A New Reality

- Outlook for Oil & Gas Industry 2016
- Trends & Outlook of Subsea Processing

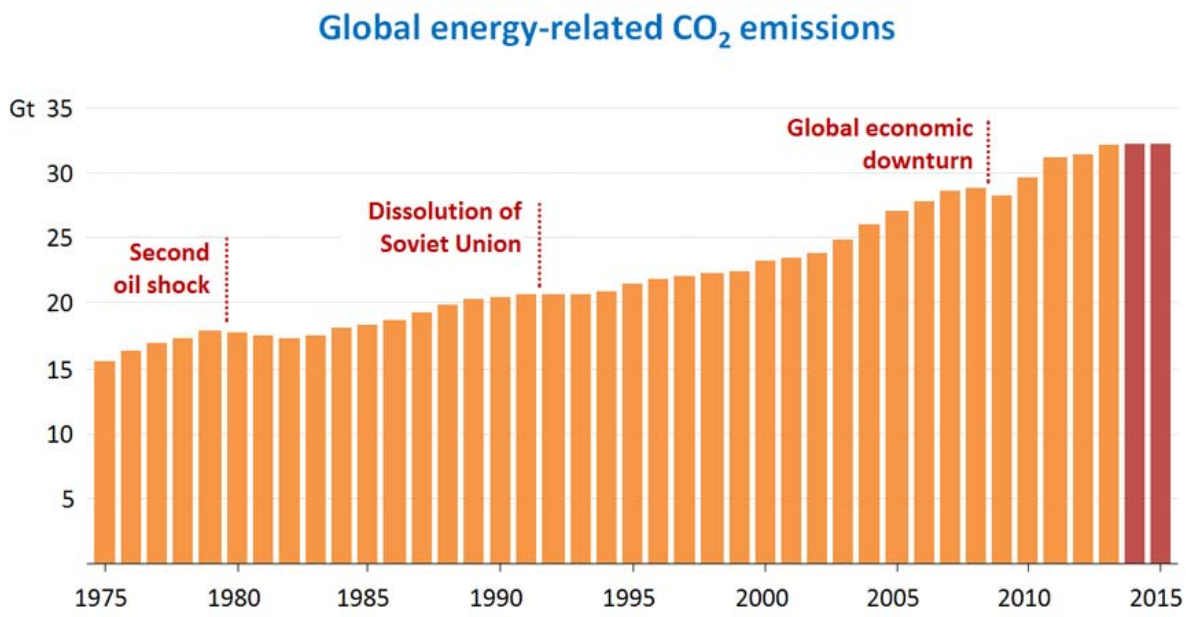
Øystein Grande

DNV·GL

Decoupling of global emissions and economic growth

- Global Growth
  - 2015 ~ 3%
  - 2014 – 3,4%
  - 2013 – 3,1%
- New Electricity Generation 2015
  - Renewables - 90%
  - Wind accounted for more than 50%
- Energy efficiency
- How will low oil price play in?

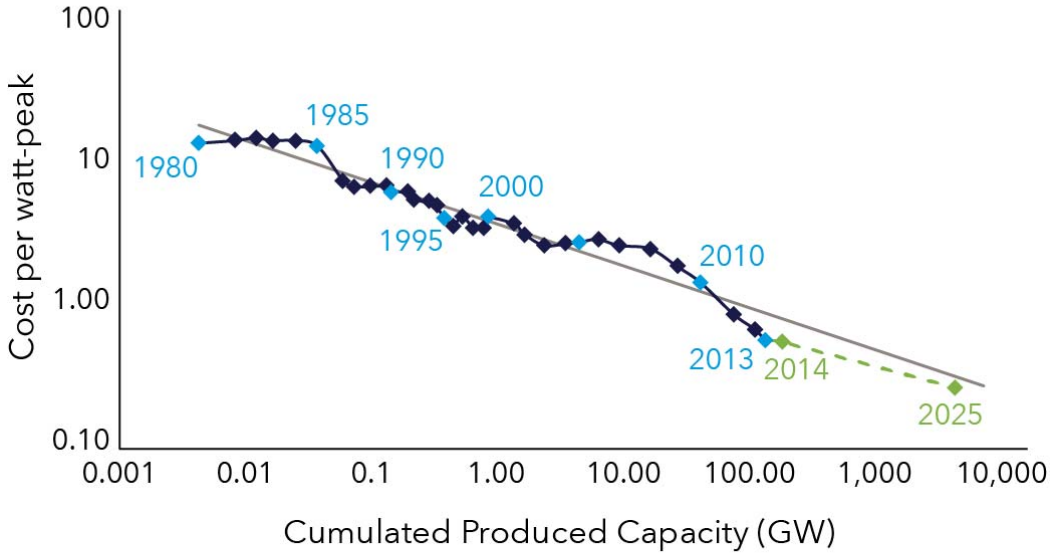
Source: IEA, 16 March 2016



IEA analysis for 2015 shows renewables surged, led by wind, and improvements in energy efficiency were key to keeping emissions flat for a second year in a row

Drivers energy market 2025

- The imperative to reduce anthropogenic CO2 emisions
- The rapid decline in the cost of electricity generated from solar and wind
- Cost pressure in oil & gas industry
- The emergence of a more distributed and consumer-centric power system



Source: Fraunhofer ISE 2015

Learning curves:
Solar – 24%
Wind – 14%

(cost reduction per doubling of installed capacity)

The outlook for Oil & Gas industry 2016

43%
Upstream

11%
Downstream

7%
Midstream

921 senior professionals

35% oil and gas operators

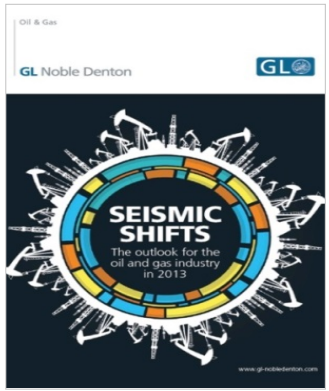
60% suppliers and service companies across the industry

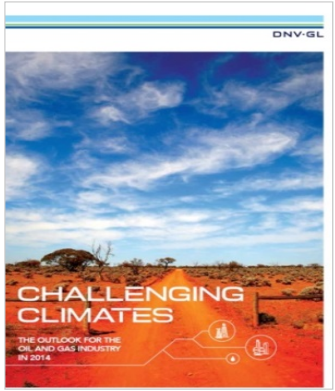
40% annual revenue of USD500m or less

14% annual revenue in excess of USD10bn

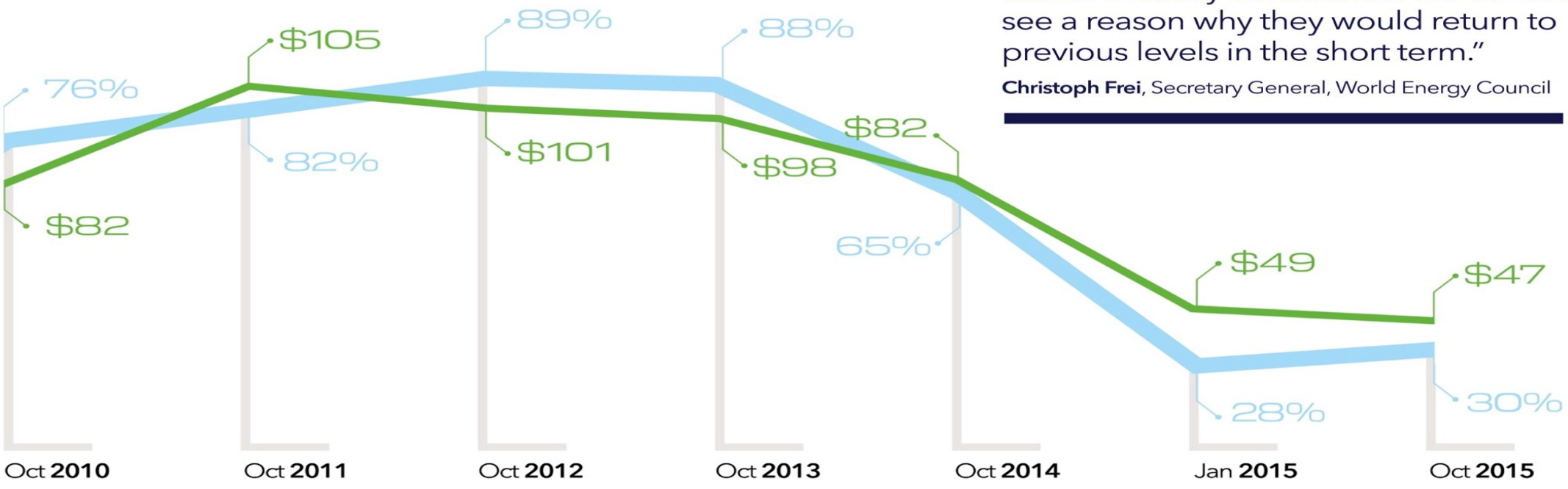
‘A new reality’ Oil & Gas Industry Outlook is the last of a six year series

2011	2012	2013	2014	2015	2016
Deep water Ahead?	Big Spenders	Seismic Shifts	Challenging Climates	A Balancing Act	A New Reality





Overall industry confidence follows oil price

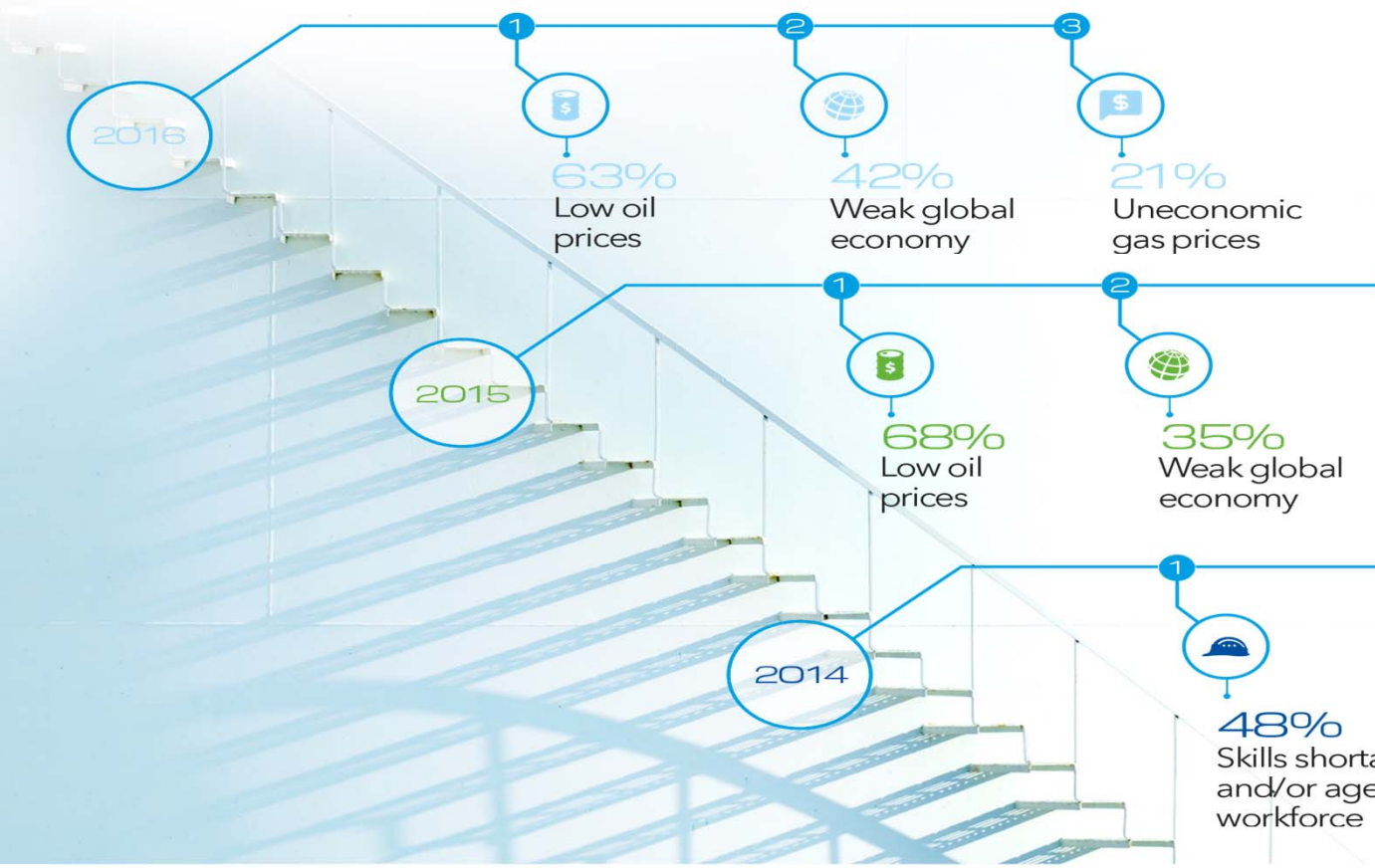


"Prices are obviously the source of a lack of industry confidence. We do not see a reason why they would return to previous levels in the short term."

Christoph Frei, Secretary General, World Energy Council

Oil price calculation: average oil price (WTI, Brent) during relevant fieldwork periods (Source: eia.gov)

Top three barriers to growth



'Collectively, we all are subscribing to the 'lower-for-longer' view on commodity pricing for oil, gas, and LNG products."

Michael Utsler, COO, Woodside Energy

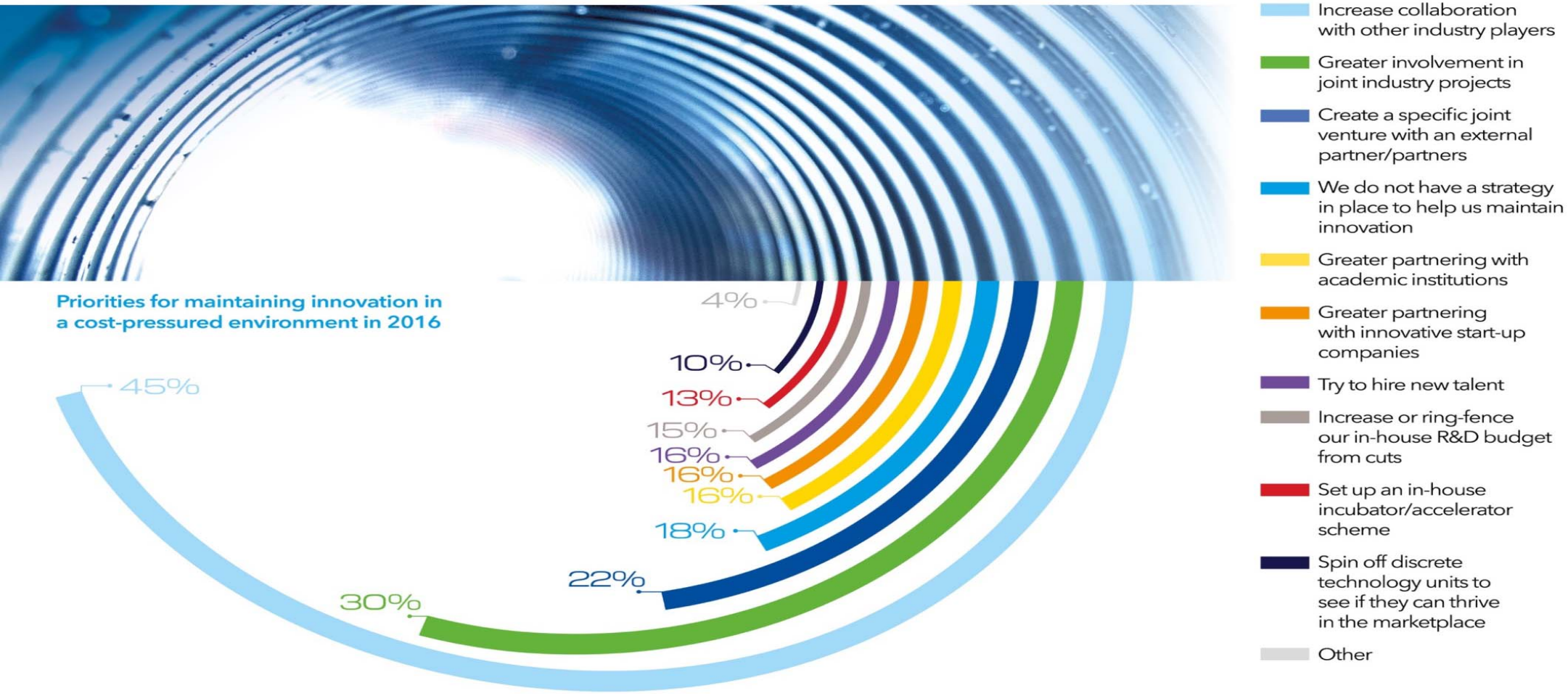
Cutting complexity is an important part of adapting to the current price regime

Percentage of respondents that agree that operators will increasingly push to standardize their delivery globally in 2016

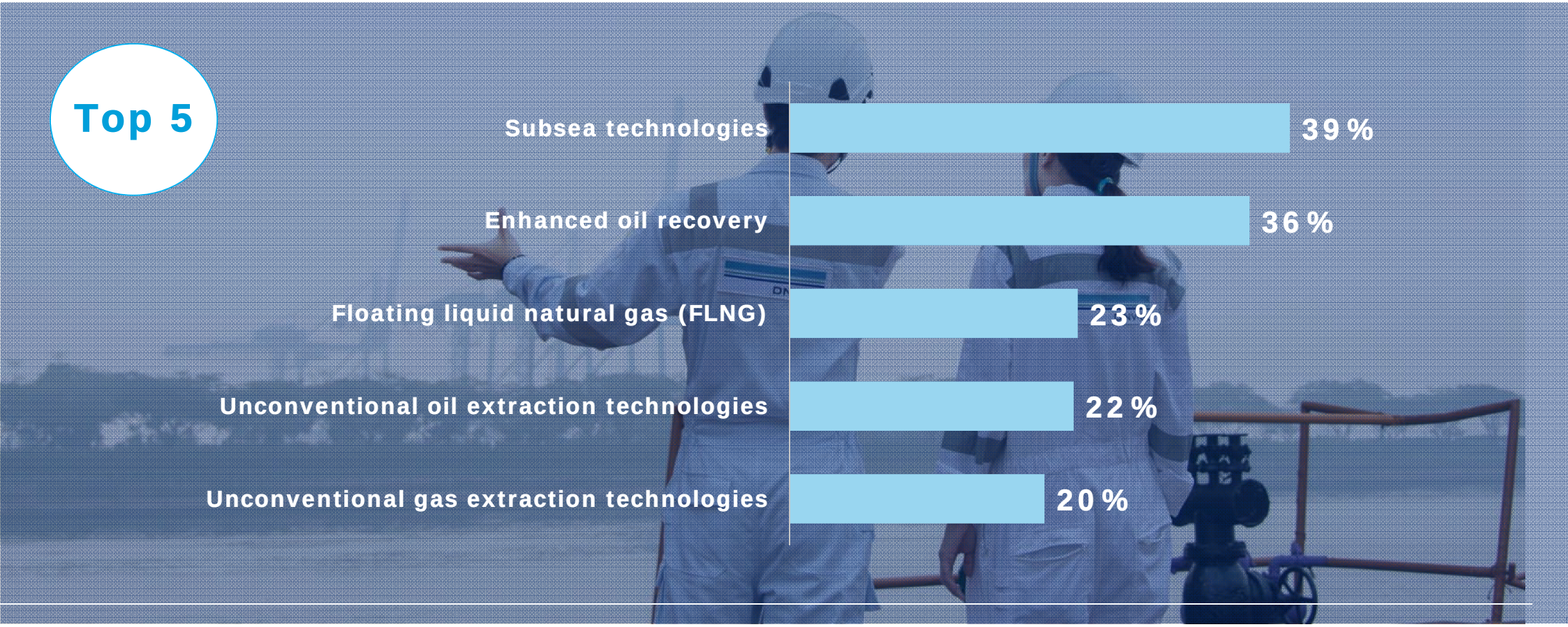
"There is a huge opportunity for standardization, and bringing down costs significantly as a result."

Thore Kristiansen, COO E&P and Executive Director, Galp Energia

Collaboration is the focus area for the ongoing innovation - Will this support disruptive innovation?



Subsea technology believed to have the greatest impact in 2016 - How does this stack up with our findings for Subsea Process?



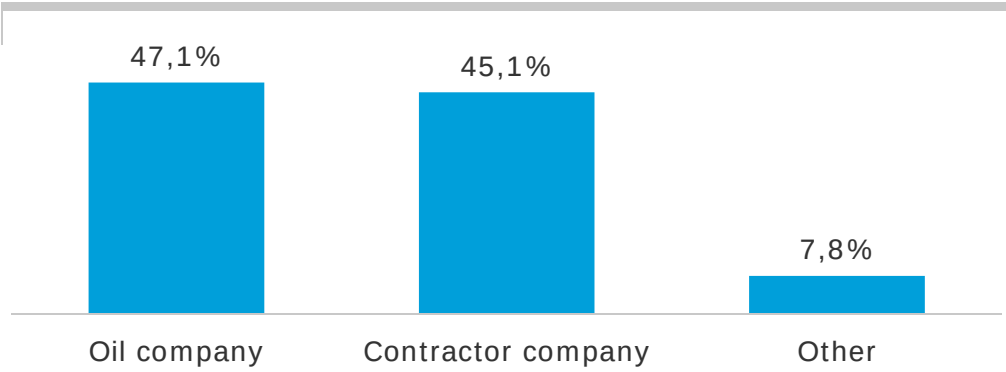
Outlook for Oil & Gas industry 2016

- Industry confidence will remain low
  - Overall confidence follows oil price
  - Few believe in a balance of supply and demand in 2016
- Cost management continues to be a top priority globally
  - Dramatic reduction in planned Capex
  - 9 of 10 believe industry will be successful in reducing cost
- Standardization to drive efficiency improvements, not innovation
  - Simpler process and design
  - Adoption of industry standards
  - Increased replication
- Balancing short-term cost control with long term value
  - 50% responded that R&D had not suffer in the current environment
  - Subsea technology to have the greatest impact

TRENDS AND OUTLOOK OF SUBSEA PROCESSING

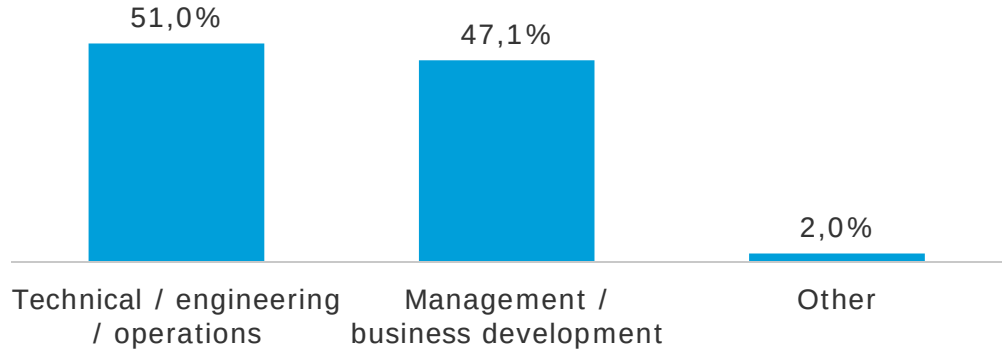
Respondents were evenly distributed between oil companies and suppliers, mainly senior personnel, evenly split between technical experts and management

Respondents

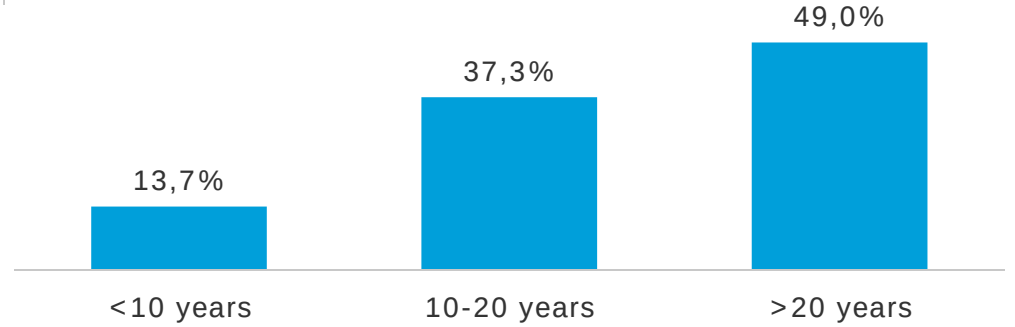


- 200 subsea industry practitioners were invited to participate
- 70 responded
- The respondents equally represents both oil companies and their suppliers

Respondents' position

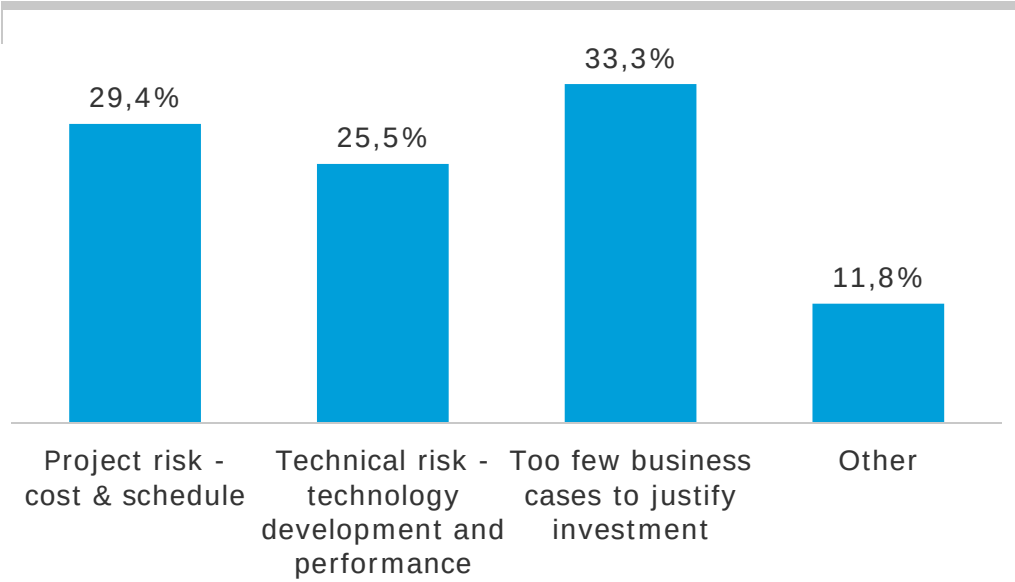


Respondents' experience in industry



Subsea processing is struggling to justify itself and is continuously delivering below growth projections

For the last 15 years a number of market outlooks have had very optimistic projections for subsea processing installations. What do you think is the MAIN reason for these projections being too optimistic?



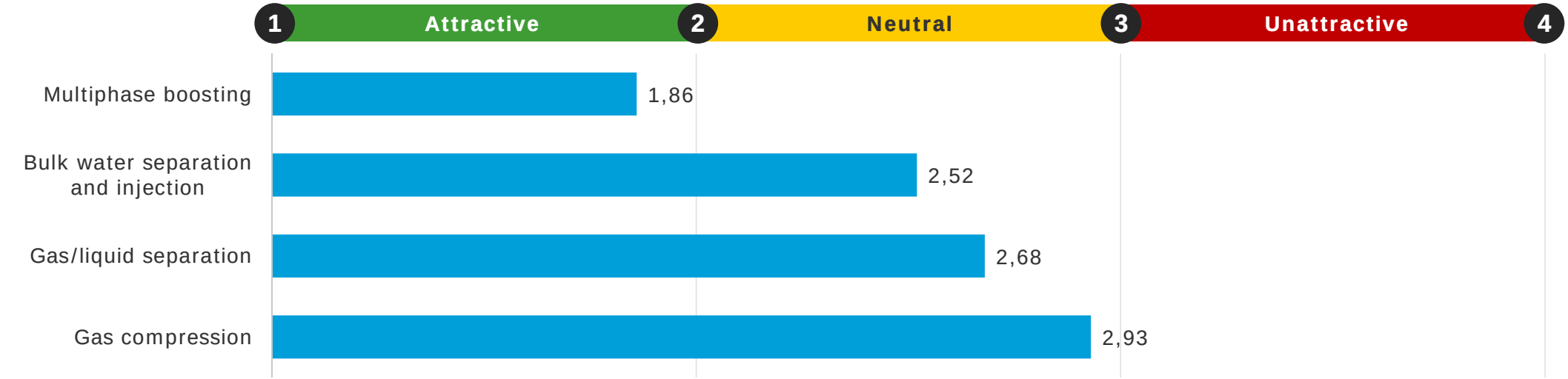
- Subsea processing market projections have consistently overestimated the growth of the market
- When asked why
  - 33% of the respondents said it simply was a lack of business cases that stacked up
  - 29% identified the project risk, cost & schedule, which mean a total of 62% thinks it is down to economics
  - 25% answers technical issues, which thus are overshadowed by economics

It seems the engineers' have done their part of the job

Unsurprisingly, multiphase boosting is considered the most attractive technology

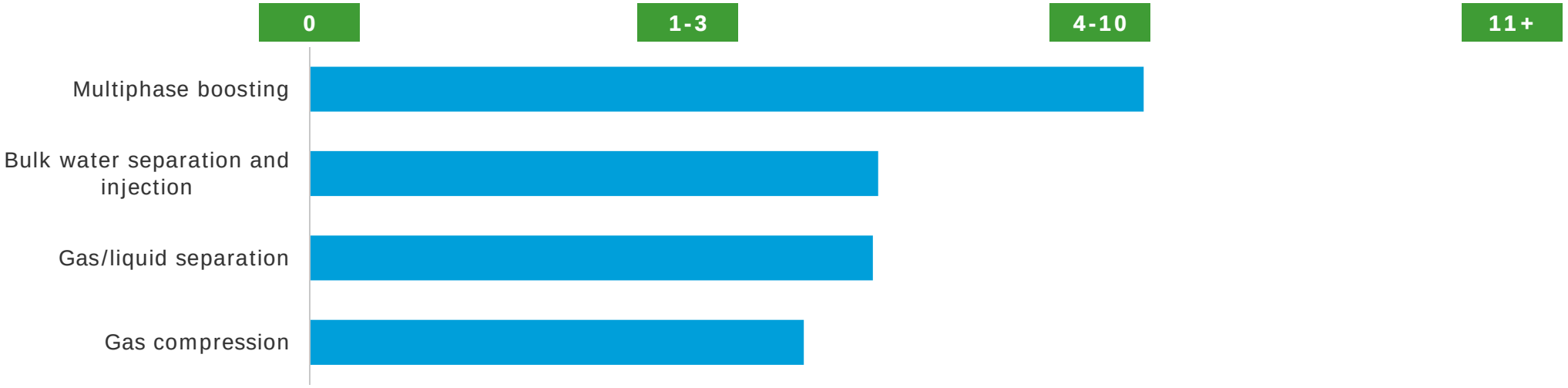
- When asked to rate different subsea processing technologies based on attractiveness, multiphase boosting was the clearly preferred technology
- Gas compression is considered the least attractive technology, but also the only technology not in operation at the time of the survey

Rate the attractiveness of these different subsea processing technologies on a scale from 1 to 4, where 1 is the most attractive and 4 is the least attractive?



When asked to indicate number of subsea processing projects to be sanctioned over the next 5 years, the results are sobering

Rate the attractiveness of these different subsea processing technologies on a scale from 1 to 4, where 1 is the most attractive and 4 is the least attractive?

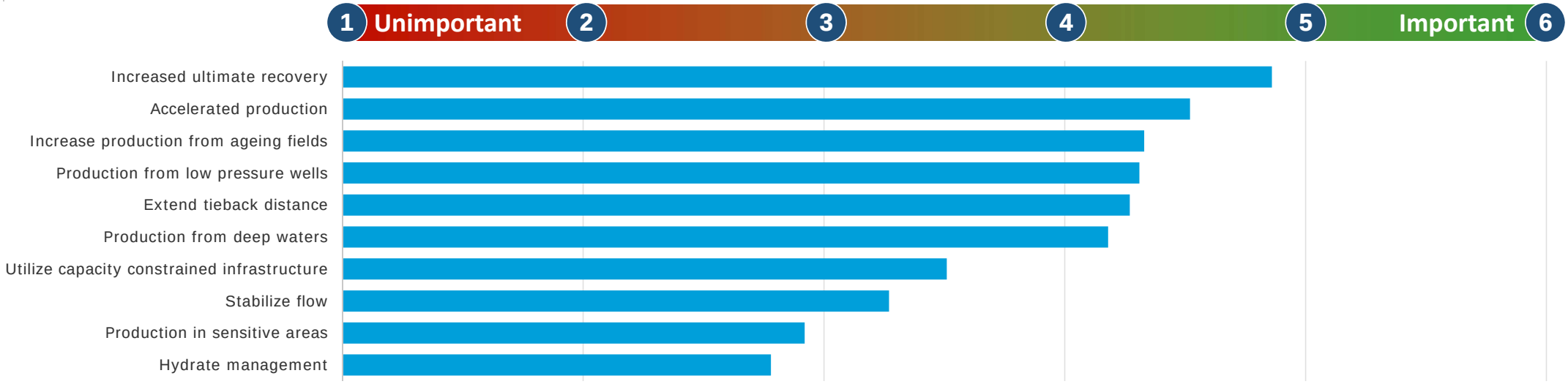


Attractiveness	Technology	Equal to
4-10	multiphase boosting projects	1-2 /yr
1-3	bulk water separation projects	0-1 /yr
1-3	gas/liquid separation projects	0-1 /yr
1-3	gas compression projects	0-1 /yr

Multiphase boosting has, as expected, a clear business case driven by faster and higher production

- Enhancing production performance through higher and faster production is unsurprisingly identified as the most important drivers
- Enabling production from low pressure wells, deepwater, and long distance tie-ins is identified as the second most important category of driver
- Flow related improvements are subordinated
- Note that the different alternatives are not necessarily mutually exclusive

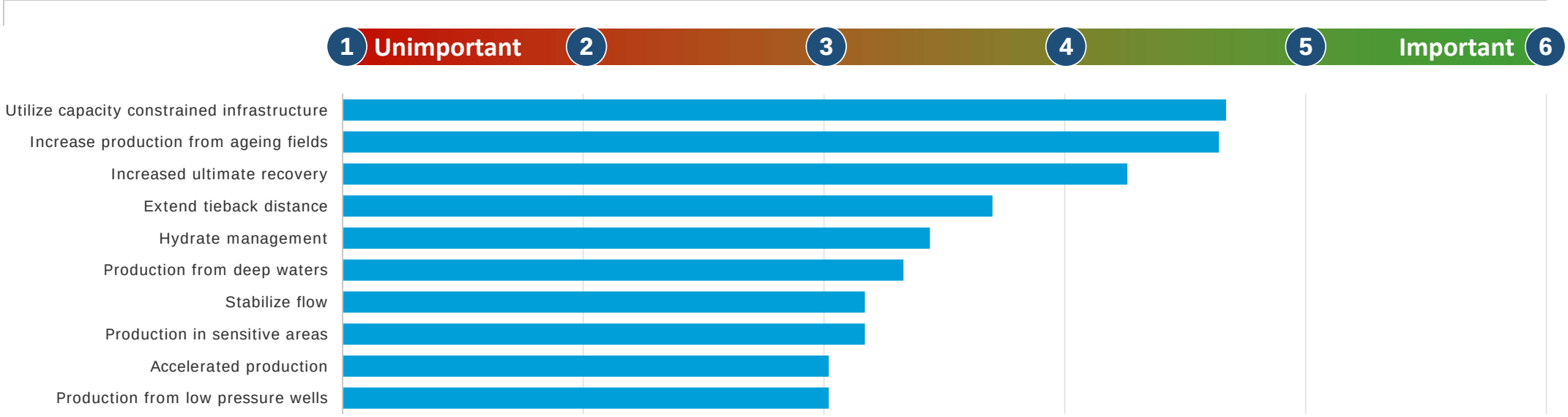
What are the most important drivers for the use of subsea multiphase boosting?
Please indicate on a scale from 1 to 6, where 6 is very important and 1 is not important at all



Bulk water separation is driven by improved infrastructure capacity utilization

- Relative to multiphase boosting, water separation is to a larger degree seen as a way of improving capacity utilisation, be it flowlines or processing equipment
- Increased production from ageing fields and ultimate recovery is important as for multiphase boosting, but less focus on accelerated production
- Flow related issues like hydrates and tie-back distance has a significantly lower score

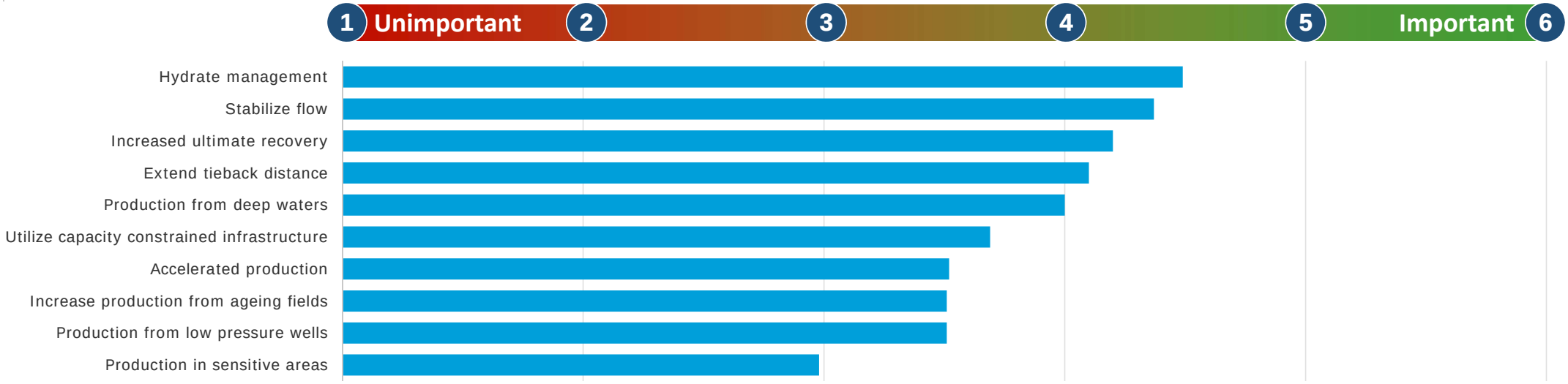
What are the most important drivers for the use of bulk water separation?
Please indicate on a scale from 1 to 6, where 6 is very important and 1 is not important at all



Gas/liquid separation business case is to a large degree driven by flow assurance

- The most important drivers for gas/liquid separation concerns flow assurance; stabilize flow and hydrates.
- This is different from the increased production focus of multiphase boosting and capacity utilization of water separation
- Increased ultimate recovery emerges behind the flow related issues, but not seem to be considered to be a typical brownfield solution like multiphase boosting and water separation

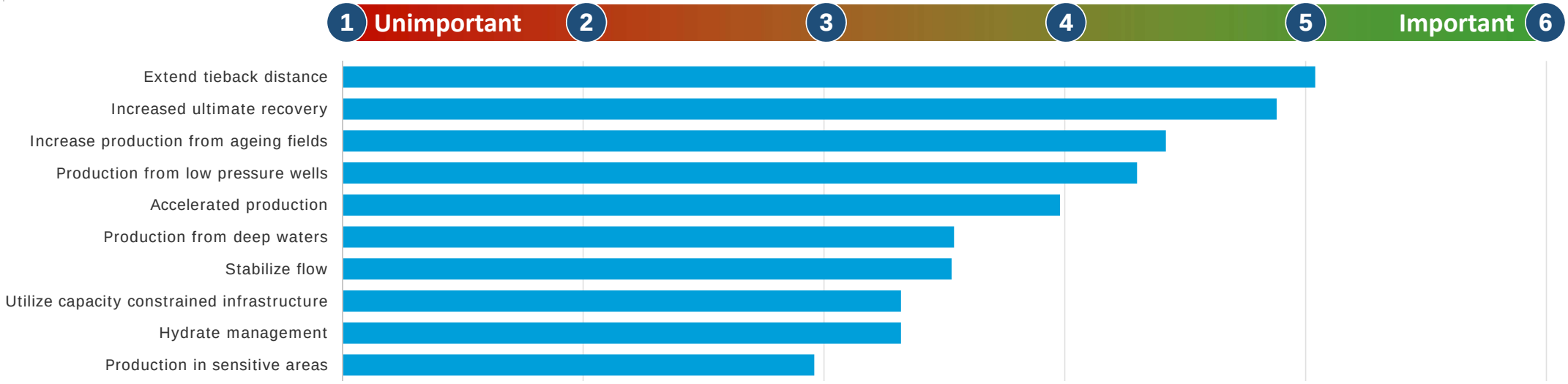
What are the most important drivers for the use of gas/liquid separation?
Please indicate on a scale from 1 to 6, where 6 is very important and 1 is not important at all



Gas compression – as multiphase boosting – is all about either enabling longer tie backs, or increased production

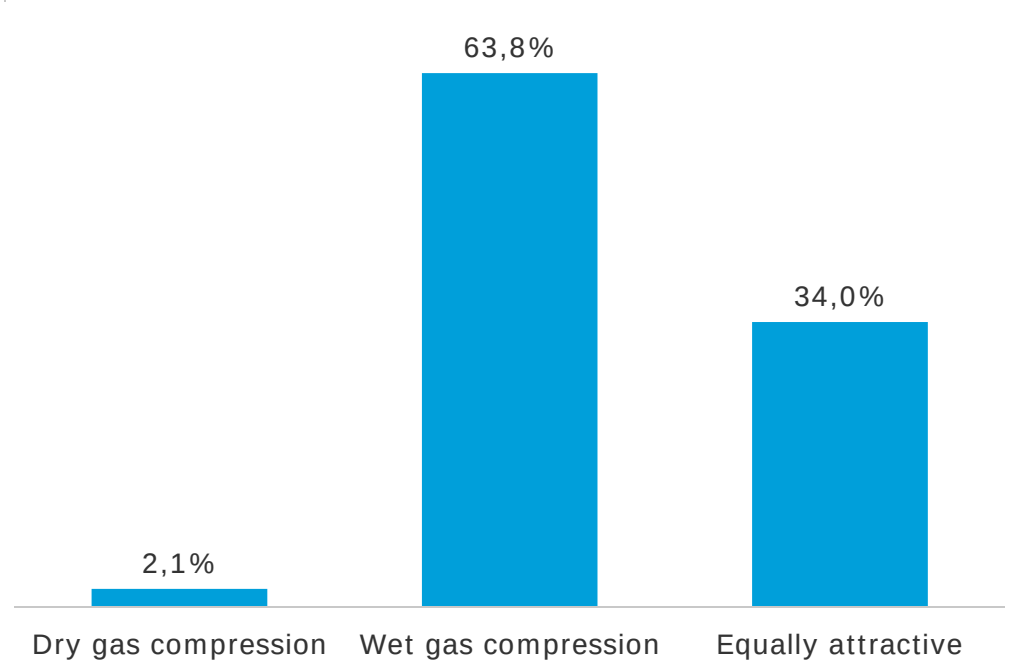
- The identified reflect the drivers of the two only subsea compression projects globally: extending the production of existing fields
- Interesting to note is that gas compression is considered an enabler for longer tie-backs

What are the most important drivers for the use of gas/liquid separation?
Please indicate on a scale from 1 to 6, where 6 is very important and 1 is not important at all



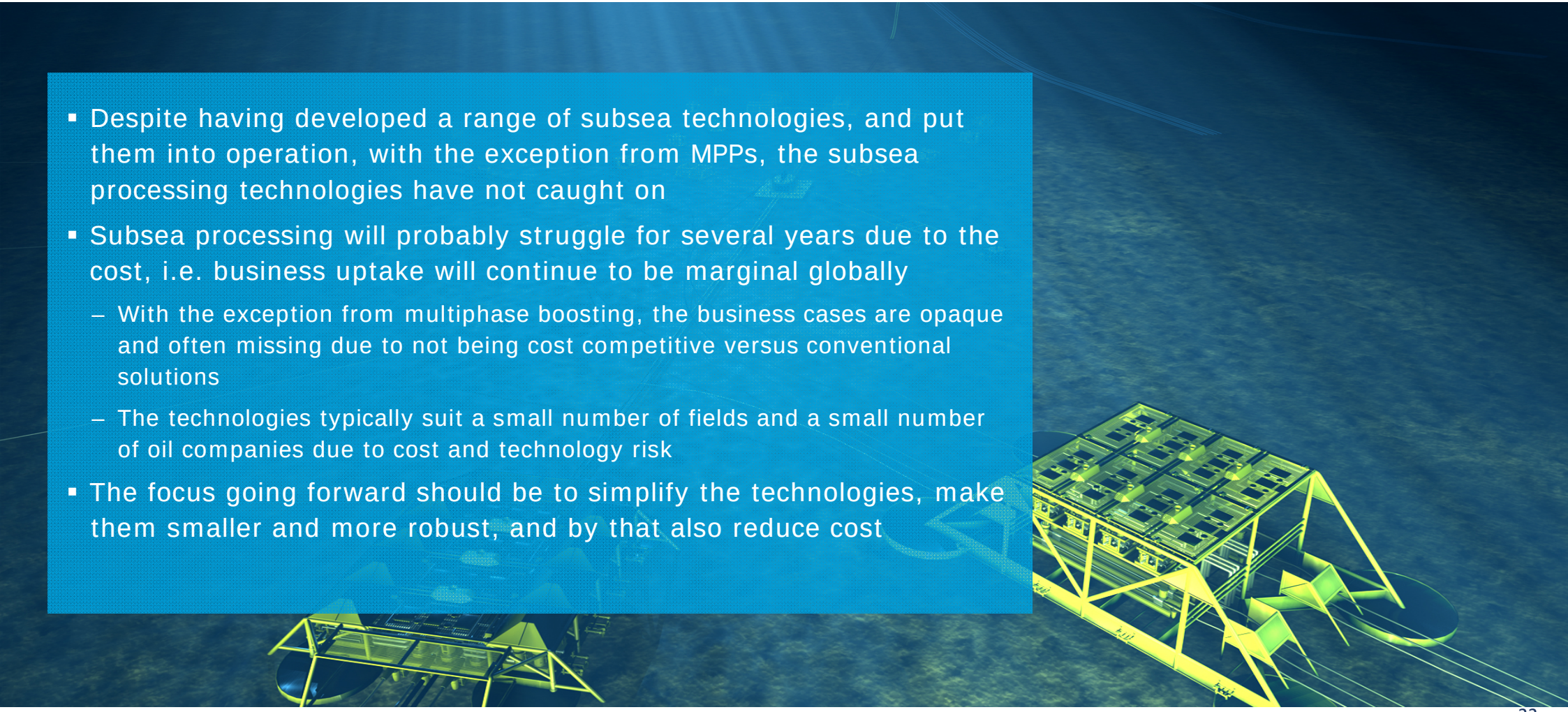
Respondents either prefer wet gas compression, or have no view

In a 10 years perspective, which of the two subsea compression technologies do you think will be dominating subsea?



- 2/3 believes in wet gas compression, while 1/3 finds both technologies equally attractive
- Is the complexity described under “weaknesses” putting people off dry gas compression, at least until it is proven?
- Or is it a fundamental issue, where the simpler, cheaper but smaller and less efficient wet gas compression will continue to be preferred also when both compression projects are on stream?
- Åsgard start-up have increased preference for dry gas compression

Subsea Processing Survey



- Despite having developed a range of subsea technologies, and put them into operation, with the exception from MPPs, the subsea processing technologies have not caught on
- Subsea processing will probably struggle for several years due to the cost, i.e. business uptake will continue to be marginal globally
  - With the exception from multiphase boosting, the business cases are opaque and often missing due to not being cost competitive versus conventional solutions
  - The technologies typically suit a small number of fields and a small number of oil companies due to cost and technology risk
- The focus going forward should be to simplify the technologies, make them smaller and more robust, and by that also reduce cost

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Contact

oystein.grande@dnvgl.com

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