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Access, Development and Climate Change: Where does the rubber meet the road?

Columbia Global Energy Program
Columbia University, New York City
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Act 1

Energy drives our climate constraint

Energy's GHG emissions

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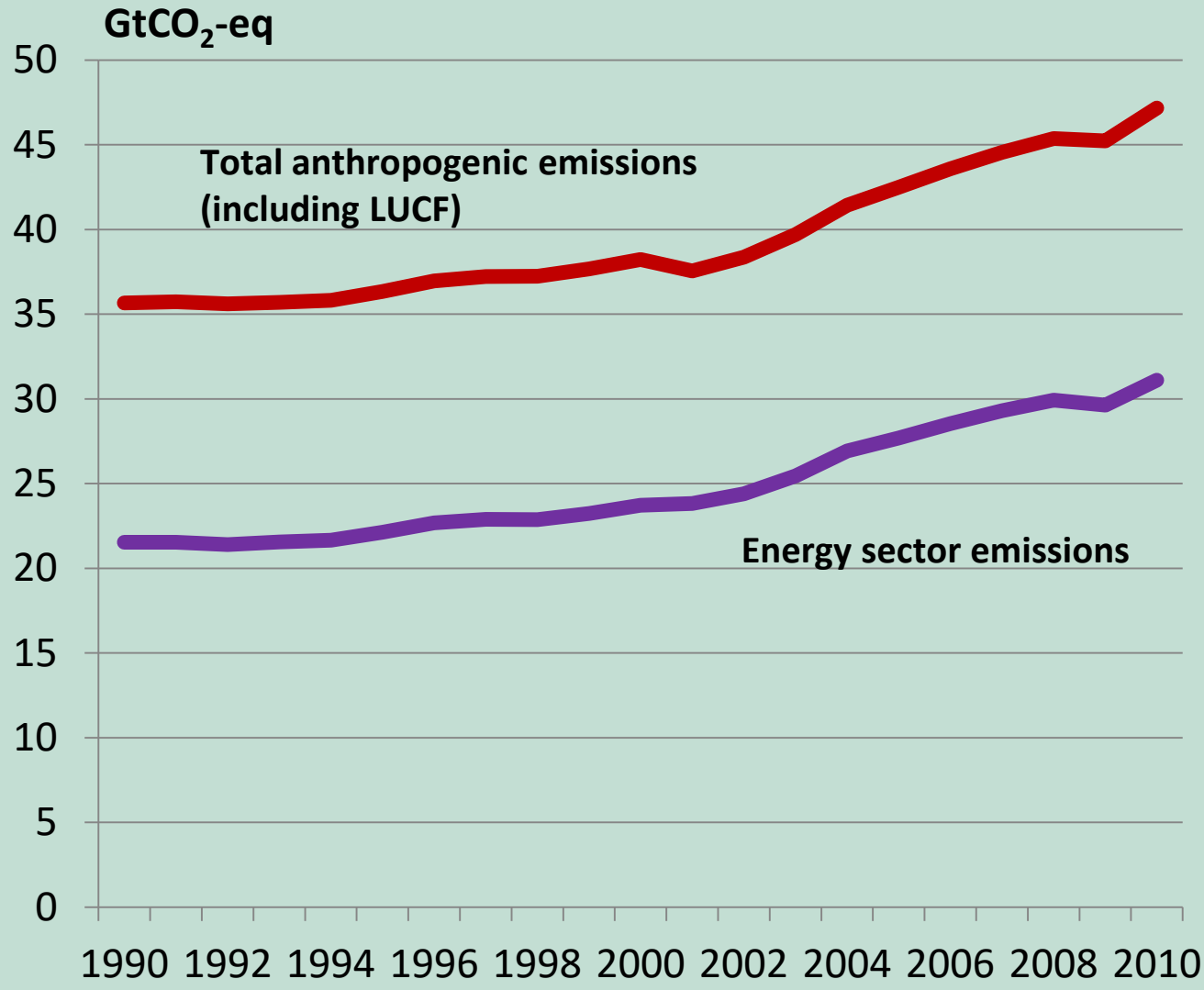

Energy sector is a key driver as it represents over 60% of human generated emissions...

Source: IEA graphics

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Act 2

… energy demand drives energy emissions

GHG emissions/climate change and energy demand are closely linked

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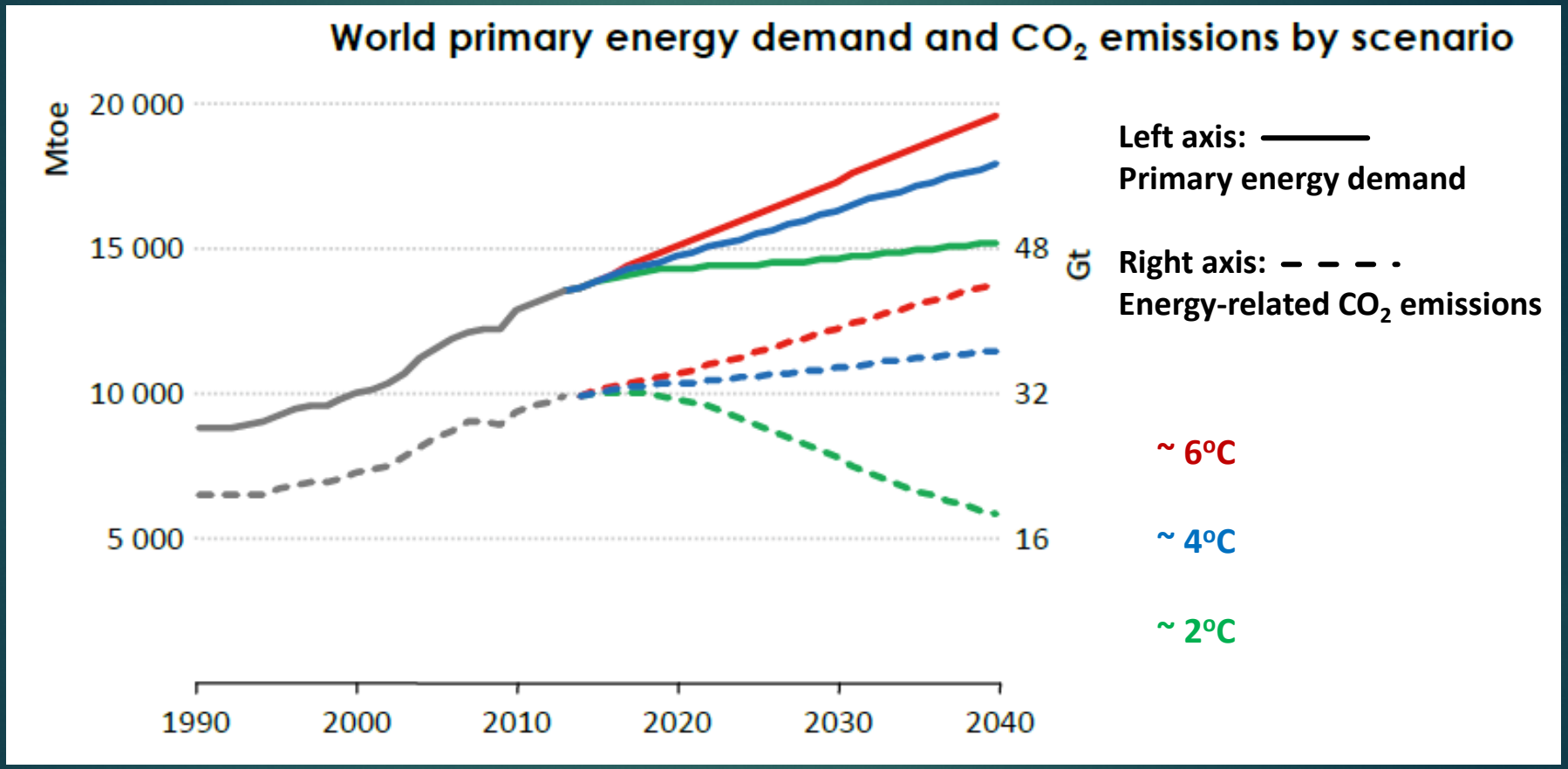

Source: IEA's WEO 2015

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The climate change constraint has fundamentally altered sustainability of energy for development

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Act 3

Access and the climate constraint

Lack of energy access continues to affect billions

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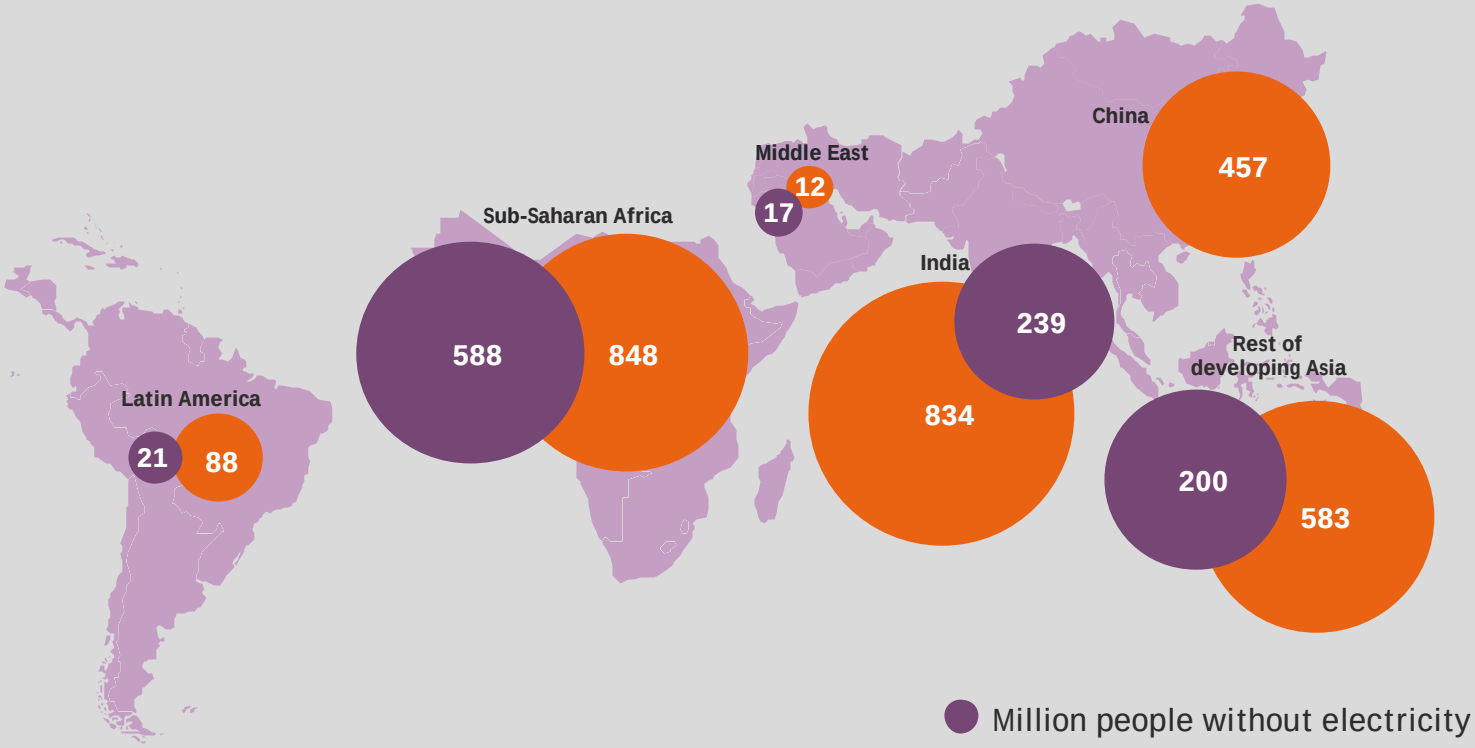
Number of people without modern energy access by selected region, 2016



Nearly 1.1 billion people without electricity

and 2.8 billion without clean cooking facilities

Source: IEA WEO 2017; OLADE

What impact will access have on energy demand and climate?

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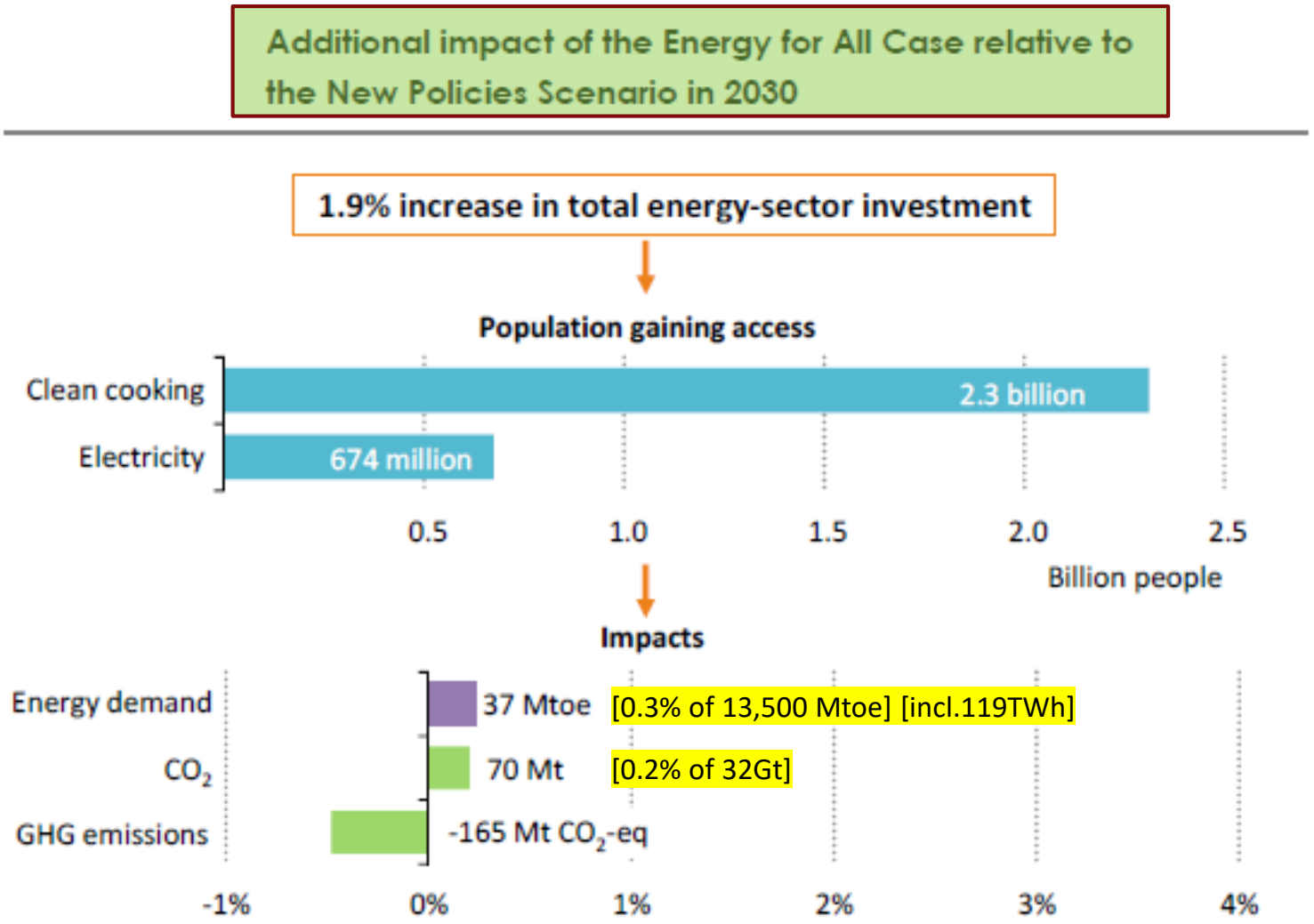
IEA's 2017 Energy Access Outlook Report



Source: Reproduced from IEA WEO Access Special Report 2017

How much power & emissions in providing access to 1.1 billion?

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	Population (billions)	Power Generation (TWh)	Power CO_2 emissions (Gt)	Power CO_2 / 1.1 billion (Gt)	% of Energy CO_2 (32GT)
Uni. elec access WEO 2011	1.1	840	0.2	**0.2**	**0.7%**
US	0.3	4,200	2.0	**7.3**	**23%**
Europe (EU)	0.5	3,100	1.1	**2.8**	**7%**
China	1.3	5,000	4.1	**3.5**	**10%**
India	1.3	1,100	1.0	**0.8**	**2%**
Sub-Saharan Africa	1.1	440	0.3	**0.3**	**0.9%**

Source: Production and emissions from 2014 IEA data

What impact will basic access have on energy demand and climate . . .

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a. Upward pressures: population needing access might grow from 1.1 billion today to >1.5 billion by 2030 if no action (Cf. WEO 2011)

b. Downward dynamics:

- **from access to actual energy consumption**
  - **Poor (mostly rural) populations don't consume much**
  - **Limited resources and limited opportunities for consumerism**
- **From energy consumption to CO_2 emissions:**
  - **High % rural population (~85%) and many remote households (e.g., logistical challenges for re-fueling) …**
  - **favors off-grid, incl. small/mini grids and household systems …**
  - **facilitates renewable systems.**
  - **Various donors have preference for renewables**
  - **High % of renewables further delinks access from emissions**

What impact will basic access have on energy demand and climate . . .

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Energy for all* by 2030 would increase only minimally global demand (~1% or less) and GHG emissions (~0.5% to negative)

** Basic access*

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How the 'energy for development' dynamic has pivoted to domestic consumption

Shift from ‘energy for development via revenues from extractives’ …

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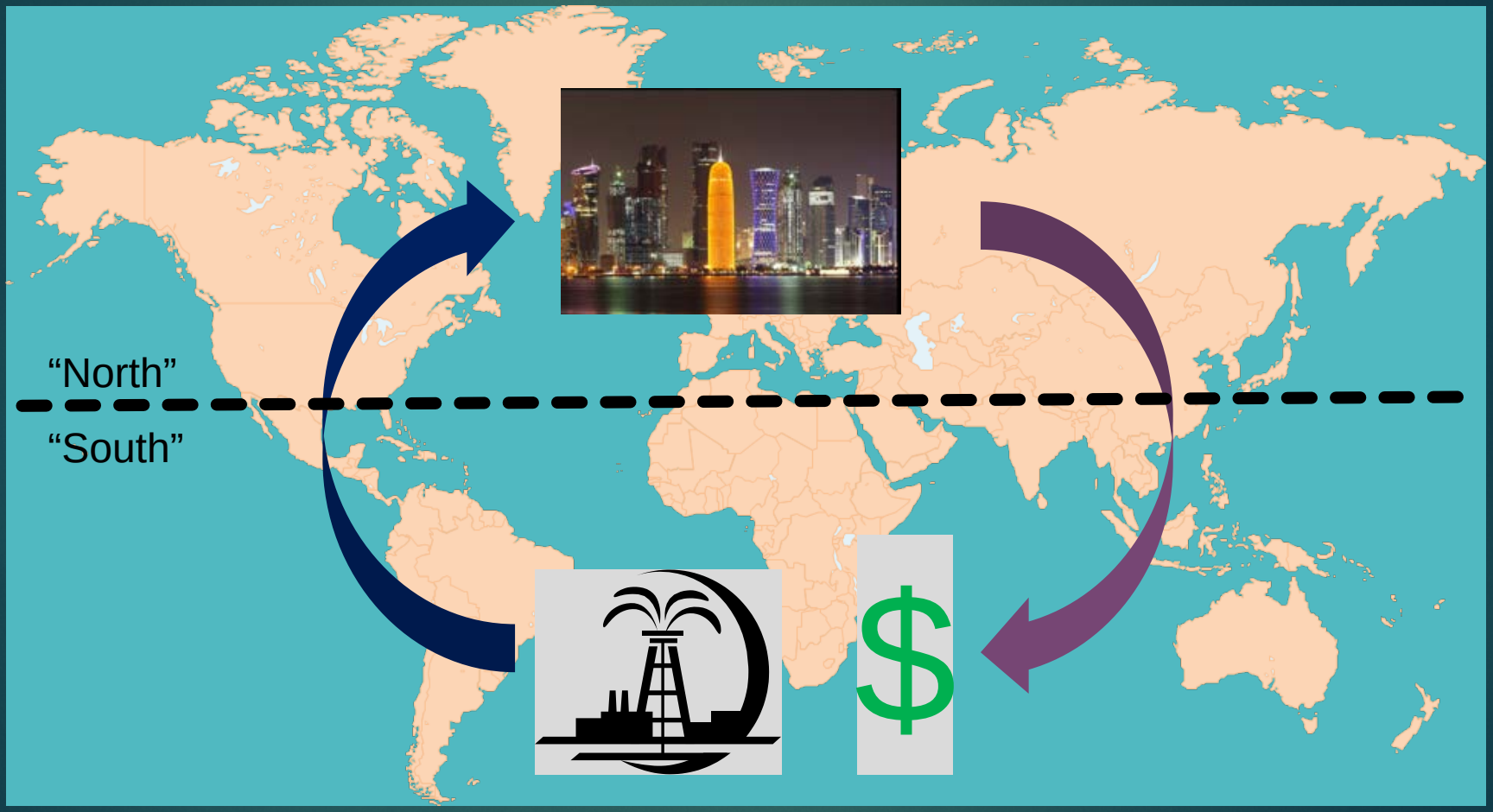

GDP and domestic energy demand: partners in China's growth to date

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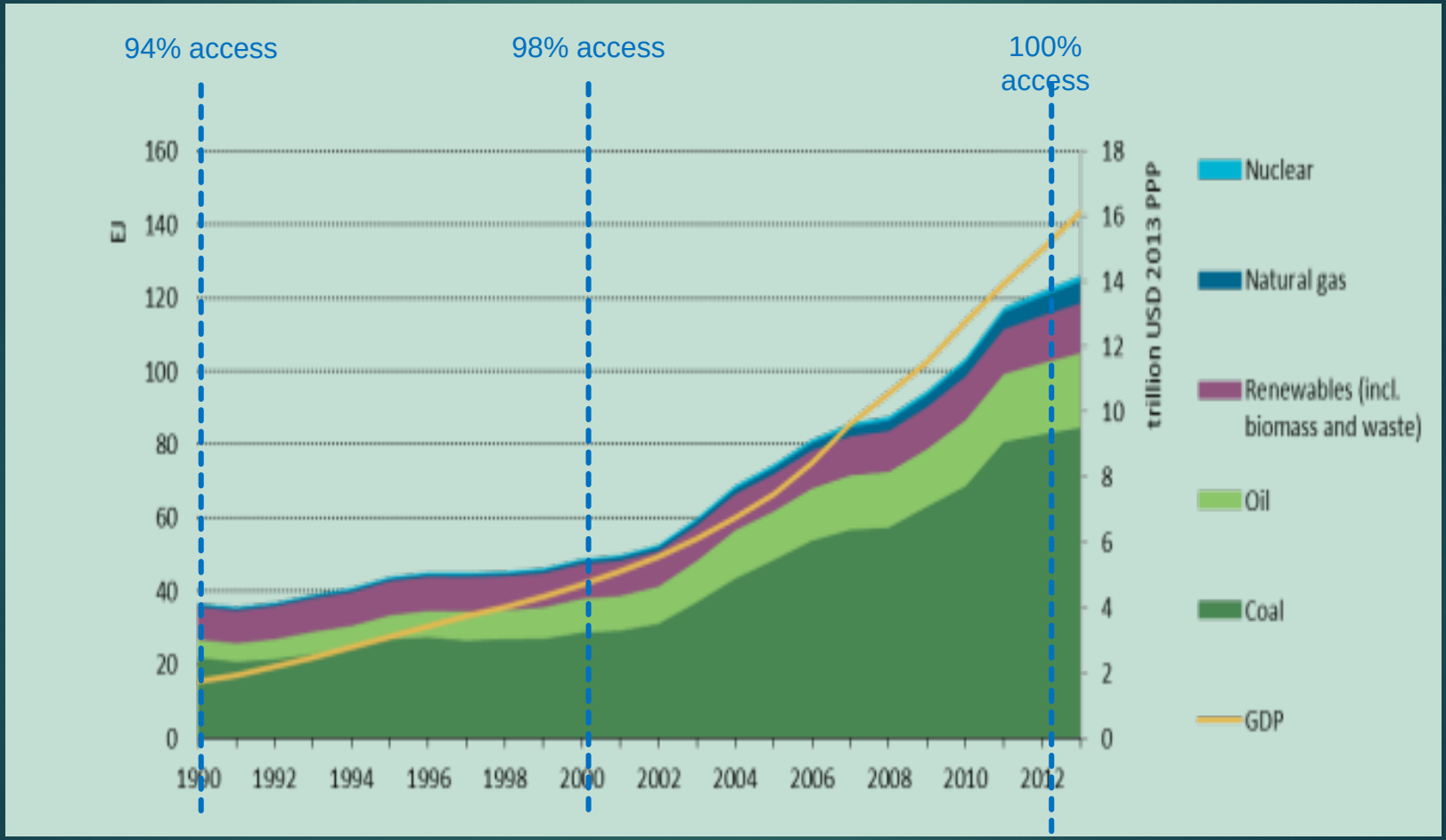

Source: IEA; Access source: indexmundi from World Bank

GDP and domestic energy demand: partners in India's growth to date

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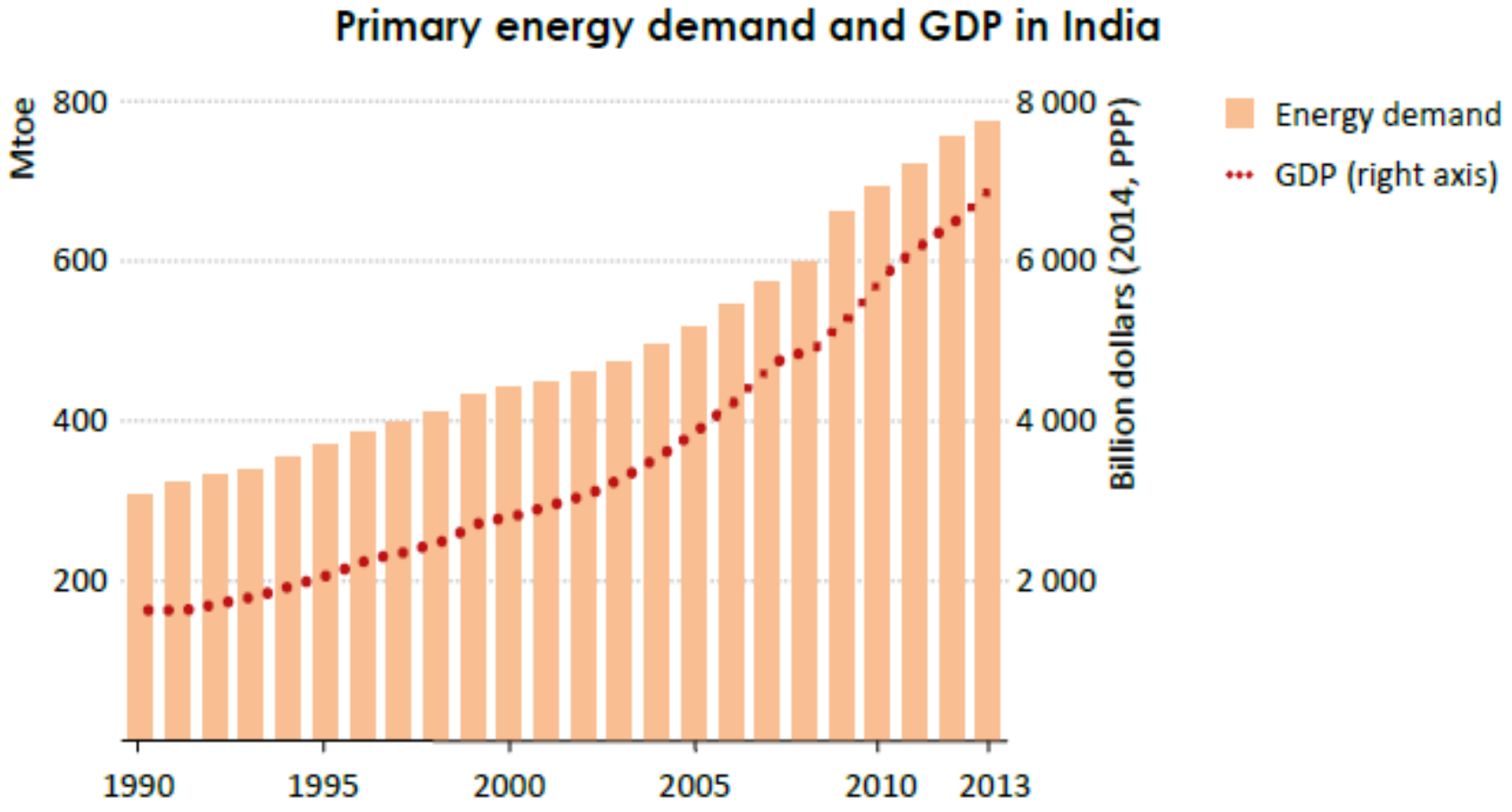

Source: IEA - WEO 2015 – India Special Report

GDP and domestic energy demand: partners in Brazil's growth to date

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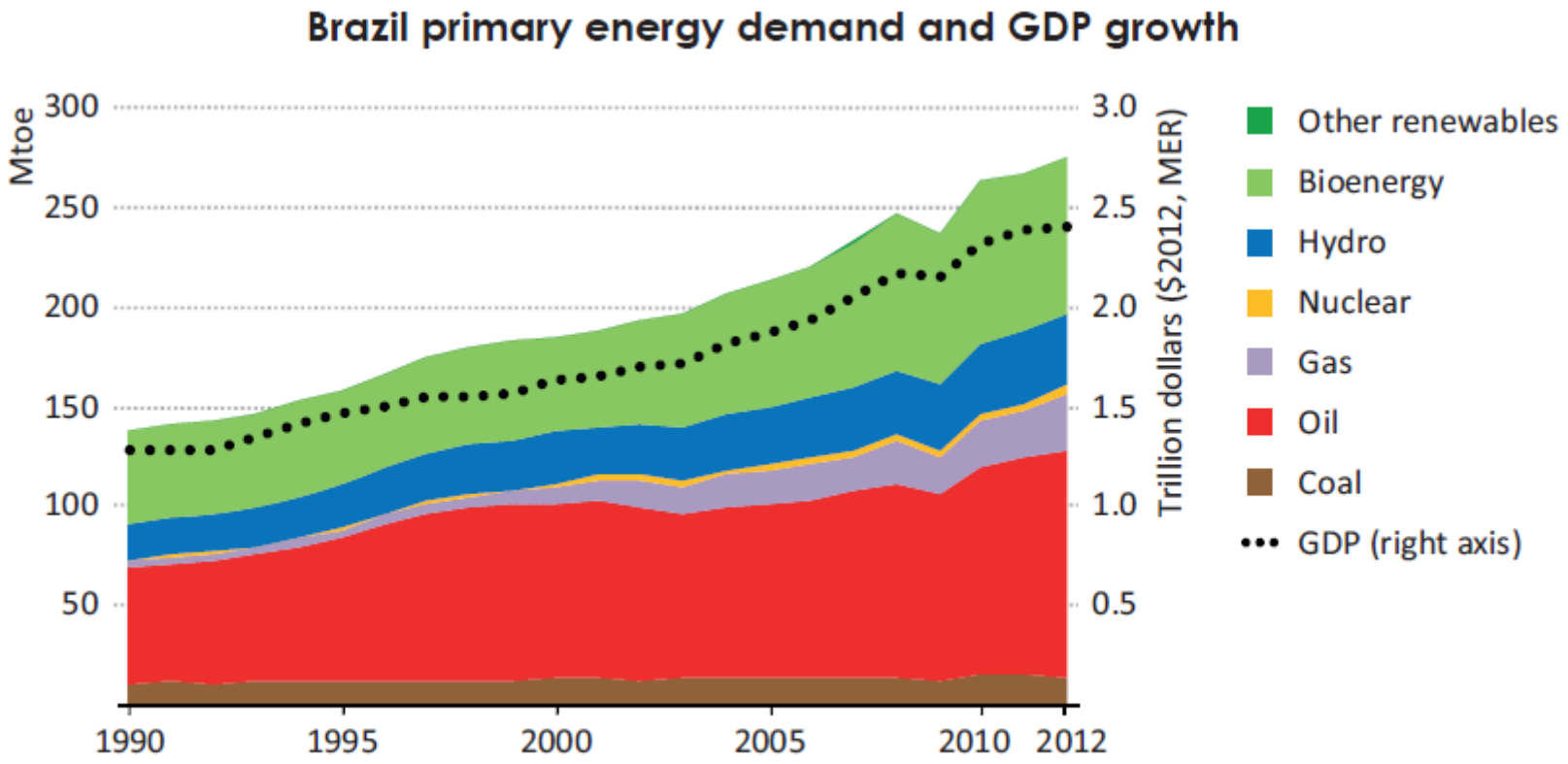

Source: IEA - WEO 2013

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Domestic energy consumption in developing countries has been driving development

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Looking ahead: even more energy for development

China's energy demand: still growing, albeit at a slower rate

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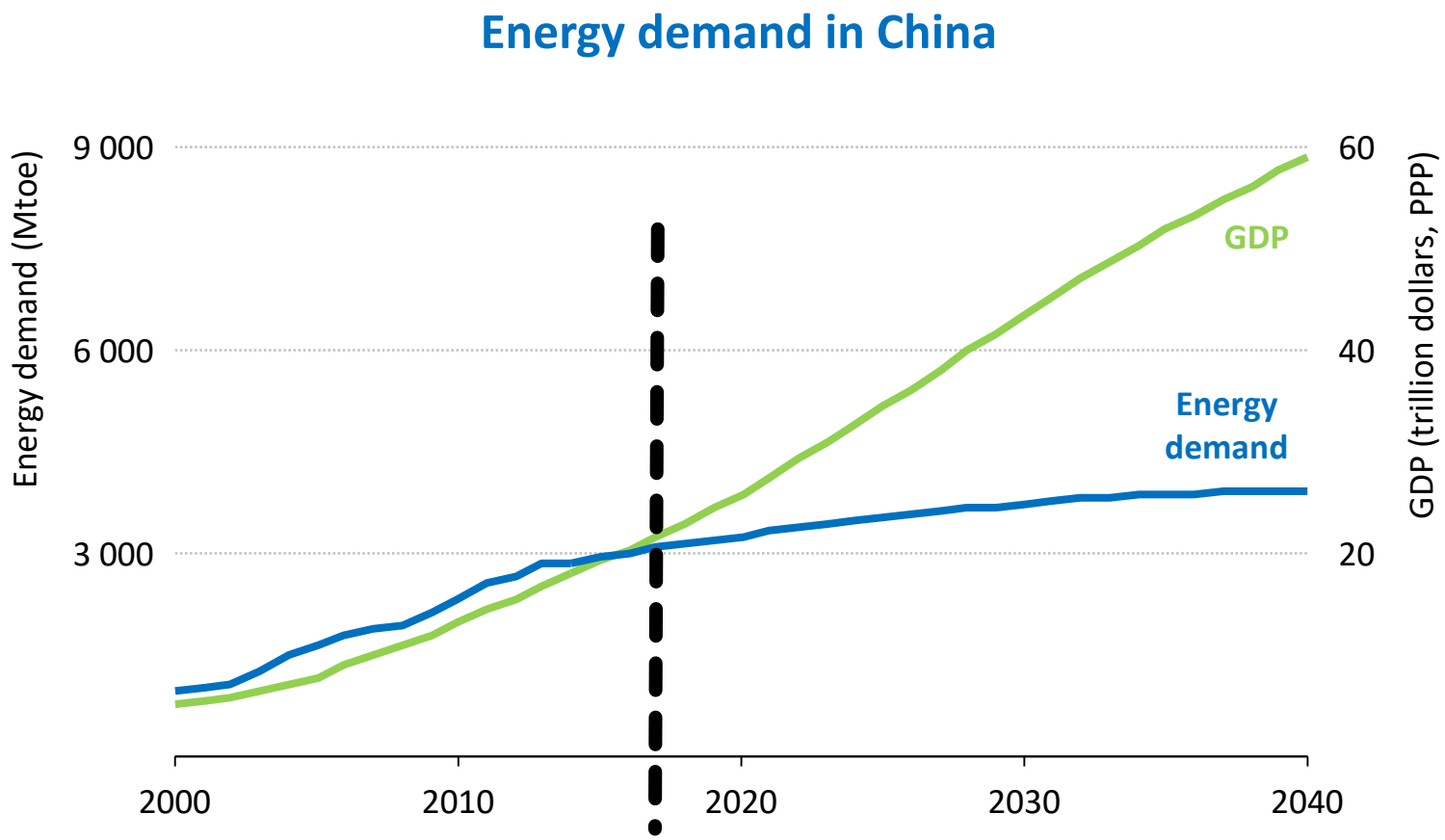

Source: IEA Graphics- WEO 2014, 2015

Energy demand in India growing rapidly going forward

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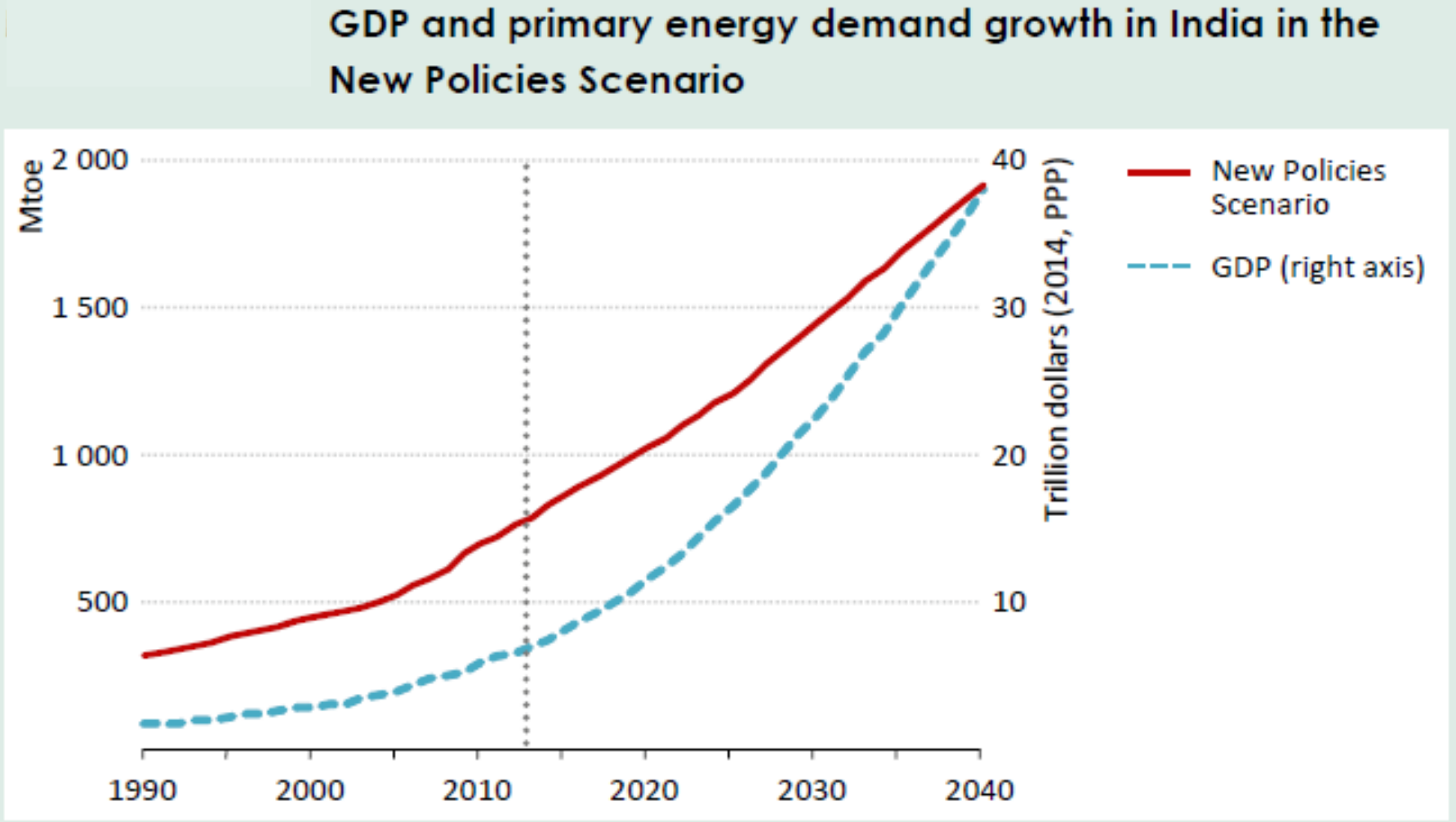

Note: PPP = purchasing power parity.

Source: IEA - WEO 2015 – India Special Report

Global demand: Developing countries set the pace while OECD recedes

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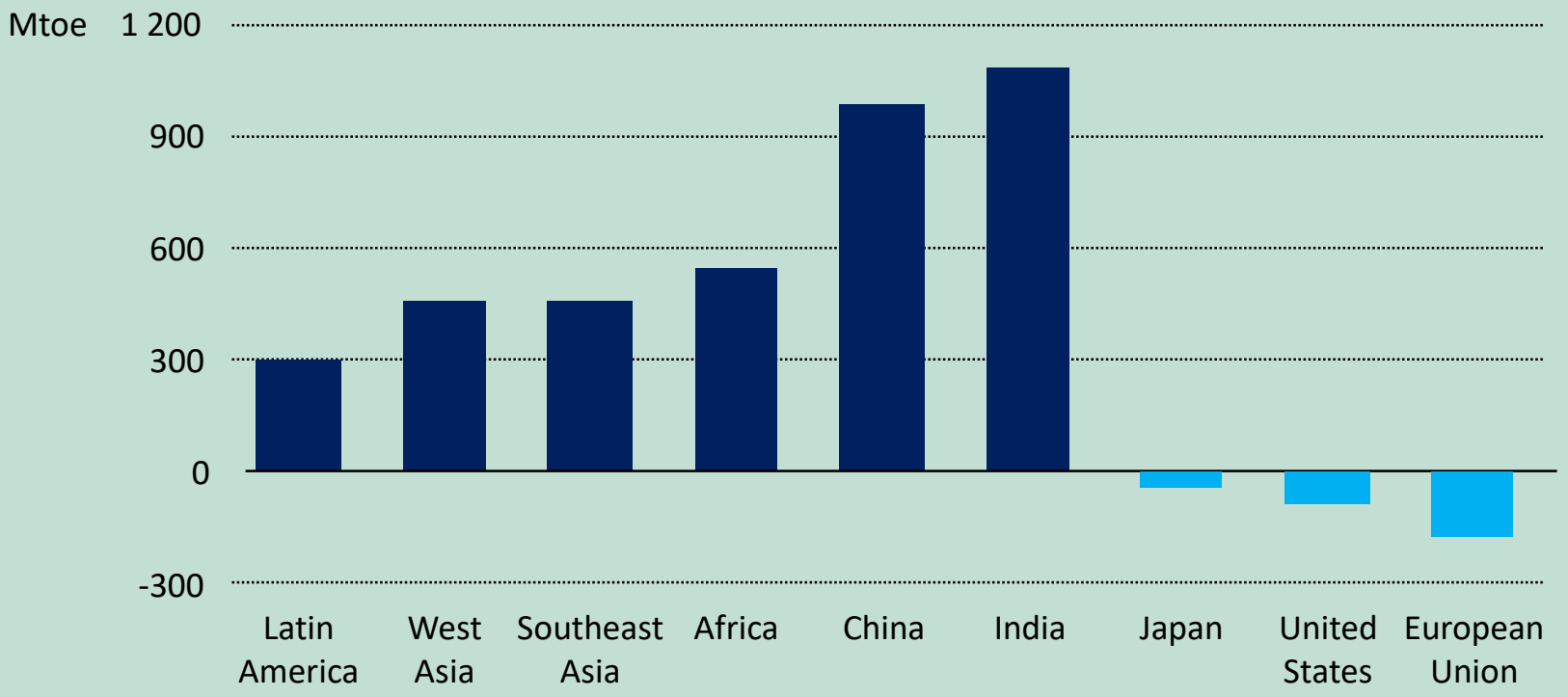

Source: IEA - WEO 2014, 2015

Developing countries set the pace on energy demand while OECD recedes

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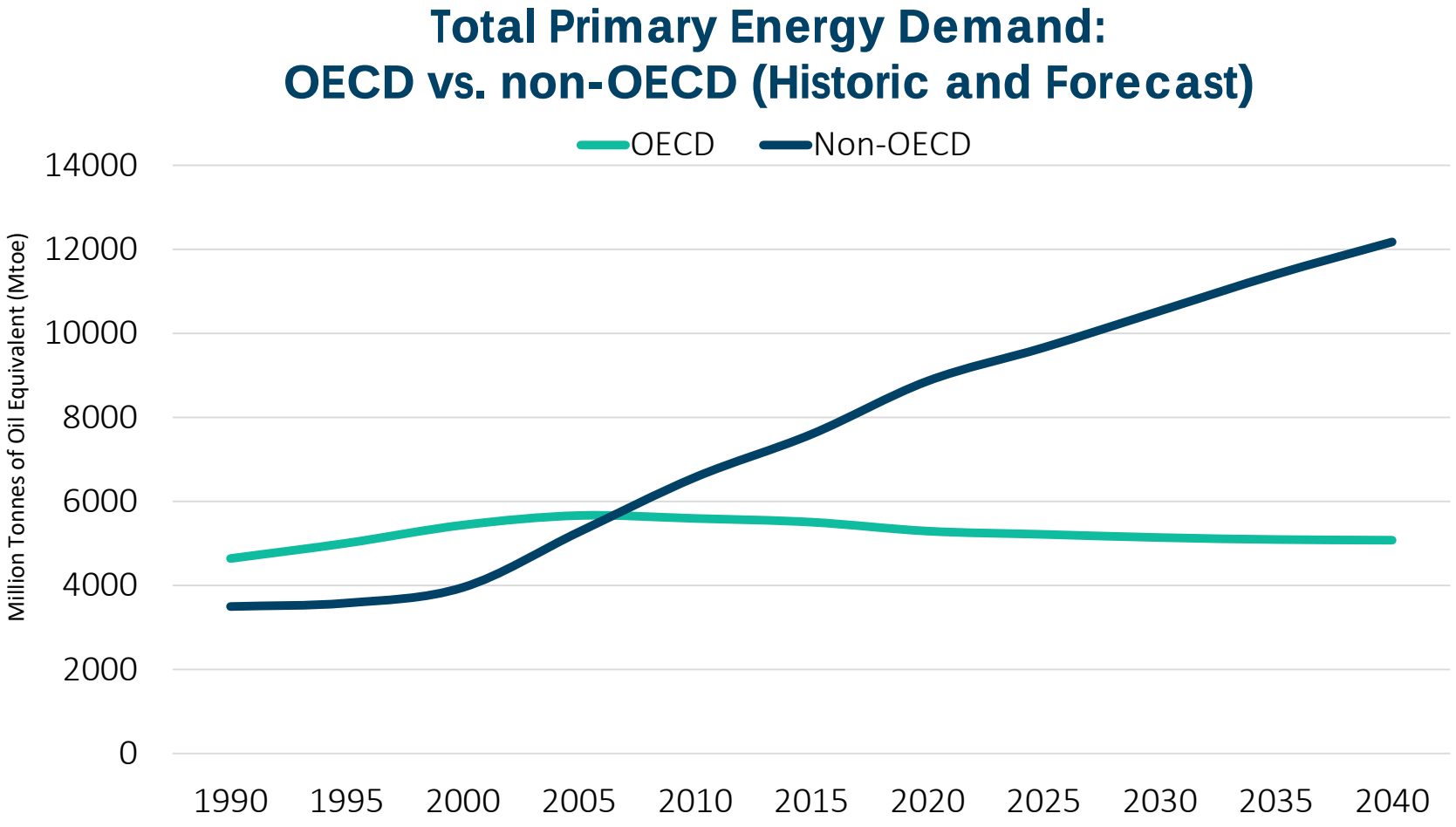

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

Source: Center for Strategic and International Studies | Energy and National Security Program
Source: Adapted from BP and IEA data (August 2017)

Source: Ladislaw, Benoit (CSIS, 2017)

What is driving future demand growth? The "Emergent Consumer Class"

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- **What is the emergent consumer class?**
  - **middle class segment ($10-100/d/person, 2005 PPP),**
  - **rich (>$100/day), and**
  - **'aspirants' consumer segment (~$3-10/d) wedged between middle and extreme poor;**
- **Emergent consumer class does not include extreme poor, who consume little (except local traditional biomass, with little impact on global flows)**
- **Numbers growing from less than 2B in 1990 to nearly 4B in 2015 to over 6B in 2030 (OECD pop remains constant around 1.2B)**
- **Developing country energy demand projected to grow by nearly 4000 Mtoe by 2040 (double the U.S. demand), while access needs <200 Mtoe**

Source: Benoit (CSIS, 2018)

What is driving future demand growth? The "Emergent Consumer Class"

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- **Emergent consumer class responsible (directly and indirectly) for most of energy demand**
- **More demand for:**
  - **Transport (from minibuses to commuter trains to personal cars)**
  - **New homes/apartments, cars, petrochemicals, appliances, ACs, etc.**
- **China's emergent consumer population grew from less than 60% in 1990 to over 96% today**
- **China's exporting smaller share of its GDP (down from 35% in 2006 to 18% in 2016); GDP net of exports is over $9 trillion; net exports <5% of GDP; more/most of its GDP is being used for domestic consumption**
- **In 2018, Chinese domestic retail purchases projected to equal U.S. at $5.8 trillion (more than the GDP of Japan, Germany or any other country)**
- **As China goes, will (can) other developing countries follow?**

Source: Benoit (CSIS, 2018)

E.g.: Middle class segment of Emerg. Cons. Class is getting bigger & consuming more

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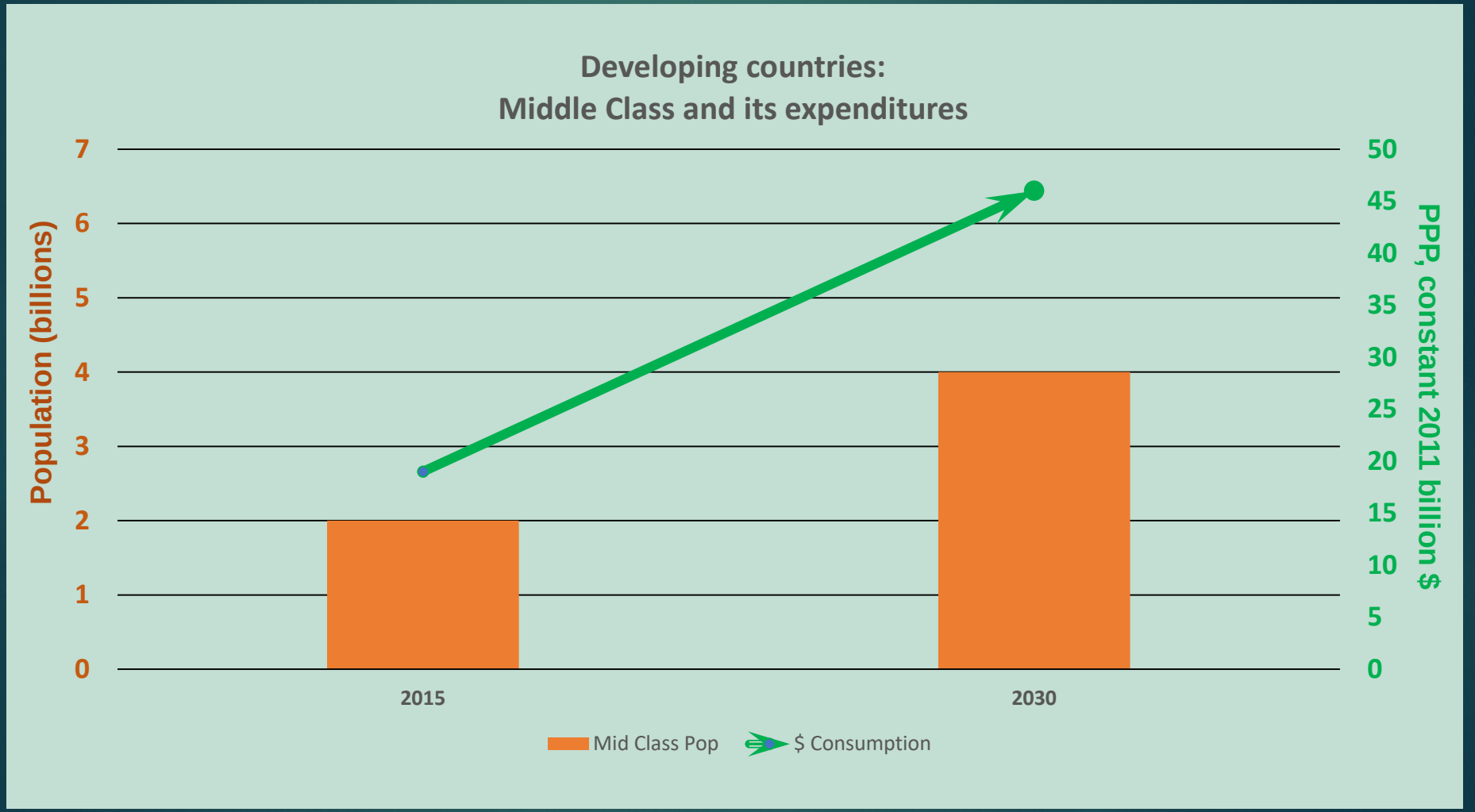

Source: Kharas, 2017 Brookings 2016

Exploding demand for cars in developing countries

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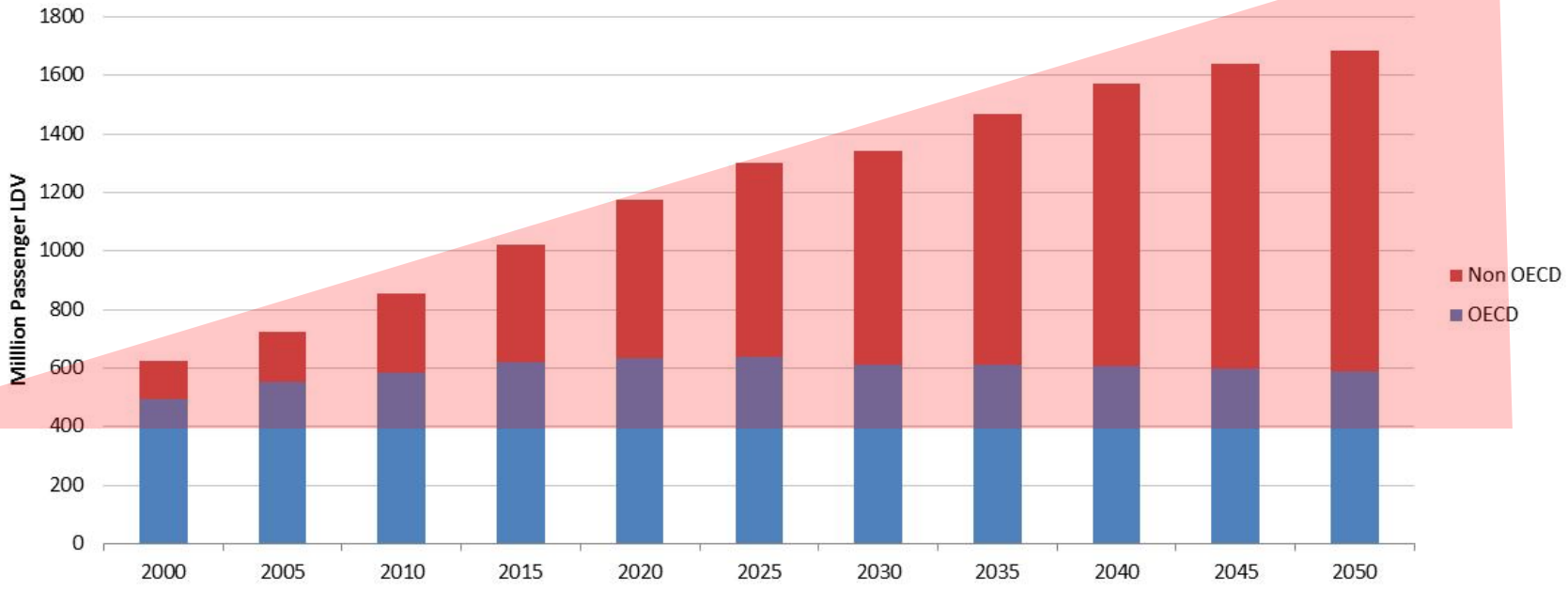
Passenger vehicle growth to 2050 (6DS)



Source: IEA Mobility Model

Large projected increase in non-OECD countries

Cities in emerging/developing economies will be critical

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Source: IEA ETP © 2016

Cities in emerging/developing economies will be critical

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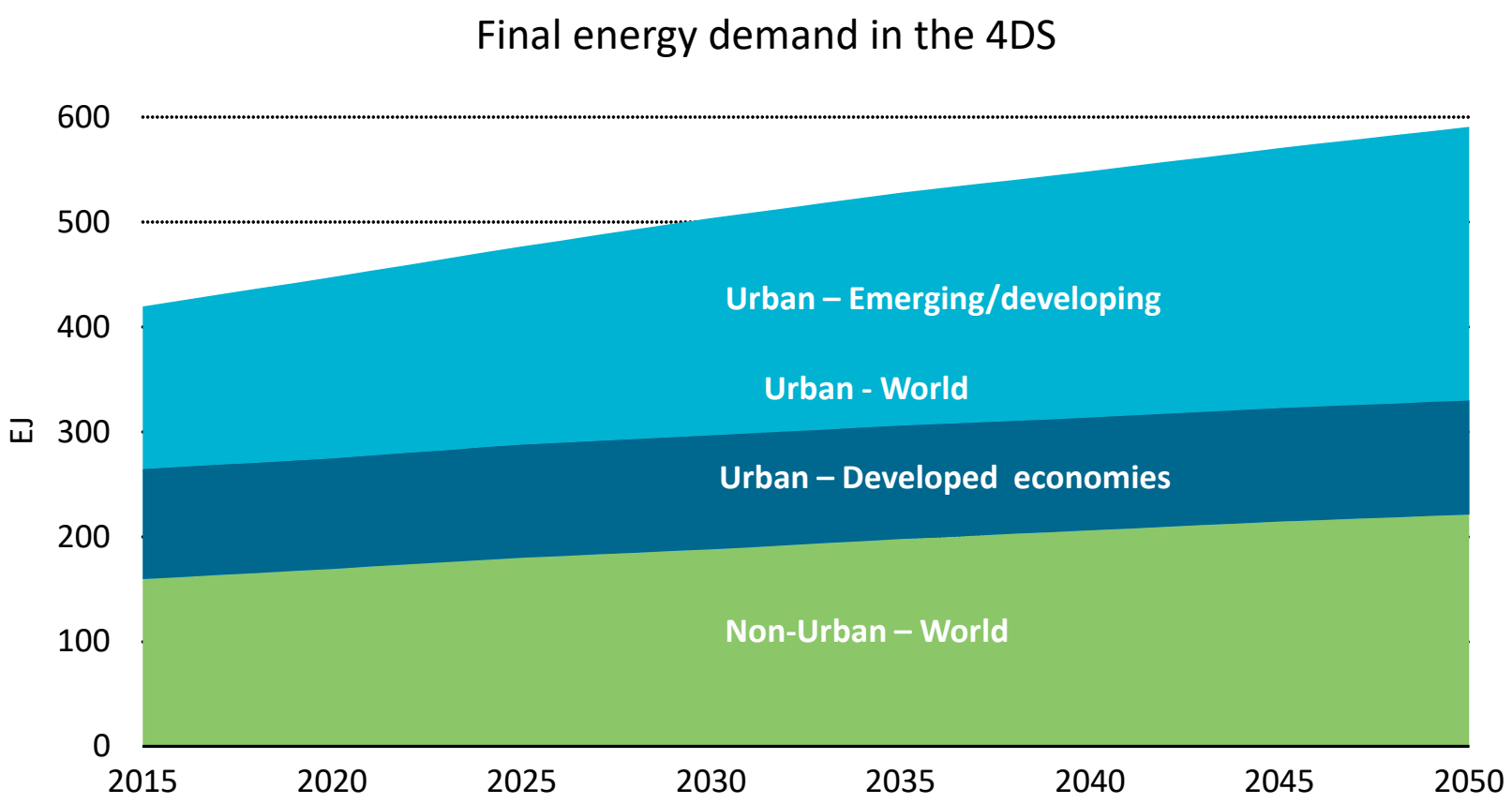

Two-thirds of the growth in global energy demand to 2050 comes from cities in emerging and developing economies

Source: IEA ETP © 2016

Energy CO_2 emissions in developing countries and the 2°C budget

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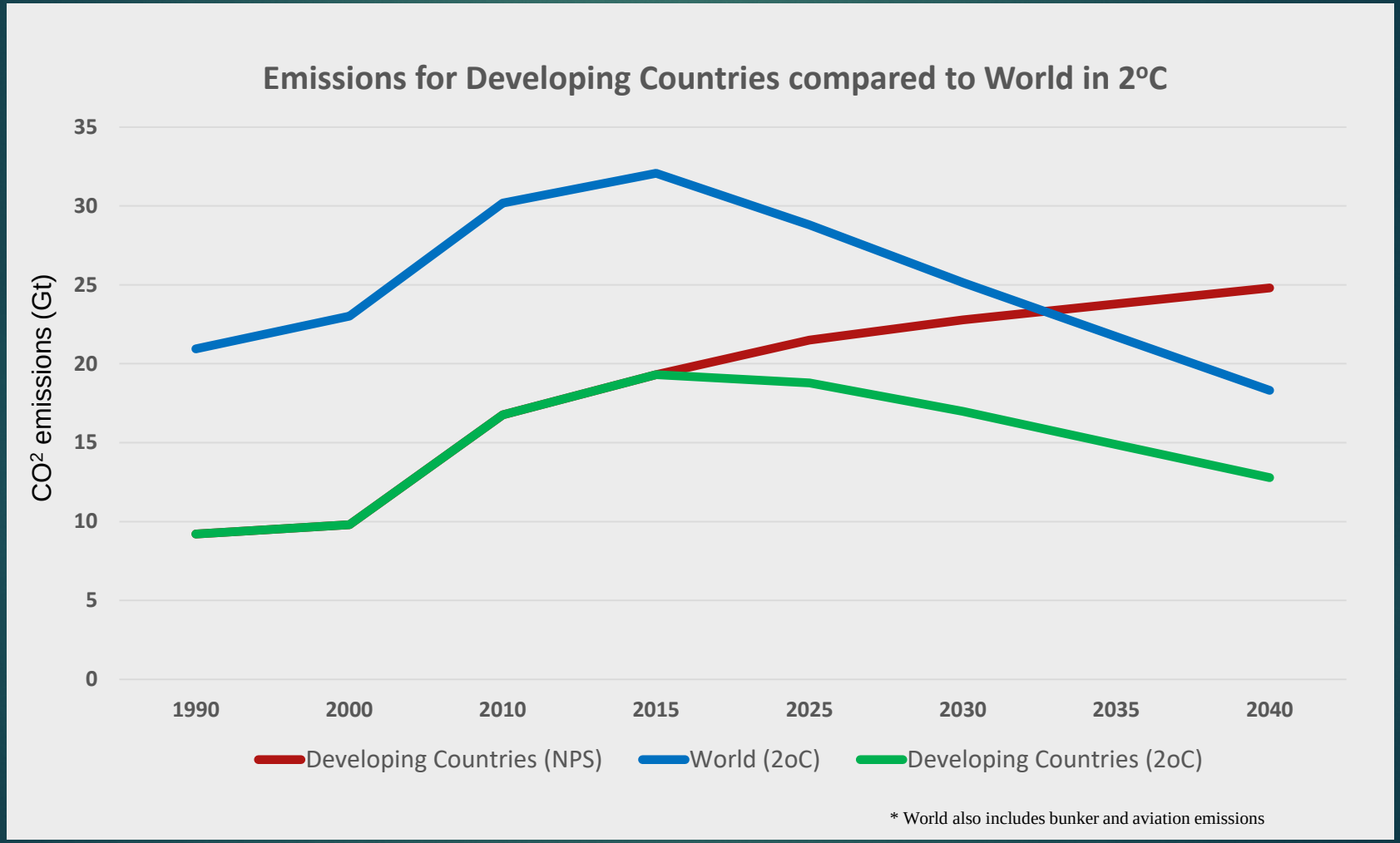

Source: IEA data – WEO 2017

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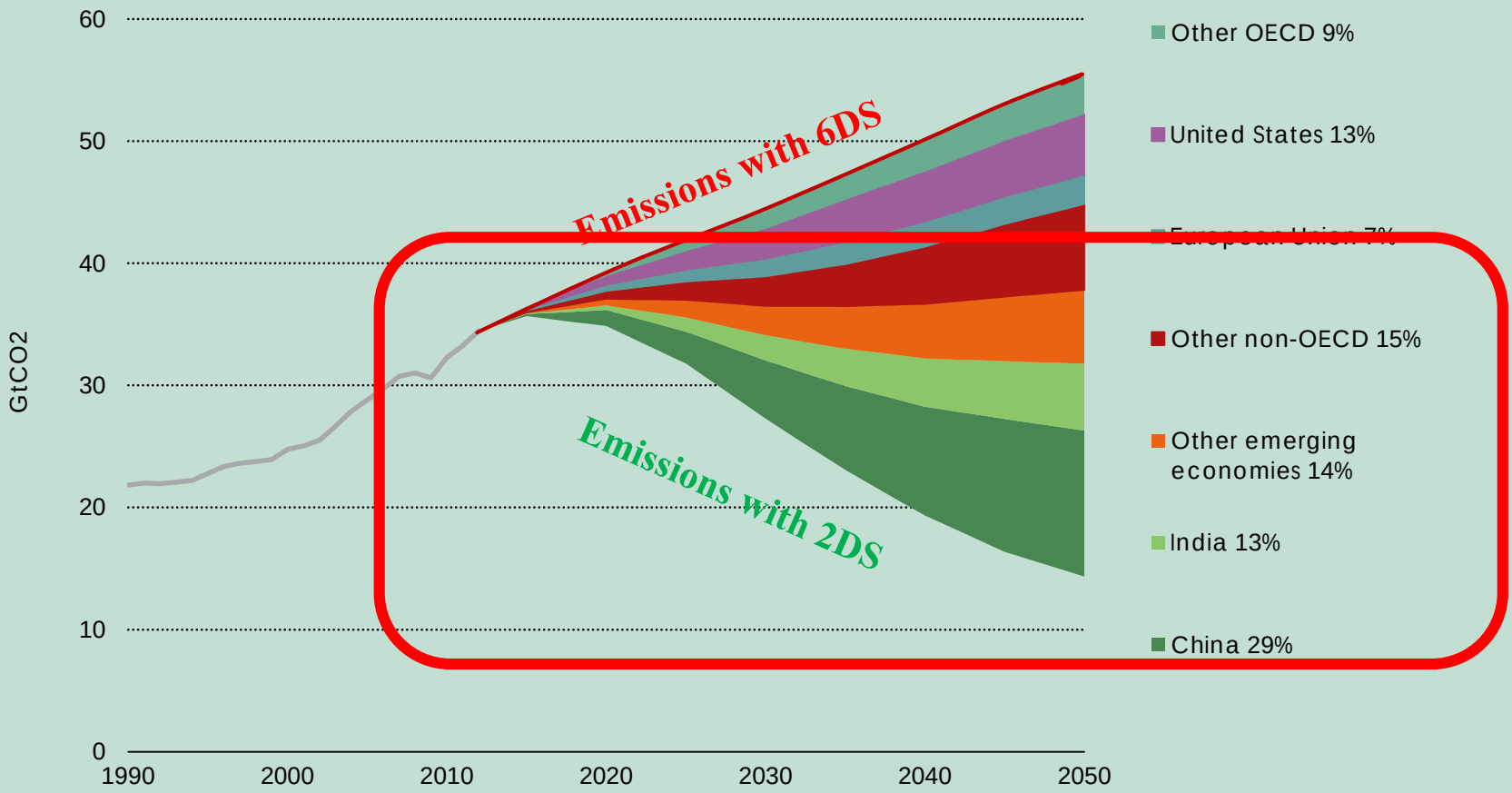
The needs of developing countries for energy to promote growth is at the center of the climate dynamic

(this is where 'the rubber meets the road')

Most action in 2ºC Scenario takes place in developing countries



Source: IEA ETP 2014, 2015

Bulk of low carbon investments take place in developing countries

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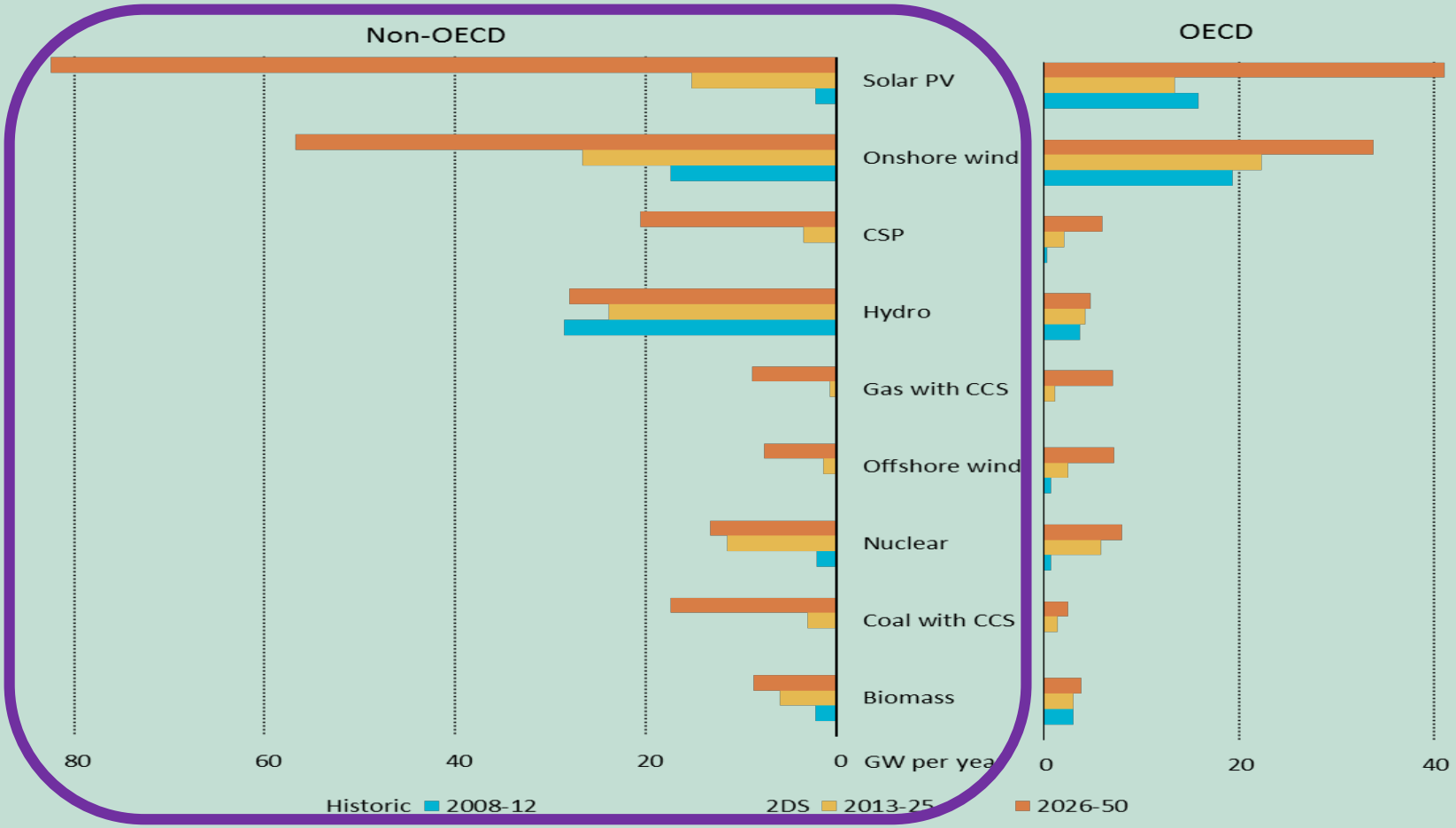
Power sector technology deployment rates in the 2DS



Source: IEA ETP 2014, 2015

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How to grow while lowering energy emissions

Renewables growth has shifted to developing countries

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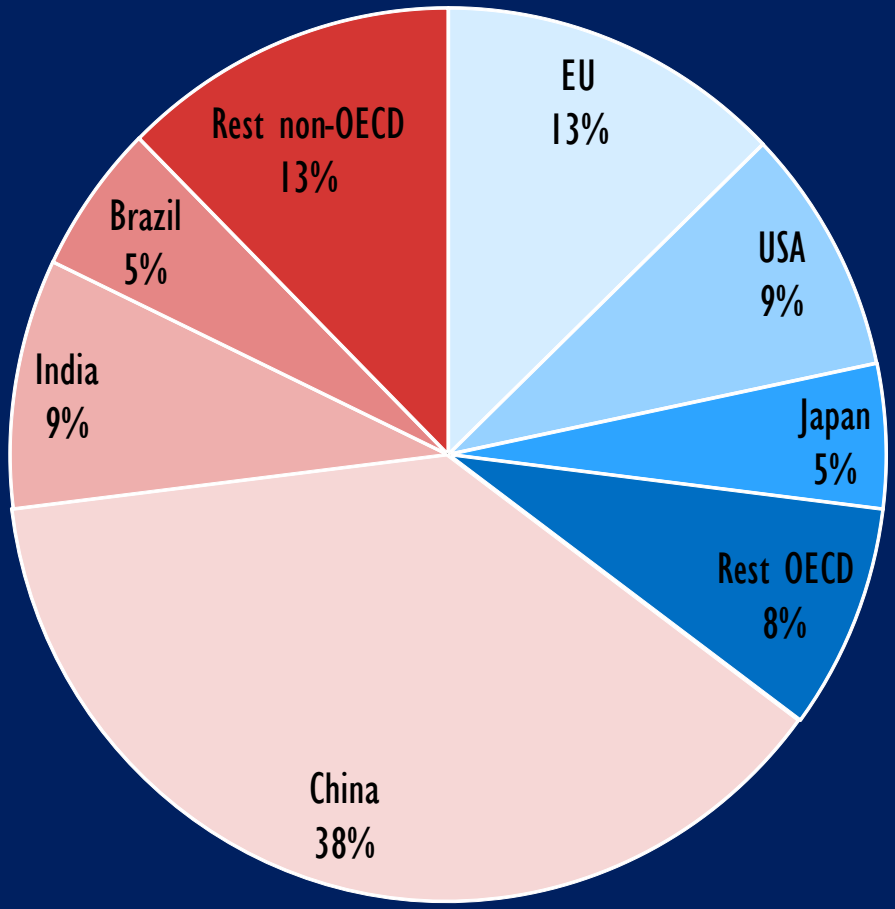
Projected growth of 40% in cumulative capacity from 2014-2020 (700 GW)

Shares of net additional renewable capacity, 2014-20



As the OECD slows, non-OECD countries account for two-thirds of renewable growth, driven by fast-growing power demand, diversification needs and local pollution concerns

Source: IEA © 2016

Sustainable transport systems: cheaper cleaner way to provide service

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Source: IEA ETP © 2016

Sustainable transport systems: cheaper cleaner way to provide service

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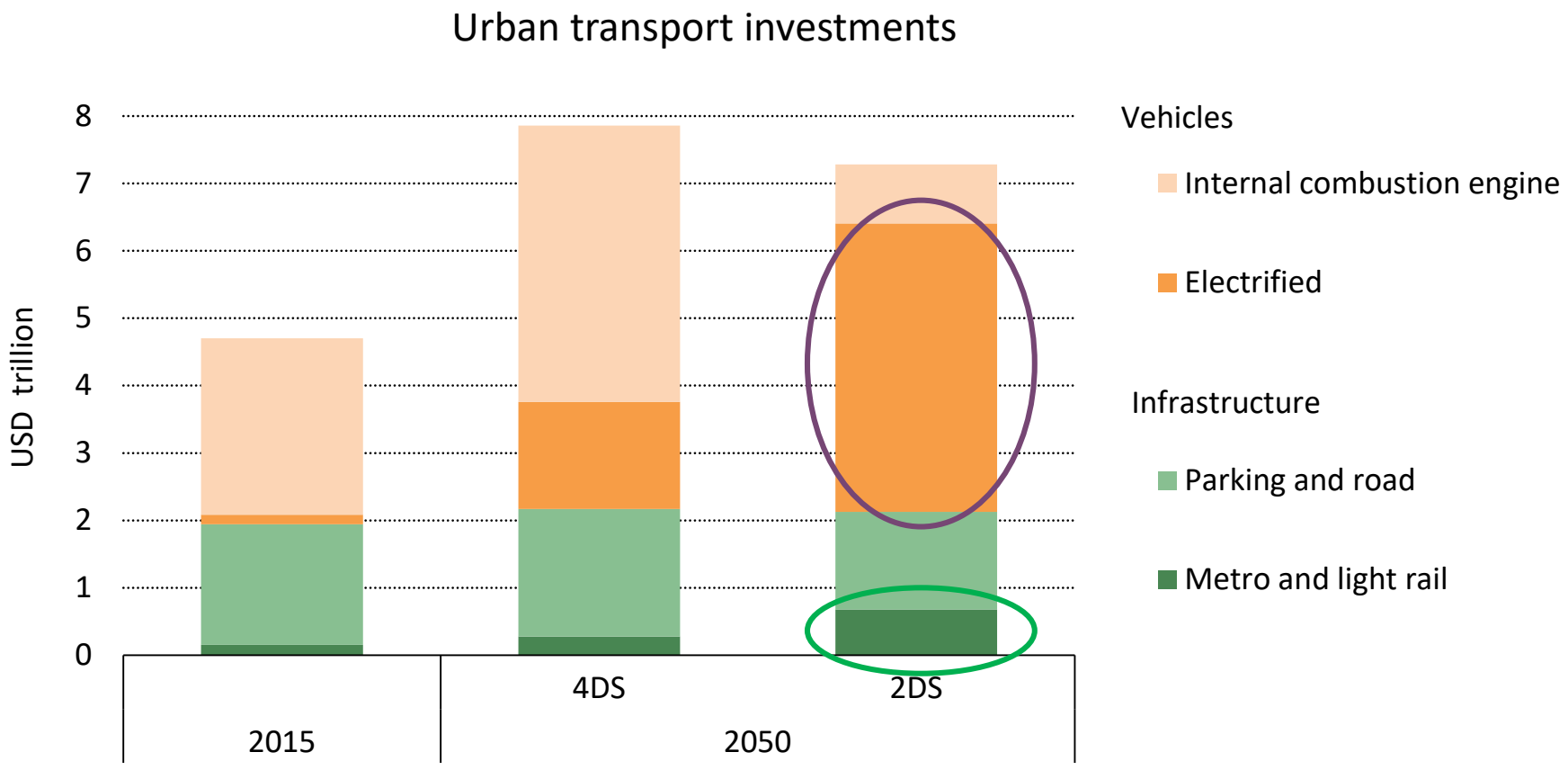

In the 2DS, by 2050 one billion cars are electric vehicles while public transport travel activity more than doubles

Source: IEA ETP © 2016

Cooling and heating: the growing elephant in the room

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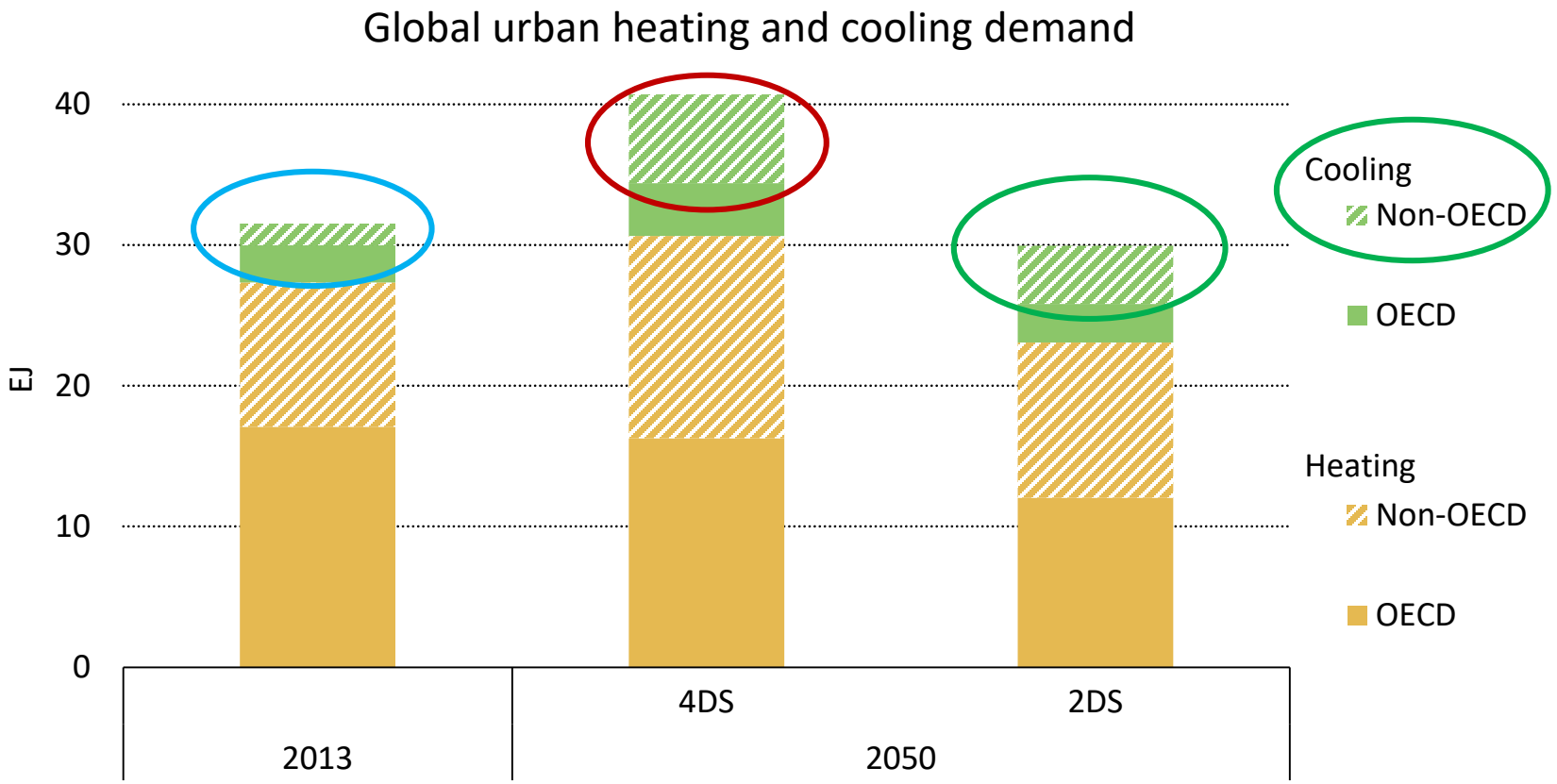

Heating and cooling energy demand in cities can be reduced by 25% without compromising thermal comfort, particularly cooling in emerging economies

Source: IEA ETP © 2016

Energy has an air pollution problem … that can motivate climate action

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Energy has an air pollution problem … that can motivate climate action

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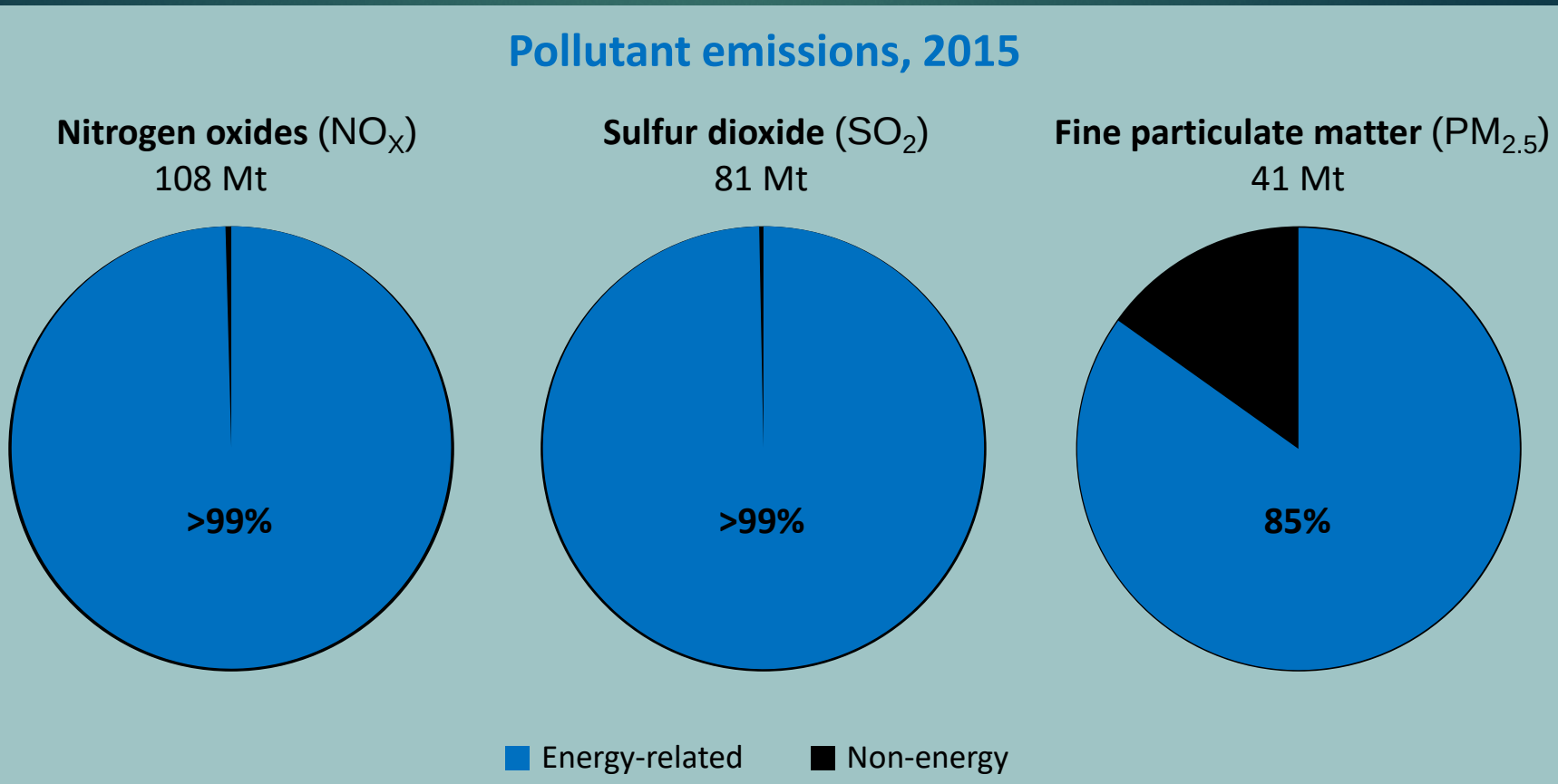

Energy is the single most important cause of emissions of all main pollutants

Source: IEA WEO AQ special report launch presentation, 2016 ©

Energy has an air pollution problem … that can motivate climate action

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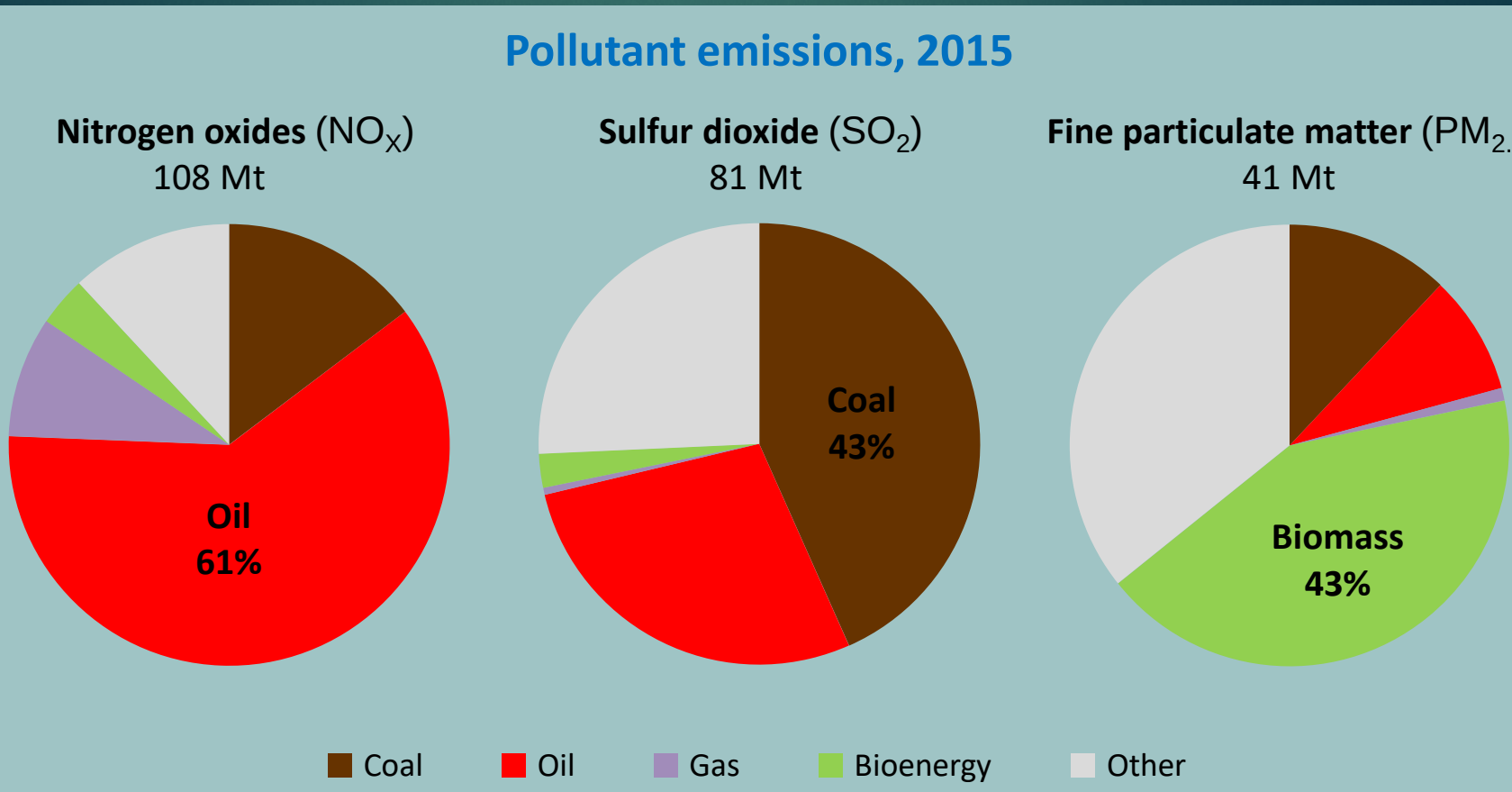

Energy is the single most important cause of emissions of all main pollutants

Source: IEA WEO AQ special report launch presentation, 2016 ©

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Act 7

Access and the climate constraint - revisited

Energy consumption increases with increasing incomes out of poverty

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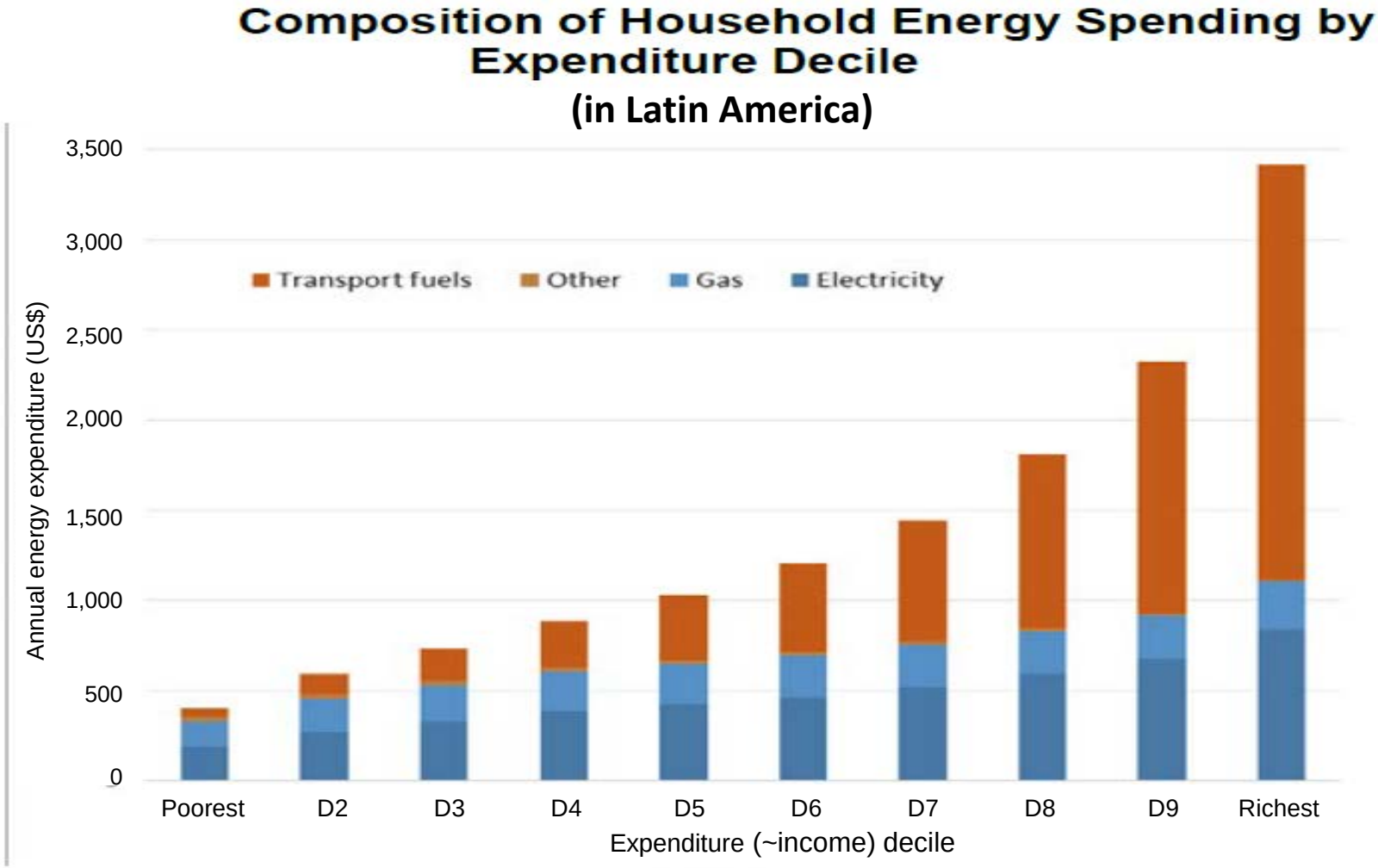

Source: IDB, Jimenez, Yepez, (2017)

CO_2/capita has changed over time …as poverty has reduced

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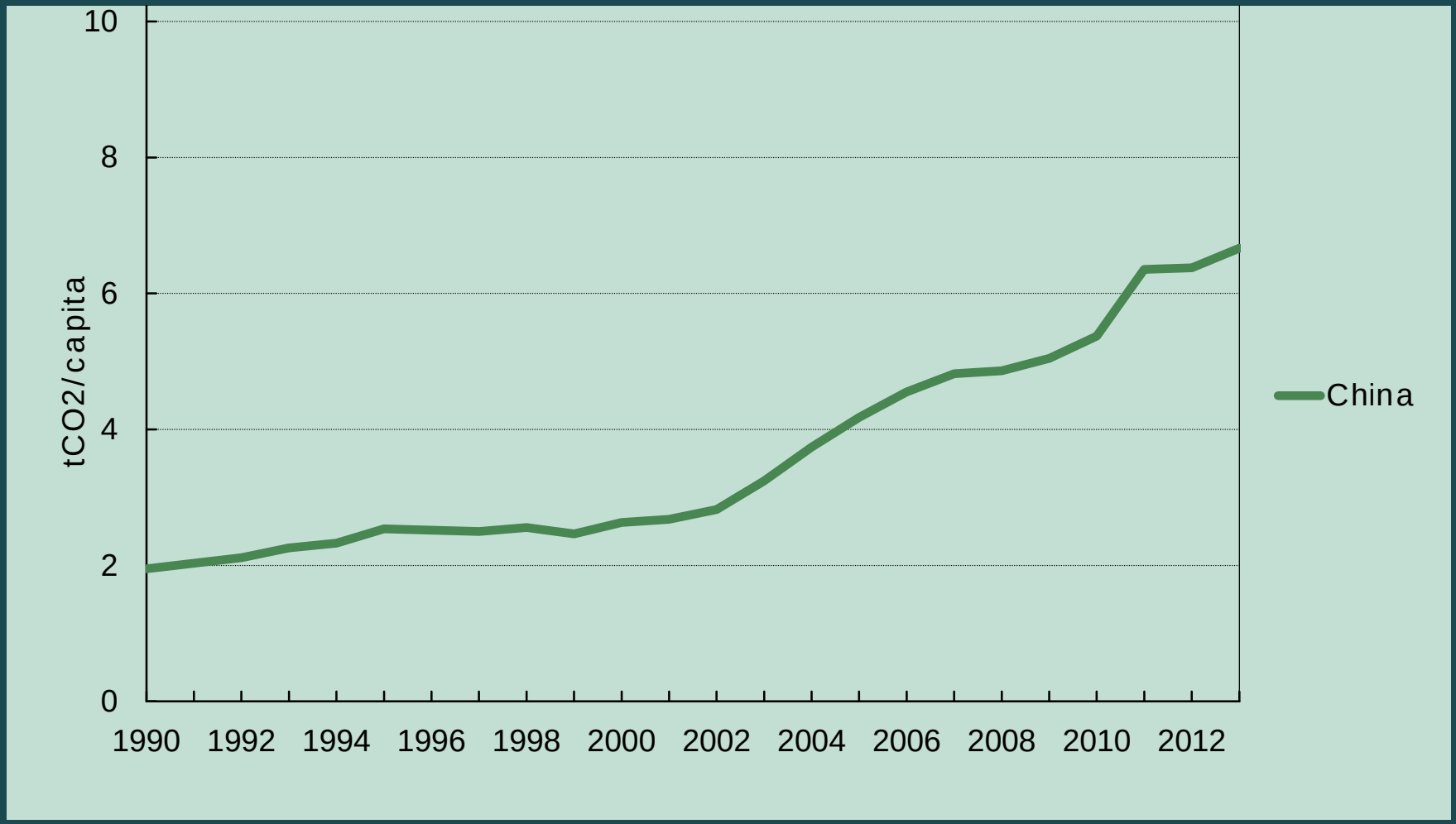

Source: IEA - Track the energy transition (2015)

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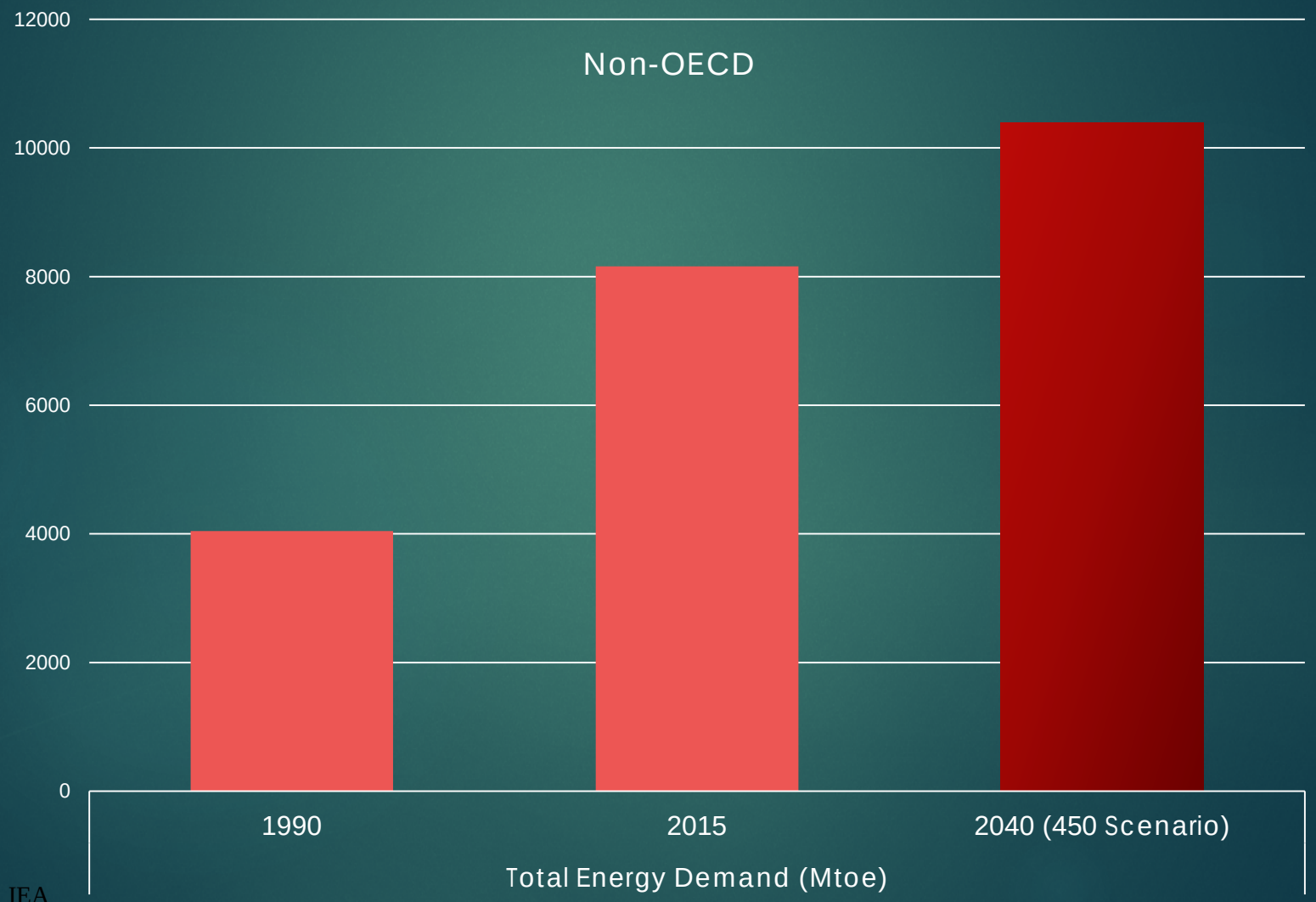
Basic access affects climate only at the margin

but

longer-term fuller prosperity will change the equation

Growth in developing country energy demand is compatible with 2ºC goal



Source: IEA

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Act 8

… but what happens in developed economies remains key

CO_2 energy GHGs shares:

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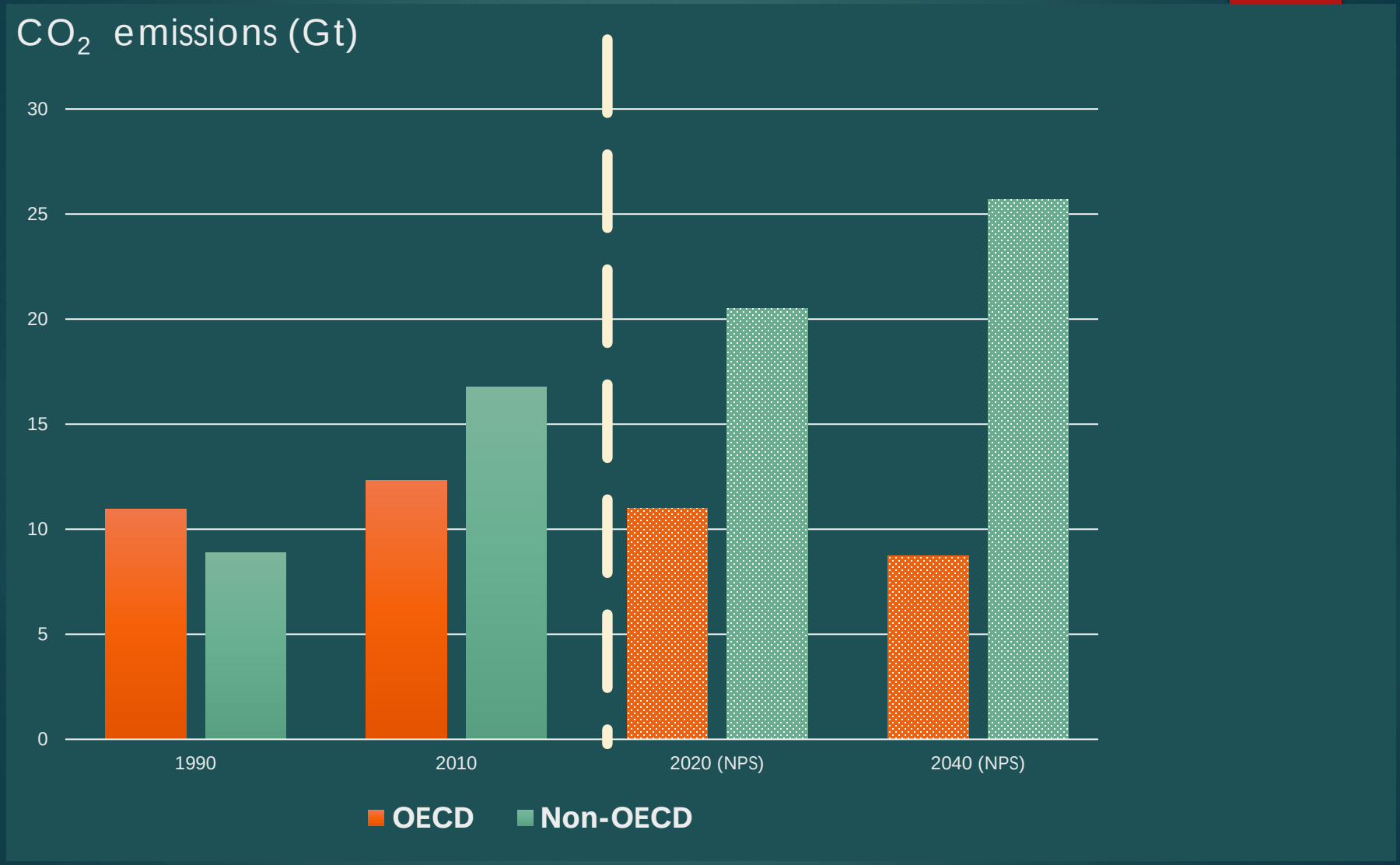

Source: IEA data – WEO 2016

CO_2 energy GHGs shares:

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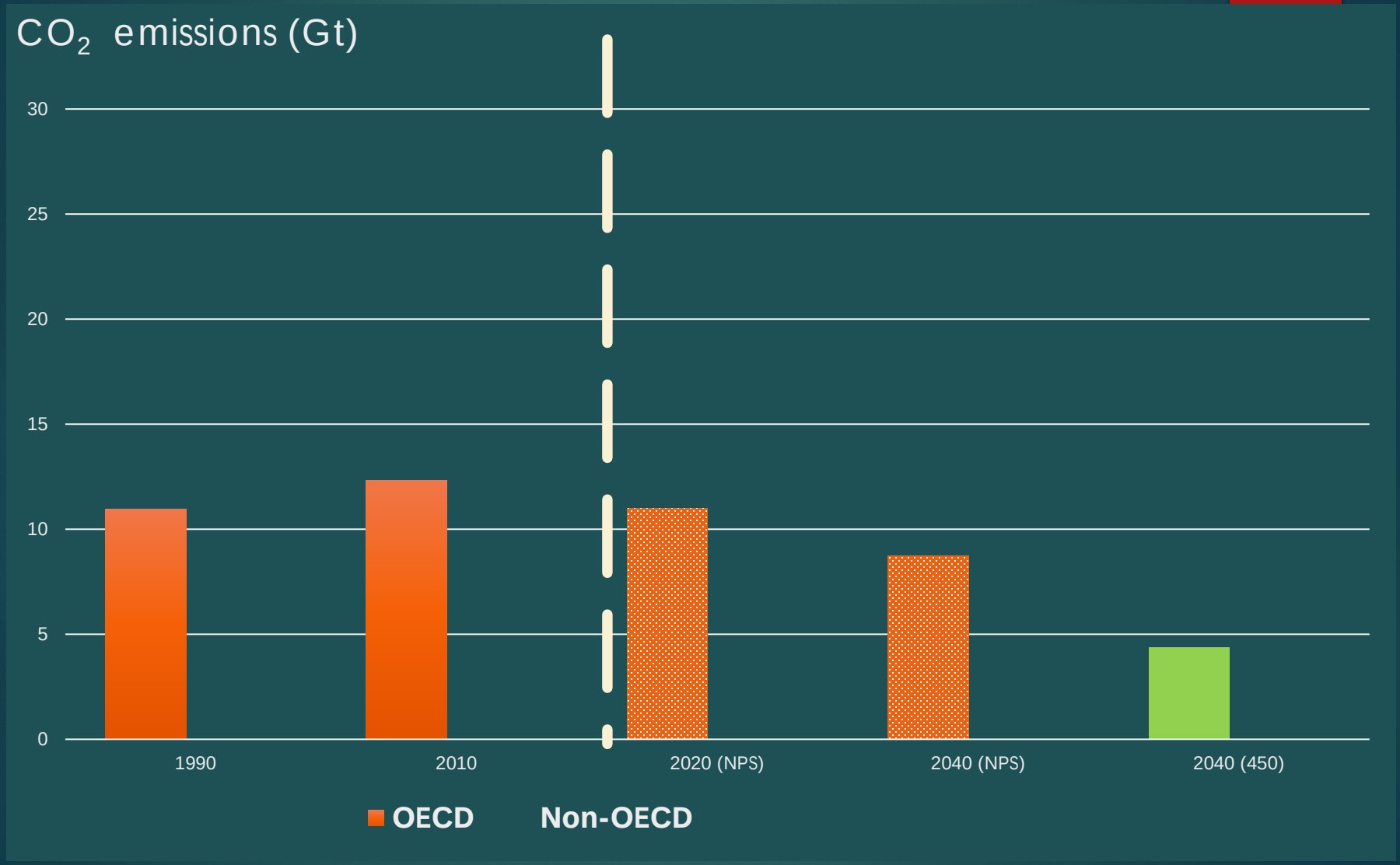

Source: IEA data – WEO 2016

OECD and Non-OECD GDP/capita

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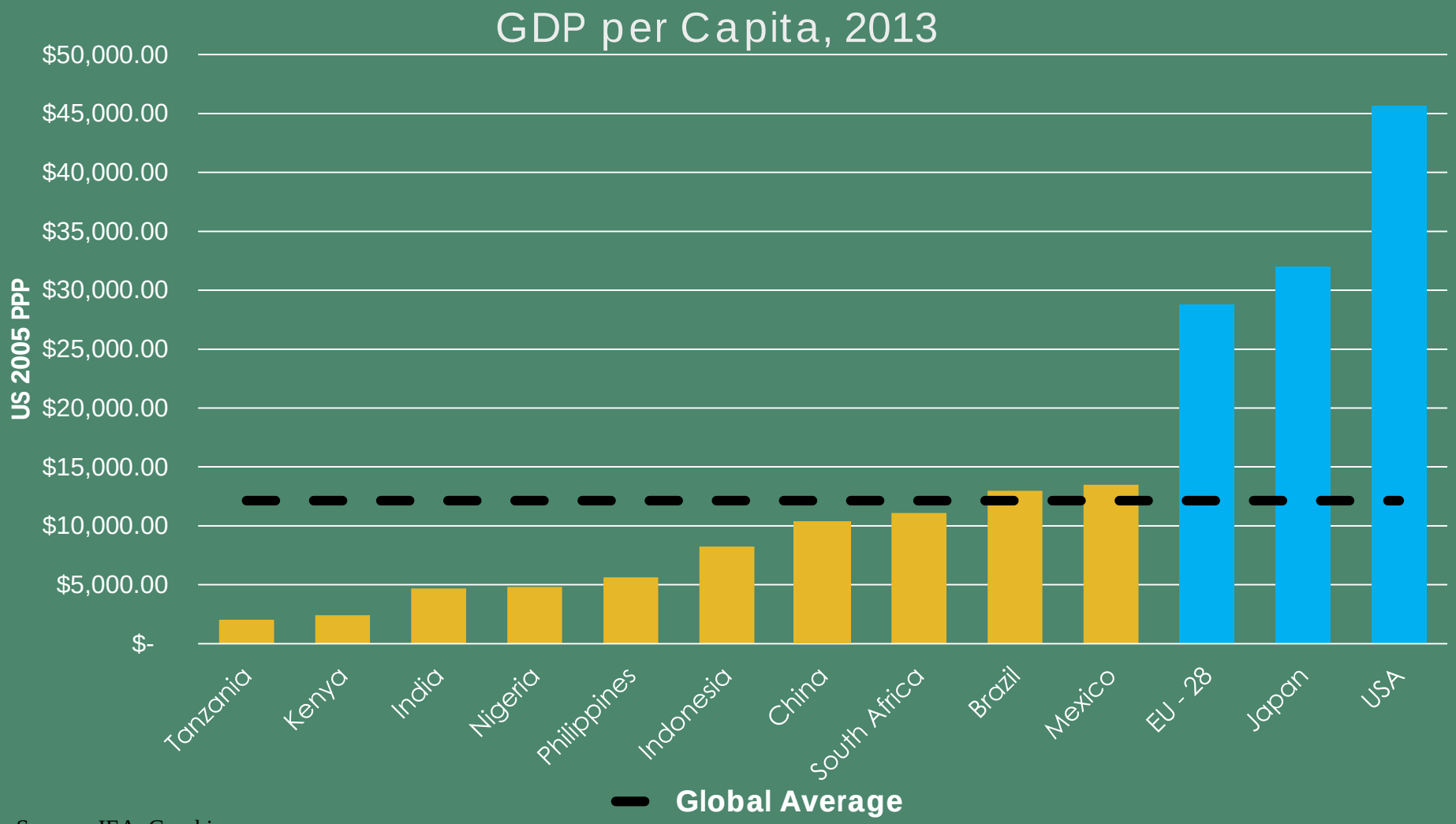

Source: IEA Graphics-

CO_2 emissions per capita

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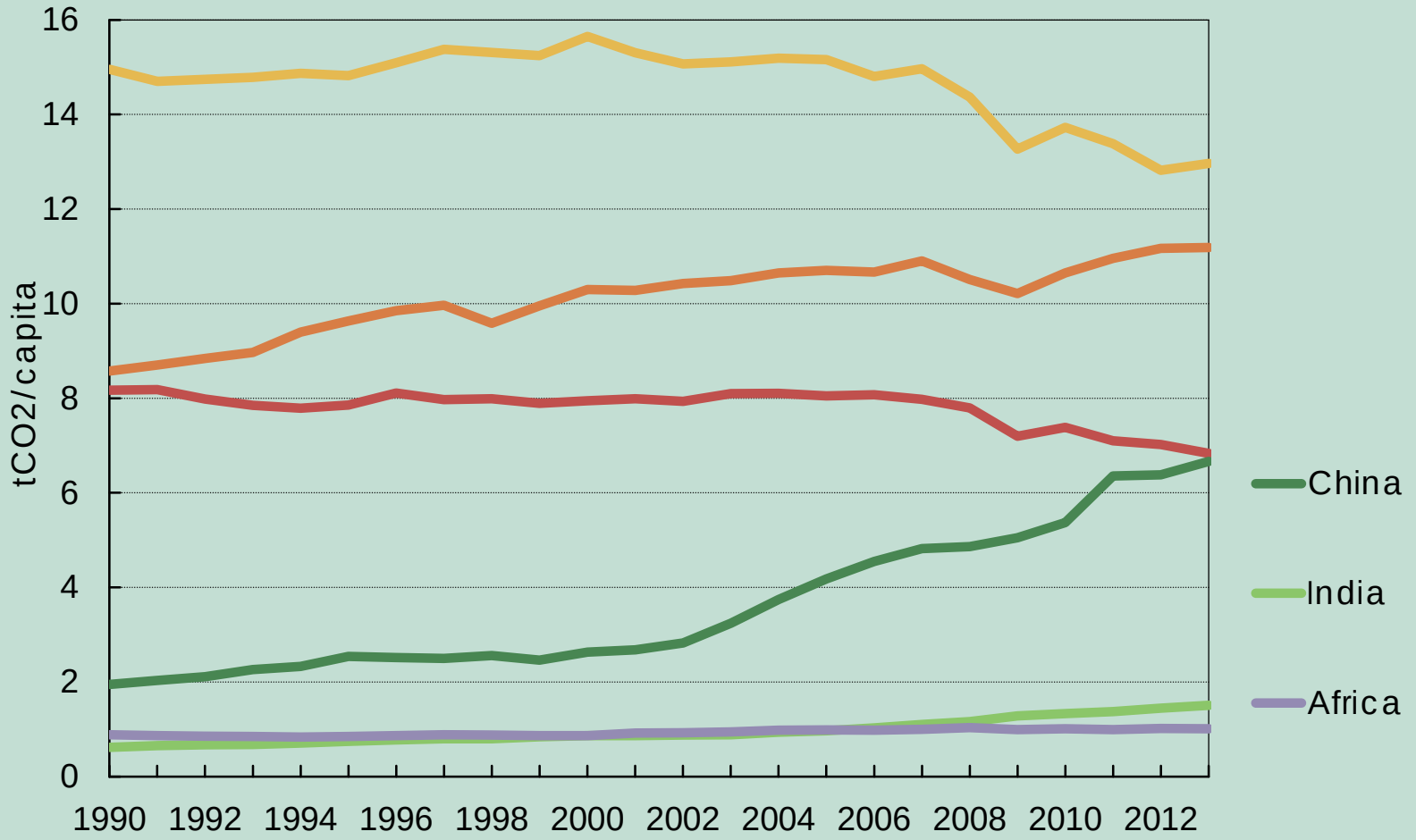

Source: IEA - Track the energy transition (2015)

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Epilogue

Closing thoughts

Some closing thoughts

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- ***Energy has fueled the recent economic & social development boom … but climate constraint fundamentally alters the role of energy going forward***
- ***As developing countries grow, energy demand will also grow . . .***
- ***While some growth in energy demand in developing countries is consistent with 2^{o}C target, we need to delink economic growth from emissions***
- ***Need to meet challenge of increasing household/business consumption that will accompany poverty reduction and wealth creation***
- ***Requires focus on the 'emergent consumer class' (soon to number 6B) and their aspirations for transport, appliances, heating, cooling, etc.***
- ***Access for 1.1B poorer households only affects climate at the margin***
- ***…but as poor (hopefully) move towards middles class status, increasing consumerism and energy demand will generate pressure on climate***
- ***Lowering emissions in developed countries faster and deeper leaves more room for growth in developing countries consistent with 2^{O}C***

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Thank You

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Advisory Services 2050

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