The role of Trans-European gas infrastructure in the light of the 2050 decarbonisation targets

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Study team

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- Lead partner and lead for tasks 3 and 4
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- Lead for tasks 1 and 2
- E3M, N. Psichiko (GR) and Artelys, London (UK)

Involved as experts in tasks 1 and 2, in view of defining links between output of storylines and possible modelling in PRIMES and METIS.

Context & objectives of study

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- Qualitative evaluation of impact of decarbonisation targets on gas demand & infrastructure
- Important to gain better understanding of possible role of Trans-European gas infrastructure in future energy landscape

- Objectives/tasks
  - Review existing 2050 storylines and develop three well-reasoned storylines for gas infrastructure role in 2030-2050 (Tasks 1&2)
  - Assess readiness of selected regulatory regimes in significantly changing energy landscape and evaluate consequences of storylines for large gas infrastructure (Tasks 3&4)

Types of gas considered

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- **(Fossil) natural gas** (mainly CH_4) → in full decarbonisation by 2050 only relevant with CCS
- **(Renewable) synthetic methane (e-CH_4)** → synthetic methane produced from H_2 from (renewable) electricity through water electrolysis and CO_2 obtained from organic processes, or captured from air by elevated temperature processes
- **Biomethane (bio-CH_4)** → methane from organic matter (purified biogas), produced by anaerobic digestion or thermal gasification
- **(Renewable) Hydrogen (H_2)** → either fossil-based hydrogen in combination with CCS, e.g. from steam methane reforming of natural gas, or produced through water electrolysis from (renewable) electricity.

Identification and analysis of existing storylines

Lessons learnt from existing storylines

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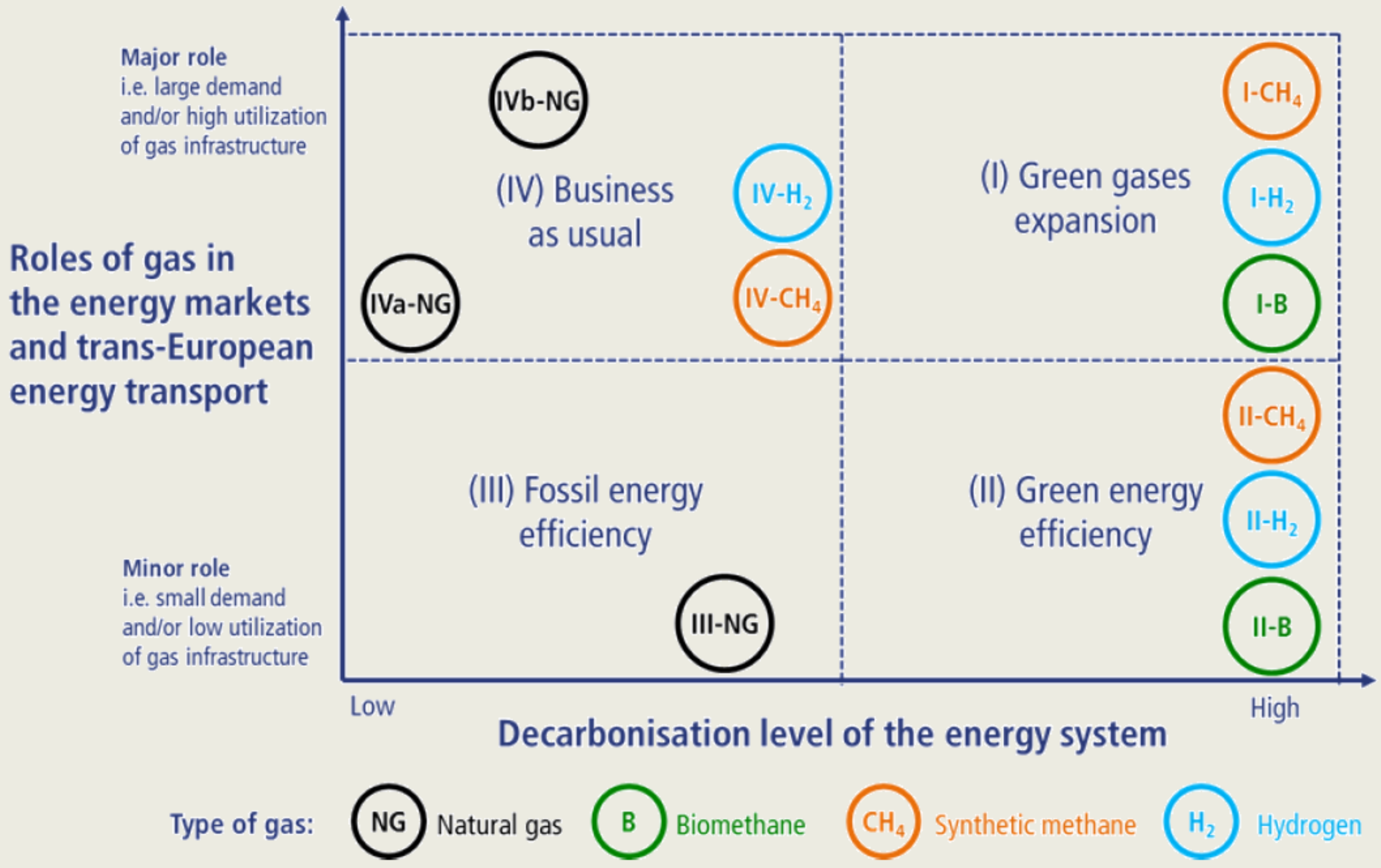
Storyline classification

- Decarbonisation level
- Role of gas for energy supply
- Role of gas infrastructure



Evaluation of existing storylines (1/4)

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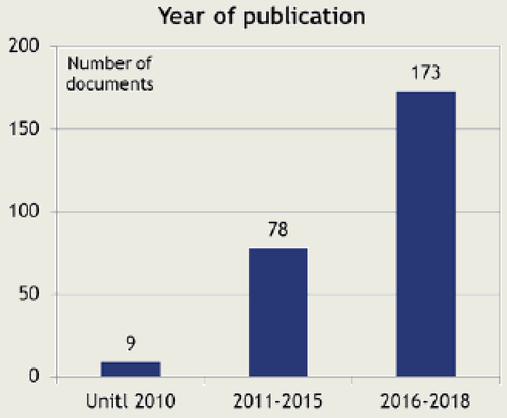

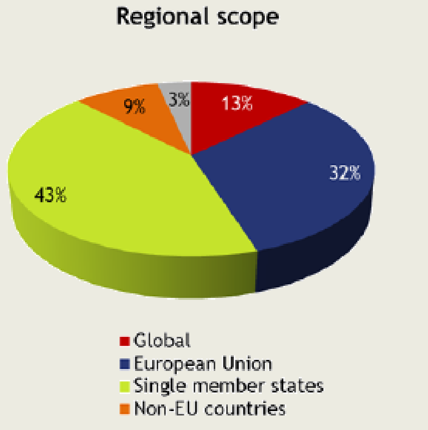

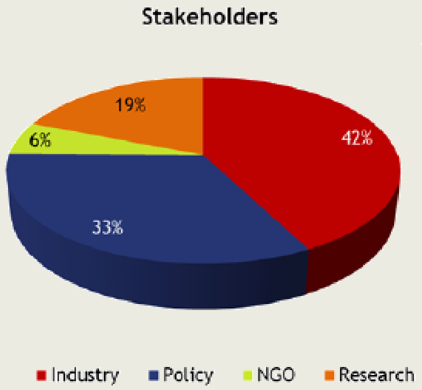

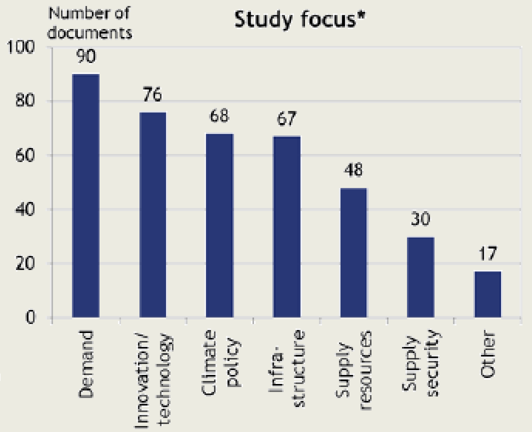

- 2/3 of all (>200) documents from primary literature ≥ 2016 based on EC’s 2015 climate protection goals
- Study’s focus being on EU’s gas infrastructure, most documents cover EU or individual MSs
- 13% address global gas infrastructure aspects, and 9% non-EU storylines
- Stakeholders involved in studies (author, client) well balanced between industry (43%), policy makers (33%) and R&D institutes (18%) and NGOs (6%)
- Balanced stakeholder view on EU gas infrastructure

Evaluation of existing storylines (2/4)

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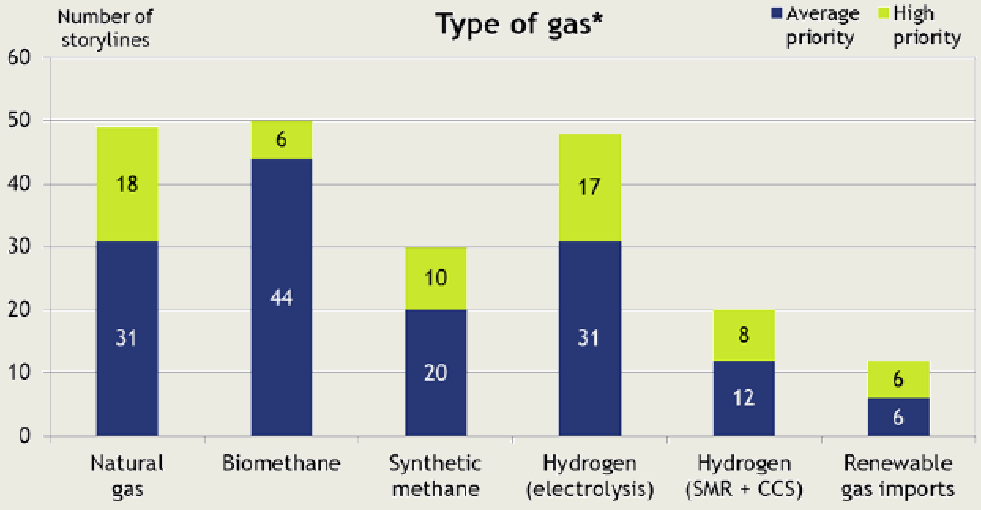
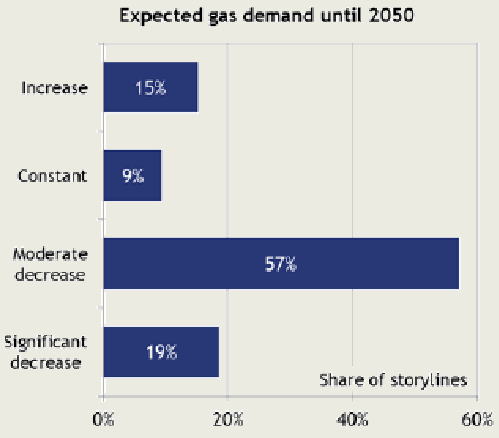
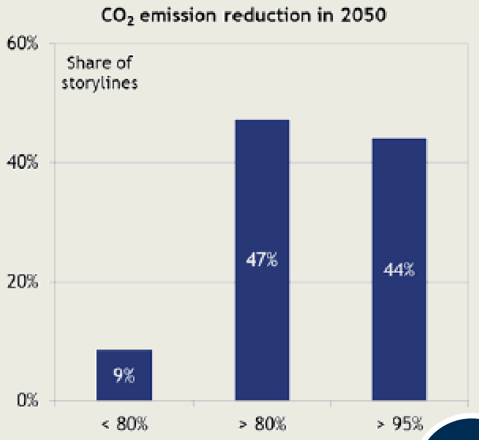
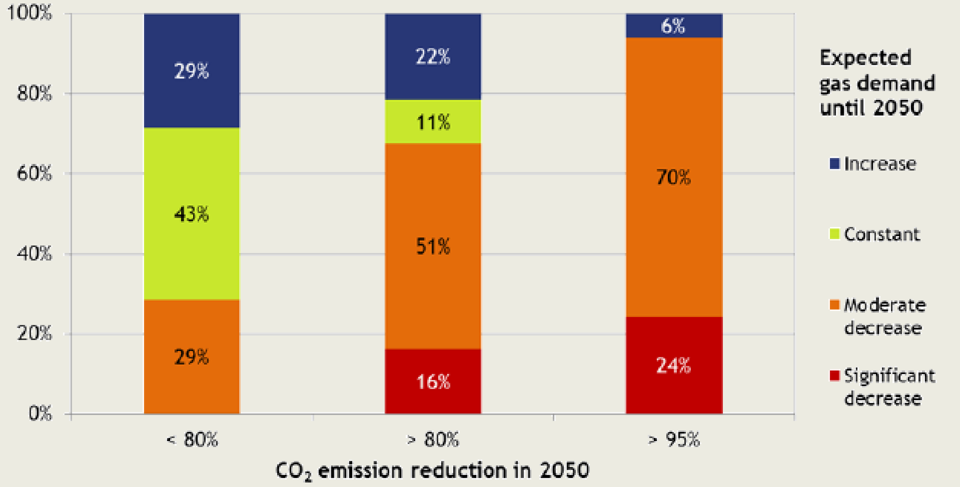


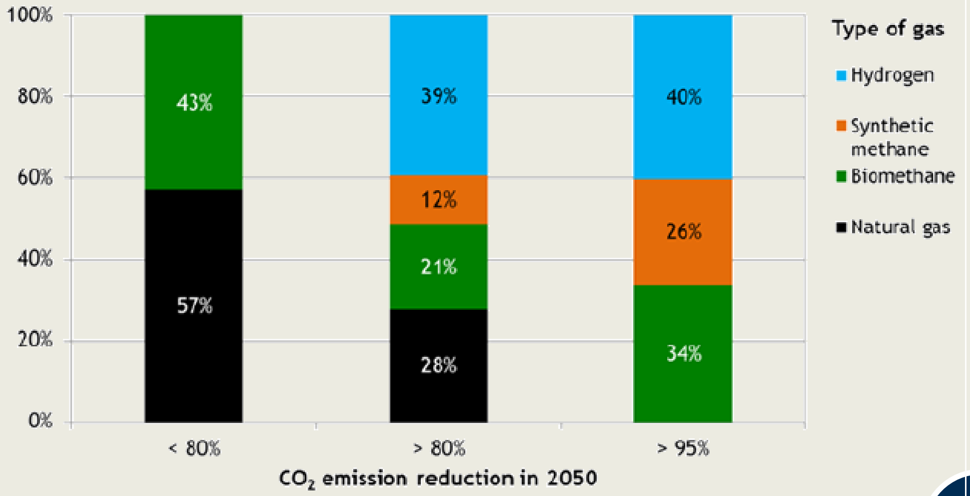




- Type of gas:
  - Fossil NG, REN-H2, biomethane prioritised future gas types.
  - Synthetic methane (PtCH4) selected by comparatively few storylines.
  - Few MSs select H2 from NG w CCS.
  - Few storylines address renewable gas imports → potential research gap?
- 91% of selected storylines expect ≥80% GHG emission reduction by 2050, 44% assume very strong decarbonisation of ≥95%.
- 76% expect decreasing gas demand by 2050
  - 20% predicting significant decrease
  - 57% expecting moderate decrease (electricity to gas switch)
  - 24% expect constant or growing gas demand (coal to gas switch)

Evaluation of existing storylines (3/4)





- Interdepending effects: Reduction of overall energy demand <--> role of electricity versus gas.
- For -95% GHG emission reduction scenarios use of fossil gas replaced with PtH2 or PtCH4 (66% of selected storylines; 34% for biomethane). Explanation: both gases can easily be stored in large quantities in a renewable dominated energy system at comparatively low costs.
- The stronger the GHG reduction ambition, the higher the importance of synthetic methane & hydrogen; biomethane covered rather independently from GHG reduction ambition.

Evaluation of existing storylines (4/4)

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- Some more extreme storylines anticipate behavioural and societal changes (public acceptance as “new currency”)
- Strong regional differentiation expected (availability of REN energy, role as gas use or transit)
- Role to balance seasonal versus short-term energy fluctuations yet to be modelled in detail
- The level of decarbonization is of game-changing quality, specifically the path from -80% to -95%

Existing non-EU storylines

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- Russia/Ukrarine/Belarus: World's largest NG exporter with major transit capacities; little evidence on REN gas activities, but with the option to export REN gas to EU in the future using established gas grid.
- Japan: Electricity shortage & strong dependency on fossil energy imports today; H2 identified as increasingly clean energy import fuel; strategies being different, H2 technologies will be similar, opening EU opportunities for cooperation or competition.
- Norway: Major NG exporter today & blueprint profile for application of clean energy technologies; H2 for mobility incl. maritime, vast REN electricity capacities for exporting clean electricity or gas to EU or balancing services.
- China: Leapfrogs methane & green H2 infrastructure development today; H2&FC technologies now being commercialized at yet unnoticed pace, offering EU role of co-operator or competitor.
- MENA: Huge REN energy potentials as source for large scale energy imports; electricity transport considerations have dwarfed but also blocked gas transport, yet have huge potential; further competition can cause lock-ins from developing PtL in short-term.
- All: Methane leakage becoming an issue to be considered for all methane gas imports.

Development of 3 well-reasoned generic decarbonisation storylines for the EU

Three generic EU storylines

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Strong electrification

- Decarbonisation achieved by strong electrification of important EU energy sectors
- Direct electricity use enables high efficiency in distribution & energy use (energy resources)
- 2050 emission reduction target (-95%) reached; reductions already around 2030
- Gas as energy carrier significantly reduced

Strong development of REN-methane

- Methane key in 95% GHG reduction by 2050
- Major role in heating & industry beyond 2050
- Replacing fossil energy in other sectors
- Higher REN energy potentials required
- Role of gas in energy system remains strong

Strong development of hydrogen

- H2 to become major energy carrier (all sectors)
- El-heat pumps/BEVs retain low/medium share
- Energy system with good efficiency
- 2050 emission targets met, but later than in other 2 storylines

Three generic EU storylines

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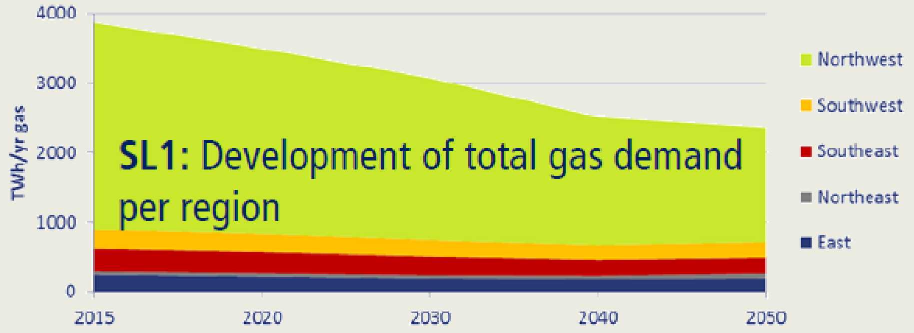
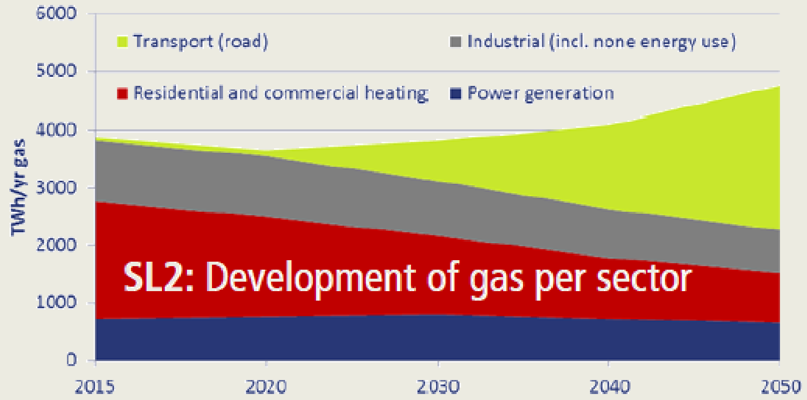
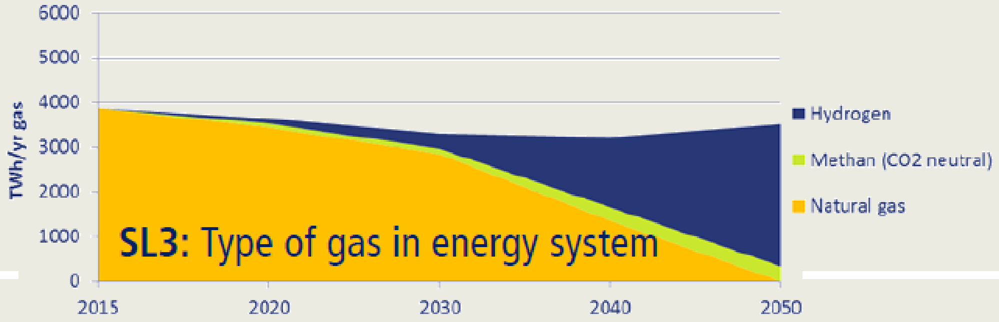
Strong electrification



Strong development of REN-methane



Strong development of hydrogen



Regional focus on gas technology & infrastructure innovation

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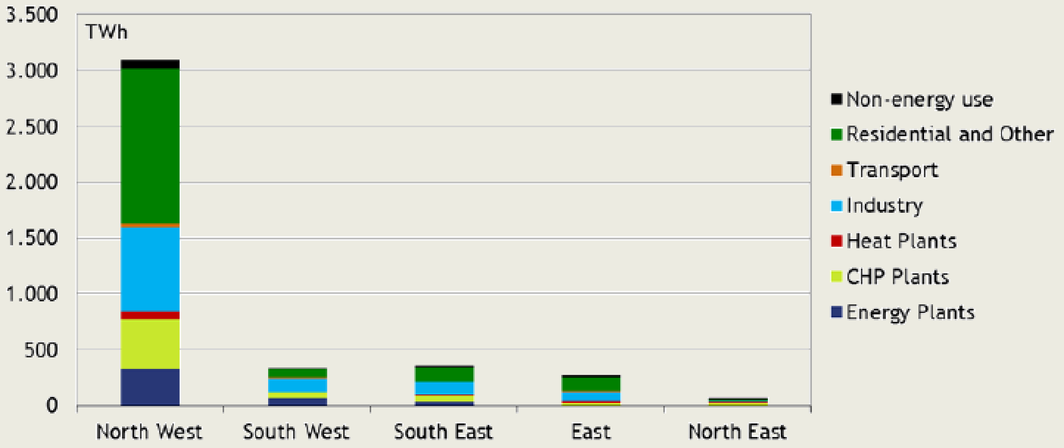
- Today's gas demand strongly varies amongst EU regions/MSs: in 2015 Western & Central EU consumed a factor 3 more than all other regions taken together (→ focal actions).
- Largest gas consumers in EU gross demand: Germany (24.5 %), UK (23.0 %), Italy (20.8 %), France (13.1 %) and the Netherlands (10.9 %).
- Western EU relying on its gas transport & distribution infrastructure for domestic applications.
- Eastern EU gas infrastructure strongly based on gas transit business.



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Impact of selected decarbonisation storylines on:

- Gas use and infrastructure
- TSO business and transmission grid tariffs
- Readiness of national regulatory regimes

Impact on gas demand

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Storylines	1: Strong electrification	2: Strong development of carbon-neutral CH_4	3: Strong development of H_2
2030 gas demand*	Lower	Slightly higher	Stable
2030 mix	90% natural gas 10% renewable gas	90% natural gas 10% renewable gas	90% natural gas 10% renewable gas
2050 gas demand*	Substantially lower	Higher	Stable
2050 mix	70% H2 30% carbon-neutral methane	10% H2 90% carbon-neutral methane	90% H2 10% carbon-neutral methane
Impact	• Significant reduction in overall gas demand by 2050 → at MS level 20 to 50% lower than current level depending on national specificities	• Increase in overall gas demand by 2050 → decrease in some MS versus increase (up to 50%) in other MS • Decrease of demand in heating sector would be compensated by higher use in transport & industry	• Overall gas demand stable → different evolutions at MS level depending on national specificities

Gas demand compared to 2015

Impact on gas infrastructure

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- Use of **natural gas** would in all storylines drastically decrease – some MS would however consider to invest in CCGTs with CCS (e.g. IE)
- **Renewable gas** mainly locally produced => imported/transported volume in 2050 substantially lower than demand
- Major impact on **LNG terminals and interconnectors** :
  - Utilisation level of LNG terminals is decreasing (29,1% in 2012 => 19,6% in 2018) and would further decline, also taking into account ongoing and planned capacity extensions
  - Utilisation of interconnectors would also decrease (utilisation rate in 2017 = 57% measured by yearly average nominations over booked capacity)
  - Some assets may need to be decommissioned or used for other purposes (e.g. import/transit of other types of methane or hydrogen)
- Lower impact on volumes transported via **TSO network**, as grid is expected to be used for renewable gas. Specific investment needs depending on storylines : reverse flow D-T (if local injection > demand) – refurbishment to H2 (if volume concentration > threshold)
- Impact on **gas storage** (currently low utilisation level: withdrawal in winter 2017/18 = 23% of capacity and injection in summer 2017 = 30% of capacity) different depending on type (salt caverns and aquifers vs depleted gas fields) and storyline. Existing sites can be further used for seasonal storage of methane; suitability for H2 and for short term flexibility under study.
- Storylines would have different **impact on security of supply** (including energy system adequacy and operational reliability), and on **cost and energy efficiency of overall energy system**.

Gas demand/supply and infrastructure

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- Report provides overview of current and expected (horizon 2025-2030 depending on sources) **gas demand/supply** and current **policies to develop renewable gas** in 6 MSs (DK - FR – IE – IT – PL – RO)
- It also provides overview and characteristics of **existing and planned (PCIs) infrastructure** in 6 selected MSs and expected impact of storylines per MS
  - LNG terminals
  - Interconnections
  - Transmission network
  - Storage

→ Notwithstanding decreasing utilization levels of LNG/pipeline infrastructure still high investment budgets, mainly to ensure SoS and to facilitate market integration. Limited projects in storage - reregulation of storage in FR to ensure its availability.

Drivers for investments in gas infra

- Drivers for recent/ongoing gas infrastructure investments
  - Evolution of overall gas demand and peak demand
  - Shifts in gas supply (LNG vs pipeline gas, domestic gas vs imports, phasing out of L-gas)
  - Security of gas supply (access to 3 sources, N-1 infra standard)
  - Wholesale markets' integration
  - Safety and environmental regulation (e.g. reduce CH4 leakages)

- Drivers for future gas infrastructure investments
  - Shifts in gas demand and supply (e.g. renewable gas)
  - Connection of new users (e.g. filling stations) and local gas producers
  - Replacement of ageing assets (e.g. RO 46% of pipelines > 40 yr and 70% > 30 yr)
  - Refurbishment of assets to accomodate hydrogen and biomethane
  - Security of energy supply, including adequacy and operational reliability of energy system => sector coupling
  - Safety and environmental regulation

Impact of selected decarbonisation storylines on:

- Gas use and infrastructure
- TSO business and transmission grid tariffs
- Readiness of regulatory regimes

Analysis performed for 6 TSOs:

Energinet (Denmark) - GRTgaz (France) - Gaz System (Poland) - Transgaz (Romania) - Gas Networks Ireland - Snam Rete Gas (Italy)

Impact on TSO business & transmission grid tariffs

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- TSO assets represent high economic value
  - Net accounting value or RAB of TSOs is high (€ 28,6 billion for 6 considered TSOs) and would remain high in 3 storylines => high capital and depreciation cost in coming decades
  - Long depreciation period (up to 50 years for pipelines)

RAB or net accounting value of assessed TSOs

TSO	Transported volumes	Net assets value/ RAB	Outlook
Energinet (Denmark)	51 TWh	€ 618 million	Will gradually decline by 2050
GRTgaz (France)	627.3 TWh	€ 8.3 billion (RAB)	Slight increase in short term, then decreasing - different impact depending on storyline (highest decrease in storylines 2 and 1)
Gaz-System (Poland)	198 TWh	€ 1.7 billion (RAB)	Increase until 2025 and then slight decline (storyline 1), decline (storyline 2) or stable (storyline 3)
Snam Rete Gas (Italy)	795 TWh	€ 16 billion	Stable (storyline 1 & 2) or slight increase (storyline 3)
Gas Networks Ireland (Ireland)	72.5 TWh	€ 1.4 billion	Decreasing, however investments for CCS (independently of storylines) and H2 refurbishment (storyline 3) might limit decrease
TransGaz (Romania)	157.5 TWh	€ 649 million (RAB)	High increase in short term (+ 30% by 2020) – stable in medium/long term due to large investments in 3 storylines to replace ageing assets

Impact on TSO business & transmission grid tariffs

Trinomics

- Ongoing/planned TSO investments are high, and expected to only slightly decline
  - Several large ongoing or planned PCIs
  - Need for upgrading/replacement of ageing pipelines
  - Investments in compressor stations
  - Reverse flows D -> T for biomethane (if local injection > local demand, storyline 2)
  - Refurbishment to H_2 (if volume concentration > threshold, storylines 1 and 3)

Investment levels of assessed TSOs

TSO	Current investment level	Transported TWh	Outlook
Energinet (Denmark)	€ 3.6 million	51 TWh	Currently low investment level - 2020-2023: decrease or increase depending on decision on Baltic Pipe - Post 2023: decrease (mainly limited to maintenance and refurbishment H2)
GRTgaz (France)	€ 657 million	627.3 TWh	Future investments needed for ensuring operational security and safety. Investments for extensions and refurbishments will differ per storyline: highest in storyline 3 due to refurbishment H2
Gaz-System (Poland)	€ 512 million	198 TWh	High investment levels for network development until 2025 Post 2030 investments depend on storyline except for maintenance to ensure operational security and safety
Snam Rete Gas (Italy)	€ 917 million	795 TWh	Stable maintenance investments to ensure security in operations Stable for network development in storylines 1 and 2; stable to slight increase for storyline 3.
Gas Networks Ireland (Ireland)	€ 125 million (including distribution)	72.5 TWh	Increasing maintenance costs, focus on refurbishment of existing network to ensure operational security and safety. Possibly limited investments after 2025, including investments to accommodate H_2, biomethane and CCS.
TransGaz (Romania)	€ 120 million	157.5 TWh	Investment level was in near past low (€ 30 million p/a) but would in coming 10 years substantially increase to € 120 million p/a, mainly for grid extensions/reinforcements and replacement of ageing assets. Investments post 2030 for network refurbishment will depend on storylines (i.e. to accommodate H_2 and biomethane)

Impact on TSO business & transmission grid tariffs

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- Operational expenses of TSOs would not substantially decrease
  - OPEX represent 35 to 60% of overall TSO cost and are mainly fixed or infrastructure related
  - Falling gas demand would not lead to proportionate OPEX decrease

OPEX levels of assessed TSOs

TSO	Current OPEX level	Pipelines km	Outlook
Energinet (Denmark)	€ 32 million	924 km	Stable or slight decline due to efficiency standard imposed by NRA. Increase if Baltic Pipe project is realised
GRTgaz (France)	€ 764 million	32,414 km	Relatively stable. Impact of storylines is not decisive.
Gaz-System (Poland)	€ 245 million	11,743 km	No major impact from storylines. Expected to remain at same level (increase if Baltic Pipe project is realised)
Snam Rete Gas (Italy)	€ 441 million	32,584 km	Stable in storylines 1 and 2. Slight increase in storyline 3.
Gas Networks Ireland (Ireland)	€ 86 million	2,427 km	Slight decrease in line with cost efficiency targets imposed by NRA. However, CCS and H2 may lead to increase (depending on storyline).
TransGaz (Romania)	€ 264 million	13,303 km	Expected to remain more or less stable (ageing assets). No major impact of storylines

Impact on TSO business & transmission grid tariffs

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- Capital costs expected to stay at relatively high level
  - CAPEX represent 40-65% of overall costs
  - Depreciation of current (long depreciation period) + new assets and related capital cost
- Regulated ("guaranteed") revenues for TSOs recovered via regulated (mainly capacity based) tariffs
  - Falling transported gas volumes in storylines 1 and 3 (with stable/slightly decreasing overall cost levels) have increasing effect on grid tariffs → impact on affordability and competitiveness of gas
  - Storyline 2 would allow maintaining gas grid tariffs at lowest level.

Impact on TSO business & transmission grid tariffs

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Impact of storylines :

On gas users:

- Lower transported volumes (mainly in storylines 1 and 3) would lead to higher grid tariffs per transported MWh => negative impact on affordability or competitiveness of gas for households and industrial users facing international competition
- Increasing gas infrastructure capacity availability leads to shift to short term capacity bookings

On TSO business:

- In current regulatory regime profitability level of TSO would not be directly affected
- Higher grid tariffs would negatively affect business case of injection of renewable gas and competitiveness of gas in general, and hence have negative impact on medium/long term perspectives of TSOs, mainly in storylines 1 and 3
- Storyline 2 is most positive scenario from gas TSO perspective

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Impact of selected decarbonisation storylines on:

- Gas use and infrastructure
- TSO business and transmission grid tariffs
- Readiness of national regulatory regimes

Readiness of regulatory regimes

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- MS take initiatives to substitute oil/coal/peat with gas
  - Power generation (back-up or base load – CCGTs with CCS considered in IE – methanation of fossil fuel with CCS considered in PL)
  - Industry : specific measures in FR

MS	Policies to phase out coal/peat /oil in power sector and industry
Italy	Phasing out coal fired power plants by 2025
Denmark	Phasing out all fossil fuels by 2050 with gas playing important role in transition (back-up power plants for intermittent power generation)
Ireland	Phasing out coal by 2025 and peat for power generation by 2030 Ireland would consider building CCGTs with CCS for baseload power generation
France	Switching in industry from coal or fuel to gas stimulated by NRA decision to grant connection fee discounts to new industrial gas users

Readiness of regulatory regimes

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- RES deployment in selected MS
  - Huge impact of RES-E on gas use and infra
  - In some MS specific policies/targets for phasing out fossil fuels (e.g. DK) or development of renewable gas (e.g. FR)
  - Strong focus on development of biogas for local use (electricity and/or heat generation)
  - Injection of biomethane into grid not yet common practice in all considered MS
  - Few initiatives to develop hydrogen

Readiness of regulatory regimes

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National policies to stimulate renewable gas deployment

MS	Overall RES target 2020	Overall RES target 2030	Renewable gas injection	Policies facilitating renewable gas injection
Denmark	30%	NA	7% of gas demand 2018 covered by biomethane; 26 biomethane plants connected to DSO grid and 1 to TSO grid. Pilot project for H2 (1.2 MW PEM) **Target:** 10% in 2019	Subsidy scheme for biogas/biomethane produced from anaerobic digestion H2 and synthetic methane not (yet) eligible for support
France	23%	32%	215 GWh biomethane (2016) P-2-G demonstration project (Jupiter 1000) Injection planned in 2018 **Target:** Law on Energy Transition imposes target of 10% of green gas consumption by 2030. 1.3 TWh biomethane in 2018 and 8 TWh in 2023	Feed-in tariff for biomethane: from 65 to 125 €/MWh, depending on biomass input type and capacity of installation Rebate on connection charges
Ireland	16%	NA	1 biomethane plant (108 GWh/yr) connected to TSO grid in 2018 **Target:** 6 injection plants connected to TSO grid in 2020	Specific support scheme for renewable heat implemented in 2018
Italy	17%	28%	Large biogas capacity (1406 MW) 18 biomethane injection contracts signed in 2016-2017 with TSO. 1st biomethane injection plant in TSO grid (348 GWh/yr) in 2017. No projects for injection of H2 or synthetic methane	Biomethane Decree of 2nd March 2018 establishes incentives for biomethane injected into gas grid
Poland	15%	NA	Only biogas (234 MW) for local use. No renewable gas injection	Changes in law ongoing to support injection of biomethane in DSO grid
Romania	24%	NA	Only biogas for local use. No renewable gas injection	Financial support (Government Decision 216/2017) for 'less exploited' renewable energy sources, including renewable gas

Readiness of regulatory regimes

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Drivers and barriers for use of gas in transport sector

- Availability of gas infrastructure (& vehicles)
- Cost/price of energy vectors & vehicles (impact of taxation)
- Technical performance : CO2 emissions – NOx and other emissions – energy efficiency
- EU and national policies : e. g. Clean vehicles directive – RES-T

Use of LNG/CNG for transport

MS	Status and developments
Denmark	Limited use of gas (460 vehicles + 1 ferry) Higher taxes on CH4 & gas vehicles than on diesel & diesel vehicles Potential of 10 GJ, mainly for trucks and ships LNG bunkering and liquefaction infrastructure to be developed
France	90 filling stations – 3500 vehicles (mainly trucks and buses) Biomethane = 9% of NG consumption for vehicles Specific financial support for NGV
Ireland	14 filling stations in development by TSO (TEN-T project) Excise rate at minimum level allowed in ETD
Italy	1040 CNG filling stations – 1 million vehicles Growth expected of use of LNG for trucks and ships
Poland	Exemption of excise tax on LNG & CNG under discussion in government/parliament Obligation on DSOs to develop LNG & CNG filling stations

Readiness of regulatory regimes

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Regulation of TSOs	France	Denmark	Poland
Regulatory system	Revenue cap, incentive based with pass through of actual costs	Regulated tariffs based on actual costs - Energinet has to respect break-even for all its tariffs	Cost of service with elements of revenue cap
Capital remuneration	Capital remuneration-based on RAB	Regulated return on capital	Capital remuneration-based on RAB
Access/use tariffs	Regulated	Regulated	Regulated
Tariff setting	Fixed ex-ante for 4 years	Fixed ex-ante for 1 year	Fixed ex-ante for 1 year
Share of commodity versus capacity-based revenues	0-100	50-50 Capacity share will increase in future	10-90 0-100 from 2019
Allocation of grid costs	Based on capacity bookings and small fixed charges per delivery point	Based on capacity bookings and transported volumes	Based on capacity bookings and transported volumes
Specific conditions for transport of renewable gas via grid	Decree obliges grid operators to apply rebate on connection costs for biomethane	No	No
Entry-exit split	35-65	Not predefined	45-55 for 2019

Readiness of regulatory regimes

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- Diverging depreciation rules for gas infra
  - Most MSs apply long depreciation periods (50 yr for pipelines) which do not account for specific risks related to changing gas demand and supply patterns
  - Suggestion to consider shorter (e.g. 30 yr such as in DK) and/or degressive depreciation, at least for new assets
- Need for future-proof investment policy in gas infrastructure
  - suitable for renewable gas
  - avoid investments that risk to become devalued/stranded
  - projects should be evaluated on the basis of their added value for global energy system (including impact on system adequacy and operational reliability)

(Cross-)Subsidisation of grid infrastructure costs

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(Cross-)Subsidisation of grid infrastructure costs could be considered to mitigate impact of falling gas demand on grid tariffs

Type of measure Criteria	Cross-subsidisation of renewable gas versus natural gas	Cross-subsidisation amongst grid users	Subsidisation via public funds
Cost-reflectiveness of access/use tariffs	negative	negative	negative
Economic efficiency	negative	negative	negative
Transparency	neutral or negative	neutral or negative	neutral or negative
Non-discrimination	negative	negative	neutral
Competitiveness -affordability	positive for renewable gas – negative for NG	positive for benefiting users – negative for other users	positive for gas users negative for tax payers
Security of supply	neutral	neutral	positive
Sustainability	positive	neutral	neutral or positive depending on concrete modalities*

*For example, this could be negative if it promotes use of gas against other non-fossil solutions.

Conclusions and recommendations

Conclusions and recommendations

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- **Storylines would have major impact on gas demand and infrastructure**
  - LNG terminals and gas import pipelines : utilisation level is decreasing and would further decline, also due to ongoing/planned investments in capacity extensions
  - storage : can further be used for seasonal storage of methane. Some types might also be suitable for hydrogen and short term flexibiity needs
  - transmission network : can further be used for increasing share of carbon-neutral gas but overall investment and operational cost would remain high => increasing grid tariffs would negatively affect affordability and competitivenss of gas

- **To mitigate negative impact on competitiveness of gas and gas infrastructure, fixed costs could be reduced by valuing synergies**
  - within gas sector (e.g. shared services for HR, IT, procurement, etc. and mergers, also cross-border)
  - between electricity and gas sectors, by more integrated planning and operation of gas and electricity infrastructure
  - new dedicated pipelines (H2, CO2) could be operated by TSOs under TPA

- **Development of carbon-neutral gas and injection into gas system can be further facilitated**
  - enabling technical specifications for injection
  - priority dispatch
  - guarantees of origin for all renewable energy vectors, including biomethane and hydrogen (addressed in recast RED)
  - policy and regulatory framework: technology and energy vector neutral support scheme – adequate carbon price (also for non ETS)
  - cost-reflective but enabling grid charging methodology : connection costs of gas production plants (e.g. shallow methodology) - access/use tariffs for local injection

Conclusions and recommendations

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- **P2G development**
  - need for further R&D and demonstration projects to improve technical/economic feasibility
  - possible role of grid operators in P2G activities should be clarified (enhancing development while preventing risk for competition distortion)
  - further studies needed to assess suitability of grids, storage sites and end-user appliances for high volumes of H2 and to estimate cost for refurbishment
- **Use of LNG/CNG in transport sector** as intermediate step in energy transition
  - possible role of grid operators in LNG and CNG filling stations to be clarified
  - Impact of policies and regulation : charging of connection costs (shallow vs deep) – taxation – etc.
- **Cross-subsidisation or subsidies for gas infrastructure** could be considered to keep gas grid tariffs affordable or competitive => risk for distortions
- **Drivers for gas infrastructure investments**
  - security of gas supply and gas markets' integration were main drivers for recent and ongoing investments in gas infrastructure
  - future investments would be driven by safety imperatives, development of renewable gas, and flexibility needs to ensure adequacy and operational reliability of energy system
- **Future investments in gas infrastructure and related depreciation** rules
  - new investment projects (in particular PCIs eligible for CEF financing) should be assessed on basis of direct and indirect economic and environmental costs/benefits, suitability for renewable gas and flexibility potential for overall energy system
  - depreciation rules for gas investments should be assessed and where appropriate adapted to avoid risks for stranded/devalued assets