european network
of transmission system operators
for gas

TEN-YEAR NETWORK DEVELOPMENT PLAN

2018

EXECUTIVE SUMMARY

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FOREWORD

I am honoured to preface this fifth edition of the Union-wide Ten-Year Network Development Plan of 2018. I hope the stakeholders can observe its continuous improvement since the first edition: with each edition ENTSOG endeavours to deepen its analysis, and align it within the evolving European energy and climate framework. I truly believe that the Ten-Year Network Development Plans deliver real added-value to a wide range of stakeholder and decision-makers.

This TYNDP process has been delivered to you in a changing and important context for the role of gas in the European energy sector. The tasks for the infrastructure operators include as a major focus not only the security of supply but also the sustainability agenda.

It is paramount that policy and decision-makers consider the European gas infrastructure in the content of the completion of the Internal Energy Market and the contributions it can bring to the achievement of European climate and energy policy. The European gas infrastructure has seen decades of development and the existing international gas system already ensures a high level of market integration across most of Europe. The gas transmission infrastructure, LNG terminals and gas storages provide safe, reliable and affordable low carbon energy to European citizens.

However, in specific areas, further development of the infrastructure is still required. These investments will connect isolated areas and achieve further integration. They will bring affordable, diversified and competitive supplies of gas, in turn providing a stimulus for further development of the gas market. It is particularly important for those areas in the context of evolving Member States decisions on their energy mix and embrace the decarbonisation agenda.

Based on the previous edition's feedback, ENTSOG has undertaken significant changes to further improve the TYNDP and to make it better interlinked with the electricity system. We worked on common scenarios built in cooperation with ENTSO-E to represent differentiated paths towards achieving the EU decarbonisation targets. For the first time in TYNDP 2018 we applied a new CBA methodology to make this TYNDP more transparent and streamlined with the PCI selection process.

ENTSOG TYNDP 2018 ensures a robust and reliable assessment of the gas system and identification of the remaining infrastructure needs. We hope it will deliver real added-value to stakeholders and decision-makers. Together with ENTSO-E TYNDP 2018 it has a key role to play in the 4th PCI selection process led by the European Commission

At all stages of the TYNDP development, ENTSOG has ensured a very high standard of stakeholder involvement and transparency.

At ENTSOG we believe that in future, the Hybrid Energy Infrastructure, building on both electricity and gas systems as cross-border energy carriers will be able to deliver more efficient, resilient, sustainable as well as faster and cheaper decarbonisation of the European energy sector. The joint effort of ENTSOG and stakeholders contributing to this TYNDP, shows the willingness of the European energy players to work closely together to meet EU climate goals.

On behalf of ENTSOG, I would like to thank all parties involved in the TYNDP process. I encourage you to provide your feedback through our upcoming consultation process. This feedback, together with ACER Opinion, will be considered by ENTSOG to release the TYNDP final version in June 2018.

Stephan Kamphues

ENTSOG President


Picture courtesy of TAP

1 INTRODUCTION

The global and European energy systems are undergoing a major transition towards decarbonisation. Europe has already set ambitious targets for 2030 and committed to achieve 80 to 95 % net GHG reduction by 2050. This 2018 edition of the Ten-Year Network Development Plan assesses the capability of the European gas system to achieve the EU internal energy market goals along three scenarios representing markedly different and ambitious paths towards delivering the future European climate targets. For the first time, ENTSOG and ENTSO-E have pooled efforts to develop common scenarios to perform a fully-fledged and fully consistent test and assessment of the electricity and gas infrastructure.

The European gas infrastructure has seen decades of investment and development. The gas system connects most of European countries, ensuring the most efficient solution for transporting and storing large amounts of energy over long distances.

The European gas system is a key player in achieving the European energy and climate ambitions. The gas system can offer unique opportunities – in energy storage and transmission – to support the power, heat and mobility infrastructures in enabling the decarbonisation of the European energy system in a cost effective, secure and achievable way.

TYNDP 2018 assessment confirms that the current gas infrastructure is close to achieving the internal energy market. However, some specific areas still show investement needs, in terms of better interconnections and connection to new supplies and the projects addressing these needs are included in TYNDP 2018. Most of these projects are already at an advanced stage of development or are part of the 3rd PCI list, and are planned to be commissioned in the coming years.

THE EUROPEAN GAS SYSTEM: A CONTINENTAL ENERGY INFRASTRUCTURE PRESENTING AN AVAILABLE SOLUTION TO MEET CLIMATE TARGETS

In view of future environmental challenges and goals, both electricity and gas sectors – through the process of sector coupling – can contribute to the solution by integrating more renewable and decarbonised energy sources with new and clean technologies like Power-to-Gas as a link between the two sectors.

The joint scenario building exercise by ENTSOG and ENTSO-E is a first step towards a closer cooperation between the electricity and the gas sector, supporting the vision of a Hybrid Energy Infrastructure – building on the strengths of both energy carriers and sectors (gas and electricity) – as the backbone of the EU energy system.

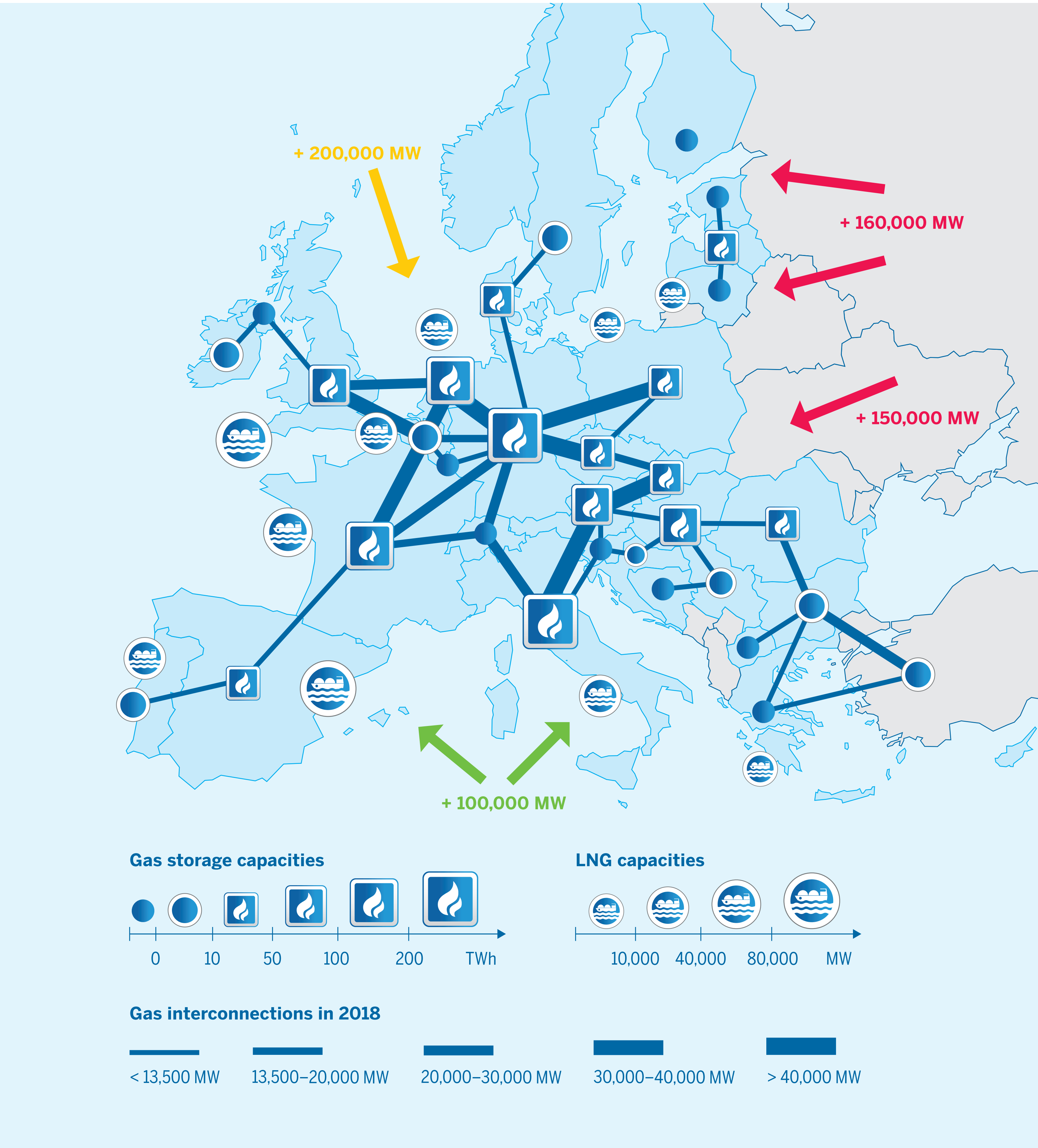


Figure 1.1: EU gas system 2018 at a sight

2 TYNDP 2018: FURTHER INTERLINKAGE AND TRANSPARENCY

2.1 INTERLINKED MODEL AND JOINT GAS AND ELECTRICITY SCENARIOS

For TYNDP 2018 in a context where the energy sector has to undergo significant changes to achieve the EU decarbonisation targets, the ENTSOs for gas and electricity, ENTSOG and ENTSO-E, have joined their efforts to build an interlinked model between gas and electricity[1]. This model has been published in April 2017 and all relevant stakeholders were providing the opportunity to provide feedback during a consultation process. It aims at ensuring that the assessment of the infrastructure needs in the frame of the TYNDP process is performed on a consistent and transparent basis.

For the first time, the ENTSOs developed common scenarios for the 2018 edition of gas and electricity TYNDPs, outlining three markedly different possible paths towards a low-carbon energy system in line with EU targets. They build on innovative, challenging and contrasting storylines and are complemented by an additional perspective based on the European Commission EUCO30 policy scenario.

These robust and ambitious scenarios describe possible evolutions of the Europe's energy system up to 2040. The scenarios have extensively been consulted with representatives of the industry, NGOs, National Regulatory Authorities and Member States.

2.2 NEW COST-BENEFIT ANALYSIS (CBA 2.0): INCREASED CONSISTENCY AND TRANSPARENCY

ENTSOG developed TYNDP 2018 based on the new Energy System Wide 2nd Cost-Benefit Analysis Methodology (CBA Methodology 2.0). The new CBA methodology builds on opinion from the Agency for the Cooperation of Energy Regulators (ACER), on stakeholders' feedback and on the draft report released in March 2017 by the Florence School of Regulation[2] as part of a related study undertaken for the EC. It also builds on an engagement process initiated in early 2017, which involved interested stakeholders, EC and ACER. As part of it, a stakeholder consultation process was undertaken between 19 May and 23 June 2017, the outcome of which is available on ENTSOG's website.

INCREASED CONSISTENCY

The new CBA methodology ensures consistency between the gas system assessment – identifying the infrastructure gaps – and the project-specific assessments by applying the same rules and metrics to all.

1) https://entsog.eu/publications/cba-methodology#CONSISTENT-AND-INTERLINKED-ELECTRICITY-AND-GAS-MODEL

2) http://fsr.eui.eu/gas-cba-consultation/

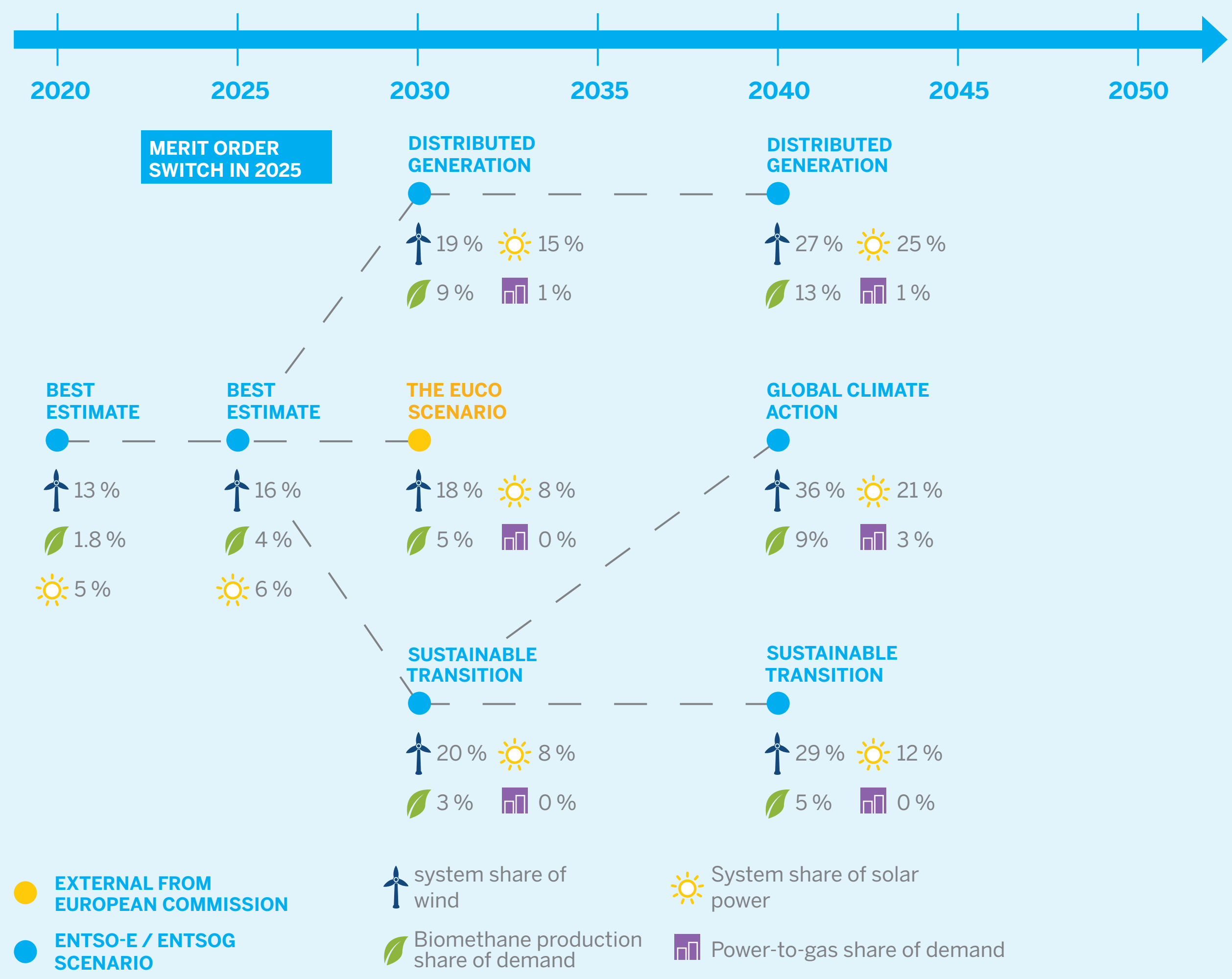


Figure 2.1: The scenario building framework for the TYNDP 2018. Renewable Energy Systems (RES) share of demand for electricity and gas

CLOSER TO REALITY

The CBA 2.0 now considers refined market modelling assumptions and simplified indicators. Following the feedback received during the stakeholder engagement process, ENTSOG introduced the consideration of infrastructure tariffs in the modelling and further sensitivity analyses together with a new concept regarding the supply assumptions. These improvements reduce the numbers of indicators used for the different assessments and produce results closer to reality for an easier interpretation.

INCREASED TRANSPARENCY

For the first time, in line with the new CBA methodology, TYNDP 2018 delivers specific projects assessment (PS-CBA) for all projects having declared their intention to apply to Project of Common Interest (PCI) status during the TYNDP 2018 project collection. The results will be published in the form of project fiches with the Final TYNDP Report in view of supporting the 4th PCI selection process.

2.3 AN IMPROVED ANALYSIS

One of the specific TYNDP tasks is to identify the investment gaps, where missing infrastructure prevents supporting the pillars of the internal energy market: sustainability, security of supply, competition and market integration. This constitutes a key element of the PCI selection process.

Subsequently, the projects submitted to the TYNDP are jointly assessed at energy system wide level to identify how they contribute to mitigate the investment gaps. To ensure a European-wide perspective, it is therefore fundamental that all relevant projects, promoted both by TSOs and third-party promoters, are submitted as part of the TYNDP project collection. For those projects in particular wishing to take part in the PCI selection process, submission to TYNDP is a pre-requisite under Regulation (EU) 347/2013.

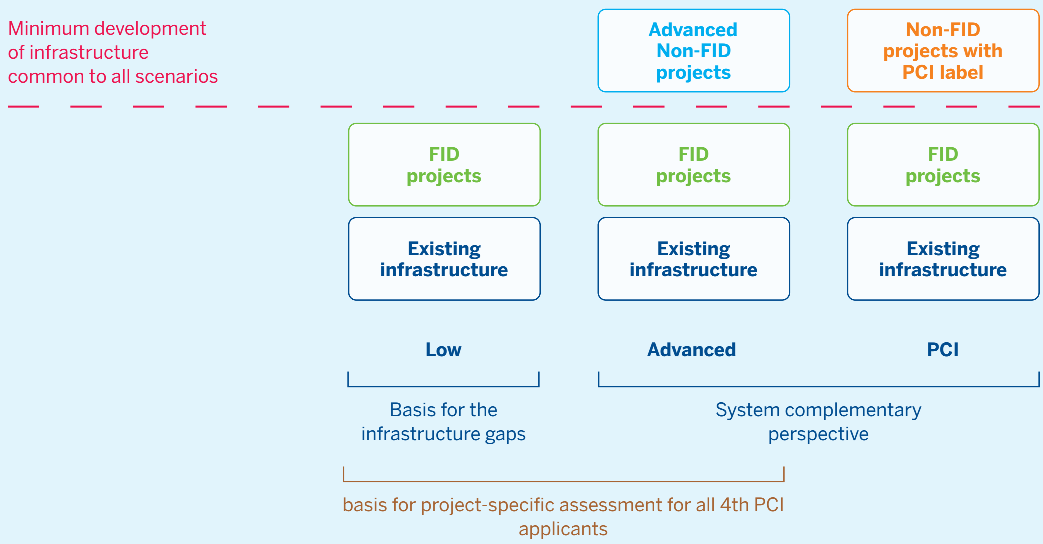


Figure 2.2: Infrastructure Levels

IDENTIFICATION OF INFRASTRUCTURE NEEDS

The Low infrastructure level, which considers only existing infrastructure and FID projects, is the reference for the identification of the additional infrastructure needs.

HOW ADVANCED OR PCI PROJECTS ADDRESS THE NEEDS

The Advanced infrastructure level considers existing infrastructure, FID and advanced projects[1]. This represents a level of development of the infrastructure with a reasonable level of confidence, therefore providing a meaningful basis for the energy system-wide assessment of the concerned projects. This will also provide useful information for the assessment of specific projects applying to the 4th PCI selection process.

A specific infrastructure level includes all projects listed on the 3rd PCI list to build a bridge between two sequential PCI selection rounds and to enable the assessment of the cumulative effects of the 3rd list of PCI projects.

1) The advanced status, covers the non-FID projects having already initiated either their front-end engineering or permitting phase and planned to be commissioned by 2024.

3 THE FUTURE ROLE OF GAS: SEVERAL PATHS TO ACHIEVING THE EU TARGETS

TYNDP 2018 looks twenty years ahead. To perform a sound assessment, scenarios must cover the reasonable possible evolutions that the European energy sector can undergo in the coming decades to ensure the energy transition, taking into consideration the ambitious European climate and energy targets.

For the first time, the ENTSOs for gas and electricity have joined their efforts and expertise to provide a joint set of scenarios, as part of the consistent and interlinked model, in accordance with Art. 11(8) of Regulation (EU) No. 347/2013, allowing for assessments of future investment decisions in Europe to be based on comparable analysis between the sectors.

Dozens of representatives from all sides of the energy sector, consumer and environmental associations, governments and regulators have co-constructed a new set of storylines with the ENTSOs. Together, we described three markedly different and ambitious paths towards delivering the future European emission targets. They have been complemented by a scenario for 2030 based on the European Commission indications (EUCO30). These scenarios set the frame for a rich range of indicators including macro-economic trends, energy use in different sectors, technological input assumptions and power generation by fuel type.

The TYNDP 2018 scenarios cover the period from 2020 to 2040. 2020 and 2025 are labelled as Best Estimate scenarios due to a lower level of uncertainty linked to the proximity of the considered time horizons. As uncertainty increases further into the future, the 2030 and 2040 scenarios have been designed with European 2050 targets as an objective, recognising the work undertaken in the *e-Highway 2050* project.

SUSTAINABLE TRANSITION

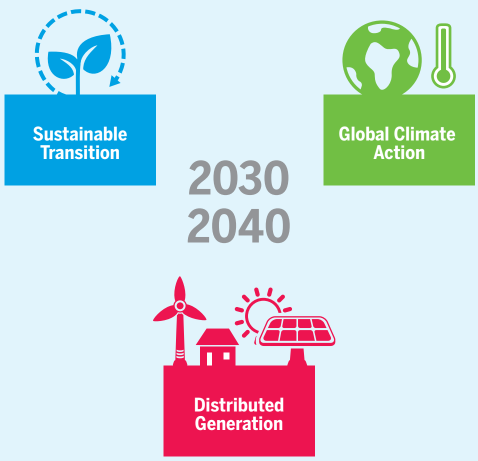
Targets reached through national regulation, emission trading schemes and subsidies, maximising the use of existing infrastructure.

DISTRIBUTED GENERATION

Prosumers at the centre – small-scale generation, batteries and fuel switching society engaged and empowered.

GLOBAL CLIMATE ACTION

Full speed global decarbonisation, large-scale renewables development in both electricity and gas sectors.



EXTERNAL SCENARIO: BASED ON EUCO 30

is a core policy scenario produced by the European Commission (EC). It models the achievment of the 2030 climate and energy targets as agreed by the European Council in 2014, but including an energy efficiency target of 30 %. The ENTSOs both welcome this new collaboration with the EC and welcome further cooperation.

Figure 3.1: Scenarios for 2030 and 2040

DECARBONISATION AND RENEWABLE ENERGY SOURCES: THE GAS SYSTEM HAS INITIATED ITS TRANSITION

Another key aspect is the decarbonisation of the gas supply. Biomethane development is strong in all scenarios and forms the majority of the green gas supply. This only represents the biomethane injected into the transmission network and the potential for the upgrading of biogas sources across the EU may offer further gains. Power-to-gas development starts from 2030 in Distributed Generation and Global Climate Action as variable RES increases. This represents low volumes of synthetic natural gas entering the transmission network, but this is an emerging technology with potential that currently is being explored through a number of pilot projects and studies. It represents another interaction between the gas and electricity networks in the future. In the next scenario building process, ENTSOG will also assess the potentials of further gas decarbonisation technologies such as steam methane reforming and methane cracking. These can enable a fast decarbonisation of existing natural gas sources with an increasing role for hydrogen in the future gas mix.

ALL SCENARIOS GO BEYOND THE 2030 TARGET OF 40 % EMISSIONS REDUCTIONS COMPARED TO 1990 AND ARE ON TRACK TO REACH 60 % CO_2 REDUCTION BY 2040

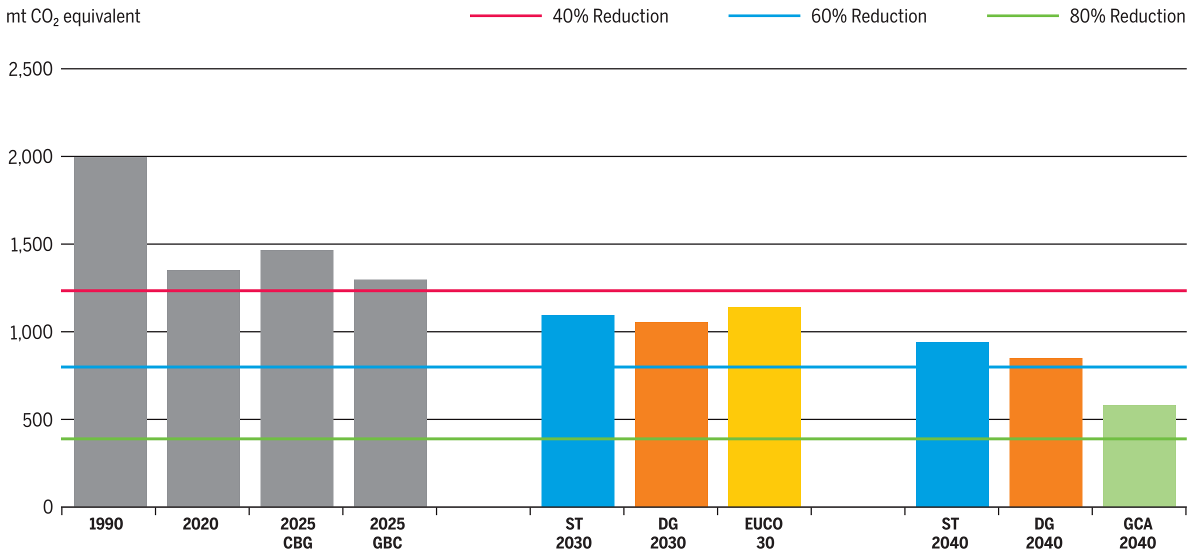


Figure 3.2: EU28 percentage reduction of CO_2 emissions from power and gas sectors by scenario

ENTSOs SCENARIOS IN THE RANGE OF IEA SCENARIOS

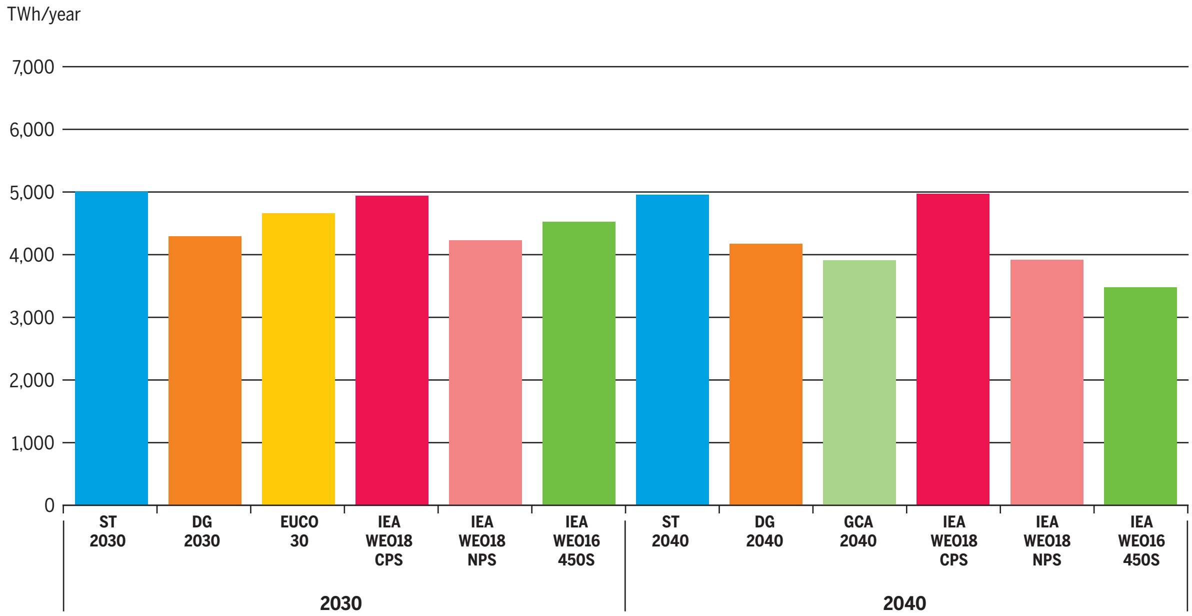


Figure 3.3: Comparison of TYNDP scenarios to European Commission and IEA World Energy Outlook 2018 scenarios

Picture courtesy of TAP

4 THE GAS INFRASTRUCTURE: AN OPPORTUNITY FOR THE ENERGY SYSTEM IN VIEW OF A DECARBONISED FUTURE

4.1 GAS INFRASTRUCTURE: MOVING TOWARDS THE ACHIEVEMENT OF THE INTERNAL ENERGY MARKET

Since TYNDP 2017, progress has been made in terms of gas infrastructure projects enabling the EU to move towards the full achievement of the internal energy market with the implementation of 19 projects. (see figure 4.1 to the right)

The TYNDP assessement results show, looking at the 2018 situation, that the current infrastructure already achieves many of the aims of the internal energy market with some exceptions in specific areas. To investigate the investment needs on the longer term, TYNDP looks at what the FID projects[1] will already allow to deliver in terms of security of supply, market integration and competition over the 20 next years, taking into consideration the evolutions of the gas demand in the different scenarios.

TYNDP 2018 concludes that FID projects already significantly improve the current situation, in particular in the South-Eastern part of Europe, and some further improvements will require additional projects.

1) Representing 46 items, the majority of which are planned to be commissioned by 2020.

Picture courtesy of Teréga

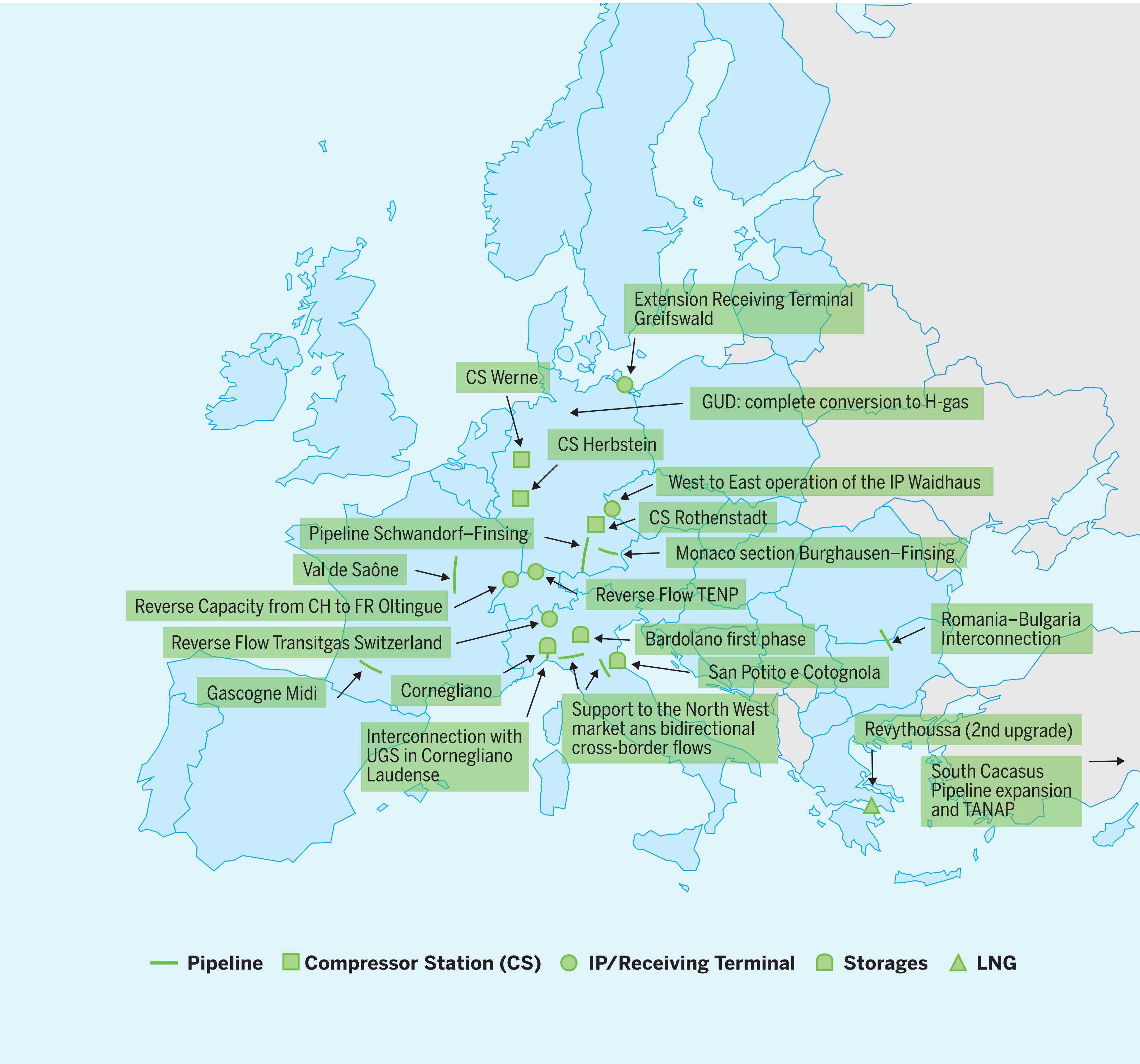


Figure 4.1: Map of projects with 2018 as commissioning year

4.1.1 SUPPLY AND DEMAND ADEQUACY

Supply adequacy is ensured for the next 20 years and gas system can offer the necessary flexibility to support the development of renewable gases.

Over the coming years, European indigenous natural gas production is set to decline in a number of countries, in particular in the Netherlands where the depletion of the Groningen field is being closely monitored by the authorities.

In a context where achieving the EU climate targets could result in either an increase or decrease of gas demand by 2040, this implies that European supply needs are foreseen to increase or at best stay stable.

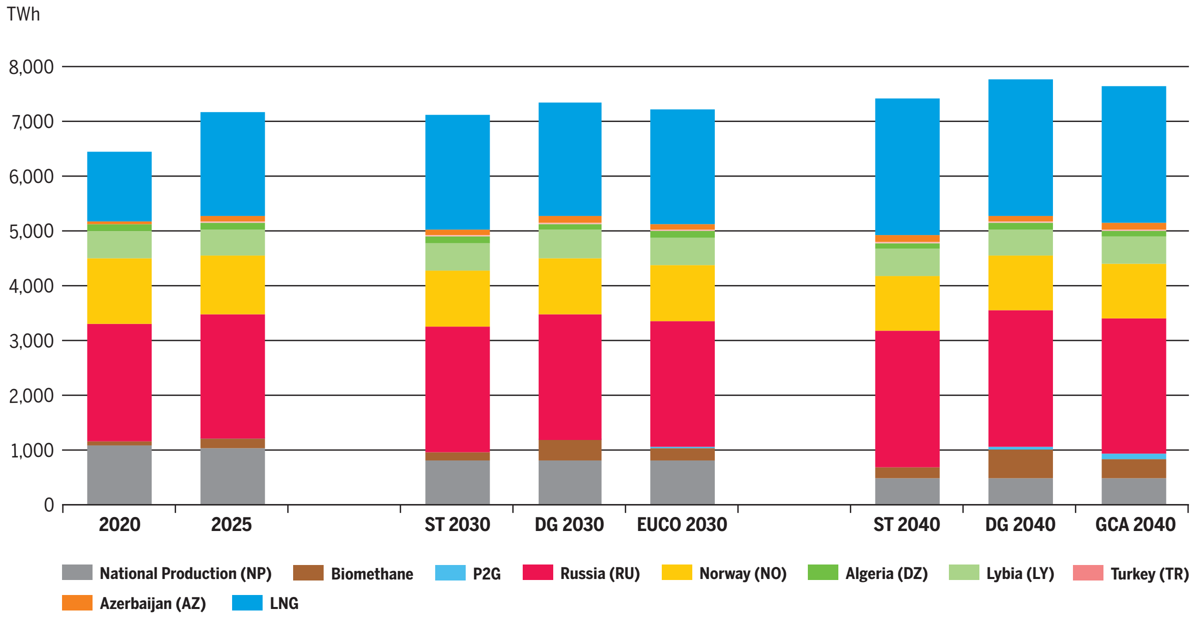


Figure 4.2: Gas supply – Indigenous production and maximum supply potentials by source

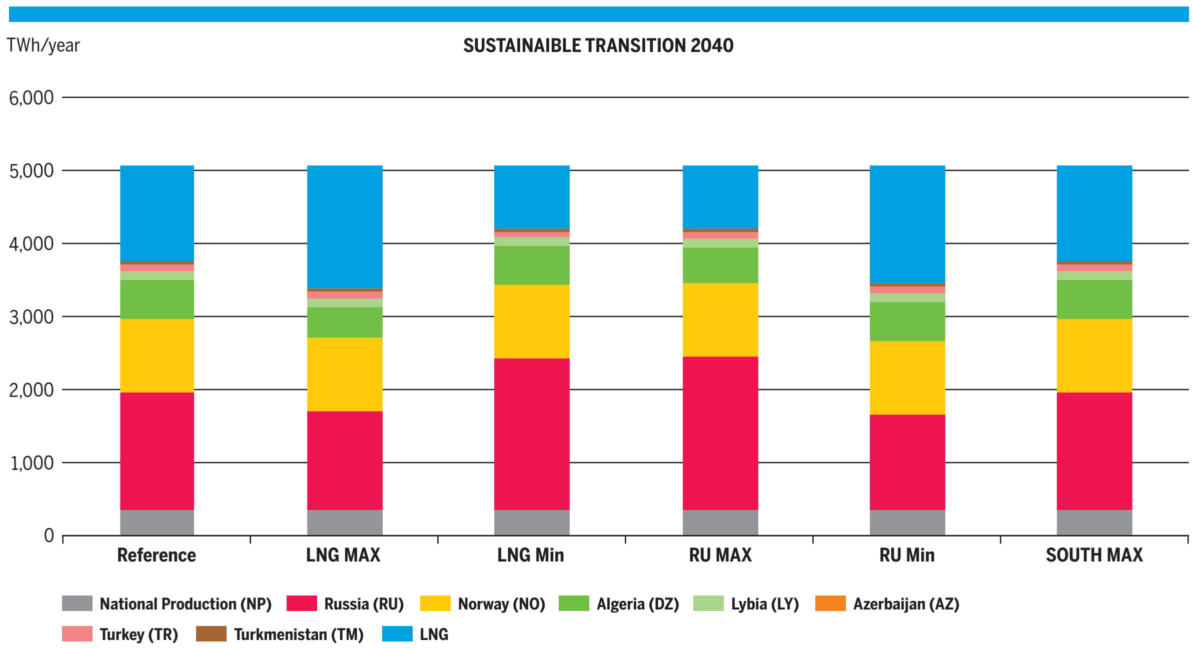


Figure 4.3: Supply mix in 2040 under various maximisation/minimisation configurations (Sustainable Transition scenario)

The TYNDP assessment shows that the supply-and-demand balance can be achieved at European level and that, from an infrastructure perspective, Europe can accomodate a wide sprectrum of supply mixes.

While Russian gas and LNG have the ability to address the increasing supply needs, new sources from the Caspian sea, the Black sea or from the East-Mediterranean area (e. g. Cyprus, Israel and Egypt) can contribute to more diversification of the gas supply to Europe.

Furthermore, decarbonised and renewable gases also have the potential to substitute the declining conventional gas production with a potential reported by the TSOs increasing from 7 bcma in 2020 to possibly 53 bcma 2040. However, recent studies consider that the potential for production of renewable gases could be much wider. Green gases produced from biomass or renewable electricity injected into the gas grid have an increasing potential to be used for green mobility (biomethane for CNG vehicles and hydrogen for fuel cell vehicles).

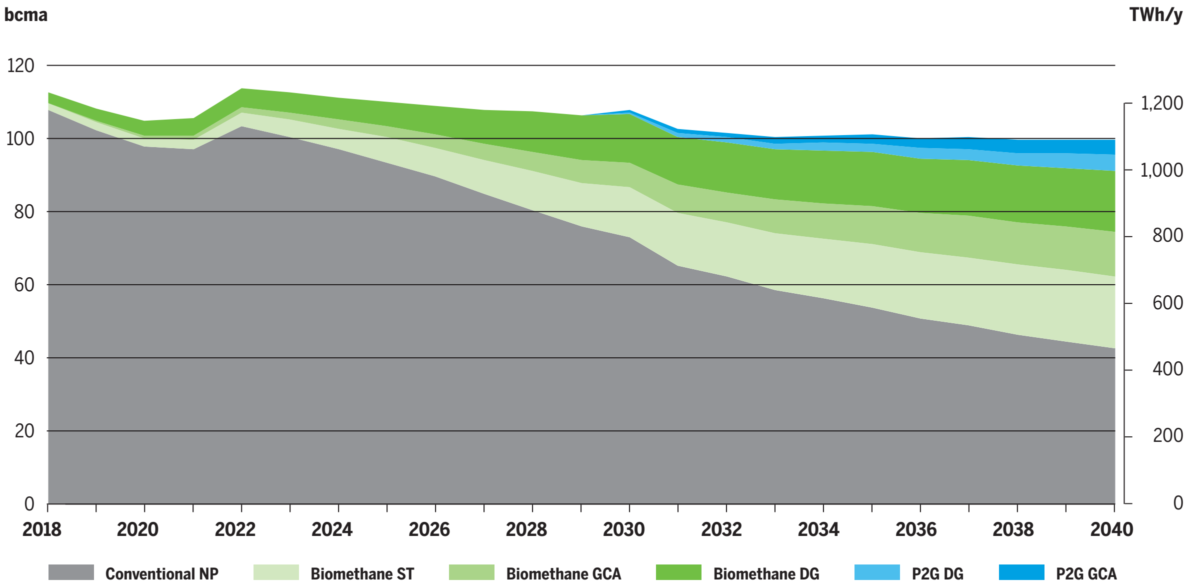


Figure 4.4: Potential EU indigenous production considered in TYNDP 2018 (2018 – 2040)

Green gases produced from different technologies such as biogas upgrading and power-to-gas will have a key role to play in decarbonising the European economy in a cost-efficient way, as they represent a carbon-neutral primary energy source. These are also important elements of the physical coupling of the gas, power, heat and mobility infrastructure (sector coupling) with the aim of making the optimal use of their respective potentials, allowing cost-efficient long-haul transmission and storage of renewable energy via mainly existing infrastructure.

L-gas to H-gas conversion

The situation differs when considering areas (parts of Belgium, France and Germany) supplied with low calorific gas (L-gas). These areas face a declining production (Groningen and German L-gas fields) while L-gas cannot be directly substituted with high calorific gas (H-gas) at consumer level. For the concerned areas, this will require to start the parallel connection of L-gas areas to the H-gas network and the conversion of consumers to H-gas.

4.1.2 SECURITY OF SUPPLY

Climatic resilience

The TYNDP assessment confirms that the gas infrastructure is resilient to extreme demand situations such as a peak day, where all European countries would not only be able to cope with an EU-wide peak demand but most of these countries would still show a comfortable remaining flexibility under such an extreme situation.

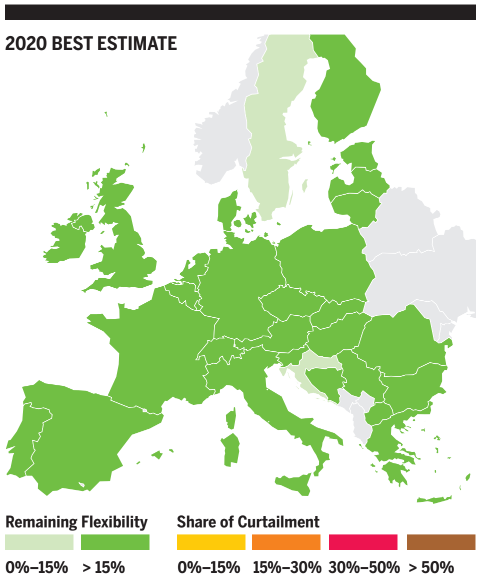


Figure 4.4: Remaining Flexibility and Exposure to demand curtailment, 2020, Low infrastructure level (existing infrastructure and FID projects), Peak Day

Picture courtesy of Gasum

4.2 SPECIFIC AREAS STILL IN NEED

The European gas infrastructure is able to ensure day-to-day supply-and-demand balance, even in case of an extreme cold situation, for all assessed scenarios.

However, in some specific regions additional infrastructure would be needed to allow for sufficient supply diversification and alleviate excessive dependence on the main supply source, therefore improving competition and mitigating risks of exposure to crisis situations such as major supply disruption.

4.2.1 COMPETITION AND MARKET INTEGRATION

Supply diversification: a corner stone of the internal energy market

The TYNDP assesses the level of significant supply diversification that the European gas infrastructure would allow. Some specific areas clearly show lower ability to diversify supplies. In the long-term, the decline of indigenous production generally reduces the number of sources European countries can access.

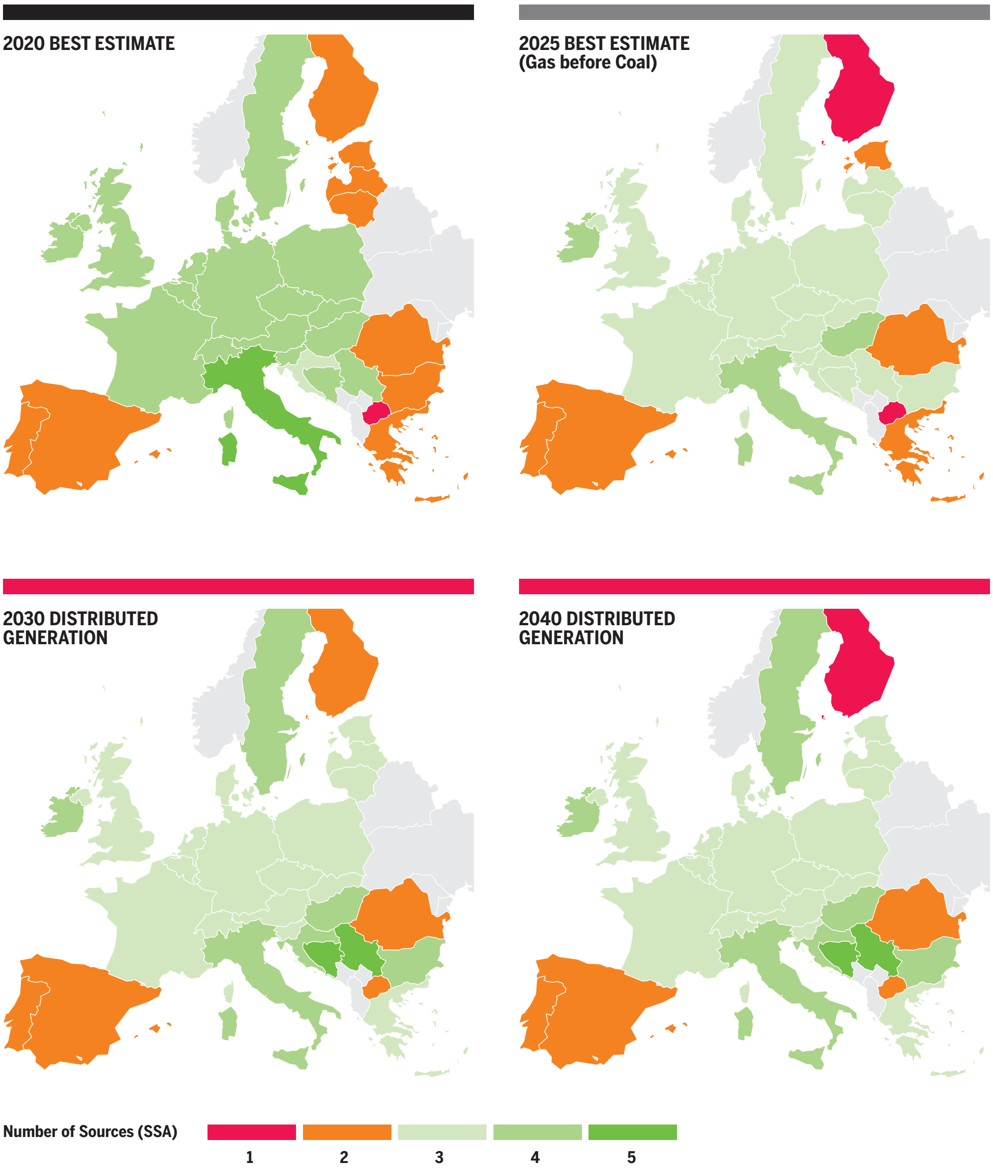


Figure 4.5: Level of supply diversification (expressed as number of supply sources to which countries can have a significant commercial access), Distributed Generation scenario, Low infrastructure level (exiting infrastructure and FID projects) – Supply sources representing a limited share of the overall European supplies are not shown on the map.

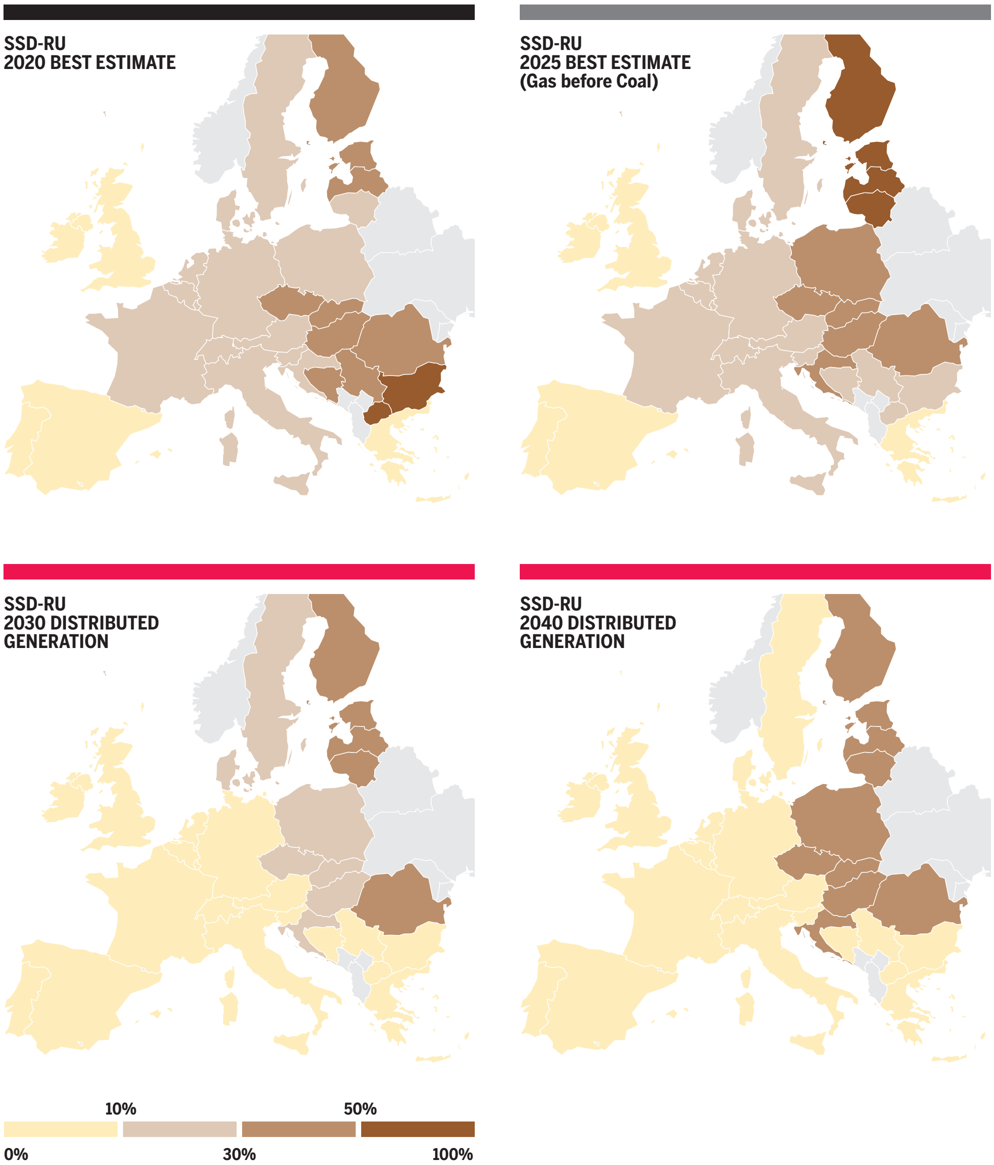


Figure 4.6: Dependence to Russian supply on annual basis, Distributed Generation scenario, Low infrastructure level (existing infrastructure and FID projects)

This limited ability of specific areas to diversify is strongly related to their dependence to specific supply sources as shown in Figure 4.6 and Figure 4.7.

Today, a number of countries located in the East Baltic Region, Central Eastern and South Eastern Europe are mainly supplied by Russian gas. The commissioning of planned FID projects partially mitigates this situation from 2025 onwards. In the longer term, the dependence of Central and North-Eastern countries on gas supplies from Russia remains significant, especially in comparison to the rest of the continent. Some more infrastructure will be needed specifically in these regions so that they can further improve their diversification of supply sources, in order to fulfil the requirements of the internal energy market.

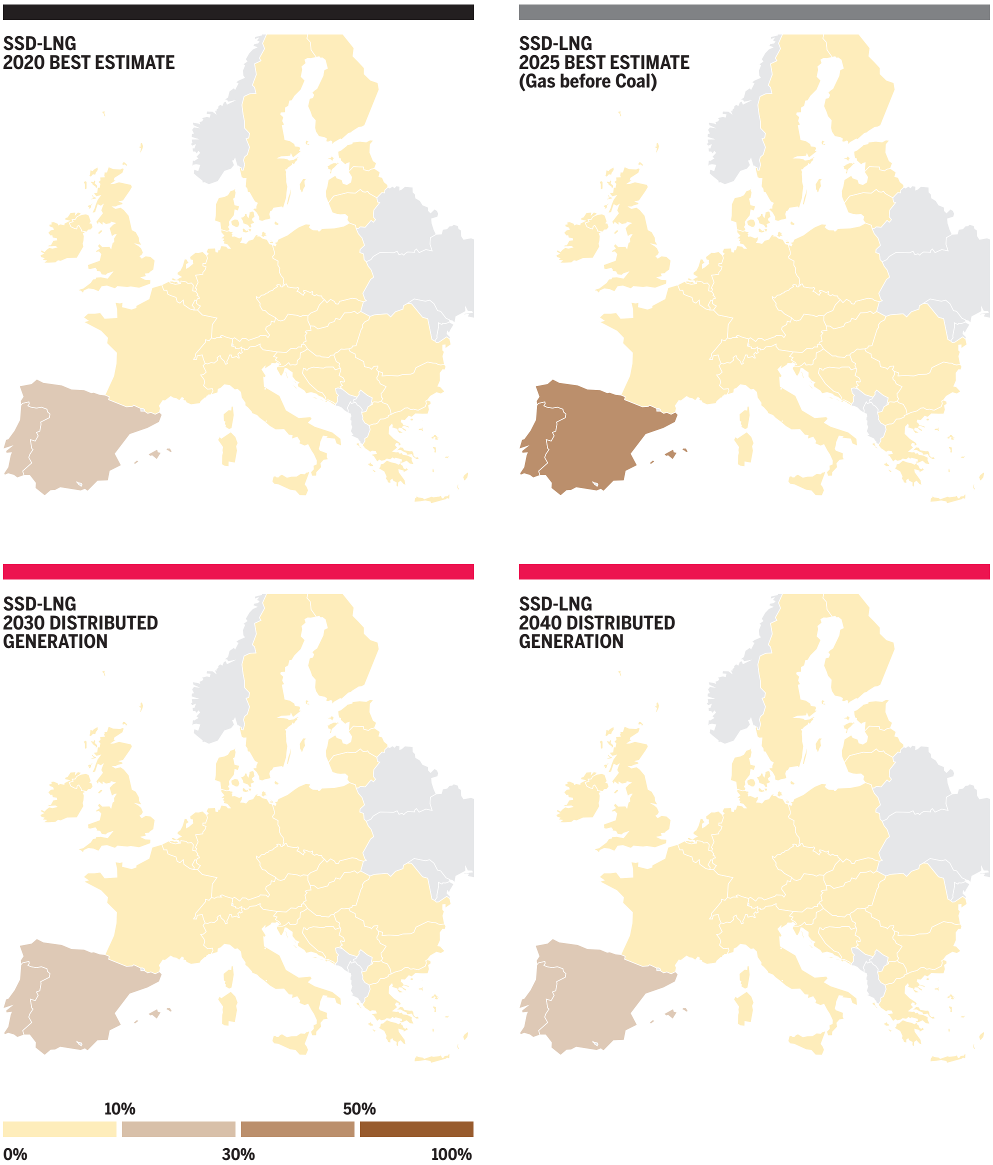


Figure 4.7: Dependence to LNG supply on annual basis, Distributed Generation scenario, Low infrastructure level.

Regarding LNG supply, the dependence is a matter of competition only. The LNG market is a global market composed of diversified sources, thus preventing those countries highly dependant on LNG to be exposed to a physical supply disruption from a single LNG supplier. However, the Russian supply dependence is not only a matter of competition, but security of supply could also be at stake.

4.2.2 SECURITY OF SUPPLY

Infrastructure disruption

The EU gas system is resilient to the disruption of the Single-Largest Infrastructure (SLI) of most European countries. However, in some specific areas, countries are exposed to a risk of disruption of their Single Largest Infrastructure, raising security of supply issues. Furthermore, in some instances, these disruptions can have a wider impact and expose several countries.

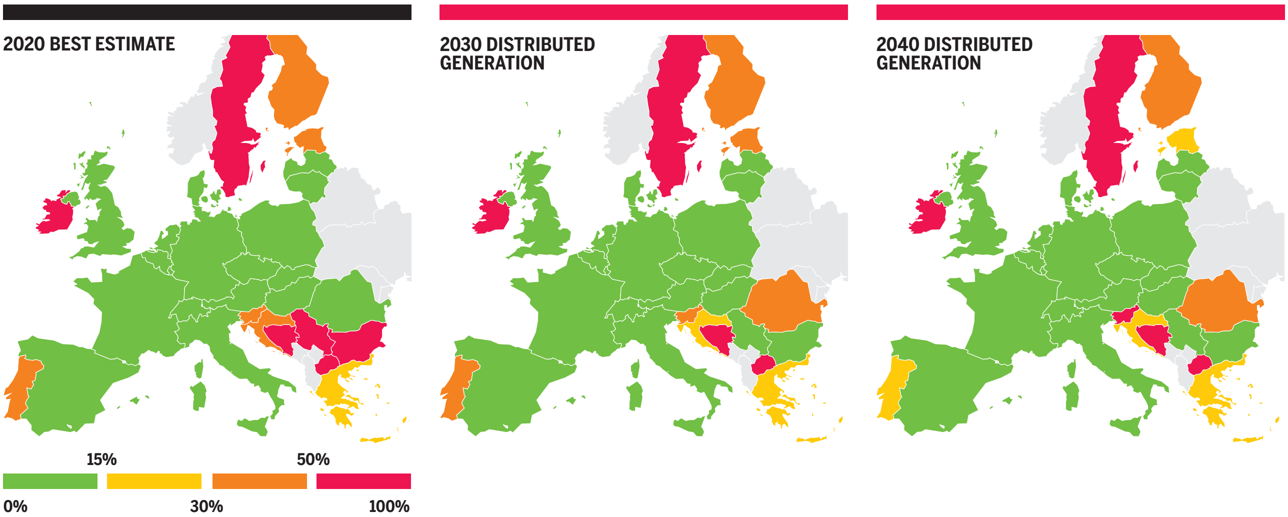


Figure 4.8: Exposure of European countries to the disruption of their Single-Largest Infrastructure, Distributed Generation scenario, Low infrastructure level (existing infrastructure and FID projects)

Supply disruption

Access to diversified supply sources is key to ensure security of supply in the event of a supply or infrastructure-related crisis situation. The gas infrastructure already ensures a good level of diversification resulting in a high resilience in many parts of Europe. The gas system is able to cope with a wide range of route disruption cases[1]. In case of Ukraine route disruption, the overall EU situation in particular for the South-Eastern region is foreseen to improve thanks to the commissioning of projects which have already taken their final investment decision. However, full mitigation of the risks may call for additional infrastructure reinforcements. Some projects submitted to the TYNDP are able address these risks and are part of the Advanced or PCI infrastructure levels.

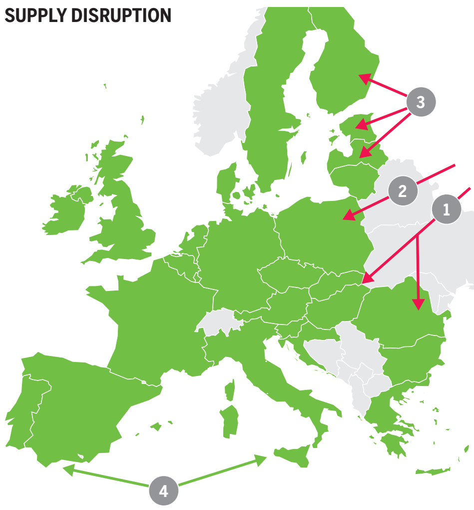


Figure 4.9: Supply disruption cases assessed in TYNDP 2018

1) see ENTSOG EU-wide SoS simulation

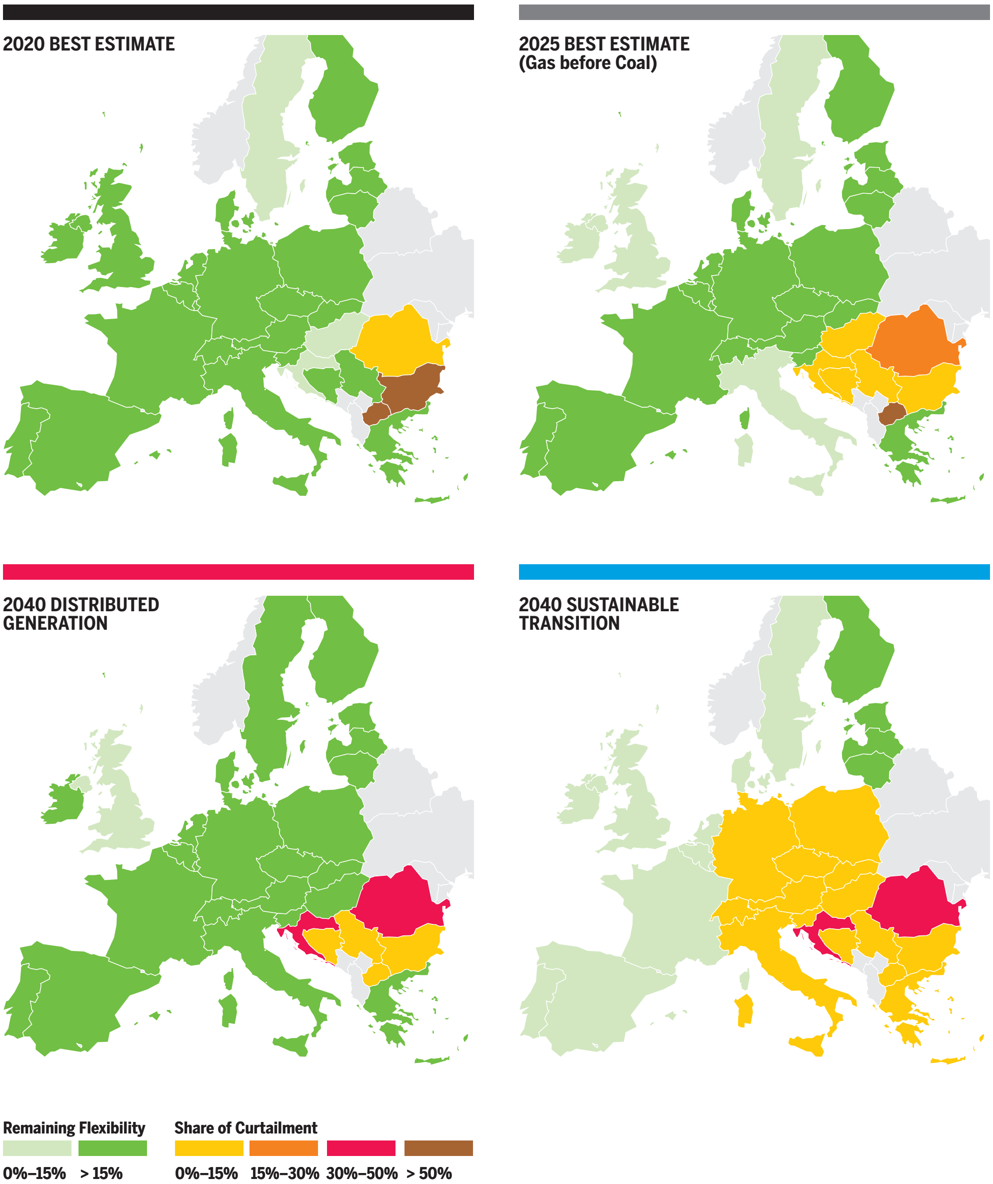


Figure 4.10: Risk of demand curtailment in case of Ukrainian transit disruption and Peak day demand, Distributed Generation scenario, Low infrastructure level (existing infrastructure and FID projects),

4.3 THE SOLUTION IS AT HAND

TYNDP 2018 concludes that existing infrastructure and upcoming reinforcement with FID projects already achieves many of the aims of the internal energy market. However, in some circumstances and for some specific areas there are still pending infrastructure needs.The assessment of the Advanced or PCI projects indicates that for most of the needs, the solution is at hand and achievable at limited cost.

COMPETITION AND MARKET INTEGRATION

In terms of diversification, the Advanced projects in addition to the FID projects, improve the situation in the Baltic region in South-Eastern Europe and allow the vast majority of EU countries to access at least three supply sources by 2025. The Iberian peninsula still mainly has access to LNG and to Algeria, and in some demand scenarios would have access to additional supply sources.

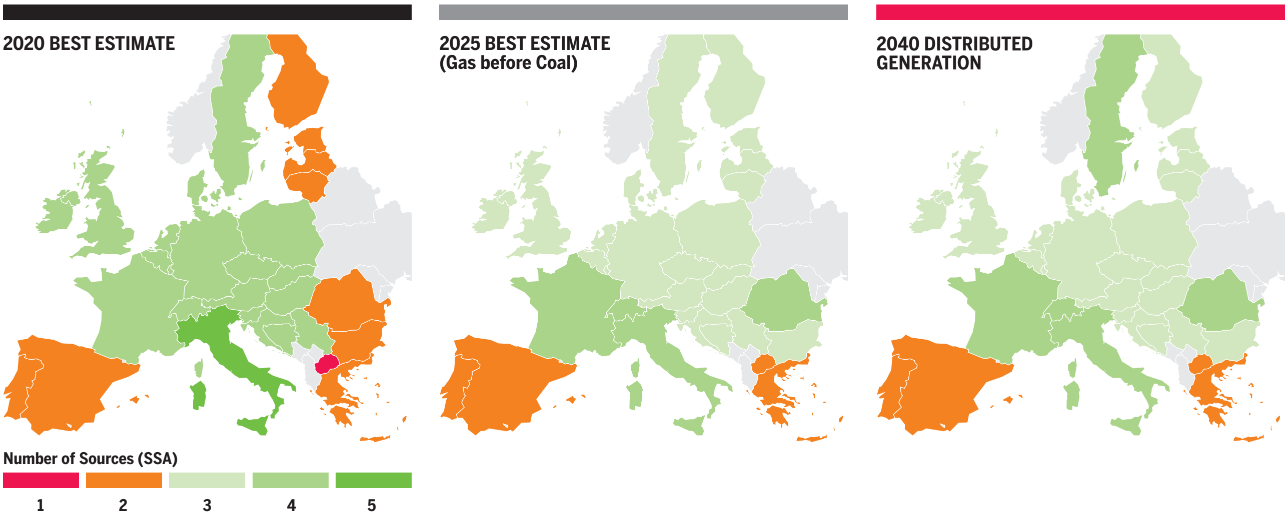


Figure 4.11: Level of supply diversification (expressed as number of supply sources to which countries can have a significant commercial access), Distributed Generation scenario, Advanced infrastructure level (existing infrastructure together with FID and advanced projects) projects)

Some Advanced projects improving the commercial access to other supply sources also contribute to mitigate the dependence to Russian supply by decreasing the isolation of Finland and solving the issue in South-Eastern Europe. However, they do not fully mitigate the dependence of the Iberian peninsula to LNG.

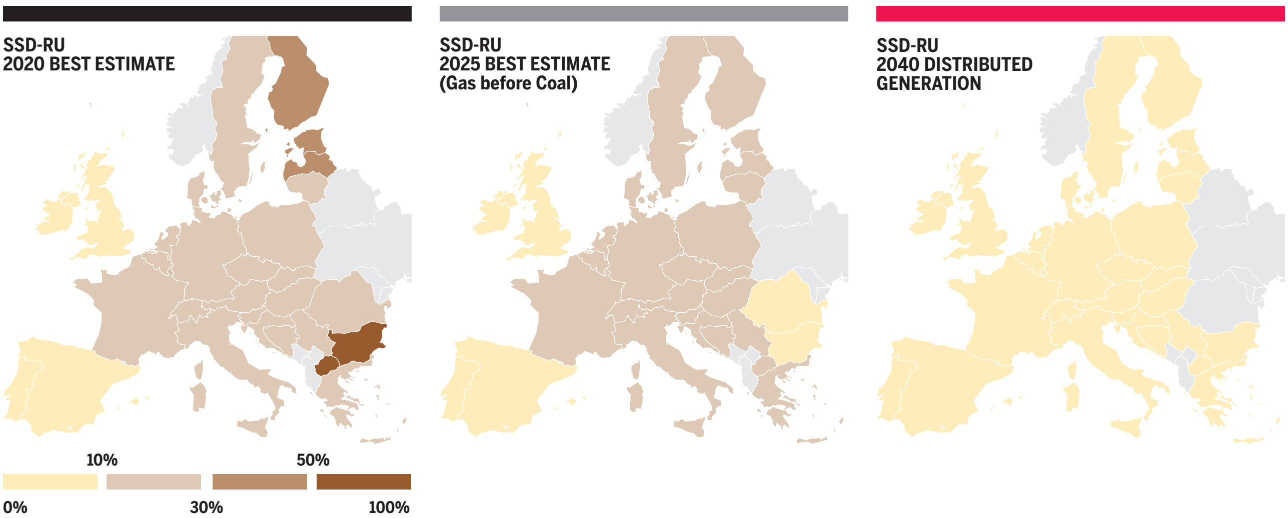


Figure 4.12: Dependence to Russian supply on annual basis, Distributed Generation scenario, Advanced infrastructure level

SECURITY OF SUPPLY

The resilience of the European gas system to the disruption of the Single-Largest infrastructure of each country is significantly improved by the implementation of Advanced projects, with very limited possible impact in the longer term. The risks in the case of disruption of the Ukrainian transit are also significantly mitigated. The implementation of further 3rd PCI list projects beyond 2020 would generally address risks of demand curtailment in case of Ukraine or Belarus route disruption.

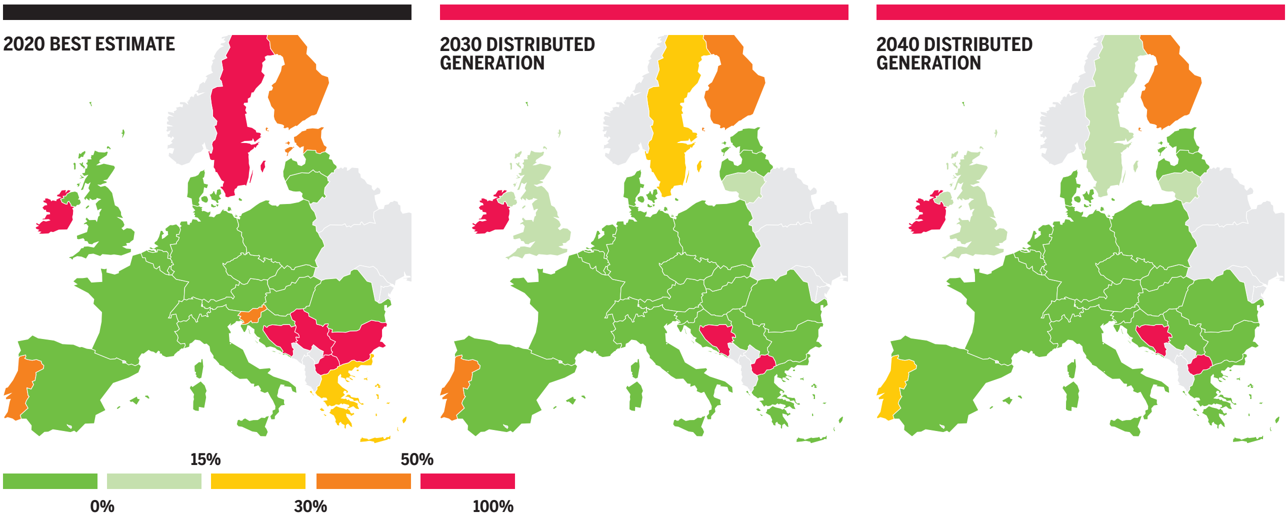


Figure 4.13: Exposure of European countries to the **disruption of their Single-Largest Infrastructure** considering advanced projects (existing infrastructure together with FID and advanced projects), peak day demand

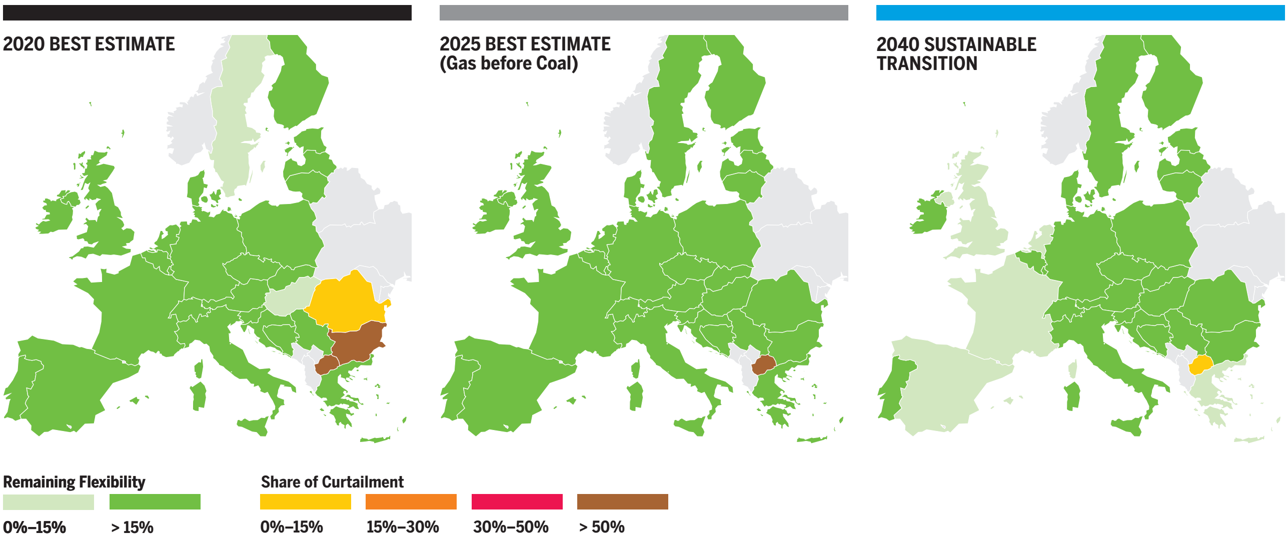


Figure 4.14: Exposure to demand curtailment in case of **Ukrainian transit disruption** and peak day demand, considering Advanced projects

5 **TYNDP 2020** ON ITS WAY

The gas system has achieved the market and security of supply goals in most EU Member States with some exceptions, while most of the remaining gaps are planned to be addressed within few years. A well interconnected, diversified and a functioning internal energy market, where energy can flow freely across borders and across sectors is supporting any vision related to the future of gas and gas infrastructure. However, achieving the sustainability goals of the EU requires a strong focus on the decarbonisation of gas and gas infrastructure in the coming years.

The gas system is undergoing a transition towards the use of more renewable and decarbonised gases, building on synergies with other energy carriers and gas innovation, necessary conditions to achieve the climate and energy targets for 2050 in a competitive and secure way.

For TYNDP 2020, ENTSOG is continuing its collaboration with ENTSO-E for an interlinked approach to the assessment of the gas and electricity infrastructure, and already initiated the scenario development process in 2018. The storylines proposed for TYNDP 2020 have been developed and consulted with stakeholders in view of publishing the final scenario report in 2019.


Picture courtesy of Enagás

LIST OF **ABBREVIATIONS**

ACER	Agency for the Cooperation of Energy Regulators
Bcm/Bcma	Billion cubic meters/Billion cubic meters per annum
CAM NC	Capacity Allocation Mechanism Network Code
CAPEX	Capital expenditure
CBA	Cost-Benefit Analysis
CIS	Commonwealth of Independent States
DIR-73	Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC.
EBP	European Border Price
EC	European Commission
EIA	Energy Information Administration
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSOG	European Network of Transmission System Operators for Gas
ETS	European Trading Scheme
EU	European Union
FEED	Front End Engineering Design
FID	Final Investment Decision
GCV	Gross Calorific Value
GIE	Gas Infrastructure Europe
GHG	Greenhouse Gases
GLE	Gas LNG Europe
GRIP	Gas Regional Investment Plan
GSE	Gas Storage Europe
GWh	Gigawatt hour
e-GWh	Gigawatt hour electrical
GQO	Gas Quality Outlook
HHI	Herfindahl-Hirschman-Index
H-gas	High calorific gas
HDV	Heavy duty vehicles
HGV	Heavy goods vehicles
IEA	International Energy Agency
IP	Interconnection Point
ktoe	A thousand tonnes of oil equivalent. Where gas demand figures have been calculated in TWh (based on GCV) from gas data expressed in ktoe, this was done on the basis of NCV and it was assumed that the NCV is 10 % less than GCV.
L-gas	Low calorific gas
LDV	Light Duty Vehicles
LNG	Liquefied Natural Gas

mcm	Million cubic meters
MMBTU	Million British Thermal Unit
MS	Member State
MTPA	Million Tonnes Per Annum
mtoe	A million tonnes of oil equivalents. Where gas demand figures have been calculated in TWh (based on GCV) from gas data expressed in mtoe, this was done on the basis of NCV and it was assumed that the NCV is 10 % less than GCV.
MWh	Megawatt hour
e-MWh	Megawatt hour electrical
NCV	Net Calorific Value
NERAP	National Energy Renewable Action Plans
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
OPEX	Operational expenditure
PCI	Project of Common Interest
P2G	Power-to-Gas
REG-703	REGULATION (EU) 2015/703 of 30 April 2015 establishing a network code on interoperability and data exchange rules
REG-347	Regulation (EU) No 347/2013 of the European Parliament and of the council of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009
REG-715	Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks.
REG-SoS	Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC.
RES	Renewable Energy Sources
SIF/SWF	Seasonal Injection Factor/Seasonal Withdrawal Factor
SoS	Security of Supply
Tcm	Tera cubic meter
TSO	Transmission System Operator
TWh	Terawatt hour
e-TWh	Terawatt hour electrical
TYNDP	Ten-Year Network Development Plan
UGS	Underground Gas Storage (facility)
WI	Wobbe Index

COUNTRY CODES (ISO)

AL	Albania
AT	Austria
AZ	Azerbaijan
BA	Bosnia and Herzegovina
BE	Belgium
BG	Bulgaria
BY	Belarus
CH	Switzerland
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
DZ	Algeria
EE	Estonia
ES	Spain
FI	Finland
FR	France
GR	Greece
HR	Croatia
HU	Hungary
IE	Ireland
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
LY	Libya
MA	Morocco
ME	Montenegro
MK	FYROM
MT	Malta
NL	Netherlands, the
NO	Norway
PL	Poland
PT	Portugal
RO	Romania
RS	Serbia
RU	Russia
SE	Sweden
SI	Slovenia
SK	Slovakia
TM	Turkmenistan
TN	Tunisia
TR	Turkey
UA	Ukraine
UK	United Kingdom

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