RAP
REGULATORY
ASSISTANCE PROJECT

03 December 2024

Gas in decline – what to do with the gas grid when we no longer need it?

Energy Seminar

Dr Jan Rosenow
jrosenow@raponline.org
RAP

One Earth

CellPress

Commentary

The elephant in the room: How do we regulate gas transportation infrastructure as gas demand declines?

Jan Rosenow,[1,2,*] Richard Lowes,[1,3] and Claudia Kemfert[4,5]
[1]Regulatory Assistance Project, Rue de la Science 23, 1040 Brussels, Belgium
[2]University of Oxford, Environmental Change Institute, 3 South Parks Road, Oxford OX1 3QY, UK
[3]University of Exeter, Energy Policy Group, Penryn Campus, Treliever Road, Penryn, Cornwall TR10 9FE, UK
[4]Leuphana University Lüneburg, Institute of Sustainability Governance, Universitätsallee 1, C11.221, 21335 Lüneburg, Germany
[5]German Institute for Economic Research, Mohrenstraße 58, 10117 Berlin, Germany
*Correspondence: jrosenow@raponline.org
https://doi.org/10.1016/j.oneear.2024.05.022

The use of gas will decline dramatically as part of the transition to net zero. Modeling at European levels shows that by 2050 about 70% less gaseous fuels will be used. Significant regulatory reform is needed to deal with the impacts of this decline on the gas grid.

Fossil gas today serves many end uses, from power generation to residential cooking. In order to transport gas, vast gas grids have been built over the past decades. In Europe, there are now over 130,000 km of gas transmission pipelines—a distance of more than three times the circumference of the Earth. At the more local distribution level, there are another 1,800,000 km of pipeline.[1] At the moment, regulation in most European countries treats gas distribution networks broadly as if they are expected to operate in perpetuity, though there are some exceptions. But the era of widespread fossil gas consumption will come to an end as the world decarbonizes its energy use. This poses a significant challenge for policy makers: if fewer and fewer people use gas, how is the decline of the system managed, who pays for it, and how does this work support a rapid energy transition?

Gas in decline

Globally, unabated fossil gas consumption will need to decline by around 80% by 2050 if the goals of the Paris Agreement on climate change are to be met.[2] In Europe, fossil gas makes up 95% of gaseous fuels consumption as of today. Driven by a number of developments, including climate targets at the European Union (EU) and national level, energy security concerns after the invasion of Ukraine by Russia, and gas price volatility,[3] a steep decline in the use of fossil gas is expected over the next two decades.

A recent impact assessment by the European Commission[4] of the proposed 2040 90% greenhouse gas reduction target (relative to 1990 levels) indicates that total demand for gaseous fuels, including gases such as hydrogen, will fall between 71% and 73% between 2019 and 2050 (Figure 1).

Impact of declining gas demand on final customers

Fuel switching away from gas means that the costs of running gas infrastructure and the amortization of the sunk network costs will be paid by fewer and fewer customers. Typically, tightly regulated grid fees for remaining gas customers would rise as more consumers decouple from gas grids, for example by switching to a heat pump or district heating.

Analyses of the effects of declining gas consumption on network costs by the British energy regulator Ofgem show that network charges could rise by a factor of 10 within 20 years.[5] Gas grid tariffs in Austria could increase up to 4-fold by 2040 under decarbonization scenarios.[6] Projections for Germany and France indicate a 5-fold and 3-fold increase, respectively.[7] Figure 2 shows the projections for all four countries.

The longer regulation allows for the continued investment into the gas grid without a credible plan for decommissioning, the bigger the problem becomes. Rising gas network fees result in an increased incentive to switch away from the gas grid, resulting in more customer switching and even higher network fees. Low-income households, in particular, are exposed to a considerable risk here, as they may not have the means to easily switch away from the gas grid to other alternatives such as heat pumps.

Alternatives to gas grid decommissioning

Gas network operators have promoted the replacement of fossil gas with hydrogen and other low carbon gases as an alternative to grid decommissioning.[8] At first glance, this may seem like an attractive option to policymakers who want to minimize impacts of the energy transition on customers and gas industry stakeholders. Using the existing gas grid for hydrogen transportation is both technically challenging and economically irrational, however.

From a purely technical point of view, an existing natural gas infrastructure cannot simply be used with hydrogen. This is due to the lower energy density and higher flow resistance, making it harder to transport the same energy content, and the corrosive effect of hydrogen. In some countries the gas grid has been upgraded. For example, in the UK, old metal gas pipes have been replaced with polyethylene pipes through the iron mains risk reduction program. However, the UK gas infrastructure would still require

RAP REGULATORY ASSISTANCE PROJECT

Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

October 2024

Planning and regulating Europe's gas networks: breaking up with fossil gas

Final report

RAP®

AUGUST 2022

REGULATORY ASSISTANCE PROJECT

The clash with gas: Should it stay or should it go?

Principles to address the changing role of gas in a decarbonised energy system

Megan Anderson, Jan Rosenow, Richard Cowart

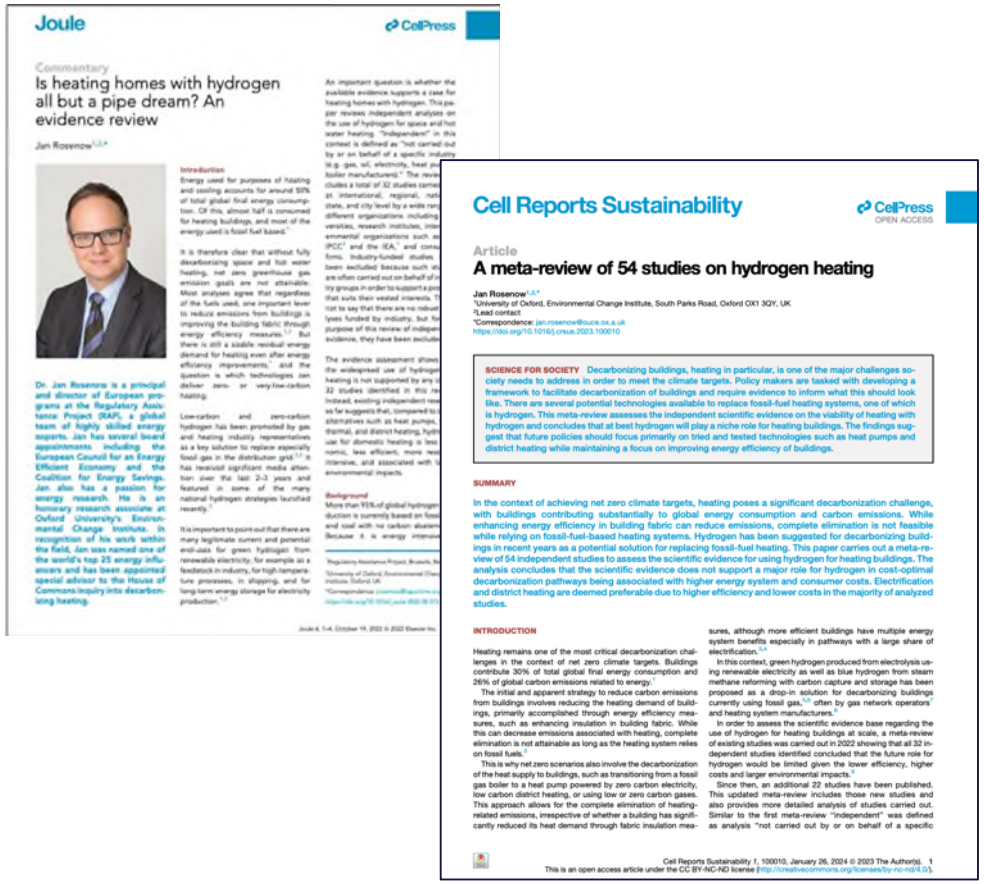
1

Gas grids today

2

Gas demand projections

Evidence suggests role for hydrogen in replacing fossil gas is limited



International Energy Agency

IRENA
International Renewable Energy Agency

ipcc
INTERGOVERNMENTAL PANEL ON climate change

McKinsey & Company

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

CREDS
CENTRE FOR RESEARCH INTO ENERGY DEMAND SOLUTIONS

PIK
Potsdam Institute for Climate Impact Research

Agora Energiewende

Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

UKERC
UK Energy Research Centre

Energy Transitions Commission

Fraunhofer

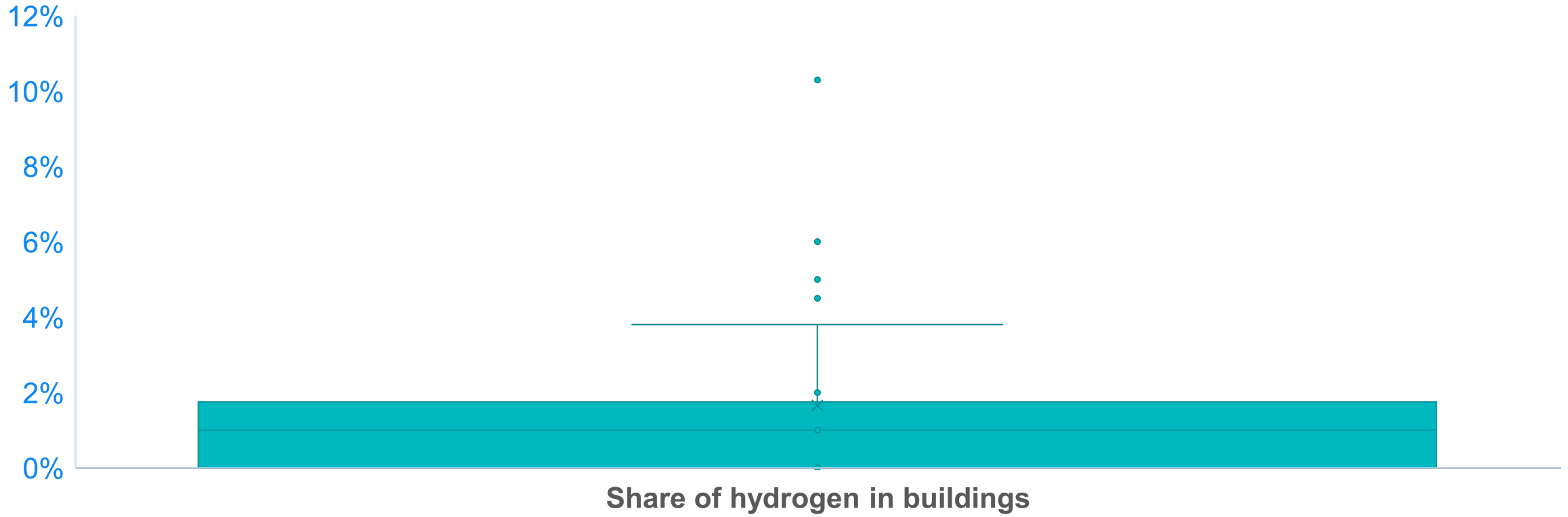
Imperial College London

Wuppertal Institut

UCL

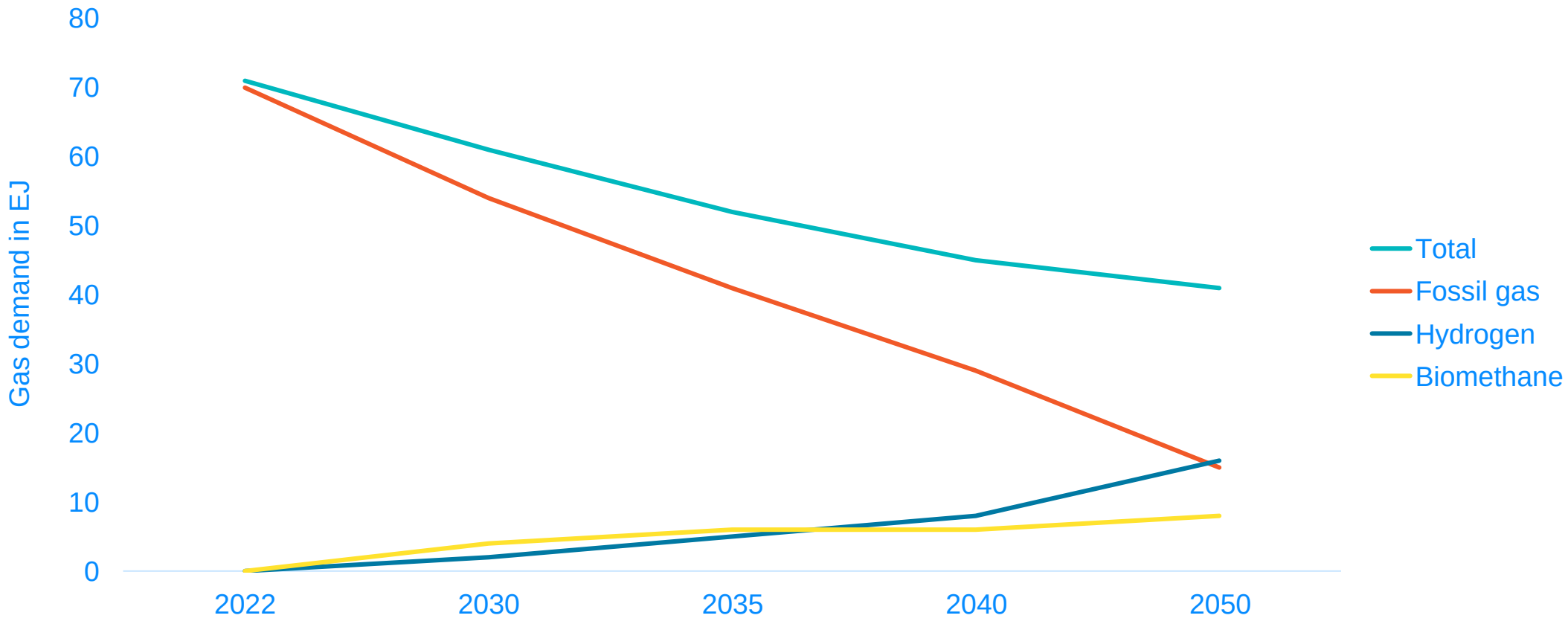
BEUC
The European Consumer Organisation

Median share of hydrogen in heating buildings in independent decarbonisation scenarios: 1%



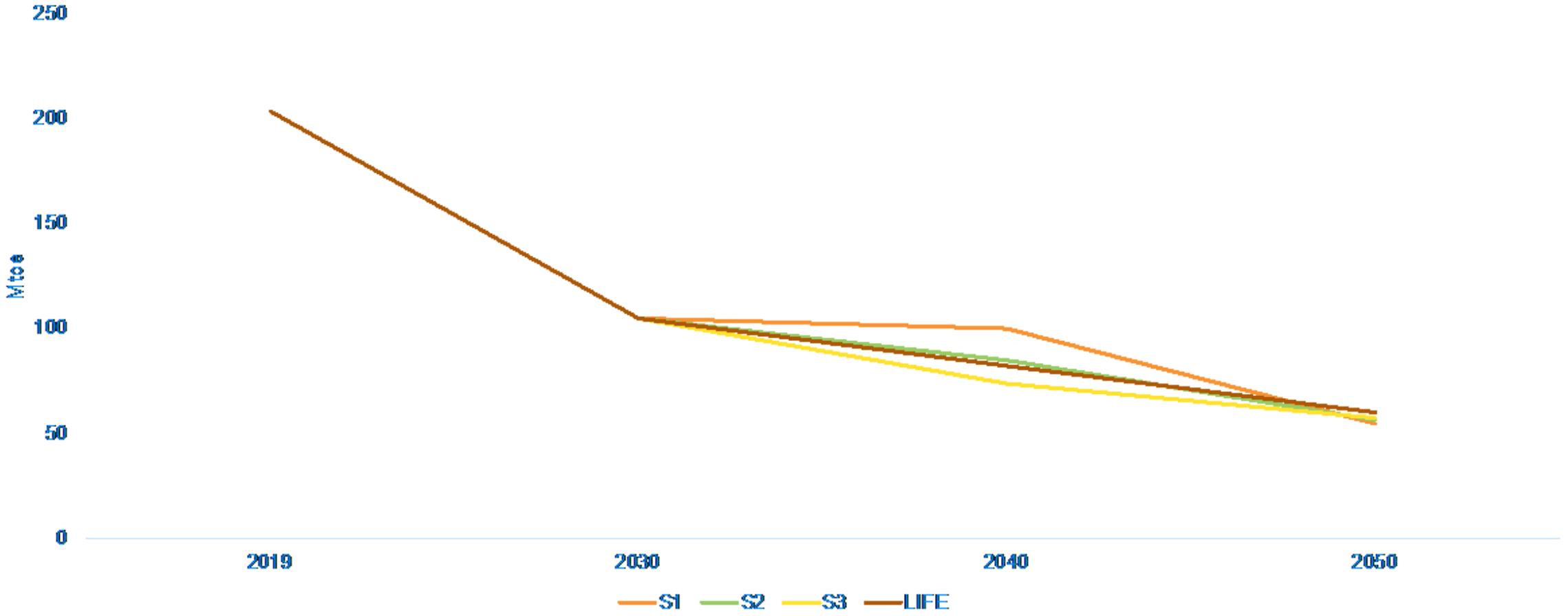
Source: Rosenow 2023

IEA Net Zero 2050 roadmap



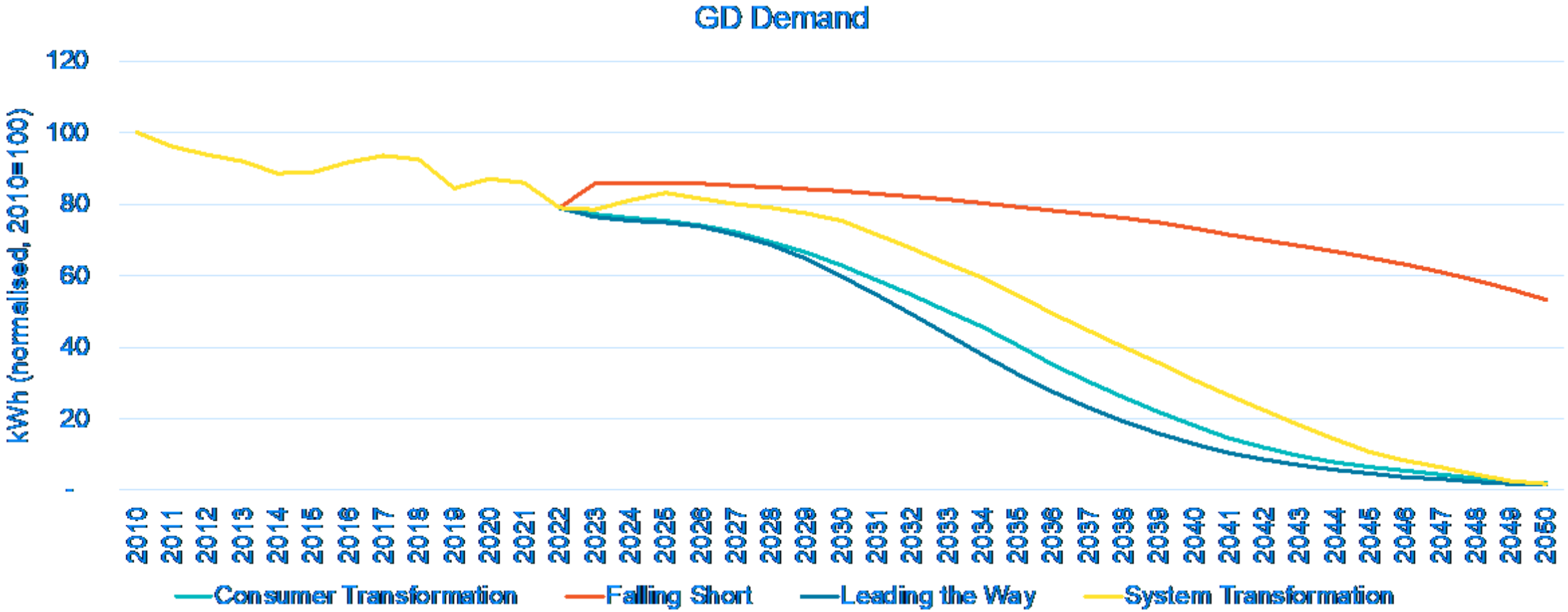
Source: based on IEA 2023

Gas demand decline in EU scenarios



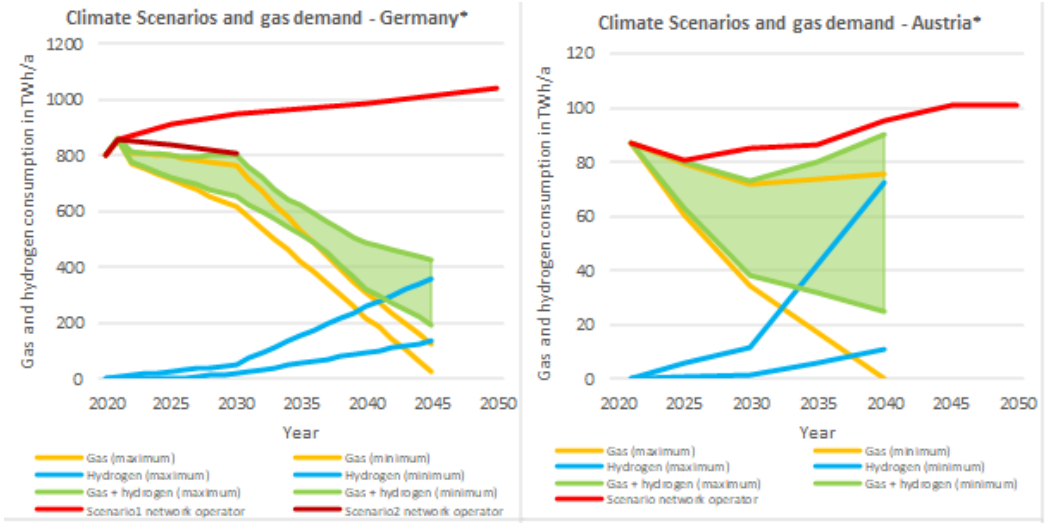
Sources: based on European Commission (2024)

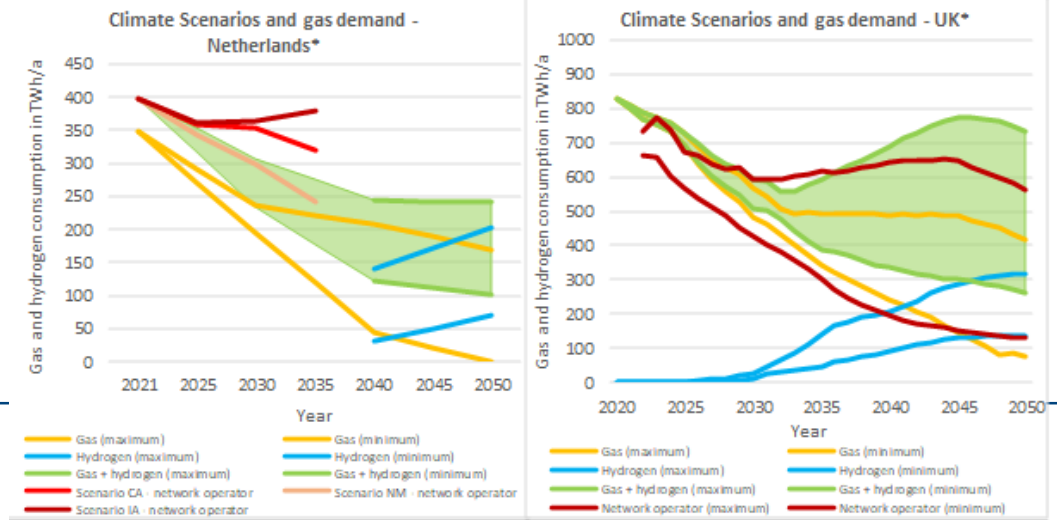
Gas demand decline in UK scenarios



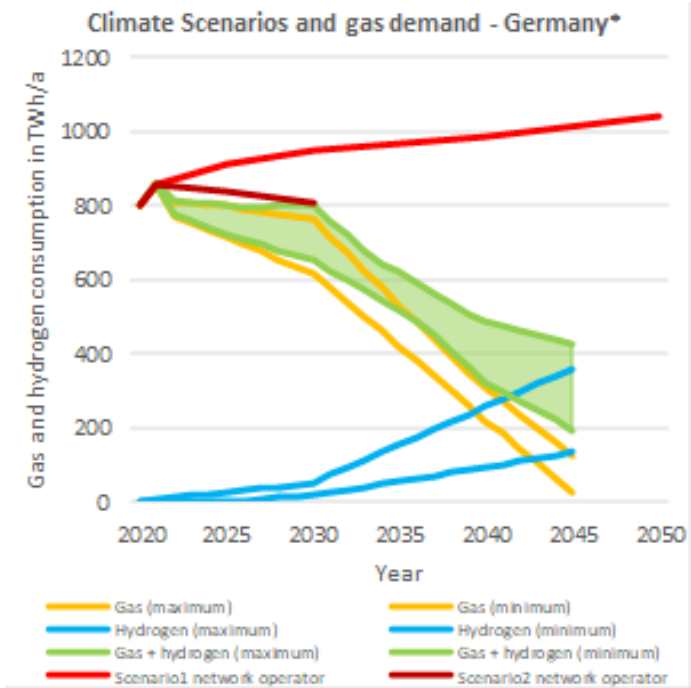
Sources: Ofgem (2023)

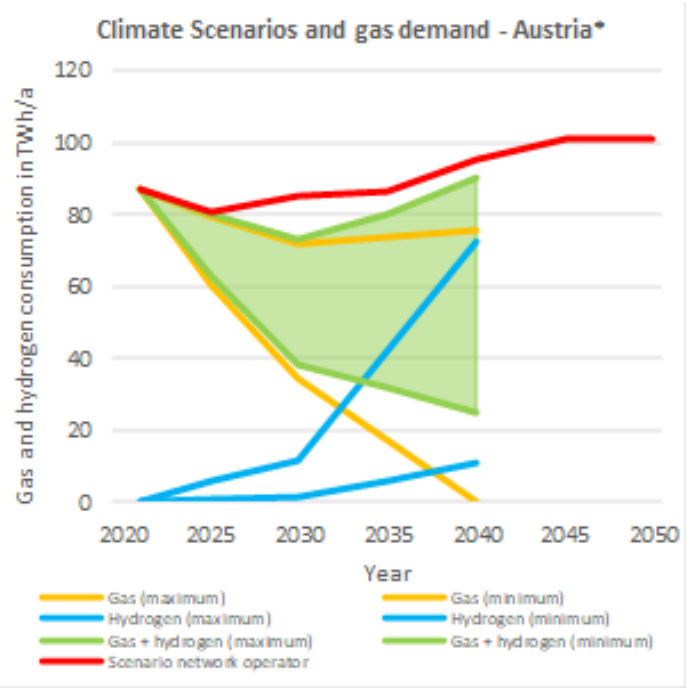
Gas grid operators often assume more gas demand than compatible with climate targets

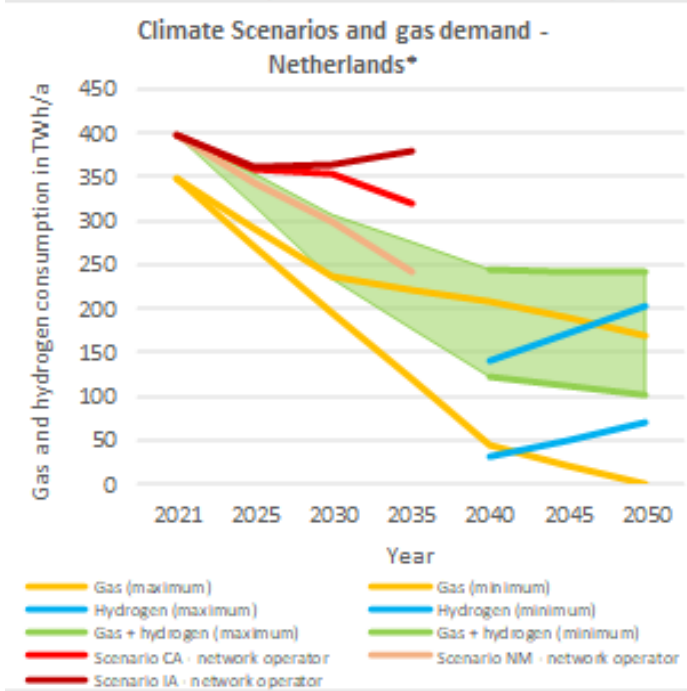


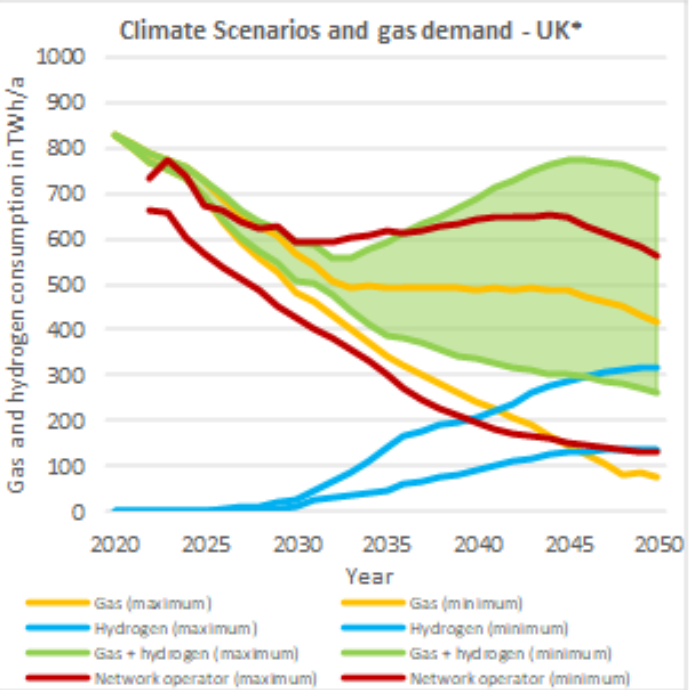


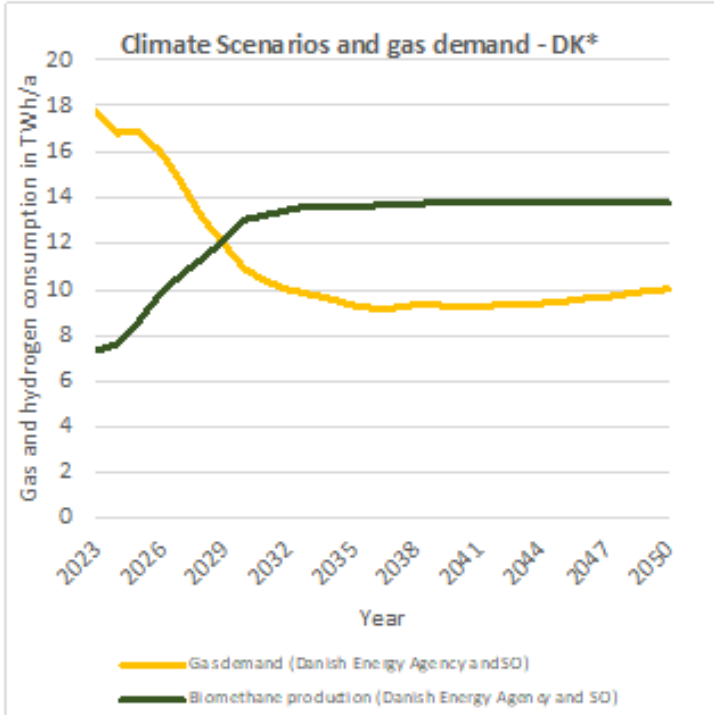
Source: RAP/Oeko-Institut forthcoming

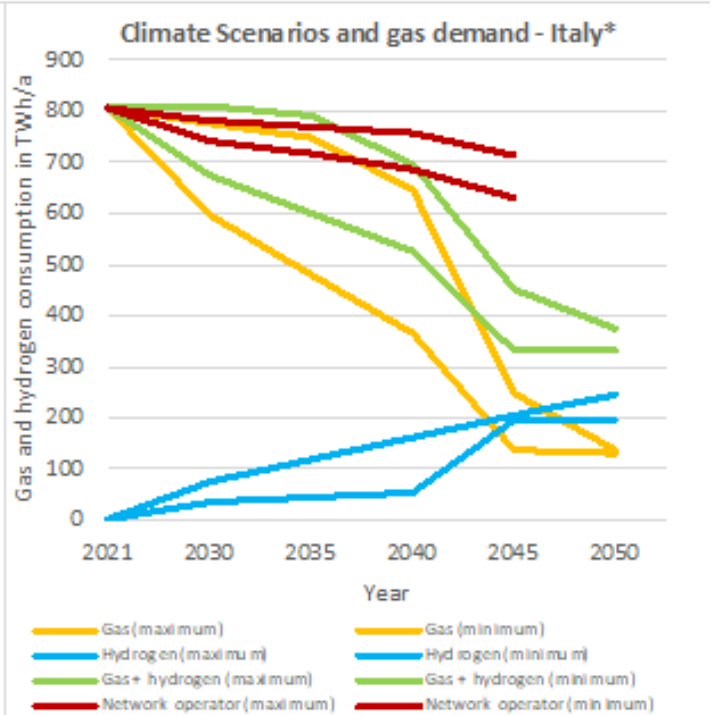

Climate Scenarios and gas demand - Germany*
Gas and hydrogen consumption in TWh/a
1200
1000
800
600
400
200
0
2020
2025
2030
2035
2040
2045
2050
Year
Gas (maximum)
Gas (minimum)
Hydrogen (maximum)
Hydrogen (minimum)
Gas + hydrogen (maximum)
Gas + hydrogen (minimum)
Scenario1 network operator
Scenario2 network operator

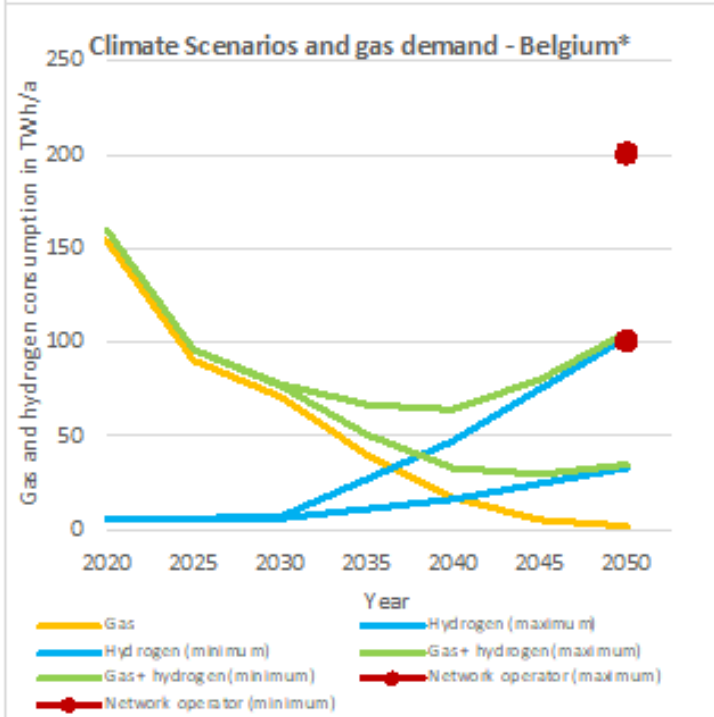

Climate Scenarios and gas demand - Austria*
Gas and hydrogen consumption in TWh/a
120
100
80
60
40
20
0
2020
2025
2030
2035
2040
2045
2050
Year
Gas (maximum)
Gas (minimum)
Hydrogen (maximum)
Hydrogen (minimum)
Gas + hydrogen (maximum)
Gas + hydrogen (minimum)
Scenario network operator


Climate Scenarios and gas demand - Netherlands*
Gas and hydrogen consumption in TWh/a
450
400
350
300
250
200
150
100
50
0
2021
2025
2030
2035
2040
2045
2050
Year
Gas (maximum)
Gas (minimum)
Hydrogen (maximum)
Hydrogen (minimum)
Gas + hydrogen (maximum)
Gas + hydrogen (minimum)
Scenario CA - network operator
Scenario NM - network operator
Scenario IA - network operator


Climate Scenarios and gas demand - UK*
Gas and hydrogen consumption in TWh/a
1000
900
800
700
600
500
400
300
200
100
0
2020
2025
2030
2035
2040
2045
2050
Year
Gas (maximum)
Gas (minimum)
Hydrogen (maximum)
Hydrogen (minimum)
Gas + hydrogen (maximum)
Gas + hydrogen (minimum)
Network operator (maximum)
Network operator (minimum)


Climate Scenarios and gas demand - DK*
Gas and hydrogen consumption in TWh/a
20
18
16
14
12
10
8
6
4
2
0
2023
2026
2029
2032
2035
2038
2041
2044
2047
2050
Year
Gas demand (Danish Energy Agency and SO)
Biomethane production (Danish Energy Agency and SO)

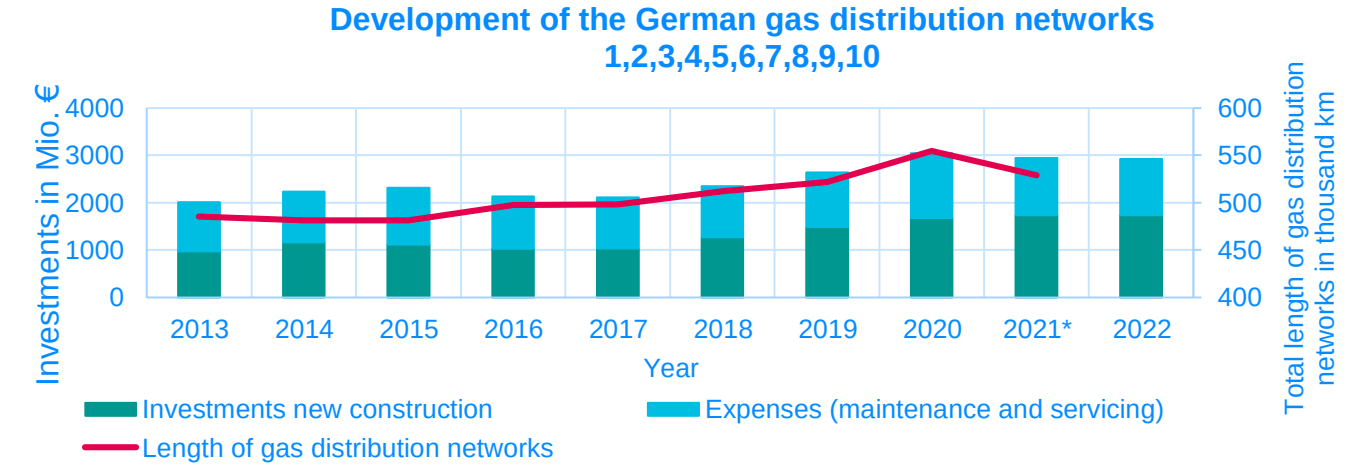

Climate Scenarios and gas demand - Italy*
Gas and hydrogen consumption in TWh/a
900
800
700
600
500
400
300
200
100
0
2021
2030
2035
2040
2045
2050
Year
Gas (maximum)
Gas (minimum)
Hydrogen (maximum)
Hydrogen (minimum)
Gas + hydrogen (maximum)
Gas + hydrogen (minimum)
Network operator (maximum)
Network operator (minimum)

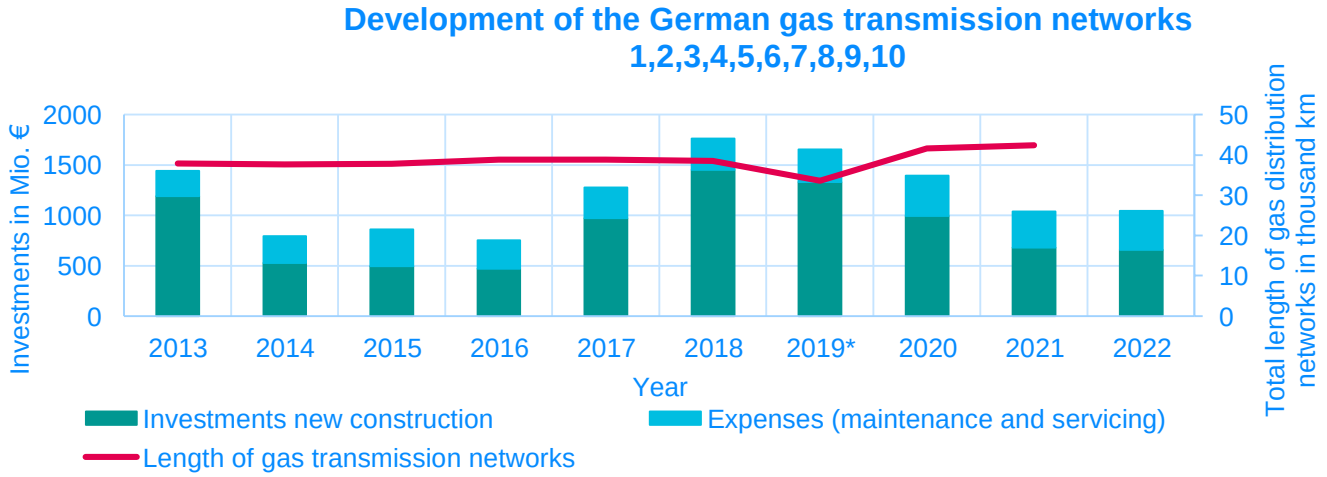

Climate Scenarios and gas demand - Belgium*
Gas and hydrogen consumption in TWh/a
250
200
150
100
50
0
2020
2025
2030
2035
2040
2045
2050
Year
Gas
Hydrogen (maximum)
Hydrogen (minimum)
Gas+ hydrogen (maximum)
Gas+ hydrogen (minimum)
Network operator (maximum)
Network operator (minimum)

3

Gas grid decommissioning at local level

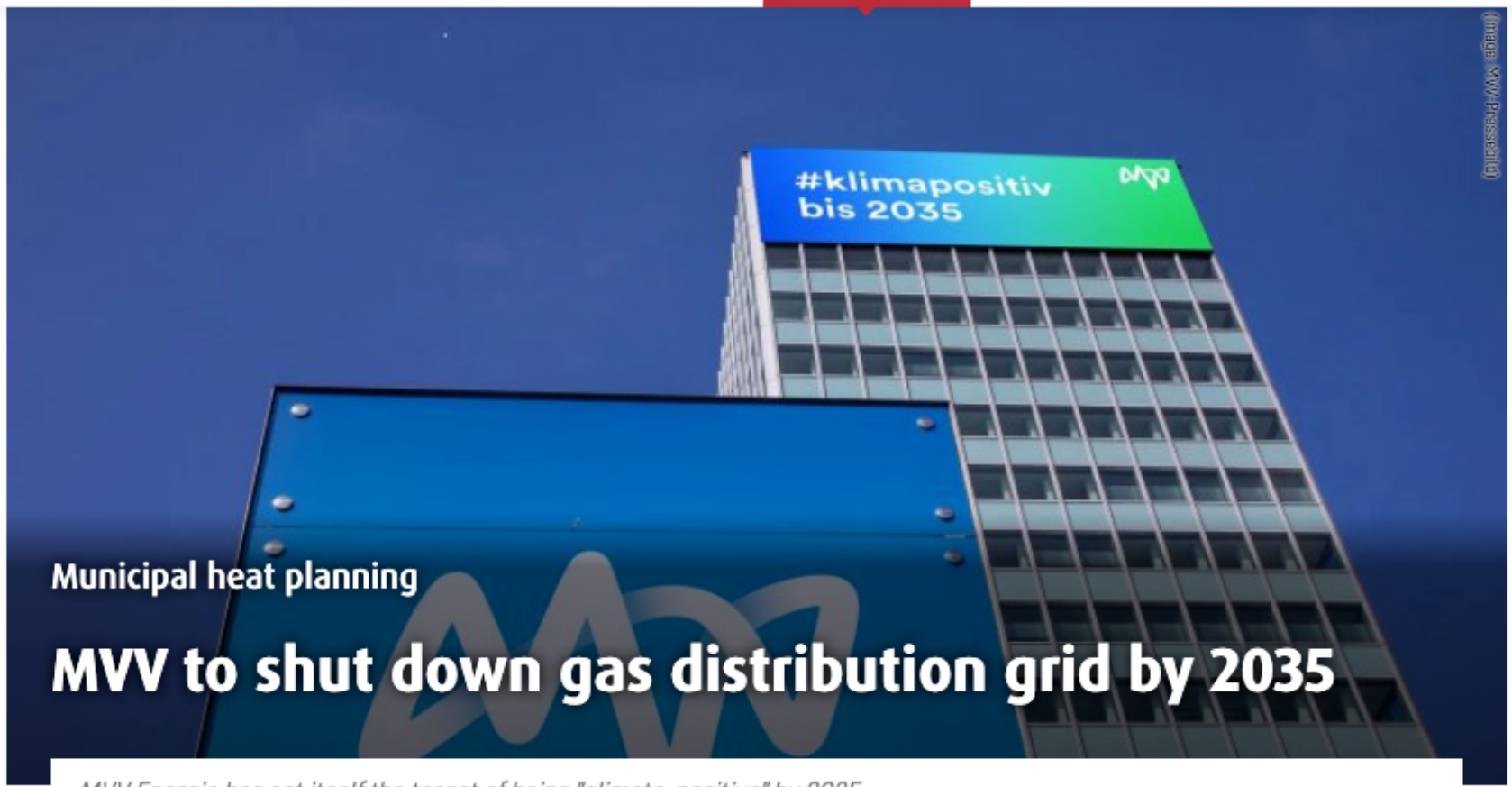
No signs of decommissioning until recently – example Germany





Sources: [1]Federal Network Agency (BNetzA) (2023); [2]Federal Network Agency (BNetzA) (2022a); [3]Federal Network Agency (BNetzA) (2021); [4]Federal Network Agency (BNetzA) (2020); [5]Federal Network Agency (BNetzA) (2019); [6]Federal Network Agency (BNetzA) (2018); [7]Federal Network Agency (BNetzA) (2017); [8]Federal Network Agency (BNetzA) (2016); [9]Federal Network Agency (BNetzA) (2015); [10]Federal Network Agency (BNetzA) (2014)

ener|gate
messenger english edition



Municipal heat planning

MVV to shut down gas distribution grid by 2035

MVV Energie has set itself the target of being "climate-positive" by 2035.

ener|gate
messenger english edition

Summer interview

Augsburg plans gas grid decommissioning with foresight

Basel-Stadt plant Schritte für den Gas-Ausstieg bis 2037

Bis im Jahr 2037 wird im Kanton Basel-Stadt das Gasnetz stillgelegt. Die ersten Stilllegungen sollen im Jahr 2026 stattfinden. Ab 2028 wird der Energieversorger IWB jährlich etwa 1000 Gasanschlüsse vom Netz nehmen, wie der Kanton am Donnerstag mitteilte.

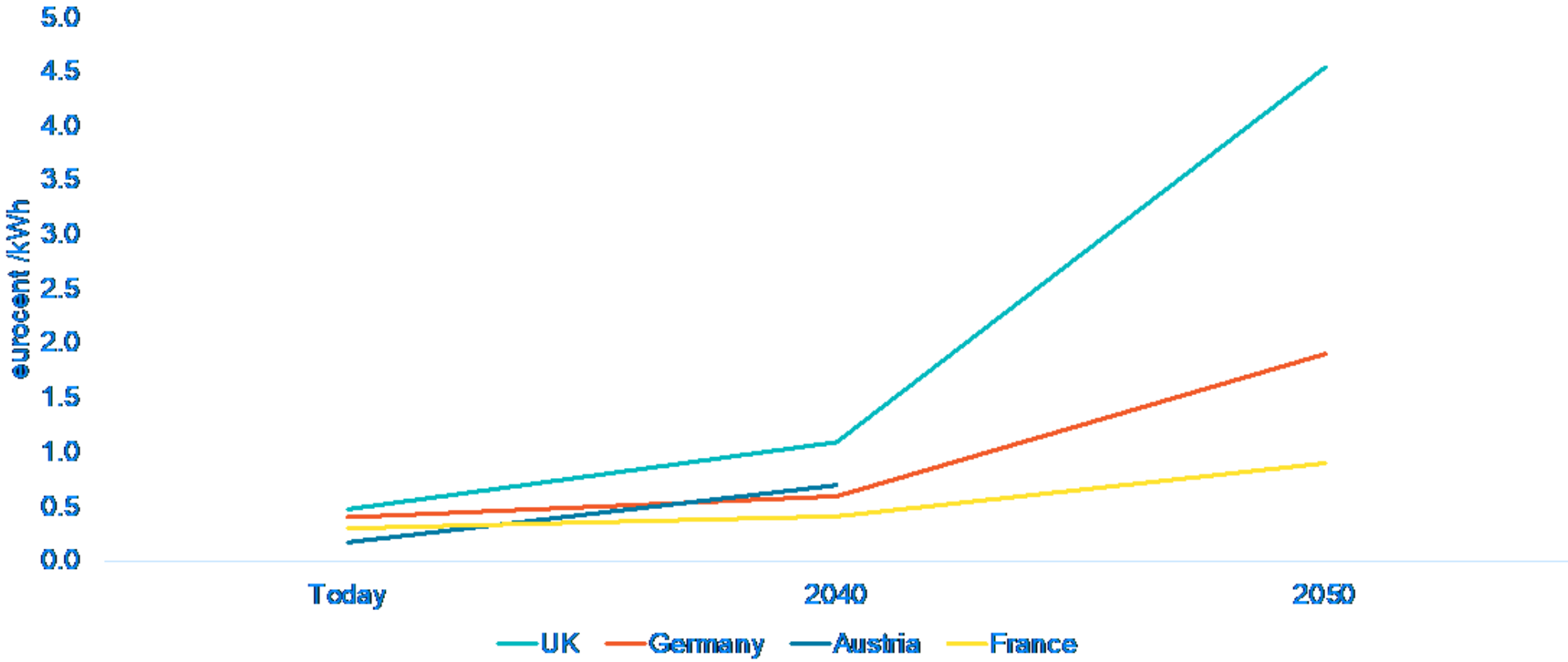
Publiziert: 26.10.2023 um 10:32 Uhr | Aktualisiert: 26.10.2023 um 16:27 Uhr

3

4

Impact on gas grid fees

Rising gas grid fees projected across Europe



Sources: based on Ofgem (2023) from three decarbonisation scenarios (Consumer Transformation, Leading the Way, System Transformation); Germany and France: based on Bouacida et al. (2022); Austria: based on Zwickl-Bernhard et al. (2024)

THE LOCAL fr

NEWS PODCASTS MOVING TO FRANCE ESSENTIALS LANGUAGE HOMES JOBS IN FRANCE

Money

Gas bills to increase in France this summer

The Local France - news@thelocal.fr
Published: 5 Feb, 2024 CET. Updated: Mon 5 Feb 2024 11:08 CET

1 comment

“If we spread the cost of using the network amongst a smaller group, inevitably each consumer ends up paying a little bit more.”

Emmanuelle Wargon, President of the French Energy Regulatory Commission (CRE)

Louise Sunderland
Managing Principal, The Regulatory Assistance Project (RAP)

Getting off gas: future risks for energy poor households

The gas package and renovation wave in the European Green Deal raise new opportunities for ending Europe's dependence on gas. We need to think about what this means for energy poor households, writes Louise Sunderland from the Regulatory Assistance Project

15 July 2020 6 min. 2 shares

The views expressed are those of the author and do not necessarily reflect the position of FORESIGHT *Climate & Energy*

ener|gate
messenger english edition

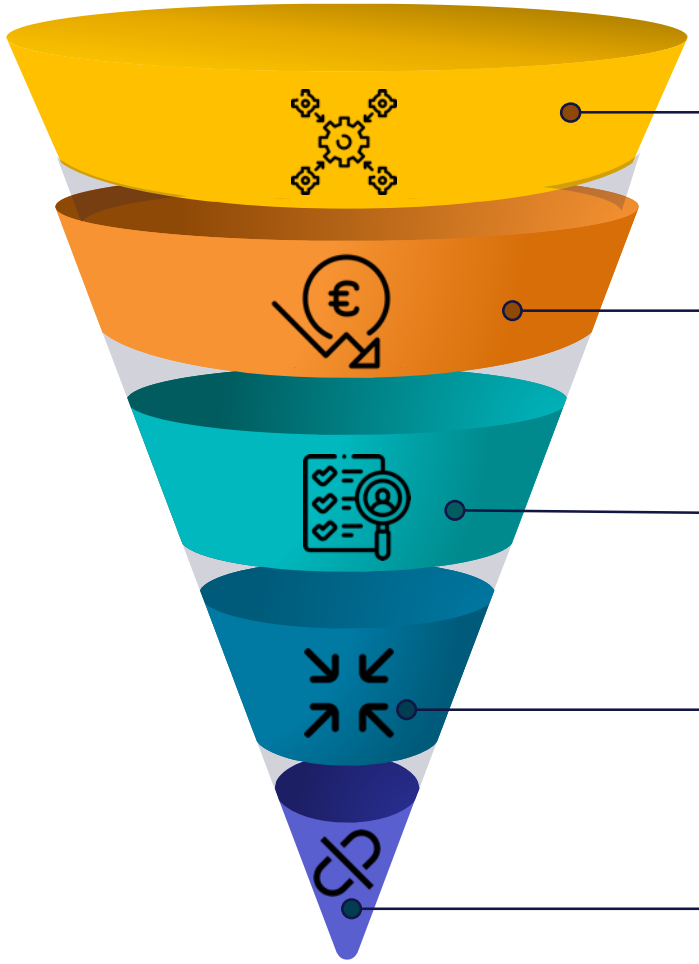
Enet evaluation

Electricity grid fees surprise, gas grid fees explode

5

A way out

Regulation to deal with gas grid decline



INTEGRATED PLANNING

Carry out integrated planning across gas, electricity and district heating infrastructure.

SET APPROPRIATE DEPRECIATION RATES

Carry out a recalibration of depreciation rates in line with expected gas demand reduction between today and future target dates for net zero emissions.

DEFINE CRITERIA AND THRESHOLDS FOR DECOMMISSIONING

Define criteria and thresholds above or below which the grid operator should be able to no longer supply customers or disconnect them from the grid (e.g. number of customers/km, MW/km, MWh/km, MWh/km^2).

MINIMISE CAPITAL INVESTMENT

Ensure capital investment is minimised to a level required to maintain network integrity in areas where the gas grid is still being used.

FUND DISCONNECTIONS AND DECOMMISSIONING

Establish funding mechanism for gas network disconnection and decommissioning.

Source: Rosenow et al. 2024

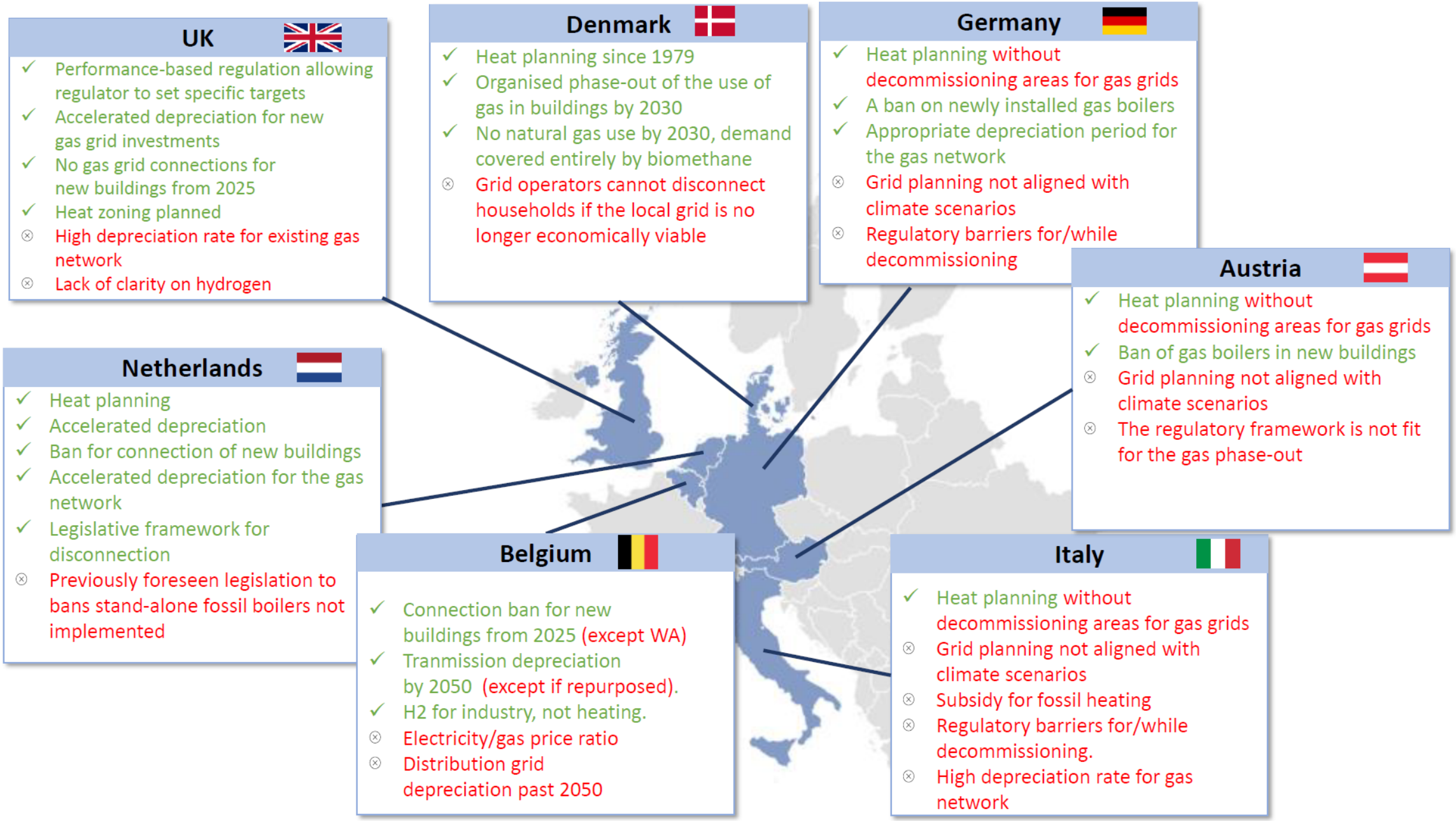
Heat planning

EU Energy Efficiency Directive: mandatory heat planning for towns >45.000

UK moving to heat zoning

But, this will require:

- National level support
- Standardisation and monitoring
- New legal powers for local authorities
- Capacity building



Source: RAP/Oeko-Institut forthcoming

6

Wrap up

Wrap up

1. Under-researched topic
2. Complex as part of wider energy systems analysis
3. Lack of understanding amongst stakeholders
4. Fast moving policy landscape

About RAP

Regulatory Assistance Project (RAP)® is an independent, global NGO advancing policy innovation and thought leadership within the energy community.

Learn more about our work at raponline.org

Dr Jan Rosenow
jrosenow@raponline.org

Posterchild Denmark

- heat planning and zoning since 1979 through Heat Supply Act
- Danish government set up a decommissioning fund to cover costs associated with removing gas supplies from homes, anticipating all homes switching to heat pumps or heat networks by 2030
- Danish government bought back the gas grid now owned by ministry of finance

In second place: Netherlands

- distribution system operators are permitted to depreciate investments in their grids on a degressive basis (paying off early) recognising a shrinking grid
- gas distribution system operators receive compensation for the costs of dismantling the gas distribution networks and for removing connection points
- mandatory local heat planning at municipality level

Early beginnings: Germany

- mandatory heat planning at municipal level from 2026
- where no future gas grid is foreseen households will no longer be able to connect new or replacement heating systems to the grid (applies to new and existing buildings)
- Energy regulator consulted on gas use decline and potential regulations for dealing with the impacts this has

Better late than never: UK

- Ofgem decided to follow accelerated depreciation for new gas grid investments in line with net zero 2050 target
- this might be applied also to the existing distribution grid but transmission may be exempt as Ofgem sees need for future use
- to address uncertainty about hydrogen and the gas grid in particular so-called “re-openers” provide the option to modify the price control framework during the next period in case of major events (e.g. decision on hydrogen)