is not constrained by the system.

The development in Power-to-X requires an approach which spans to the whole of the electricity and gas infrastructure, where there are various potentials. For example, hydrogen could increase biomethane production and parts of the gas system could eventually be converted to transport hydrogen.



EXISTING SYSTEMS

Needs often arise in society which are not related to the green transition, but still have consequences for the gas system. They are often driven by urban growth or new roads and railways requiring Energinet to move gas pipelines, facilities or to take remedial action in relevant parts of the existing gas infrastructure.

NEW PLAYERS IN THE ENERGY SYSTEM AND SECTOR COUPLING

The goal is a climate-neutral society

The Danish Parliament adopted the Danish Climate Act (*Klimaloven*) in 2019, with the target of a 70 percent reduction in Danish climate gas emissions by 2030. Together with the goal of net zero emissions by 2050, these objectives set the general direction for development of the energy system. The objectives were revisited on multiple occasions in 2020 and 2021. The climate agreement for the energy sector from June 2020, for example, has moved towards specifying how the objectives can be met.

Difficult to forecast development

It is clear that the energy system is facing a major transformation in order to meet the political objectives. But how will the development unfold?

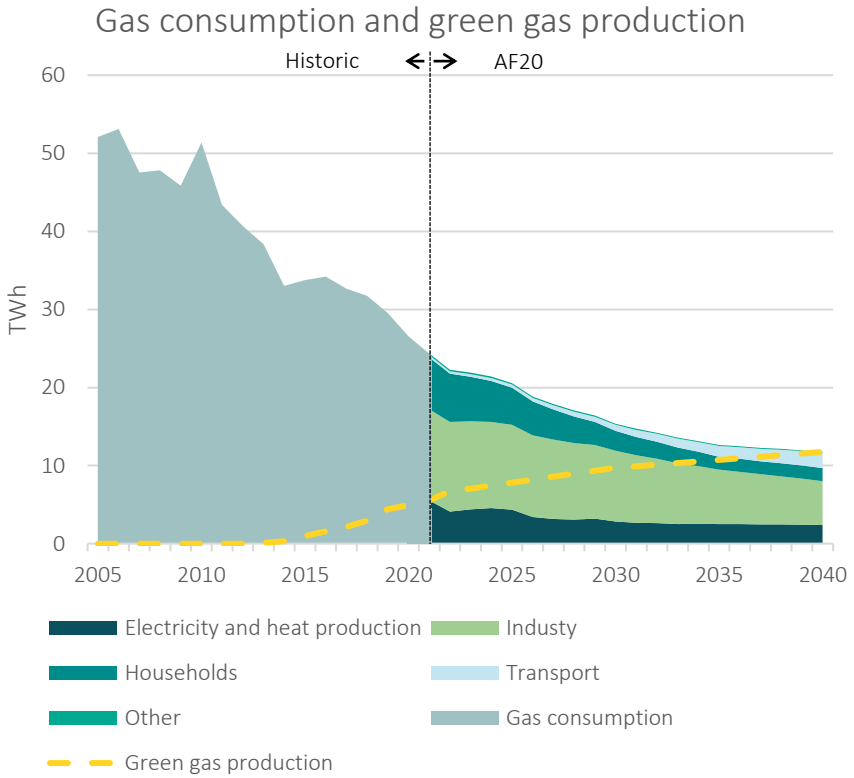
Every year, the Danish Energy Agency prepares key data projections for the Danish energy system in the Analysis Assumptions (AF). They were published most recently in August 2020 and describe a likely development of the energy system over the next 20 years, in line with the current political objectives.

AF20 is the main basis for the work done by Energinet. The rapid pace and unpredictable nature of the development, however, means that we must take a number of uncertainties into account. For example, it is difficult to predict the pace of expansion and the location of Power-to-X plants and green gas. The government is currently working on a gas strategy and a Power-to-X strategy in Denmark. Depending on how the strategies turn out, the development could take a different direction. Power-to-X plants may become so large that even just one plant could be a game changer for the needs we are looking into.

Energy islands, Power-to-X and sector coupling will play an important part

AF20 addresses new players in the energy system – energy islands and Power-to-X – for the first time. It is generally agreed that these new technologies will play a part in the energy system of the future even though they are associated with many unknowns. For Power-to-X, important details are uncertain, such as the geographical location of the plants and the end product. Energinet is able to influence many of these factors, but the final decisions – of significant importance to Energinet's work – are made elsewhere.

As new players emerge, sector coupling is now on the agenda. Here, too, it is generally agreed that the interaction between the electricity, gas and heating sectors is crucial for the effective transition of the energy system. As the transmission system operator for both electricity and gas in Denmark, Energinet is working hard to integrate the two systems more closely.



Gas consumption in general is expected to decrease, but there are big differences in the way the various sectors will develop. Increasing electrification is expected to result in a sharp decrease in gas for household heating, and by 2040, gas consumption is forecasted to be more than halved compared to 2020. During the same period, the production of green gas is expected to more than double. The demand for gas is likely to primarily come from industry in 2040, and gas will also play an important role in handling peak loads in the electricity and district heating sectors.

UNCERTAINTIES

The Danish Energy Agency's Analysis Assumptions (AF) are the main basis for Energinet's work and for this needs analysis. AF represents one of many possible ways to achieve the political objectives.

AF offers a likely development, but there is considerable uncertainty regarding the precise direction the development will take. The uncertainties concern the rapid pace, the amount of renewable energy to be transported, and the geographical distribution.

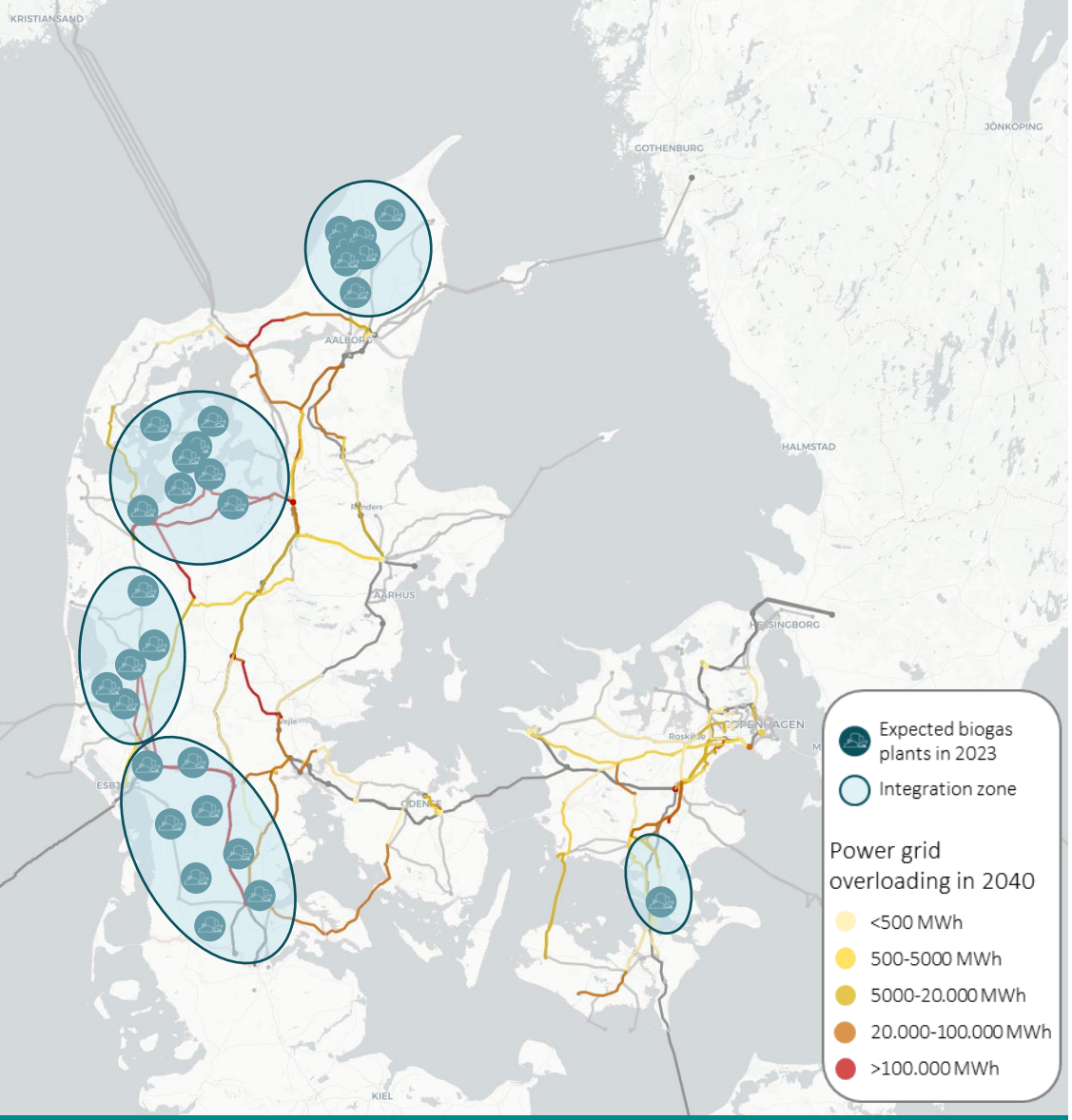
Selected examples of these uncertainties are shown to the right, and they could have a big impact on the needs analysed by Energinet.

CHANGES IN GAS CONSUMPTION

Political ambitions to phase out gas consumption are causing considerable uncertainty about how quickly and where in the country the phase-out will happen. In certain areas, gas consumption is even expected to increase in the short term.

POWER-TO-X AND GREEN ENERGY PRODUCTION

A new subsidy scheme for biogas plants could have an impact on the pace of development of biomethane production and the location of these plants. Power-to-X could also increase the amount of green gas injected into the gas system.



BIOGAS METHANISATION

A process in which CO_2 separated from biogas is combined with hydrogen to produce a synthetic biomethane. 70 percent more green gas can potentially be produced because biogas contains about 35 percent CO_2. CO_2 from biogas is a by-product of the process to upgrade biogas to natural gas quality. That is why CO_2 from biogas is seen as an easily accessible source of carbon.

TOPIC: SECTOR COUPLING OF ELECTRICITY AND GAS IMPROVES INTEGRATION OF GREEN ENERGY

Sector coupling will play an important part in achieving the objectives of the green transition. Energinet continuously investigate and support opportunities for sector coupling. This page presents an example showing how the electricity and gas systems can support each other in the context of methanisation.

Methanisation can ease parts of the electricity system with excess of green electricity

By 2040, parts of the electricity transmission system are expected to become overloaded as more green electricity is produced which cannot all be utilized where it is generated. In many of these areas there is also significant biomethane production. In these areas, methanisation can help integrate green electricity by increasing electricity consumption.

According to the expectations in AF20 for the quantity of green gas in 2030, methanisation could consume up to 2.8 TWh of electricity at the national level. However the potential is much greater, especially in the regions generating large amounts of green electricity, where methanisation could create a demand for 7 TWh of electricity by 2030. This is 20-30 percent of total generation of green electricity in those areas. The extent to which the potential for offtake of green electricity can be realised will depend on how widespread methanisation becomes. The potential is expected to increase towards 2040.

The potential for green gas can utilize both the electricity and gas systems

Methanisation of CO_2 has considerable potential to increase the quantity of green gas without the need to build more biogas plants or use biomass. Increasing the quantity of green gas through methanisation, however, may necessitate changes to existing gas infrastructure. The potential for methanised biogas is as high as 4.2 TWh in parts of the country with the highest anticipated generation of green electricity. Thus the gas system would receive 40-45 percent more green gas in 2030 than assumed in AF20 so far.

Methanisation could change the pattern of gas supply

With methanisation, the gas system must be prepared for a more fluctuating green gas supply, with periods of abundance as a result of a hydrogen supply that depends on low electricity prices. The low electricity prices usually occur when RE electricity generation is high, where the electricity system, in the areas, needs to be relieved.

Analyses show that supplies will be abundant mainly outside the summer months when gas consumption is low. This helps to avoid imbalance in the local gas distribution grid in the summer, and allows green electricity to be integrated in the gas system in the winter when gas consumption is high.

MAIN DEVELOPMENT NEEDS IN THE GAS SYSTEM

The future needs for the gas system has been summarised in a number of analyses. Each of these analyses provides particular insights concerning the operation and development of an effective gas system towards 2040.

Close dialogue with the market requires action

In Energinet we are also in close dialogue with the market, which provides us with important input that will need to be acted upon. One of these initiatives is incremental capacity, in which the users of the gas system are involved in defining the future development needs. Another initiative is focused on hydrogen. In the summer of 2021, the Danish Energy Agency and Energinet invited all potential hydrogen market players to a market consultation about meeting the need for a hydrogen infrastructure.

The main conclusions from the needs analysis requiring action are presented on the right. The following pages go into more detail about the individual needs, including oxygen in the transmission grid and the climate impact of the gas transmission system.

LOCAL BIOMETHANE SURPLUS MUST BE ADDRESSED

Biomethane surplus must be addressed in order to ensure full and effective integration.

AVOID LOSS OF GAS AT REVERSE-FLOW FACILITIES

Reverse-flow facilities reliability is an important focus in order to avoid the loss of biomethane, when parts of the facility are out of operation.

ADJUSTMENT OF CAPACITY

The capacity of M/R-stations must be adjusted as a result of changing consumption, consumption patterns and increasing biomethane production.

OPERATIONAL OPTIMISATION OF M/R-STATIONS

Operation and maintenance of the M/R-stations must be optimised and coordinated with the other developments in the gas system.

THE NEEDS ANALYSIS IS THE BASIS FOR FURTHER WORK WITH SOULTIONS

This needs analysis contributes with an overview of the challenges and needs we foresee. Energinet continuously work with several types of solutions that support the development needs of the gas system in a future with a large share of biomethane and a lower gas consumption. Below on the right you will find the four main categories of solutions we work with. The solutions are further described in Energinet's solution catalogue, which you can read more about here: www.en.energinet.dk/gas-solutions2021. The needs analysis and the solution catalogue forms the basis for a dialogue on how both known and new solutions can be brought into play when solving the identified needs.

DEVELOPMENT NEEDS

LOCAL SURPLUS OF BIOMETHANE MUST BE HANDLED

AVOID LOST GAS AT REVERSE-FLOW FACILITIES

ADJUST THE CAPACITY

OPERATIONAL OPTIMIZATION OF M/R-STATIONS

SOLUTION TYPES

CONSTRUCTION SOLUTIONS

OPERATIONAL SOLUTIONS

MARKET SOLUTIONS

THIRD-PARTY SOLUTIONS

NEEDS ANALYSIS FOR THE DANISH GAS SYSTEM

These pages go into more detail about the needs of the gas system towards 2040.

BIOMETHANE SURPLUS DEPENDS ON LOCAL BIOMETHANE PRODUCTION AND LOCAL GAS CONSUMPTION

In the long term, it is difficult to estimate the expected biomethane surplus locally. It very much depends on where consumption decreases and where new biogas plants are built. This depends on the availability of public subsidies and whether or not local industries convert their energy supply.

BIOMETHANE PRODUCTION MUST BE LINKED TO CONSUMERS

The need to handle local biomethane surplus after 2025 in the gas transmission system

Local biomethane surplus occurs when production of biomethane in an area exceeds consumption in the same area, without the possibility of transporting the biomethane away from the local grid. This means that the biomethane output might not be fully utilised, and measures may be necessary to ensure that society does not miss out on the produced biomethane. biomethane surplus occurs primarily in the summer months, when the consumption of gas for heating is low and industries are closed down for the summer holidays.

There is a risk of biomethane surplus in a number of areas between 2025 and 2030 in the gas transmission system. The precise extent and locations will depend on how the actual development in local gas consumption and biomethane production will occur.

After 2040, local biomethane surplus will increase unless the gas system is modified

Without new measures to manage biomethane, the surplus will increase to the order of 100 million Nm^3 per year in 2040 – or 5-10 percent of overall gas consumption. Meanwhile, our consumption will decrease while biomethane production increases to meet all gas needs in Denmark by 2040.

It is uncertain where this biomethane surplus will occur as this depends on where biomethane production is expanded and also on where gas consumption declines. However, biomethane surplus is expected to primarily occur in the areas that are already expected to have biomethane surplus by 2030 and where the gas system already has established facilities to handle the surplus.

Biomethane surpluses will also be a challenge in areas which are already connected

The challenge of biomethane surplus will also affect areas where modifications to the gas system has already been made or is planned to be made. For example, Energinet has reverse-flow facilities operating or planned in Southern Jutland, Funen and Central Jutland. Reverse-flow facilities are essentially compressor stations which compresses gas from local distribution grids to the high pressure transmission grid.

The biomethane surplus is now expected to be greater than originally assumed in the analyses that were used in the design of reverse-flow facilities in some areas. The reverse-flow quantities and the periods of operation may change. Certain reverse-flow facilities may have to be expanded as a result.

FULL SYSTEM UTILISATION WITH VERY HIGH GAS CONSUMPTION

There is enough capacity in the gas system in 2030 even on days with extremely high gas consumption

THERE MUST BE SUFFICIENT CAPACITY IN PERIODS WITH HIGH CONSUMPTION

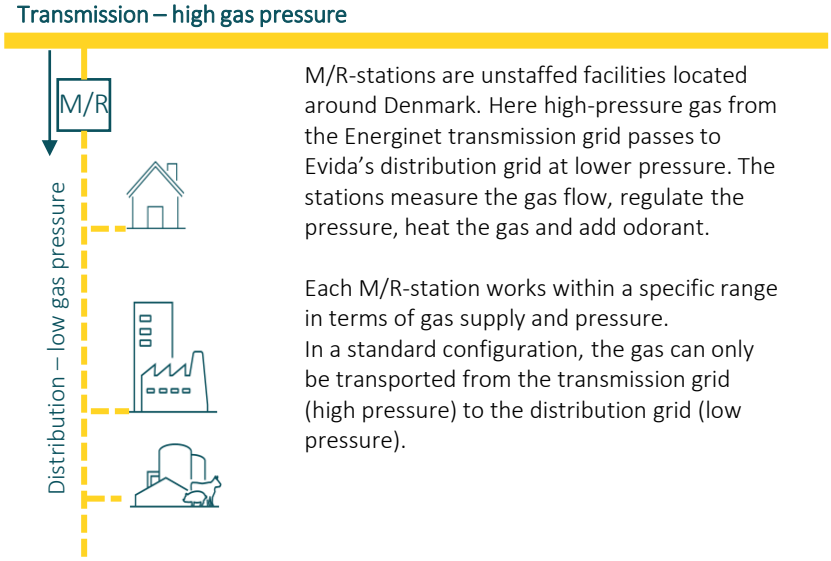
Capacity of M/R-stations are pressured by new large gas consumers

New large gas consumers are putting pressure on the capacity of M/R Aalborg, along with M/R Koelbjerg and M/R Højby near Odense. The demand for gas in Aalborg will be within the capacity of the station, whereas the capacity of the two M/R-stations near Odense will not be sufficient and modifications will be necessary.

Local biomethane production and decreasing consumption reduces the need for M/R-stations

Local biomethane production and decreasing consumption will reduce the need for M/R-stations in Southern Jutland.

Analyses indicate that the need for capacity at M/R-stations in Southern Jutland will decrease by 75-94 percent by 2030 and by up to 70 percent in Middelfart and the greater Copenhagen area. The reduced need could mean that M/R-stations are downscaled or closed.



M/R-stations are unstaffed facilities located around Denmark. Here high-pressure gas from the Energinet transmission grid passes to Evida's distribution grid at lower pressure. The stations measure the gas flow, regulate the pressure, heat the gas and add odorant.

Each M/R-station works within a specific range in terms of gas supply and pressure.
In a standard configuration, the gas can only be transported from the transmission grid (high pressure) to the distribution grid (low pressure).

GAS TRANSPORT TO THE EAST GUARANTEES SUFFICIENT BLENDING

The large volumes of gas transported from the North Sea to Poland will guarantee sufficient blending of the biomethane to keep down the oxygen content – provided that the gas transported to the east makes up at least 10 per cent of total capacity to Poland.

HIGH OXYGEN CONCENTRATION IN THE GAS MUST BE ADDRESSED BEFORE EXPORT

Country specific requirements for gas quality create challenges in relation to export

Biomethane injected into the Danish gas system may contain a higher concentration of oxygen than our neighbours in Germany, Sweden and, in time, Poland allow. As more biomethane is injected into the Danish gas transmission grid, there is a risk that the oxygen content of the gas will be higher than permitted by the receiving country. This creates challenges for our gas export. An oxygen concentration of maximum 0.5 percent I biomethane is allowed in the Danish gas transmission system.

At the moment we deal with this through sectioning and blending

In practical terms, sectioning means that one transmission pipeline to Germany is kept free of biomethane, allowing gas with a low oxygen content to be sent from the North Sea to Germany without being blended with biomethane. This is also the reason why no biomethane is injected into the transmission grid west of Egtved.

With blending, biomethane from South and North Jutland is mixed with gas from the North Sea or Germany before being transported east to Sweden. This ensures that the excess oxygen remains below that country's limit value.

Gas quality depends on transport to Poland

The future gas pipeline, Baltic Pipe, will transport large volumes of gas from Norway to Poland from the end of 2022. An analysis of how the gas quality is affected if more biomethane is injected into the transmission system shows that it will not cause any problems. The biomethane will be mixed with large volumes of gas from Norway, ensuring that the gas quality meets the requirements in Poland as well as Sweden.

The analysis assumes that gas will be transported through Denmark to Poland year-round throughout the period of analysis. Occasionally, there may be brief periods without gas transport, for example during maintenance of gas treatment plants in Norway. In these situations, our neighbours' oxygen limit in the transmission grid may be exceeded. To restore gas transit, measures will be needed to reduce the oxygen concentration in the transmission system.

THE CLIMATE IMPACT OF THE GAS TRANSMISSION SYSTEM MUST BE REDUCED

Operation of the gas transmission system, from for example M/R-stations and reverse-flow facilities, contributes to the climate impact of Energinet. The climate impact includes CO_2 and methane emissions. In 2020, 90 percent of Energinet's climate impact from the gas transmission system came from preheating at M/R-stations, from leaks, and from the electricity used by compressors. The emissions from operating the gas system are very low in relation to the energy in the gas system – corresponding to 0.35 g of CO_2 equivalents/kWh

Climate-neutral energy consumption in 2030

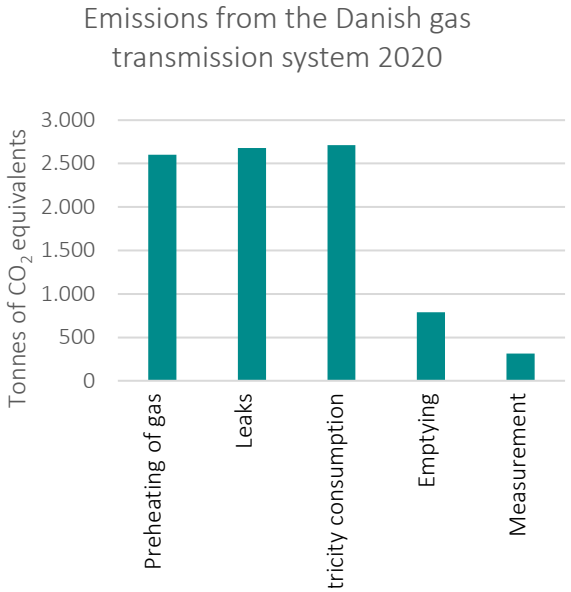
Energinet aims to make all energy consumption, including gas for preheating at M/R-stations, CO_2 neutral by 2030. To achieve this goal, there are plans to use heat pumps instead of gas boilers at the M/R-stations to preheat the gas. The expectation is that Energinet will be able to significantly reduce the climate impact. The actual reduction will depend on gas consumption, which is declining.

EU directive to regulate venting and flaring

To achieve compliance with a forthcoming EU directive to eliminate routine venting and flaring of gas, Energinet is investigating whether there is merit in acquiring mobile compressors. Mobile compressors can move the gas to other parts of the network while parts of the gas grid is under maintenance or renovated.

Reverse-flow facility outages can cause CO_2 emissions

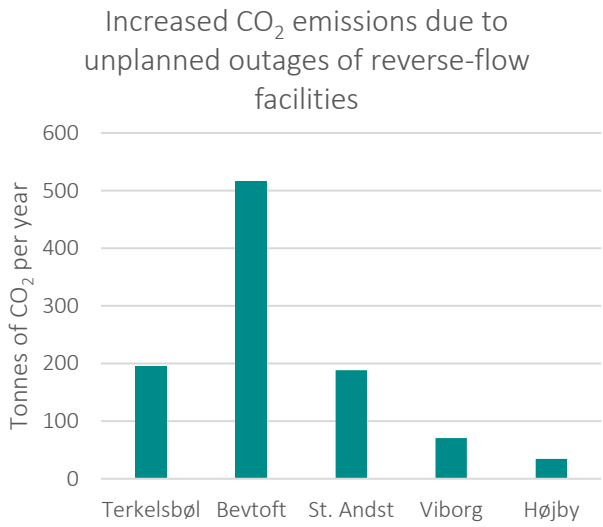
Most of Energinet's reverse-flow facilities are designed with two compressors operating simultaneously to achieve maximum reverse-flow capacity. Biomethane production can be lost if one of the compressors fails. Natural gas is then used to replace the lost biomethane, worsening the climate impact for society. It is estimated that theoretically, compressor outages can increase CO_2 emissions by 1,500 tonnes of CO_2/year due to not all the biomethane being used. This corresponds to an economic loss of DKK 1 million per year.



30 PERCENT OF CLIMATE IMPACT IN 2020

Preheating is used to mitigate the temperature reduction that occurs when the gas pressure is reduced from the 80-bar system to the 40-bar system.

The use of fuel gas for preheating at the M/R-stations accounts for about 30 percent of Energinet's climate impact in the gas transmission system for 2020, corresponding to 2,600 tonnes of CO_2 equivalents.



THE DANISH WORKING ENVIRONMENT AUTHORITY'S SAFETY RULES FOR NATURAL GAS FACILITIES AND BIOGAS PLANTS

For reasons of safety, Energinet can be instructed to take action if urban development and road building, etc. takes place too close to the gas system. The legislation contains a number of distance requirements, such as proximity to road and railway infrastructure and to residential areas.

THE GAS INFRASTRUCTURE MUST FOLLOW DEVELOPMENTS IN SOCIETY

When highways and construction projects get closer to the gas system it is necessary to establish remedial actions, or relocation of pipelines and M/R-stations, in order to comply with distance requirements form The Danish Working Environment Authority. The specific projects are:

Urban development at Ballerup

The local authorities in the municpalities of Ballerup and Egedal have asked Energinet to reroute the Torslunde-Lynge gas transmission pipeline to allow residential and commercial development to take place. The reason for rerouting the pipeline is that Energinet must continue to follow rules concerning the distance from buildings and meet safety requirements applicable to construction projects. Moving the pipeline means that the local municipalities can grow and develop.

Energinet will have to move the gas transmission pipeline and probably also the M/R-station serving large parts of North Zealand.

New railway over West Funen

The Danish Road Directorate is planning to build a new railway over West Funen. The project is described in the Act on the construction of a new railway over West Funen (*Lov om anlæg af en ny jernbane over Vestfyn*), which states that Energinet must relocate the gas transmission system in part of the route of the new Spedsbjerg-Nørre Aaby railway.

The relocation will require Energinet to move the affected M/R-stations in the gas transmission pipeline. One of them is M/R Koelbjerg, which consequently may be closed instead.

Urban development in Fredericia

Existing development and related local plans in the municipality of Fredericia will require remedial actions for transmission pipelines and stations in the area in order to meet safety rules and distance requirements.

Proximity to highways and buildings

Motorway and construction projects are getting closer to gas pipelines, and to meet safety requirements, remedial action must be taken.

NEEDS ON LOLLAND-FALSTER

The project enabling the transport of gas to Lolland-Falster is an example of a project that was submitted in the Incremental Capacity process in 2019 and taken forward by Energinet.

INCREMENTAL CAPACITY – THE USERS DEFINE THE NEED FOR FUTURE GAS CAPACITY

The people who are best placed to estimate the future need for capacity in the gas system are the consumers themselves. That is why Energinet every two years conduct a survey of the users' (the shippers') capacity needs in the Danish gas system.

Non-binding bids for extra capacity in the gas system

The process is called Incremental Capacity and enables the shippers to state where in the gas system they would like more capacity going forward. Based on their non-binding bids, Energinet publishes a report on the demand for extra capacity. This is followed by a design phase and a public consultation to work out how the non-binding bids can be satisfied. The Danish Utility Regulator then decides whether the non-binding bids can be implemented.

Non-binding bids become binding bids

Before a final investment decision can be made, the gas system users must commit themselves with a binding bid for more capacity. This is so that non-binding bids do not result in overinvestment in the gas system.

The Incremental Capacity process in 2021 closed on 30th August 2021. No bids were received. Read more here.

MARKET DIALOGUE TO ASCERTAIN THE INTEREST IN HYDROGEN INFRASTRUCTURE

There have been many announcements about large-scale Power-to-X projects, suggesting that the hydrogen infrastructure could become an important issue by 2030. Numerous market players are already in dialogue with Energinet so they can align their project designs with a potential hydrogen infrastructure. Energinet also experience growing interest from foreign gas TSOs regarding the possibility of exporting green hydrogen from Denmark.

Invitation to a market consultation

That is why on July 2nd, the Danish Energy Agency and Energinet invited all potential market players to a market consultation about meeting the need for a hydrogen infrastructure. As part of the study, non-binding expressions of interest could be submitted concerning capacity and flexibility needs, and geographical areas where a hydrogen infrastructure would be particularly relevant.

Valuable input into the long-term development plan

On the basis of the information received, the Danish Energy Agency and Energinet will publish an anonymised report on the level of interest in hydrogen capacity. The results could be used as follows:

- Input into the Danish Energy Agency's Power-to-X strategy
- Input into Energinet's long-term electricity and gas infrastructure planning
- Possible launch of feasibility studies

The non-binding bids will not result in specific projects to find solutions. That would require a binding follow-up process. Planning and building a hydrogen infrastructure could easily take more than five years so it is important to include it in the electricity and gas infrastructure planning at an early stage.

Hydrogen infrastructure as part of holistic planning for electricity and gas

Energinet does not have the authority to establish and operate a hydrogen infrastructure. Even so, the hydrogen infrastructure should be coordinated with the rest of the energy infrastructure so that potential investments in new infrastructure or market models are considered in the context of alternative solutions in both electricity and gas. Specifically, it may be necessary to handle hydrogen in the existing gas infrastructure, or in a converted natural gas pipeline that will only transport hydrogen in the future.

Future Power-to-X plant owners, who are expected to become major electricity consumers, may need flexibility. Here, possible solutions could include access to a hydrogen infrastructure and hydrogen storage, or new market models for demand-side response.

The market consultation closed on 31st August 2021. In collaboration with the Danish Energy Agency, data and registrations will be processed. A report will be published once the analysis work is completed. Find out more here.

BALTIC PIPE

The Baltic Pipe project, under construction, will make it possible to transport gas from Norway to Poland via Denmark. This is the biggest physical change in the Danish gas system since it was established. The gas volume Baltic Pipe can carry is approx. four times greater than the current Danish gas consumption. When Baltic Pipe is in operation, there will therefore be a very high flow of natural gas from Norway to Poland through Denmark.

WHAT ARE WE WORKING ON RIGHT NOW?

The analysis of future needs for the gas system is based on the existing infrastructure, including approved projects in the construction phase.

Approved projects in the construction phase

- Biomethane reverse-flow at M/R Terkelsbøl station (2021)
- Biomethane reverse-flow at M/R Højby station (2021)
- Biomethane reverse-flow at M/R Viborg station (2021)
- MR-Newtech (2023) – new technology at stations
- Adjustments to the reverse-flow facility near M/R St. Andst (the project has been paused due to uncertainty regarding the need for reverse flow of biomethane)
- Baltic Pipe (2022) – see description
- Needs on Lolland-Falster (2024) – see description

NEEDS ON LOLLAND-FALSTER

Energinet and Evida will build a new gas pipeline that connects the Zealand gas system with Lolland and Falster. The gas pipeline allows local companies, such as the sugar factories, to replace their existing coal and oil-based energy supply with gas and ultimately climate-friendly biomethane.

APPENDIX

GAS TRANSPORT AND STORAGE

Danish gas consumers are supplied via the distribution grid which is the responsibility of Evida. The distribution grid is connected to the gas highway – the transmission grid – through Energinet's metering and regulator stations (M/R stations) throughout the country.

THE DANISH GAS SYSTEM

The transmission grid runs across Denmark. The gas consumers are supplied via distribution grids which are connected to the transmission grid at Energinet's M/R-stations throughout the country. The Danish gas system also consists of two gas storage facilities – in Ll. Torup in northern Jutland and Stenlille on Zealand.

The gas is mainly transported from the transmission grid to the distribution grids, but two M/R-stations (and three more on the way) have facilities allowing gas to be transported in the other direction. These are called reverse-flow facilities. A different type of reverse-flow facility is a compressor facility, where a biogas plant is directly connected to the transmissions grid. One facility of such has been established in the gas system.

Transmission grid

The transmission grid consists of a high-level network which in the past distributed North Sea gas to the distribution grid, which distributes the gas to the individual consumers. The gas is under high pressure in the transmission grid, and high volumes are transported. Energinet is responsible for the gas transmission grid.

Local and regional distribution grids

Evida is responsible for the regional and local distribution grids which transports the gas the last mile to the individual consumers. The regional distribution grid distributes the gas regionally, and the local distribution grid distributes the gas at a very local level. In this report, the term 'distribution grid' is used as a generic term for Evida's local and regional distribution grids.

GLOSSARY

AF20
The Danish Energy Agency's Analysis Assumptions for Energinet, 2020 (In Danish "Analyseforudsætninger 2020, AF20"). Energinet must plan the power and gas systems according to the Danish Energy Agency's annual projections concerning the generation and consumption of electricity, gas, district heating, etc. These Analysis Assumptions are based on political decisions and on projections concerning the market and technological development.

Evida

Evida owns, operates and maintain the gas distribution system

Fuel gas

Gas used at M/R-stations to preheat the gas to prevent if from cooling down too much when the pressure is reduced.

Gas-to-liquid

Process that converts gas, such as natural gas or biomethane, into a liquid fuel such as petrol, diesel or aviation fuel.

Green gas

Green gas covers biomethane, which is produced at biogas plants from livestock manure and organic waste from food consumption as well hydrogen, which is produced by water electrolysis using green power from wind and solar energy.

Linepack

Storage of gas in pipelines by allowing the gas pressure to increase.

LNG

LNG is an abbreviation of Liquefied Natural Gas, which forms when natural gas is cooled.

Methanisation

A process in which hydrogen and CO_2 are combined to form a synthetic biomethane. Allows the output from biogas plants to be increased by 70 percent because biogas contains about 35 percent CO_2.

Mobile compressor

A mobile compressor is an equipment that can move the gas to other places in the grid if e.g., a gas system has to be emptied in connection with maintenance.

Meter and regulator station (M/R-station)

Connection between Energinet's transmission grid and Evida's distribution grids. The meter and regulator station measures and regulates the gas pressure.

Odorant

Chemicals added to gas in the regional and local distribution grids to give it a smell.

Power-to-X (abbreviated to PtX)
Denotes the process in which power is used to produce hydrogen by water electrolysis. Hydrogen can be used on its own as a green energy source, or as a component in green fuels or other green products (hence the 'X').

Redundancy

When reverse-flow facilities or meter and regulator stations, for example, are designed to allow parts of the facility to break down without affecting operation. For example, there are two compressors when only one is needed.

Peak-load consumption

Consumption when the system is under the highest load. Defined as consumption when the temperature is -13°C.

Stations

Generic term for facilities in the gas transmission system including meter and regulator stations.

Reverse-flow facility

Facility which sends biomethane from the distribution grid to the transmission grid.

Shippers

Companies that buy capacity for the transportation of gas in Energinet's transmission grid. For example, gas traders, gas producers or other companies needing to send gas to or through Denmark.

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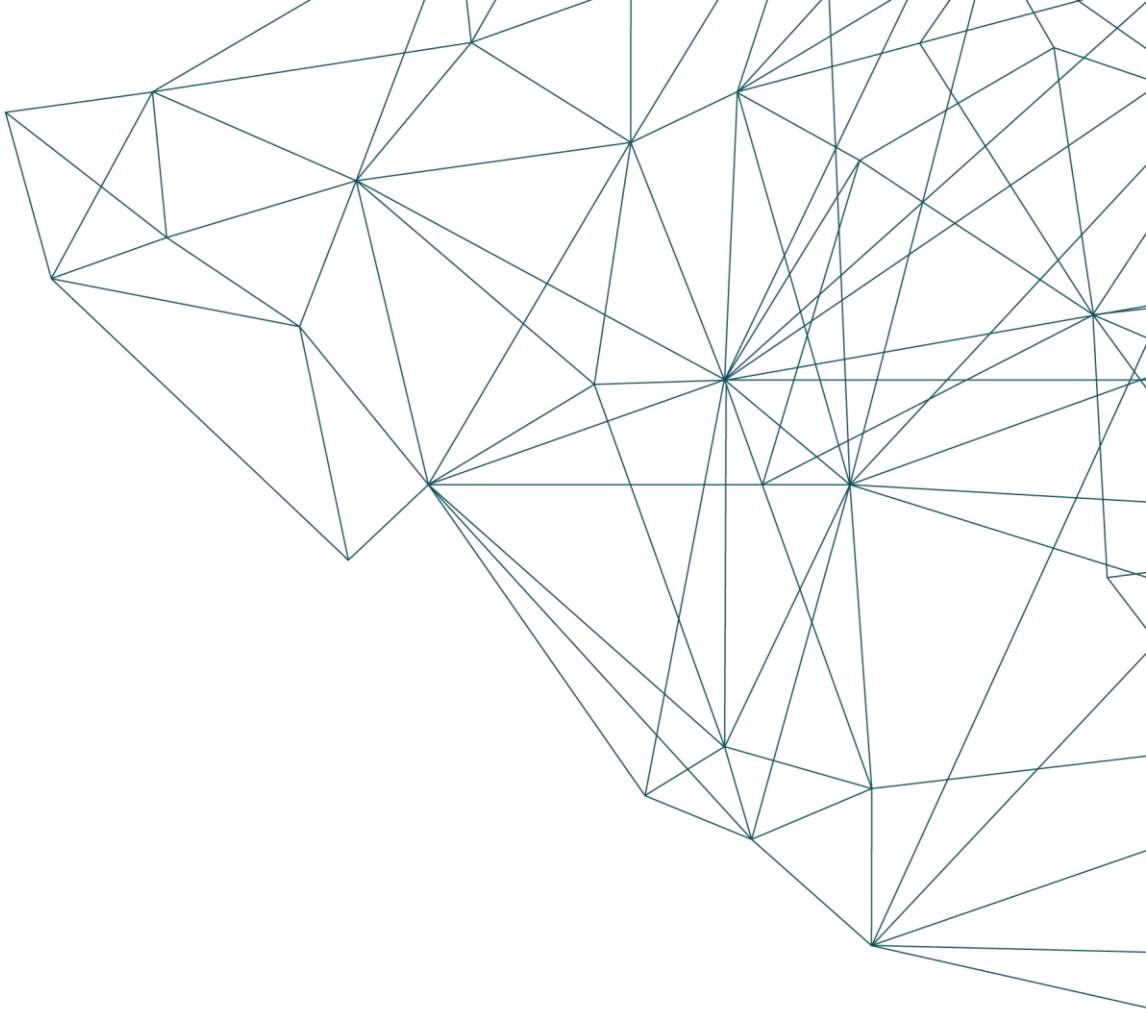

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