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**FSR** ENERGY

Florence School of Regulation

# 3rd AIEE Energy Symposium

## Session 10: The union of national energy markets

### **“Sector Coupling: the New EU Climate and Energy Paradigm?”**

Maria Olczak, Andris Piebalgs  
Florence School of Regulation

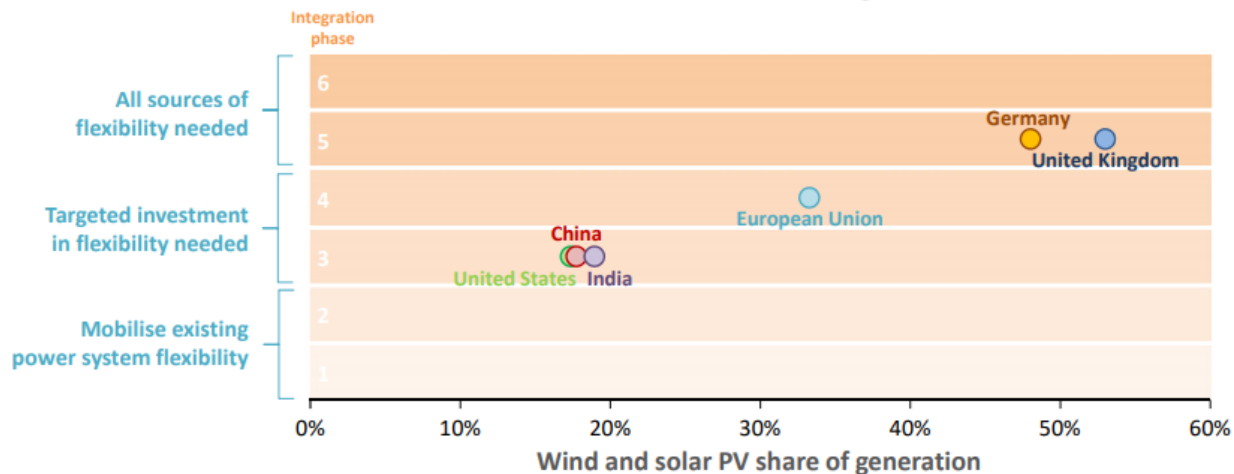
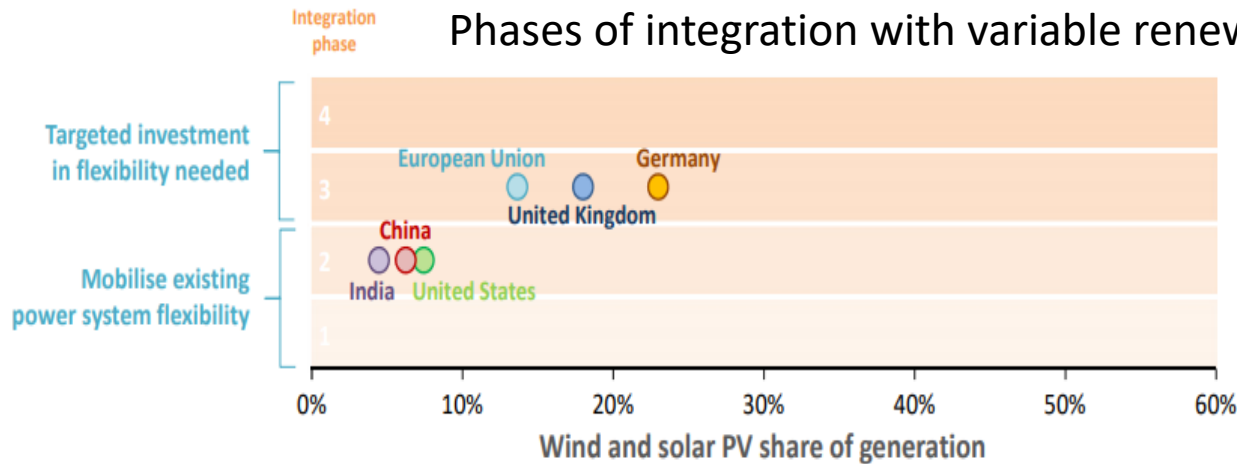
# Sector Coupling: the New EU Climate and Energy Paradigm?

Introduction

Methodology

Results

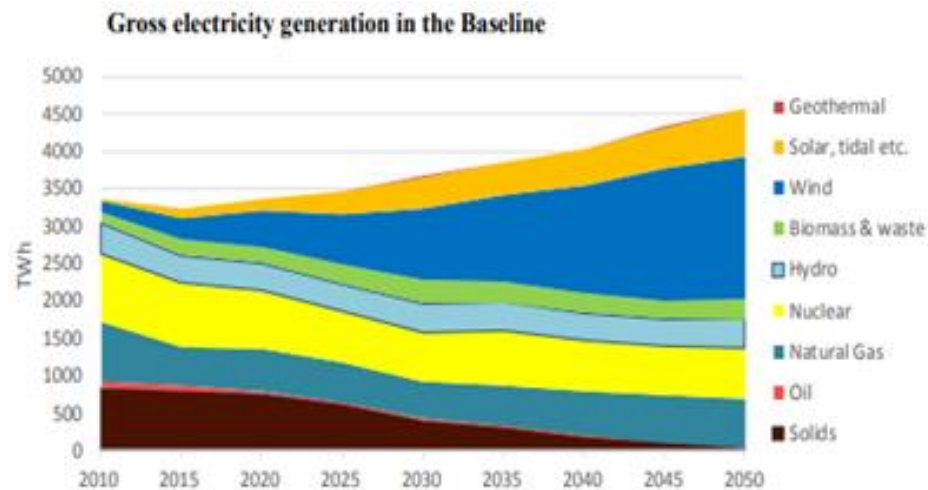
# WEO18: the rise of VRE makes the flexible operation of power system a key challenge



Currently, conventional power plants are the main source of system flexibility. Followed by new interconnections, storage and Demand Side Response (DSR).

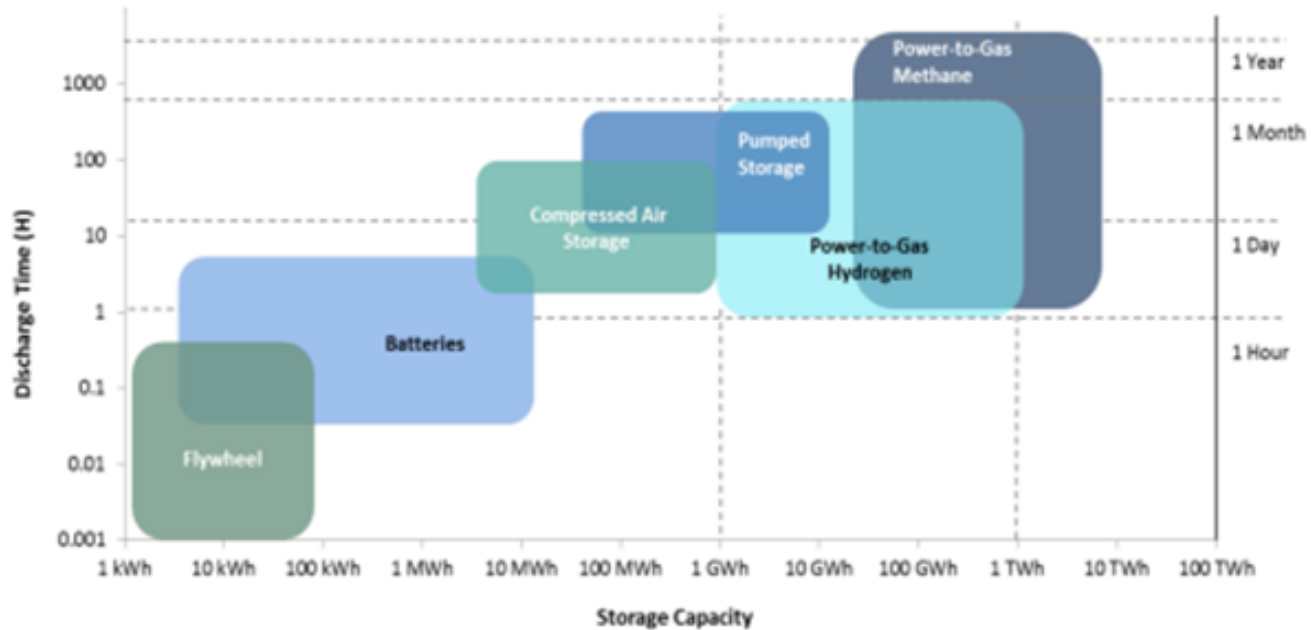
# EU strategy for long-term emissions reduction

- Building block: renewables and electrification
  - >80% of electricity from RES by 2050
- Electrification of demand (heating&cooling, transport)
  - need for high deployment of storage - 6 times current levels



Source: Eurostat (2010, 2015), PRIMES.

# Overview of storage technologies



Source: European Commission (2017), *Energy storage – the role of electricity*<sup>178</sup>.

# EU 2050 long-term strategy: how the climate policy objectives impact the functioning of the EU energy system?

- Integration of the rising share of VRE and the increased seasonality of power demand.
- Greening the gas grids in a way allowing to utilize the value of existing gas assets.
- Decarbonisation of end-use sectors (transport, heat) and the industry.

How to enable the transformation towards the net-zero GHG economy?

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# Research question

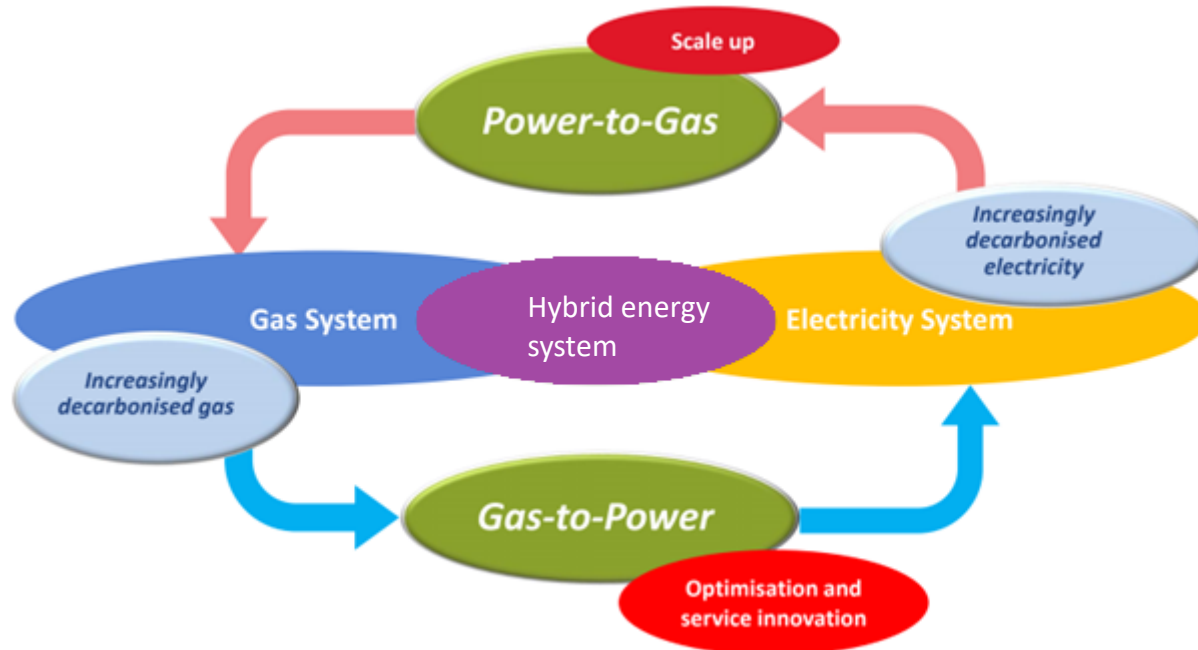
- How can we characterise sector coupling?
- How can we translate the concept of sector coupling in the EU energy and climate policies and regulation?



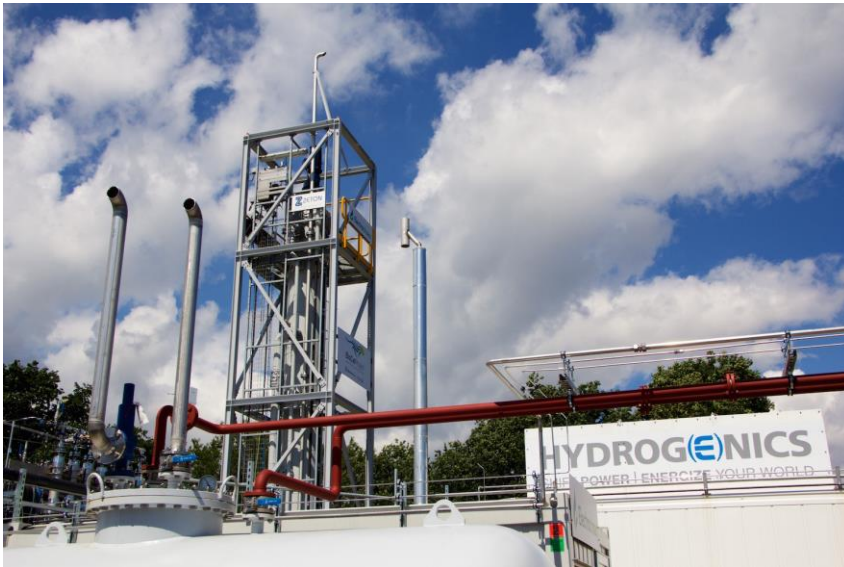
# Sector coupling

- IRENA, OECD/IEA and REN21 (2018): the concept of “sector coupling” encompasses **co-production, combined use, conversion and substitution of different energy supply and demand forms** – electricity, heat and fuels.
  - Sector coupling **binds together power and end-use sectors** to integrate the rising share of VREs
  - **News links are created between energy carriers** and the respective transport infrastructure – electricity is used to produce hydrogen (electrolysis) and synthetic methane (methanation) that can serve to provide energy service through technologies such as Power-to-Gas (P2G), Power-to-Liquid(s) (P2L) or Power-to-Heat (P2H).-> **indirect electrification**
- taxonomy on sector coupling is missing – the difference between “sector coupling” and “sector integration”?
- Definition is a matter of a political decision?

# Electricity and gas systems integration in practice



# PtG projects



## BioCat project (Denmark)

Status: operational since 2017

Project partners: Electrochaea GmbH, Hydrogenics Europe N.V., Audi AG, NEAS Energy A/S, HMN Gashandel A/S, Biofos A/S, Inero Business Services A/S



## WindGas Falkenhagen

Status: operational since 2013

Project partners: E.ON SE, Swissgas AG, Hydrogenics

Source: Vartiainen, 2016

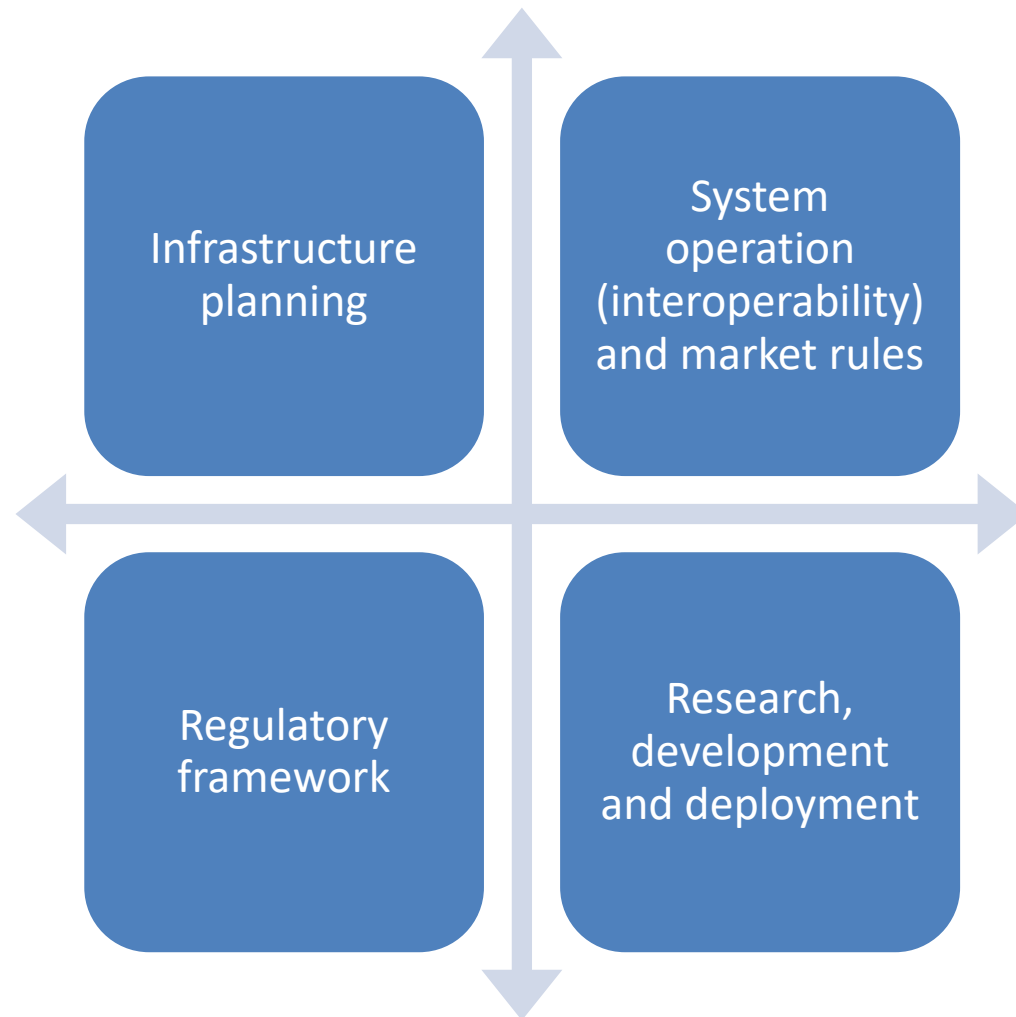
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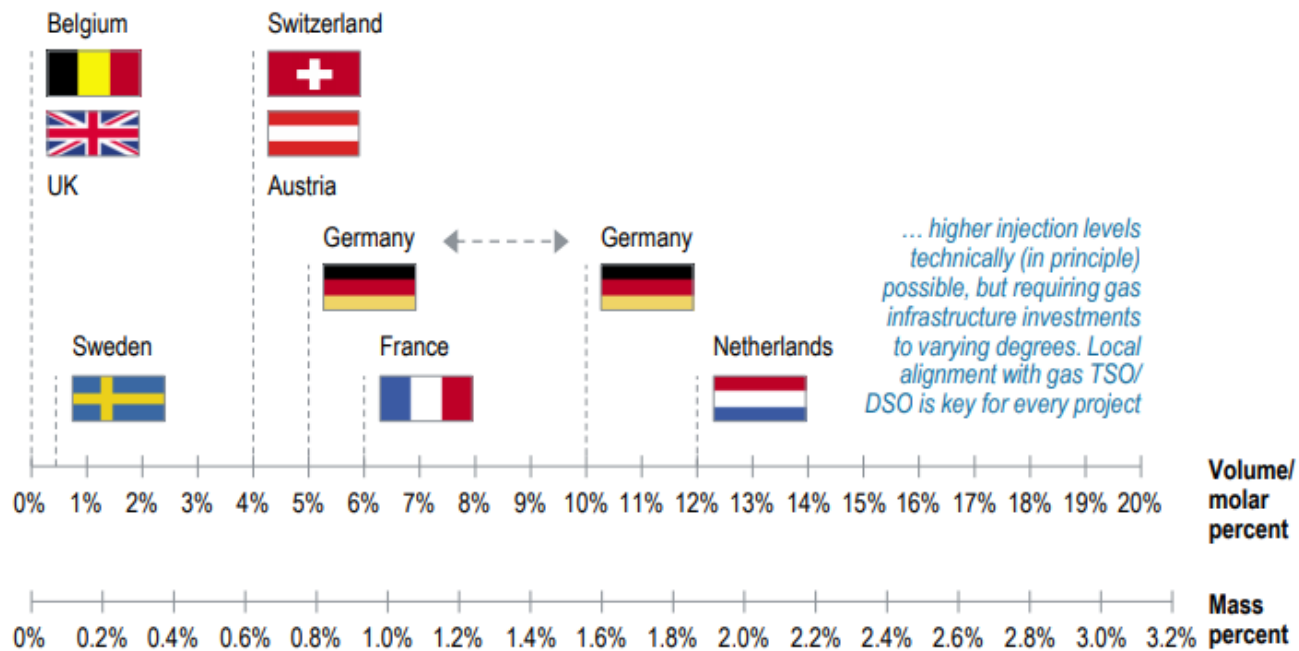
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# Sector coupling – the building blocks:



# The maximum blend level / H2 injection limit in the EU



Source: Hinico, Tractebel ENGIE, ITM Power, FCH2 JU, Roland Berger

# Recommendations:

- **Infrastructure planning**
  - Power-to-Gas installations in TYNDP process
  - The interlinked model
- **System operation and market rules**
  - Electricity price structure
  - Electrolysis = end-use or process?
  - Ancillary services
  - Gas quality considerations could constitute a barrier to cross-border trade
- **Regulatory framework**
  - Unbundling rules applicable to energy storage
  - Common Target Model for Electricity and Gas
- **Research, development and deployment**
  - Capital cost reduction
  - Role of the industry and shared infrastructure

# Thank you for your attention

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