

OIL & GAS

# Value creation from R&D

*Ways to make the gas sector more sustainable and efficient*

**Etienne Romsom**



## Major changes in the gas industry

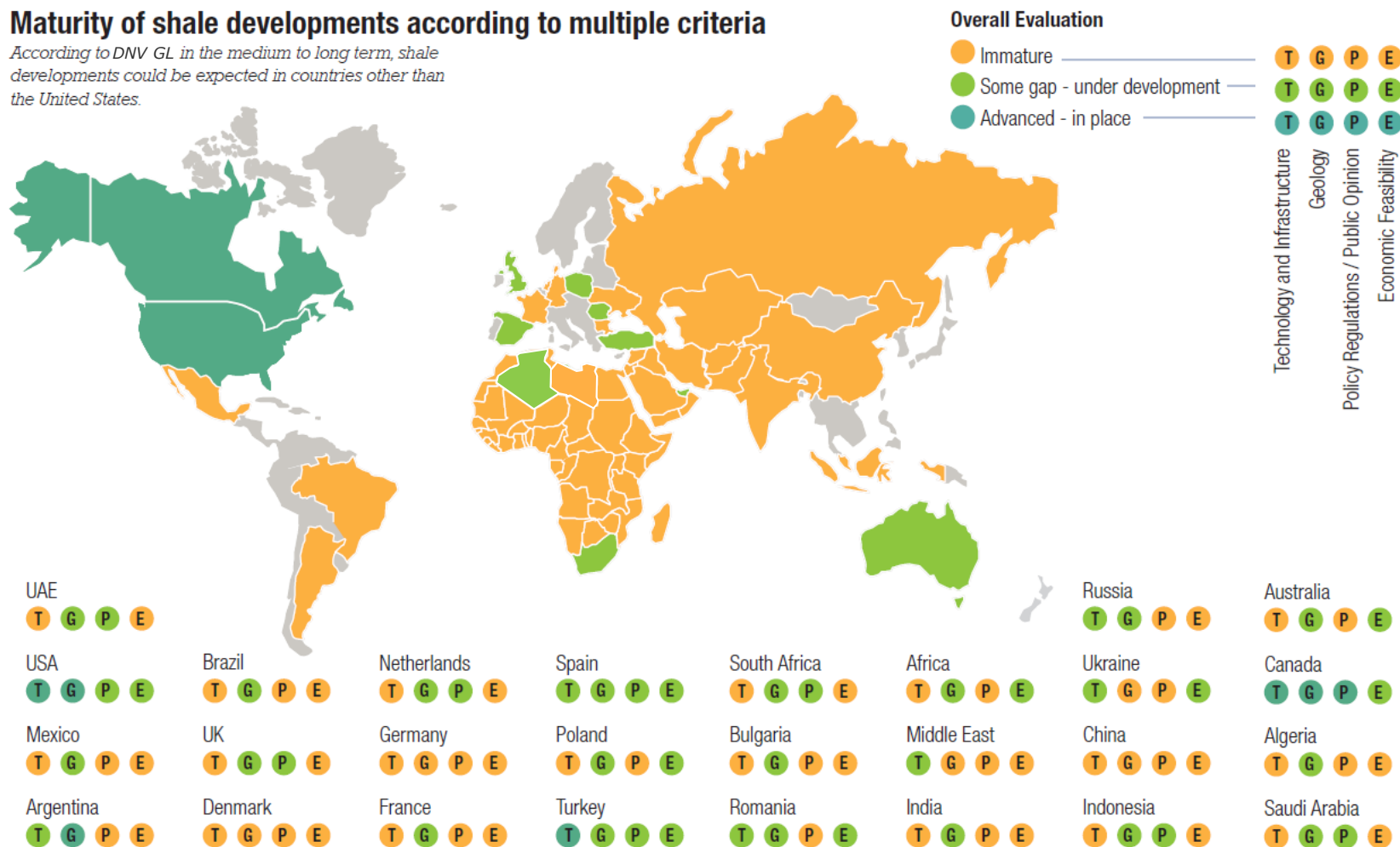
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- The end of the “easy gas” era
- Unconventional gas is rapidly changing the global gas market
- Further development of the global LNG market:  
FLNG, small scale LNG, LNG as transportation fuel
- Growing interconnectivity of gas markets
- Increasing costs slowing down the speed of some developments
- Severe competition between different sources of power generation (wind, solar, coal, gas) with different drivers (emissions and power price)
- Climate change and efforts to reduce greenhouse gases
- Natural gas facilitating the transition towards a sustainable energy system

# The success of shale depends on a combination of factors

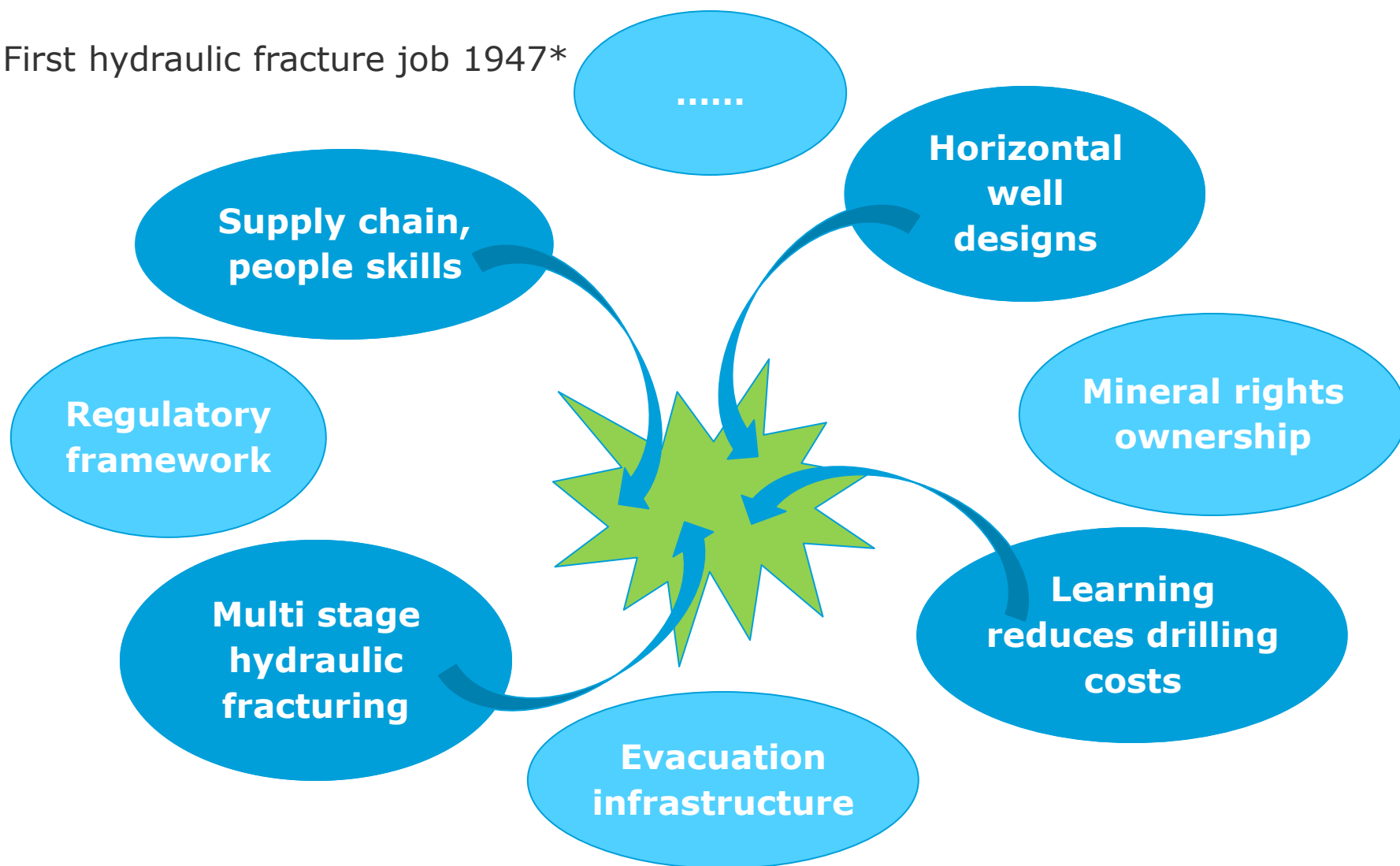
## Maturity of shale developments according to multiple criteria

According to DNV GL in the medium to long term, shale developments could be expected in countries other than the United States.



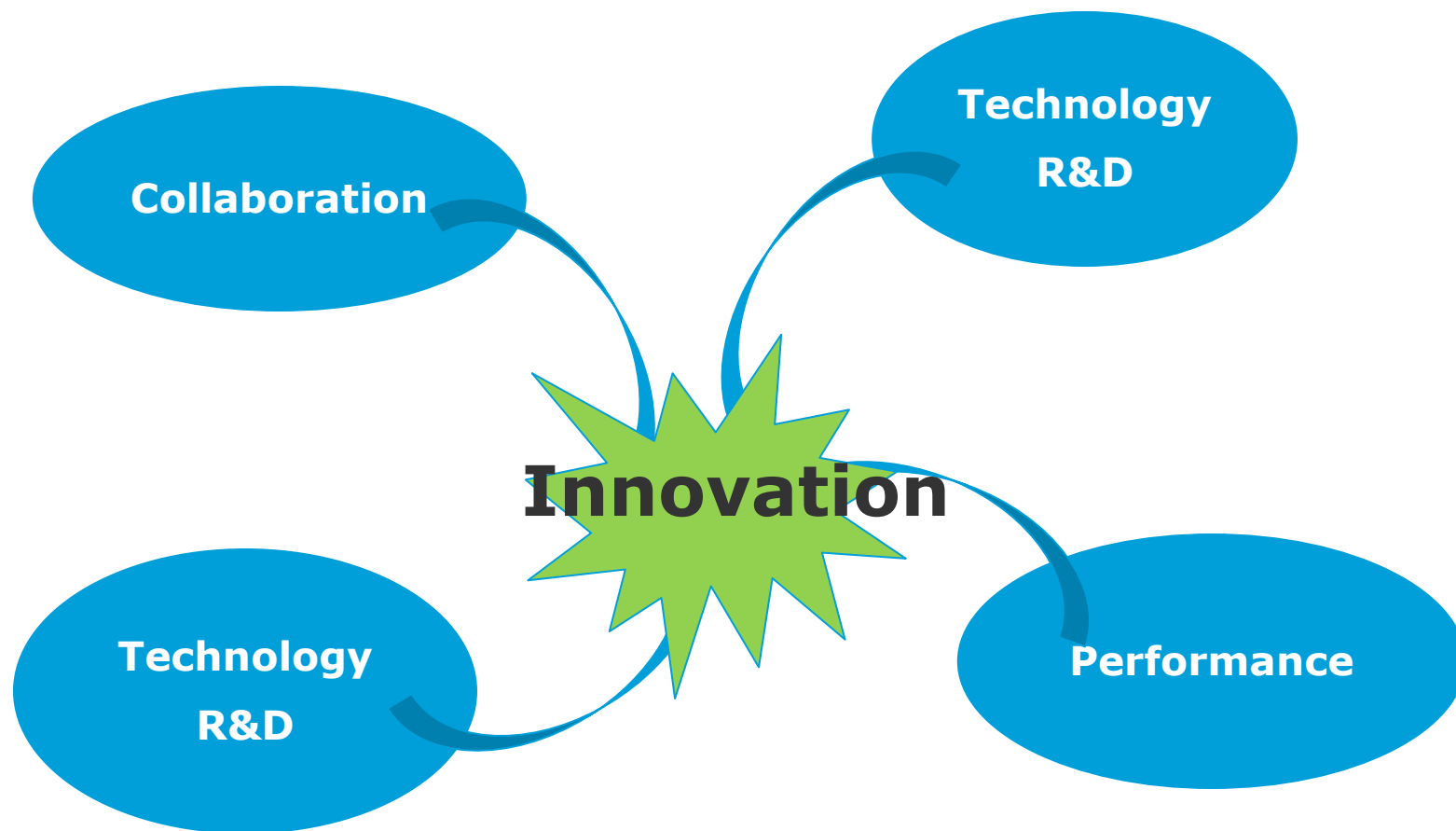
## Key enablers for shale developments

- First hydraulic fracture job 1947\*

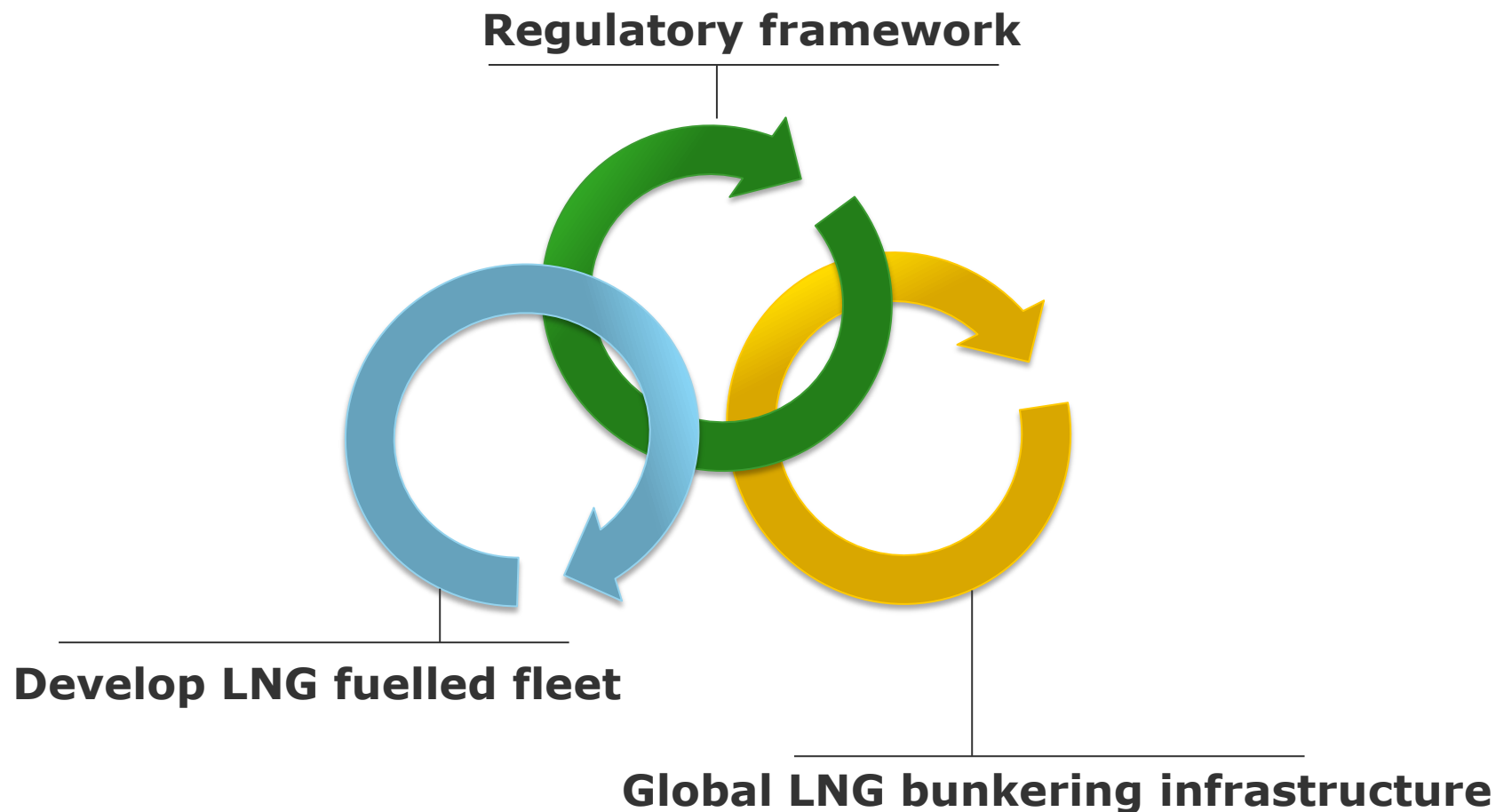


## Key enablers for Innovation

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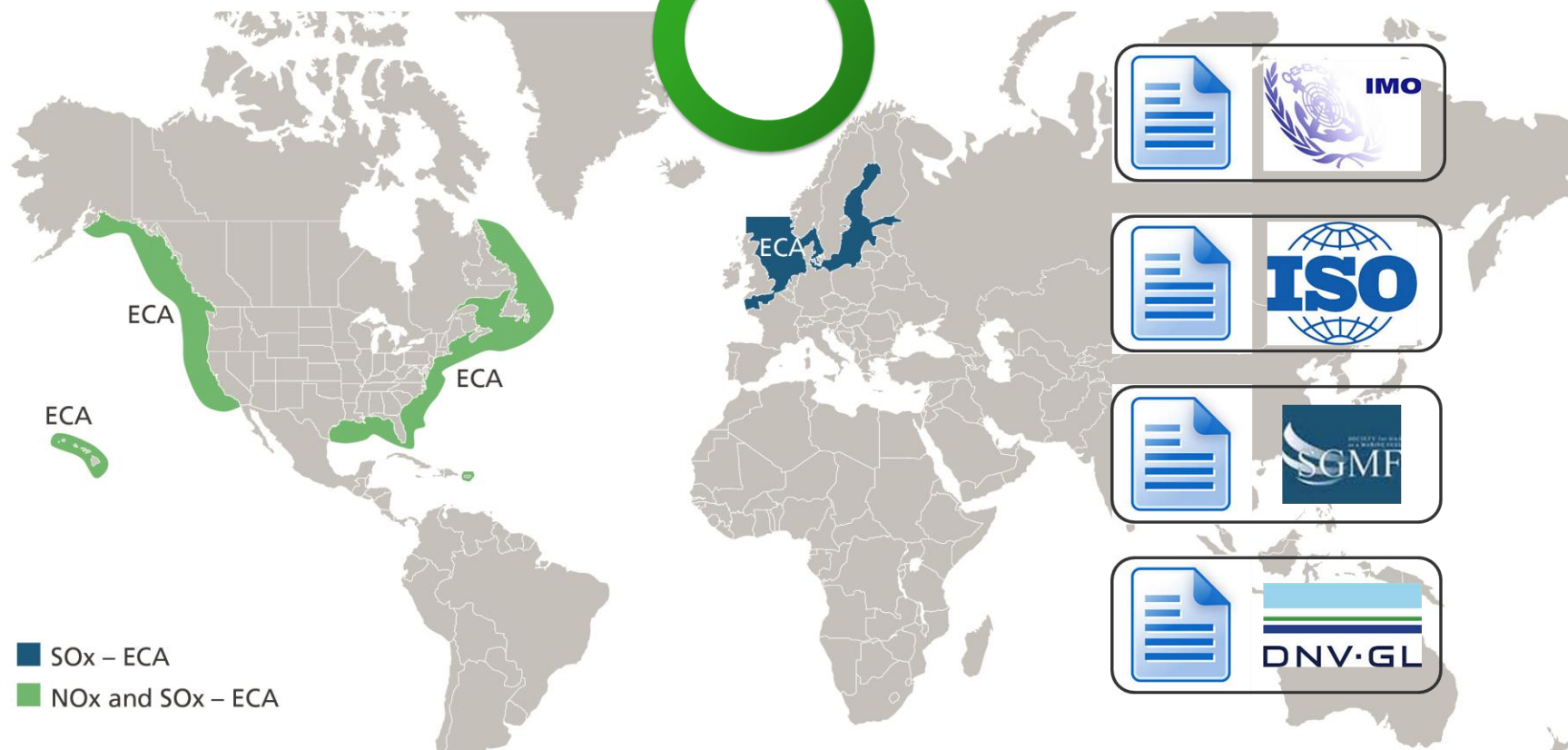


## Enablers for LNG as marine fuel



# Ship owners respond to stricter environmental regulations

# Regulatory framework for LNG fuelled shipping maturing



## GLOBAL REQUIREMENTS

2020 / 2025\*:  $SO_x < 0.5\%$   
Build after 2011:  $NO_x$  Tier II, -20%

\* Date TBD pending 2018 review  
– but 2020 will apply in EU waters

## ECA $SO_x$ REQUIREMENTS

2010: Sulphur  $< 1.0\%$   
2015: Sulphur  $< 0.1\%$

## ECA $NO_x$ REQUIREMENTS

NB after 2016:  $NO_x$  Tier III, -80%

# 49 LNG fuelled ships in operation worldwide and 62 confirmed new build vessels ordered (June 2014)



## Ships in operation

Year	Type of vessel	Owner	Class
2000	Car/passenger ferry	Fjord1	DNV
2003	PSV	Simon Møkster	DNV
2003	PSV	Eidesvik	DNV
2006	Car/passenger ferry	Fjord1	DNV
2007	Car/passenger ferry	Fjord1	DNV



2010	Car/passenger ferry	Fjord1	DNV
2010	Patrol vessel	Remøy Management	DNV
2010	Car/passenger ferry	Fjord1	DNV
2010	Car/passenger ferry	Fjord1	DNV
2010	Car/passenger ferry	Fosen Namsos Sjø	DNV
2011	PSV	DOF	DNV
2011*	Chemical tanker	Tarbit Shipping	GL
2011	Car/passenger ferry	Fjord1	DNV
2011	PSV	Solstad Rederi	DNV

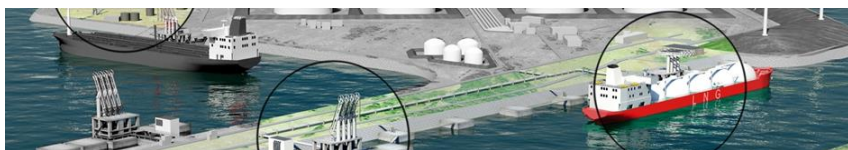
Year	Type of vessel	Owner	Class
2012*	Car/passenger ferry	Fjord1	DNV
2012	PSV	Eidesvik	DNV
2012	PSV	Olympic Shipping	DNV
2012	PSV	Island Offshore	DNV
2012	General Cargo	Nordnorsk Shipping	DNV
2012			DNV
2012			DNV
2012			DNV
2012			DNV
2012			DNV
2013			DNV
2013			LR
2013			DNV
2013			KR
2013			DNV
2013			DNV
2013	High speed RoPax	Bağcıbas	DNV
2013	Tug	CNOOC	CCS
2013	Tug	CNOOC	CCS
2013	Car/passenger ferry	Norled	DNV
2014	Car/passenger ferry	Norled	DNV
2014	Tug	Buksér & Berging	DNV
2014	RoPax	Fjordline	DNV
2014	Patrol Vessel	Finish Border Guard	GL



**Excluding LNG carriers and inland waterway vessels**



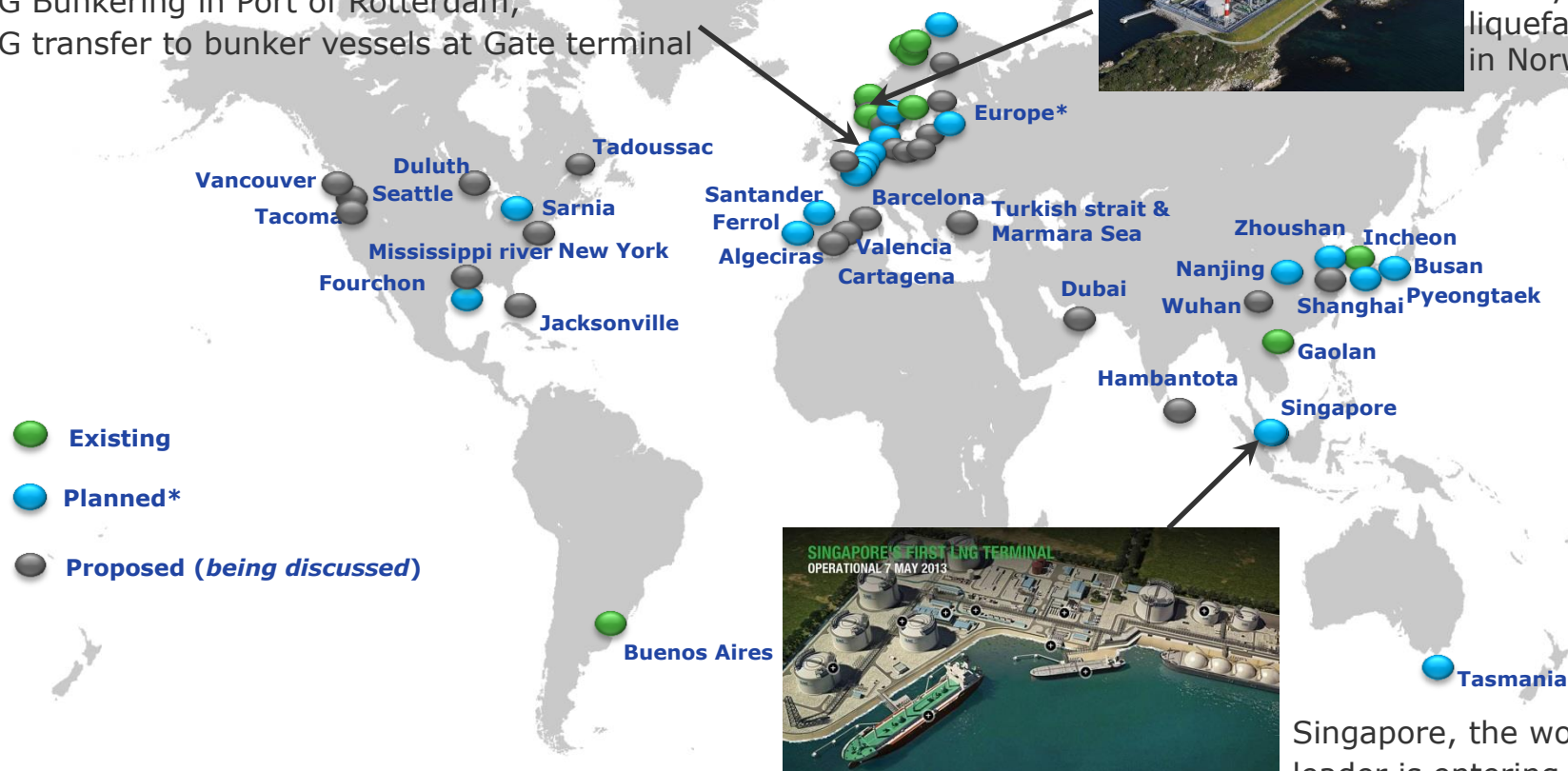
# Development of global LNG bunkering infrastructure



LNG Bunkering in Port of Rotterdam,  
LNG transfer to bunker vessels at Gate terminal



LNG bunkering  
facility at Risavika  
liquefaction plant  
in Norway



Singapore, the world's bunker leader is entering the LNG for fuel business

\* Feasibility study, risk study, proposed locations, pending approval

# Innovation of LNG as transportation fuel

**environmental**

**Performance**

**fuel efficiency**

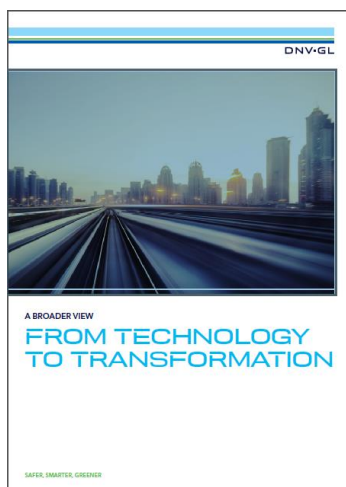
**Increased gas  
market efficiency**

**Collaboration**

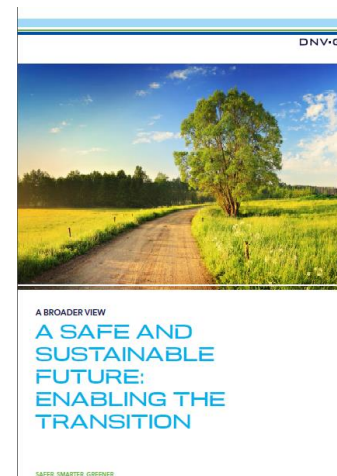
**Technology  
R&D**



# Innovation in DNV GL



**Broader view - Better decisions**  
six 'themes for the future' – as part of our efforts to take a broader view of the relationship between technology, business and society.

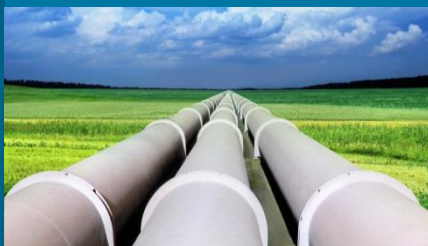


# Strategic areas for innovation

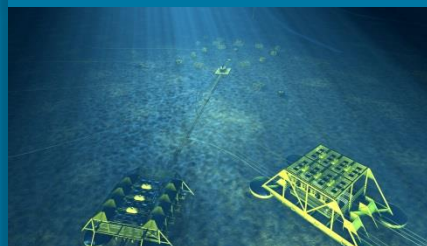
*Developing ideas into value for our customers*

Strategic  
growth  
segments

Pipelines



Subsea and Floaters



Gas value chain



Sustainability



Smarter Operations



Automation and Big Data



Building  
new  
insight



# Joint Industry Projects 2014

Generated  
**200**  
JIP ideas

Testing out  
**60+**  
ideas in the  
market

Actively target  
**40+**  
proposals

execution of  
**30**  
JIPs

**1**  
ideation costs

**X10**  
initiation  
funding

**X100**  
JIP  
execution



Great value to  
our customers  
and to DNV GL

## JIP example: STEEL FORGINGS FOR SUBSEA APPLICATIONS

### Challenge:

End users' individual technical requirements to forgings for subsea systems leads to unnecessary long delivery times.

### Solution:

Harmonize end user requirements and improve industry practices through a DNV GL Recommended Practice.

Enable stocking of forgings.

### Value proposition:

Contractors and manufacturers will benefit from reduced lead time and better consistency, repeatability and quality.

Improve  
efficiency

Operators	Contractors	Manufacturers
 Statoil  ExxonMobil  Lundin  Chevron  Shell  DET  NORSKE  eni	 FMC  AkerSolutions  OneSubsea A Cameron & Schlumberger Company  GE  DRIL QUIP	 Scana SCANA SUBSEA AB  RINGMILL  JSW  EQI EQUIMOD GROUP INCORPORATED  celsa hutaostrowiec  BRÜCK DIE BESSENER VERBUNDUNG

- JIP start-up: November 2013
- Completion: December 2014
- RP scheduled for Q1, 2015

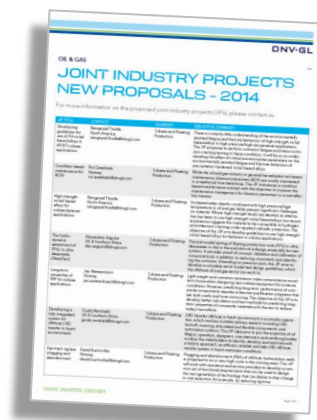
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# Strategic areas for innovation

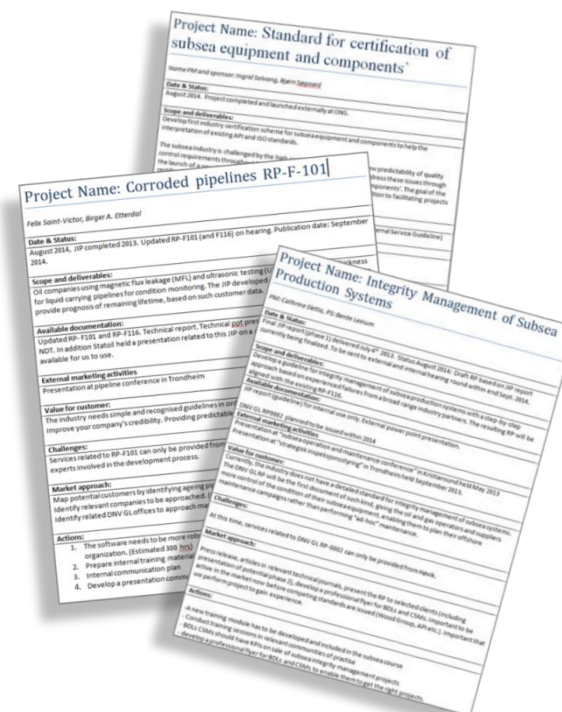
## Strategic innovation areas



## Joint Industry Projects



## Recommended Practices & Standards



Technology  
R&D

Collaboration

Performance

## Improving efficiency in gas through innovation

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Requires a combination of

- Technology development
- Openness through collaboration
- Demonstrating performance

Attracting the best human talent to face the energy challenges of our time

These are also the enablers for increased sustainability performance....

*Safer, Smarter, Greener*



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**SAFER, SMARTER, GREENER**