ACER
European Union Agency for the Cooperation of Energy Regulators

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ON THE REVIEW OF GAS AND HYDROGEN NATIONAL NETWORK DEVELOPMENT PLANS TO ASSESS THEIR CONSISTENCY WITH THE EU TEN-YEAR NETWORK DEVELOPMENT PLAN

THE EUROPEAN UNION AGENCY FOR THE COOPERATION OF ENERGY REGULATORS,

Having regard to 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 and repealing Regulation (EC) No 1775/2005[1], and, in particular, Article 8(11) thereof,

Having regard to the outcome of the consultation with ACER's Gas Working Group,

Whereas:

1. INTRODUCTION

(1) The Opinion reviews the most recent editions of the EU gas national development plans (NDPs) in view of ACER's task to assess their consistency with the EU-wide Ten-Year Network Development Plan (EU TYNDP), pursuant to Article 8(11) of Regulation (EC) No 715/2009.

(2) The consistency of the NDPs and EU TYNDP is analysed based on information provided by 26 national regulatory authorities (NRAs) from 8 June until 8 September 2022[2]. The projects' consistency is analysed based on information publicly available

[1] OJ L211, 14.8.2009, p. 36.

[2] Cyprus, Latvia and Malta submitted responses to the questionnaire. Their responses are included, although these NRAs were not always in a position to provide the required answers, and marked "other options/n.a." when responding. Cyprus currently has no gas or infrastructure, but infrastructure projects are planned to bring gas to the country or deliver it to other countries. Malta switched its primary source of energy from heavy fuel oil to natural gas in 2017. The Finish NRA did not submit an answer arguing that a Finish gas NDPs is not required by national legislation in view that that the Finnish TSO's ownership is fully unbundled and that investment plans are not overseen by the NRA.

by ENTSOG and the NRAs' review of the draft EU TYNDP 2022 project candidates between 17 December 2021 and 14 January 2022[3].

(3) This Opinion assesses:

a. The consistency of the most recent gas NDPs across Europe with the draft EU TYNDP 2022, focusing on methodological aspects and on the changes since 2020, when the previous review of gas NDPs was carried out;

b. The integration of decarbonised and low carbon gases (renewable hydrogen and biomethane) into network development plans, either as part of gas network plans or as dedicated plans for hydrogen; and

c. The readiness of the gas infrastructure to accept injections (blends) of hydrogen and biomethane.

2. MAIN FINDINGS

2.1. Regulatory aspects related to gas NDPs: unbundling and certification

(4) The NRAs reported that there were 47 certified transmission system operators (TSOs), 2 more than 2 years ago. The certified gas TSOs and the chosen certification model have changed very little during the last 2 years.

(5) In the following Member States (MS), three or more certified TSOs exist and operate: Germany (16), Spain (4) and Italy (3). All other MS have two or fewer certified TSOs.

(6) The Full Ownership Unbundling (OU) model is chosen by 13 MS, one more than in 2020, followed by the Independent Transmission Operator (ITO) model (6 MS). Romania is the only MS with an Independent System Operator (ISO) model. In some MS where two or more TSOs operate (France, Germany and Spain), two or more unbundling models have been implemented.

(7) In more than half of the MS, slightly more than in 2020, there are specific provisions in place in the national regulatory framework regarding NDPs in line with the provisions of Article 22 of Directive 2009/73/EC[4], which relates to national network development plans and the NRA powers to ensure that relevant investments are made.

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[3] ENTSOG invited ACER and NRAs to crosscheck the input data (project attributes, including the consistency with NDPs) of the TYNDP 2022 project candidates in December 2022. The NRAs views and comments on the projects were communicated to ENTSOG aiming to improve the quality of the input data of TYNDP 2022 projects and allow NRAs to express early comments on the projects.

[4] Art. 22(7): *"In circumstances where the transmission system operator, other than for overriding reasons beyond its control, does not execute an investment, which, under the ten-year network development plan, was to be executed in the following three years, Member States shall ensure that the regulatory authority is required to take at least one of the following measures to ensure that the investment in question is made if such investment is still relevant on the basis of the most recent ten-year network development plan:(a)to require the transmission system operator to execute the investments in question;(b)to organise a tender procedure open to any investors for the investment in question; or (c)to oblige the transmission system operator to accept a capital increase to finance the necessary investments and allow independent investors to participate in the capital.*

2.2. Key features of network development plans

Integration of hydrogen into gas network planning

(8) ACER notes that around 60% of the most recent gas NDPs include hydrogen developments, an increase of more than 30 percentage points (pp) in comparison with 2020 data. The main hydrogen aspects covered in the gas NDPs are network adaptations (retrofitting) to allow H2 blending into gas networks (7 instances), new dedicated 100% H2 networks (6 instances) and H2 market demand studies underpinning a possible need of enabling H2 infrastructure (5 instances). Renewable hydrogen developments are expected to gain importance in view of the need to decarbonise the gas sector or to reduce the carbon footprint of hard-to-abate sectors such as high-temperature industrial processes and heavy-duty transport. In the future, hydrogen may be increasingly included in more gas NDPs.

Single vs. consolidated NDPs

(9) Similarly to 2020 data, in 3 (Austria, Germany and Spain) out of the 6 MS where more than one TSO exists, there is a consolidated NDP. In Portugal, there are different operators for underground gas storages (UGS) and liquefied natural gas (LNG) infrastructure, but the NDP proposals for all gas infrastructure are coordinated and presented by the TSO. In Romania, the 2 UGS operators' development plans are included in the NDP. In Italy, the largest TSO (Snam Rete Gas) also assesses the potential interlinkages between projects put forward by different TSOs.

(10) ACER reiterates its view that the elaboration of a consolidated transmission NDP, preferably also including LNG and UGS projects, in MS where more than one network operator exists, would provide added value by presenting joint analyses of investment needs and reflecting such needs in a single document. ACER welcomes that the proposed gas decarbonisation package[5] establishes that there shall be at least one single network development plan per Member State.

Stakeholder consultations

(11) Stakeholder consultations are essential for devising NDPs serving the needs of network users and other stakeholders, both at national and EU level. ENTSOG carries out a public consultation during the elaboration of the draft EU TYNDP, thus offering a platform for the engagement of market players and other stakeholders. However, the

Where the regulatory authority has made use of its powers under point (b) of the first subparagraph, it may oblige the transmission system operator to agree to one or more of the following: (a) financing by any third party; (b) construction by any third party; (c) building the new assets concerned itself;(d) operating the new asset concerned itself. The transmission system operator shall provide the investors with all information needed to realise the investment, shall connect new assets to the transmission network and shall generally make its best efforts to facilitate the implementation of the investment project. The relevant financial arrangements shall be subject to approval by the regulatory authority.

[5] Article 51 of the proposed Directive on common rules for the internal markets in renewable and natural gases and in hydrogen.

level of engagement of stakeholders' during the EU TYNDP development process has decreased over time[6].

(12) With a few exceptions, most NDPs are prepared with a varying degree of stakeholder involvement and engagement. In particular, public consultations of NDPs are usually held during the preparation stage and involve existing and potential network users and other relevant stakeholders. 17 out of the 26 responding NRAs provided information regarding the timeframe of the stakeholder consultation. Most NDPs foresee firstly a stakeholder consultation followed by a draft NDP proposal by the TSO, which is then submitted to the NRA or another public authority for its opinion, amendment, and/or approval. In a few cases, the stakeholder consultation takes place after the draft NDP proposal by the TSO. NRAs report no changes to the stakeholders' consultation process with respect to 2020.

(13) Gas network expansions should be primarily demand-driven, but they could also serve other needs, for example related to security of supply risks or sustainability. The European Commission's Repower EU communication[7] has recently set a clear direction to reduce and ultimately phase out the European import dependency on Russian gas. Some NRAs have reported some investments projects with a focus on enabling West to East gas flows, increasing the gas LNG import capacity and creating routes from littoral Member States with LNG terminals to landlocked ones depending highly on Russian gas.

Frequency of publication of the EU TYNDP and the NDPs

(14) The EU TYNDP is published biennially and more than 90% of the NDPs are published at least every two years. With the exception of the Spanish and Swedish NDPs, which date back to 2008, and the Portuguese NDP, which dates back to 2017, all NDPs have been published during the last 2 years.

(15) ACER positively notes that most NDPs have been updated in the last two years and it recalls the importance of keeping them up-to-date. ACER notes that in the independent transmission operator (ITO)[8] and independent system operator (ISO)[9] models, gas TSOs are obliged to submit their respective NDPs to the NRA every year, in compliance with the European gas legislation (Articles 22(1) and 41(3)(c) of Directive 2009/73/CE). In electricity the frequency of NDPs was recently changed from yearly to at least every two years in the recast electricity Directive 2019/943

[6] ACER Opinion No 02/2021 on ENTSOG draft TYNDP 2020, para 21-24. https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2002-2021%20on%20the%20ENTSOG%20draft%20Ten-Year%20Network%20Development%20Plan%202020.pdf

[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A108%3AFIN

[8] Cf. Chapter IV of Directive 2009/73/EC.

[9] Ibid, see Article 41(3)(c).

(Article 51 (1)). ACER supports that the gas decarbonisation package proposal[10] introduces biennial gas NDPs by default, irrespective to the unbundling model of the TSO, in order to align their timing with the EU TYNDP, with the periodicity of electricity network planning, and to achieve better cross-plan and cross-sectoral time-consistency[11].

Regulatory environment and oversight

(16) ACER notes once more that the level of regulatory oversight is generally higher for NDPs, which are often legally binding[12], than that of the EU TYNDP, which is legally non-binding. In 11 instances public authorities, the NRAs in most cases and/or the Ministry for a few cases, are formally empowered, albeit in different ways, to approve, reject or validate the NDP proposals drafted by the TSOs. The new TEN-E Regulation[13] partially increases the oversight over the TYNDPs, in particular by ACER issuing framework guidelines for scenario development process and Opinions on reports related to the identification of long-term infrastructure gaps and bottlenecks.

(17) In several MSs, NRAs play only a limited consultative role in the process of NDP elaboration and have no effective powers to review or validate the NDPs. ACER reaffirms its view that strengthening the NRAs' oversight and regulatory powers over NDPs could have a positive effect on improving the consistency and efficiency of national and EU-wide network planning.

2.3. Input used to elaborate the NDPs

(18) Scenarios are a key element framing the environment under which infrastructure projects are assessed. They include, among other aspects, projections of gas demand, supply, energy efficiency, CO_2 emissions and fuel prices.

(19) According to NRAs, 8 (31%) NDPs take into account a single scenario, 4 NDPs (15%) 2 scenarios, while 5 NDPs (19%) include 3 scenarios. In most cases, the time horizon of the general scenarios / visions in the NDP is 10 years. Most gas NDP scenarios are subject to a public consultation, and in addition some NDPs target specifically certain stakeholders in their consultations, such as universities and academics, market players (shippers) and governmental bodies and regulatory authorities. 20 NDPs (77%) consider gas demand breakdown by type of customers or by economic sector. These

[10] Article 51(1) of the proposed Directive on common rules for the internal markets in renewable and natural gases and in hydrogen

[11] See ACER Position Paper on TEN-E Regulation http://www.acer.europa.eu/Official_documents/Position_Papers/Position%20papers/ACER_CEER_paper_on_TEN_E.pdf

[12] See Annex I to the Opinion, p. 7, Q 4.1 Role of the TSOs, NRA and Ministries in the NDP development process, and p. 17, Q 4.10 Legal nature of the NDP (indicative, mandatory).

[13] Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure.

numbers are similar to the 2020 report, with 2 additional NDPs providing a gas demand breakdown.

(20) 13 NRAs (50% of respondents) indicate that the NDP is aligned with the latest National Energy and Climate Plan (NECP), 4 NRAs (15%) inform that scenarios are aligned with the REPower EU plan, 6 (23%) refer to the "Fit for 55 scenarios" for achieving climate neutrality, while 8 respondent NRAs (31%) indicate alignments with other relevant scenarios at national level. ACER stresses the importance of having transparent and consistent scenarios at national and EU level, as aligned as possible with the European Union energy and climate objectives and the National Energy and Climate Plans (NECPs)[14] .

2.4. Output of the NDPs

Identification of investment gaps, categorisation and assessment of projects

(21) As was the case two years ago, for most NDPs the identification of investment gaps (or needs), and the assessment of the degree to which specific projects address them, are typically based on a combination of approaches[15]. ACER recommends once again complementing the generic approach to infrastructure needs (top-down approach) with a case-specific analysis of individual projects and economic tests revealing the market interest in the projects (bottom-up approach).

(22) The EU TYNDP should be further improved to allow for an identification of the investment gaps and projects matching such gaps. Projects which do not clearly meet any need should not be included in the EU TYNDP. ACER expects that the infrastructure gaps report to be developed within the next EU TYNDP in compliance with the revised TEN-E Regulation (Article 13) will improve the identification of investment gaps, as well as the involvement of stakeholders and the regulatory oversight by ACER and the Commission.

(23) ACER welcomes the use of project-specific criteria, such as maturity, for categorising projects listed in the EU TYNDP, and notes that some progress has been achieved over time in the use of such criteria for categorising NDP projects. Some NDPs also categorise projects with respect to security of supply (9 instances), market integration (9 instances), urgency (7 instances), the contribution to sustainability and decarbonisation (5 instances) and sector integration (3 instances). NDP projects are also categorised according to their technical typology, and some NDPs distinguish between major and minor investments depending on the budget.

(24) ACER notes that natural gas would have to be decarbonised in the mid- to long-term in view of reaching the decarbonisation and climate neutrality objectives of the Energy

[14] Pursuant to the new TEN-E Regulation, ACER will adopt, by 24 January 2023, Framework Guidelines for the TYNDPs joint scenarios that are to be developed by ENTSO-E and ENTSOG.

[15] Possible approaches to investment gap identification include: evaluation after an in-depth analysis of the "needs" of infrastructure (top-down approach); outcome of the system and/or market modelling; a case-by-case analysis of project candidates (bottom-up approach); projects as outcome of an economic test.

Union [16], significantly affecting the needs for gas transportation services and infrastructure. In this context, all gas infrastructure projects should unambiguously demonstrate quantitatively their contribution to reduce methane, CO2 and other emissions.

(25) A greater focus of NDPs on analysing the options for reducing emissions, for example via network adaptations and investments aimed at increasing the use of biomethane and the blending of hydrogen produced from renewable and low carbon sources, is recommendable. In the same line, NDPs could also consider the possible future need of decommissioning gas infrastructure and include suitable areas for location of power-to-gas assets, in coordination with electricity network planning processes and assessments.

Cost data availability and transparency

(26) Most NDPs (19 out of 26, 73%) include information about investment costs, 2 more NDPs than in 2020. Where the NDPs do not include any cost information, NRAs refer to confidentiality concerns of project promoters. ACER recommends that all NDPs include cost information, in particular aggregated investment costs information, as it is essential information for any evaluation of investment proposals.

Consistency of cross-border capacities and projects in NDPs

(27) 8 NRAs (31%), 2 more than in the 2020 review, informed that the estimated cross-border capacities are in line with the capacities available in neighbouring MS. However, still the majority of NRAs were not able to assess this, and 3 NRAs[17] (12%) noted that cross-border capacities were not aligned. ACER deems that the development of cross-border capacities and other projects with significant cross-border impact should be better coordinated across neighbouring NDPs, for which the existence of up-to-date NDPs and regular neighbouring TSOs and NRAs discussions on cross-border aspects is instrumental.

2.5. Methodology used for the elaboration of NDPs

Use of market, network, sector-integrated studies, and CBA

(28) 20 NDPs (77%) include market studies, 2 more than in 2020, including projections of gas market fundamental data. The use of network modelling studies in NDPs via hydraulic simulations (carried out for assessments of the ability of the network to cover stress/high demand situations) was reported in 20 instances.

[16] In November 2019, the Council of the European Union noted that by 2050 "green gases" – mainly hydrogen (H2) and biomethane – could represent from 30% to 70% of total gas use https://data.consilium.europa.eu/doc/document/ST-13854-2019-INIT/en/pdf

[17] Ireland, Latvia, Spain.

(29) However, sector-integrated studies, at least covering the electricity and the gas sectors, are much less frequently used: only 8 NRAs[18] report the use of such studies in NDPs, 2 more instances[19] than in 2020.

(30) 10 NDPs use a cost-benefit analysis (CBA) for evaluating the merits of gas infrastructure investments. Only the Italian NRA confirms that the NDP contains an economic evaluation of the value of the cost of disruptions of gas supply due to potential gas supply interruptions. ACER notes that the evaluation of the value of the cost of disruptions of gas supply in NDPs is very challenging, but this assessment has become very relevant in view of increased risks of gas supply disruption from Russia.

Technical aspects: modelling tools, network topology

(31) The network topology currently used for the elaboration of the EU TYNDP is less granular and detailed than the one used for the preparation of NDPs. Consequently, the assessments and identification of physical capacity bottlenecks, as well as the simulation of gas infrastructure operational conditions, are generally more robust in the NDPs, where hydraulic modelling is typically used, than in the EU TYNDP. ACER welcomes that ENTSOG recently replaced its internally developed network simulation software tool (NeMo Tool) with commercial software which offers more functionalities. ACER notes that this new modelling tool, if coupled with common assumptions and input data for the electricity and gas EU TYNDPs, would allow to move towards an interlinked electricity and gas model.

2.6. Energy Transition Aspects in Gas NDPs

Hydrogen developments in gas NDPs

(32) The most recent NDPs of 16 MS[20] already address hydrogen (H2) developments. In comparison with the 2020 data, the number of gas NDPs addressing H2 doubled from 8 to 16. Some NRAs report that current TSO unbundling provisions and the legal framework governing NDPs may prevent gas NDPs from covering H2 developments as part of the gas NDP process and investment plans. The main H2 aspects that are covered are:

a. network adaptations needed to enable H2 blending in gas networks (7 instances)

b. new dedicated H2 networks (6 instances)

c. H2 market demand studies underpinning a possible need of enabling H2 infrastructure (5 instances)

d. repurposing gas networks to dedicated H2 networks

[18] Cyprus, Denmark, Greece, Hungary, Netherlands, Portugal, Spain and Sweden.
[19] The NRAs of Cyprus, Denmark, Greece and the Netherlands report for first time to use sector-integrated studies in NDPs, while the NRAs of Ireland and Latvia reported the use of sector-integrated studies in 2020, but not in 2022.
[20] Austria, Belgium, Bulgaria, Croatia, Estonia, France, Greece, Hungary, Ireland, Italy, Lithuania, Malta, Netherlands, Portugal, Slovakia, Slovenia.

e. Only a few NDPs cover connection points for H2 injection, best locations for power-to-"x" developments, based on gas TSO analysis, hydrogen production development from renewable sources (electrolysers), hydrogen underground storages and compressor stations (new or adaptations) for H2 use.

Biomethane developments in gas NDPs

(33) The most recent NDPs of 12 MSs[21] address biomethane developments, only 1 MS[22] more than in 2020. Therefore, little progress can be observed during the last two years in this respect. When biomethane is covered, NDPs include at least two of the following aspects[23]: network adaptations needed to enable biomethane injection at transmission level, direct connection points for biomethane injection, reverse flow capacity from distribution to transmission networks, and biomethane production potential. Only 1 NDP (from Denmark) covers biomethane storage projects and best locations for biomethane potential.

Future gas NDPs in view of Energy Transition goals

(34) Most of the respondent NRAs agree that while the focus of future NDPs should be on traditional gas infrastructure, NDPs should include energy transition aspects and be better coordinated and interlinked with electricity NDPs. Most NRA respondents seem to be in favour of moving towards more sector-integrated plans which cover both electricity and gas sectors. Most NRAs agree that NDPs should keep an important focus on and prioritise security of supply investments.

(35) Therefore, although progress is observed since the last review with respect to coverage of hydrogen aspects, ACER notes once again an apparent mismatch between the currently limited coverage of energy transition aspects in the NDPs, and the NRAs' clear support to put more emphasis on biomethane and hydrogen in future network plans.

2.7. Readiness of gas transmission networks for injection of hydrogen and biomethane

2.7.1. Blending of hydrogen in gas transmission networks

Current H2 blending limits

[21] Belgium, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Ireland, Italy, Lithuania, Netherlands, Slovenia.
[22] Hungary and Lithuania newly address biomethane developments in 2022, while Latvia does not address them anymore in 2022.
[23] The French NDP covers all of them.

(36) 19[24] out of 26 NRAs (73% of respondents) report that the TSOs in their domain do not accept the injection or allow[25] H2 volumes into the gas transmission network. When H2 is explicitly accepted (Austria, France[26], Germany, Italy, Portugal, Slovakia, Spain and Sweden), it is only possible at a very low concentration - see paragraph (39) below. Remarkably, there are practically no changes with respect to the 2020 situation.

(37) Like 2 years ago, in many MSs, TSOs are studying the technical constraints and necessary measures to cope with different volumes of H2 in the gas transmission network. The level of ongoing work in terms of studies and analyses differs across the European Union. Several TSO have initiated discussions on the topic in collaboration with the relevant ministries and authorities, trying to find potential target H2 concentration limits.

(38) In order to enable H2 blending, investments are needed, in particular with respect to gas quality measurement systems. The same as in 2020, in most MSs (18 out of 26, 69%), current gas quality standards do not mention H2 volumes[27].

(39) Germany reports the highest H2 concentration limit at gas transmission level (10%)[28], followed by France (6%), Spain (5%)[29] and Austria (5%)[30]. Five more countries allow for a more modest H2 concentration in their natural gas transmission networks: Lithuania (2%), Italy (2%, increase of 1% since 2020), Latvia (0.1%), Ireland (0.1%) and the Netherlands (0.02%). In Slovakia, there is no explicitly defined H2 limit; however, H2 can be present in imported gas (up to 2% maximum), but not directly injected into the network. In more than 60% of MSs, the current H2 concentration limit is zero (0%). There are very limited changes with respect to the 2020 situation.

(40) As regards the main reasons to set a certain H2 concentration limit, gas quality requirements, safety and tolerances of end-use equipment are commonly cited. Several respondents provided comments and explanations. In Belgium, the entire infrastructure, operational, legal, and regulatory framework is currently based on 0% H2 acceptance. In Denmark, network components - as identified by the TSO's own studies - have been proven to withstand at least 10% H2 blends, but there are safety

[24] Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Romania, Slovenia.
[25] H2 may be present in imported gas, although not directly injected.
[26] Only in the frame of demonstration projects.
[27] In some countries the absence of an explicit threshold for H2 in gas quality standards does not mean that the threshold is zero or that gas quality standards do not allow for H2 volumes: it simply means that H2 is not measured, while other gas parameters are.
[28] This limit is only allowed if no "sensitive" customer is connected to the network. e.g., if a natural gas filling station for vehicles is connected to the gas network, only 2% is permitted in the gas in the network.
[29] In Spain, 5% H2 concentrations are allowed in the "so-called" non-conventional gases, thus this figure does not represent the H2 blending limit at transmission level.
[30] The Austrian Gas Quality standard G B210 is based on the European standards ÖNORM EN 16726, ÖNORM EN 16723-1 and summarises additional requirements which were previously contained in the ÖVGW guidelines G 31 "Natural gas in Austria" and G B220 "Regenerative gases". With the lower limit value of the relative density of 0.555 according to ÖNORM EN 16726, hydrogen contents of approx. 3-5 % are possible, depending on the gas composition.

concerns a restriction of blending limits for industrial processes where natural gas is used as feedstock – also mentioned by Luxemburg-. The main constraints identified in France relate to end-user appliance limitations on the consumption side, related to the sensitivity of specific industrial processes to the presence of H2, to natural gas vehicles (NGV) charging stations limits (only 2% H2 is allowed) as well as to the technical tolerances of network components in the gas networks. In Italy, the 2% H2 limit is a precautionary value chosen to preserve the underground gas storages and acceptance limits of end-users. Spain refers to safety concerns, and technical limits of network components. Still, the current significant differences in the H2 concentration limits, from 0% in many MSs to 10% in others, make it difficult to see this as a merely technical issue. In view of the projected increased role of H2 in the future energy system, more European coordination on the H2 blending limits could bring benefits.

(41) Only Portugal and Slovakia reported obligations for network operators to publish actual and future available capacity for hydrogen injection into the gas transmission network (in 2020, no NRA reported such an obligation).

Future H2 limits and projects

(42) 9 respondent NRAs report that their current NDPs include investments/adaptations to allow or increase the TSO acceptance of H2, 6 NRAs more than in the 2020 review. 14 NRAs[31] report plans to increase the H2 acceptance into natural gas networks for their respective MSs, in line with the 2020 review.

(43) Only Poland and Portugal report a H2 blending target for the TSO, of 10% vol. and from 10 to 15% vol. respectively by 2030 (5% vol. for Portugal in 2025). The rest of NRAs highlighted that there were currently no H2 blending targets for their TSOs, although in some MSs (Austria, France, Lithuania, Ireland, Luxembourg and Slovakia) there are ongoing studies and discussions on possible blending targets. Some TSOs are promoting specific H2 blending targets (e.g. French TSOs promote a 10% blending target by 2030).

2.7.2. Dedicated hydrogen networks

(44) Austria, Belgium, France, Germany and the Netherlands reported in 2020 the existence of 100% H2-dedicated pipeline networks for industrial purposes, i.e. networks which connect several industrial sites[32]. In 2022, Czech Republic, Poland and Portugal area also report existing H2-dedicated pipeline for industrial purposes. These H2 pipeline networks are not operated by a TSO or a DSO, and are generally used to supply hydrogen to refineries, fertiliser plants and other industries. H2

[31] Belgium, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Ireland, Italy, Lithuania, Luxembourg, Poland, Slovenia, Spain, Sweden.

[32] Austria and Hungary also report the existence of dedicated H2 pipeline networks at oil refineries, but it is our understanding that internal H2 pipelines are common inside most refineries.

transported in the decided networks is typically produced from fossil fuels by steam methane reforming and partial oxidation of methane (generally also from natural gas).

(45) Details were provided by NRAs with 100% H2 dedicated networks present in their domain. In Belgium, there is a highly developed H2 pipeline network of more than 600 km, with cross-border connections to the Netherlands and to France. The H2 pipeline network serves to supply H2 for industrial processes (e.g. oil refineries) and is operated by H2 production companies (e.g. Air Liquide). The network operates at a pressure between 10 and 20 bar. The Antwerp Port region is an important industrial cluster for H2 production. In France, a 100% H2 pipeline network outside the regulated gas network is operated by a private company (Air Liquide) in the north of France, linking industrial sites in France, and crossing and connecting with the network in Belgium. In the Netherlands, there are several H2 pipeline networks supplying H2 for industrial processes, operated by private non-regulated companies. Currently one dedicated (closed) H2 network in the province of Zeeland is operated by a subsidiary of Gasunie. In Germany, 100% H2 networks currently are operated by non-regulated private network operators (Linde, Air Liquide). Some NRAs (e.g. Croatia, Denmark, Greece, Hungary, Slovenia and Sweden) reported MS plans to develop more 100% H2 ready pipelines in the future.

(46) Since 2020, the number of NRAs reporting that a H2 strategy exists, either under development or planned, has nearly doubled from 11 to 21. 14 MS[33] have published a dedicated H2 strategy or vision, while several other NRAs report ongoing discussions regarding the role of H2, in particular in the context of the national energy and climate plans (NECPs).

2.7.3. Injection of biomethane at transmission level

(47) Biomethane has the same or very similar chemical composition as natural gas, hence its injection does not seem to lead to technical issues. Reverse flow capacity from the distribution to the transmission network may be required to enable the injection of locally produced biogas, once upgraded to biomethane, into the gas transmission network at appropriate pressure. In such cases, additional facilities are needed to enable the injection of biomethane into the transmission network, e.g. gas quality upgrading installations (i.e. from biogas to biomethane) and injection facilities. The investment associated with enabling such reverse flow is only needed when volumes of locally produced biogas and/or biomethane exceed the demand for these products within the distribution network (e.g. during the summer). Another way to inject biomethane into the transmission network is by using a direct connection between the biogas plant (in this case it is likely to be a large production plant) and the gas transmission network, including the necessary facilities for quality upgrading and injection.

[33] Austria, Belgium, Croatia, Czech Republic, France, Germany, Hungary, Italy, Luxembourg, the Netherland, Poland, Portugal, Slovakia and Spain

(48) Currently Denmark, France, Germany, Hungary, Ireland, Italy, the Netherlands, Spain, and Sweden already have injections of biomethane into TSO systems, the same countries as in 2020 with the addition of Hungary and Ireland.

(49) Several NRAs provide additional information on this topic. Most of the NRA respondents noted that biomethane producers were responsible for gas quality upgrading. The injection is coordinated with the TSOs, who check the acceptance of biomethane in the transmission network.

(50) In 2020 only France reported the existence of obligations for network operators to publish actual and future available capacity for biomethane injection into the gas transmission network. In 2022, three additional MS (Ireland, Lithuania, Portugal) have established such obligation.

(51) 17 NRAs, one more than in 2020, report the existence of obligations for network operators to provide a connection point for biomethane injection upon a request by a network user. No such obligations currently exist in Belgium (at least not on TSO level), Croatia, Cyprus, Greece, Poland, Slovakia, Sweden. In France, network operators are obliged to provide a biomethane connection point (at DSO or TSO level) in cases where the cost of this connection is below a given threshold. The 'right to inject' was adopted by a decree published in June 2019, and the French NRA introduced an injection tariff which is valid for the new regulatory period from April 2020. In Germany, the biomethane has to be prioritized over regular natural gas, and the TSOs/DSOs have the legal obligation to connect biomethane operators and their facilities to their network. In the Czech Republic, the injection pipelines of biomethane producers can be sold to a DSO, who operates it and includes it into the regulatory asset base (RAB). In Greece, there is an ongoing process for updating the regulatory framework to include provisions regarding hydrogen and biomethane production, distribution and transmission. Additionally, the DSOs are performing relevant pilot projects. In Hungary, when biomethane fulfils the gas quality requirements, it is handled no differently from any other domestic gas producers under the technical conditions defined by the TSO. In Ireland, Gas Networks Ireland now facilitates direct grid injection projects through a connection policy framework. In Italy, there is no reverse flow from DSOs to the TSO at this time, but there are direct biomethane injections in the TSO's network. Information on biomethane production must be included in NDPs and the Italian NRA will have to define the criteria to optimize the procedure for the connection of biomethane production to the grid. In Poland, a biomethane plant which is connected to the network has to follow the rules defined by the TSO. In Portugal, according to legislation, operators shall provide information about capacity available for the injection of hydrogen and other low carbon gases (such as biomethane) into the network at different points, as well as provide a connection point upon request by a producer (if capacity is available). In Spain there are national strategies on hydrogen and biogas setting targets for the installation of electrolysers' capacities, the production of biogas and use of biogas and biomethane in the transport sector.

2.8. Consistency of Projects in NDPs and the draft EU TYNDP 2022

Consistency of project inclusion in plans

(52) ACER notes that 130 out of the 263 projects included in the draft EU TYNDP 2022 (49%) are listed in NDPs[34], down from the 75% and 62% consistency level observed respectively for the EU TYNDP 2018[35] and EU TYNDP 2020 projects. Considering only TYNDP projects located in EU MSs, this percentage is the same (49%, 127 out of 257 projects) and, again, much lower compared to the EU TYNDP 2020 (62%). Only in 8 countries the level of project consistency exceeds 70%, in terms of inclusion of NDPs projects in the draft EU TYNDP 2022.

(53) There are significant differences in the level of project consistency among Member States and, in particular, depending on the project type: 90% of EU TYNDP 2022 transmission are included in NDPs, followed by 67% of underground storages, 62% of LNG terminals, 38% of retrofitting projects, and 36% of biomethane projects. Only 17% of the EU TYNDP 2022 hydrogen projects are included in NDPs. Therefore, the decrease in project consistency ratio is largely explained by the inclusion in the EU TYNDP 2022 of an increasing number of projects related to the Energy Transition (biomethane, hydrogen, retrofitting and other), which have not been included in the most recent gas NDPs. ACER notes that the "scope" of TYNDP and NDPs might be different and not cover the same type of projects, what would explain a low level of project consistency for some type of projects.

Consistency of project data items

(54) ACER and NRAs crosschecked the input data (project attributes) of the TYNDP 2022 project candidates as submitted by the project promoters. The NRAs reviewed the draft TYNDP 2022 project candidates at an early stage of the TYNDP 2022 development process. The NRAs' views and comments on the projects were communicated to ENTSOG, with the main aim being improving the quality of the input data of the TYNDP 2022 and allowing NRAs to express their general comments and concerns on the TYNDP 2022 projects at an early stage.

(55) Out of 21 responding NRAs, 13 NRAs had comments and remarks on TYNDP 2022 projects[36], both on project data items and on the need for the TYNDP projects.

[34] Based on NRAs projects data check and draft TYNDP 2022 projects published in January 2022. On 20 October 2022, ENTSOG published an updated version of the TYNDP 2022 projects which has not been used for this analysis.

[35] See Acer Opinion No 14/2019 on ENTSOG's draft TYNDP 2018, and Acer Opinion No 02/2021 on ENTSOG's draft TYNDP 2020
https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2014-2019%20on%20the%20ENTSOG%20draft%20TYNDP%202018.pdf
https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2002-2021%20on%20the%20ENTSOG%20draft%20Ten-Year%20Network%20Development%20Plan%202020.pdf

[36] Austria, Belgium, Croatia, Cyprus, Czech Republic, France, Greece, Hungary, Ireland, Italy, Latvia, Malta, Slovakia, Spain and United Kingdom (Northern Ireland).

Reported non-aligned data between the draft EU TYNDP 2022 and NDPs for projects were of a diverse nature, but mostly concerned technical and factual discrepancies.

(56) ACER is of the view that the potential consequences of such apparent discrepancies or misalignment of data at project level varies by importance and may be, to a large extent, explained by the natural evolution of projects between the moments when they are listed in the EU TYNDP and in the respective NDP. In any case, ACER calls on project promoters to ensure that coherent and reliable project information is provided in NDPs, in the EU TYNDP, and during the project implementation monitoring.

EU TYNDP should be based on NDP projects

(57) ACER stresses, once again, that Regulation (EC) 715/2009 requires that the TYNDP be based, in particular, on NDPs and, where appropriate, on EU aspects of network planning. From this perspective, ENTSOG should strive to bring the number of projects listed in the TYNDP but not listed in NDPs to a sufficiently low level, as already recommended by ACER on several occasions.[37]

(58) ACER welcomes ENTSOG's work on providing transparent information on the consideration of EU TYNDP projects in the most recent NDPs, including the promoters' justification for not including projects in the relevant NDP(s). ACER is concerned by the overall deterioration of project consistency between NDPs and the present draft EU TYNDP. There is a mismatch between the inclusion of Energy Transition projects in the EU TYNDP and NDPs, and it recommends that NDPs include more projects related to Energy Transition aspects under the NRAs regulatory oversight. To increase project consistency, promoters should inform and discuss with national competent authorities biomethane, hydrogen, retrofitting projects before applying to the EU TYNDP. Projects listed in a European-wide plan should reasonably expect support at national level, or otherwise risk to be seen as unrealistic or exceeding the necessary investment needs.

(59) ACER notes that some of the Energy Transition projects accepted by ENTSOG (e.g. power-to-gas, hydrogen and biomethane production, carbon capture and storage) are market-based activities which should be, in principle, open to competition of market players.

(60) ACER reiterates its recommendation that, in principle, projects not having obtained *"ex-ante"* regulatory review in the context of the NDPs or in another way, should not be included in the EU TYNDP, unless they are new and recent proposals already discussed with relevant authorities.

3. CONCLUSION

[37] ACER Opinion No 09/2020 on the review of gas NDPs to assess their consistency with the EU TYNPD, p.12. https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Opinions/Opinions/ACER%20Opinion%2009-2020%20on%20the%20consistency%20of%20gas%20NDPs%20with%20EU%20TYNDP.pdf

(61) ACER reviewed the most recent edition of the gas NDPs and assessed their consistency with the draft EU gas TYNDP 2022, including the integration of decarbonised and low carbon gases (hydrogen and biomethane) into network development plans.

(62) ACER welcomes that the EU TYNDP 2022 provides transparency via cross-references to the NDP investment item (project) codes, and via the justifications provided by promoters in cases where a project is not included in the relevant NDP(s).

(63) ACER welcomes the engagement of NRAs by providing the necessary data and input, and the collaborative attitude of ENTSOG for allowing NRAs to share their views regarding project data shortly after the submission of candidate projects to the draft EU TYNDP 2022. The NRA project data checks resulted, in some instances, in data reconciliation between the NDPs and the draft EU TYNDP 2022.

(64) ACER is concerned by a continuous falling level of project consistency between NDPs and draft EU TYNDP 2022, when comparing to previous editions of the EU TYNDP. This is largely explained by the inclusion in the EU TYNDP 2022 of decarbonised and low carbon gases (hydrogen and biomethane) projects which, however, are often not part of the most recent gas NDPs.

(65) ACER recommends the following to improve the consistency of NDPs with the EU TYNDP:

a. NDPs should focus more on investments allowing low-carbon and renewable gases such as biomethane and green hydrogen to be injected into the networks, and on the supply potentials of sustainable gases.

b. NDPs should consider the possible future need of decommissioning gas infrastructure.

c. A gas NDP should be prepared and published in each MS every 2 years, in pursuit of enhanced consistency with the EU gas TYNDP, as well as with electricity network plans. A biennial frequency is necessary to allow sufficient time for the network plan preparation and proper consultation with stakeholders. This is already recommended in the Commission's proposal for the gas decarbonisation package.

d. A consolidated transmission NDP should be considered for each MS where more than one TSO exists[38], preferably also including LNG and UGS projects. This is already proposed in the Commission's proposal for the gas decarbonisation package.

e. Adequate public consultations of the draft NDPs and due coordination between operators should take place during the preparation of each NDP. The stakeholders' comments from the public consultations related to the NDPs and information about the treatment of stakeholders' comments should be

[38] Austria, Germany and Spain already publish consolidated NDPs. France, Italy should consider publishing a consolidated NDP.

published. In order to increase the consistency among neighbouring NDPs of cross-border projects and projects with significant cross-border impact, targeted consultations and regular exchange of information and discussions among neighbouring MS is needed.

f. NRAs' regulatory oversight[39] over the NDPs should be strengthened in those MSs where, so far, this oversight has been limited.

g. Cross-references should be included in the NDPs between the NDP investment item (project) codes and the EU TYNDP codes, in the same way as this is currently done in the EU TYNDP.

h. Project cost data should be included in all NDPs[40] and for all projects included in the EU TYNDP.

i. NDPs and the EU TYNDP should include soon to be operational infrastructure projects contributing to phasing out the dependency on Russian gas, increasing flows from West to East, and increasing the gas supply import capabilities, including LNG to the Union to replace missing volumes of Russian gas.

j. NDPs and the EU TYNDP should be based on compatible scenarios, aligned with the national and European Energy Climate plans and compatible with the decarbonisation targets.

(66) ACER recommends ENTSOG and project promoters improve the consistency of future EU TYNDPs with NDPs, in particular by:

a. Reconciling the large number of investment projects in the NDPs and the TYNDP with the projected mid- and long-term downward trend in gas demand.

b. Considering the need to decarbonise the gas sector as a main driver for future EU TYNDPs, and the implications of the projected changes in gas supply patterns and operations for gas network investment needs.

c. Including project costs and monetised benefits data in the EU TYNDP, while ensuring that the confidentiality claims of promoters are not detrimental to achieving an adequate level of cost transparency. In this sense, ACER recalls that all projects included in the electricity EU TYNDP 2020 include CAPEX and OPEX information. ACER expect that the gas EU TYNDP would have the same level of cost transparency as the electricity TYNDP.

d. Making sure that the EU TYNDP is primarily based on the NDPs.

e. Include suitable areas for location of power-to-gas assets, in coordination with electricity TYNDP assessments.

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[39] Oversight is seen as limited when NRAs provide non-binding scrutiny (e.g. opinion) on draft plans, as is the case in Belgium, Denmark, Estonia, Ireland, Latvia, Luxembourg, Portugal and Spain, without hard powers to approve or issue binding amendment requests on draft plans.

[40] The NDPs of the following MSs do not include any cost information: Cyprus, Denmark, Finland, Hungary, Ireland, Romania, Slovakia, and Sweden.

f. The synchronisation of reasonable expectations of increasing production of low-carbon and renewables gases, the demand centres and a compelling and prudent assessment of the need for transportation services to connect supply and demand centres.

(67) Regarding the readiness of gas transmission networks for the injection of hydrogen and biomethane, the main findings and recommendations are:

a. H2 blending is likely to be a temporary or transitional solution, given the existence of technical and economic ceiling on H2 concentration by volume that traditional gas infrastructure can handle. It seems preferable to create separate 100% H2 networks, so that the economic value of H2 could be tapped in full. Such an approach would also consider the fact that some industries need pure hydrogen, as well as the need to retrofit end-user equipment to accommodate higher H2 blending limits (i.e. market area conversion from natural gas to H2 would be necessary).

b. The NRAs generally support the harmonisation of H2 blending limits across the EU. The introduction of H2 and biomethane into the gas transmission networks should take into account technical characteristics of the networks and safety considerations but not hamper cross-border gas trading and market integration.

c. Regardless of the actual choice for a H2 concentration limit, essential network adaptations are required in order to allow H2 injections. Metering equipment requires upgrades or chromatograph replacement in order to be able to measure H2 concentrations. Gas turbines, compressor stations, CNG tanks and some types of storage can only accept low H2 concentration (< 5%), and may also need retrofitting.

d. While the number of MS with H2 strategies doubled in 2 years, limited progress is observed as regards the readiness of gas transmission network and legislation to allow injections of blends of hydrogen and biomethane.

Done at Ljubljana, on 16 December 2022.

- SIGNED -

For the Agency
The Director
C. ZINGLERSEN

Enclosures, data Annexes:

I – Gas National Development Plans: Methodological Aspects
II – Consistency of NDP and draft EU TYNDP 2022 Projects
III- Hydrogen, Biomethane injections, and Related Network Adaptations