

An aerial photograph of a dense forest with a road running through it. The text "The basics of climate change" is overlaid in white on the left side of the image.

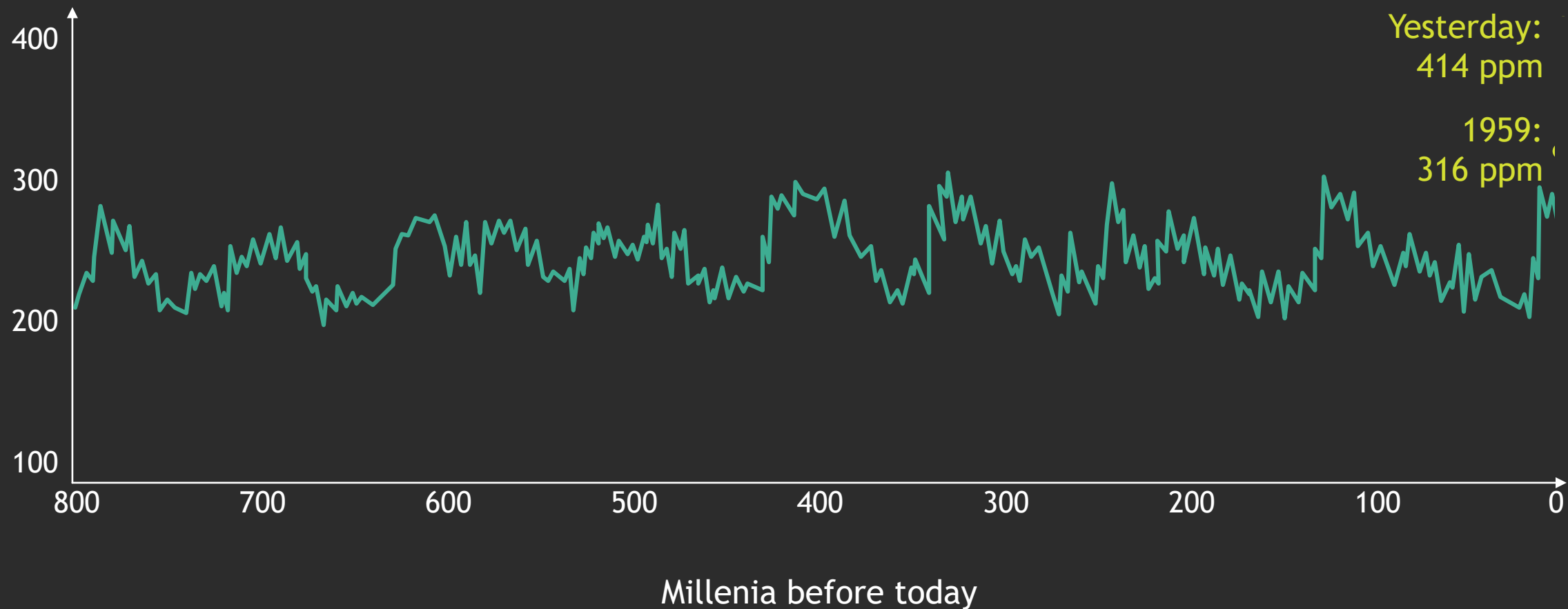
The basics  
of climate  
change

The  
transformation  
ahead

BCG's position  
and offering  
on climate

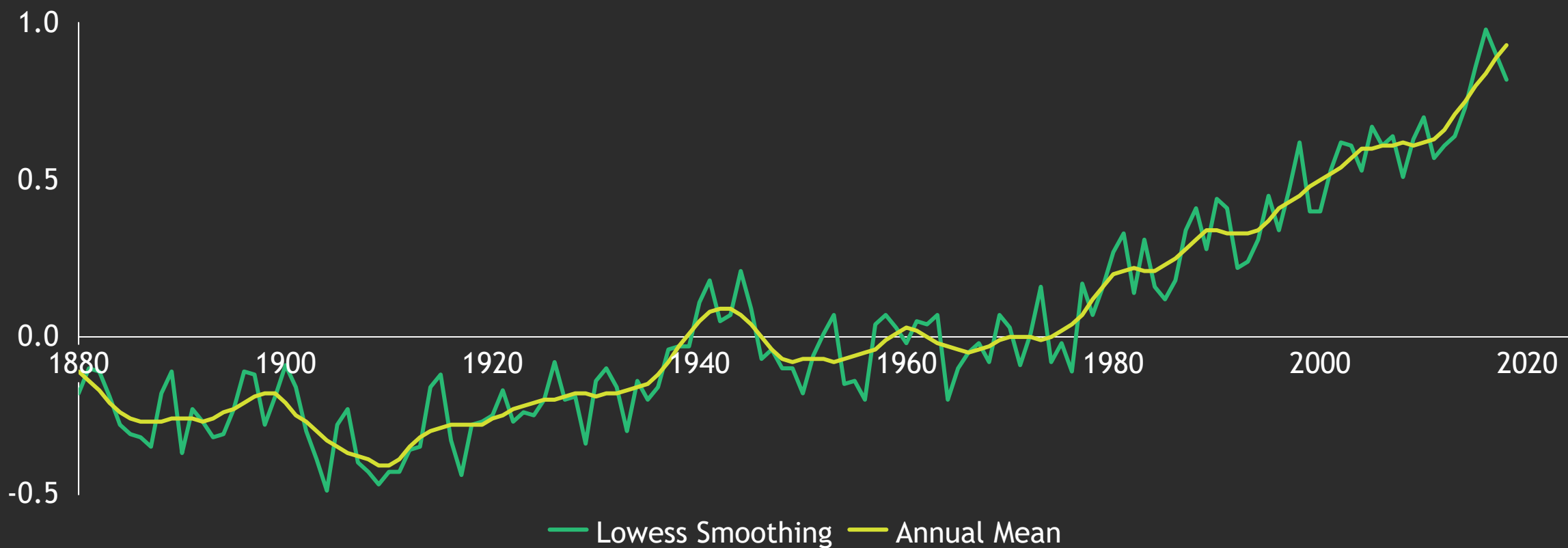
# Highest CO<sub>2</sub> concentration in a million years

CO<sub>2</sub> concentration in the atmosphere (ppm)



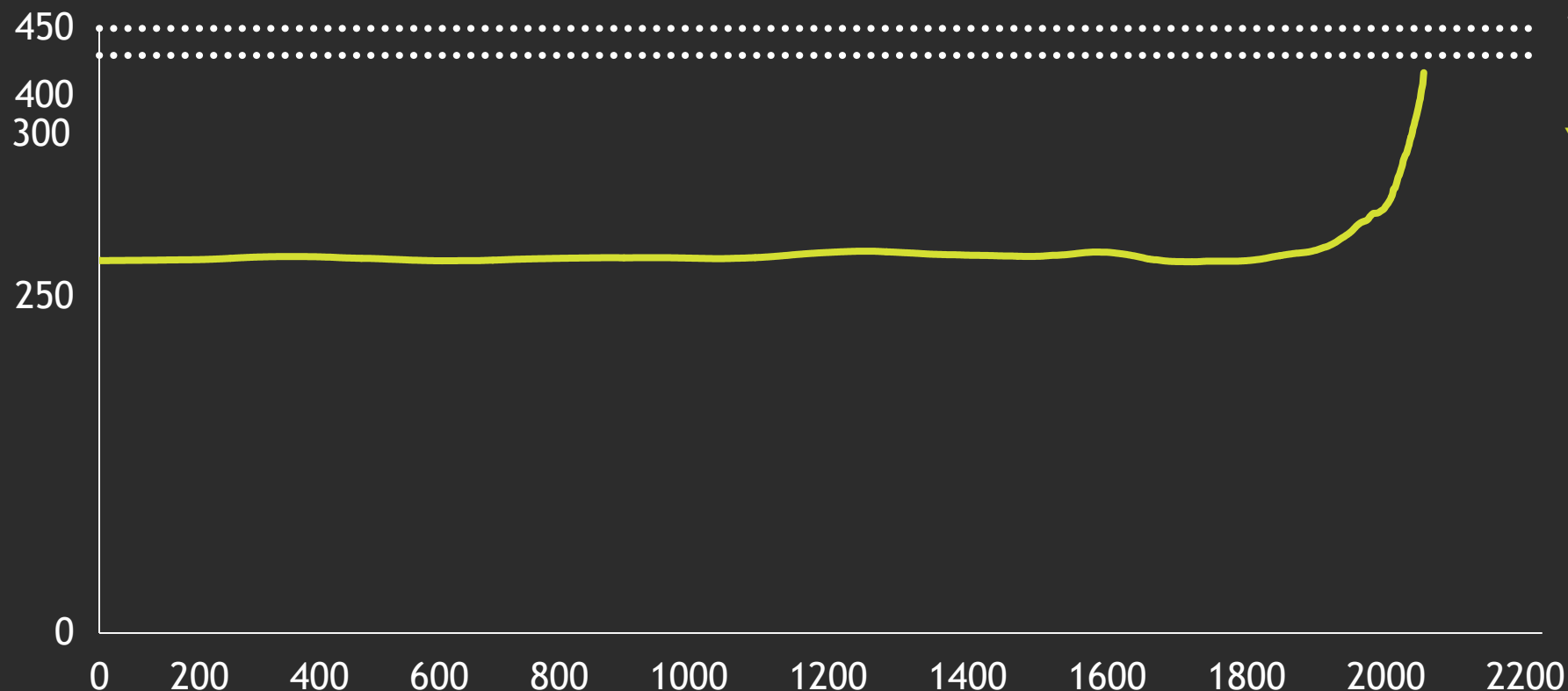
# Already 1°C of warming

Temperature anomaly (°C)



# 1.5-2°C range is getting close

CO<sub>2</sub> concentration in the atmosphere (ppm)

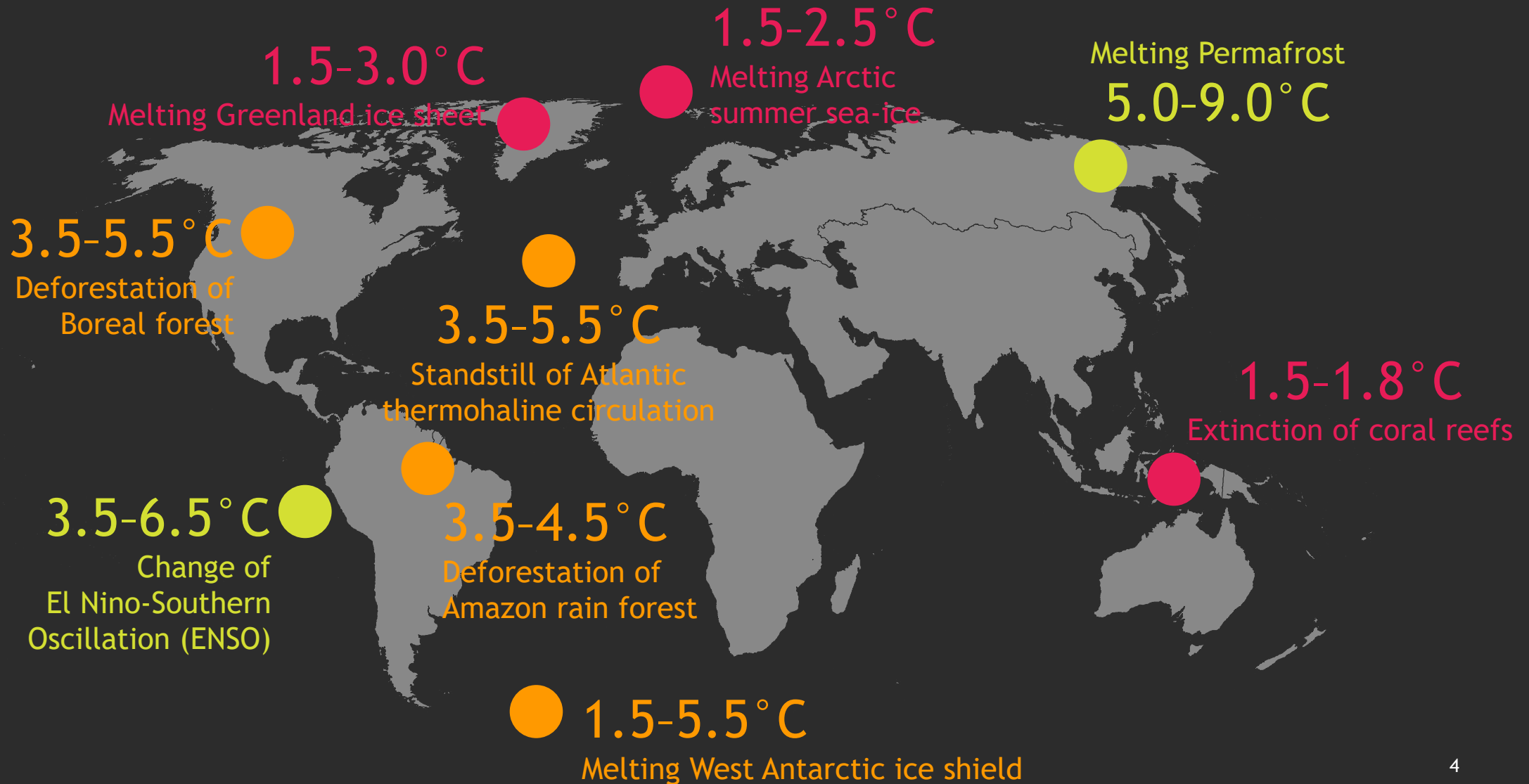


2.0°C range: ~450 ppm

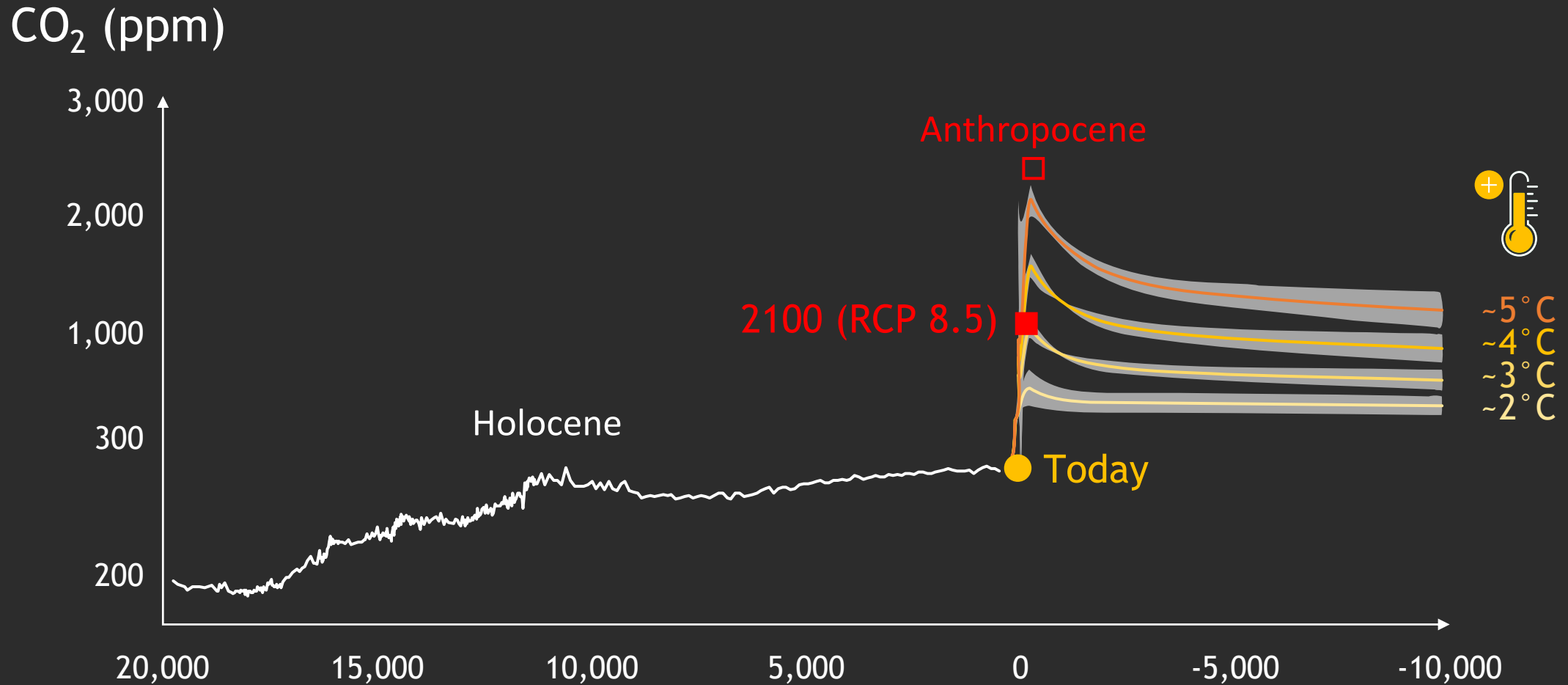
1.5°C range: ~430 ppm

**Yesterday: 410 ppm**

# ‘Tipping points’ ahead



# The next 30 years set the following 10,000





# Human civilization severely threatened

1.5° Paris ambition

**-8 % GDP<sup>1</sup>**

+2 months of droughts<sup>2</sup>

2° Paris goal

**-13 % GDP<sup>1</sup>**

+4 months of droughts<sup>2</sup>

Key “tipping points”

4+° Current path

**-30 % GDP<sup>1</sup>**

+>10 months of droughts<sup>2</sup>

Holland, NYC, ... flooded

Severe food crises risk<sup>3</sup>

6x wildfire area in US

...

1. Per capita, relative to no additional warming 2. Increase in avg. drought duration 3. Severe risk of close-to-annual occurrence

Note: Temperature increase refers to global warming by 2100

Source: UN Intergovernmental Panel on Climate Change (IPCC); Burke et al



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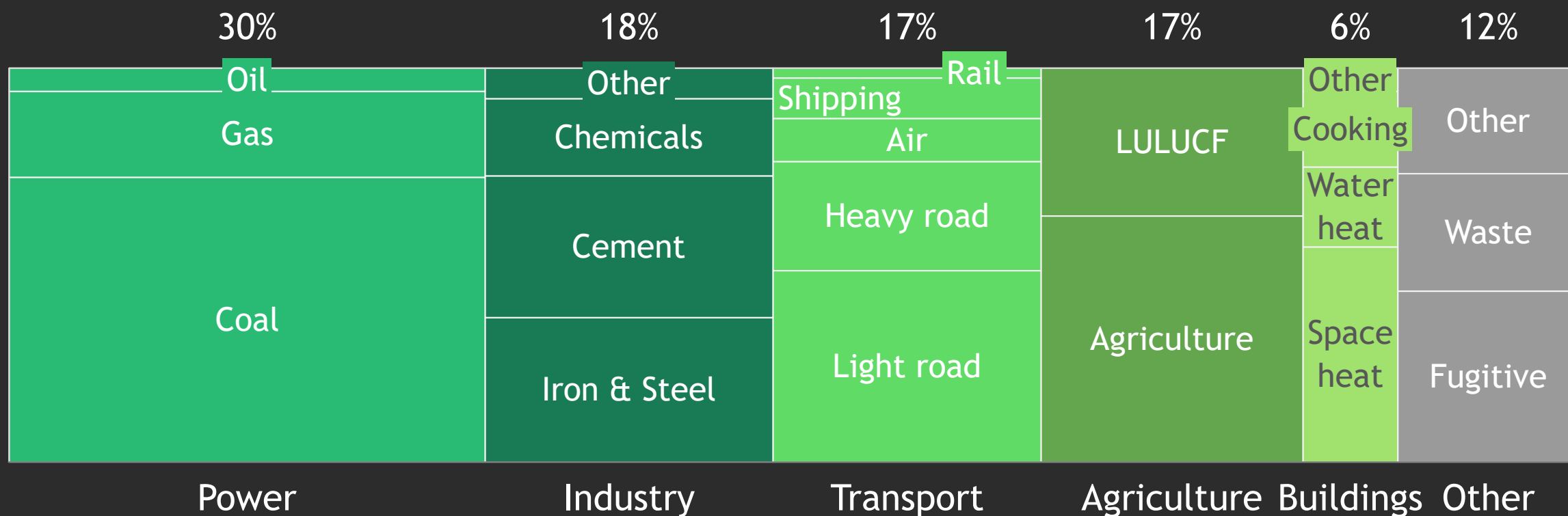
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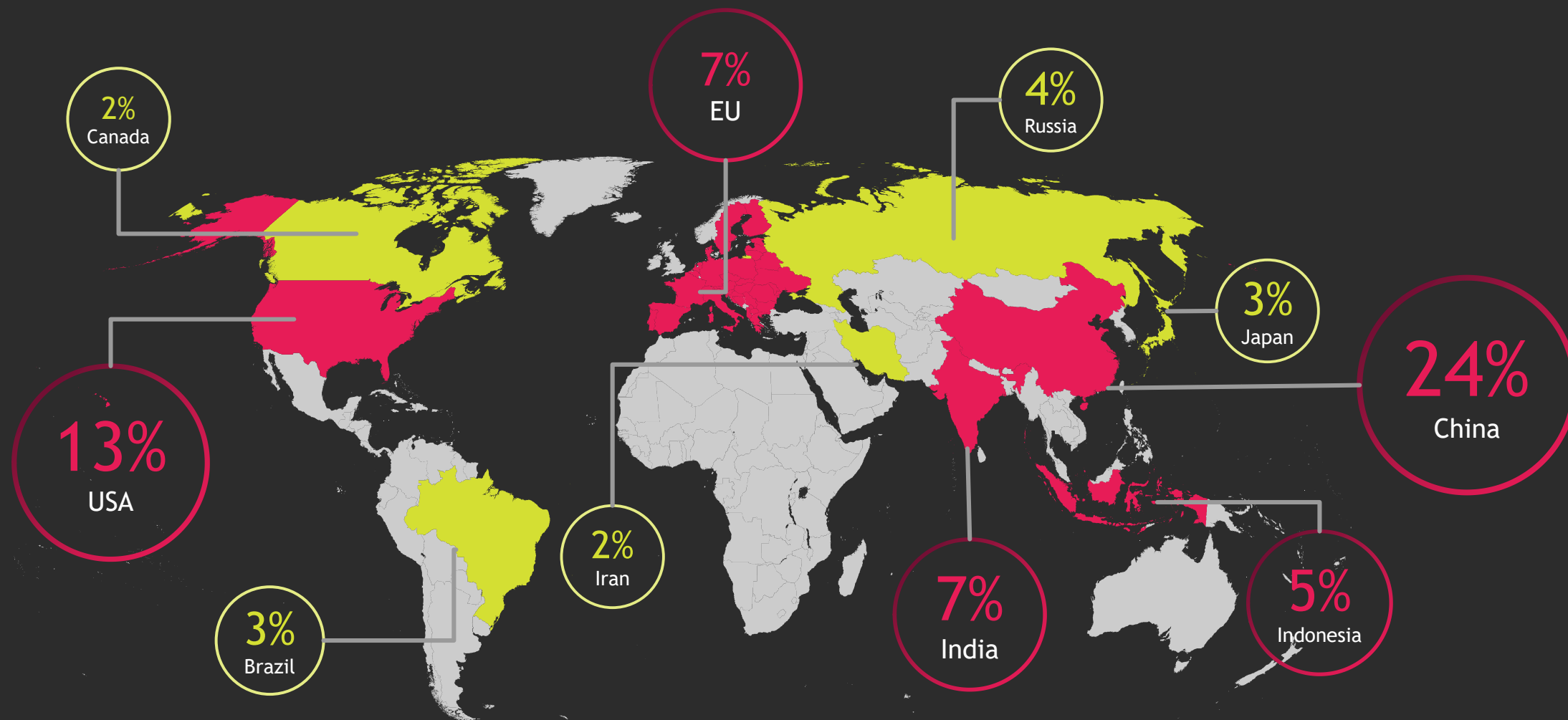


# Humans cause ~50 Gt emissions per year

Gt CO<sub>2</sub>e of global GHG emissions, 2017

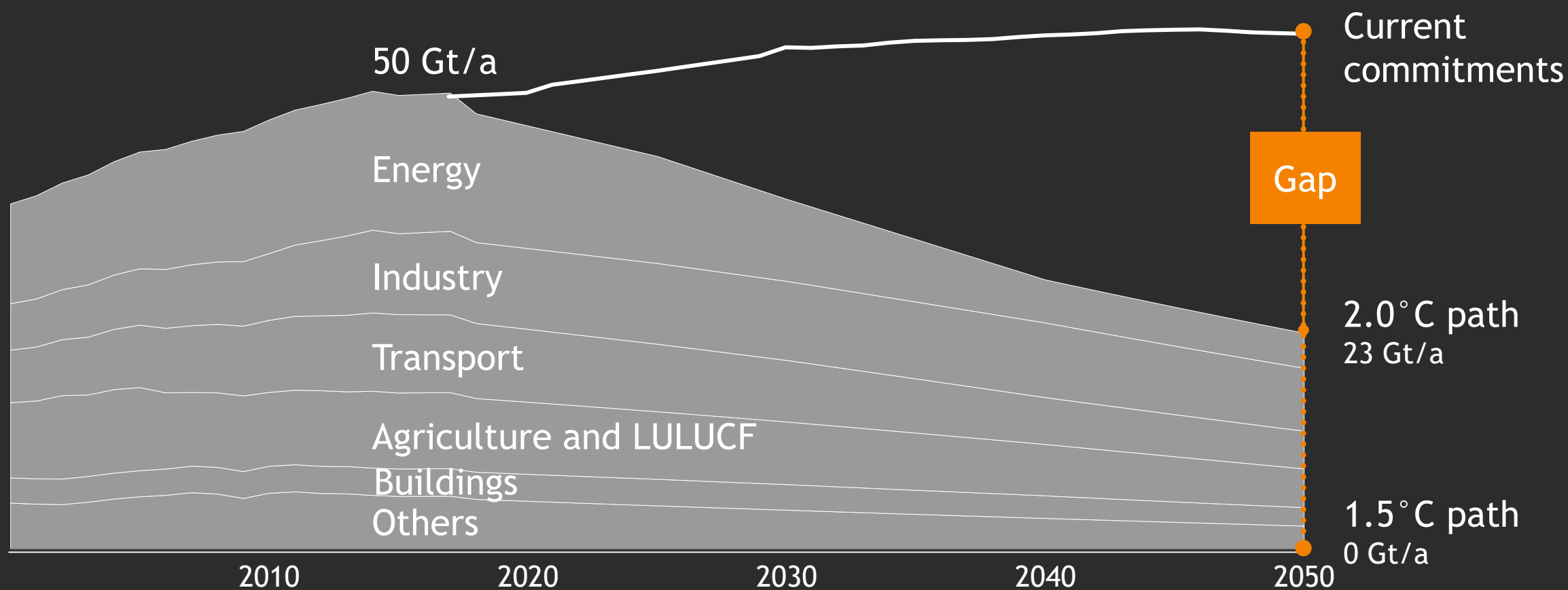


# Top five countries emit >60% of world total



# We need an immediate turnaround

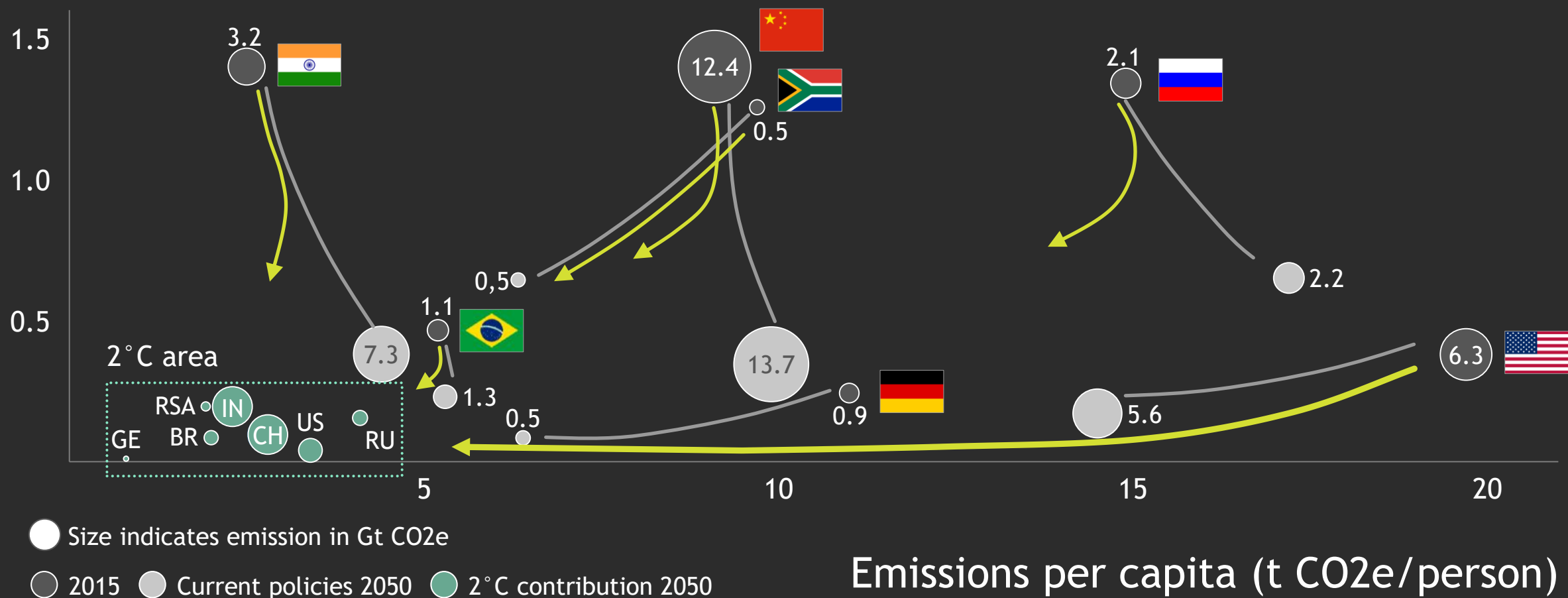
Global emissions (Gt/a CO<sub>2</sub>e)



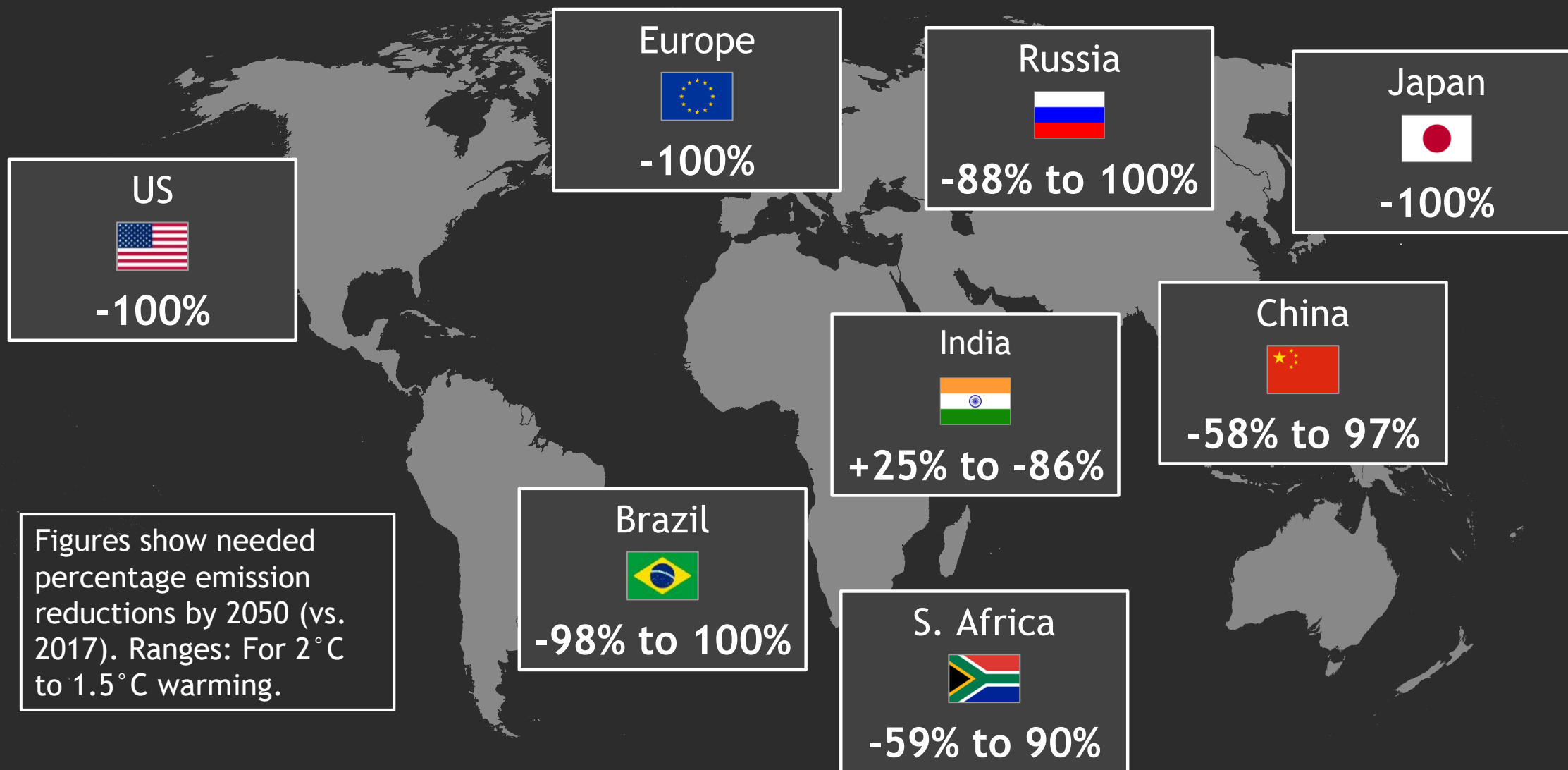


# One goal, very different challenges

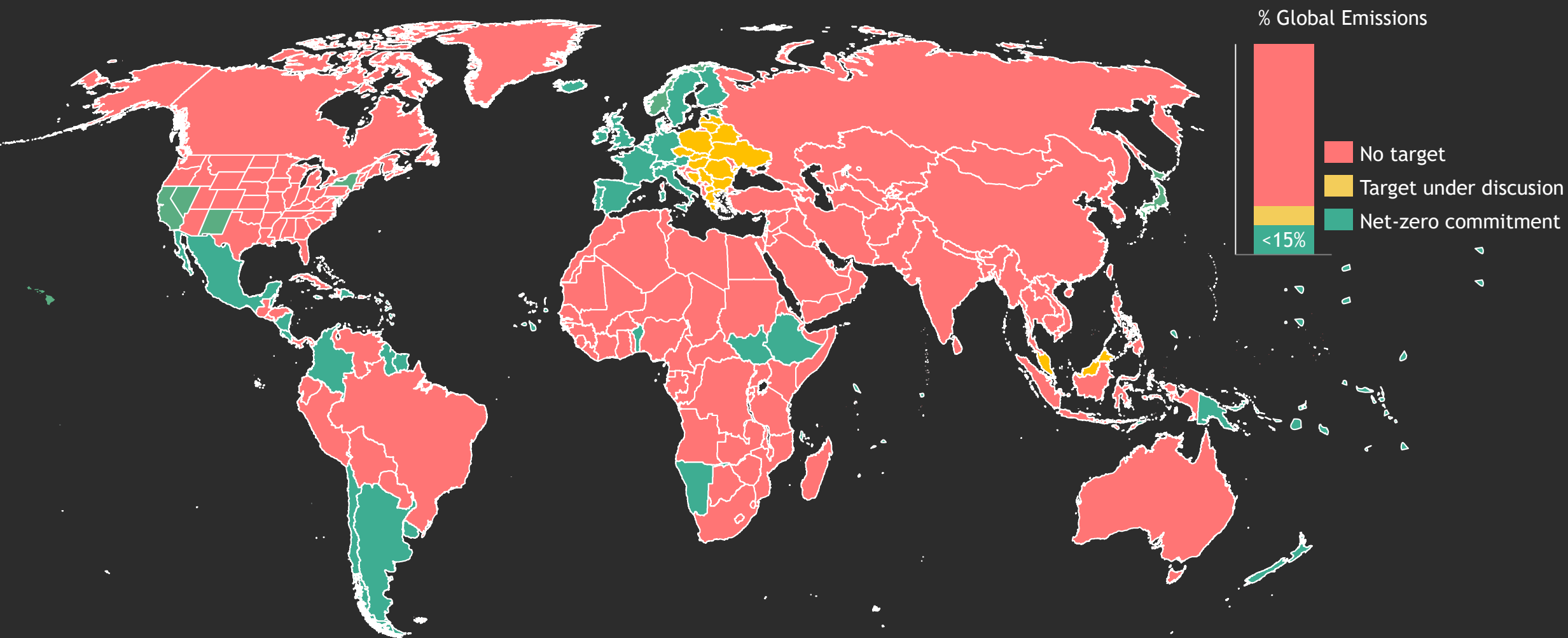
Carbon intensity (t CO<sub>2</sub>e/\$<sub>2015</sub> GDP)



# Major countries need to reach zero by 2050



# Few countries have a net zero ambition



Source: ClimateWatch; Government websites

Note: 6 US States - California, New York, Hawaii, Washington, New Mexico, Nevada (Washington, New Mexico & Nevada committed to 0 carbon energy rather than fully carbon-neutral)



# Even fewer have sufficient policies

## Ambition

Countries: 65

Emissions: <15%

## Sector roadmaps

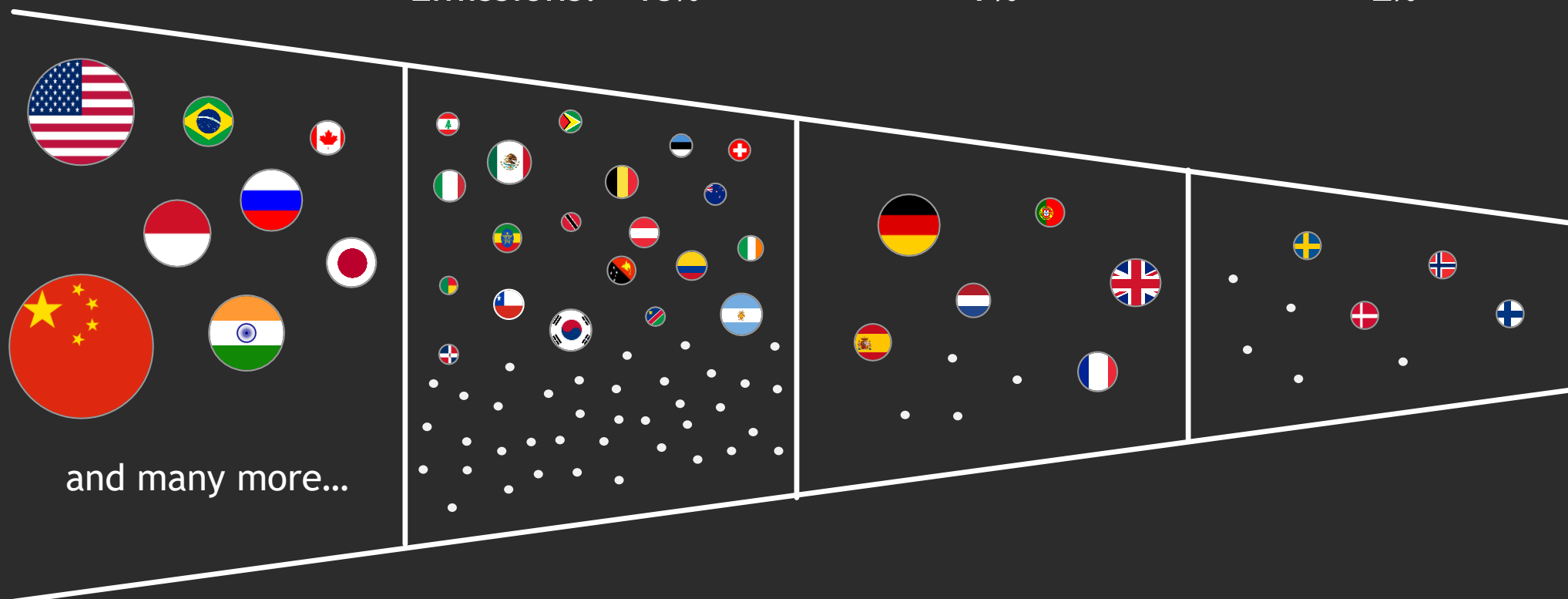
14

<7%

## Policy framework

9

<2%



Relative size of GHG emissions  
(2Gt shown)

A dark, atmospheric photograph of a stone archway leading into a dense forest, with the scene reflected in a body of water. The image is dimly lit, emphasizing the textures of the stone and the foliage.

# How to decarbonize a developed economy

# 80% path achievable with proven technologies



PV = photovoltaics  
All figures refer to 2050



# 95% path pushes boundaries of tech and acceptance

340 TWh imports  
of renewable fuels  
(PtL, PtG)

Power: 292 GW wind  
and PV, grid expansion

Energy: 100% renewable  
through PtG, gas grid as  
seasonal storage facility

Buildings: 70% more  
insulation/refurbishments  
(1.9% p.a.)

Buildings: 100% emissions-  
free heat (esp. through 16M  
heat pumps, district heating)

Industry: 100% renewable heat  
through biogas/PtG ...

Industry: ... produced with recycled  
carbon from biomass combustion

Transport: 33M electric  
vehicles, 4/5 of passenger cars

Transport: 8,000 km of freeway  
equipped with overhead lines

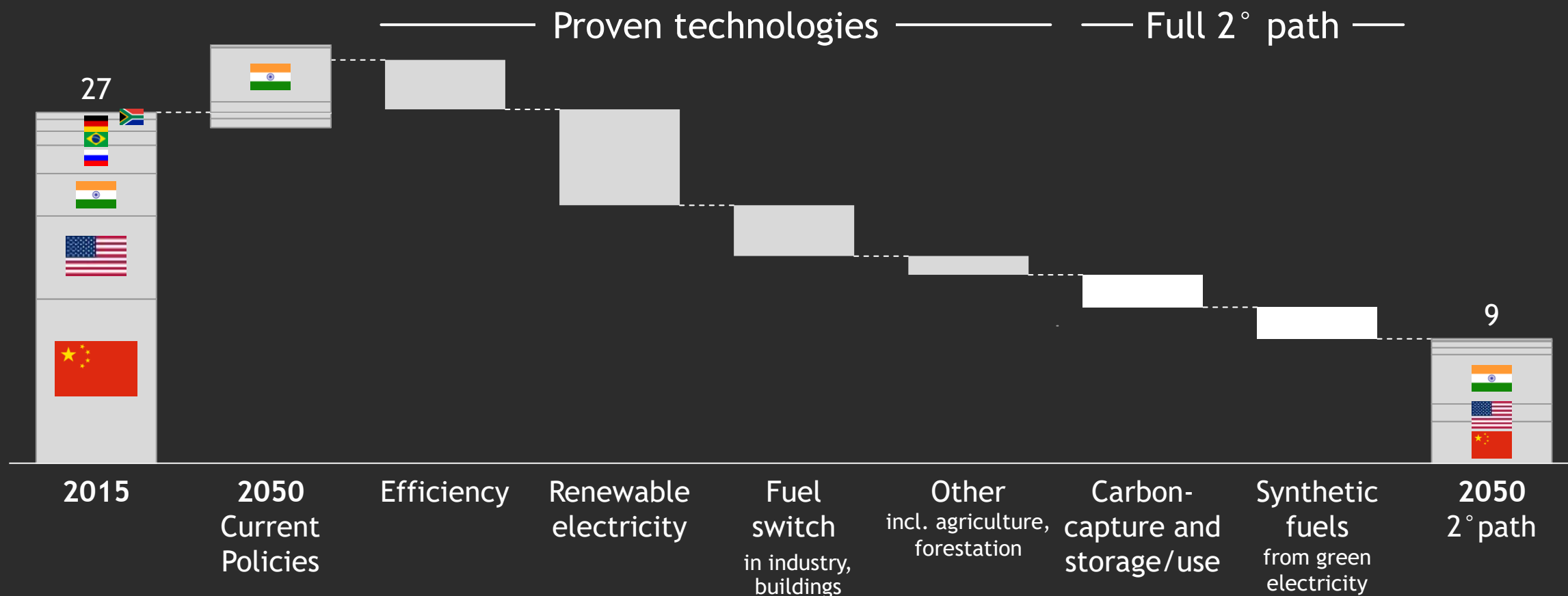
Agriculture: "Methane  
pill" for cattle

Carbon capture and  
storage for steel, cement,  
steam reforming

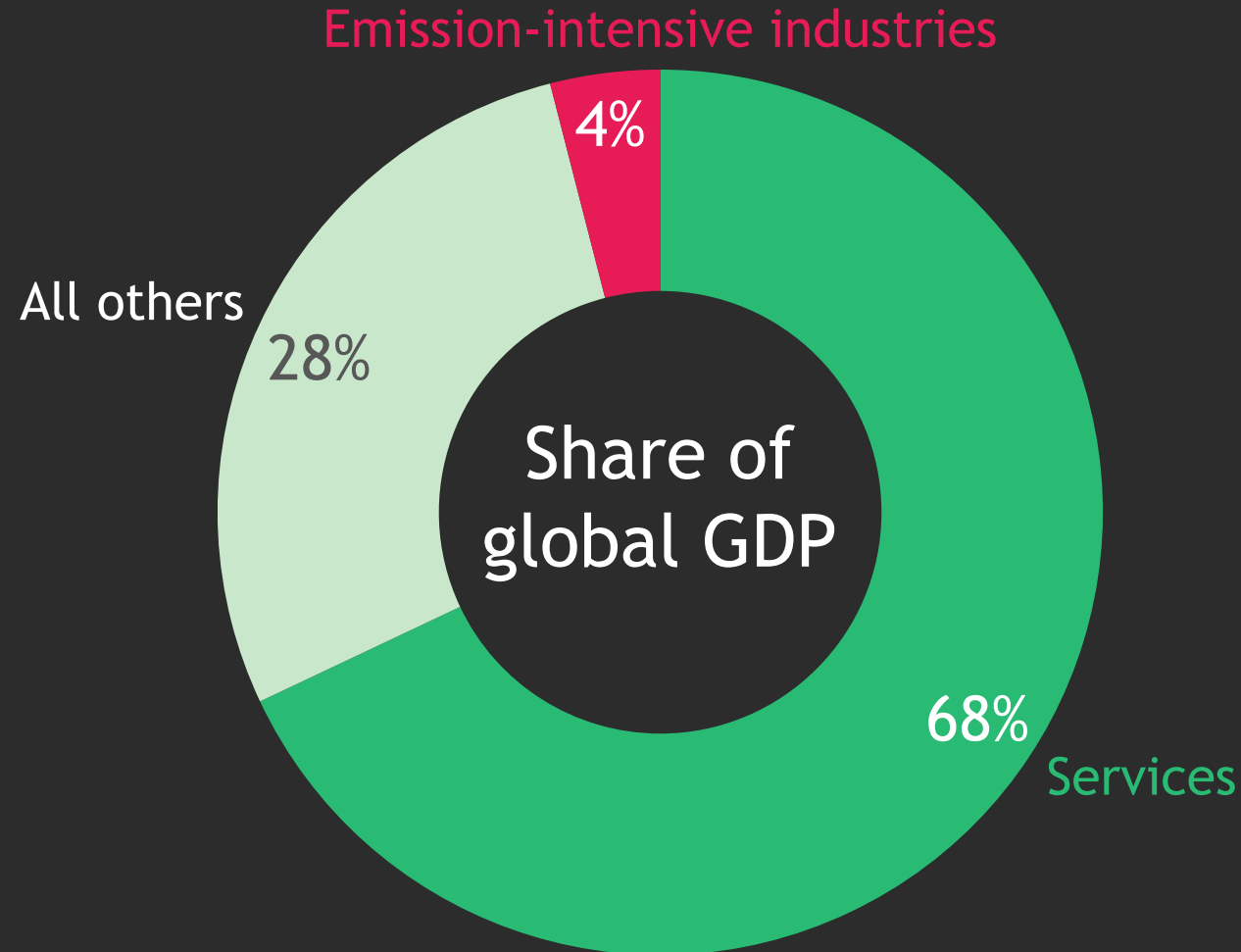
PtL = power-to-liquid, PtG = power-to-gas  
All figures refer to 2050

# Technologies are largely available

Emissions for selected countries (Gt CO<sub>2</sub>e)



# Fear of losing competitiveness is overstated



# Clear economic case for action

## IMPACT OF CLIMATE CHANGE

Devastating for all



**>-30% GDP**

per capita in 2100 globally,  
in case of unchecked warming



**±1% in GDP**

per capita impact in 2050  
dep. on country, for a 2°C path

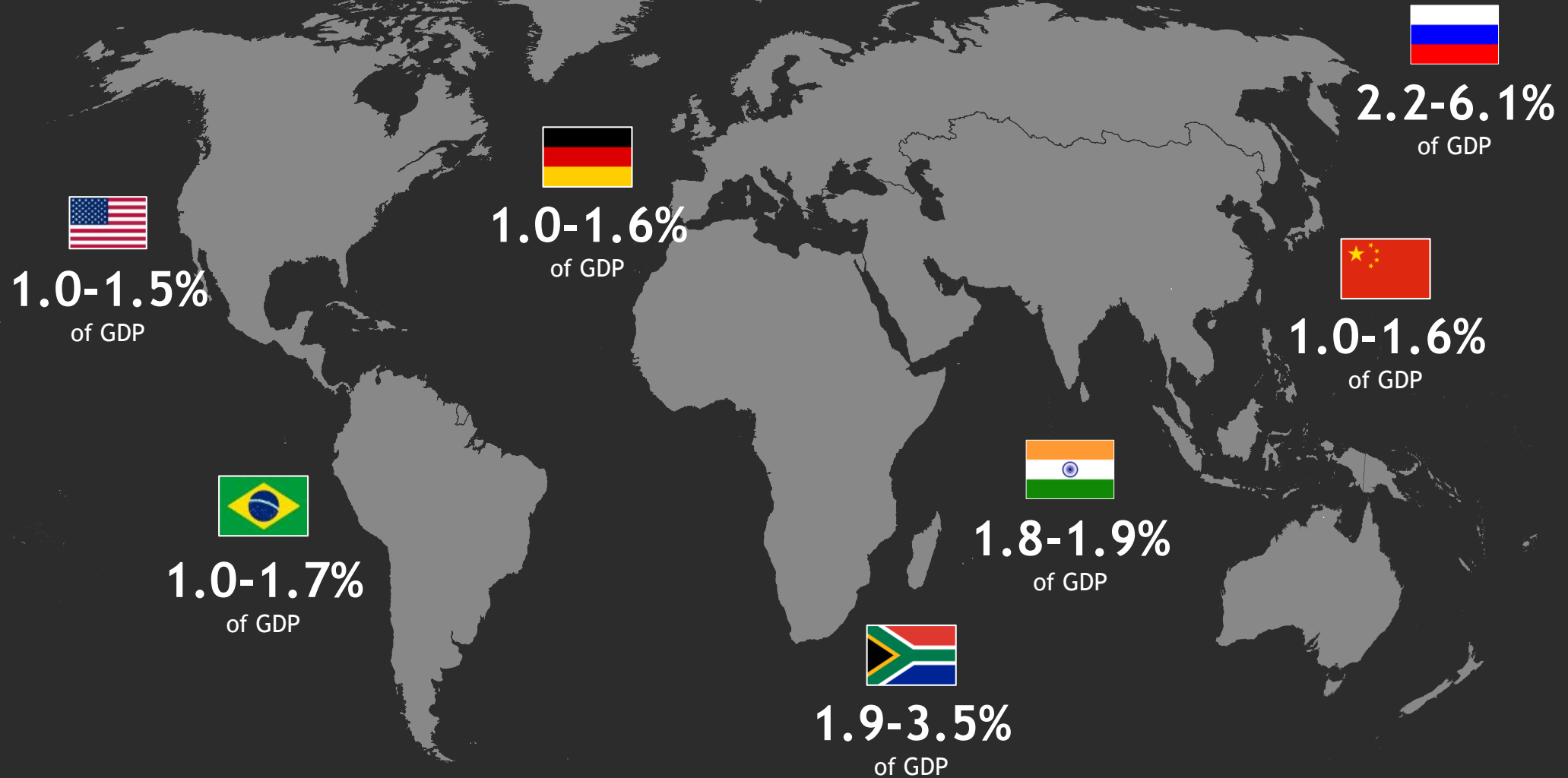


## IMPACT OF CLIMATE ACTION

Positive for many



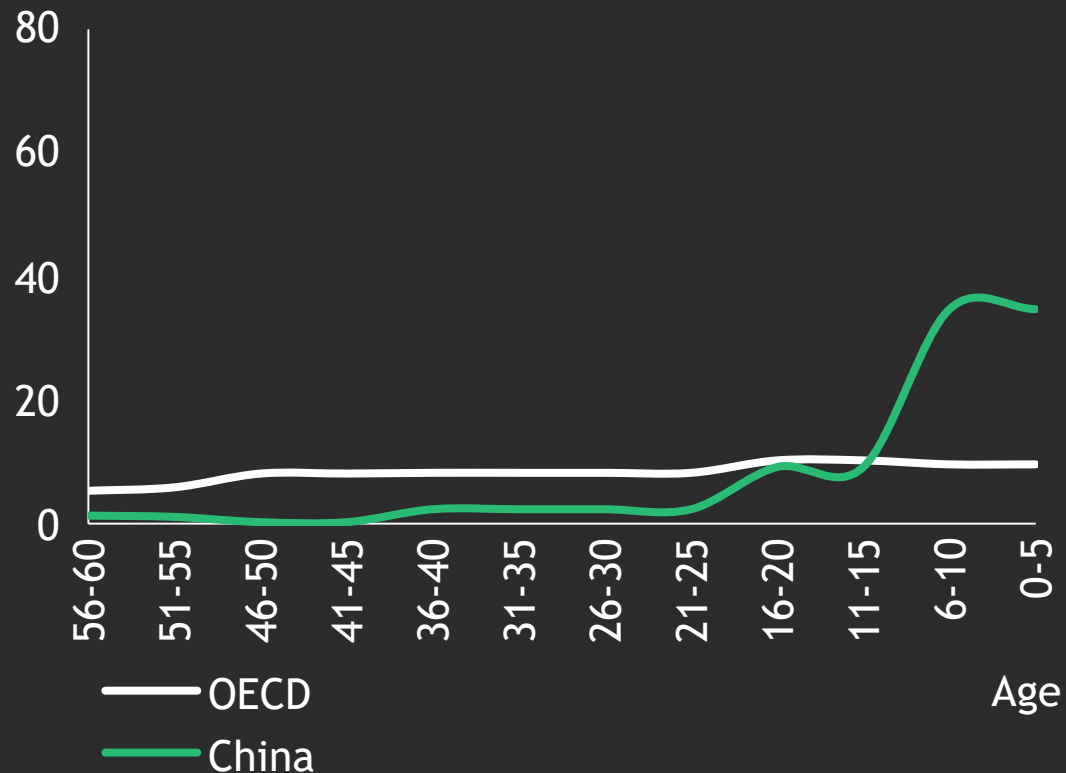
# But: Enormous investment challenge



# High resilience to change

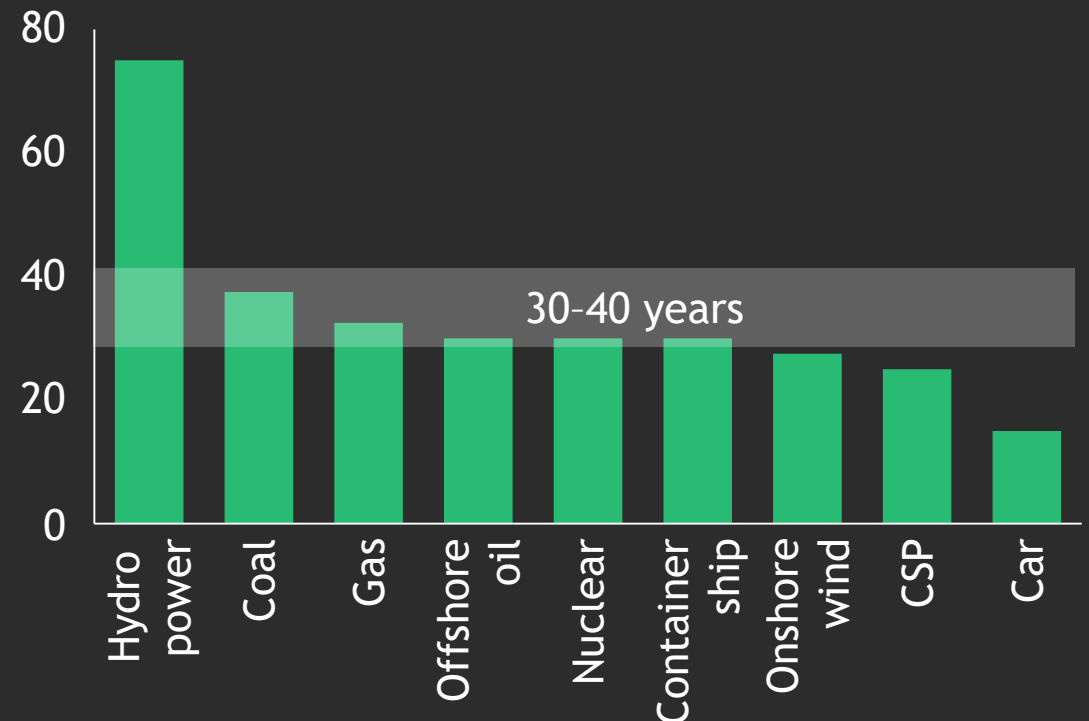
## Young asset base

Coal power generation assets (%age distribution)



## Asset lifetime >30 years

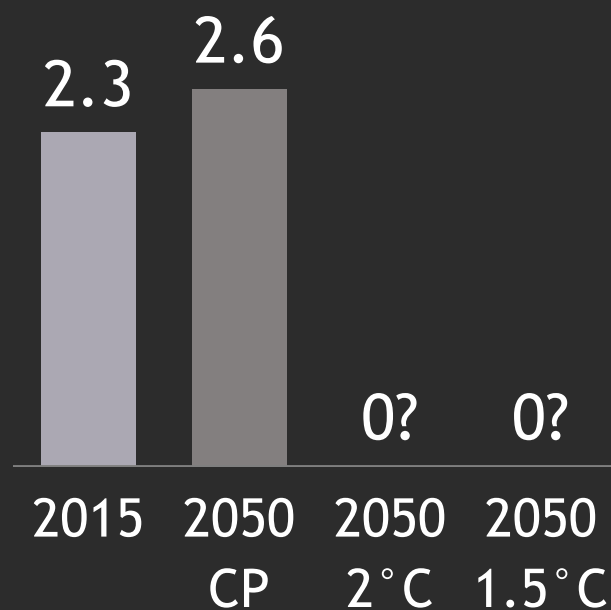
Median plant age (years)



# Fossil fuels heavily impacted

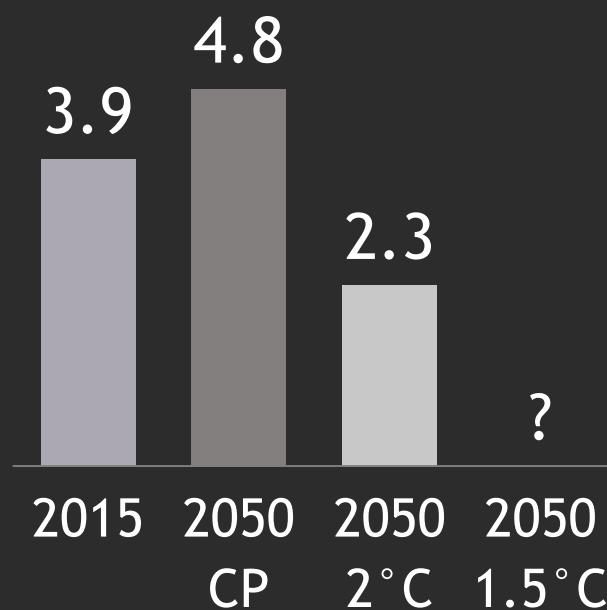
## Coal

Globally in power, Btoe



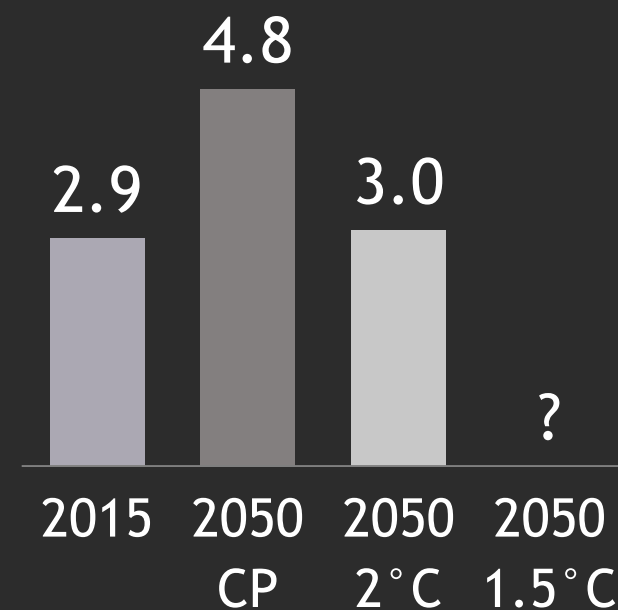
## Oil

Globally in transport, Btoe



## Gas

Globally, in Btoe



# Regulation needed—and protectionism?

## Pricing impulses

Eliminate fossil subsidies

Price carbon

### Energy

Coal phase-out  
RE, nuclear scaling  
Grid expansion

### Transport

EV incentives  
Infrastructure invest  
Sustainable fuel  
quotas

### Industry

Efficiency mandates  
Bioenergy program  
H2/CCUS research  
Product standards

### Buildings

Building standards  
Renovation program  
E-heating incentives  
Appliance standards

### Land/Agri

Stop deforestation  
Scale sustainable  
Agriculture

Plus: Carbon leakage protection for vulnerable industries



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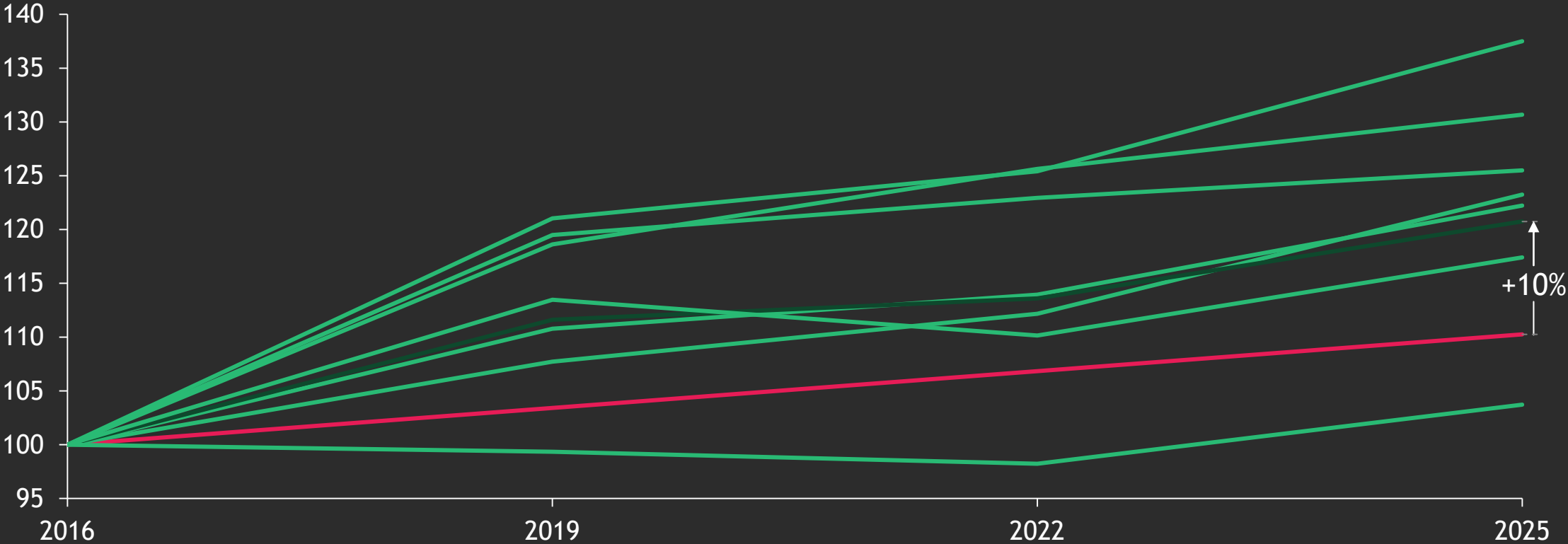
The  
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So what is the  
deal for the  
O&G industry?



# Continue banking on growth in hydrocarbons?

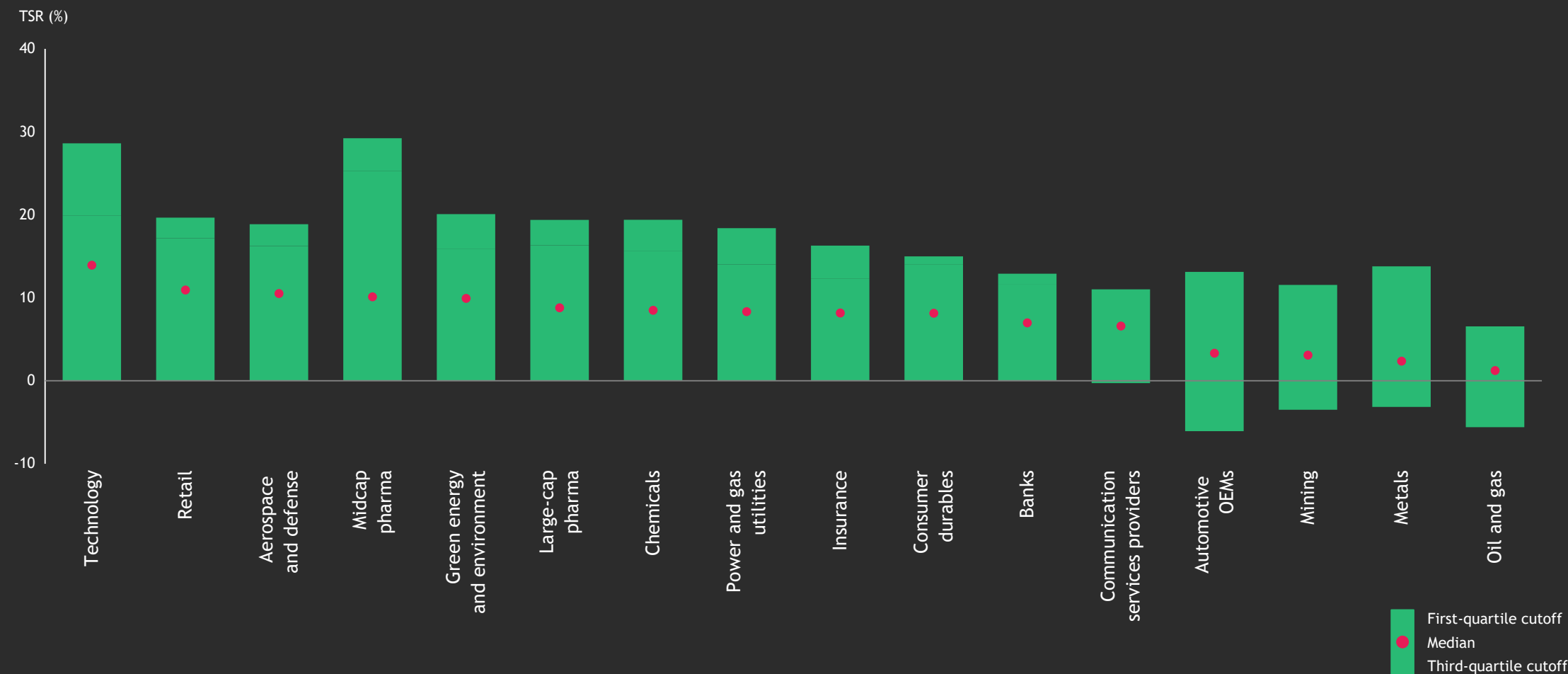
Forecast oil & gas production change (%)  
*IOC determined production forecasts vs IEA*



Note: Based on Rystad oil price projections and oil price forecasts  
Source: Rystad Ucube, IEA (2018)

# Is O&G really still an attractive sector to invest in?

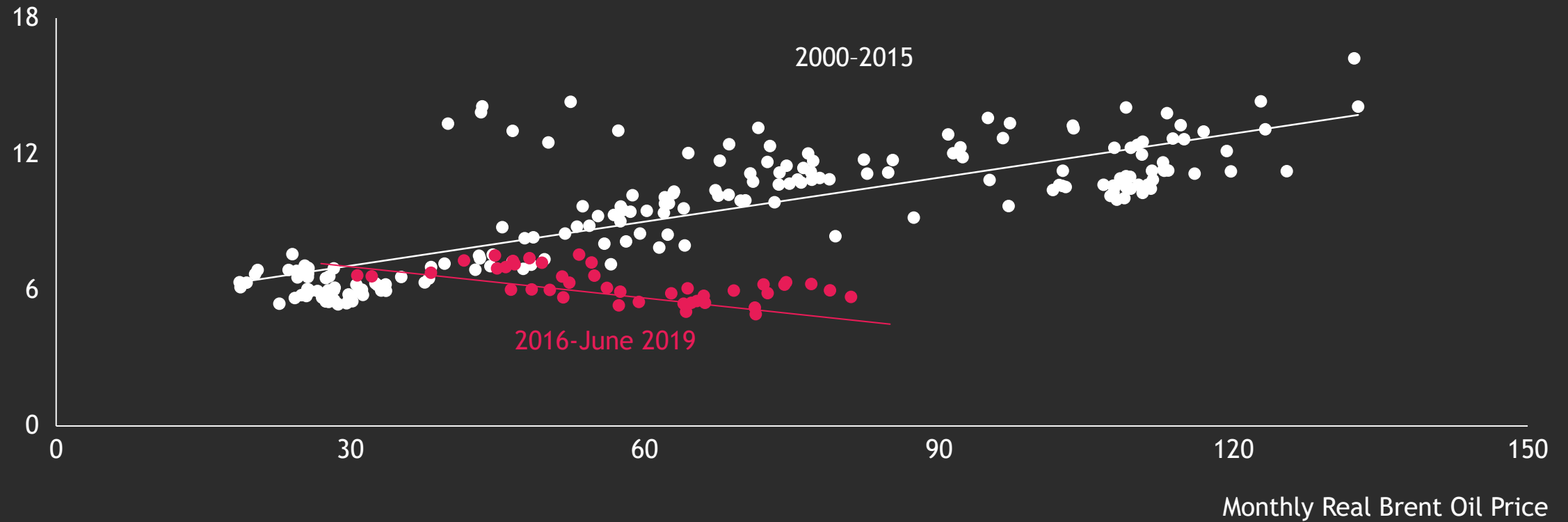
Five-year high, low, and median TSR for sample sectors, January 2014-December 2018



Sources: S&P Global Market Intelligence; Thomson Reuters Eikon; S&P Capital IQ; BCG ValueScience Center; BCG analysis

# Oil & Gas share of S&P 500 is shrinking...

Monthly oil and gas share of S&P 500



Note: Energy share of the S&P 500 of which Oil and Gas comprises ~90%  
Source: US Energy Information Administration (EIA); Bloomberg; CapitalIQ; BCG Analysis



# Which oil company will be Kodak and which one Fuji?



"We are a photography company"

...bankruptcy



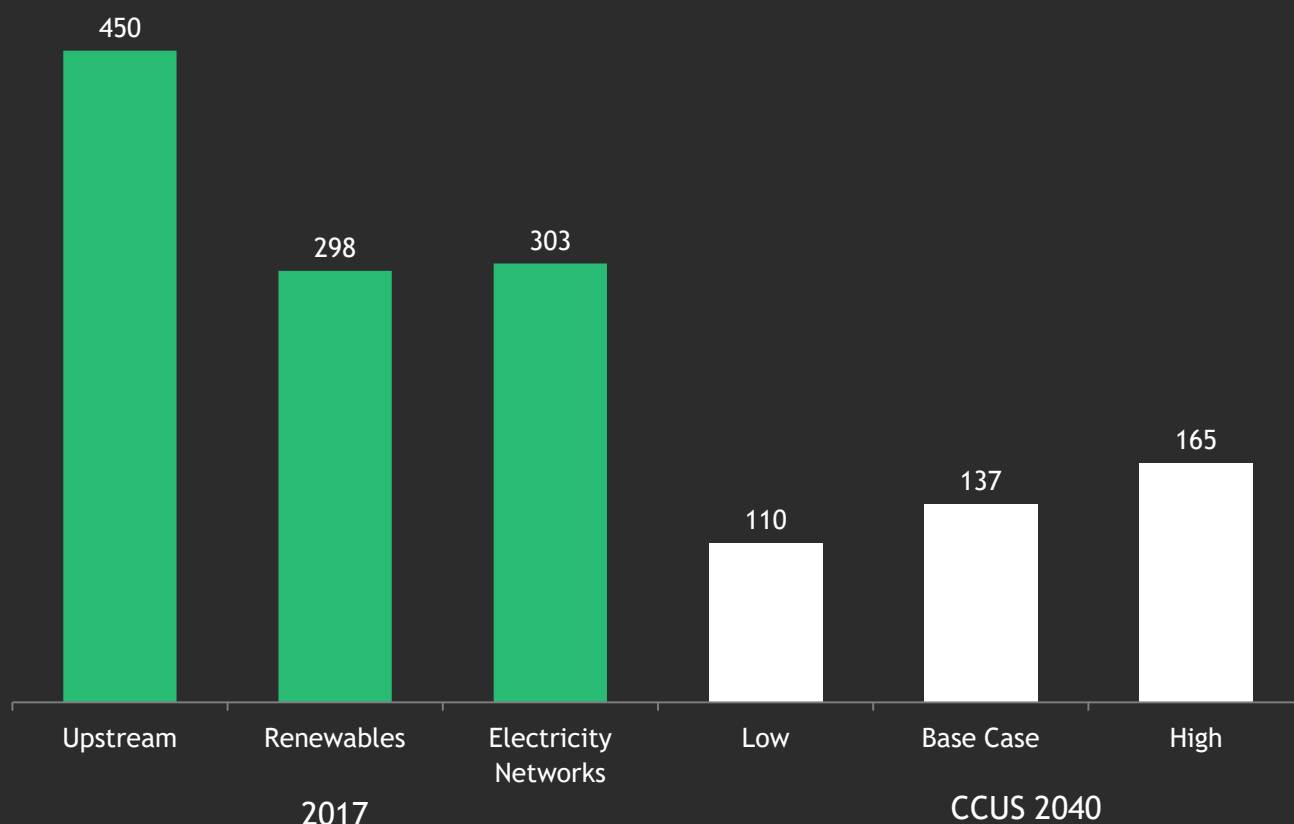
"We are good with chemicals"

...a leading Healthcare & Material Solutions company with a ~\$25B market cap

# Rise of the carbon majors?

In CCUS alone, globally ~\$150B capital required annually by 2040

Graph 1. Current world energy investments and projected CCUS capex requirements under IEA's 2DS deployment projections, USD \$B/year



**\$1+  
trillion**

**Cumulative capital  
requirement by 2040  
under 2°C pathway**

# The world needs lots of petroleum engineers!

This....



Hydrogen



CCUS



Synthetic and circular materials

...still requires a lot of this



Safety culture



Innovation and R&D



Large capital project delivery



Seismic, well monitoring, operations, ....



Setting up new value chains

Time for discussion!