



The 9th

Asian Ministerial Energy Roundtable

An IEF Dialogue Event

Bengaluru | India

Plenary Session 1:

*Addressing Energy Security and Justice
Challenges in Turbulent Times*

Background Paper

IEF

BCG

Disclaimer

The observations presented herein are meant as background for the dialogue at the 9th Asian Ministerial Energy Roundtable. They have been prepared in collaboration with Boston Consulting Group and should not be interpreted as the opinion of the International Energy Forum or Boston Consulting Group on any given subject.

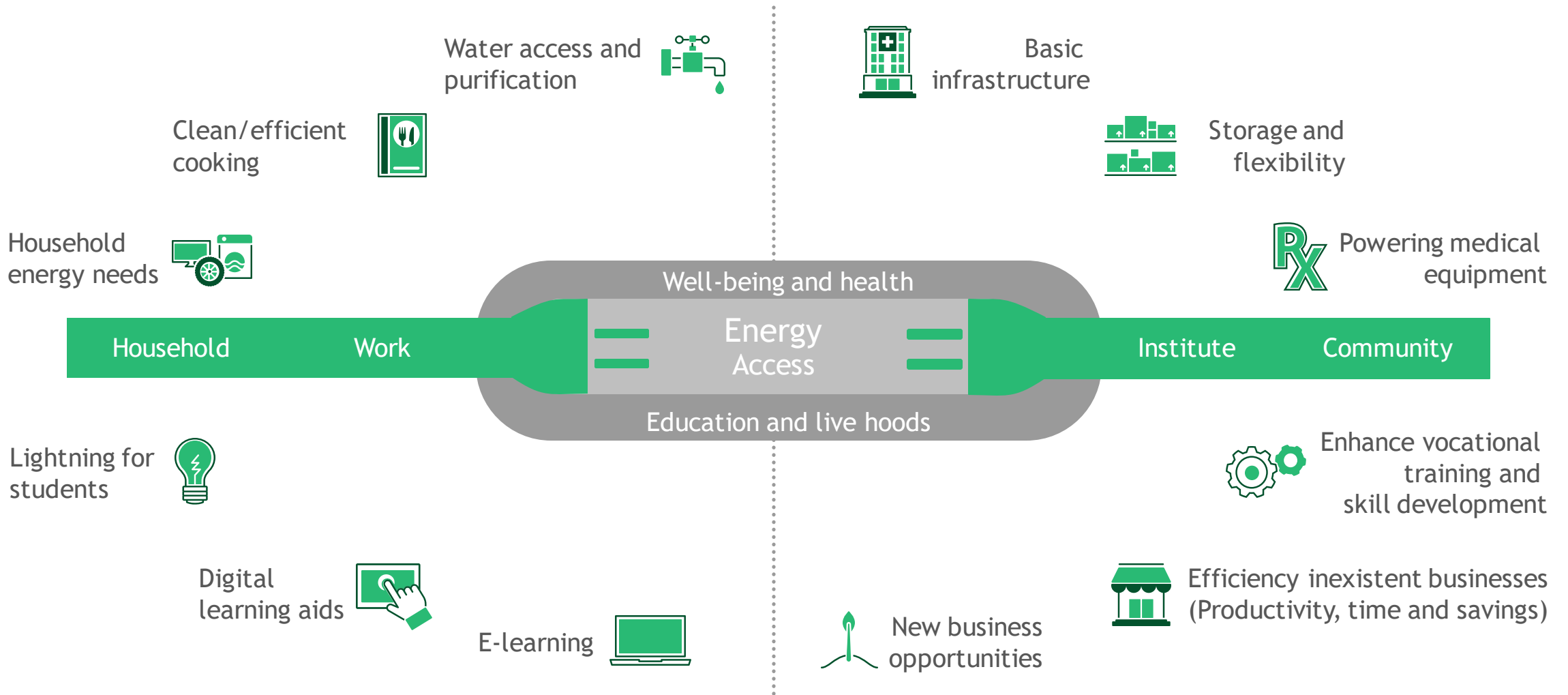
Contents

- 1 Role energy has played in achieving socio-economic benefits
- 2 Recent global trends in energy space
- 3 Asia has become center of global market growth
- 4 Asia's crucial role in energy transition
- 5 Key questions and discussions

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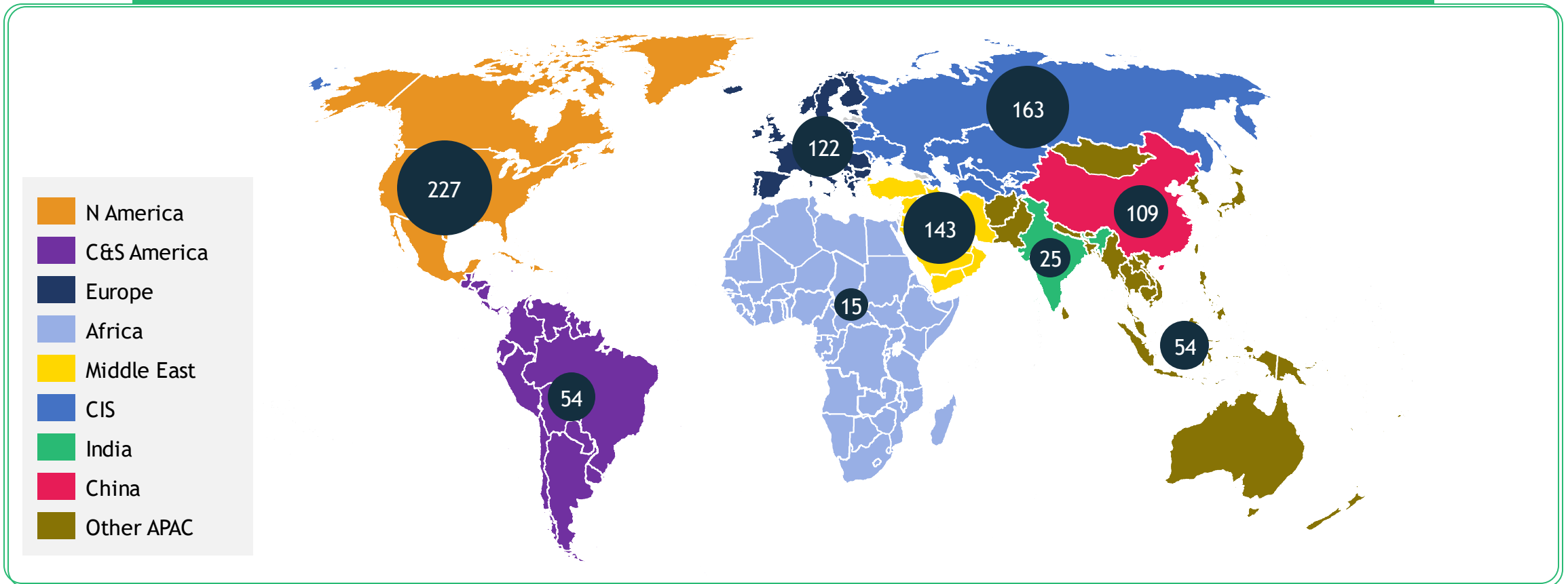
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Energy Access brings a number of benefits to the society



Globally, large variation in per capita energy consumption observed with Asian countries in lower end of spectrum

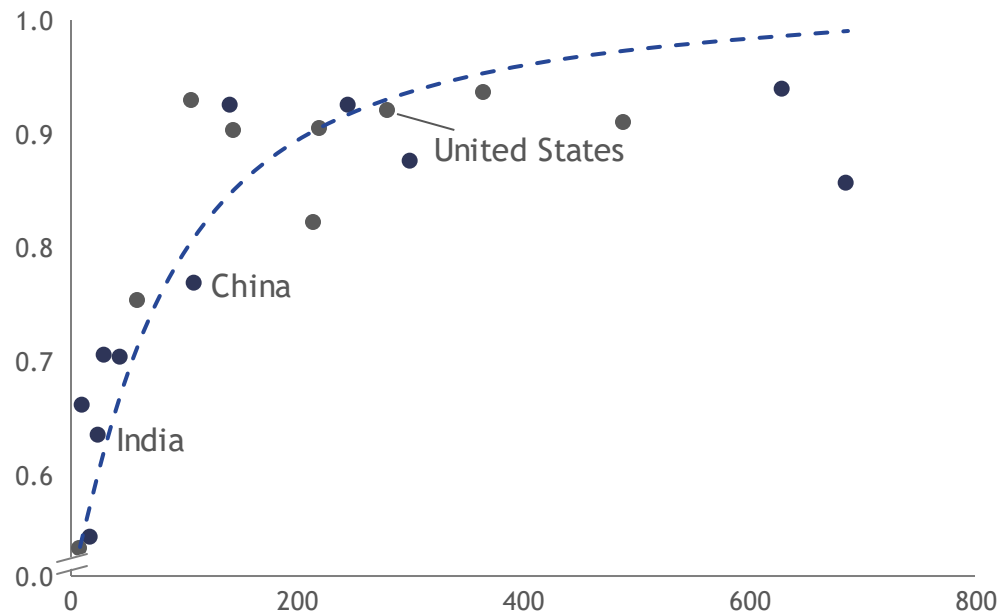
⚡ Primary energy consumption in 2021 (in GJ per capita)



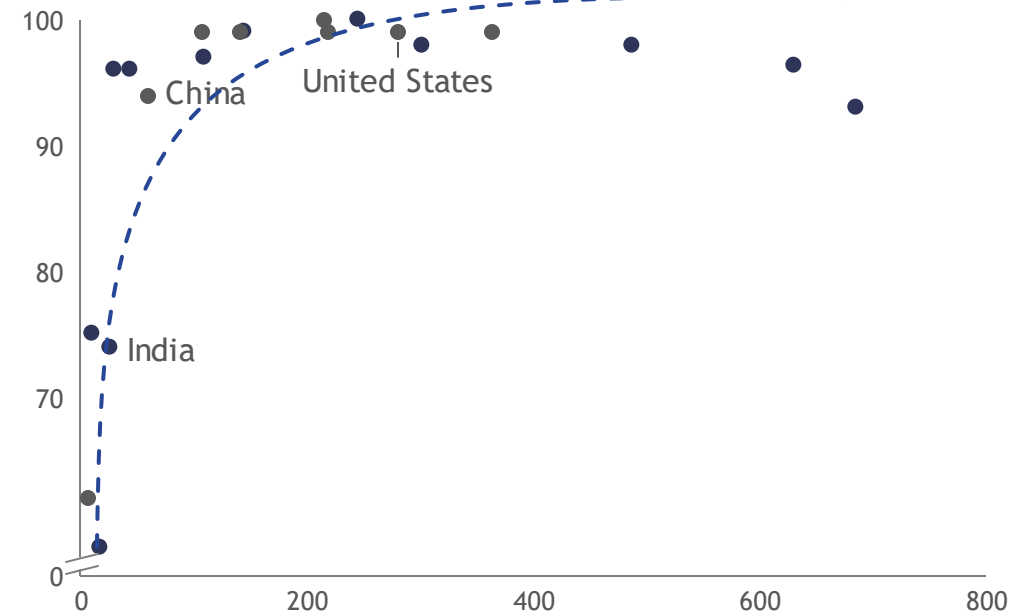
Source: Natural Earth Country boundaries without large lakes; Natural Earth Country breakaway and disputed areas, BP Energy Outlook, BP Energy Statistics 2022, UN

Access to energy plays a critical role in improving socio-economic standards

Human Development Index (HDI)



Literacy rate (%)



-- Trendline

Energy consumption per capita (GJ per capita)

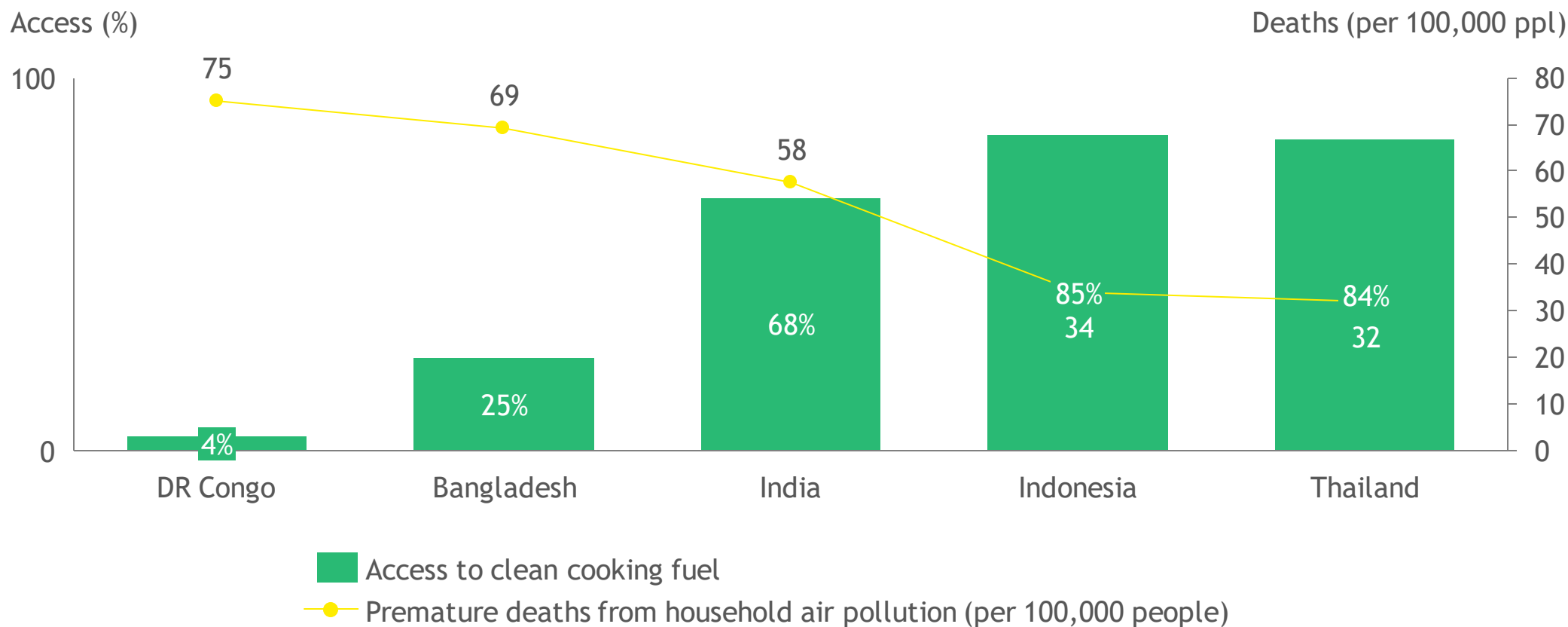
We see high correlation between HDI, literacy rate and energy consumption in countries

Source: OECD, World Bank, IMF, BP Statistics Review 2022

Note: HDI - Measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living.

Access to clean cooking fuel improves the quality of life by reducing health hazards

Lower number of pre-mature deaths from household air pollution in countries with higher access to clean cooking fuel (2021)



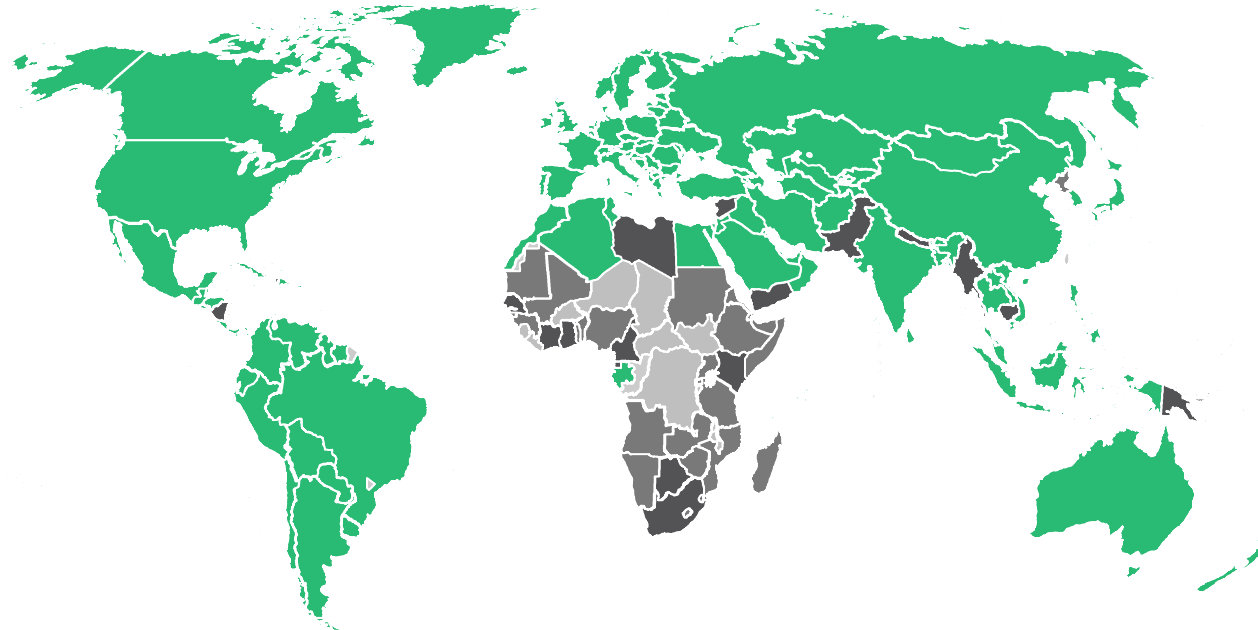
Source: World Bank Report 2021

Note: Clean cooking fuel include LPG, electricity, natural gas, biogas, solar power; Unclean cooking fuel include kerosene, charcoal, agricultural residue

Yet, 10% of global population without access to electricity

Electricity access situation, 2020

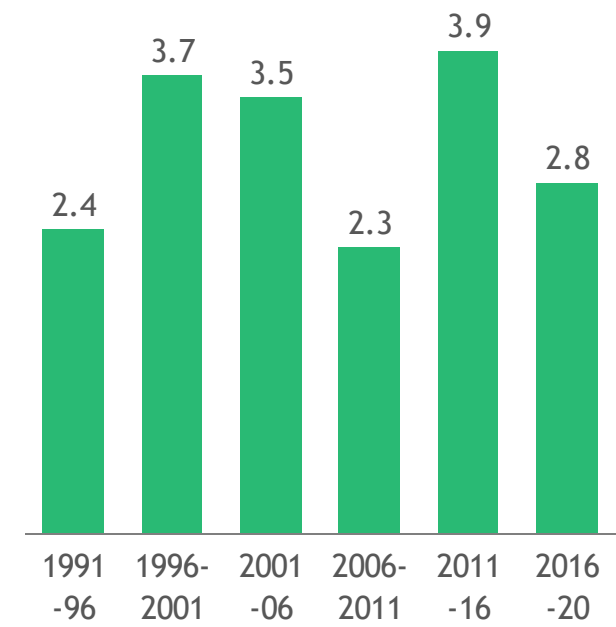
Growth in electrification



% of people with access to electricity

 <30	 30 - 60	 60 - 90	 >90
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Change in electrification rate (% points)



Sources: Natural Earth Country boundaries without large lakes; Natural Earth Country breakaway and disputed areas, World Bank

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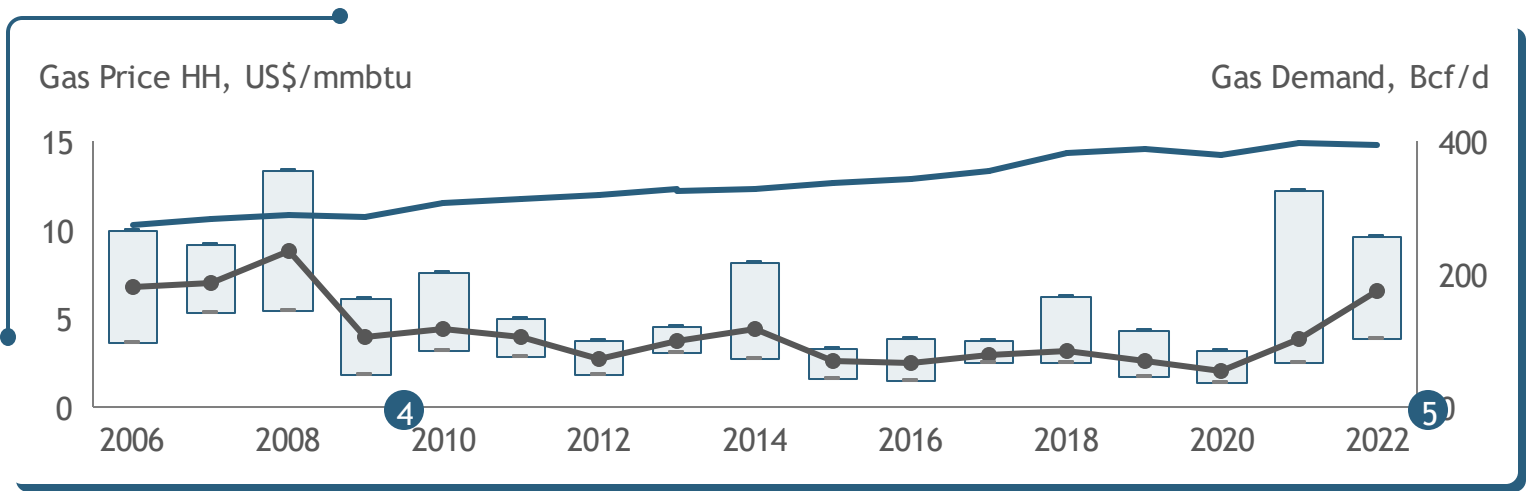
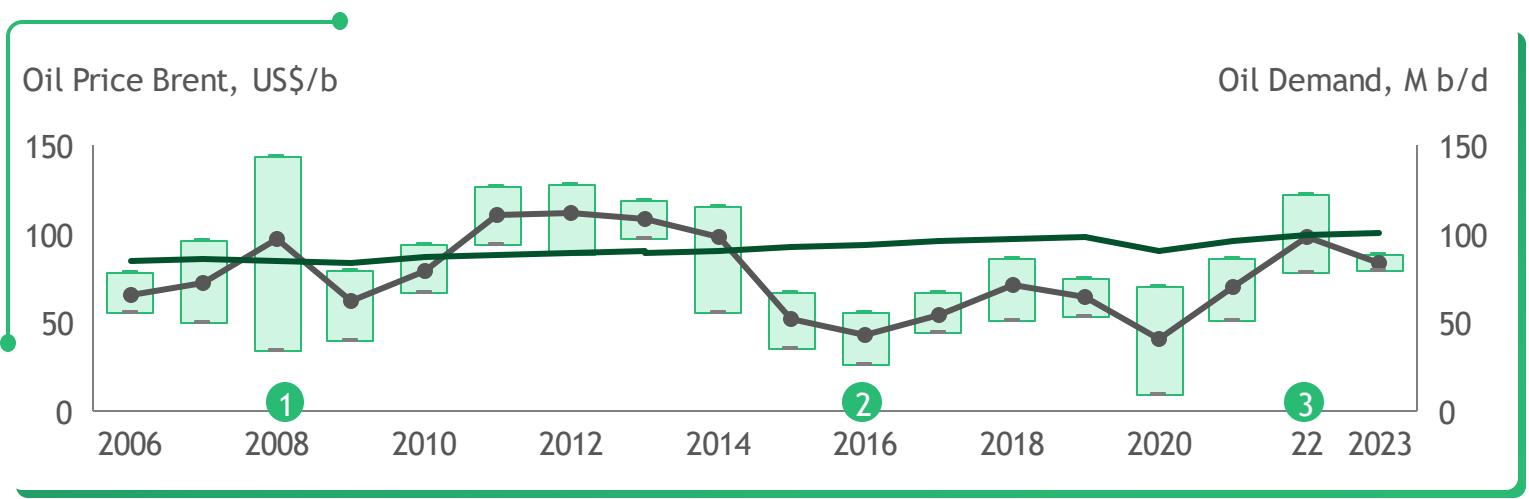
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Six
Megatrends
will be
affecting
the energy
value chain



- 1 Historically high crude, gas prices & inflation
- 2 Trade flow & supply chain
- 3 Decarbonization
- 4 Electrification of energy demand
- 5 Lack of investment in energy sector
- 6 Digitization & creating new ecosystems

Both oil and gas recorded historically high price levels in 2022



— Max —●— Average — Min — Oil Demand, M b/d — Gas Demand, Bcf/d

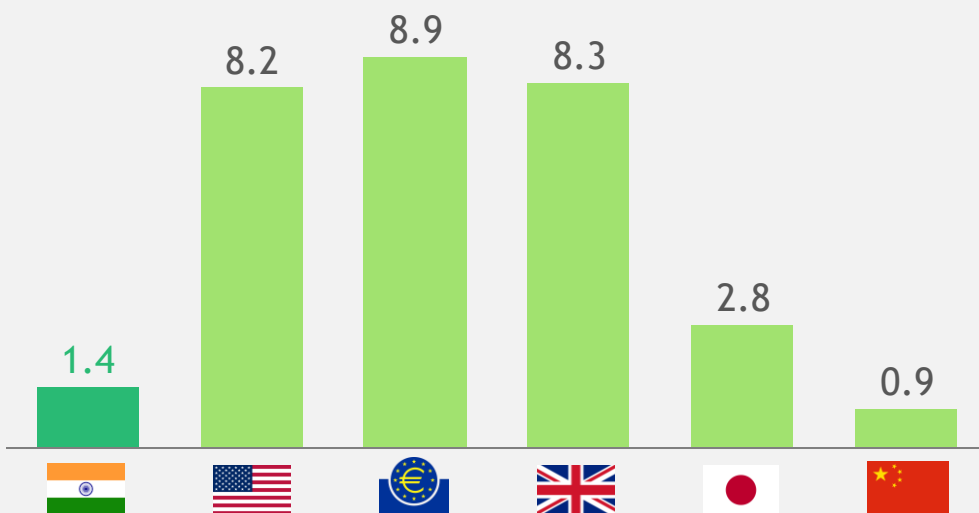
- 1 **Great Financial Crisis**
Crude prices down from record highs
- 2 **Oil Price Collapse**
OPEC maintains output in face of shale growth
- 3 **Covid**
Demand contraction (~10% in 2020) leads to rapid price drop
- 4 **Shale gas revolution**
Development of Marcellus & other plays transforms US gas market
- 5 **European Gas Shortage**
Less Russian gas, tight LNG markets & lower wind output

High prices translating into increasing pressure on consumers



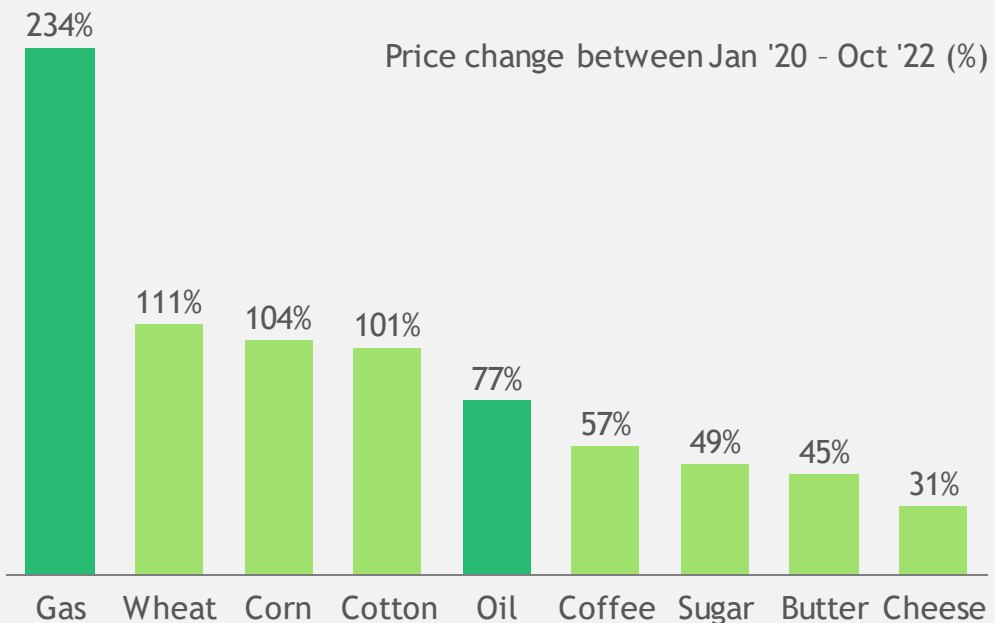
Inflation is at an all time high

CPI Y/Y % points change since '15

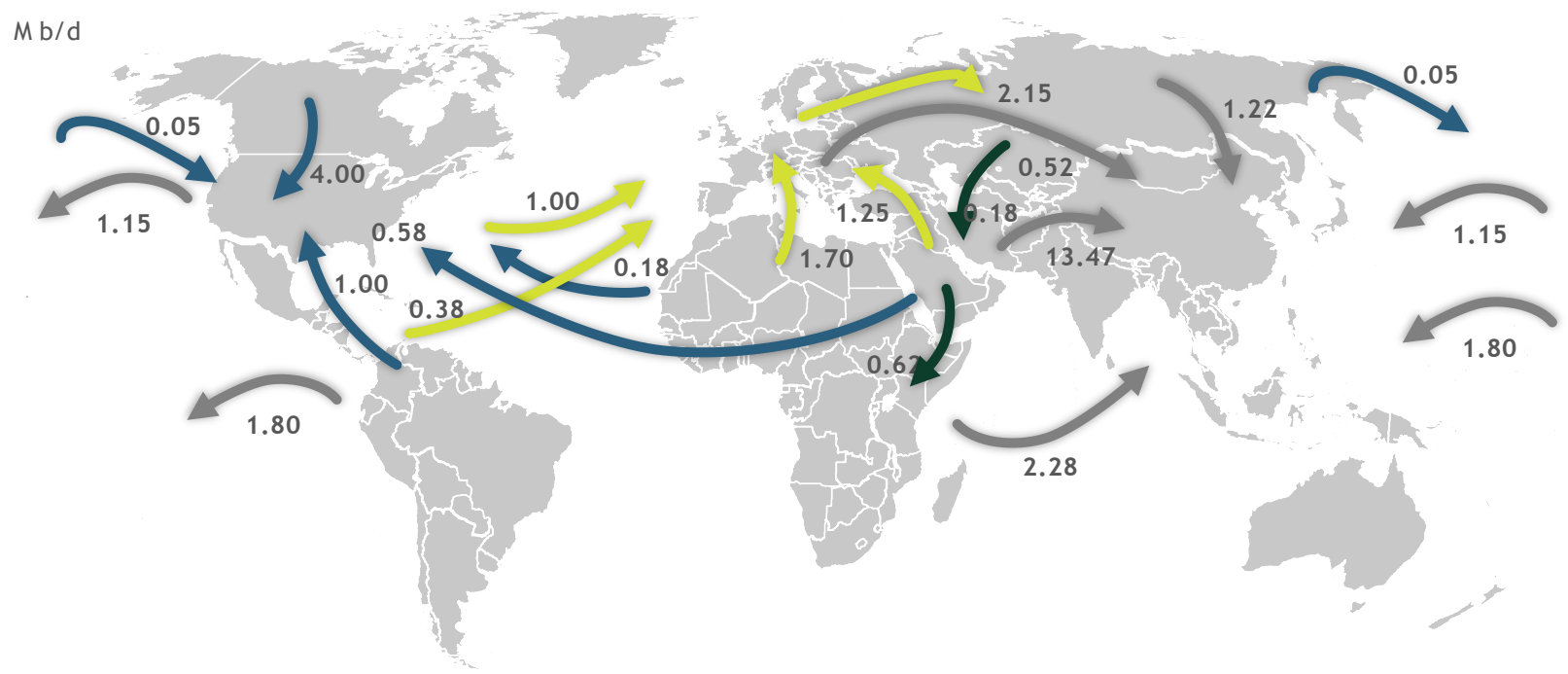
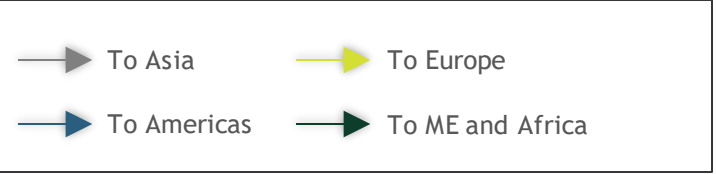


Inflationary pressures most pronounced in energy bills

Price change between Jan '20 - Oct '22 (%)



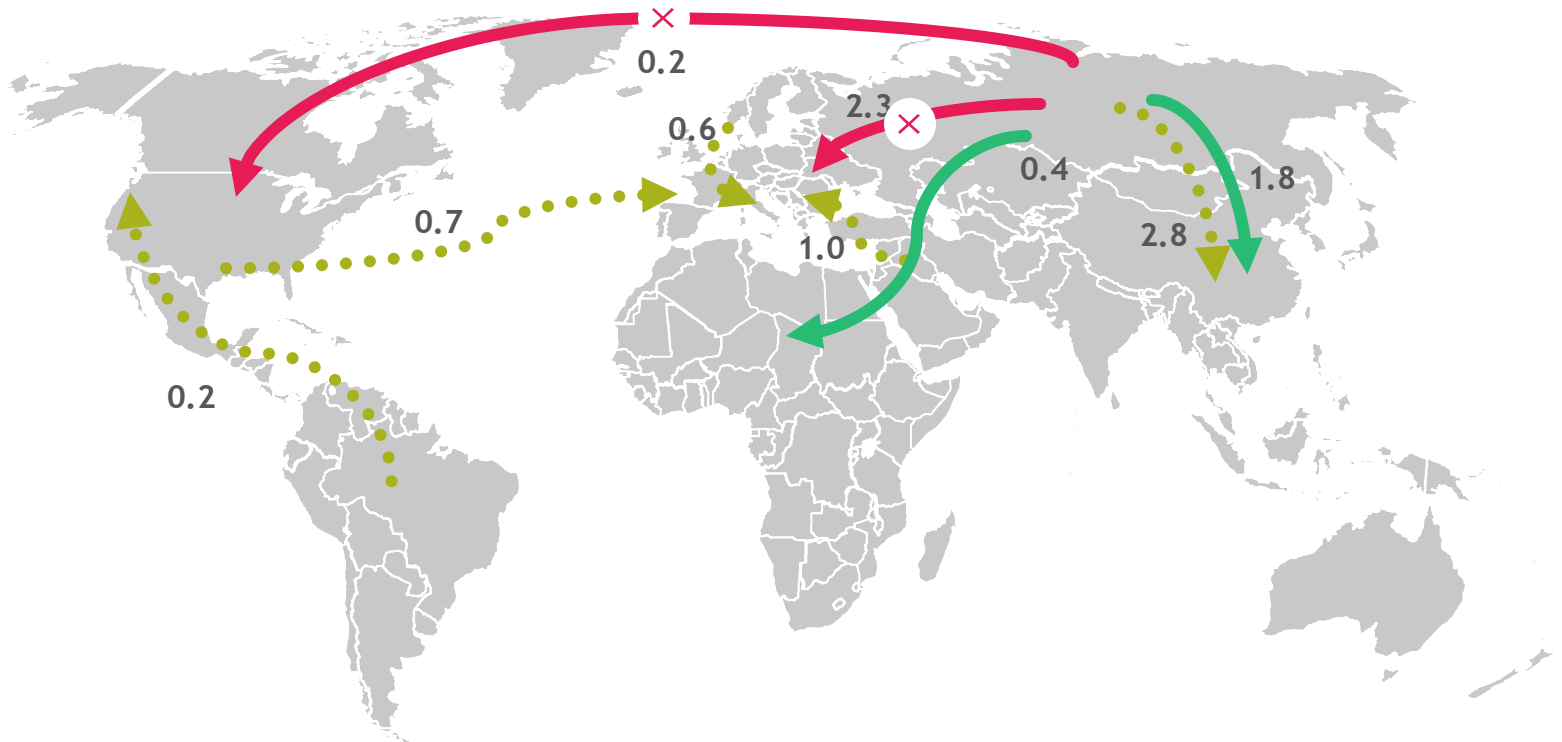
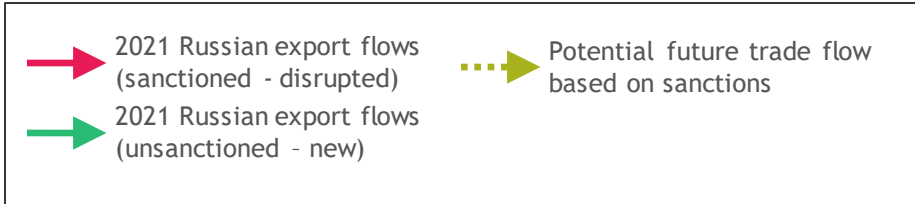
1. Direct debit, national average. Typical domestic consumption values=2.900 kWh for electricity, 12,000 kWh for gas
Source: Ofgem; Cornwall; Morningstar, OECD Inflation (CPI) growth rate (Q3 '15 - Q3 '22 Comparison); Bloomberg commodity index 3-month forward; Gov.UK, BCG



Global crude oil flows -2020

Note: Reflects major net waterborne trade flows of greater than 0.05 M b/d for full year 2020
Source: Eikon; BCG analysis

Russia crude oil exports 2021: 4.7 M b/d

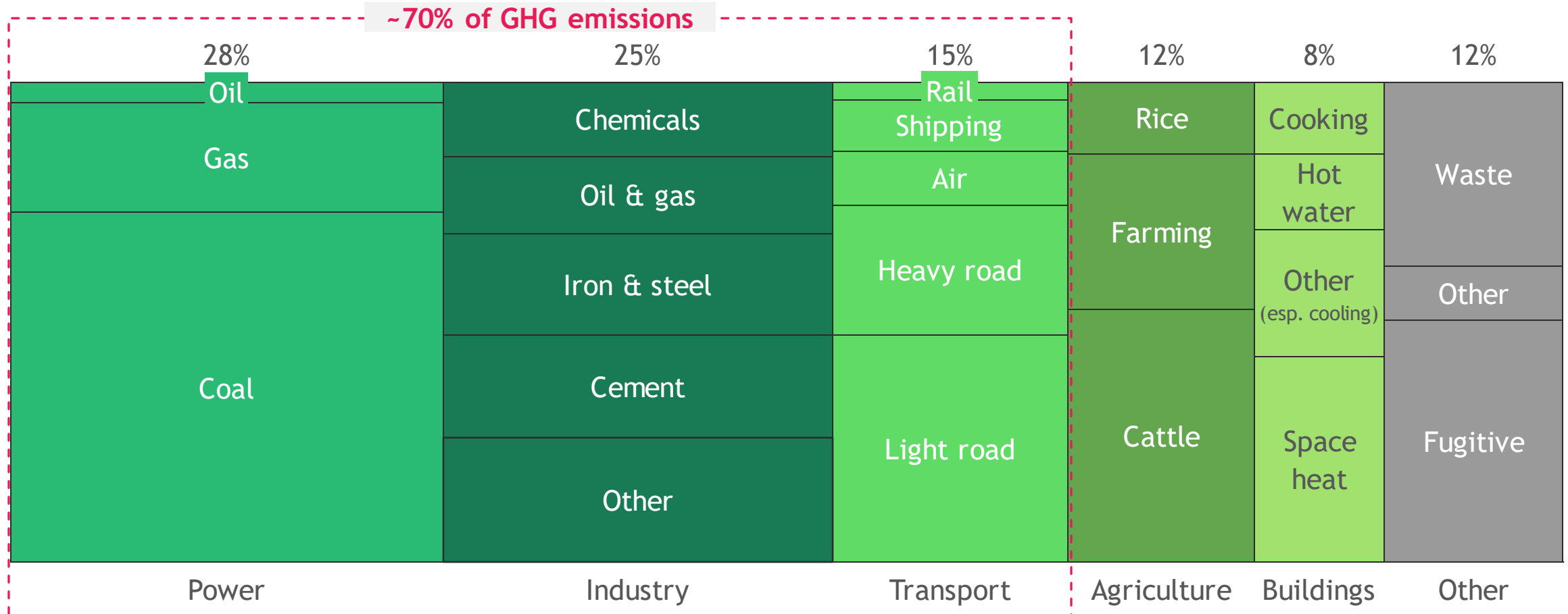


Recent global events have disrupted previously established global crude oil flows

Carbon Intensity: Volume-weighted average CI (gCO₂e MJ⁻¹); 2. Only included crude oil trade flow lines specific to Russia and Europe
Source: S&P Global Platts, Company filings

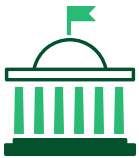
Power, industry, transportation and building account for almost 70% of GHG emissions are the main topics of today agenda

Gt CO₂e of global GHG emissions by sector, Scope 1, 2021



Note: Scope 1 emissions are direct greenhouse (GHG) emissions that occur from sources that are controlled or owned by an organization
Source: EDGAR 7.0; IEA; BCG Analysis

Four main forces will drive decarbonization



Policy Agenda

Global **steering towards sustainability** sufficiently guarantees market perspectives in Green Energy for the next years

- Ambitious INDC¹ targets with still further development ahead for countries

Several **regulators** shifting towards a **more activist role** (i.e. air quality regulation)



Customer expectations

Expectation on **competitive and green energy sourcing** (i.e. heating)

Preparing for the **electrification of transportation** (EV)

More **empowered consumer** with Distributed Energy Resources onsite

Concerned about the **impact of industry and transportation** in the environment



Investor push

Capital markets increasingly building emissions risks into asset prices, and **venture capital investments** in transition technologies are accelerating

Large energy companies directing **~\$1T to low carbon** in next 5 years

Need of pairing low carbon energy investment with identified & contracted demand



Technology Advancements

Reduced cost of capture technology

Reduced cost of CO2 conversion technology and provide CCS as a service

Improved storage technology

Push for **alternate fuel vehicles**

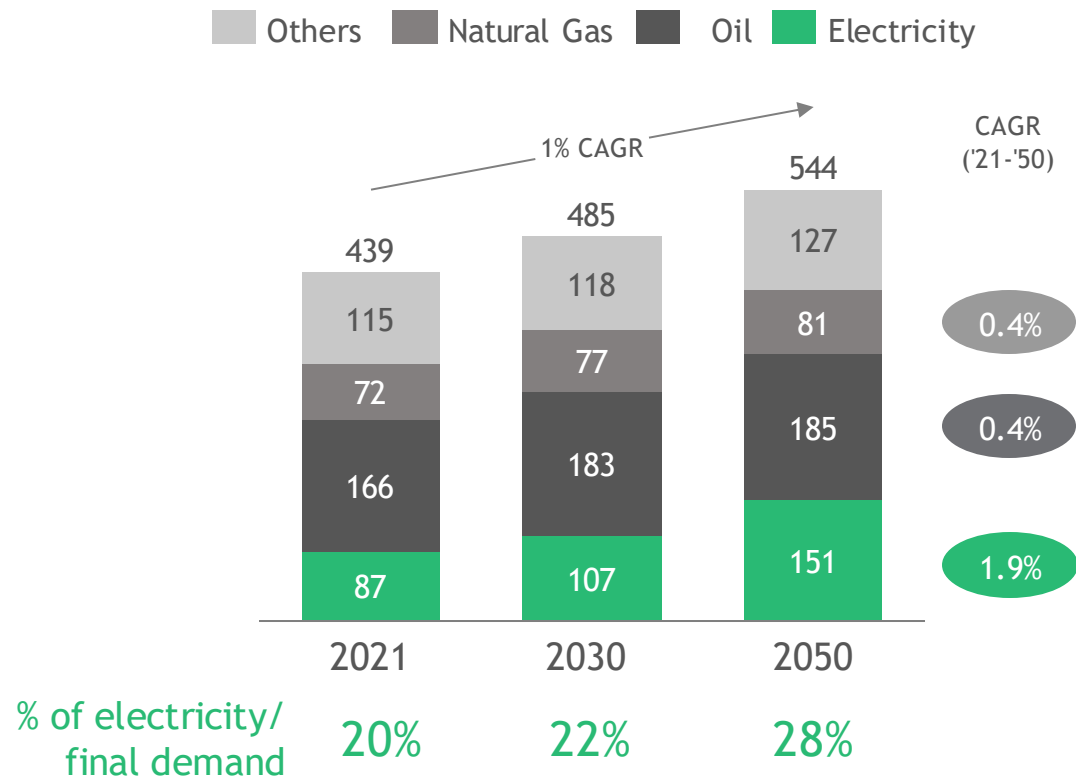
Leveraging CO2 EOR capabilities by O&G players

1. Intended Nationally Determined Contributions

Sources: S&P Capital IQ; S&P Global consensus view to operating income and dividends

Global electricity demand growing ~2x times faster than total energy demand

Final energy demand (EJ, 2021-2050)



Drivers for growth in electricity demand

Energy efficiency to reduce electricity demand, but outgrown by growth levers

- Shifts in fossil fuels heat systems to electric powered systems
- EV penetration
- Electrification of rural areas

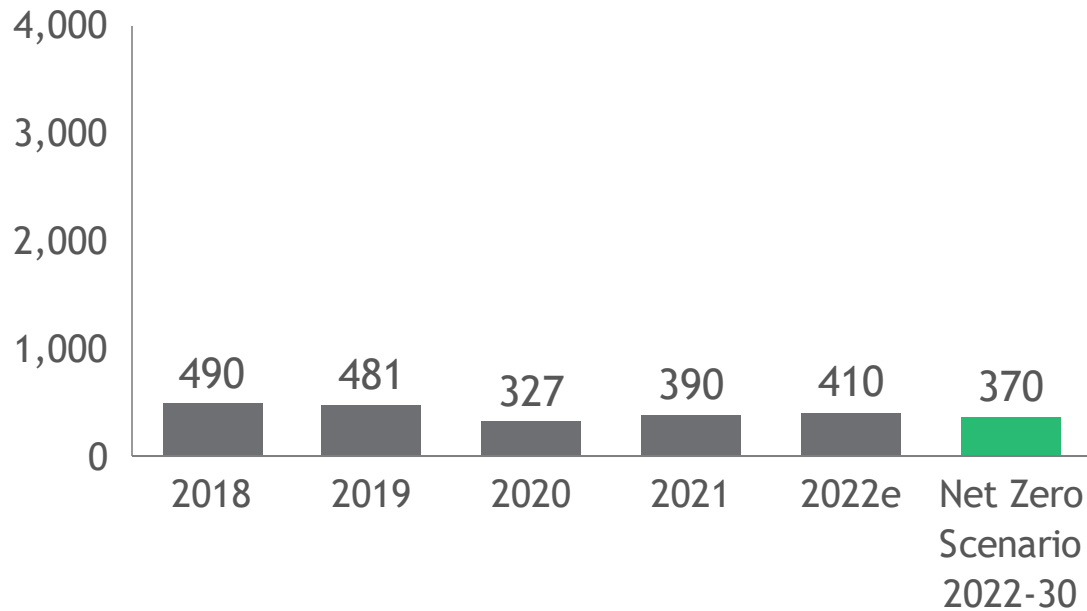
Source: IEA WEO 2022, Stated Policies Scenario (more conservative); IEA Digitalization & Energy report

Step-up in clean energy investment required to meet net zero targets



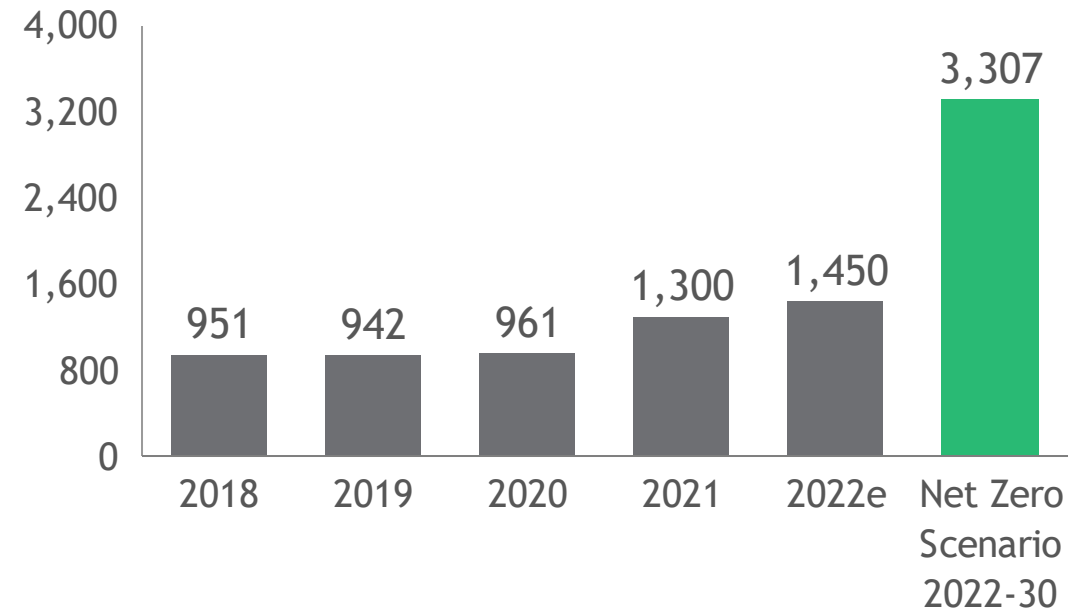
Oil and natural gas production investment

USD B (2022)



Clean energy and infrastructure investment

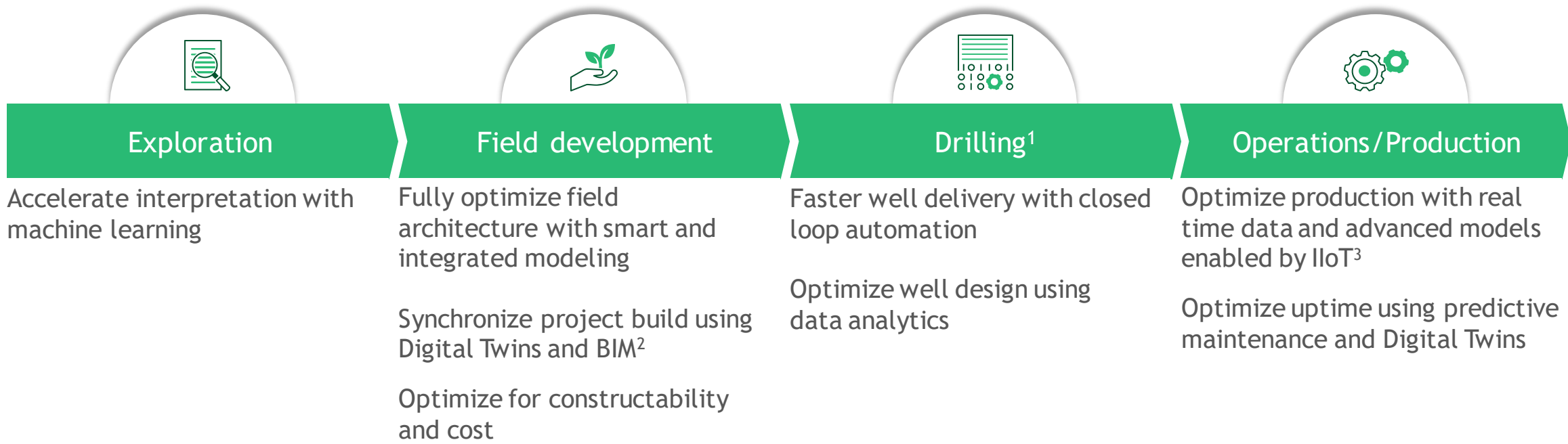
USD B (2022)



Total USD 1816.9B increased investment in the energy landscape (2022-2030)

Digitization can help unlock potential across the value chain

Illustrative



<p>50-60% reduction in interpretation time and cost</p>	<p>(up to) 70% reduction in engineering hours and higher value field concepts</p>	<p>20-30% Faster well delivery and more productive wells</p>	<p>3-5% Increased production⁴ 20-40% Reduced maintenance cost</p>
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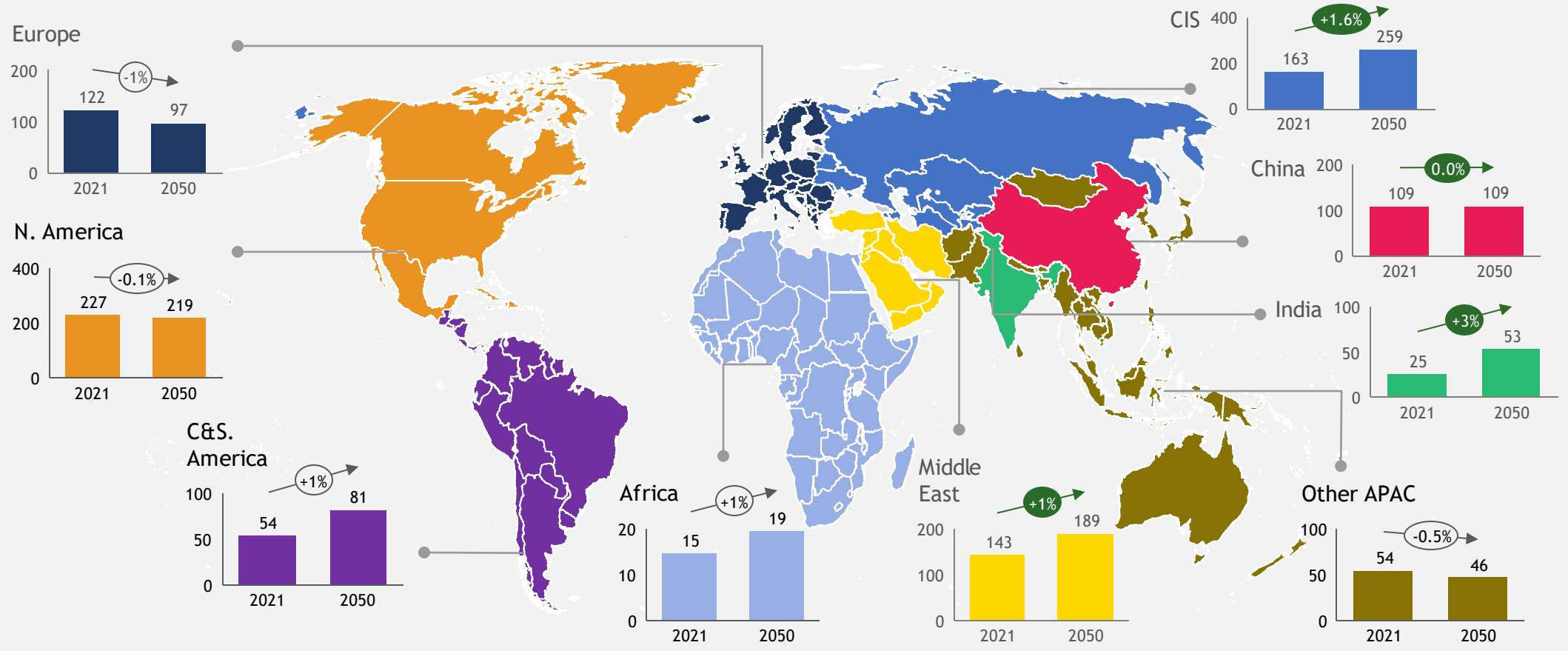
1. Drilling covers E&A and Development/Infill drilling 2. Building Information Modeling 3. Industrial internet of things 4. Assuming marginal value of US\$50 per additional bbl
Source: BCG project experience, BCG Analysis

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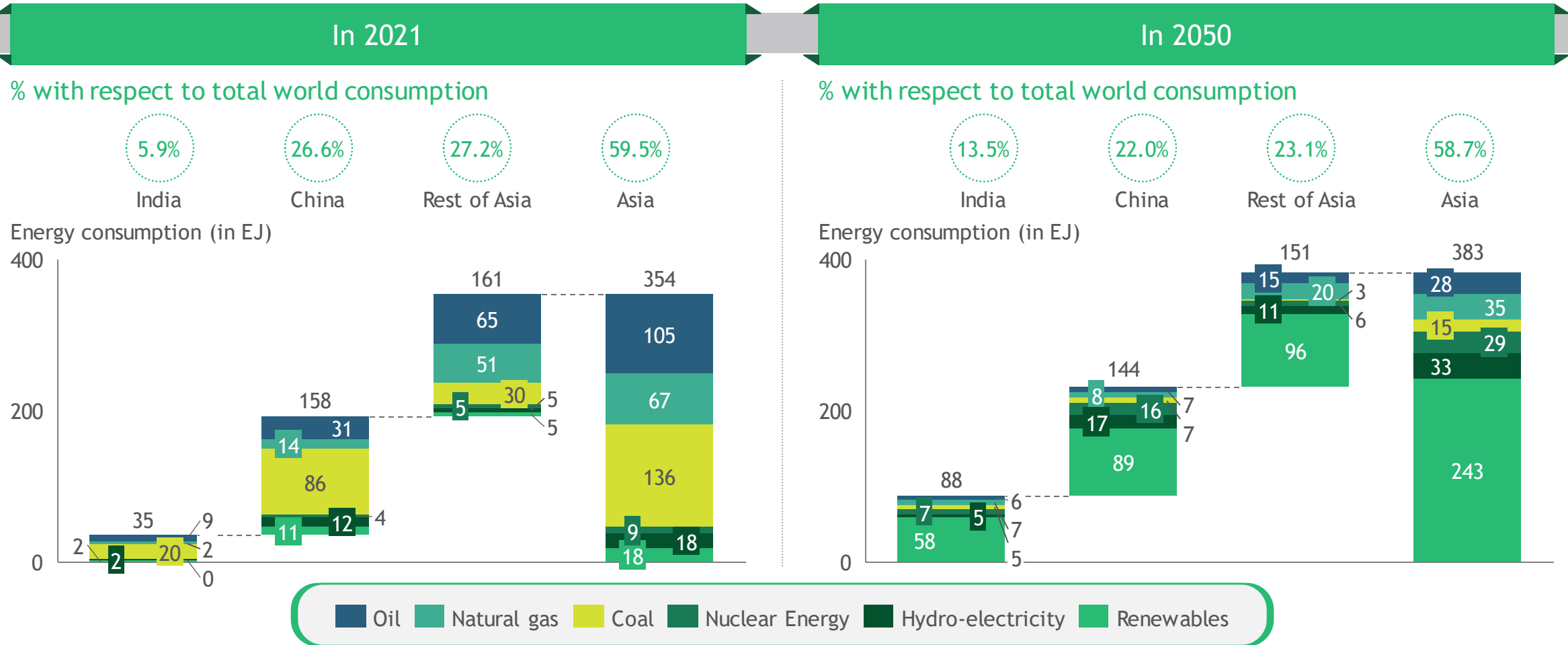
Global energy consumption will be driven by growth in Asia

⚡ Primary energy consumption (in GJ per capita)



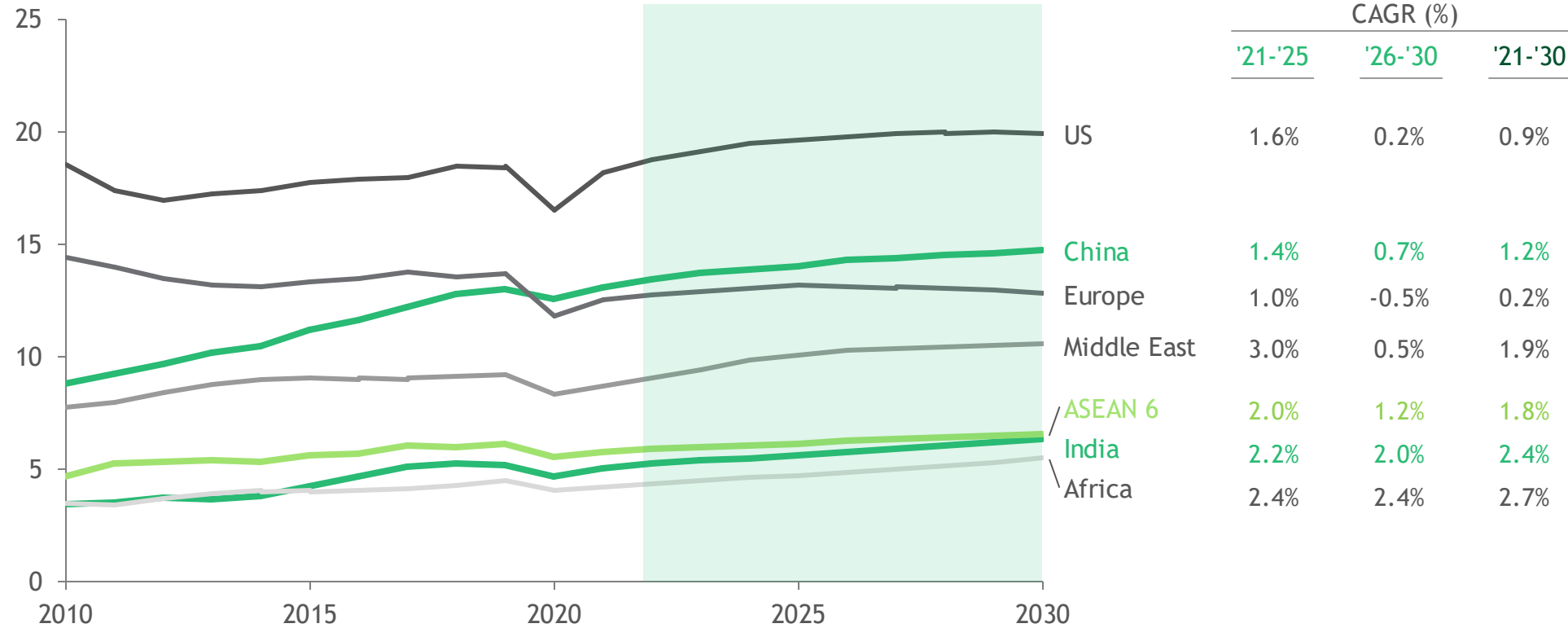
Sources: Natural Earth Country boundaries without large lakes; Natural Earth Country breakaway and disputed areas, BP Energy Outlook, BP Energy Statistics 2022, UN

Asia will increase its weight on global energy demand, driven by India



Asia will increase the share of energy demand to meet its economic development needs

Oil demand (MBPD)



Asia need to support this growth while tackling challenges such as ...



Workers and employment

- Shifting energy skills and jobs landscape
- Uneven starting positions across the globe
- DE&I in new employment space



Consumer and Community wellbeing

- Phase out of fossil-fuel investment and production
- Inequitable Climate change impact
- Industry-driven geographic displacement



Equitable transition financing

- Lack of access to investment and bridges between stakeholders
- Unbalanced funding deployment
- Affordable and transparent financing



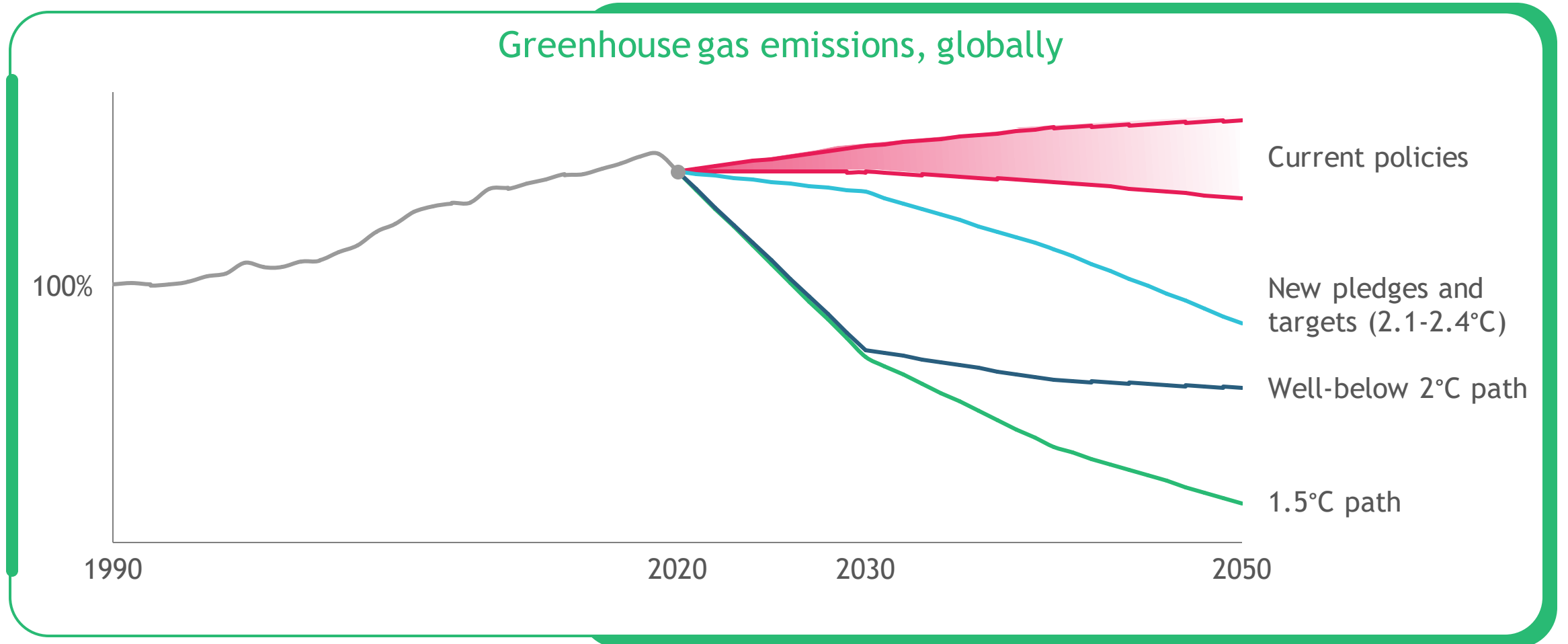
Access to green, affordable energy

- Inequitable access to energy
- Rising costs driven by transition affecting affordability
- Slow and complex renewable capacity build-up

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Current ambitions are insufficient to achieve Paris targets

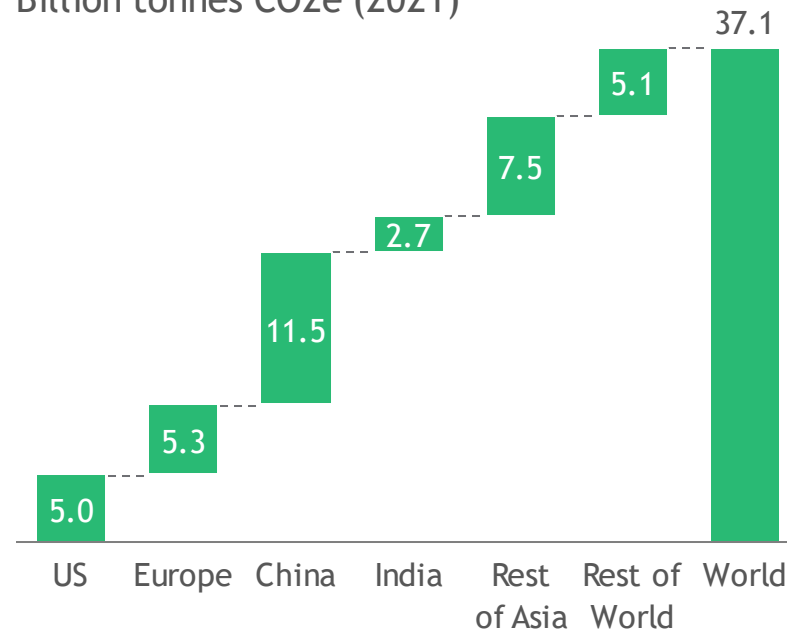


Carbon footprint of World | Asia currently contributes significant emissions at 58% but historically only 31%



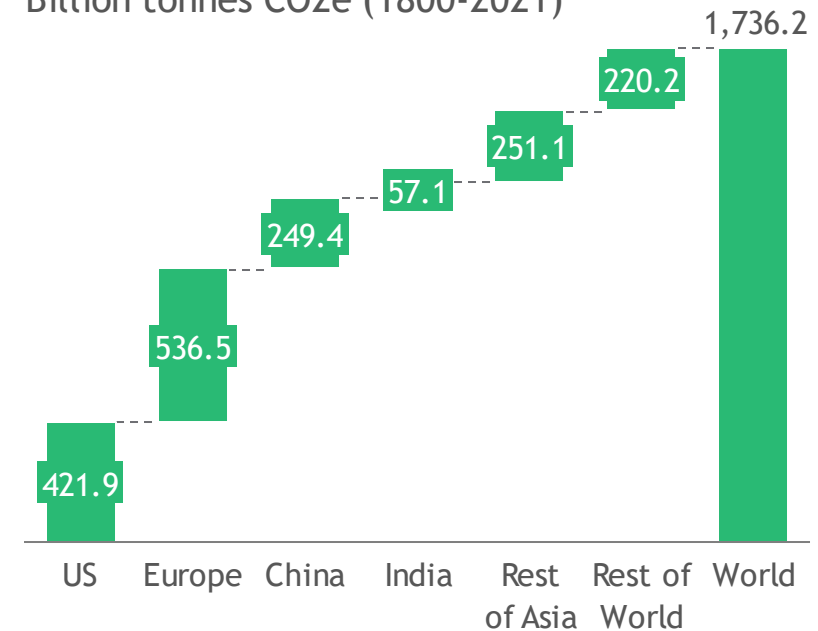
Greenhouse gases (CO₂e) emissions¹ in a year

Billion tonnes CO₂e (2021)



Greenhouse gases (CO₂e) emissions¹ in last 200+ years

Billion tonnes CO₂e (1800-2021)


















% wrt total world carbon footprint

Source: BP Statistical Review 2022, World Bank, Global Carbon Project - Friedlingstein P et.al., Our World in Data

1. CO₂e - emissions are the sum of carbon dioxide emissions from energy, carbon dioxide emissions from flaring and other greenhouse gases

15 Asian countries setting ‘Net Zero Emissions’ ambitions and regulating emissions

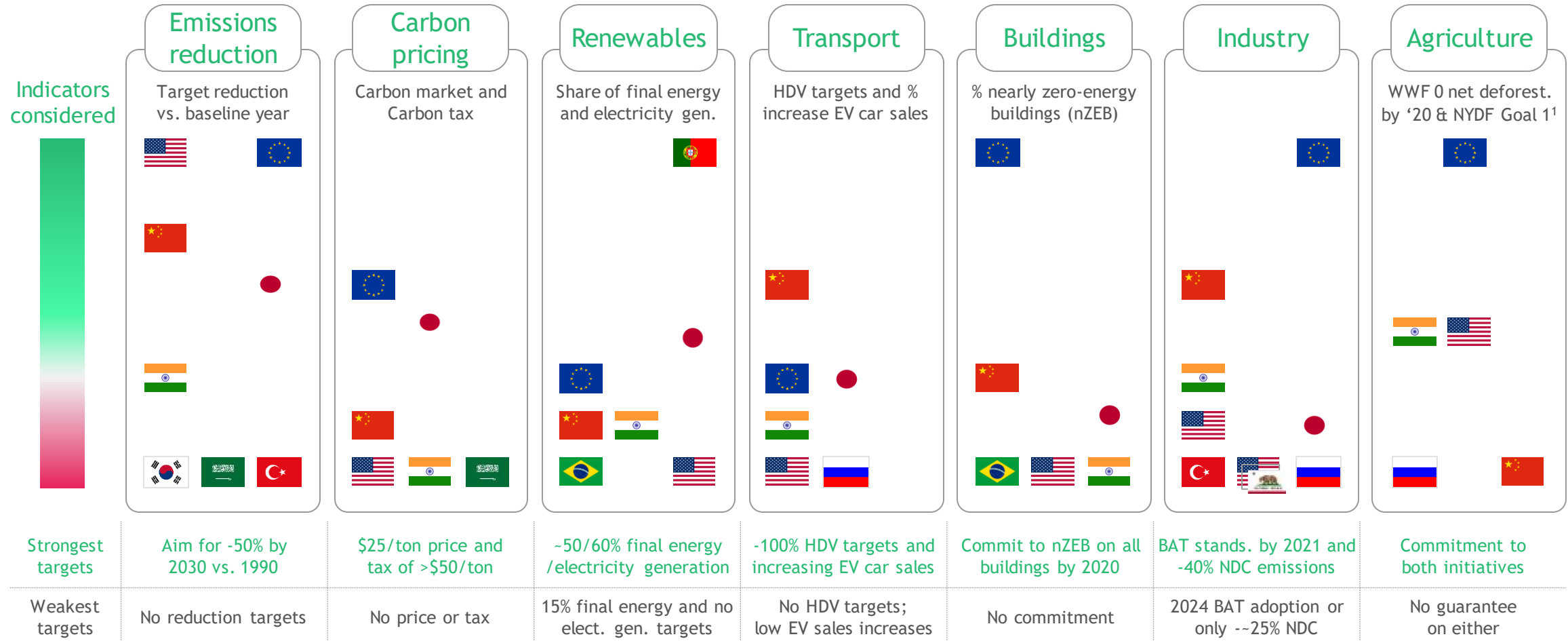
Country	Current emissions (% of Global emissions ¹)	Net Zero Target Year	Status
 China	30.9%	2060	Policy document
 India	7.3%	2070	Under discussion
 Japan	2.9%	2050	Proposed Legislation
 South Korea	1.7%	2050	Under Legislation
 Indonesia	1.7%	2060	Proposed Legislation
 Thailand	0.8%	2065	Under discussion
 Malaysia	0.7%	2050	Policy document
 Vietnam	0.9%	2050	Under discussion
 Bangladesh	0.3%	2050	Under discussion
 Singapore	0.09%	2050	Under discussion
 Myanmar	0.1%	2050	Under discussion
 Sri Lanka	0.06%	2050	Policy document
 Laos	0.06%	2050	Under discussion
 Cambodia	0.05%	2050	Under discussion
 Brunei	0.03%	2050	Under discussion

Source: Targeting Net Zero in Asia, Invesco (Feb 2022), BP Statistical Review 2022, World Bank, Global Carbon Project - Friedlingstein P et.al., Our World in Data

1. CO2 equivalent considered for 2021 - emissions are the sum of carbon dioxide emissions from energy, carbon dioxide emissions from flaring and other greenhouse gases

Countries are setting ambitious emissions targets across sectors

Selected output of BCG's regulation database for >50 countries

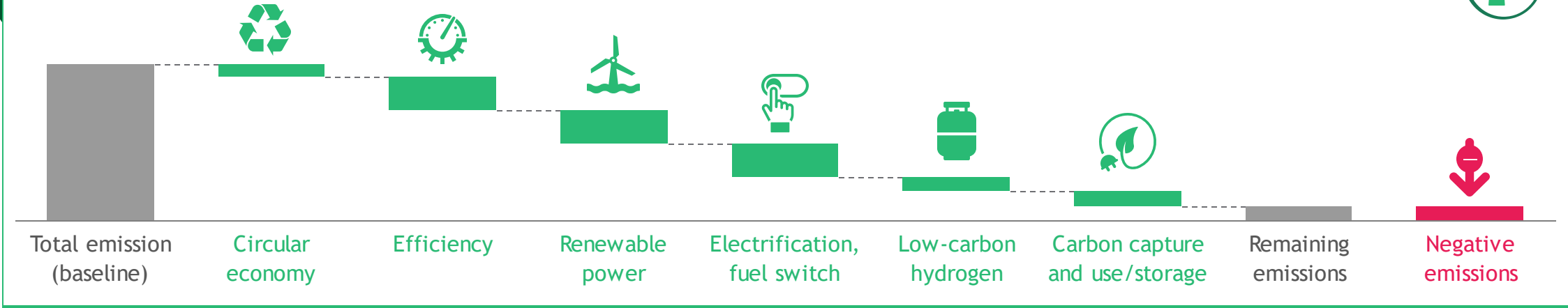


1. NYDF Goal 1 is to halve natural forest loss by 2020 and end it by 2030
 Source: Government websites; REN 21; ClimateWatch; IEA; Press Search; World Bank; WWF; UN Environment

Economics of key abatement levers and technologies are improving

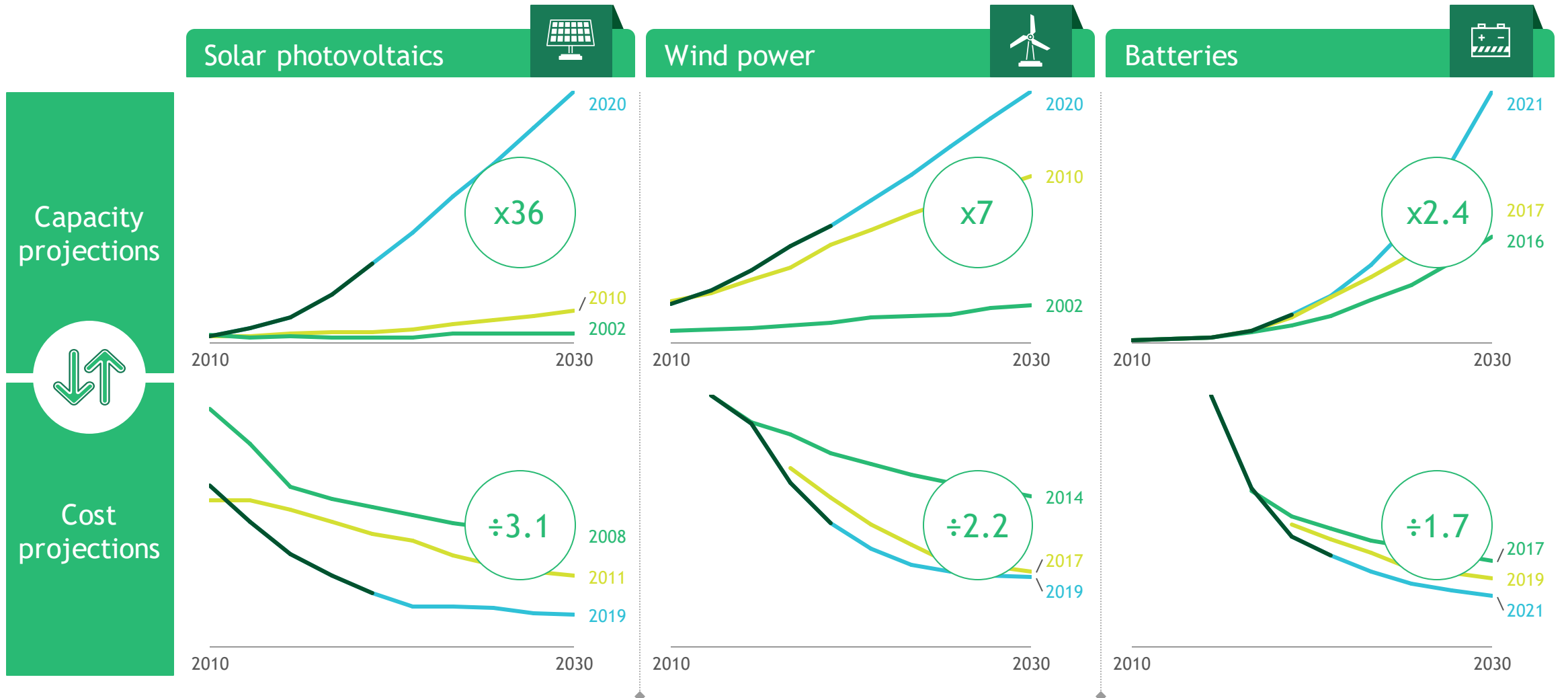
Illustrative

Exemplary emission reduction potential



Circular use of existing materials to reduce virgin production volumes	State-of-the-art technologies for all components of the production process	Substitute fossil-energy based power generation with renewables	Electrification of transport & heat, replacement of fossil with renewable fuels	Low-carbon hydrogen in industry and heavy-duty transport	Capture process-related carbon byproduct and store or recycle	Nature-based solutions, BECCS, DACCS, ...
Already economic for many applications	Significant economic potential in all sectors	Beyond cost-parity with coal and gas in many countries	Some economics improving (e.g., advanced biofuels), achieving cost competitiveness	Green H ₂ could achieve cost parity with black/gray in many countries at today's price, but economics as a fuel remain challenging	Economics improving, but most applications only economic with a carbon price	

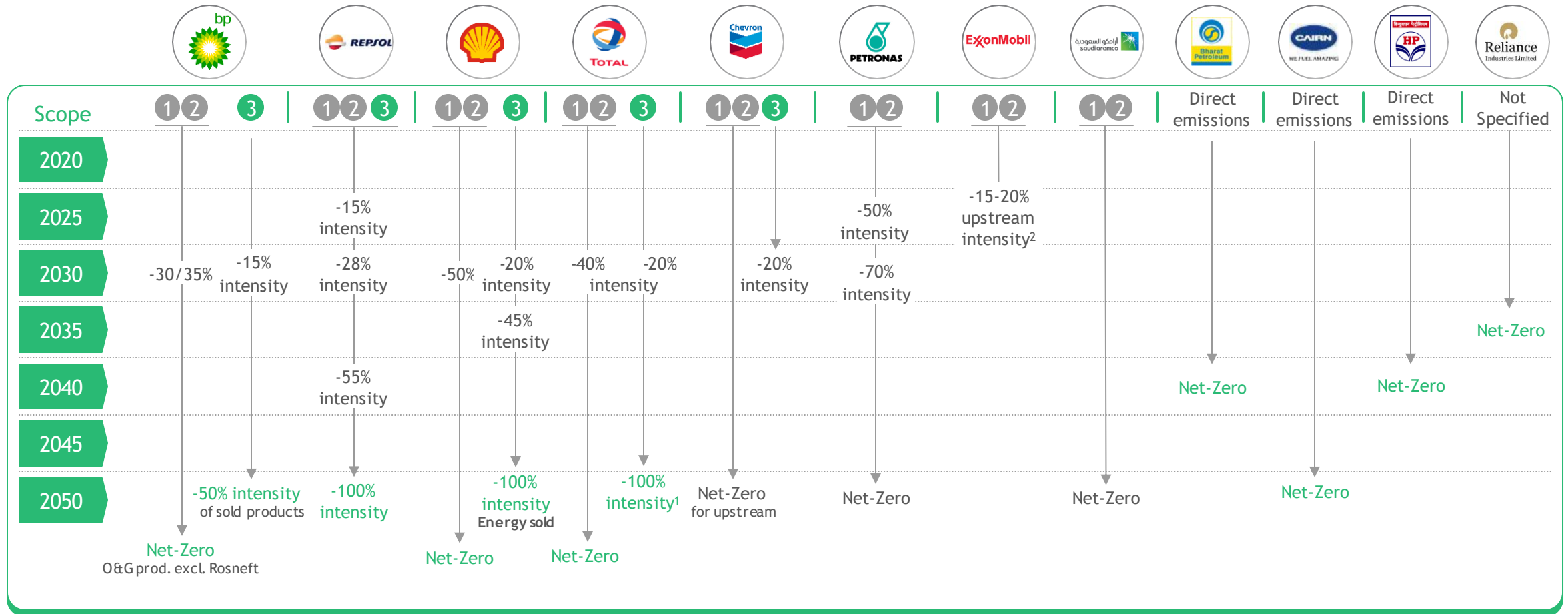
Historically we underestimate technology progress and will play a critical role



Source: IEA, BNEF, IRENA, BCG

Companies globally as well as in Asia are setting aggressive Scope 1,2 & 3 targets and converging to net zero

Non-Exhaustive



1. Collective target against 2017 levels as OGCI member 2. Paris Climate Agreement
Source: IEA Energy Transitions Indicators, Company reports

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Key Questions

1. How can the Asian continent, the current energy demand center, protect and safeguards its interest of ensuring energy security and energy justice while supporting the energy transition?
2. What collaborative steps can be taken to increase the importance of the voice of developing economies in global energy markets?
3. Where can collaboration on energy security, and social justice be improved?
4. What initiatives with Asia will accelerate energy investment and carbon abatement?
5. How can public and private sector finance conditionalities accelerate just and orderly transitions?



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Thank You!

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