Gas and hydrogen as pathways for low-carbon strategies of the Global Oil and Gas Majors

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The Majors' low-carbon energy transition: between a rock and a hard place…

Energy transition agenda

For oil and gas majors low-carbon development is a topic with **a double meaning**. They themselves designate it as a dual challenge:

- **meeting global energy needs**
- **reducing greenhouse gas emissions**.

In fact, this double challenge is somewhat different:

- on the one hand, companies need to make sure that they do not lose ground in their key hydrocarbon markets under any scenario of energy transition.
- on the other hand, they must convince investors and the public of their commitment to the development of clean energy technologies.

Source: FIEF

Consumers
State
Investors
Lenders

Requirements for climate, environmental and social responsibility of business

Majors

Potential technological and producing leadership in the "clear" energy

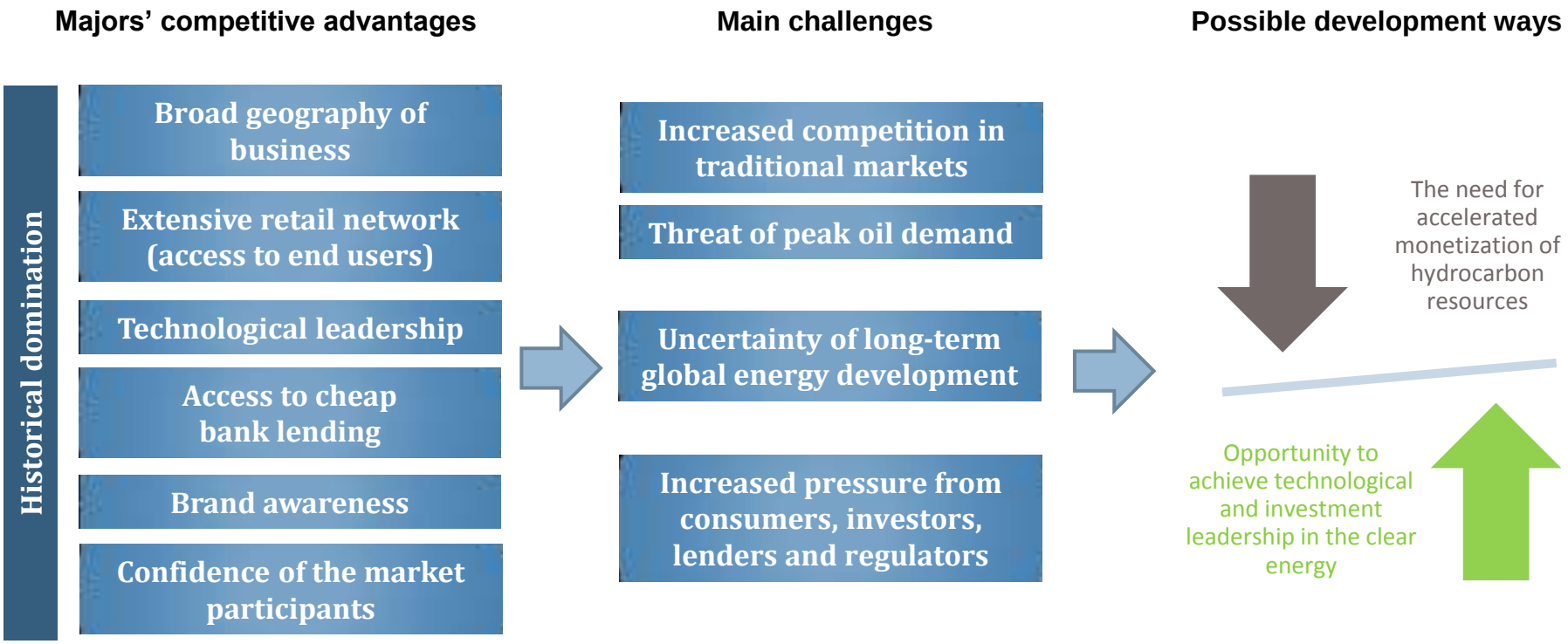
Monetization of hydrocarbon reserves

The logic of the oil and gas markets development requires majors to seek accelerated monetization of hydrocarbon reserves.

In favor of such business strategy is:

- continued growth in oil and gas demand;
- growing competition for markets from national companies and private US companies;
- expectations of reaching the crude oil demand peak in the 2030s;
- great uncertainty about the further development of the world energy sector.

Majors have the greatest incentives and opportunities among all oil&gas companies to adapt to the global energy transition

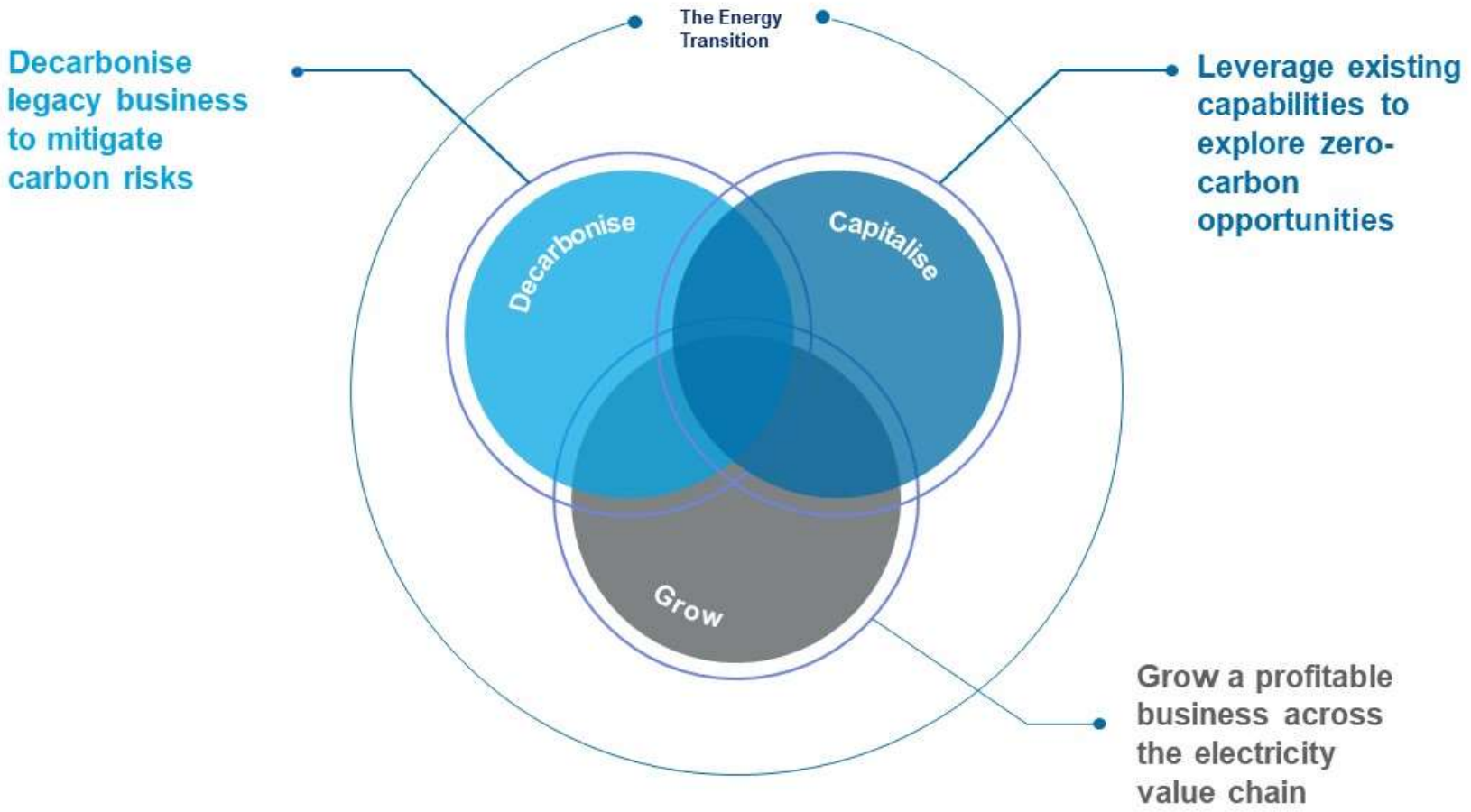


Key questions:

- Do majors believe in the reality of the Energy transition?
- Do they have a full-fledged long-term strategy to adapt to the Energy transition or is their business planning limited to the medium term?

Source: FIEF

Oil & Gas remains core business for Majors even in the Energy transition period

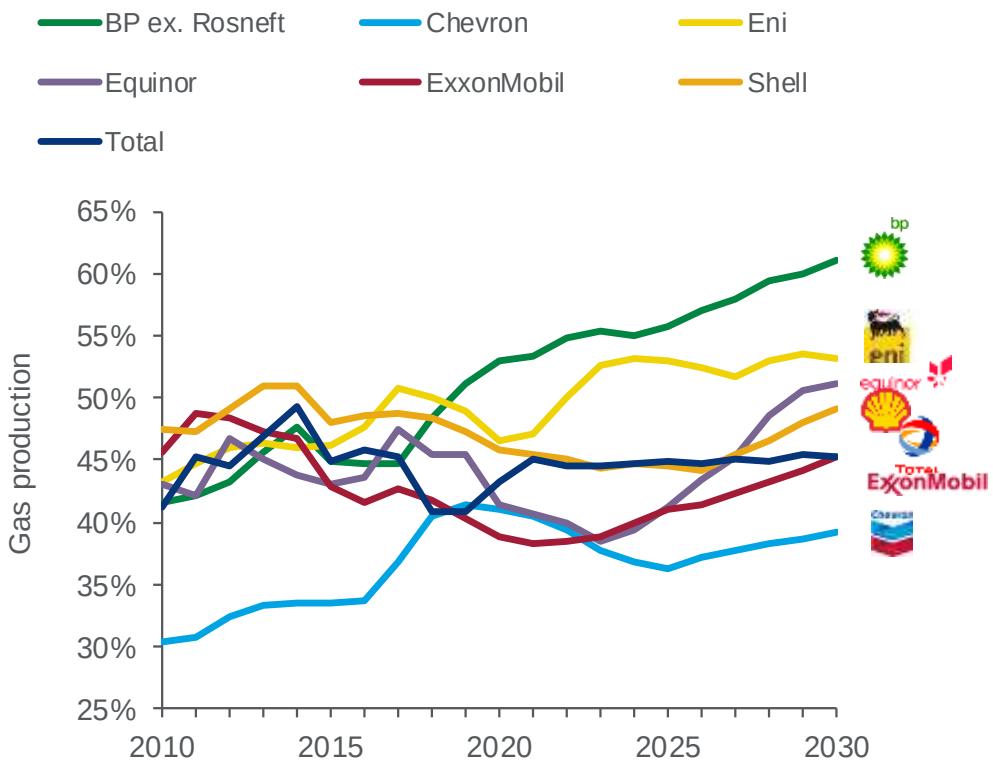


- Shift portfolio to the bottom of supply cost curve
- Increase investment in natural gas and carbon-capture technologies
- Oil and Gas Climate Initiative (OGCI)

Source: Wood Mackenzie

Oil&Gas Majors consider natural gas as the main key to further business transformation

Gas production as a proportion of total (%)



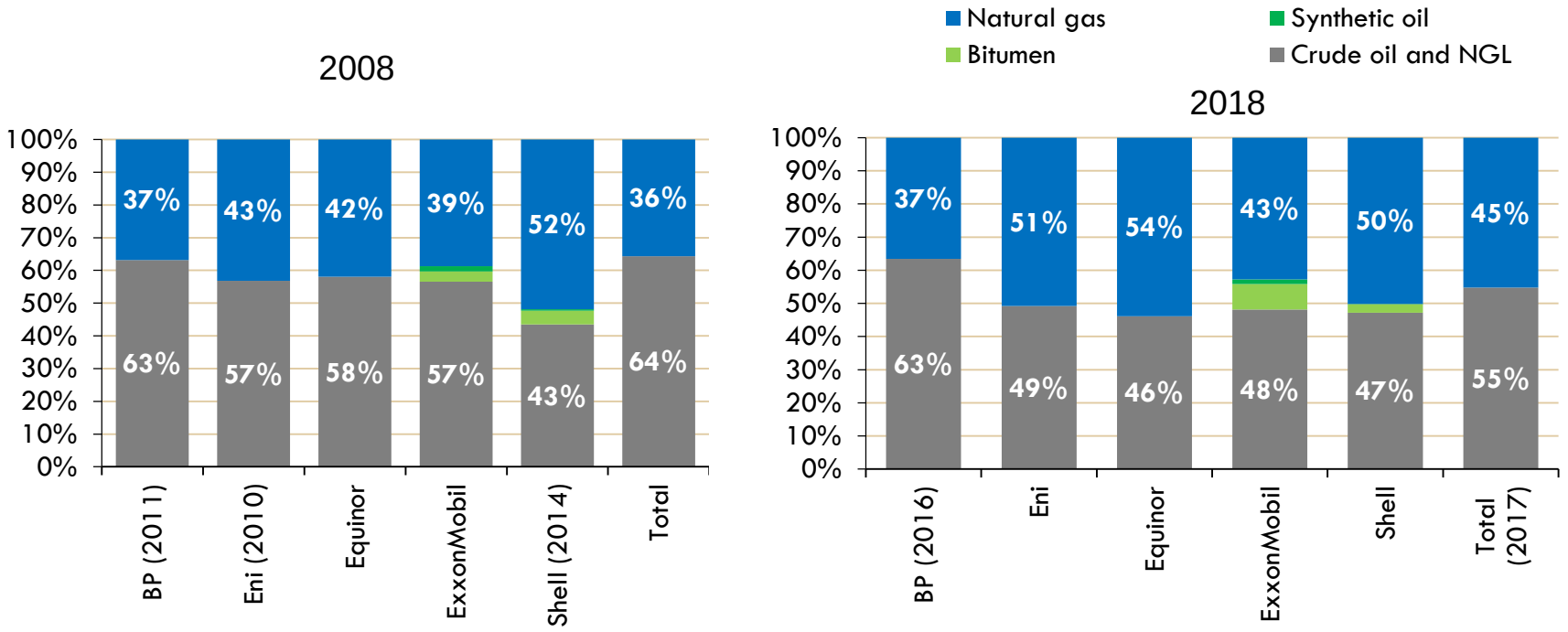
Target of **60%** gas production by 2035

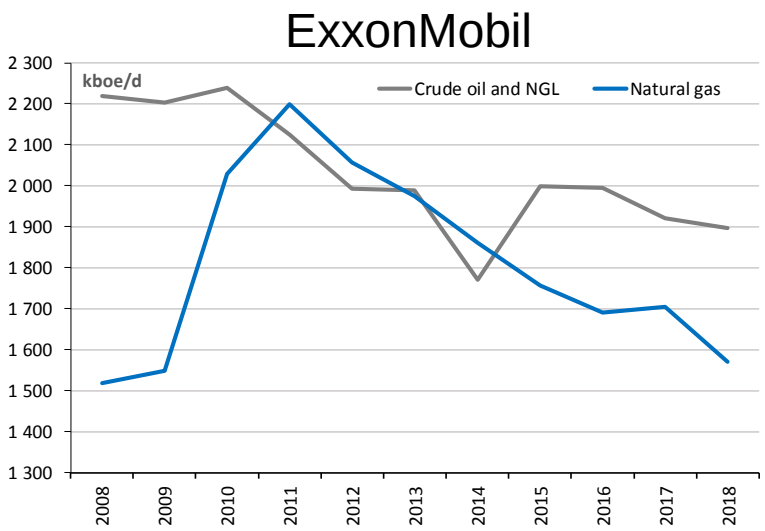
A **75:25** gas-oil ratio is possible by 2040

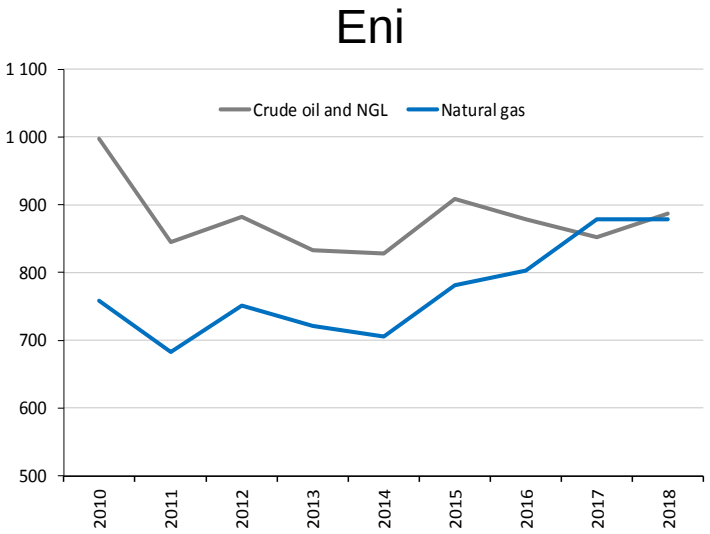
Actions	Companies
Upstream	
Expanding the supply natural gas	ExxonMobil, Total, Chevron, Shell, Eni, BP, Equinor
Downstream	
Transitioning refining facilities to growing higher-value distillates, lubricants and chemical feedstocks	ExxonMobil, Total
Developing technologies to reduce energy requirements of refining and chemical manufacturing facilities	ExxonMobil, Chevron
Green refinery, biofuels, chemistry	Eni, Chevron, ExxonMobil
LNG	Total, Shell, ExxonMobil, BP, Chevron
Aviation fuel from waste	BP
Reducing carbon intensity	
Reducing CO_2 flaring	ExxonMobil, Chevron, Equinor, Eni, Shell, BP, Total
CO_2 injection	ExxonMobil, Chevron, BP, Eni, Total, Shell, Equinor
Energy efficiency	Total, ExxonMobil, Chevron, Eni, Equinor, Shell, BP
Redirect investment to the low-cost asset classes	ExxonMobil, Chevron, Total
Renewables	
Solar	Equinor, Eni, Total, Shell, BP, Chevron
Onshore Wind	Shell, BP, Total, Eni, Chevron
Offshore Wind	Equinor, Shell
Biofuels	ExxonMobil, Eni, Shell, Total, BP
Battery Storage, EV Charging	BP, Total, Shell

Source: Wood Mackenzie

…But this trend can hardly be called stable and it does not affect all oil&gas companies

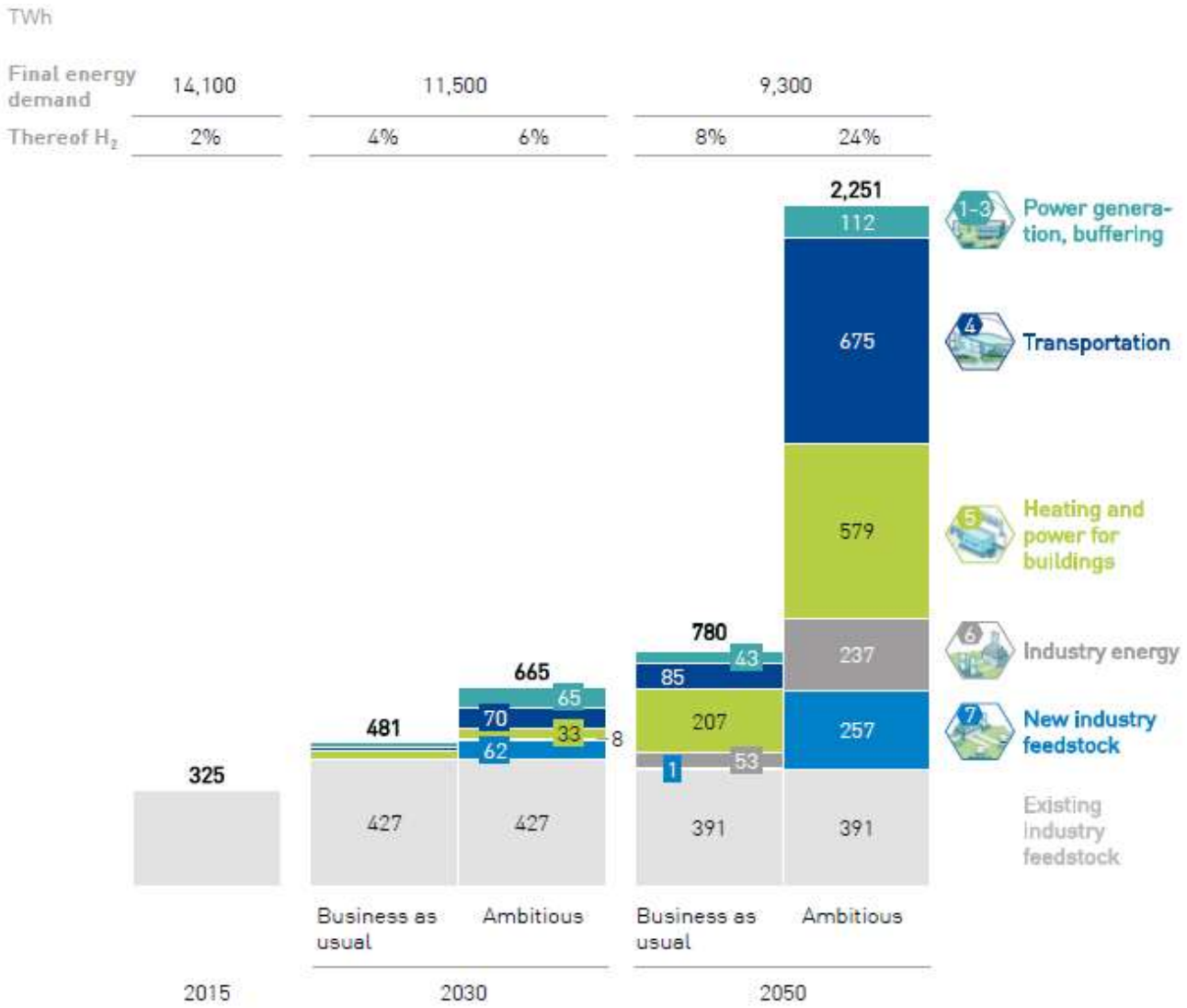






Source: FIEF based on companies' data

The possible pathways to gas decarbonization in the EU: the role of hydrogen



- According to the EU hydrogen activists (FCH Europa), hydrogen could provide up to **24%** of total energy demand in the EU by 2050

Source: Hydrogen Roadmap Europe, 2019

The role of hydrogen in the decarbonization of the EU gas grid

- The same pipelines that transport natural gas can also be used to transport hydrogen.
- Past surveys have confirmed that existing city gas supply pipelines can also be used to supply medium and low-pressure hydrogen without any problems.
- The development of large-scale hydrogen pipelines is already in progress in Europe (1,600 km has been laid in Germany, France, England, Belgium and the Netherlands)
- **The blending up to 10-20% of hydrogen into gas supplies is the technologically feasible way to decarbonize EU gas grid**
- **…but what about the costs of this blending and of hydrogen' production for it?**

The cost of hydrogen production from RES is more expensive than from methane reforming even with CCS

The average cost of hydrogen production from RES (solar+wind) in the EU

Time Frame	CAPEX, euro/kW	Efficiency factor	Electricity cost, euro/MWh	Cost of hydrogen production, euro/bcm
Before 2020	600-1000	70-75%	40-50	315-450
2020-2025	400-600	75-80%	30-40	180-270
2025-2030	300-500	80-85%	25-35	135-225
After 2030	<300	>85%	20-30 10-20	90-135 45-90

Source: FIEF calculations

- The current average cost of hydrogen production from natural gas + CCS is **70-120 euro/bcm**
- Thus, hydrogen production from RES will be economically competitive as the main source for EU gas grid decarbonization only after 2030
- Taking into account technological limitations, hydrogen' blending with gas deliveries (up to 20%) will lead to the reduction in the volume of natural gas pumping in the European gas grid at about **8%**.

Potential for EU natural gas substitution by hydrogen

IEA estimations for EU natural gas consumption up to 2040, mtoe

	2015		2030		2040	
IEA Scenario	NPS	SD	NPS	SD	NPS	SD
Electricity generation	115	115	120	109	110	78
Industry	84	84	81	72	75	57
Residential	152	152	136	125	116	93
TOTAL	351	351	337	306	301	228

Source: IEA,WEO 2018

Potential for EU gas substitution by hydrogen up to 2050

	2015	2030	2040	2050
EU natural gas consumption, NPS 2018 (IEA), mtoe	351	337	301	250
EU natural gas consumption, SD 2018 (IEA), mtoe	351	306	228	110
EU natural gas substitution by hydrogen, Ambitious Scenario (HRE)	-	14,5	-	102
% of substitution (NPS 2018)	-	4,3%	-	40,8%
% of substitution (SD 2018)	-	4,7%	-	92,7%

Source: FIEF calculations based on WEO 2018 and Hydrogen Roadmap Europe

- **Until 2030**, the real replacement of natural gas with hydrogen in the EU will be less than **5%**
- **But after 2040**, the replacement of natural gas with hydrogen can be from **40** to more than **90%**