



THE BOSTON CONSULTING GROUP



INTERNATIONAL ENERGY FORUM

Energies' New Value Propositions for Industrial Growth in Asia

2nd IEF Industry Advisory Committee Workshop

Dr Ivan Marten

Vice Chairman of BCG's Energy Practice

Beijing, 31st July, 2018

Energy sector is dependent on technology and innovation



□ Become a hub for the research, development and manufacturing of technology-intensive and renewable technologies



□ Reduce import dependence, changing the national-level energy economics



□ Increase competitiveness of energy-intensive industries in the region

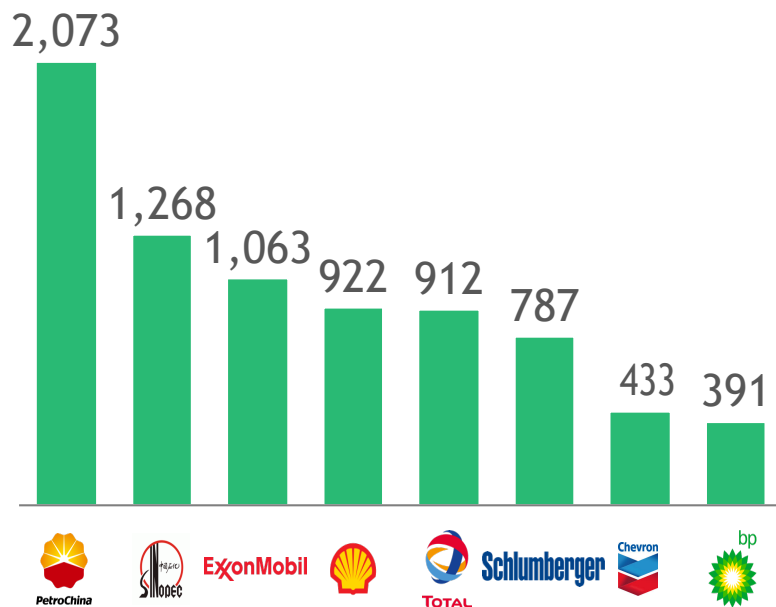
Energy transition poses new value propositions for industrial growth in Asia

Major E&P players invest actively in R&D

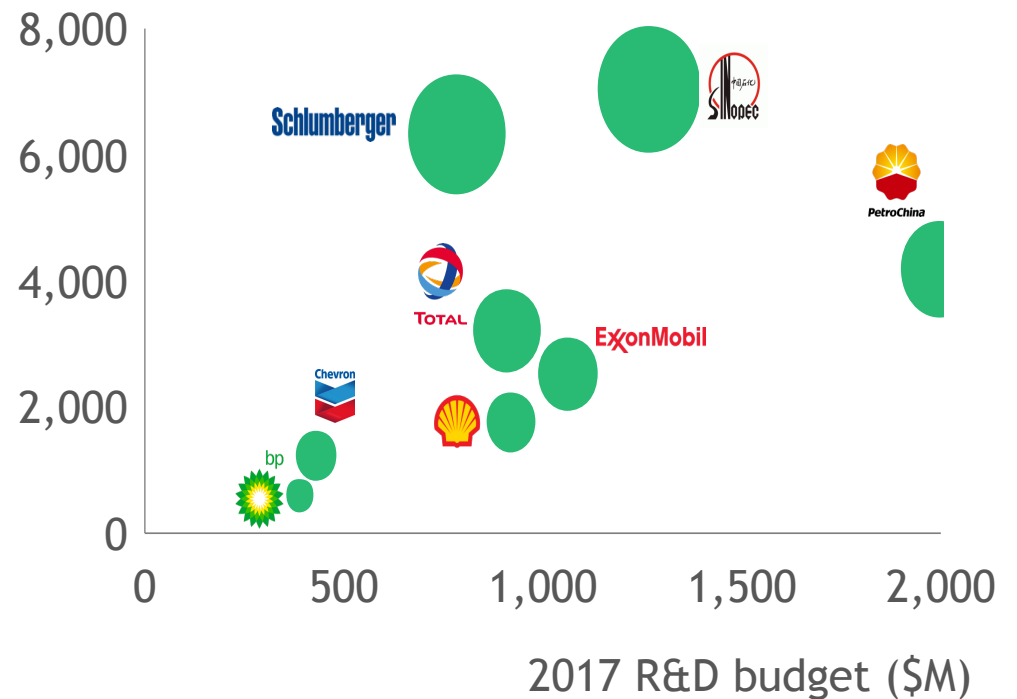
They spend ~\$1B on average annually...

... & have amassed a formidable IP base

2017 R&D budget (\$M)



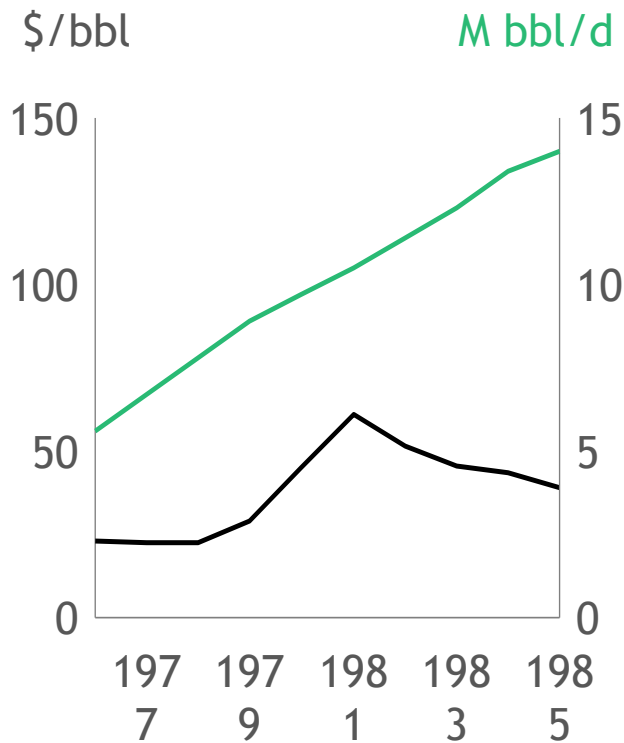
of patent families^{1,2} 2013-2017



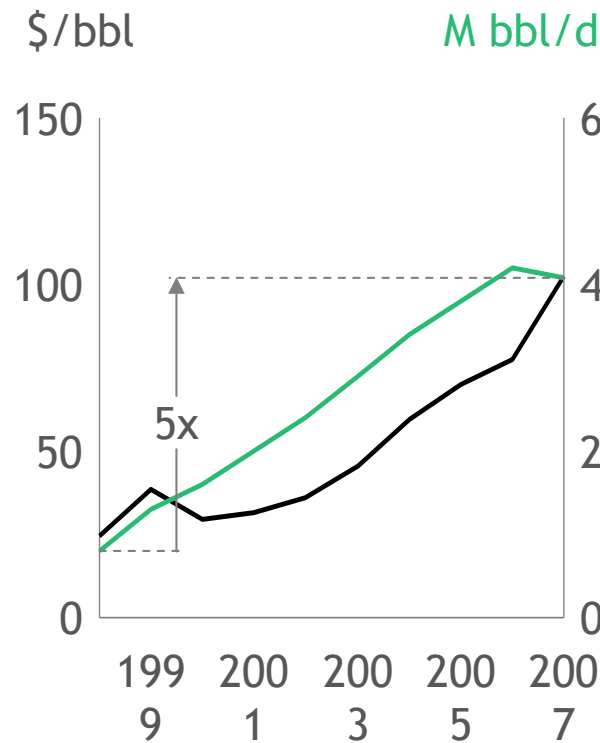
1. A collection of patent records that relate to the same innovation. For example, a patent describing a single innovation by the same group of inventors is filed in multiple jurisdictions and published at multiple stages. A patent family groups these records and selects one representative of the family; 2. For Saudi Aramco, only # of patent families shown
Source: Capital IQ, Derwent Innovation; BCG Analysis

High prices have always driven technology development

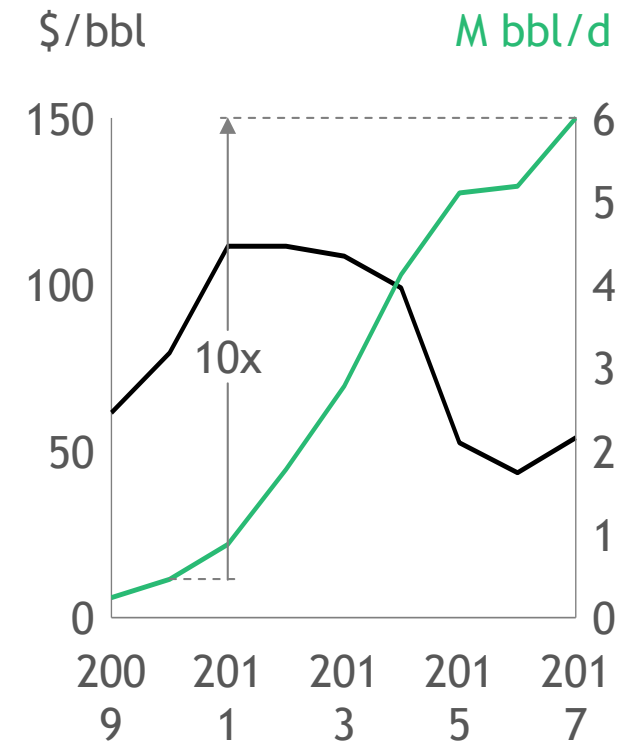
1976-1985: Offshore



1998-2007: Deepwater









2009-2017: Shale



— Oil prices
— Production

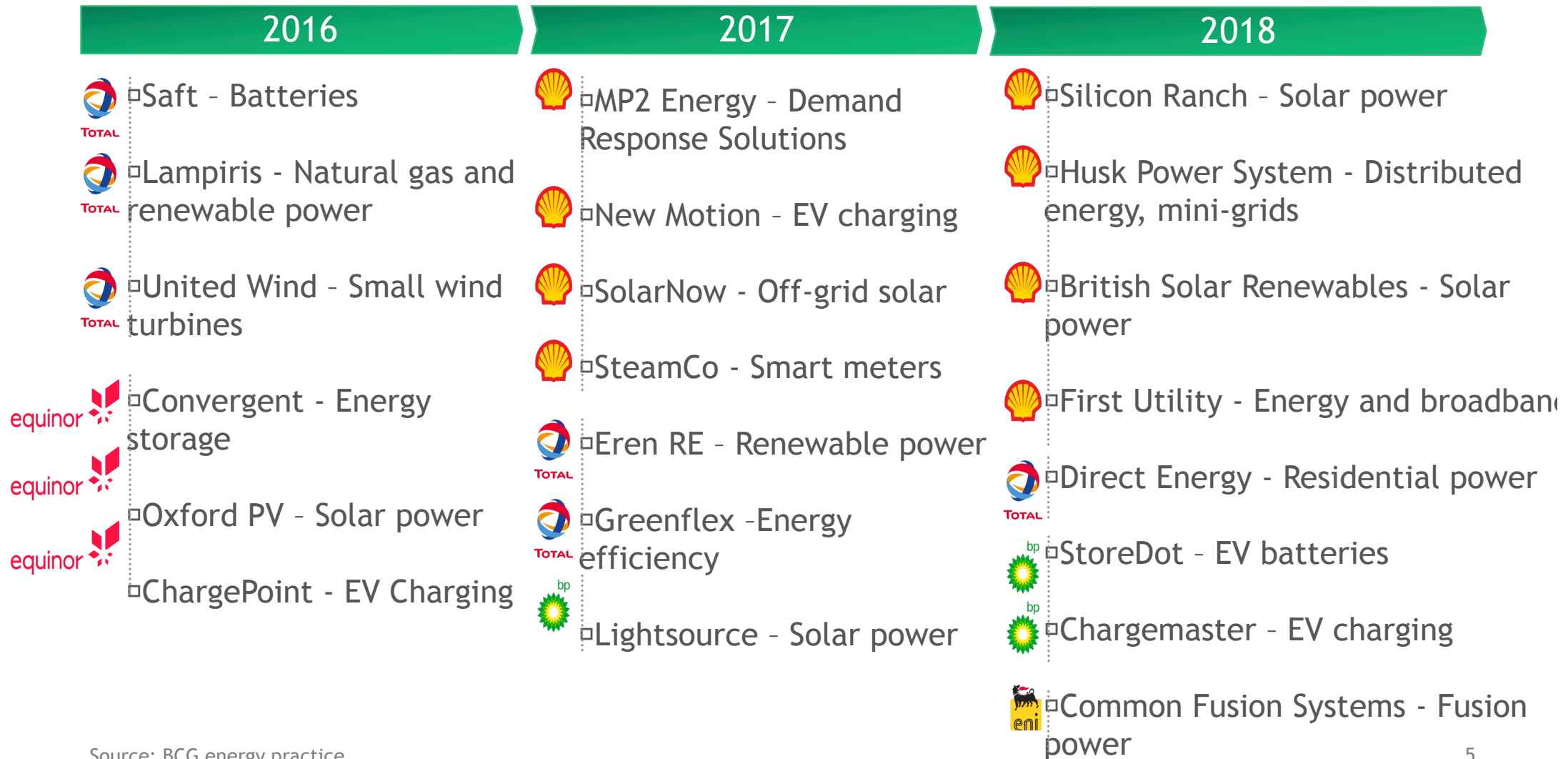
Majors have set up corporate venture capital funds to invest in Energy Efficiency and Renewable Energy

	Fund Name	Total Investment ¹	Year of Setup	Focus Technologies
 	AE Ventures	\$200M	2006	Biofuels, O&G and energy efficiency
	Chevron Technology Ventures	\$250M	1999	O&G, alternative energy, advanced materials, energy transition
	Future Energy Fund	\$100M	2018	Energy efficiency, alternative fuels, grid management
	Energy Technology Ventures	\$300M	2011	Renewables, smart grid, energy efficiency, fossil energy, nuclear, water
	Total Energy Ventures	\$175M	2016	Renewable energies, energy efficiency, waste management
	Equinor Technology Invest	\$135M	2000	Upstream O&G, renewable energy
	Equinor Energy Ventures	\$200M	2016	Renewable energy, energy storage, EV charging, solar, wind
	Saudi Aramco Energy Ventures	\$120M p.a.	2012	O&G, renewable energy, energy efficiency, water

1. Investment over the period: BP - 2006-13; Chevron - \$250M since 1999, \$100M since 2018; ConocoPhillips - since 2011; TOTAL - as of 2016; Equinor - \$135M 2000-16 and \$200M 2016 onwards for 4-7 years; Saudi Aramco - up to \$120M per year since 2012

Source: BCG Energy Practice

Majors are increasingly investing in renewables technology



In 2016, Oil and Gas Climate Initiative OGCI was launched

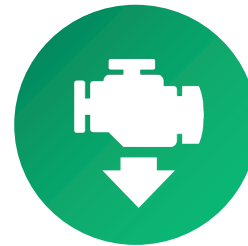
A \$1 billion investment vehicle



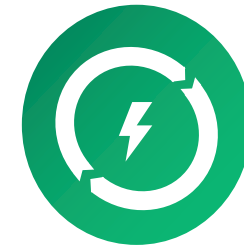
Carbon capture, utilization, and storage (CCUS)



Reducing methane emissions



Reducing transport emissions



Improving energy efficiency in industry



Investments will foster the expansion of new technologies



Big data & analytics



Cloud computing



Sensors



3D scanning



Mobile connectivity



Collaborative tech. platforms



Real-time comms & tracking



Additive manufacturing



Virtual reality



Unmanned aerial vehicles



Robots & automation



Cyber-security & blockchain

E&P companies are getting serious about Digitalization



Established
Digital Center
of Excellence



Looks to big data
to help weather
weak oil price



Partnership
with Microsoft to
fuel Digital
Transformation



Launching
second plant
4.0 start-up
incubator



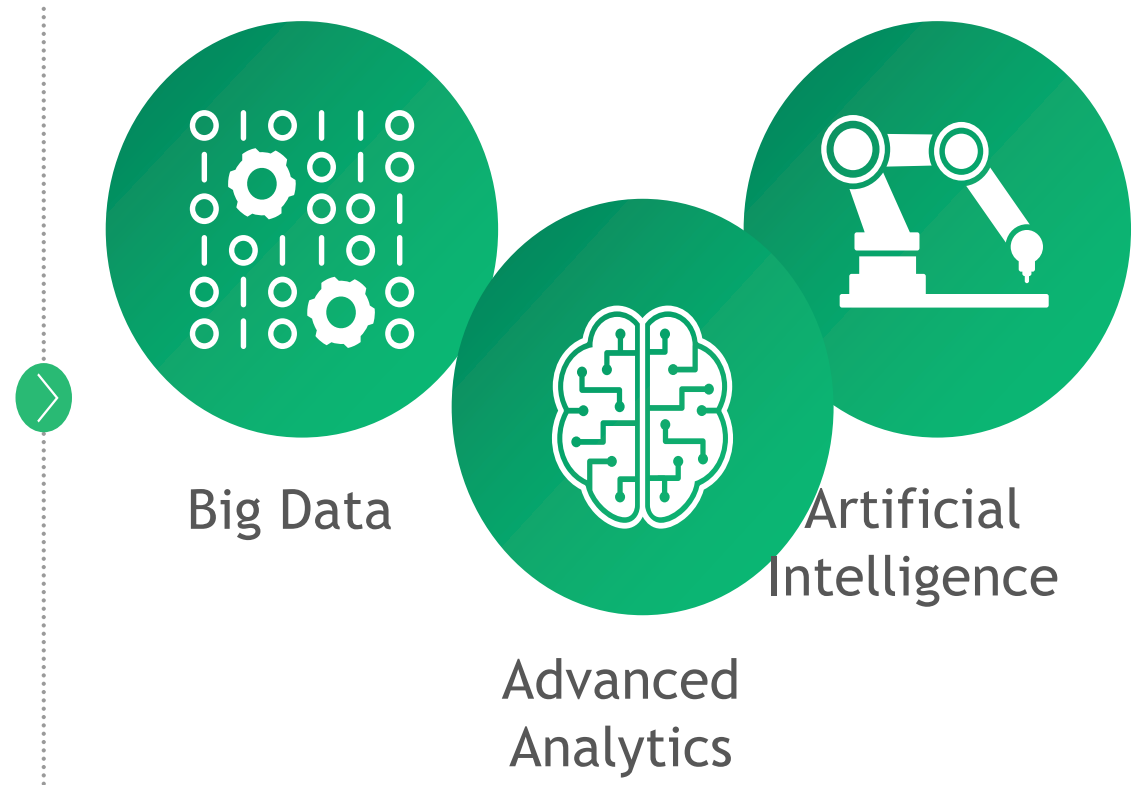
Created new
Digital Ventures

Asia is better suited for the future of E&P technology

The Past E&P Technology:
enabled access to new resource types

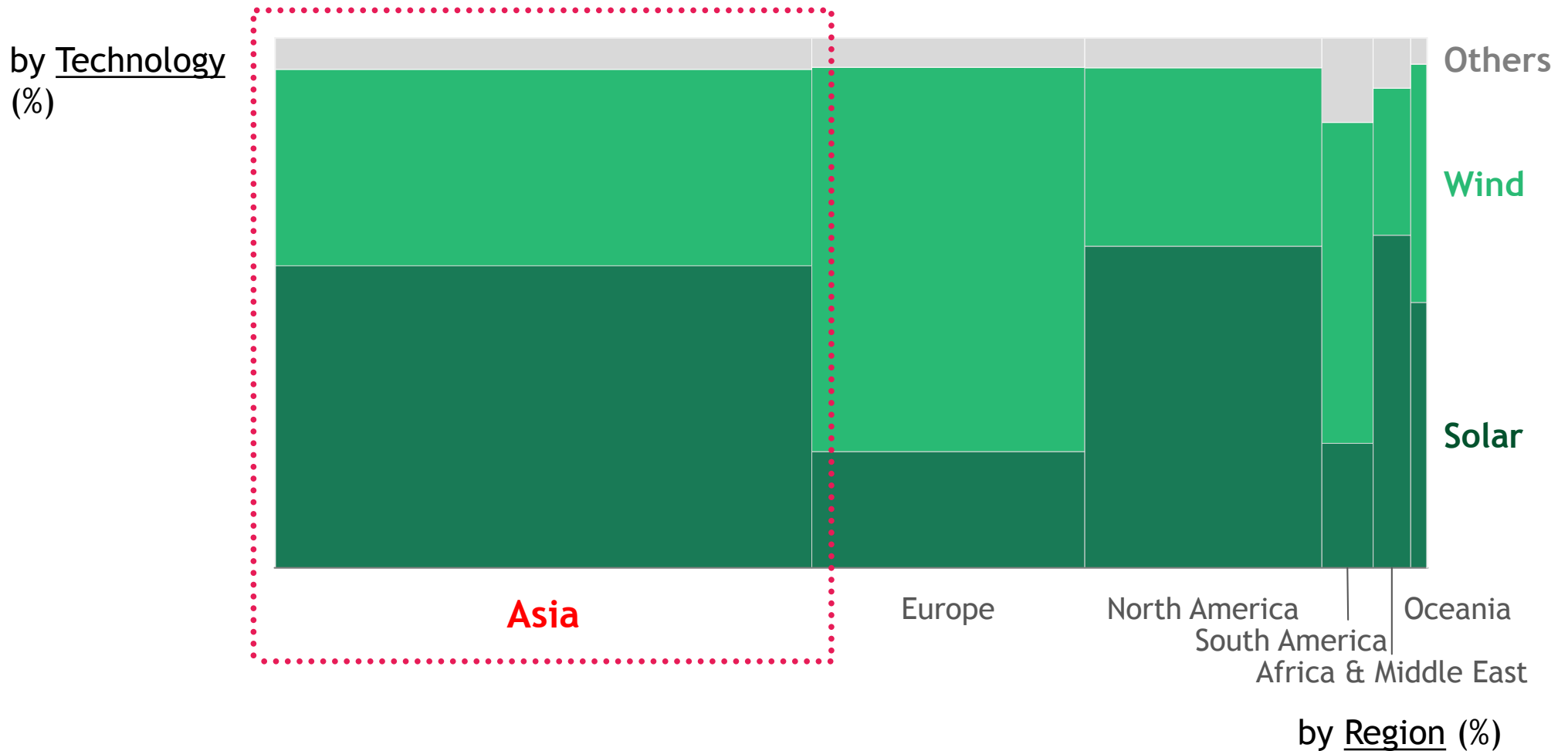


The Future E&P Technology



Asia is already a centre for Renewables growth

Renewable energy Investment by Region and Technology in 2016



1. Data for Biomass & Waste estimated from preliminary 2016 data

Note: Investment includes Asset Finance, Corporate R&D, Government R&D, Public Markets, Reinvested Equity, Venture Capital / Private Equity

Source: BNEF. BCG Analysis

Three opportunities for industrial growth in Asia



Become a hub for the research, development and manufacturing of technology-intensive and renewable technologies



Reduce import dependence, changing the national-level energy economics



Increase competitiveness of energy-intensive industries in the region



THE BOSTON CONSULTING GROUP



INTERNATIONAL ENERGY FORUM

Energies' New Value Propositions for Industrial Growth in Asia

2nd IEF Industry Advisory Committee Workshop

Dr Ivan Marten

Vice Chairman of BCG's Energy Practice

31st July, 2018