



Impact of the use of the biomethane and hydrogen potential on trans-European infrastructure

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Aim and scope of the study

Study aims at a better understanding of:

- Potential of biomethane and hydrogen to contribute to the energy transition
- Economic and technical impacts of significant deployment of low carbon gases
- Readiness of gas network operators and regulators

Objectives affect the study boundaries



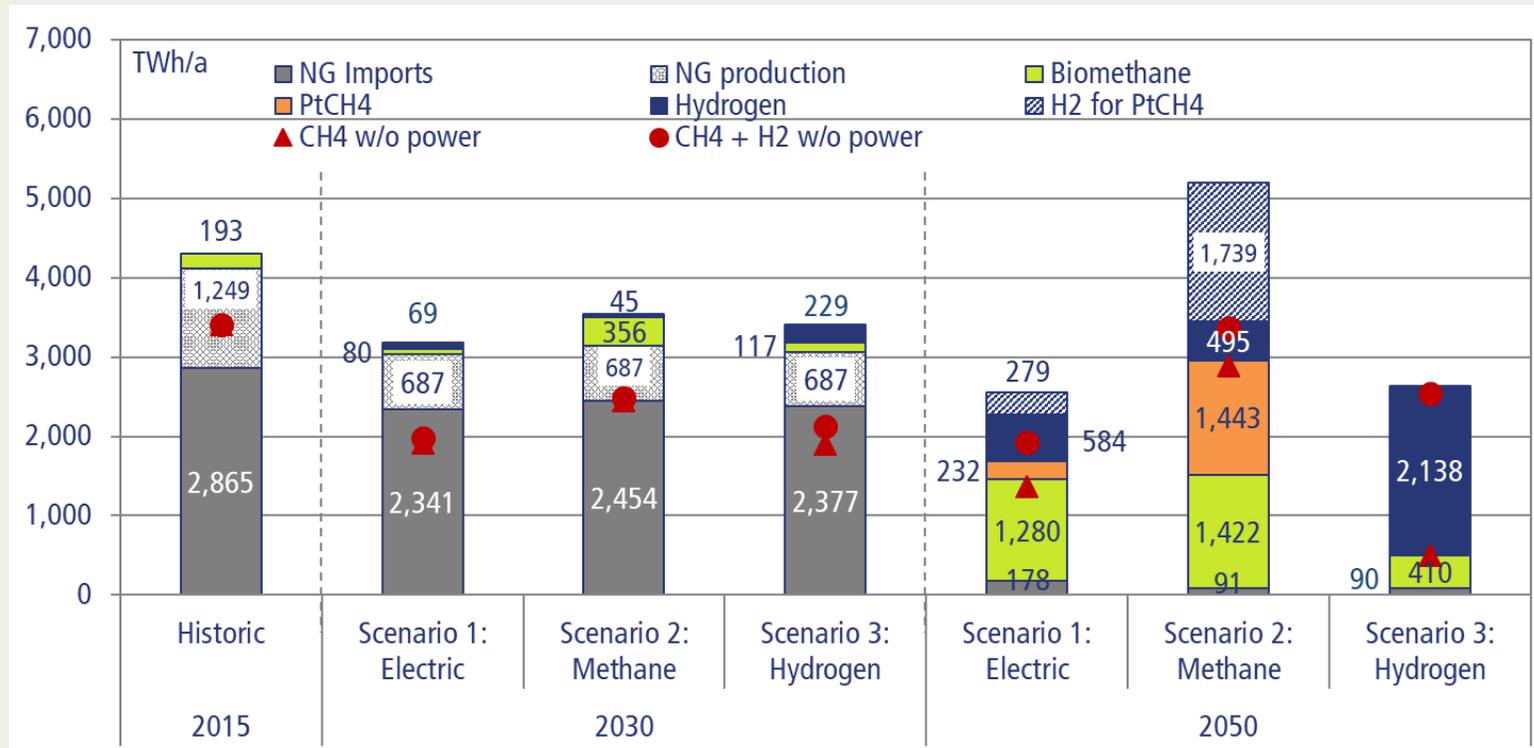
- Explorative scenarios aim to assess the impact on gas infrastructure
 - Not to forecast deployment pathways for H₂ or bio-CH₄
- Potential assessment focuses on maximum technical potential
- Assumptions regarding
 - Supply of biomethane and hydrogen (focusing on domestic EU supply)
 - Sectoral end-use demand for electricity, methane and hydrogen
 - Availability and location of flexibility resources to 2050
 - Hourly profile for supply of renewables

Explorative scenarios

	Scenario 1		Scenario 2		Scenario 3	
Storyline from the gas infrastructure study	“Strong electricity end-use”		“Strong green methane end-use”		“Strong hydrogen end-use”	
Time horizon	2030	2050	2030	2050	2030	2050
GHG emission reduction target						
Total GHG emission reduction incl. LULUCF vs. 1990	-49%	-100%	-49%	-100%	-49%	-100%
End user preferences						
End-user decision	Electricity-based end user applications		Methane-based end user applications		Hydrogen-based end user applications	
Major energy carrier	Electricity		Biomethane		Hydrogen	
Strategy for the gas infrastructure to follow end user preferences						
Expected gas type	Natural gas (+ biomethane)	Biomethane (+ PtCH ₄)	Natural gas (+ biomethane)	Biomethane (+ PtCH ₄)	Natural gas (+ biomethane)	Hydrogen
Regional distribution methane supply	<ul style="list-style-type: none"> • For natural gas according to import routes and production sites • For biomethane according to availability and supply costs • For PtCH₄ according to renewable power supply 					Close to CH ₄ demand
Regional distribution hydrogen supply	In close proximity to hydrogen demand					Close to renewable power supply
Seasonal gas storage	Conventional large-scale CH ₄ storage					H ₂ salt caverns

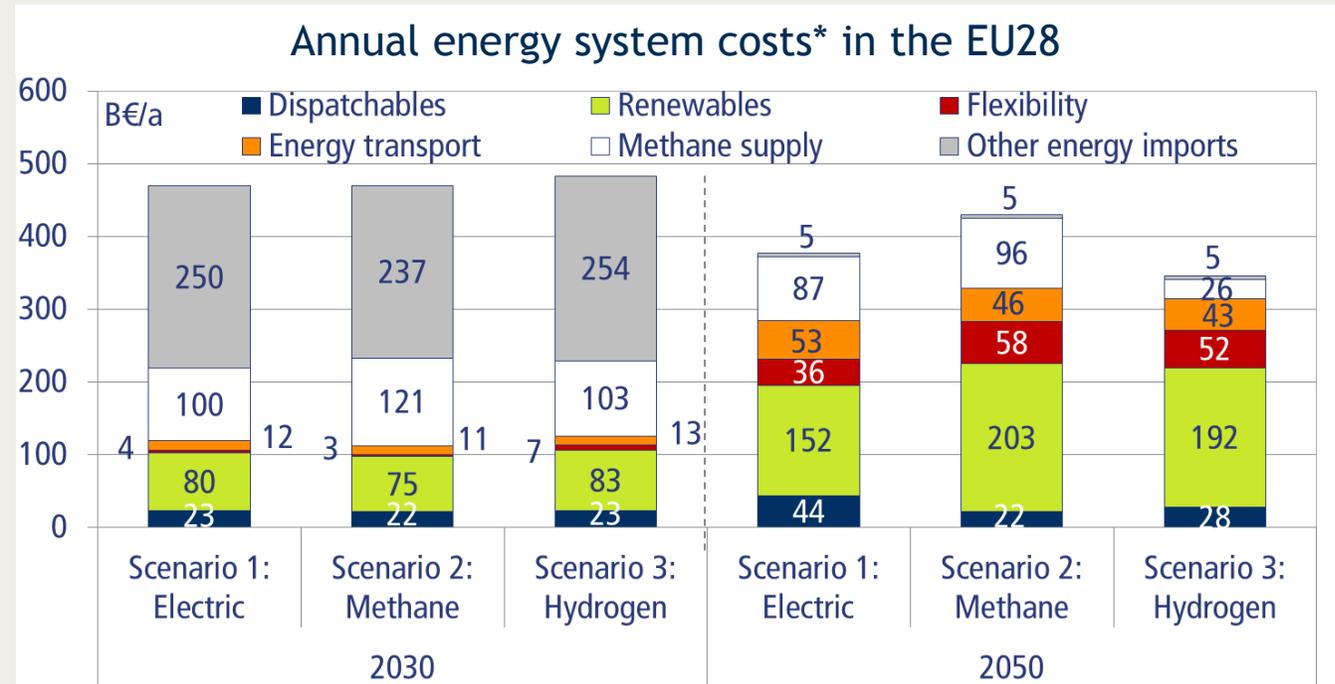
Diversified gas supply in the long-term

- Decreasing gas demand and supply in the mid- and long-term
- Fossil gas still dominant in 2030, major role for biomethane & H₂ in 2050 (and PtCH₄ in CH₄ scenario)
- Limited supply from biomethane by 2030, utilisation of full biomethane potential until 2050



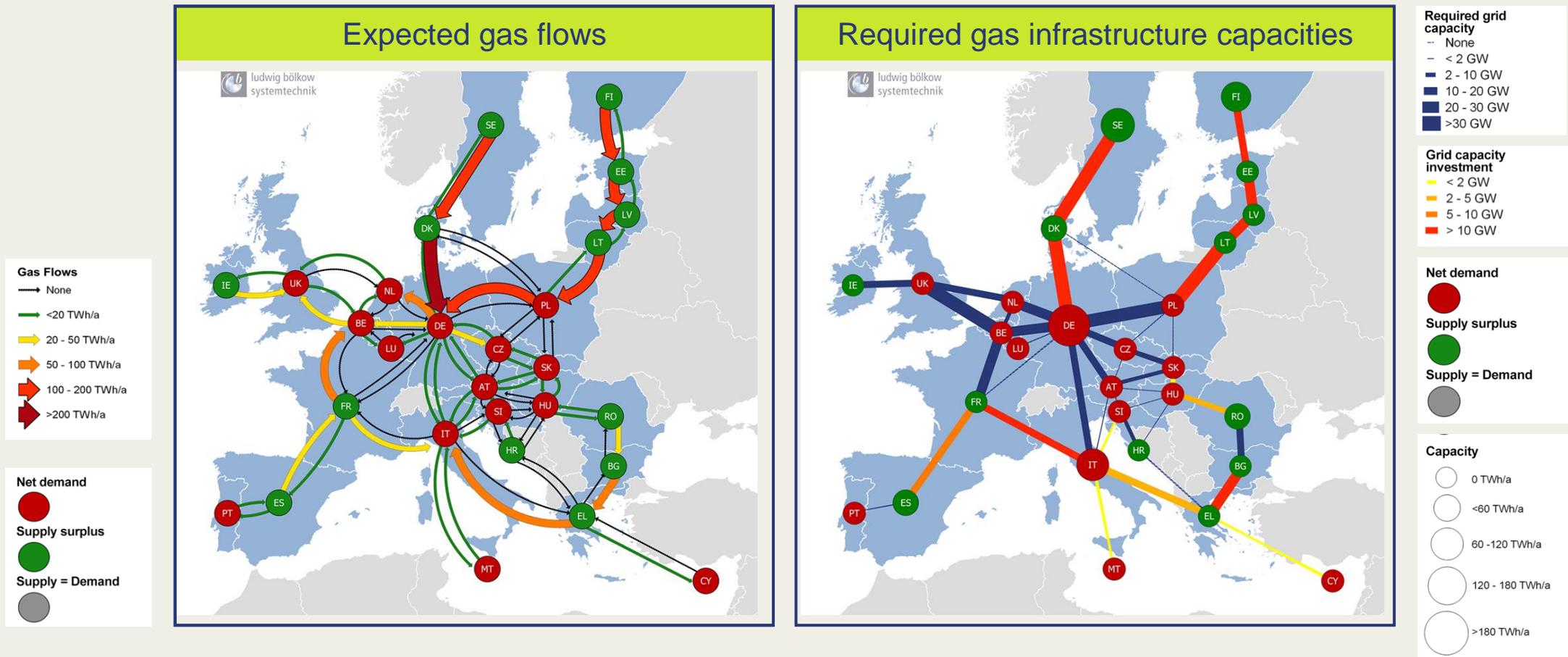
Sector coupling leads to lowest system cost

- Decreasing system costs due to increasing sector integration and substitution of energy imports
- Important role of decreasing specific renewable power generation costs
- Optimal system costs as a trade-off between renewables, system flexibility, and gas supply
- Electricity grid investments dominate costs for cross-border energy transport in 2030 and 2050
- CO₂ reduction costs are calculated as total system cost difference between 2030 and 2050 (excluding CO₂ costs) divided by emission difference
- This results in negative values ranging between -20 €/t_{CO2} in the methane focused Scenario 2 and -68 €/t_{CO2} in the hydrogen focused Scenario 3

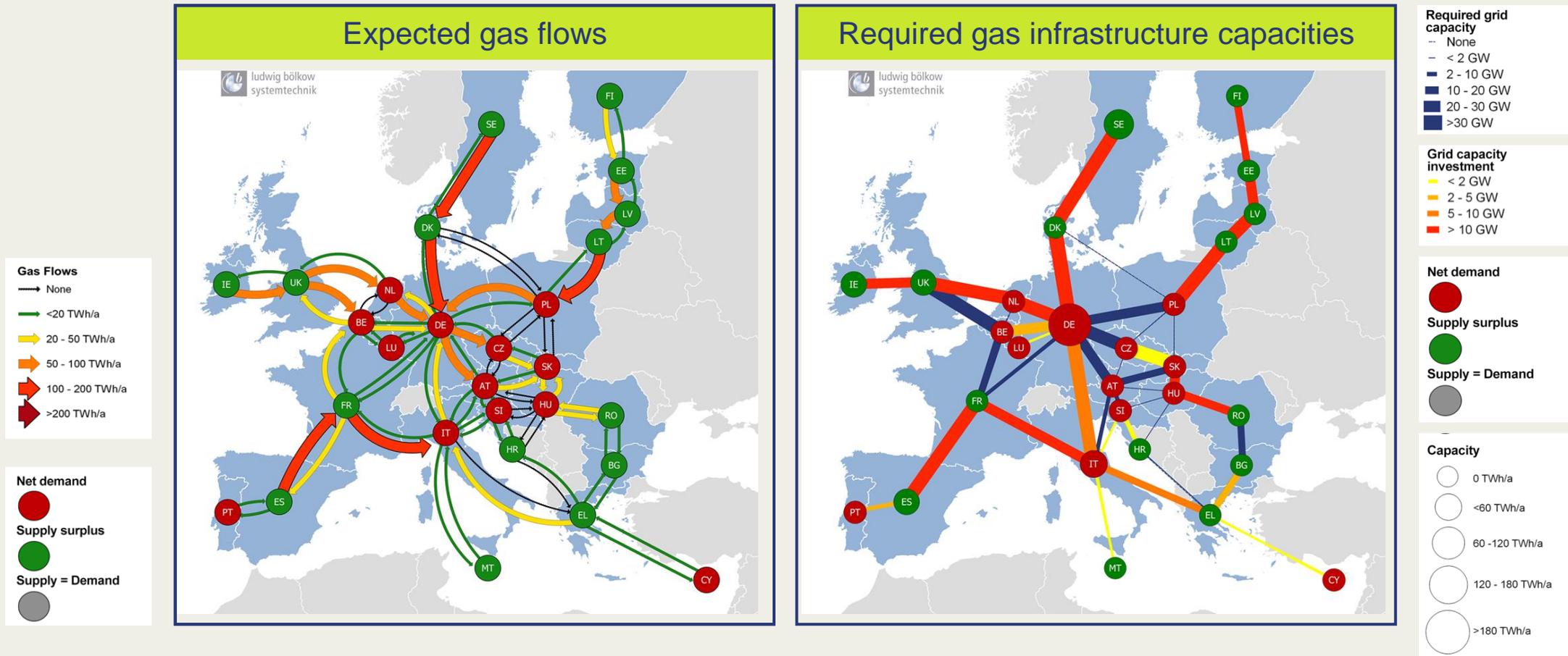


* excluding national energy transport costs

Methane scenario 2050: following biomethane potential



Hydrogen scenario 2050: following renewable power and electrolysis



Recommendations (1/2)



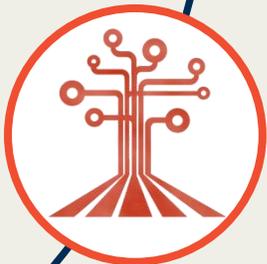
Limitations and unequal distribution of **renewable gas resources require:**

- Integrated European gas systems and markets, with EU-wide guarantees of origin
- Technical standards and specifications to facilitate biomethane and H₂ trade



Separate H₂ networks more adequate than admixture for strong deployment

- Further analysis on H₂ role and strategies for H₂ network “islands”
- Further study on framework for cross-border trade - e.g. thresholds, (de)blending



Infrastructure planning

- Optimise use of existing infrastructure, possibly through conversion to H₂ networks
- Integrate across energy carriers and T&D, with clear policy guidance
- Shift to future-proof investments
- **TEN-E & CEF:** Support integration of renewable and decarbonised gases with review of scope & eligibility

Recommendations (2/2)

Regulatory framework



Power-to-gas to be developed considering:

- Barriers to investment such as double grid charging
- Role of TSOs, weighing alternative approaches



Policy guidance to reduce uncertainties regarding H₂ pathways and integrate 'H₂ islands' in the long-term

- With **regulation** inspired on current framework for natural gas and defined sufficiently ahead of actual deployment



Transversal efforts across national frameworks to:

- Improve effectiveness and avoid stranded investments
- Avoid competition distortion between energy vectors
- Value economic benefits of local renewable gas



Measures to mitigate potential negative impacts on network operators and users could be considered