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Technical Association of the European Gas Industry

Power to Gas: Energy System Storage under System Integration

Manuel Coxe – MARCOGAZ Secretary General

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I. Presentation Outline

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  - Geographical Power Imbalances
  - Increasing Share of RES and Limitations
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  - Electrification and Gaseous Systems for End-Use
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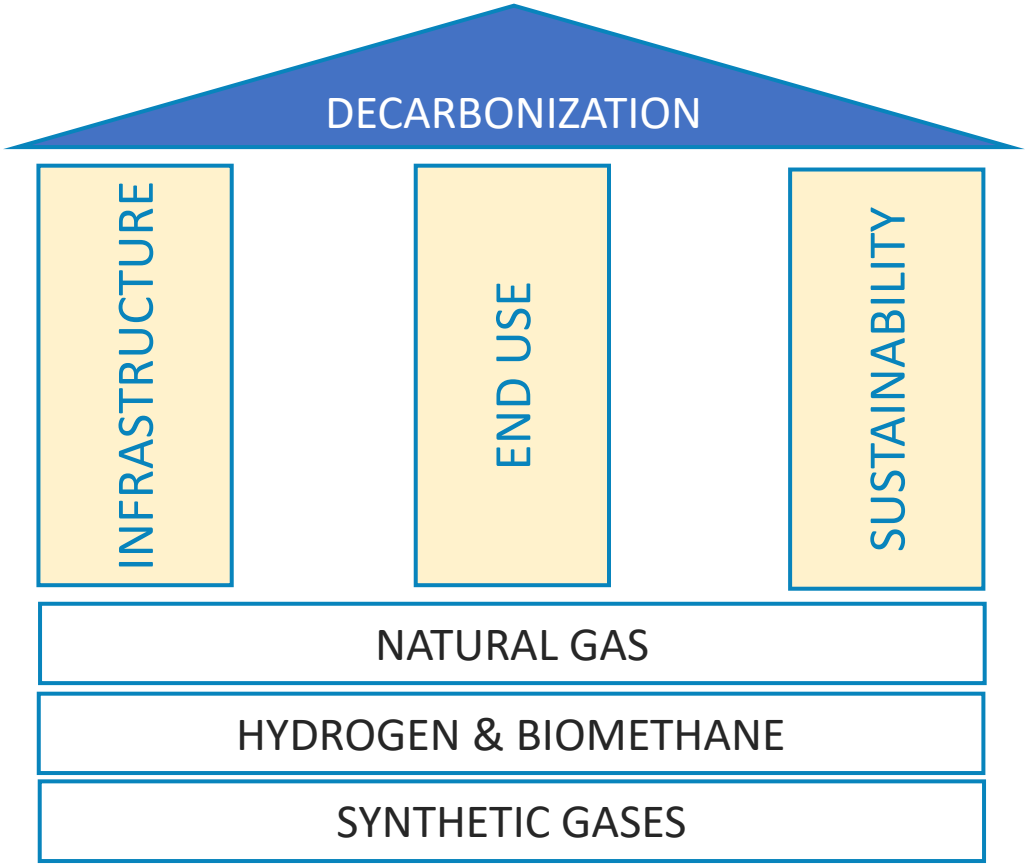
II. About MARCOGAZ

MARCOGAZ is the technical association of the European gas industry

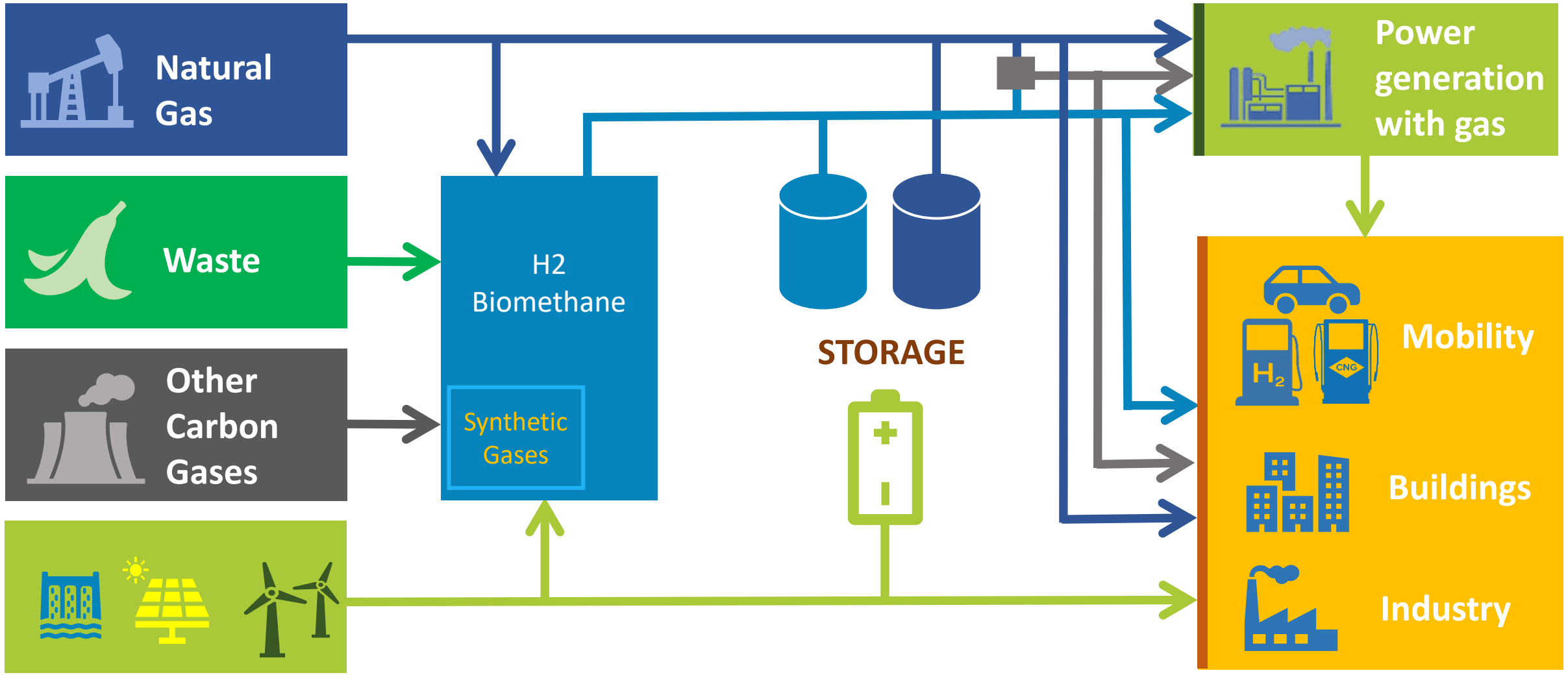


53 YEARS

30 MEMBERS

20 COUNTRIES

III. Power to Gas and Gas to Power



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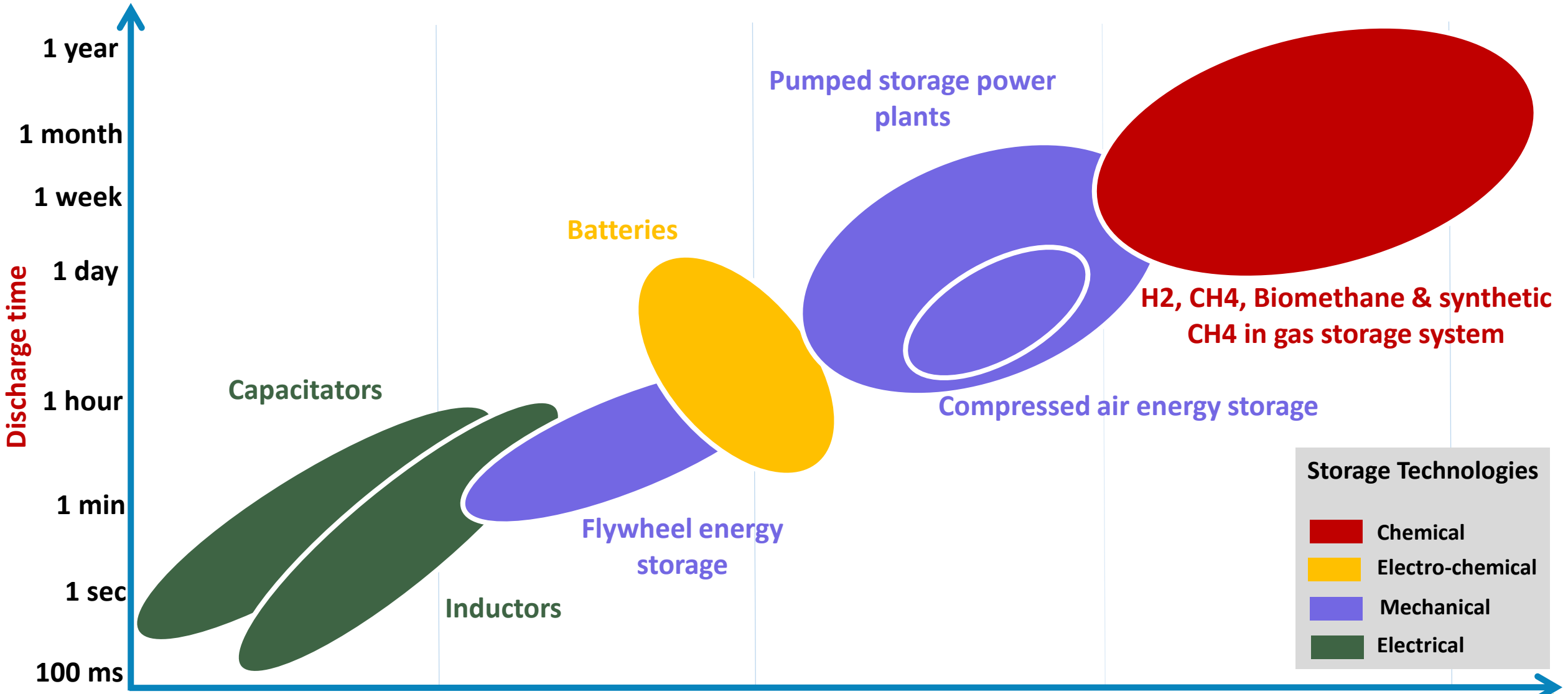
IV. Storage



Source: Frontier Economics based on Sterner and Stadler, 2014

V. USE CASES

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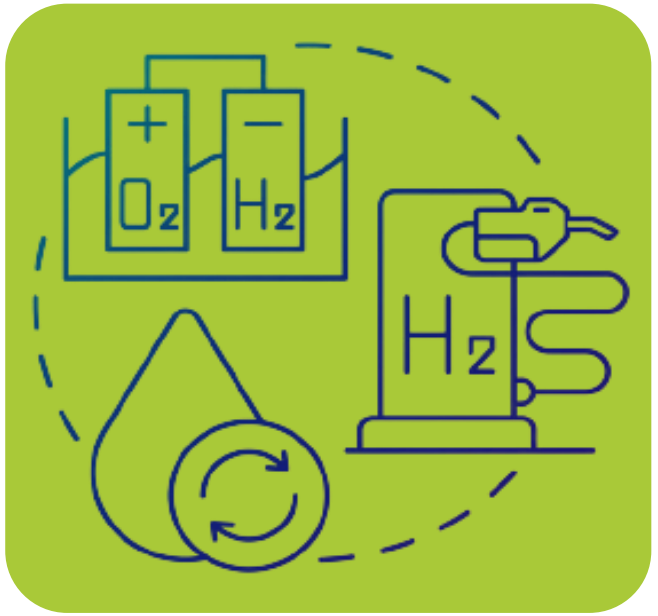
Use Case 1 – Surplus Electricity Generation

- Storing surplus power as gas is technically viable.
- Storage of Biomethane is feasible for the existing natural gas storage systems while underground storage of Hydrogen is technically feasible in salt cavern.
- Surplus electricity generation may lead to lower or negative electricity prices, hence allowing the production of renewable gas at affordable costs that can be stored.
- P2G2P produce loss of energy in the conversion process (using electricity to produce hydrogen by electrolysis, storing the hydrogen, and then converting it back to electricity by using a gas turbine and a power generator, is a process that has an energy efficiency rate of less than 40%, i.e. >60% of energy losses).



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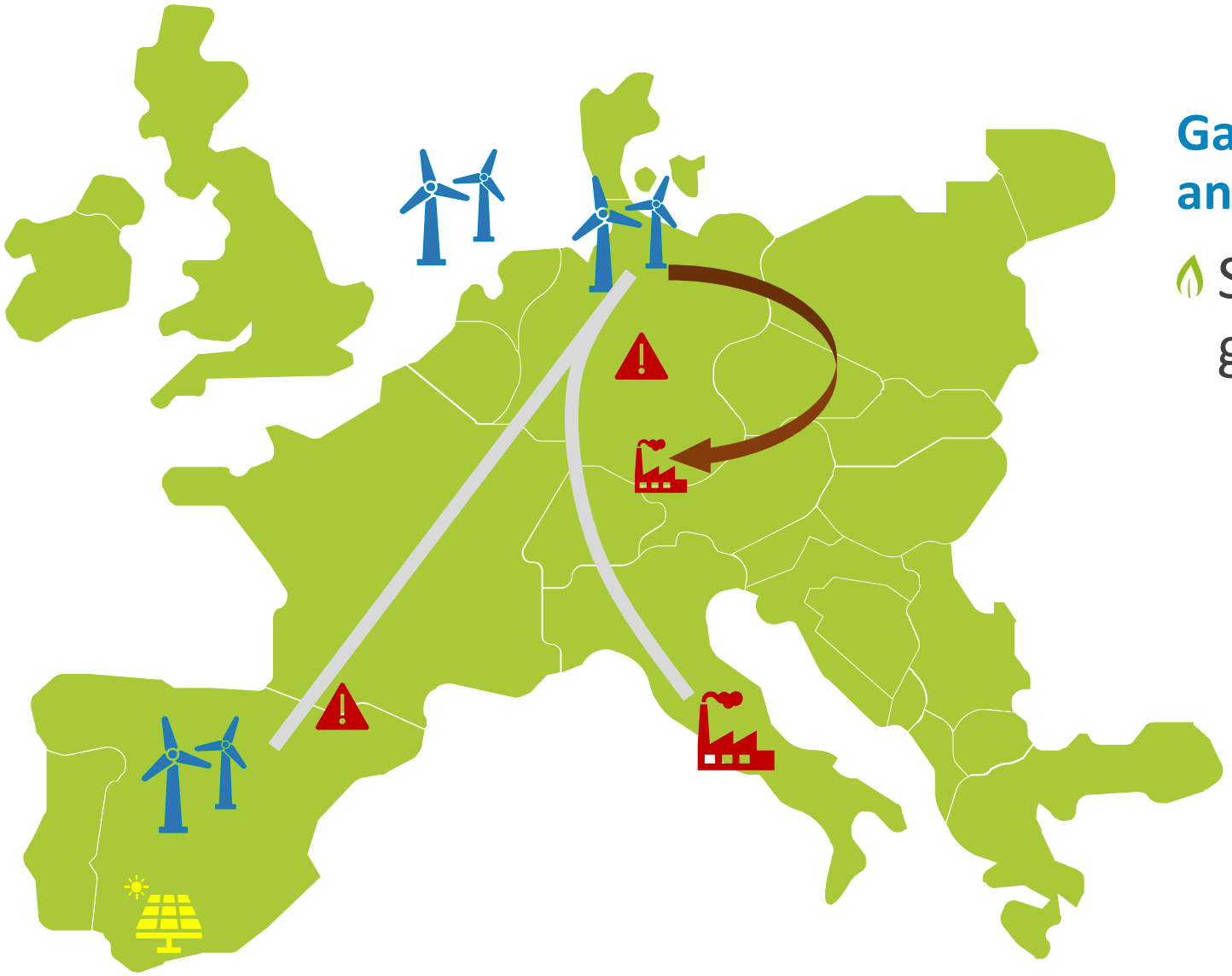
Use Case 2 – Geographical imbalances



Gas infrastructure as an energy storage and transmission system:

- Store and transport energy in gaseous form can reduce:
  - Internal power grid congestion
  - Electricity HV cross-border congestion
  - Power Loop-Flows
  - Power grid losses
  - The need for offshore DC power system
  - Additional power grid investments

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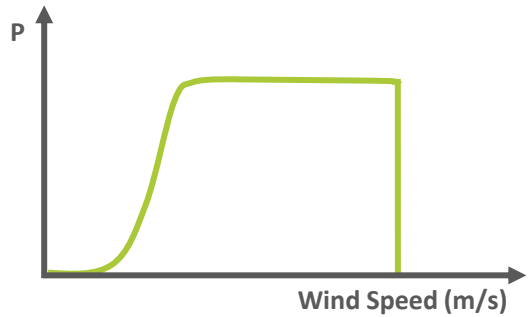
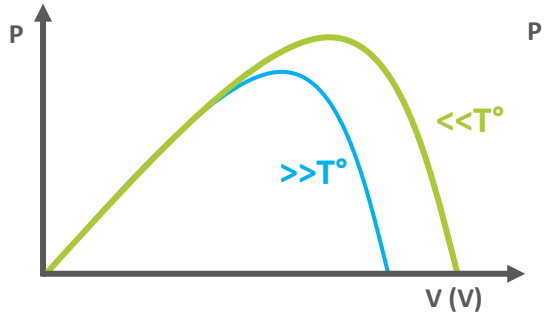
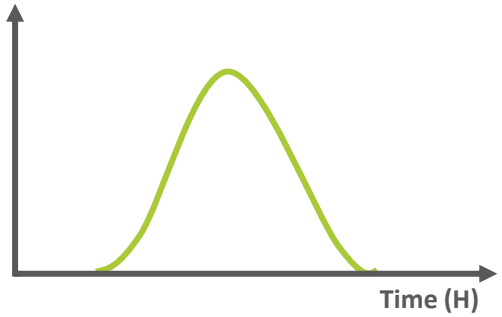
Use Case 3 – Increasing Share of RES and Limitations

WIND POWER

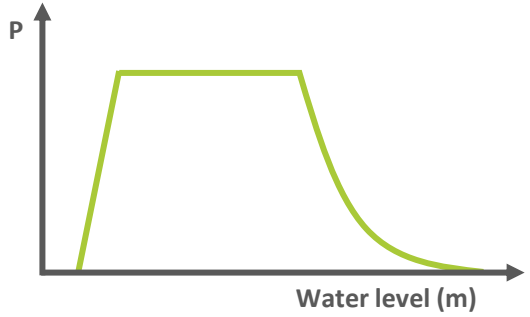


SOLAR POWER





HYDRO POWER



Electricity production through **Gas Turbines** has been, is and will be the solution to ensure primary, secondary and tertiary energy reserves

Hydrogen, Biomethane and Natural Gas storage infrastructure is already in place

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Use Case 4 – Intermittency of Renewables

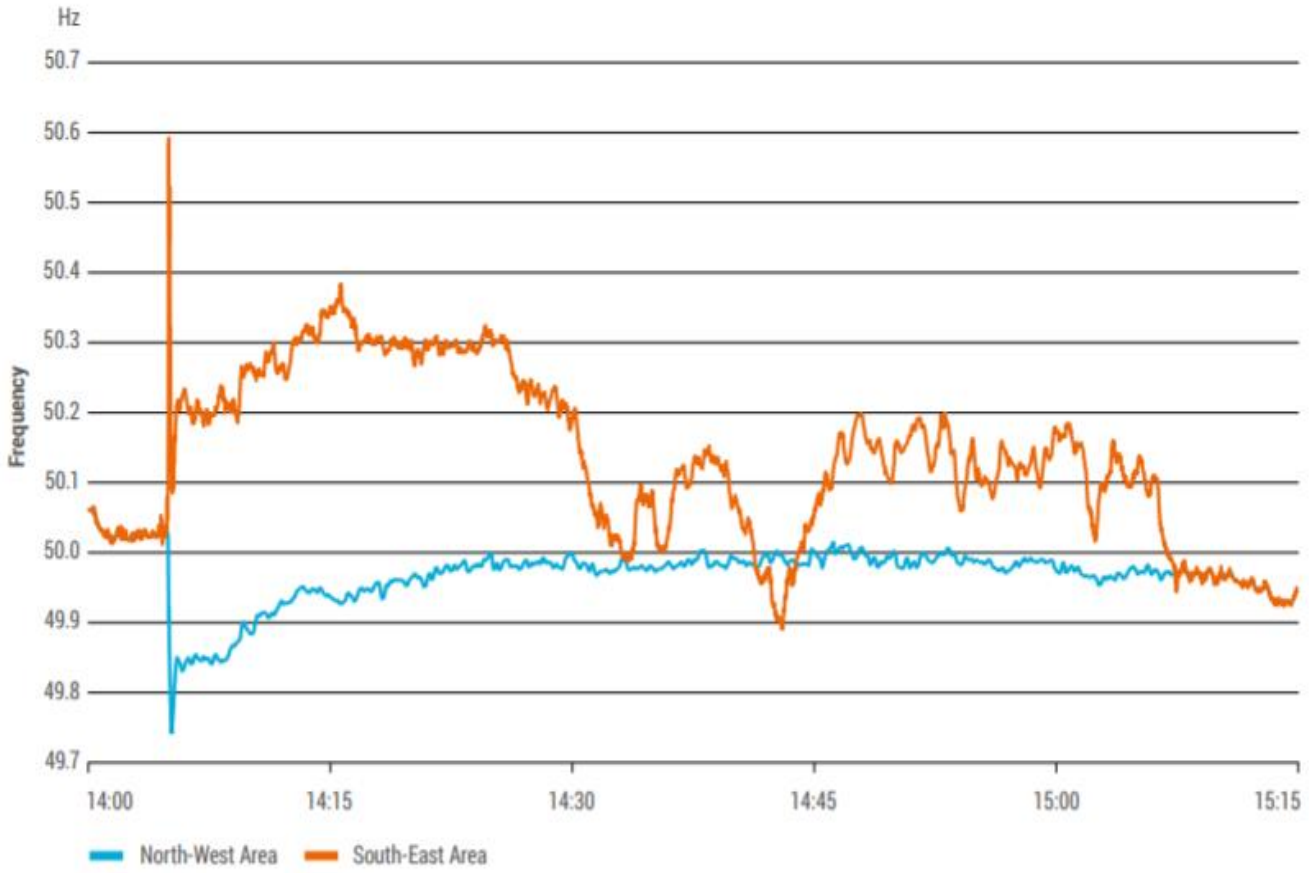

Figure 1: Frequency development during the system separation on January 8 2021
Source: ENTSOE, 2021

Gas thermal power plants ensure frequency regulation and stability of the power system

- **Maintaining grid inertia**
- **Quick response to intermittency of renewables**
- **Flexibility for not only power system but the whole energy system**
- **Boosting physical resilience of the energy system**

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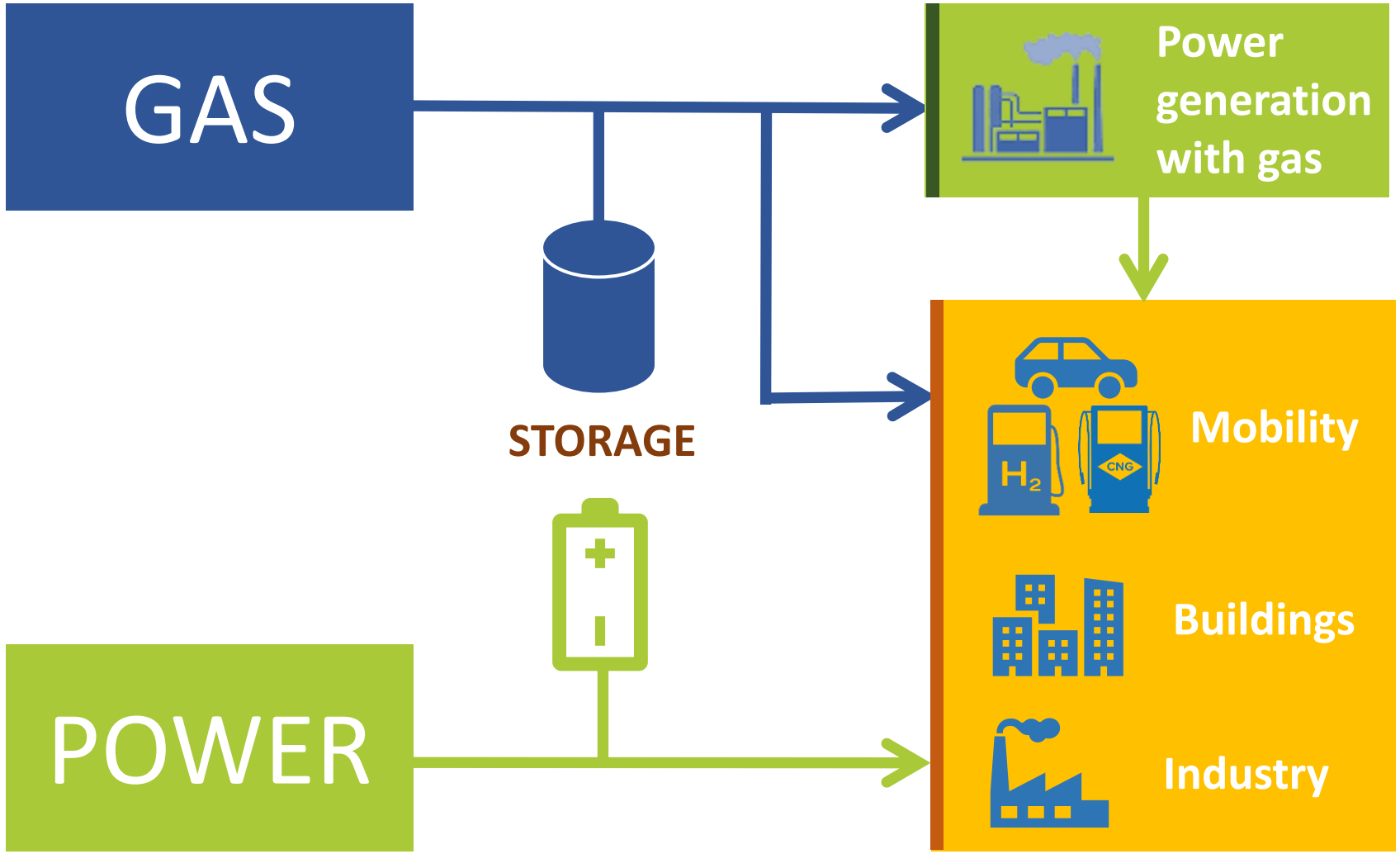
Use Case 5 – Electrification and Gaseous Systems for End-Use

A robust and resilient energy system is the one that relies on integrated power and gas systems

Decarbonization of energy system is reliable with the combination of electrification and use of renewable and low-carbon gases



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VI. Conclusion

Gas storage in the integrated energy system

- Well-established gas infrastructure across Europe and larger gas transmission capacity compared to electricity transmission capacity
- An infrastructure ready to deal with the intermittency of renewable energy generation
  - enhanced system integration
  - decreasing cost of balancing and congestion
  - increased flexibility, resilience
  - reduced need for grid extension
- Security of energy supply thanks to storing larger volumes of energy

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Thank you!

manuel.coxe@marcogaz.org

marcogaz@marcogaz.org | @marcogaz_EU

marcogaz.org | be.linkedin.com/company/marcogaz