



Oil&Gas technology: 5 years back and forward outlook

Peter Parry

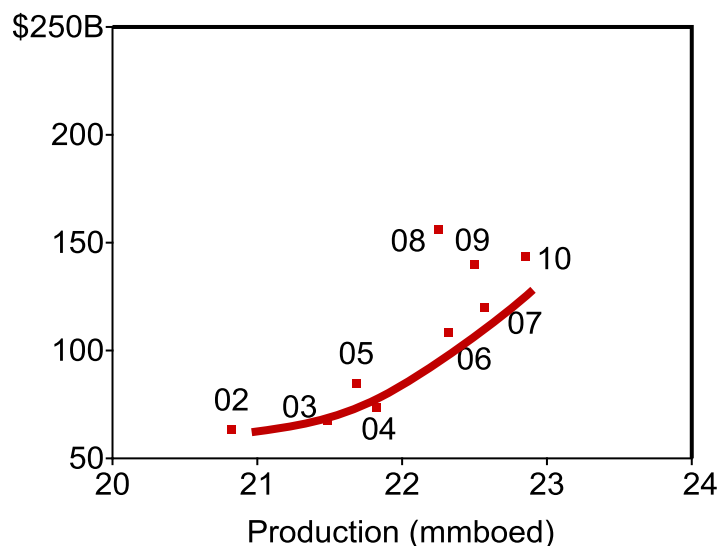
BAIN & COMPANY 

October 2019

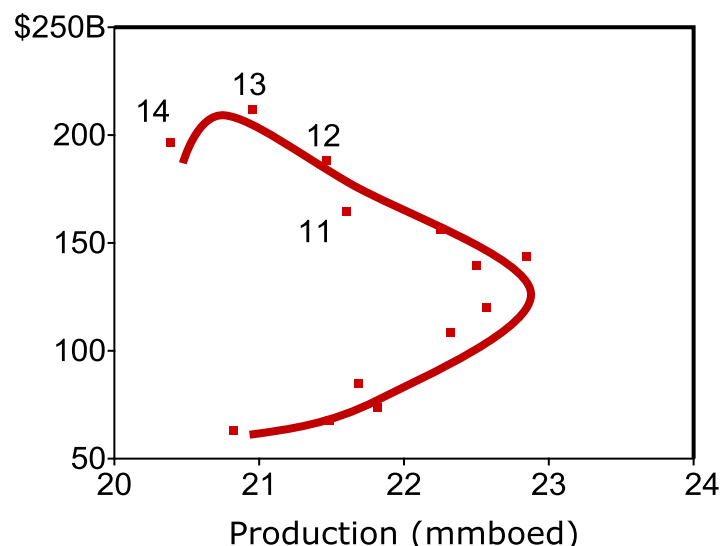
2014 oil price decline, oil majors focused on cost, efficiency and lower investment

Increased investments (2002–10)

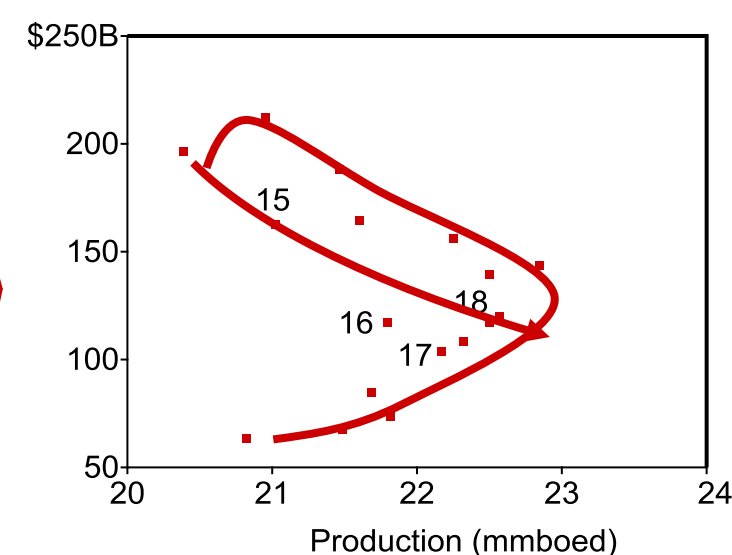
Major IOC Production and CAPEX (by year, 2002-2018)



Strong confidence (2011–14)



Declining investment (2015–now)



Period of growth with increasing CAPEX investments and production

Limited cheap oil and strong confidence pushing companies to **invest in new assets**

Reduced investment and oil price decline led companies to focus on **cost and efficiency improvements**

Note: Major IOCs include BP, Chevron, ConocoPhillips, ENI, ExxonMobil, Shell, Equinor, Total. Reuters data shifts after 2017 to HH alternative marker from SNL
Source: DNV GL – A test of resilience, The outlook for the oil and gas industry in 2019; Bain & Co O&G Benchmark Database; Bloomberg; Thomson Reuters; CapIQ; Analyst reports; Company reports

Key technology themes over the past 5 years

Exploration

- **ENHANCED EXPLORATION**
But less focus on new frontiers compared to previous decades



Projects

- **SOPHISTICATED STANDARTIZATION**
Fit-for-purpose, modular, standardized designs



Operations

- **COST OPTIMIZATION**
Design-to-cost based on costs driver trees



Digital

- **BIG DATA**
Operational improvements leveraging digital technologies around automation & robotics, big data & analytics and connectivity



Current market context and implications for future technology development

Energy transition

- **Energy markets are in transition** – pressure from regulators to meet “green” requirements is causing sustainability initiatives to become a critical business enabler

Shifting O&G portfolio

- **Onshore unconventional**s are becoming an increasingly important part of the O&G energy mix with reduced break-even costs, pushing down the industry supply curve

Cost & efficiency focus

- The O&G market has moved from supply to demand constraint, putting **pressure on margins** and emphasis on **return on capital**

Digital

- Digital is creating **new opportunities, new business models** (e.g. through untraditional market participants and partnership models), and **new ways of working (e.g. agile)**



Implications

- To address growing challenges for O&G industry and unleash the next wave of efficiency and productivity, the players will need to harness opportunities in integrated technology

O&G Industry integrated technology and comparison to others industries?

The effectiveness of integrated technologies (and many discrete technologies) will be dependent on several important factors:

- ① **Elements of value** a new way to understand technology uptake drivers
- ② **High integration technologies move** to and develop further potential in new areas
- ③ **Adoption rate** can take off as a technology, offer and integration possibilities expand
- ④ **Substitution barriers** fall away as technology integration changes or expands

Integrated technology – Elements of Value – EV customer example

Social impact elements

What value to society?

Life-changing elements

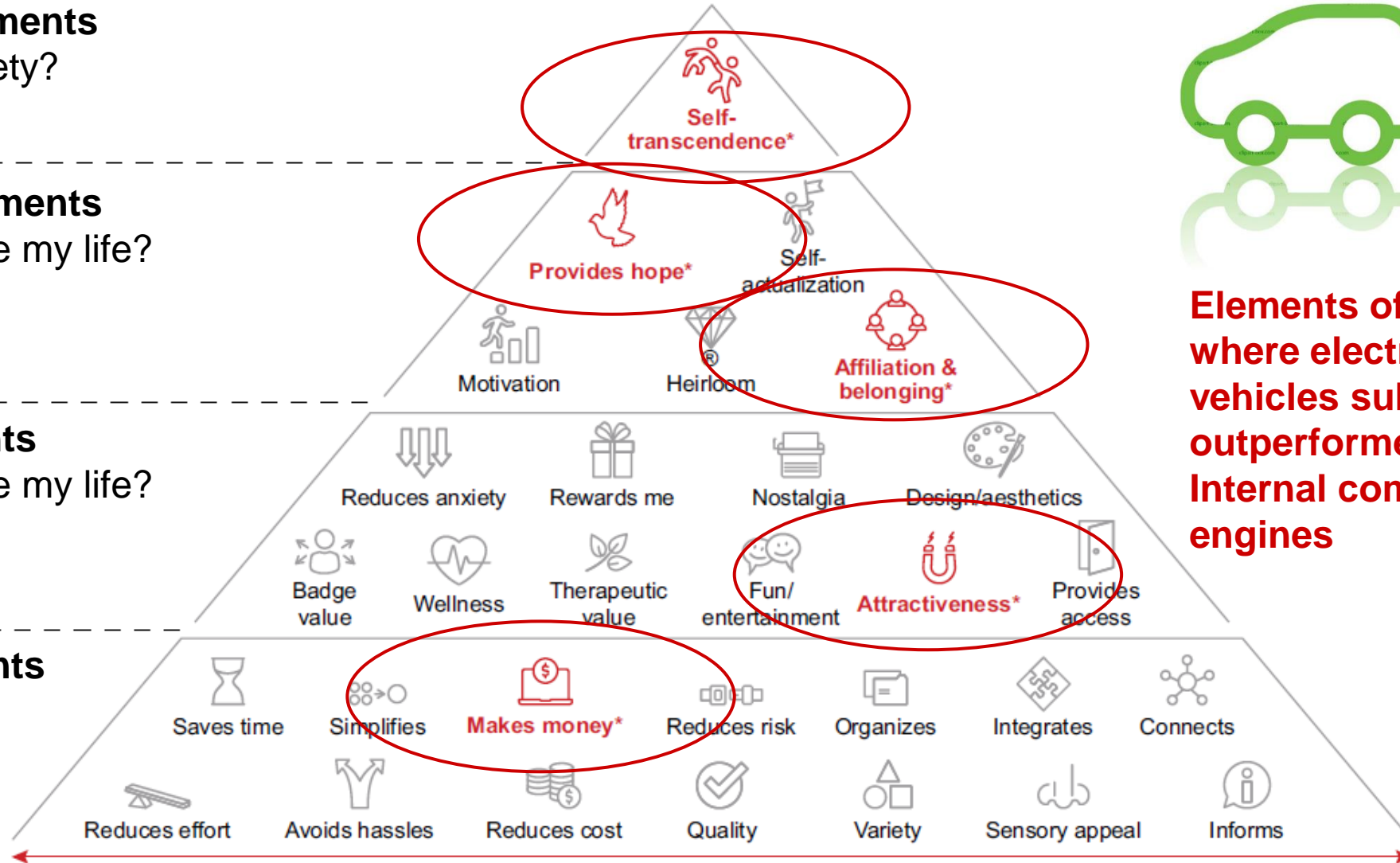
How does it change my life?

Emotional elements

How does it change my life?

Functional elements

What does it do?



Elements of value where electric vehicles substantially outperformed Internal combustion engines

Inwardly focussed value

Outwardly focussed value

Integrated O&G technology might focus almost entirety on functional elements

Social impact elements

What value to society?

Life-changing elements

How does it change my life?

Emotional elements

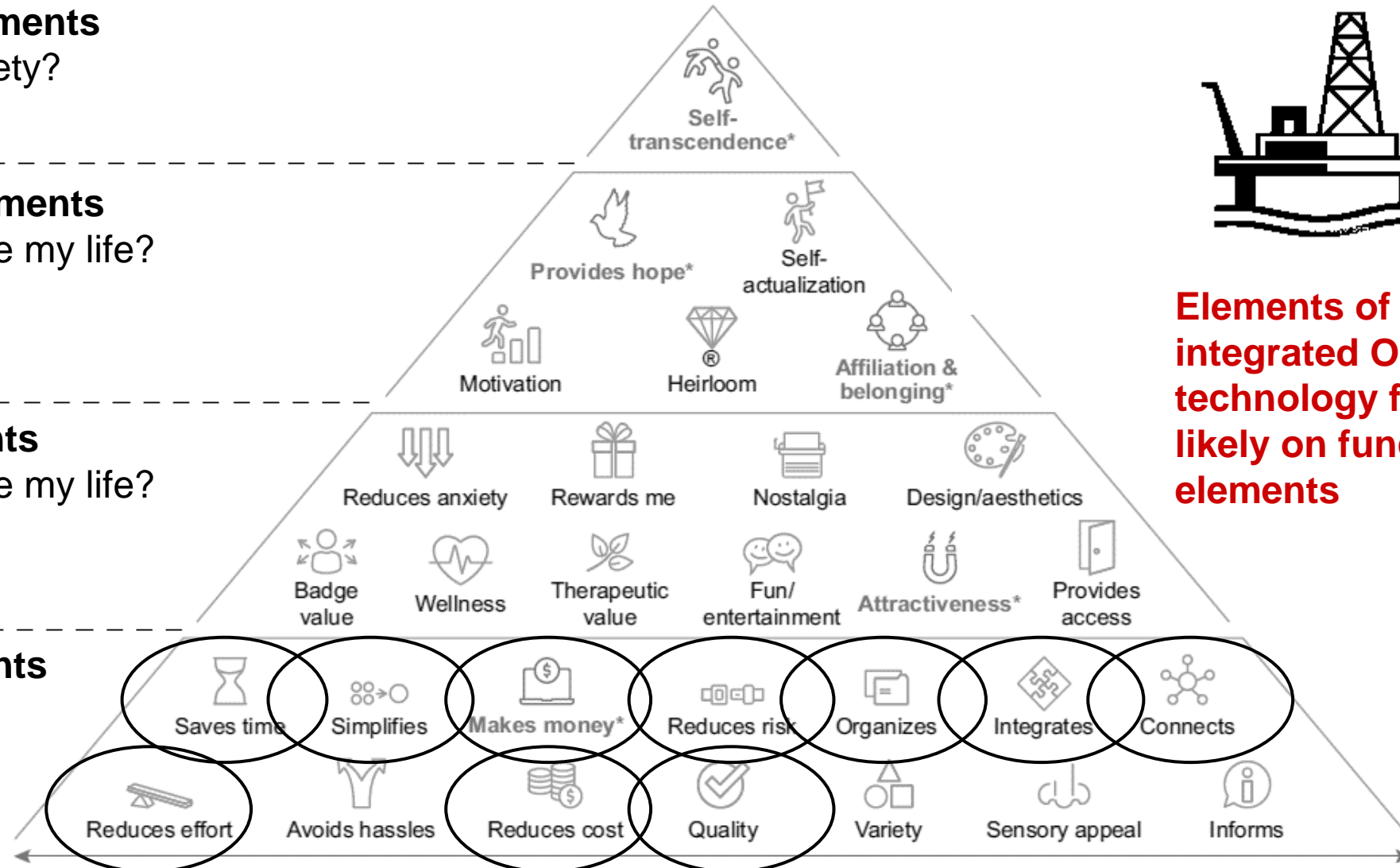
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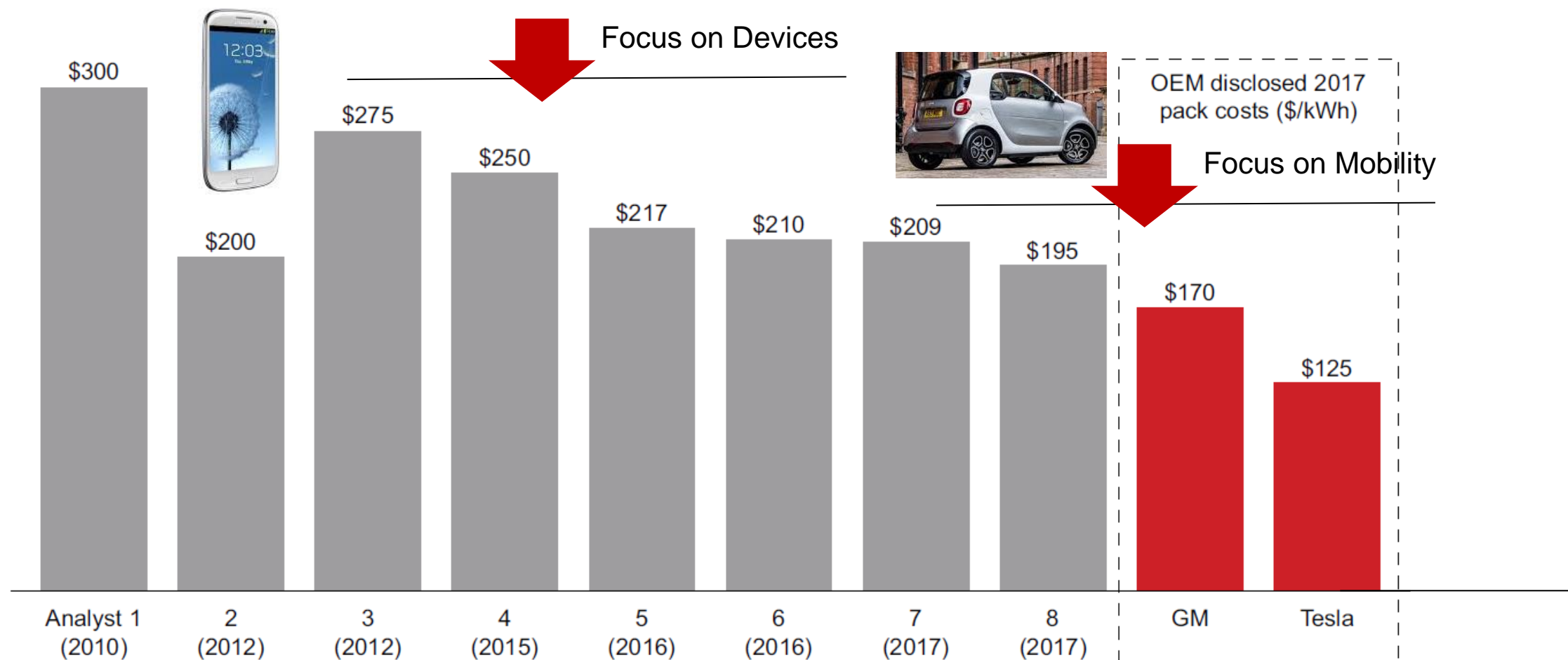


Elements of value for integrated O&G technology focus likely on functional elements



High integration technologies move to and develop further potential in new areas

Analyst lithium-ion battery price forecasts for 2020 (\$/kWh)

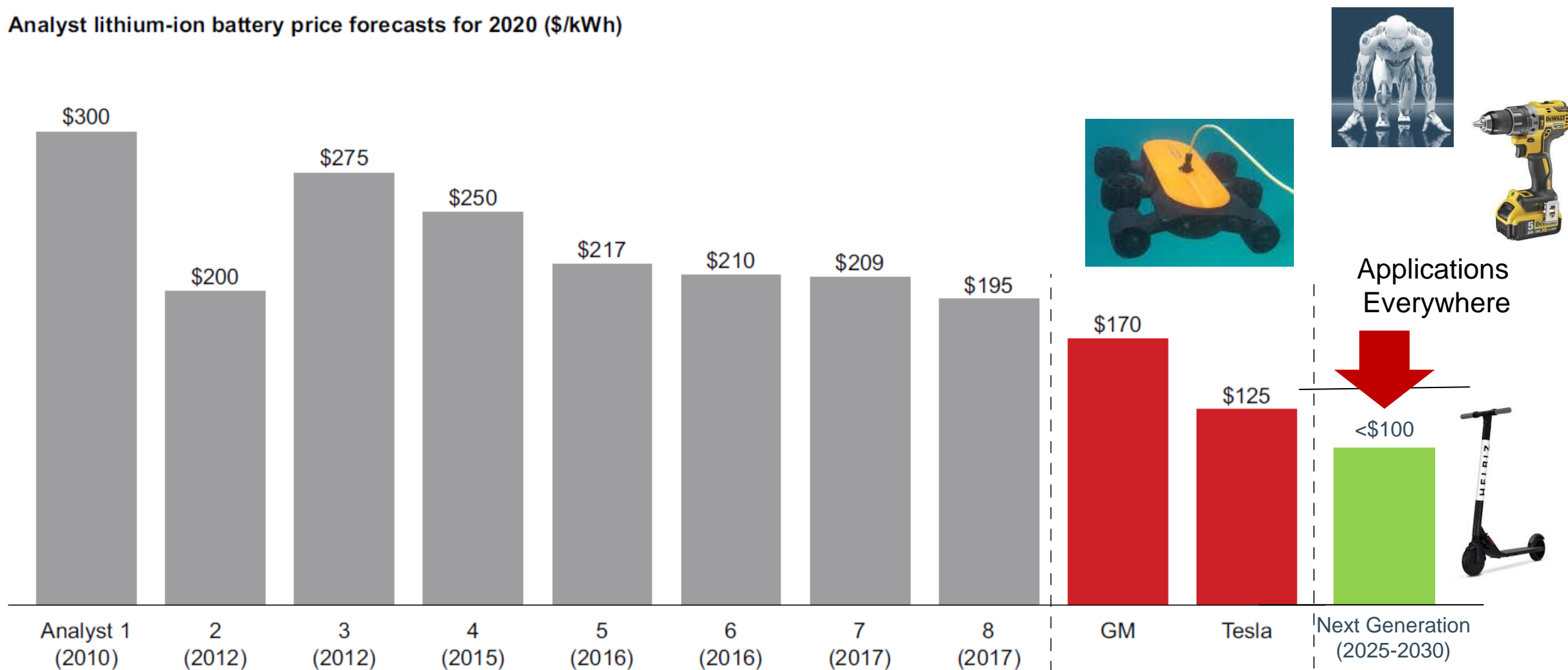


Notes: Refers to battery pack costs; assuming cell costs are ~70% of battery pack costs

Sources: MDPI (blog), "Cost Projection of State of the Art Lithium-Ion Batteries for Electric Vehicles Up to 2030," Berckmans, Gert et al., September 2017; Electrek.co; EV Obsession; Bengt Halvorson, "GM CEO Barra: Profitable, Affordable 300-Mile Electric Vehicles by 2021," *Car and Driver*, November 16, 2017; Bain & Company.

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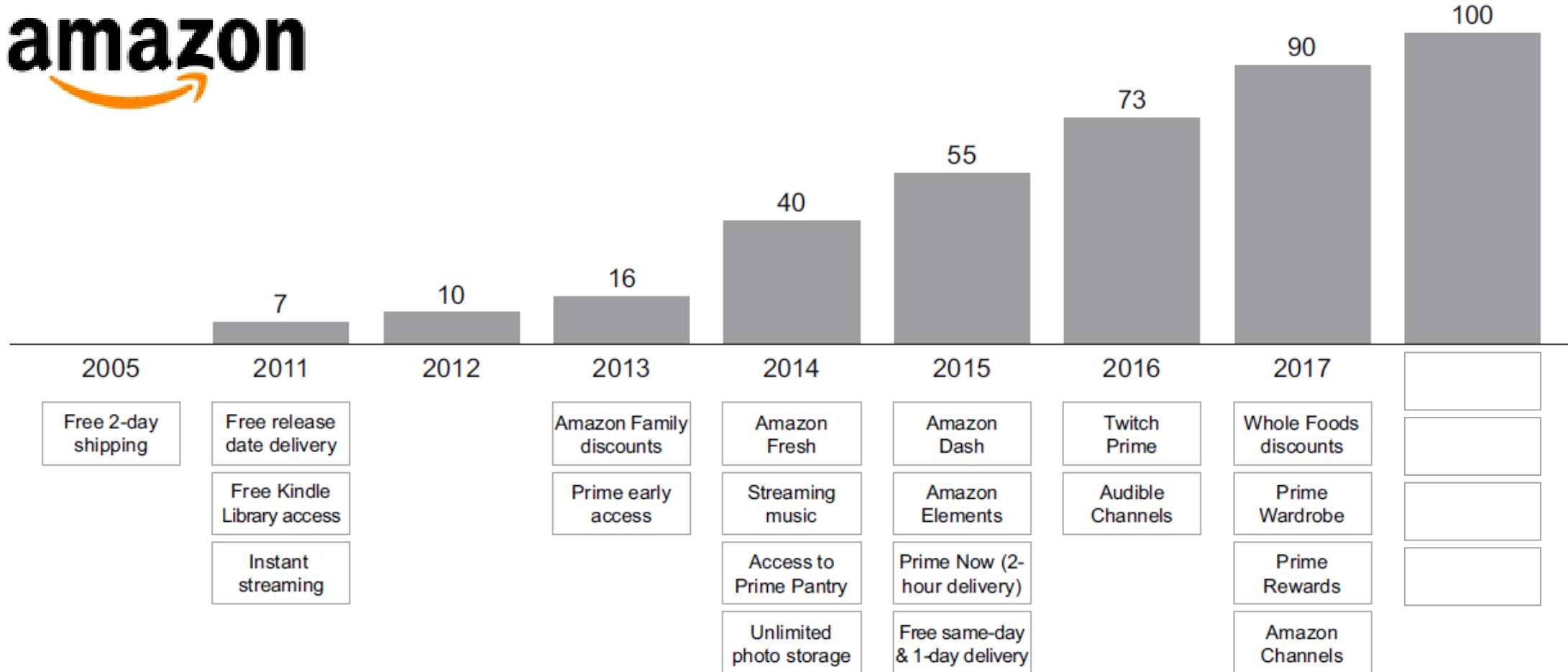
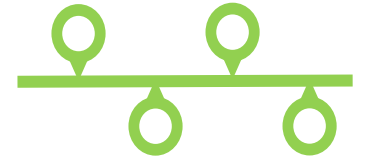


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Adoption rate can take off as a technology, offer and integration possibilities expand

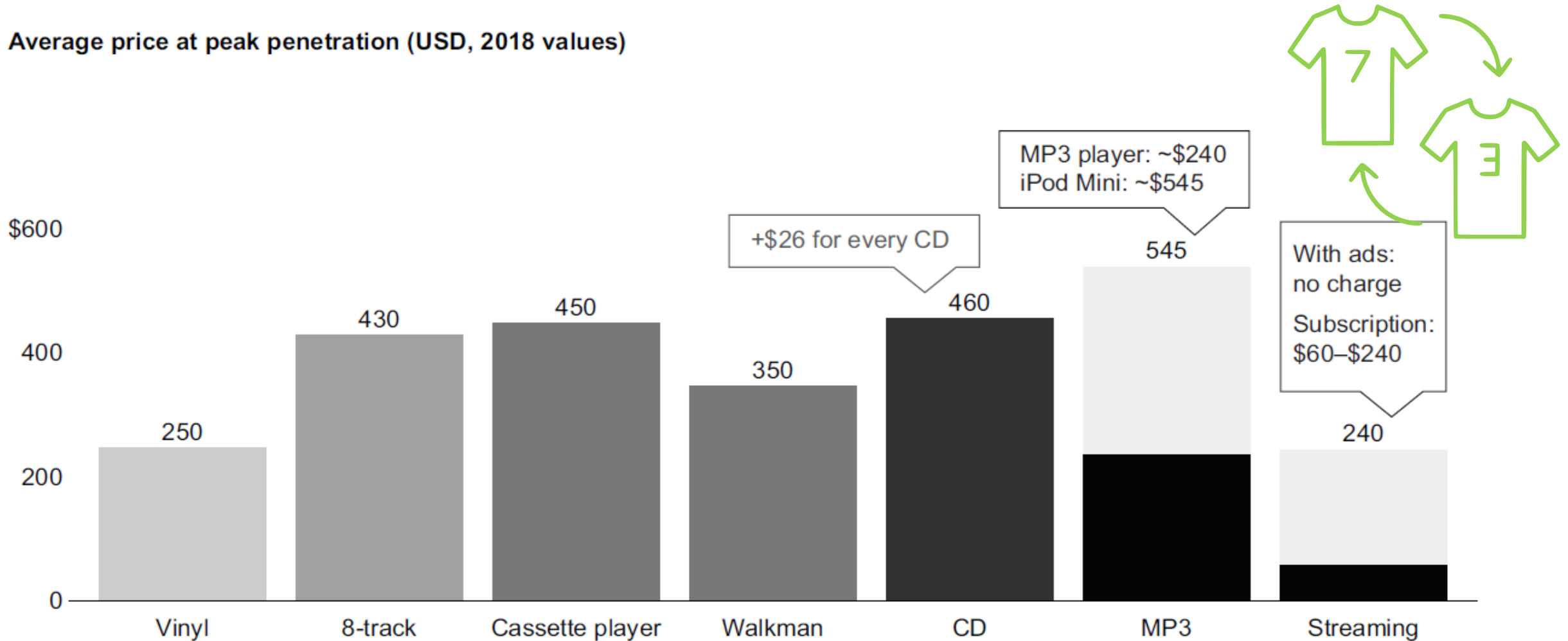
Amazon Prime US members (in millions)



Note: Elements of Value® is a registered trade mark of Bain & Company Inc Sources: Amazon.com, Digital Commerce 360, Bain & Company

Substitution barriers fall away as technology integration changes or expands

Average price at peak penetration (USD, 2018 values)



Improved value:

Less noise,
longer

Listen to music
in the car

Record at
home/longer

Listen on
the go

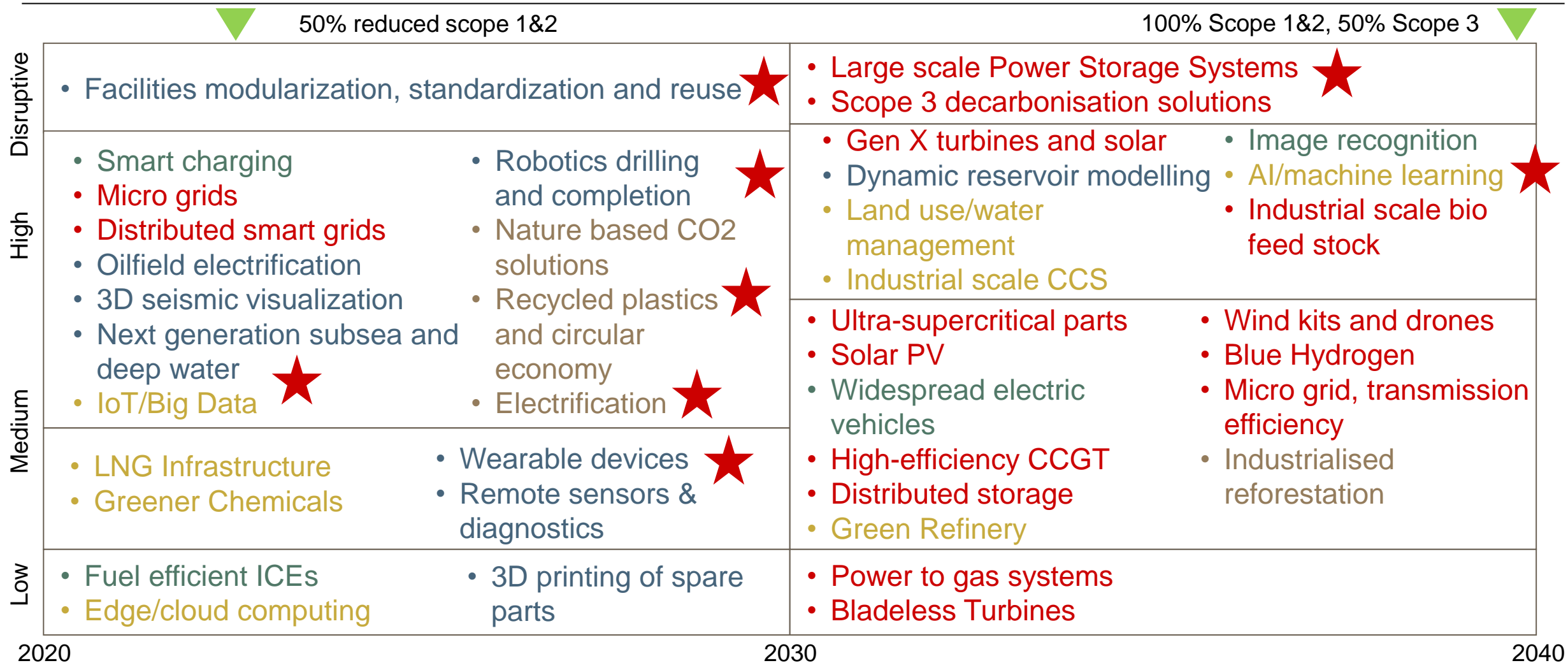
Skip tracks/
less noise

Size, capacity,
own playlist

In-app,
unlimited

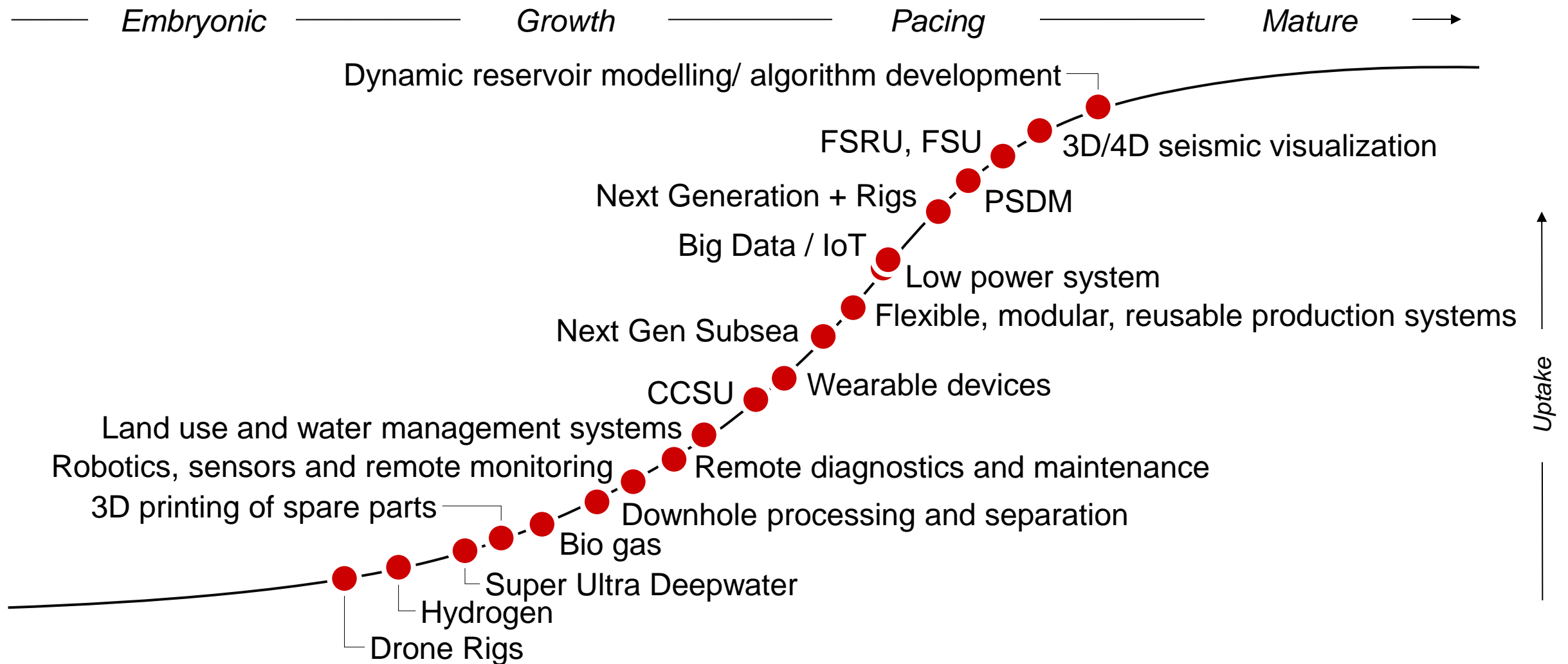
A 20 year energy sector technology roadmap highlights integration potential areas

Illustrative Energy Technology Future 2020-2040 **impact** roadmap



Source: Bain & Co

A current upstream technology S curve suggests lots of integration opportunity



Joining the dots: Next generation O&G integrated technology examples

- Offshore/ onshore facilities electrification via cable or distributed renewable power
- Carbon Capture and Sequestration, pressure pumping, large scale energy storage, communications hub services
- Reusable, mobile (floating or modular) processing plant and facilities
- Drone AI drilling, installation and logistics supply
- Integrated oil, gas and power with renewable power generation operations and maintenance, more circular and waste management
- Comprehensive digital operating envelope
- Flexible and interchangeable crews with robotics

Conclusions

- Elements of value - focus on more than the functional elements
- Drive technology platform migration and product 'reuse'
- Set aggressive time line and adoption growth rates by adding applications and continue solutions innovation
- Remove substitution barriers, integration takes off when a technology jumps to the next opportunity

