

# THE VALUE OF GAS INFRASTRUCTURE IN A CLIMATE NEUTRAL EUROPE

A study based on eight European countries

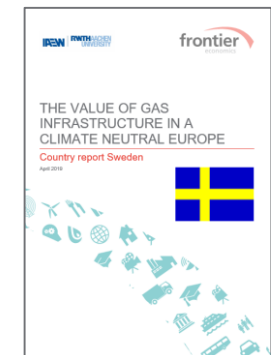
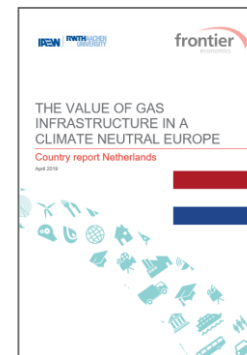
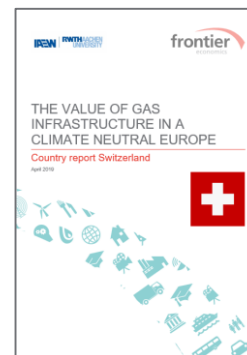
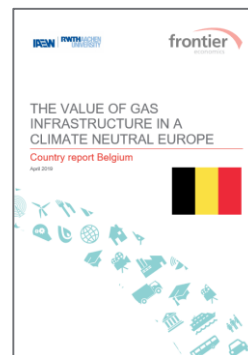
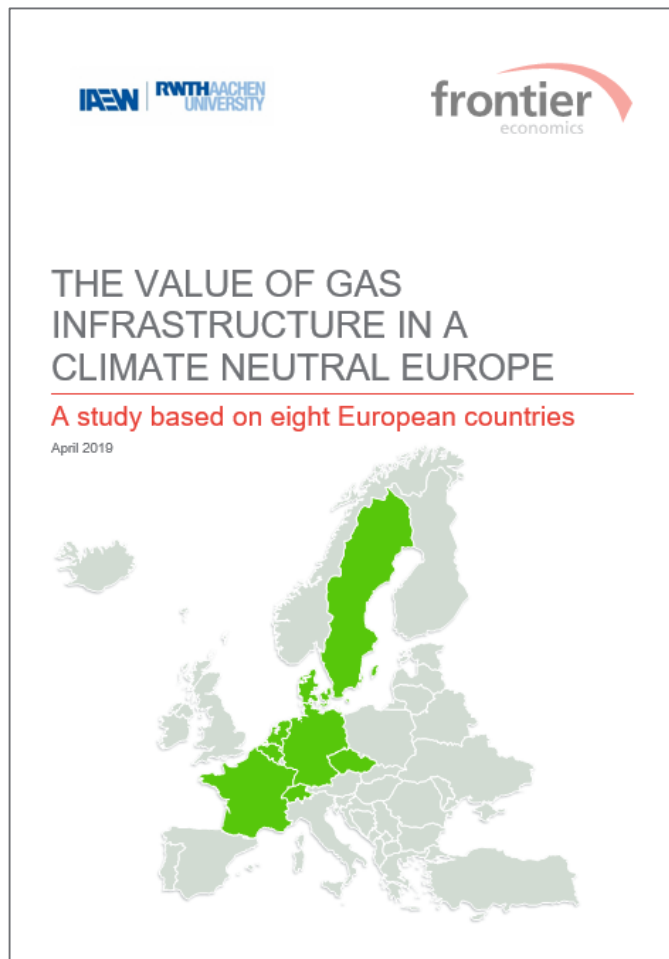
9 April 2019



# Our study: An in-debt review of the future role of gas in eight European countries

Main report

8 country studies



# Scope: This multi-country study analyses various renewable and low-carbon gases in various sectors across the entire energy supply chain



There are studies on the future value of gas out there...

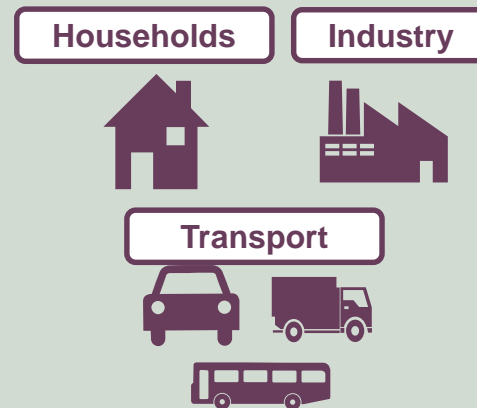
... but most of these are limited to certain countries, gases, sectors and/or supply chain stages.

This study extends the existing research

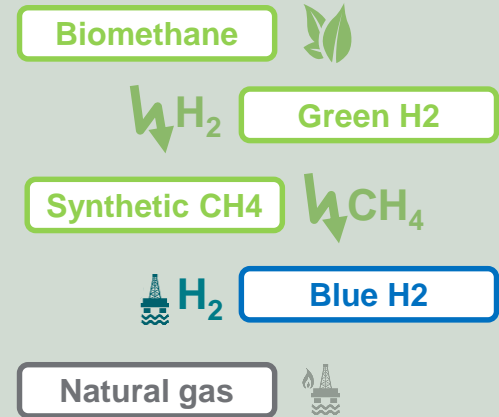
## Multiple countries and analysis of differences



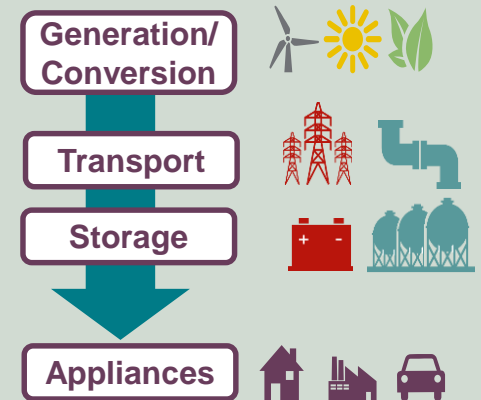
## Various sectors



## Various renewable and low-carbon gases



## Across the entire energy supply chain



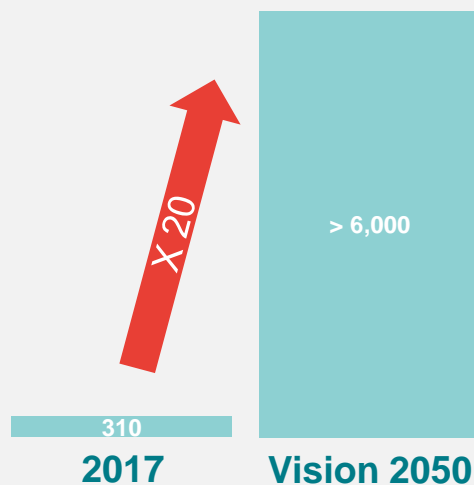
# The 3-fold challenge of decarbonisation: Supply, storage and transport of large amounts of (mostly renewable) energy

1

## Challenge of REN supply



Final energy demand served by electricity from wind and solar (TWh/a) in EU28\*



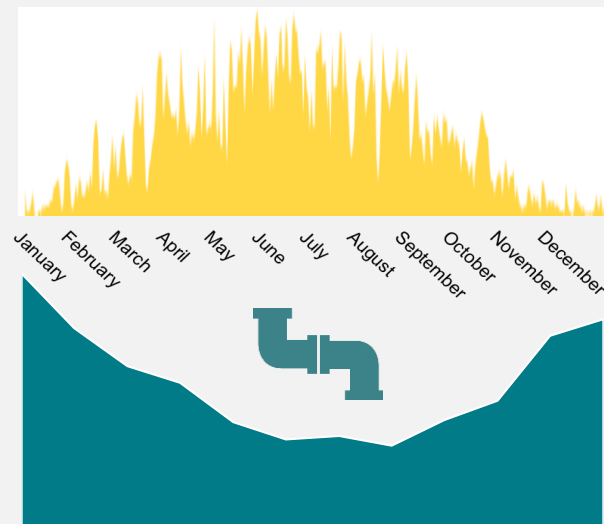
**Need for renewable energy generation will be substantial**, creating the challenge of finding appropriate and accepted **generation locations** within Europe

2

## Challenge of energy storage



Schematic annual profile of PV generation

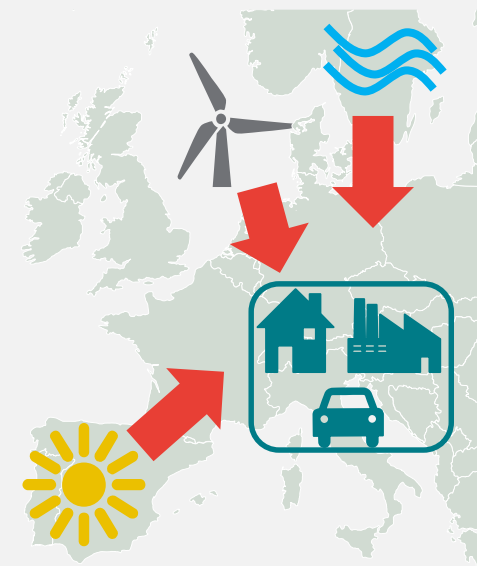


Monthly average gas load in 8 countries analysed

Intermittent renewables and seasonal heat demand **require vast seasonal energy storage**

3

## Challenge of energy transport



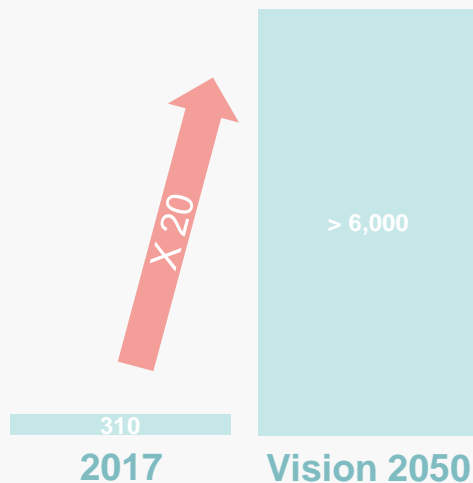
Effective **energy transport and distribution** is crucial when exploring more and more renewables

# The offers of gas infrastructure: Existing gas infrastructure is suited for a variety of REN & low-carbon gases, diversifying energy supply

## 1 Challenge of REN supply

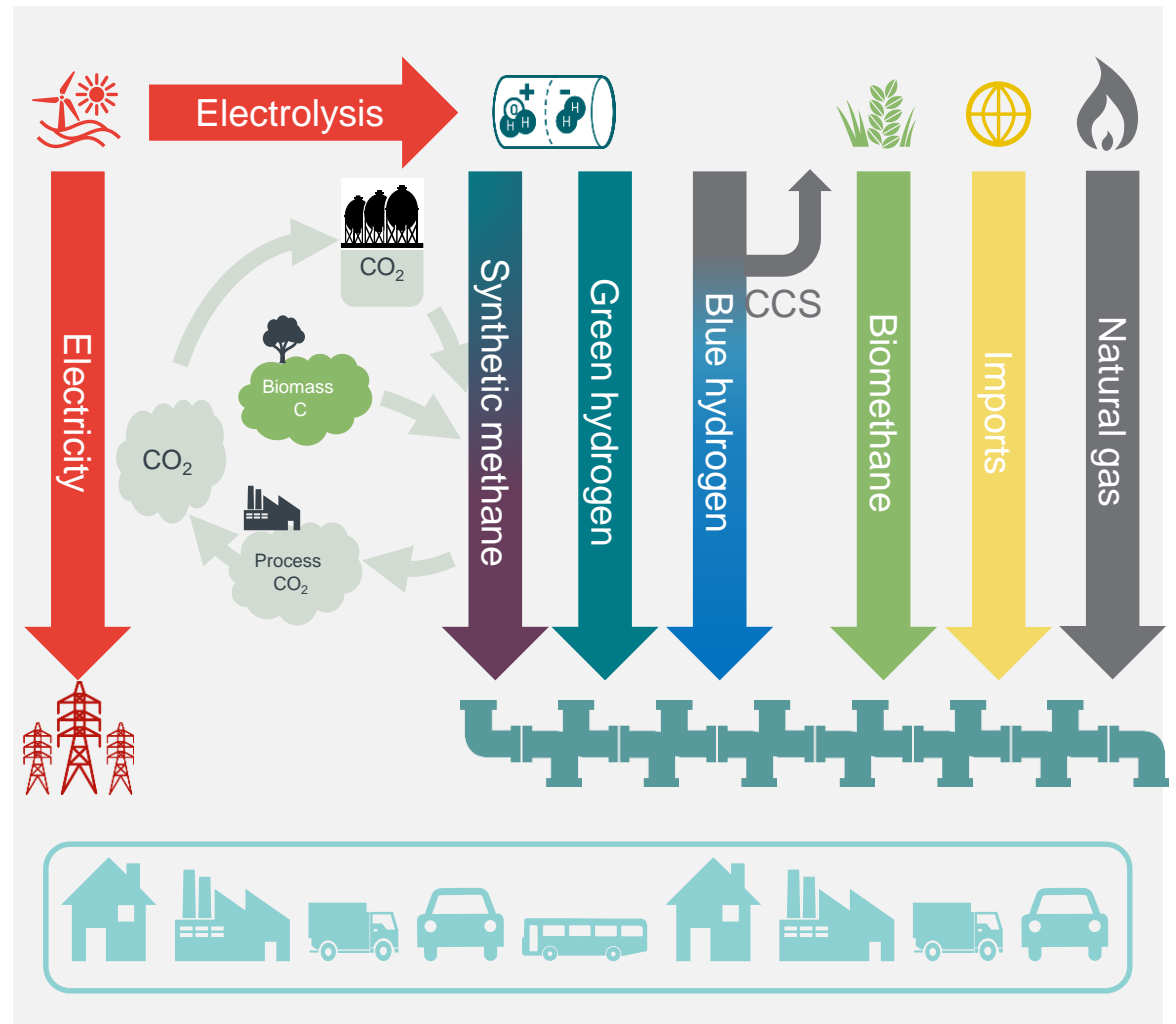


Final energy demand served by electricity from wind and solar (TWh/a) in EU28\*



Need for renewable energy generation will be substantial, creating the challenge of finding appropriate and accepted generation locations within Europe

## Gas infrastructure can accommodate a variety of renewable and low-carbon gases

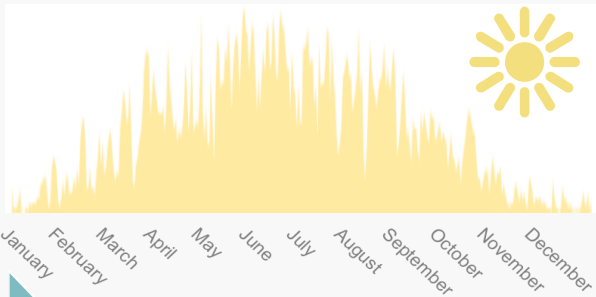


# The offers of gas infrastructure: Gas is easily storable and already stored in bulk

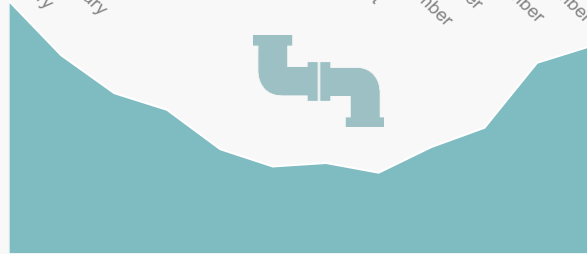
## 2 Challenge of energy storage



Schematic annual profile of PV generation



January February March April May June July August September October November December

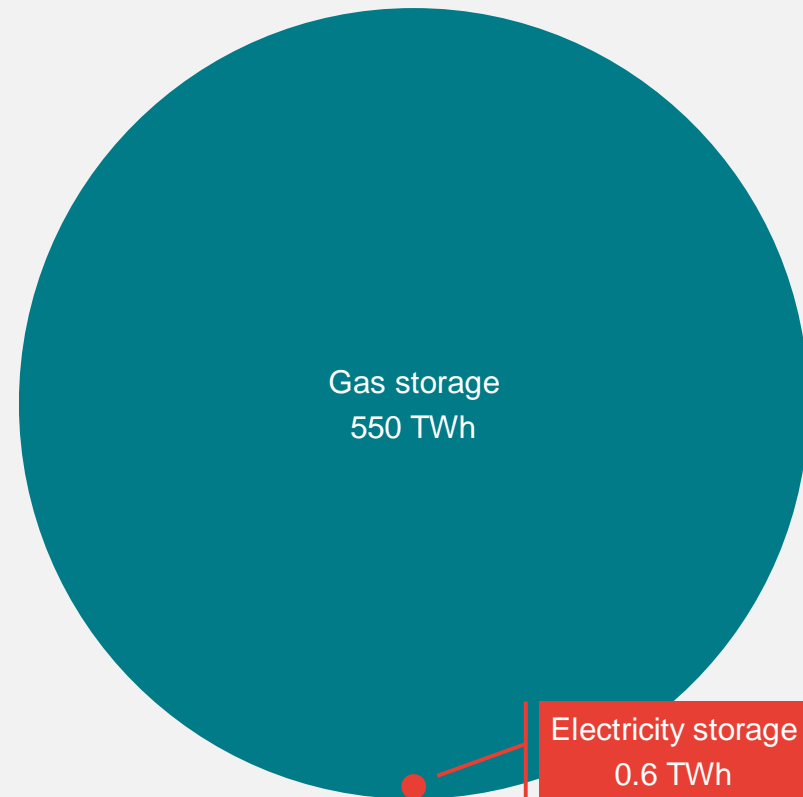


Monthly average gas load in 8 countries analysed

Intermittent renewables and seasonal heat demand **require vast seasonal energy storage**

## Gas storage volume is almost 1,000 times as large as electricity storage volume in analysed countries

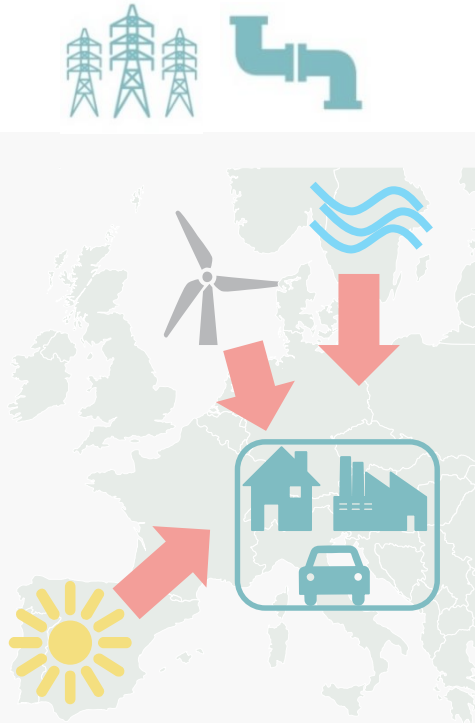
Energy storage volume in 8 analysed countries



Source: Frontier Economics based on Gas Infrastructure Europe and Geth et al.

# The offers of gas infrastructure: Transport capacities of gas infrastructure are enormous and exceed those of electricity by large

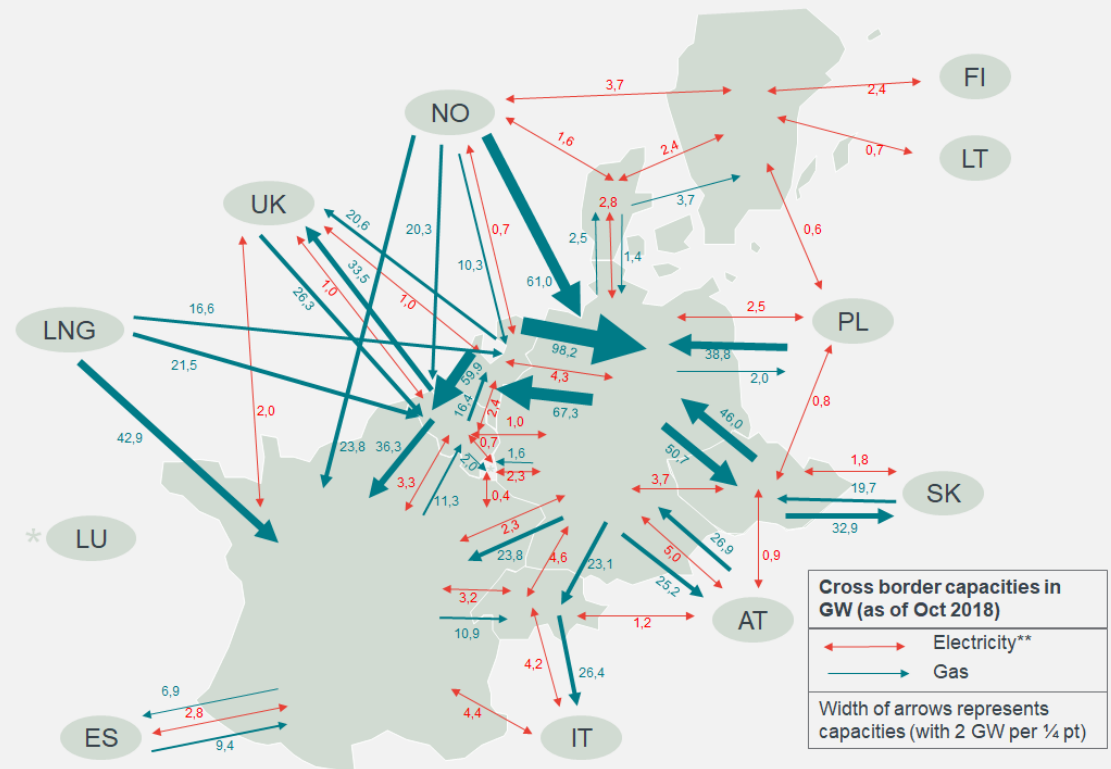
## 3 Challenge of energy transport



Effective **energy transport and distribution** is crucial when exploring more and more renewables

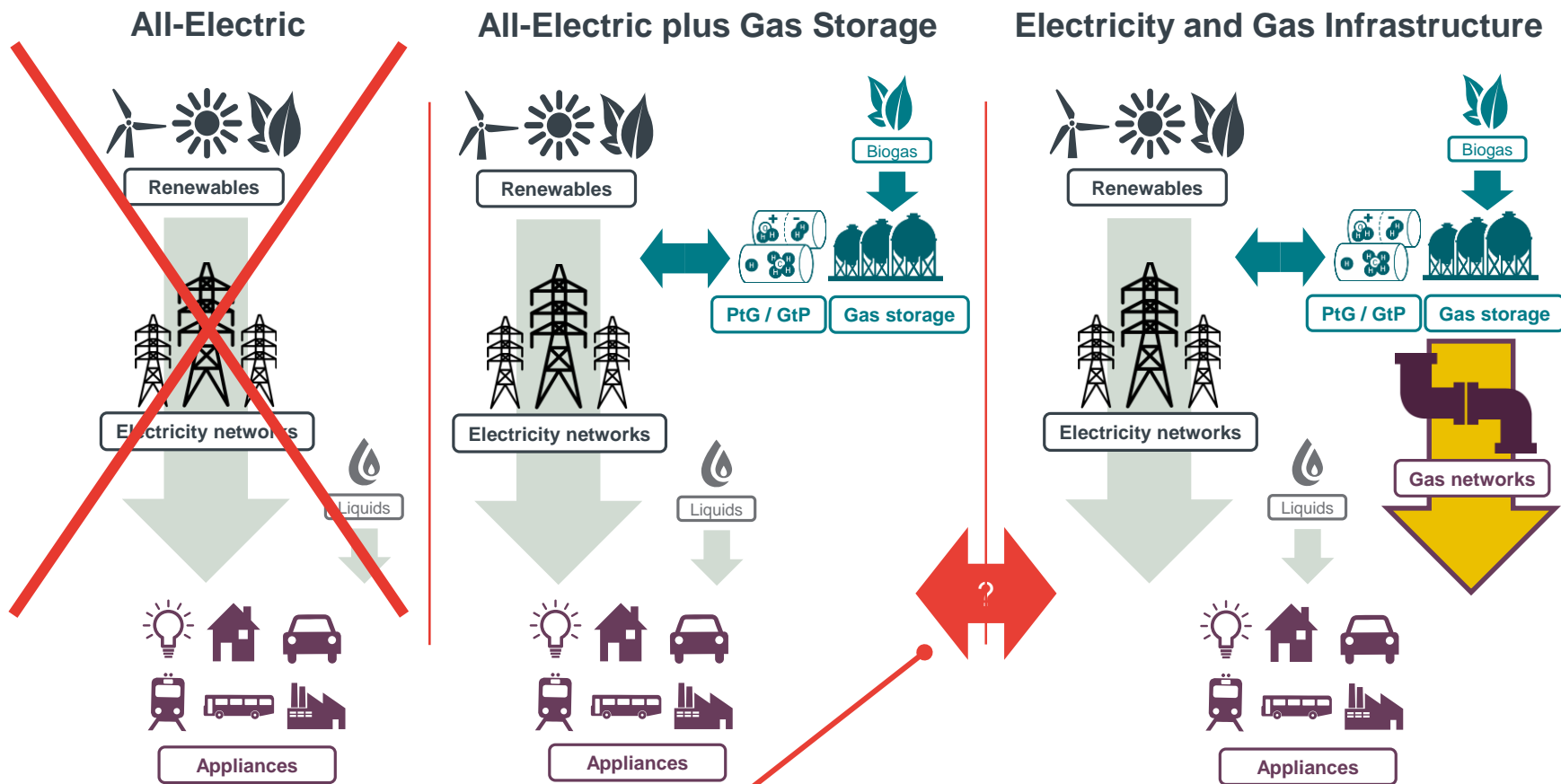
## Cross-border transport capacities for gas exceed those of electricity by large

Cross-border transport capacities for gas and electricity to / between eight countries analysed



Source: Frontier Economics based on Entso-E and Entso-G

# Scenarios: We consider three scenarios to analyse the additional benefit of the continued use of gas networks



**Not realistic & prohibitively expensive**

To estimate delta in system cost between scenarios we applied

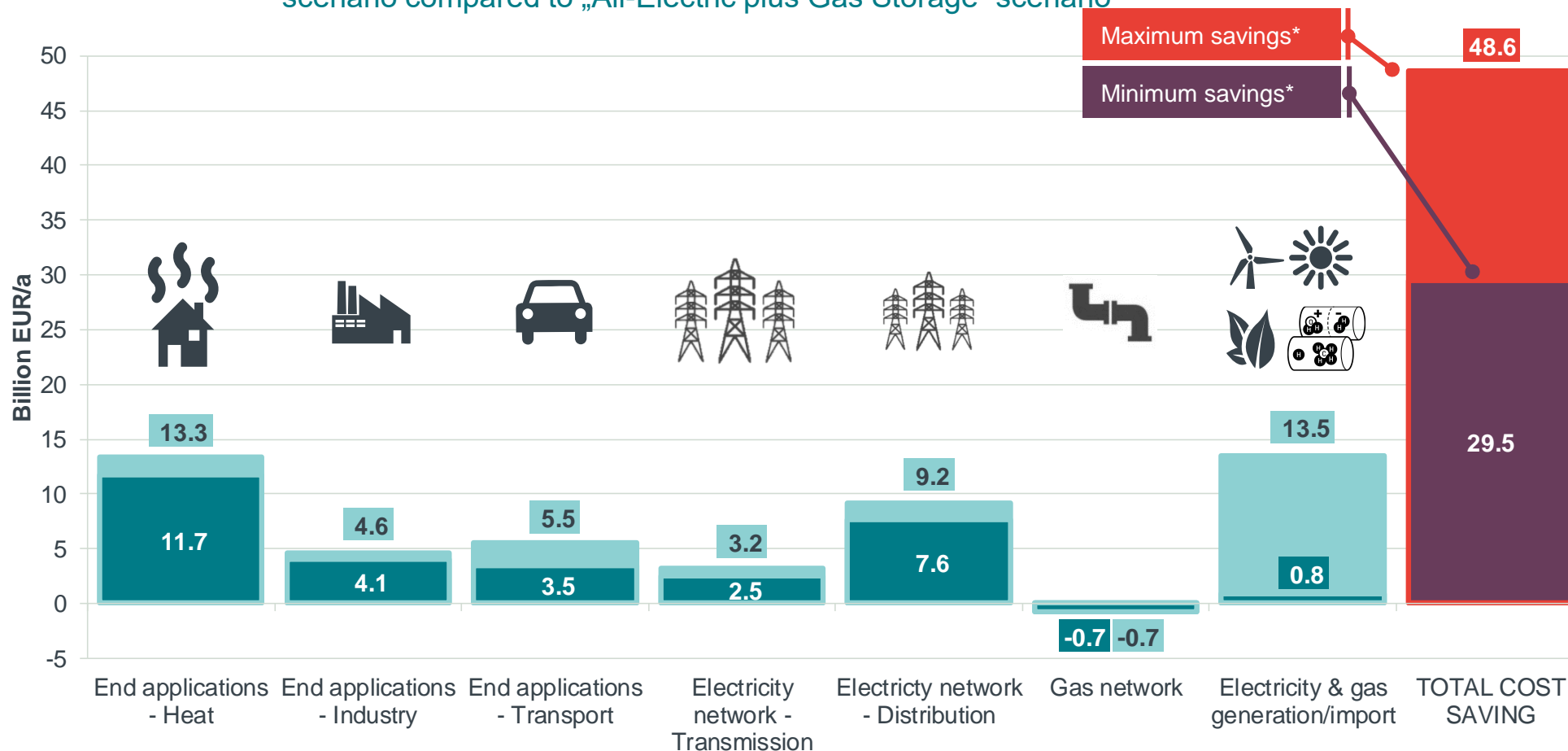
- *Bottom-up approaches* based on country-specific data (e.g. for costs of required electricity and gas or electricity distribution costs)
- *Top-down approaches* based on detailed study on Germany for FNB, corrected by fundamental country differences (e.g. electricity transmission costs, end appliance costs in households and industry)





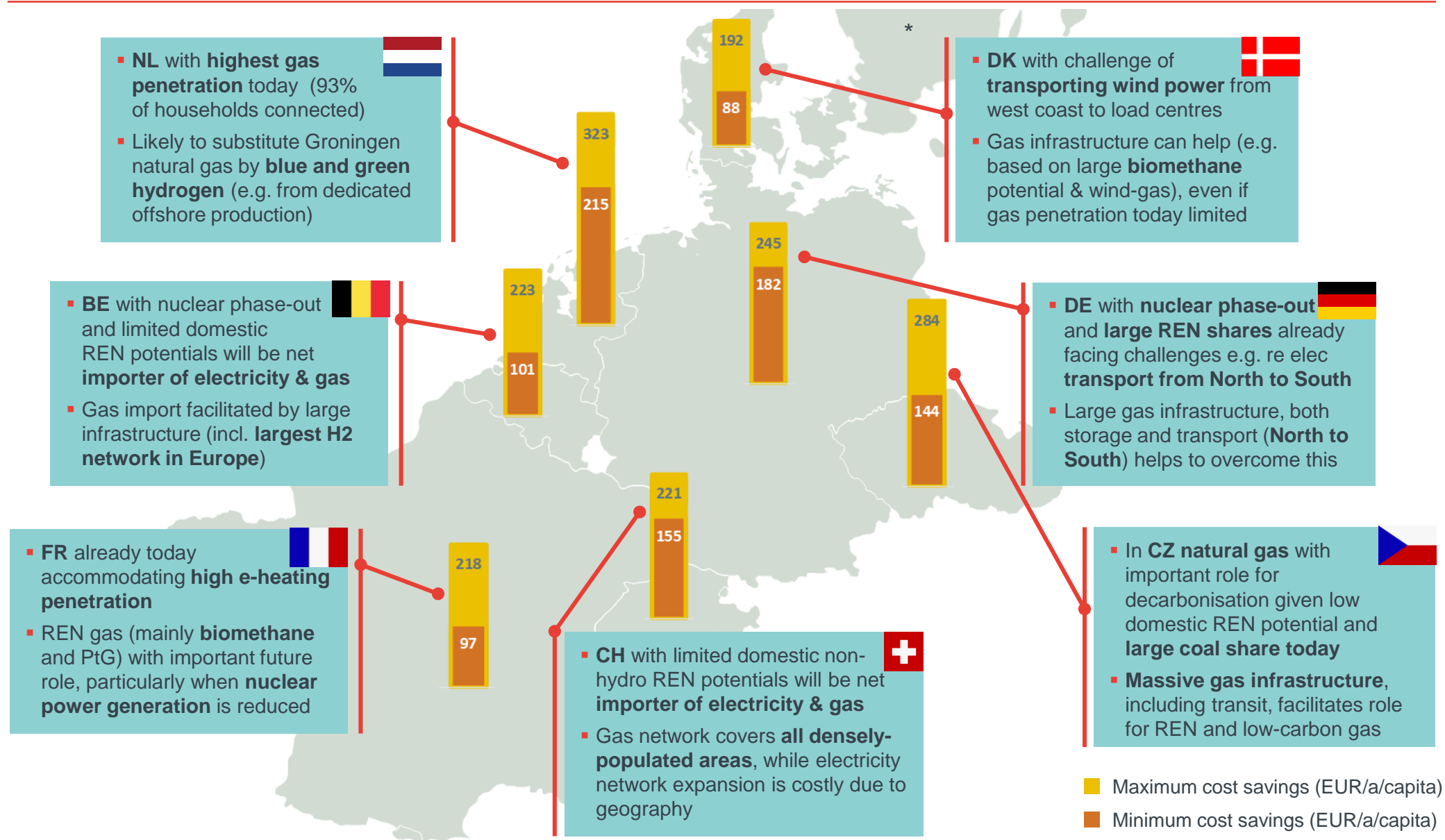
# Results: Use of gas grid can save € 30 to 49 billion per year in the eight analysed countries by 2050...

Annual cost savings in 2050 in „Electricity and Gas Infrastructure“ scenario compared to „All-Electric plus Gas Storage“ scenario



... adding up to € 487-802 bn cumulated cost savings\*\* until 2050

# Results: Cost savings vary across countries due to differences in the role of gas today, demand paths, geographic resources and policy focuses



**NL** with highest gas penetration today (93% of households connected)  
 Likely to substitute Groningen natural gas by **blue and green hydrogen** (e.g. from dedicated offshore production)

**DK** with challenge of transporting wind power from west coast to load centres  
 Gas infrastructure can help (e.g. based on large **biomethane** potential & wind-gas), even if gas penetration today limited

**BE** with nuclear phase-out and limited domestic REN potentials will be net importer of electricity & gas  
 Gas import facilitated by large infrastructure (incl. **largest H2 network in Europe**)

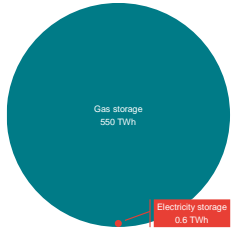
**DE** with nuclear phase-out and large REN shares already facing challenges e.g. re elec transport from North to South  
 Large gas infrastructure, both storage and transport (**North to South**) helps to overcome this

**FR** already today accommodating high e-heating penetration  
 REN gas (mainly **biomethane** and PtG) with important future role, particularly when **nuclear power generation** is reduced

**CH** with limited domestic non-hydro REN potentials will be net importer of electricity & gas  
 Gas network covers **all densely-populated areas**, while electricity network expansion is costly due to geography

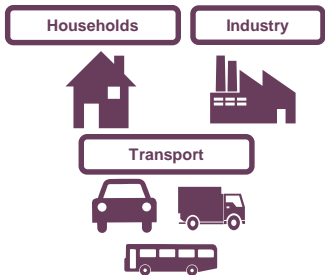
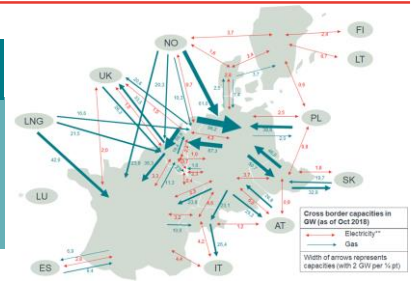
In **CZ** natural gas with important role for decarbonisation given low domestic REN potential and **large coal share today**  
**Massive gas infrastructure**, including transit, facilitates role for REN and low-carbon gas

# Conclusion: Gas infrastructure holds the key for many challenges of Europe's energy transition ...



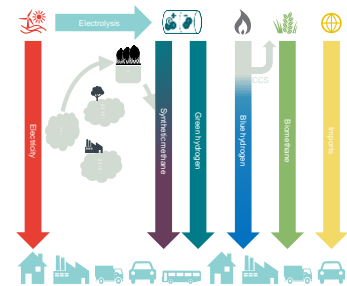
**Storage**  
... capacity to bridge seasonal fluctuations makes gas an **ideal partner for intermittent REN energy**

**Transport**  
... capacity of gas helps avoiding costly extension of power lines and **overcoming acceptance issues**



**End appliances**  
Renewable and low-carbon gases can play an essential role **in all sectors**

**Flexible infrastructure**  
... for **various** renewable and low-carbon gases



**Global trade**  
Link to global energy sources **enhances security of supply** and ensures Europe's competitiveness

**Remote areas**  
... can be supplied e.g. by **small-scale (bio-)LNG**



**Cost savings**  
... of scenario with gas networks compared to scenario without gas networks

**€ 487-802 bn**

**cumulated cost savings until 2050**



**Thank you very much for your attention**

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