



IMPACT OF GREEN GAS IMPORTS ON INFRASTRUCTURE INVESTMENTS

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ENERDAY, April 2021

BUSINESS AREAS



Trading & sales

Transport

Storage

Biogas

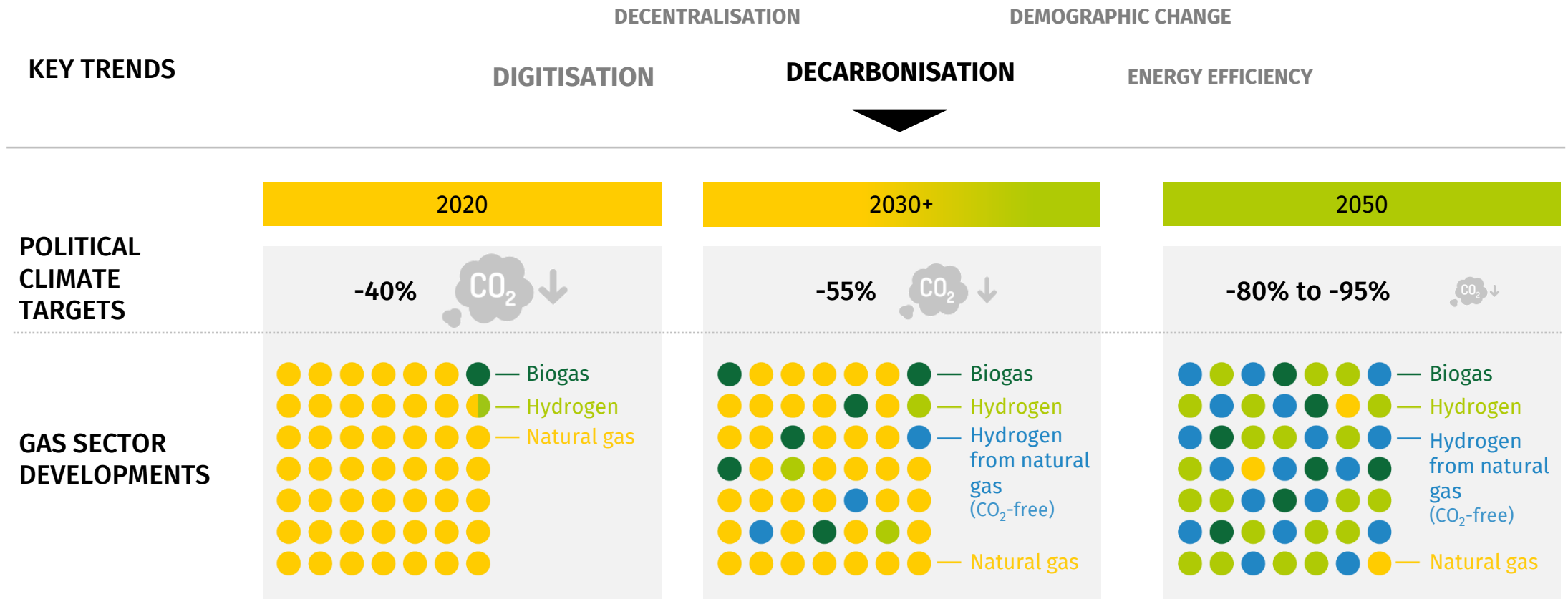


> BALANCE

New business

Green gases | Digital infrastructure

STRATEGY VNG 2030+



WHAT VNG IS DOING

VNG aims, within the framework of its core competencies – especially in the field of infrastructure – to play a **significant role** in the value chain for **climate neutral gases**. This will also lead to opportunities for **regions of Eastern Germany undergoing structural change**.



AGENDA

- ▶ Motivation – Green Gas
- ▶ Methodology – GAMAMOD-EU.sto
- ▶ Results on investment decisions
- ▶ Conclusion and discussion

DISCLAIMER



This talk reflects the view of the author only and does not necessarily represent the view of VNG AG

Erdgas-BRidge

Erdgas - Bedeutung und zukünftige Rolle in der deutschen Energiewende; Teilvorhaben:
Weiterentwicklung der Modelle ELTRAMOD und GAMMAMOD (FKZ: 03ET4055A)

Partners: Technische Universität Dresden (EE2), Energiewirtschaftliches Institut an der Universität zu Köln (EWI)

Duration: 2018-2020

Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages

TransHyDE

Developing, assessment and demonstration of hydrogen transport technologies.

Partners: VNG AG in cooperation with more than 60 other partners (industry/research)

Duration: 2021-2025



GREEN GAS AS AN ENABLER

to achieve climate objectives on all political levels



Global

Paris Climate Agreement,
2015



Europe

Green Deal, European
Hydrogen Strategy



Deutschland

National Hydrogen
Strategy

Renewables are the main source for the future sustainable energy system and to achieve the carbon dioxide reduction targets that are proposed on all political levels. However, a pure „all-electric“ will probably not ensure a reliable energy system. For that reason, the **integration of climate neutral gases** – hydrogen – into the design of our energy systems is needed.

RESEARCH QUESTION

The Green Deal provides a strategy to react on gas source dependence in two ways.

1. First, it diversifies suppliers as the introduction of Green Gas production facilities enables new supply countries to enter the gas market.
2. Second, it substitutes fossil natural gas by a new defossilized fuel, namely hydrogen.



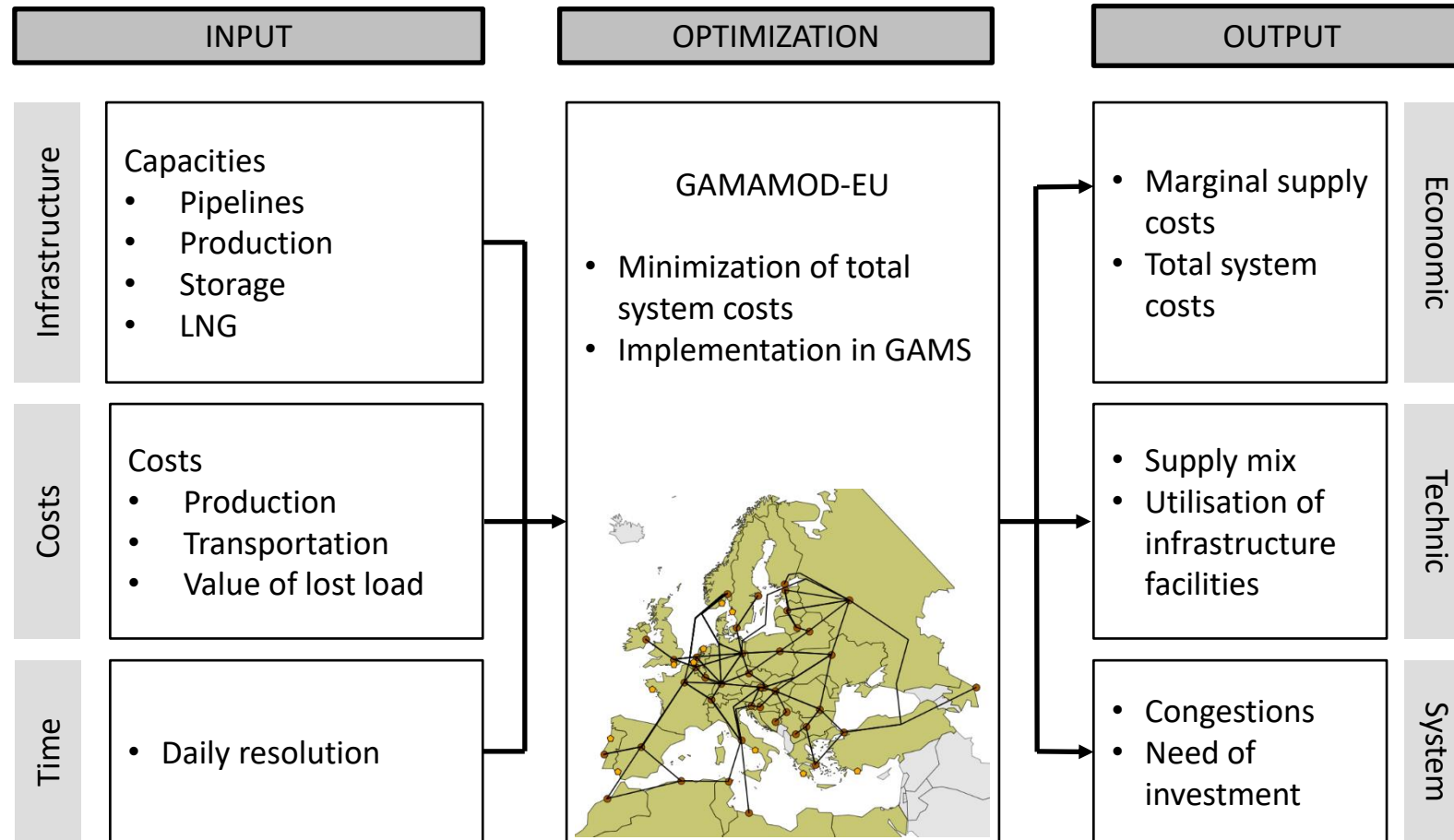
What is the impact of Green Gas on making investment decisions in gas infrastructure and for providing Security of Supply in the European gas markets?

GAMAMOD-EU



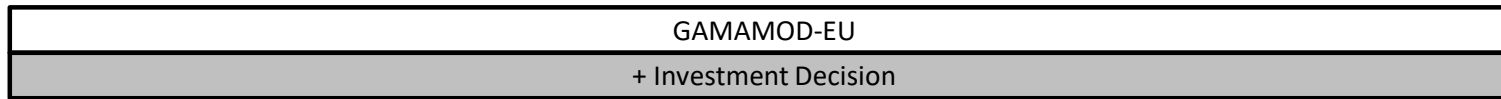
A GAS MARKET MODEL FOR EUROPE

GAMAMOD-EU, a fundamental bottom-up linear optimization model



STOCHASTIC OPTIMIZATION

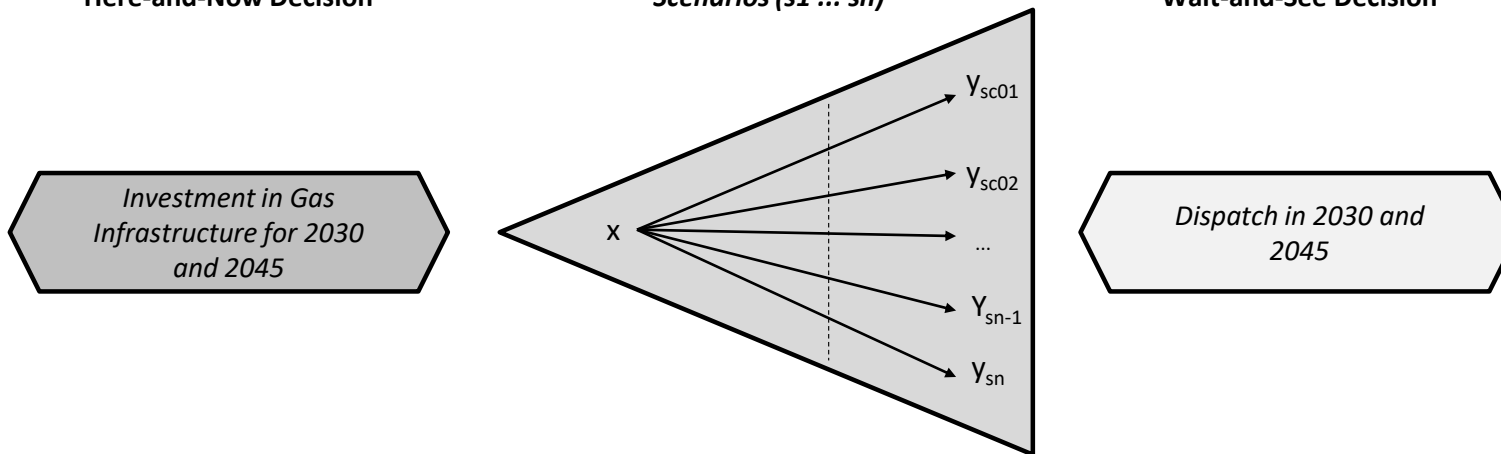
Model extension to GAMAMOD-EU.sto



First Stage:
Here-and-Now Decision

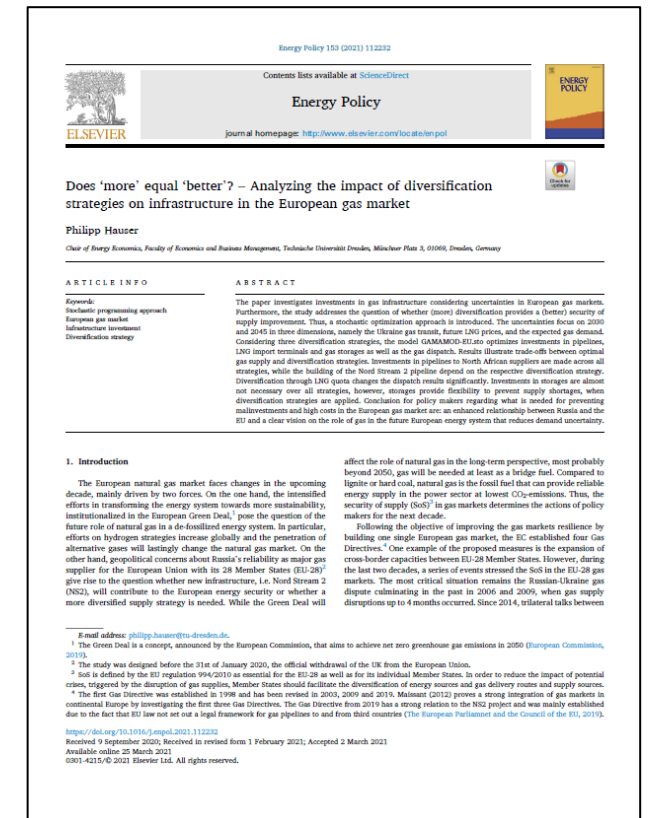
Uncertainty covered by
Scenarios (s1 ... sn)

Second Stage:
Wait-and-See Decision



Scenario parameters:
Demand, Ukraine Transit, LNG Price

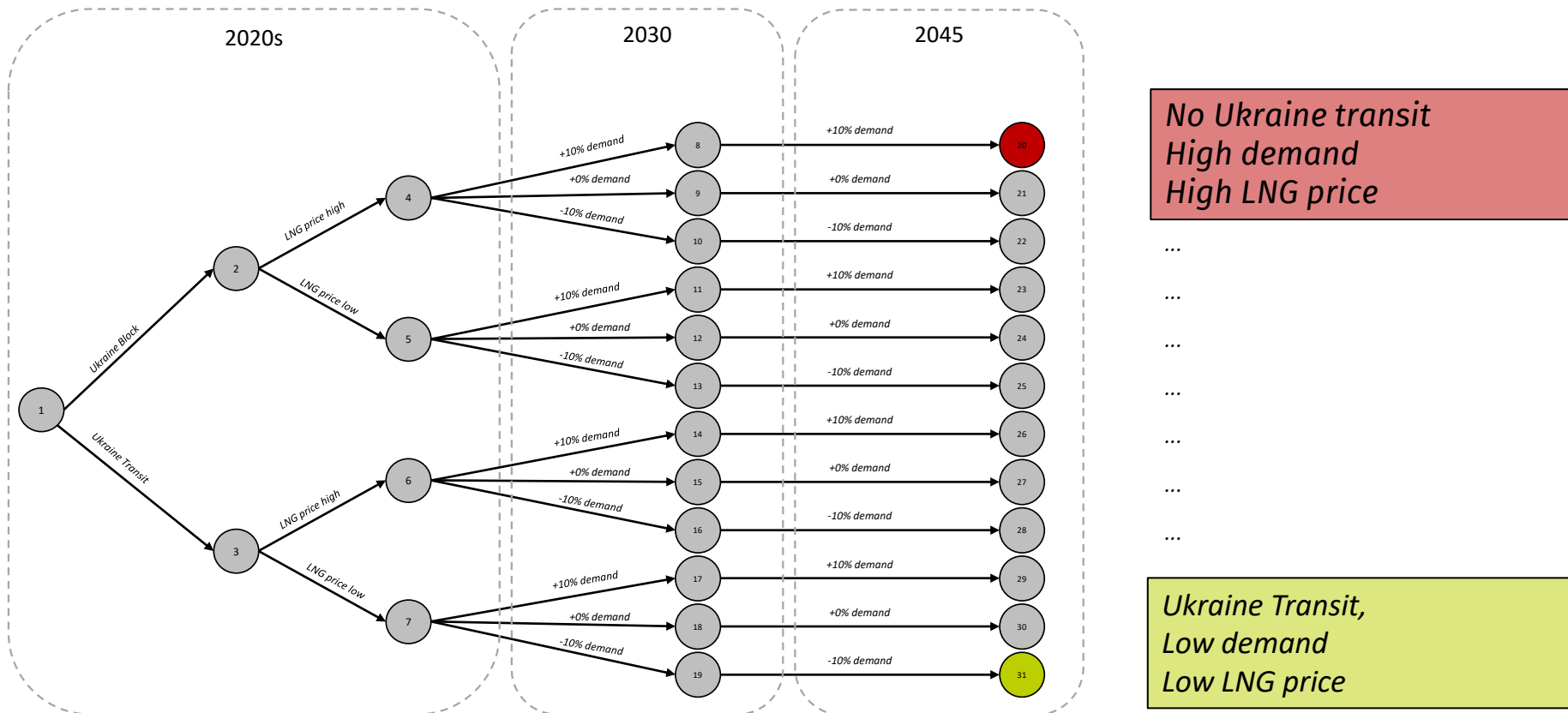
- Investment decision in LNG import terminals, pipelines and storages
- New: investment in Green Gas facilities
- Consideration of uncertainties: demand, transport route, LNG price



Hauser (2021) Does 'More' Equal 'Better'? – Analyzing the Impact of Diversification Strategies on Infrastructure in the European Gas Market; Energy Policy, Volume 153, 2021, <https://doi.org/10.1016/j.enpol.2021.112232>

UNCERTAINTIES

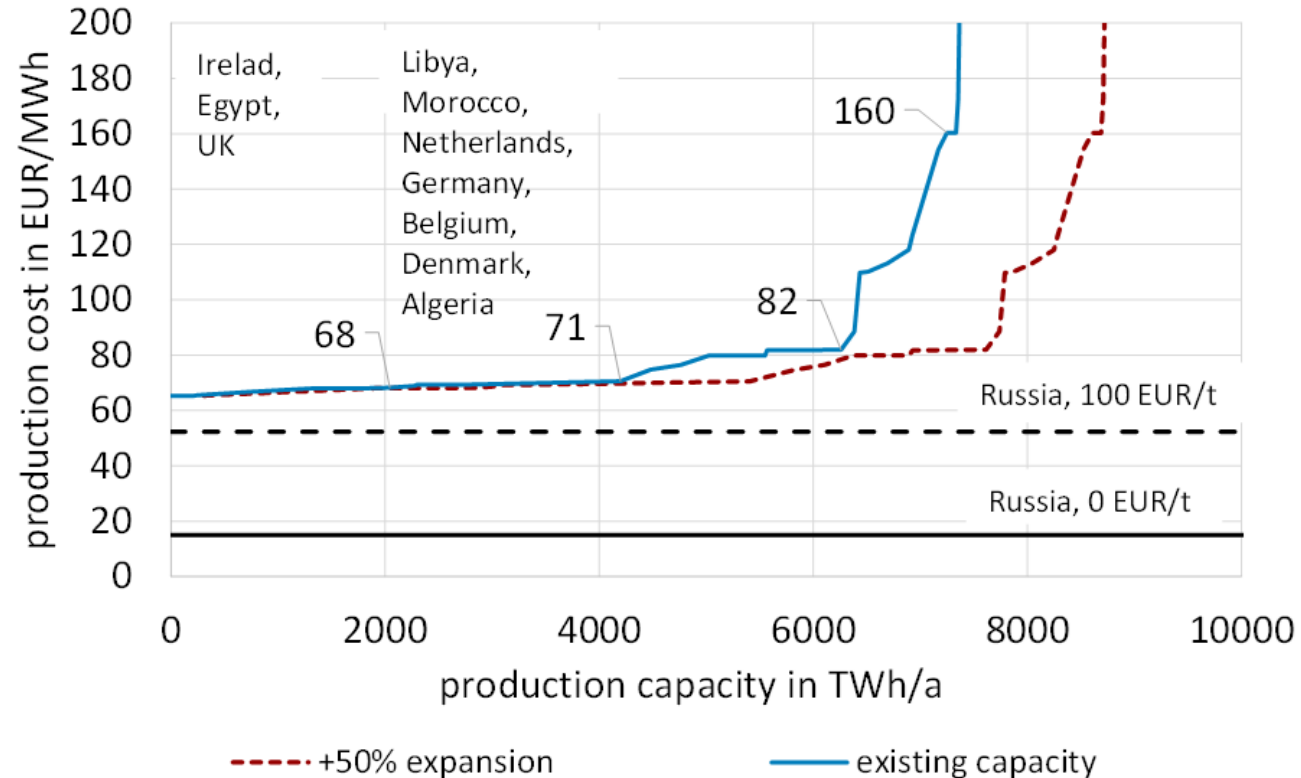
The European gas market faces a bundle of uncertainties in the upcoming decades.



- Three levels of uncertainties
- Combination leads to 12 scenario with equal probability
- Model decision considers the realization of all scenarios simultaneously

PRELIMINARY CONSIDERATIONS

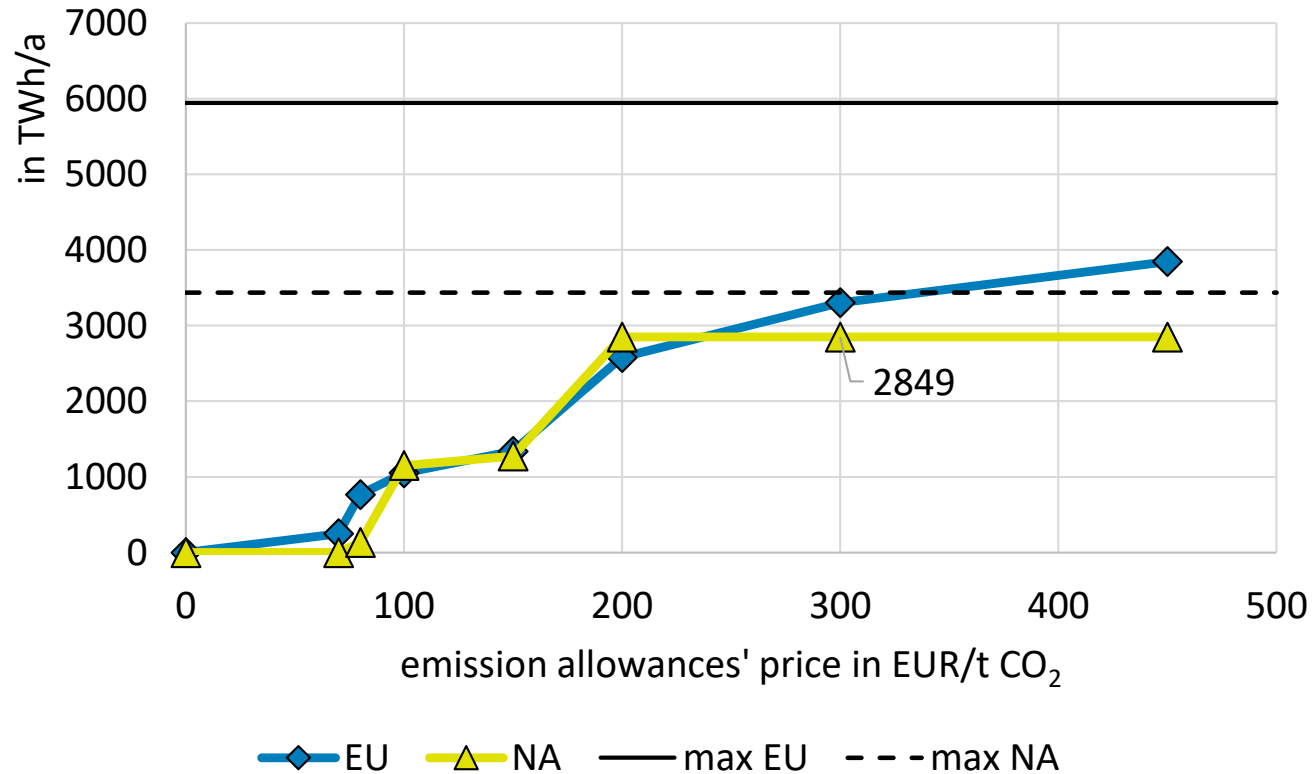
Where will the Green Gas come from?



- Consideration of renewable potential in Europe and North Africa
- Limiting factor is a) the RES potential or b) the pipeline capacity
- Green Gas has to compete with natural gas → a high CO₂ price is needed

RESULTS ON GREEN GAS PRODUCTION

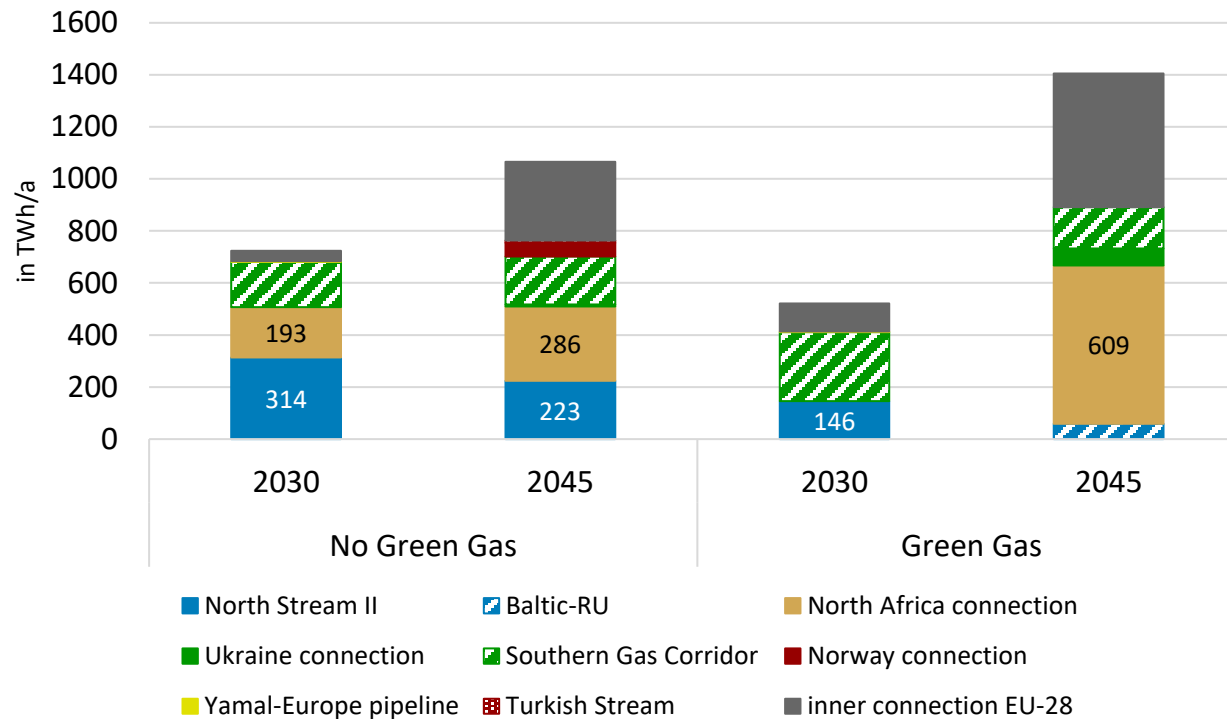
... in relation to the CO₂ price



- European RES potential will probably not completely available for electrolyzers
- North African hydrogen can be expected when CO₂ price rises above 200 EUR/t

RESULTS ON PIPELINE INVESTMENTS

... importing Green Gas shifts investments from Nord Stream II to North African pipelines



- Left: without Green Gas option → focus on Nord Stream II
- Right: with Green Gas option → focus on North African pipeline connections

CONCLUSION AND DISCUSSION

- **Climate policy** activities on all political levels encourage the realization of Green Gas projects
- Future **Green Gas demand** will be supplied also by imports that change the traditional natural gas importing routes and impacts decisions for new gas infrastructure
- The model **GAMAMOD-EU.sto** provides an approach to investigate the impact of Green Gas imports on investment decisions in gas infrastructure and dispatches by taking gas market uncertainties into account
- **The CO2-price** is one of the major driver for Green Gas imports and a price level of 200 EUR/t CO2 will lead to higher shares of imports from North Africa
- Future analysis should extend the analysis to **further potential supply regions**, e.g. the Middle East

Besides the tasks for improving the technology and economic conditions of Green Gas production and using, the major current challenge is **to ensure the social and political acceptance for hydrogen as an enabler in the ongoing energy transition.**

**THANK YOU FOR YOUR
ATTENTION!**

