



Natural gas: “the essential fuel for industry in a sustainable future”

Study Group 5.1 :Report overview & New opportunities for NG

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SG 5.1 - Report a world Survey of NG utilisations

- Economic & Technology review + industrial case studies

Industrial and Power Generation demands for Natural Gas Through 2040

High efficiency Natural Gas techno. for Industrial processes:

New Uses of Natural Gas in industrial processes

Gas to Power technologies review for centralized and decentralized power production:

Natural Gas Technologies for future "Low carbon footprint" Factories and for Future factories 4.0 :

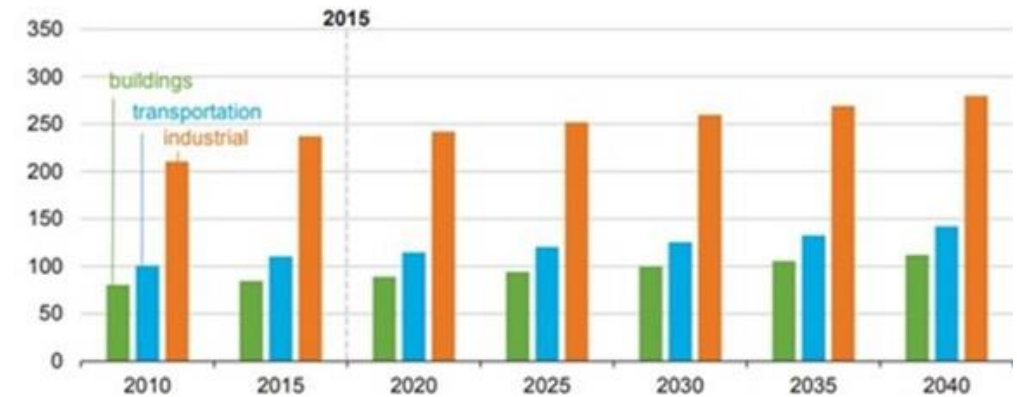
The impact of natural gas quality upon industrial gas utilization processes

The infographic features a central bar chart titled "Electricity generation capacity additions by source" showing projections for Natural gas, Renewables, Coal, and Nuclear from 2016 to 2030. A technical diagram shows a gas turbine cycle with components like "Turbina Vapor (Condensação)", "Queimador Gás Natural", and "Turbina Gás", with temperatures ranging from 400°C to 500°C. Images include an industrial facility at night, a large industrial reactor, and a natural gas processing plant.

SG 5.1: Challenges for Industries for the Future

- Industrial sectors continue to account for the **largest share of energy consumption in the world (and CO₂ emissions) through 2040** ⁽¹⁾
- 2 main **industrial Challenges** are : **Energy transition & Digitalization “industry 4.0”** → 4 simultaneous transitions requiring disruptive technologies

World energy consumption by end-use sector
quadrillion Btu



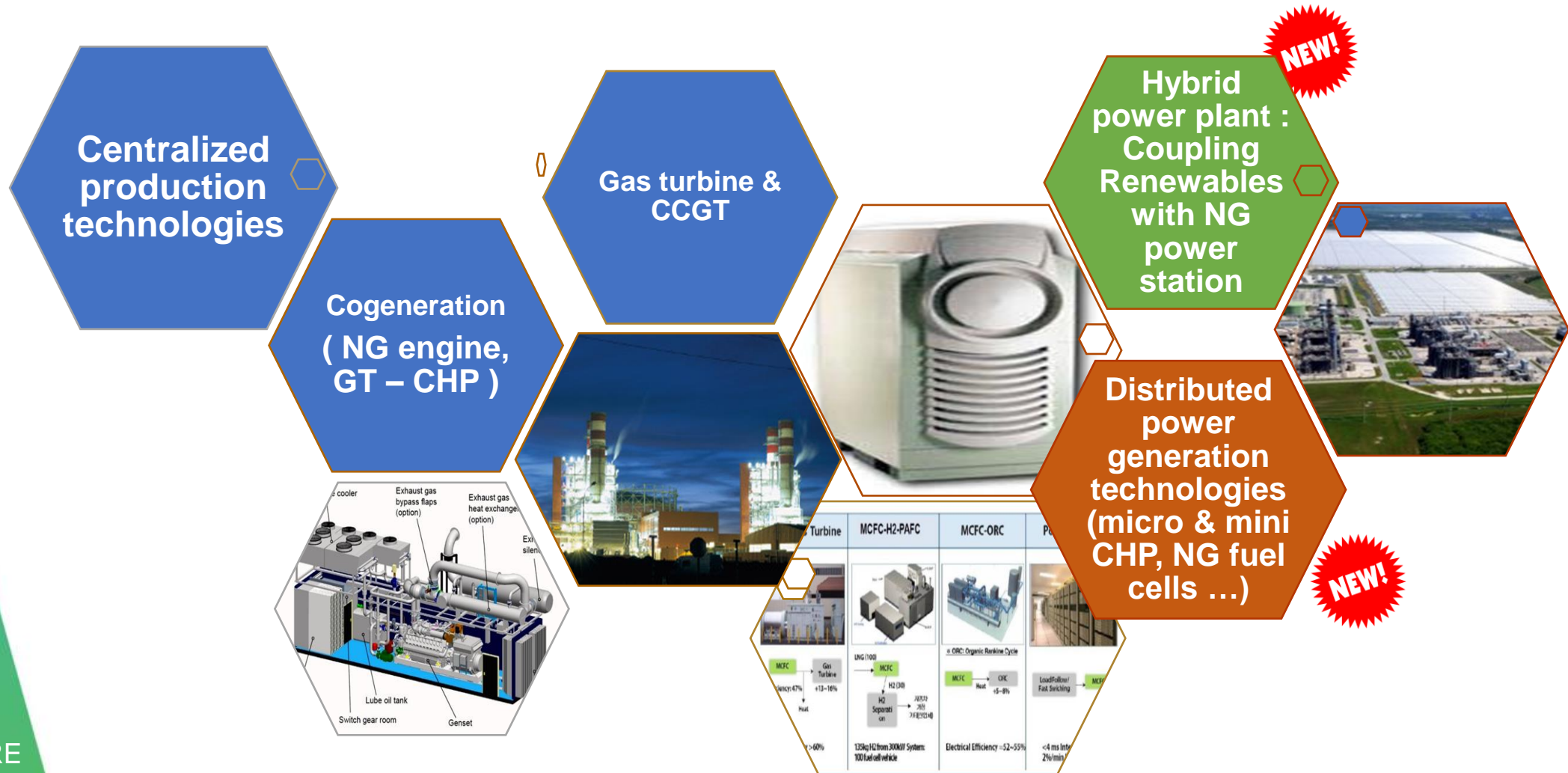
- **Energy transition:** better use of energy, high energy efficient technologies, integration renewables for innovative energy master plan ...
- **Reduction of environmental impacts:** low CO₂ processes, high environmental efficient combustion technologies, use of green energies ...
- **Digital transformation:** big-data, IoT sensors , digital control...
- **Organizational changes:** flexible factories/production, new business models...

All the scenarii confirm that Natural Gas is the best energy to support industries for these challenges

SG 5.1 : Power Generation with Natural Gas

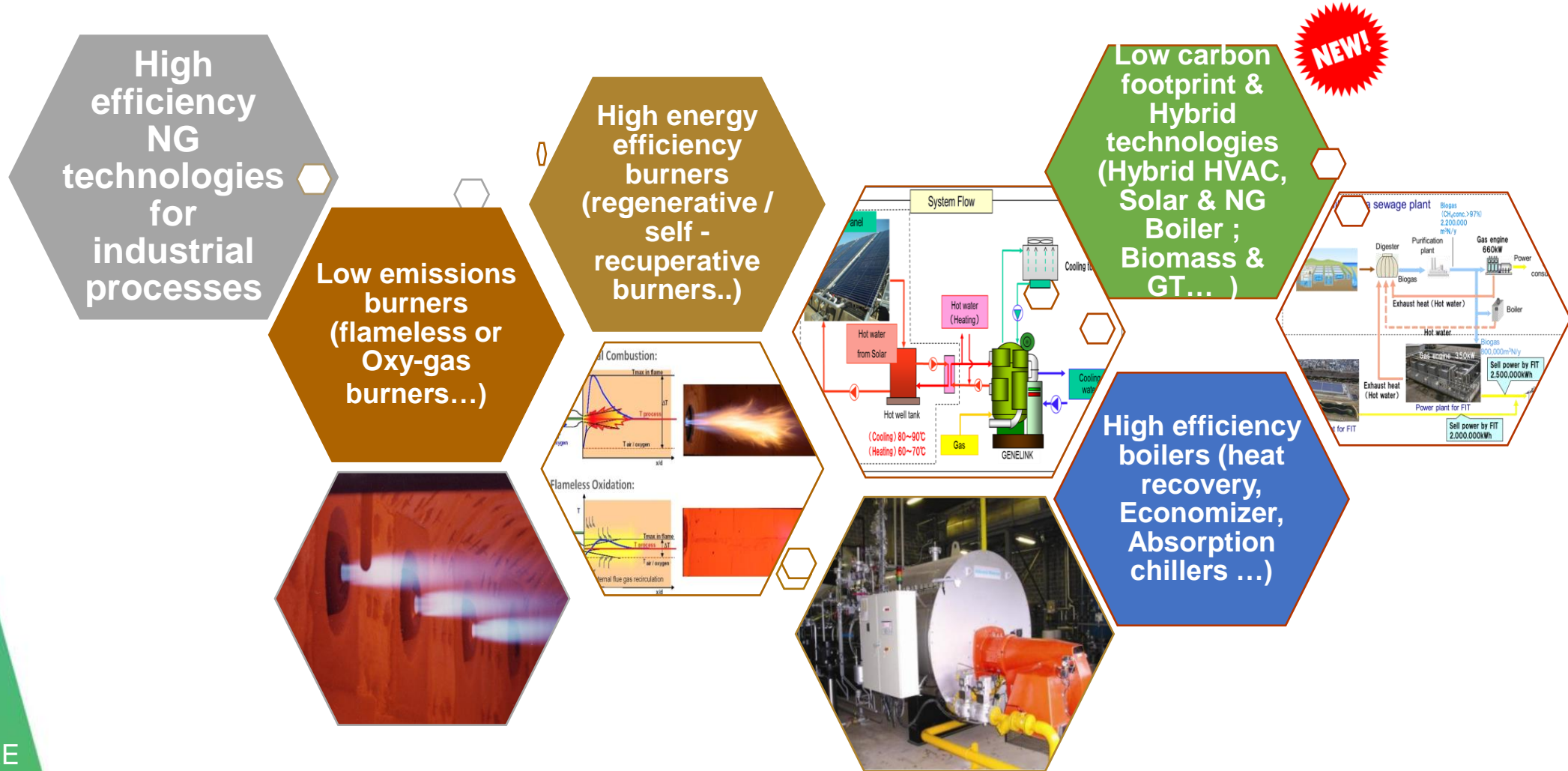
« Gas to power »

- Future challenges : Decentralization & Hybrid production with Renewables – Existing NG solutions



SG 5.1 : Energy efficiency & Energy transition with NG technologies

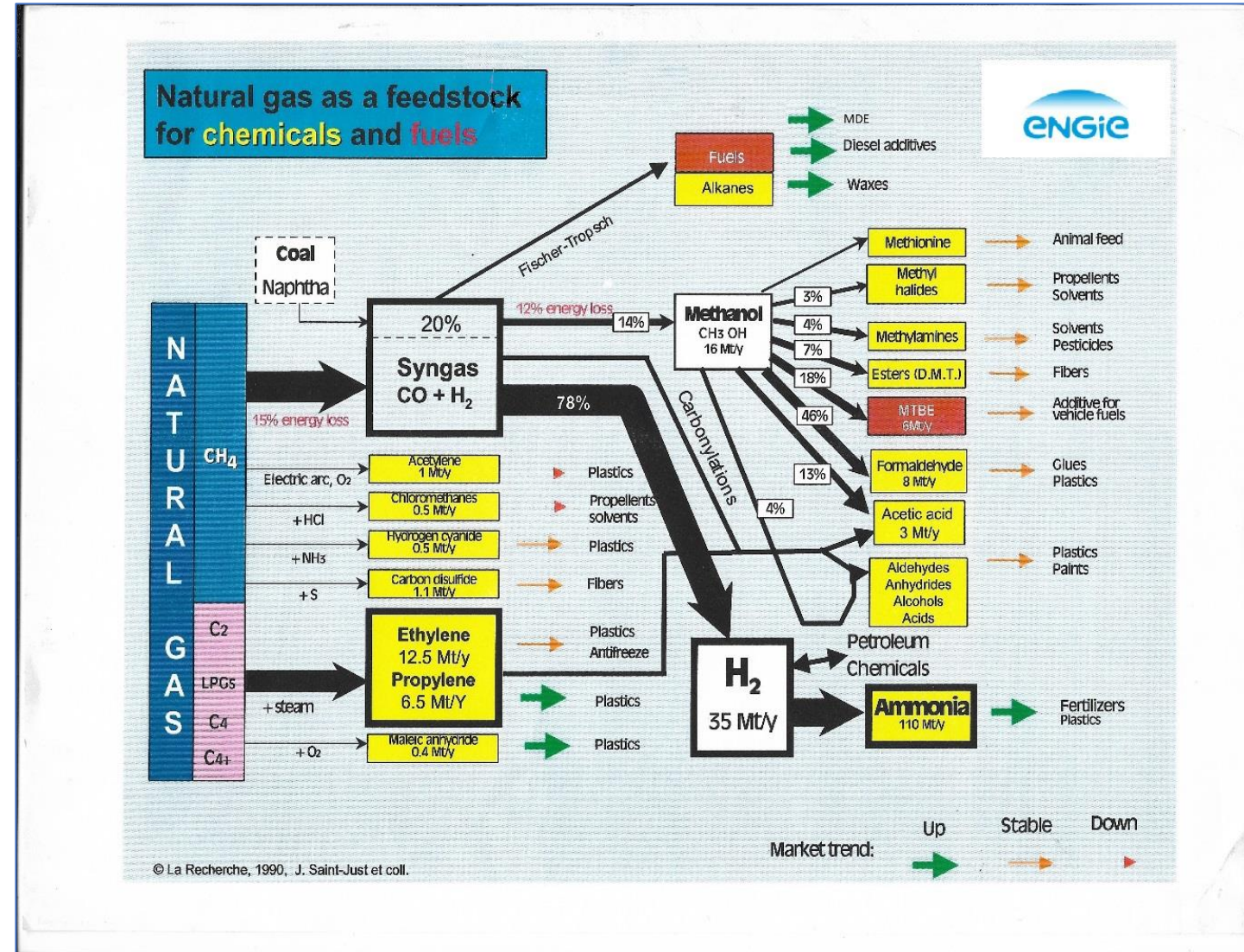
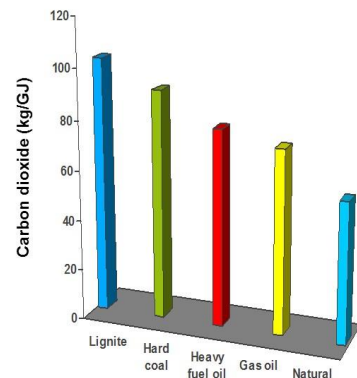
- NG technologies best solutions for energy efficiency & lower carbon footprint



SG5.1: Natural gas a « low carbon » feedstock for chemical industry

- Due to these characteristics NG demand is increasing more and more as Fuel & also as Raw material for production :

- Gasoline (Gas To Liquids) with Fischer-Tropsch process/ MDE ;
- Production of Hydrogen (SMR process);
- As Raw material for the organic Chemistry (ammonia/fertilizers) ;
- or Raw chemical gas for specific industries (Surface treatment)



SG 5.1: New Uses of Natural Gas in industrial processes

- Many opportunities of new markets & new business models



New Uses of Natural Gas in industrial processes

NG to chemical & ammonia products (fertilizers; resins & plastics...)

Low carbon "MDE/Gasoline" & LNG as fuel for transportation; Power to gas

Centralized or decentralized production of H2

NG as raw material or surface treatment gas (Carburizing...)

HYSERVE-300
OSAKA GAS

CARBURIZING

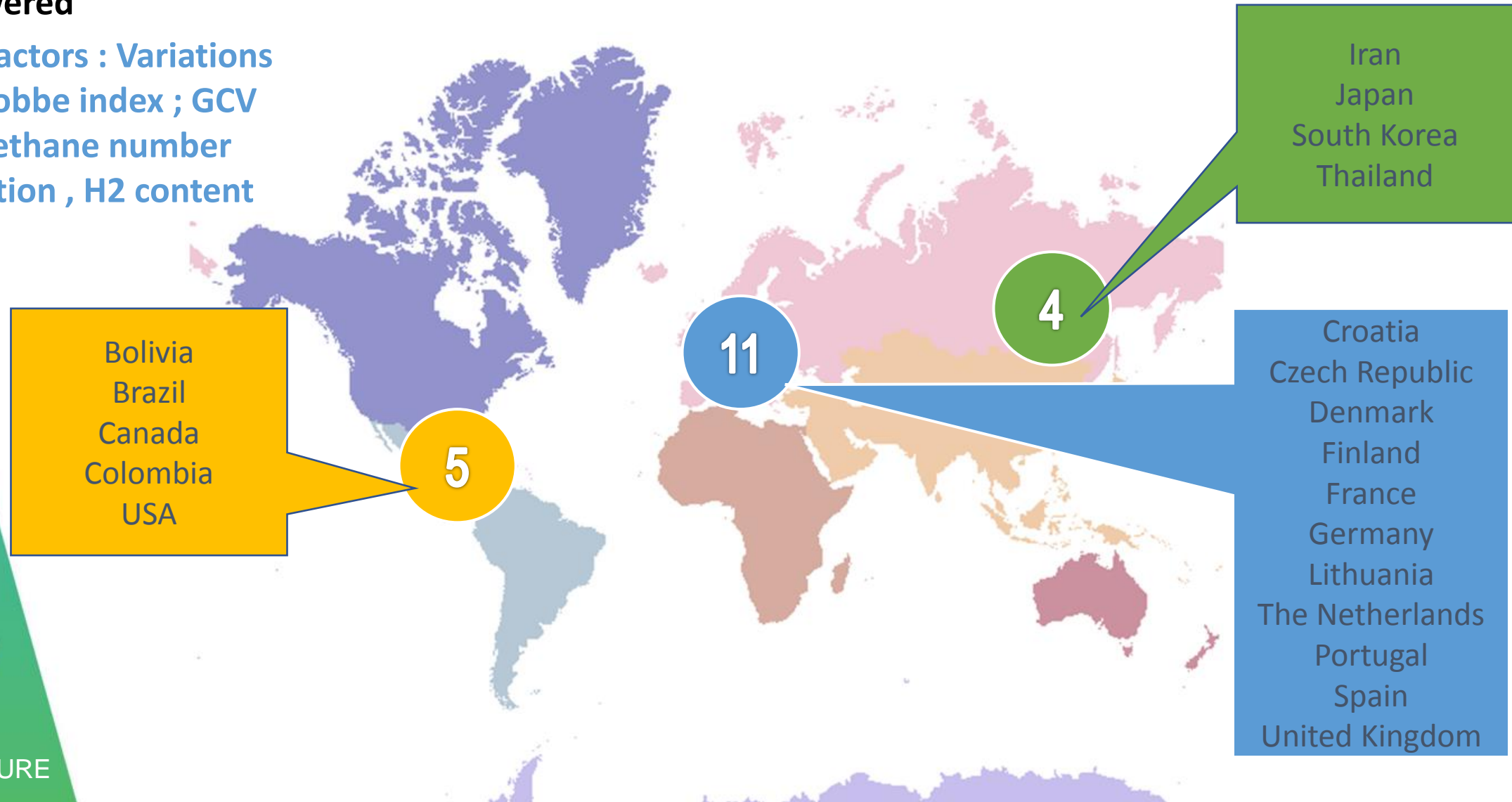
catalytic reactor

carburizing furnace

SG 5.1 : World survey on impacts of variations of NG quality on industrial processes

Method : Questionnaire sent through the IGU working groups - 20 countries answered

Key factors : Variations of Wobbe index ; GCV or methane number variation , H2 content



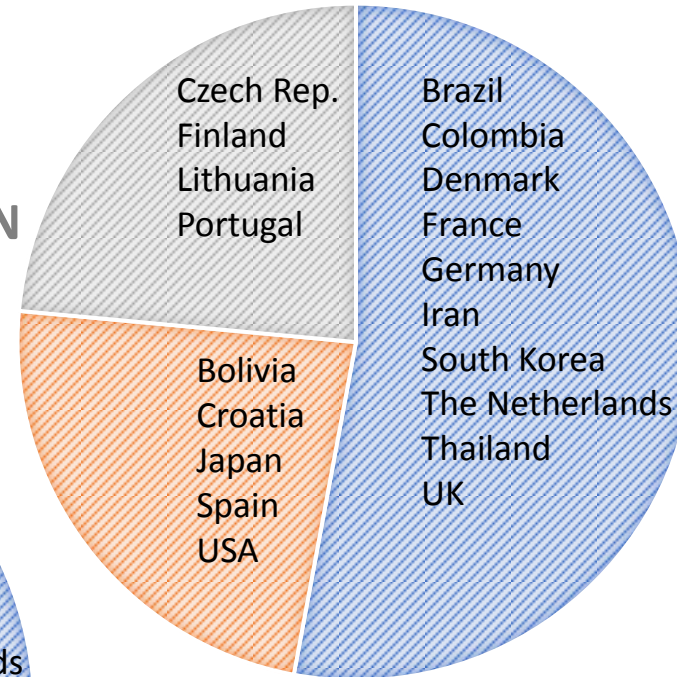
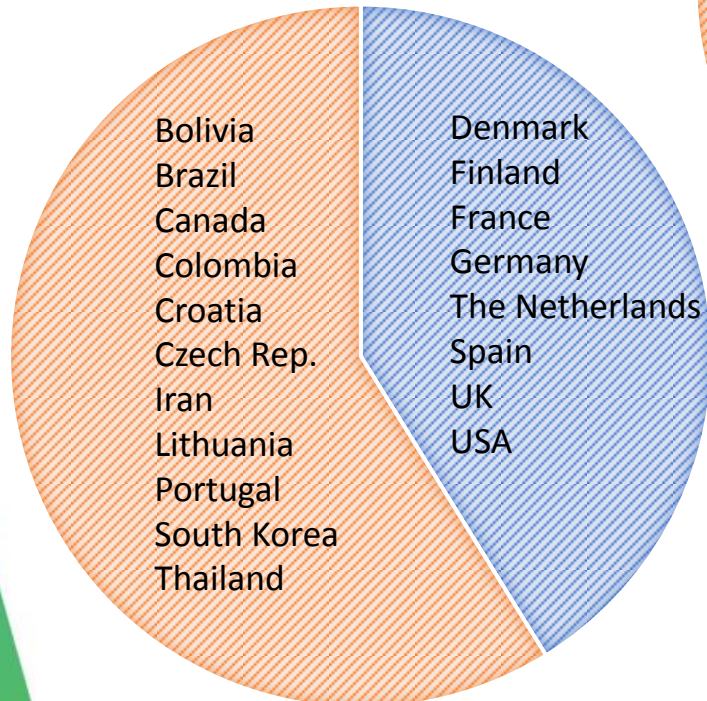
SG 5.1: New challenges face up diversification of NG resources & grid injection of Renewable gases

CHANGE IN GAS QUALITY

■ Yes ■ No ■ Don't know

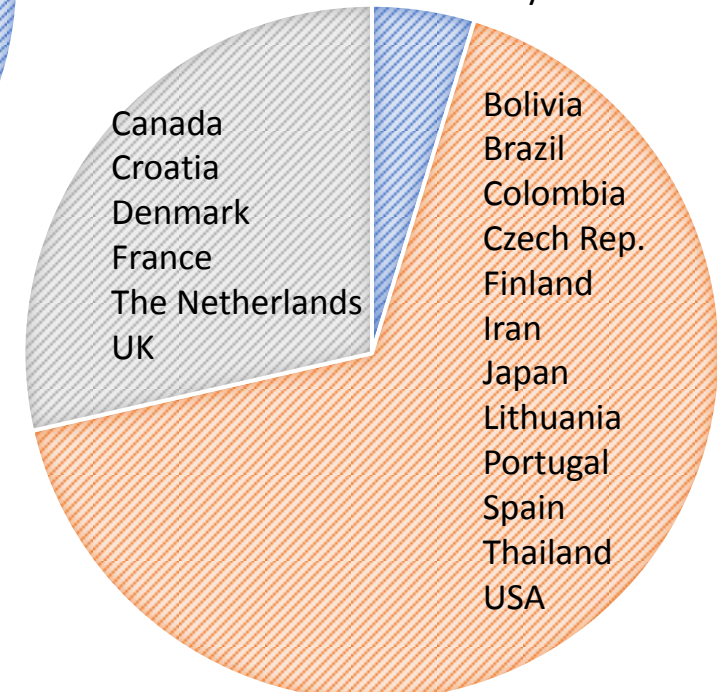
BIOMETHANE INJECTION

■ yes ■ no



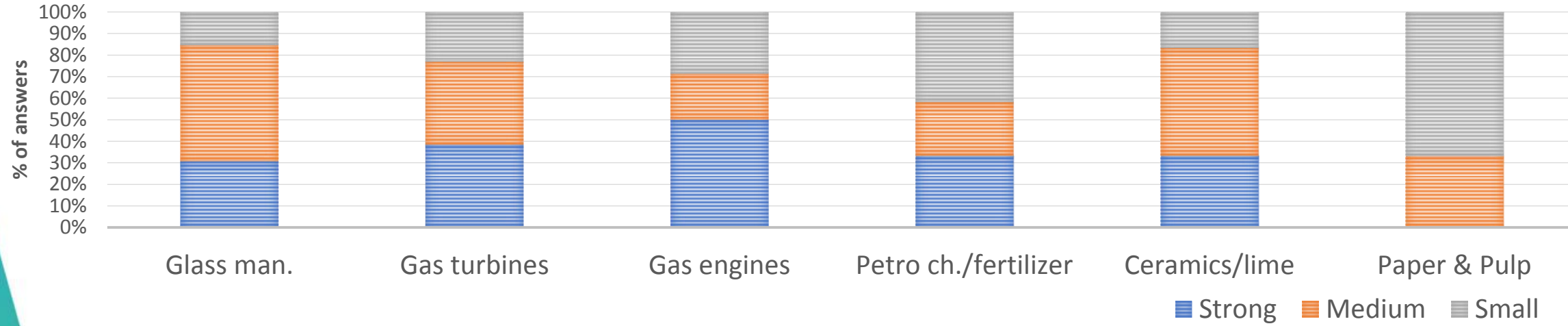
H2 INJECTION

■ Yes ■ No ■ Yes in the future
Germany

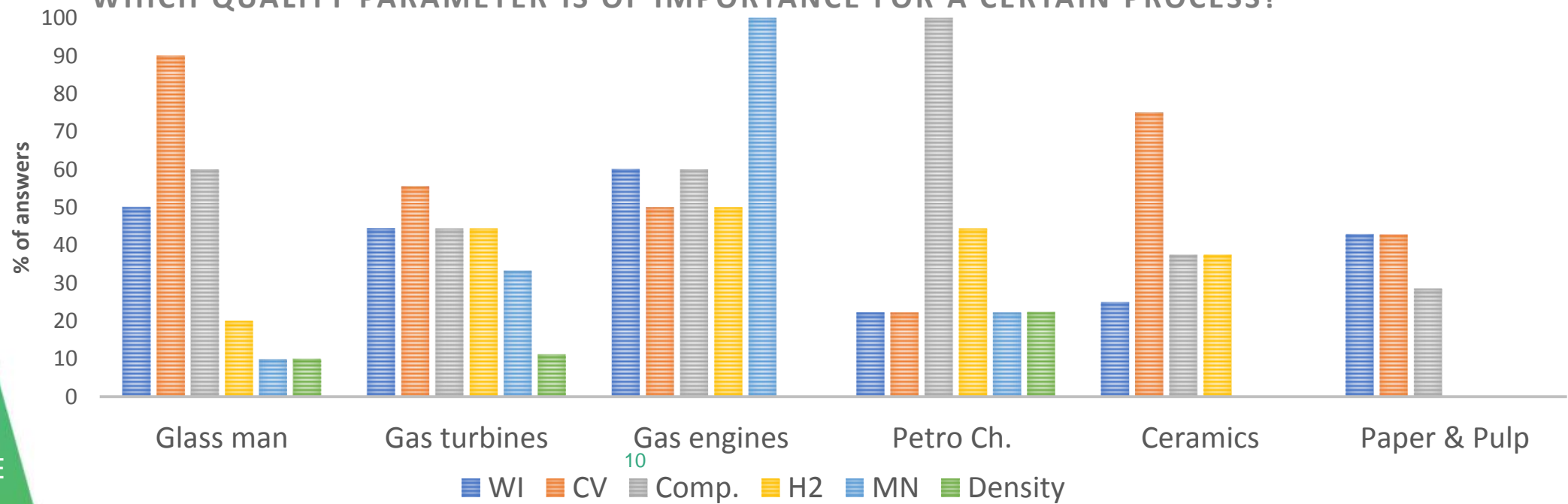


SG 5.1: IMPACT ON INDUSTRIAL PROCESSES

IMPACT OF GAS QUALITY VARIATIONS UPON A SPECIFIC INDUSTRIAL PROCESS



WHICH QUALITY PARAMETER IS OF IMPORTANCE FOR A CERTAIN PROCESS?



SG 5.1: Natural Gas «the essential fuel for industry in a sustainable future»

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