World Energy Outlook 2017

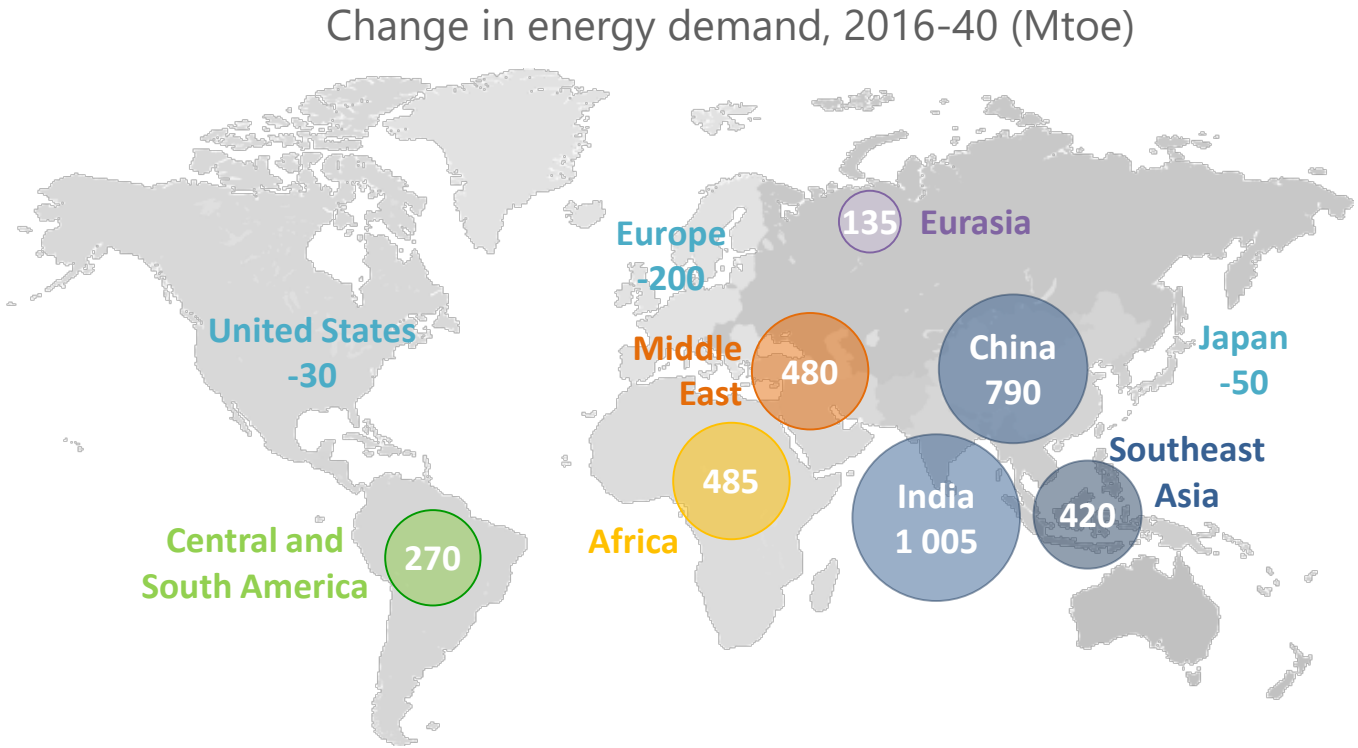
ALPS Symposium
9 February 2018

Tipping the energy world off its axis

World Energy Outlook 2017

- Four large-scale upheavals in global energy set the scene for the new *Outlook*:
  - The United States is turning into the undisputed global leader for oil & gas
  - Solar PV is on track to be the cheapest source of new electricity in many countries
  - China's new drive to "make the skies blue again" is recasting its role in energy
  - The future is electrifying, spurred by cooling, electric vehicles & digitalisation
- These changes brighten the prospects for affordable, sustainable energy & require a reappraisal of approaches to energy security
- There are many possible pathways ahead & many potential pitfalls if governments or industry misread the signs of change

India takes the lead, as China energy growth slows

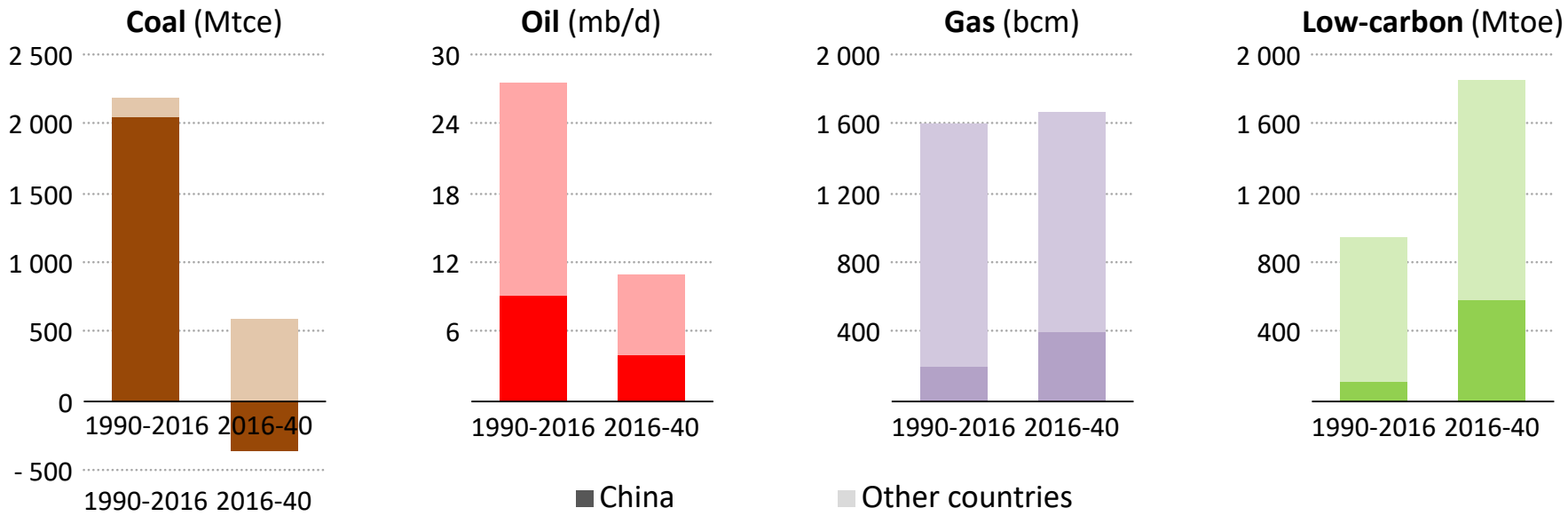


Old ways of understanding the world of energy are losing value as countries change roles: the Middle East is fast becoming a major energy consumer & the United States a major exporter

As China moves, so do global energy markets, again

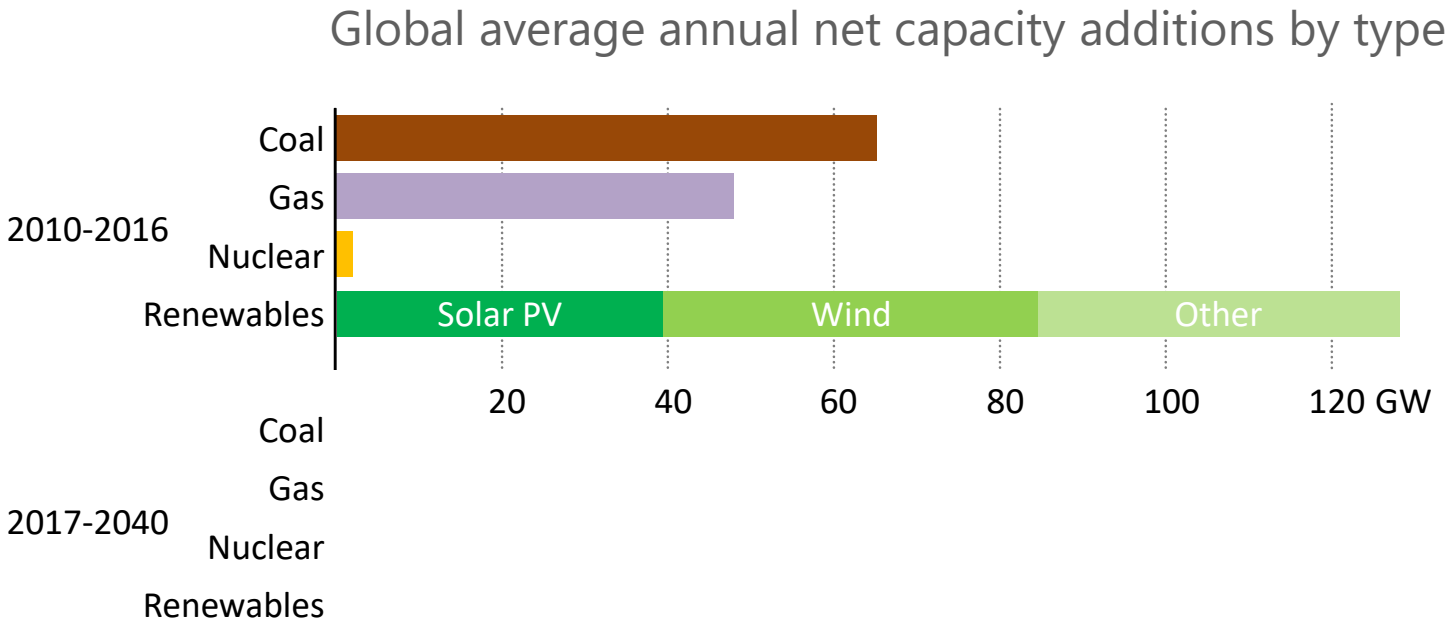
World Energy Outlook 2017

Change in world energy demand by fuel



Low-carbon sources & natural gas meet 85% of the increase in global demand: China's switch to a new economic model & a cleaner energy mix drives global trends

Solar PV forges ahead in the global power mix

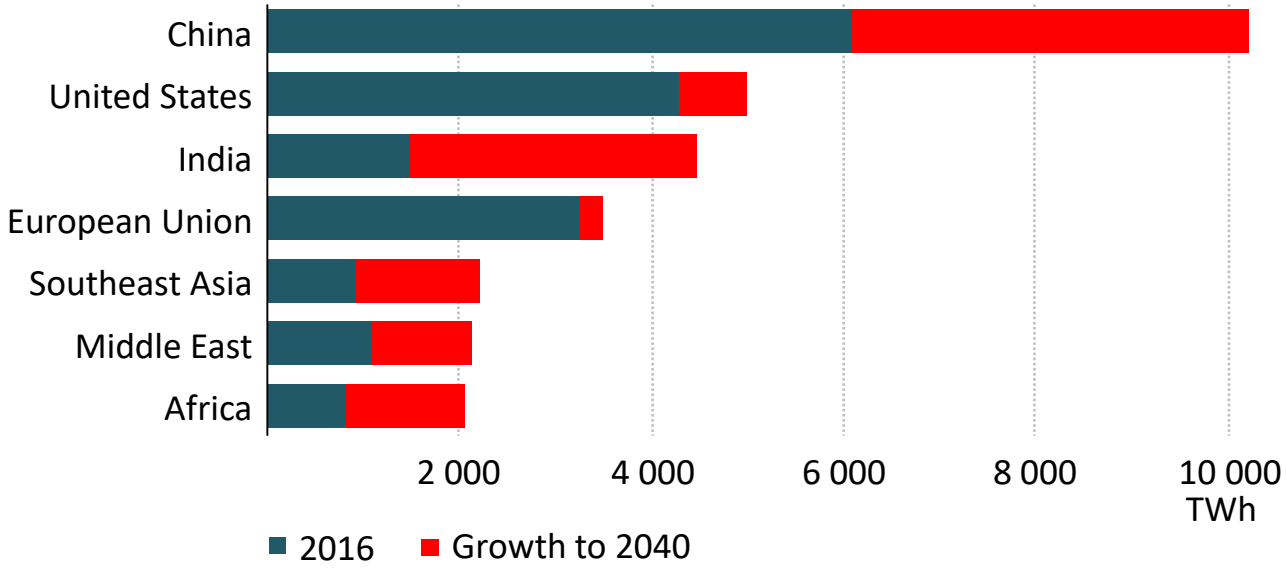


China, India & the US lead the charge for solar PV, while Europe is a frontrunner for onshore & offshore wind: rising shares of solar & wind require more flexibility to match power demand & supply

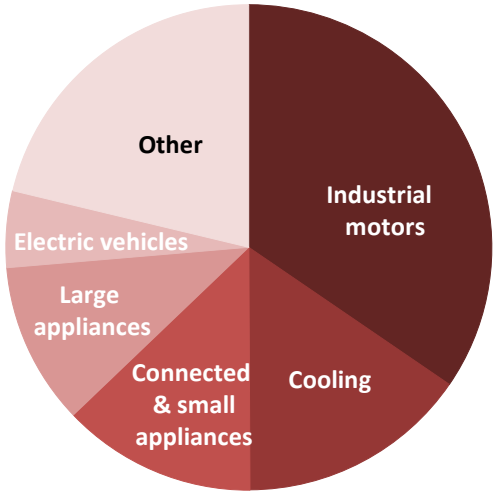
The future is electrifying

World Energy Outlook 2017

Electricity generation by selected region



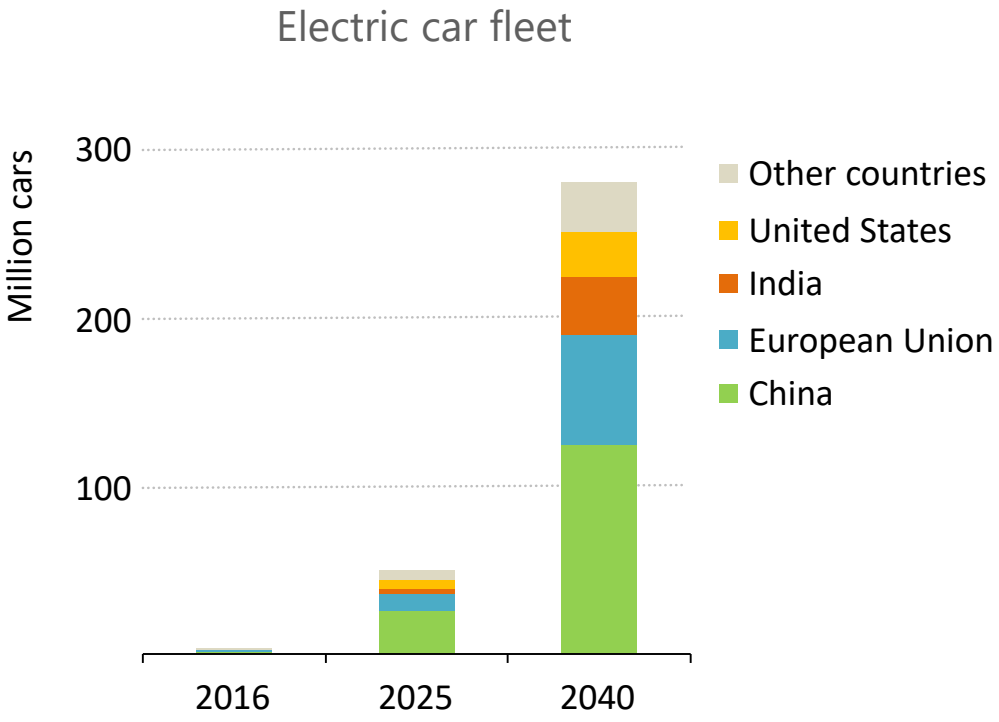
Sources of global electricity demand growth

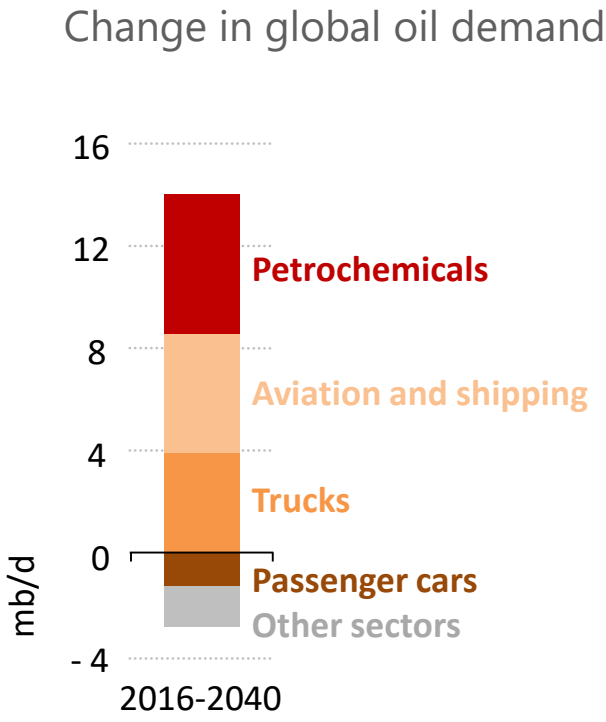


India adds the equivalent of today's European Union to its electricity generation by 2040, while China adds the equivalent of today's United States

EVs are on the way, but oil demand still keeps rising

World Energy Outlook 2017

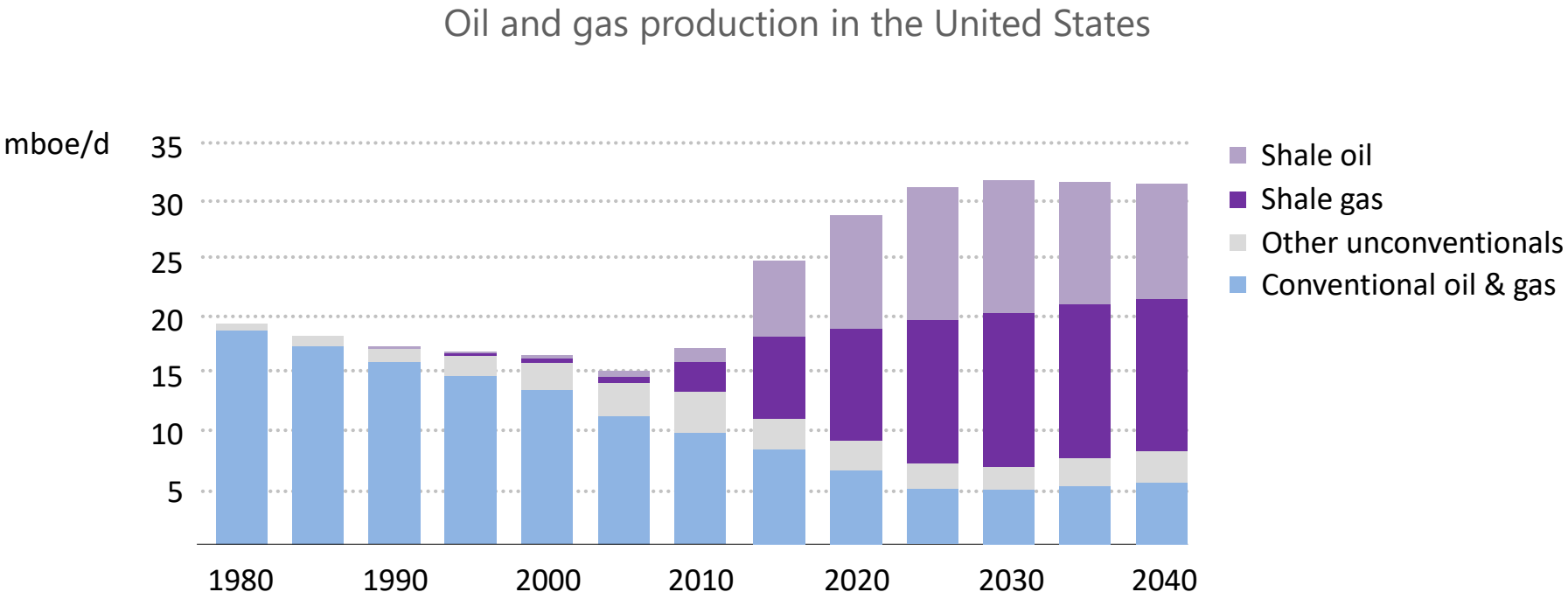




Electric cars are helping to transform energy use for passenger cars, slowing the pace of growth in global oil demand: however, trucks, aviation, shipping & petrochemicals keep oil on a rising trend

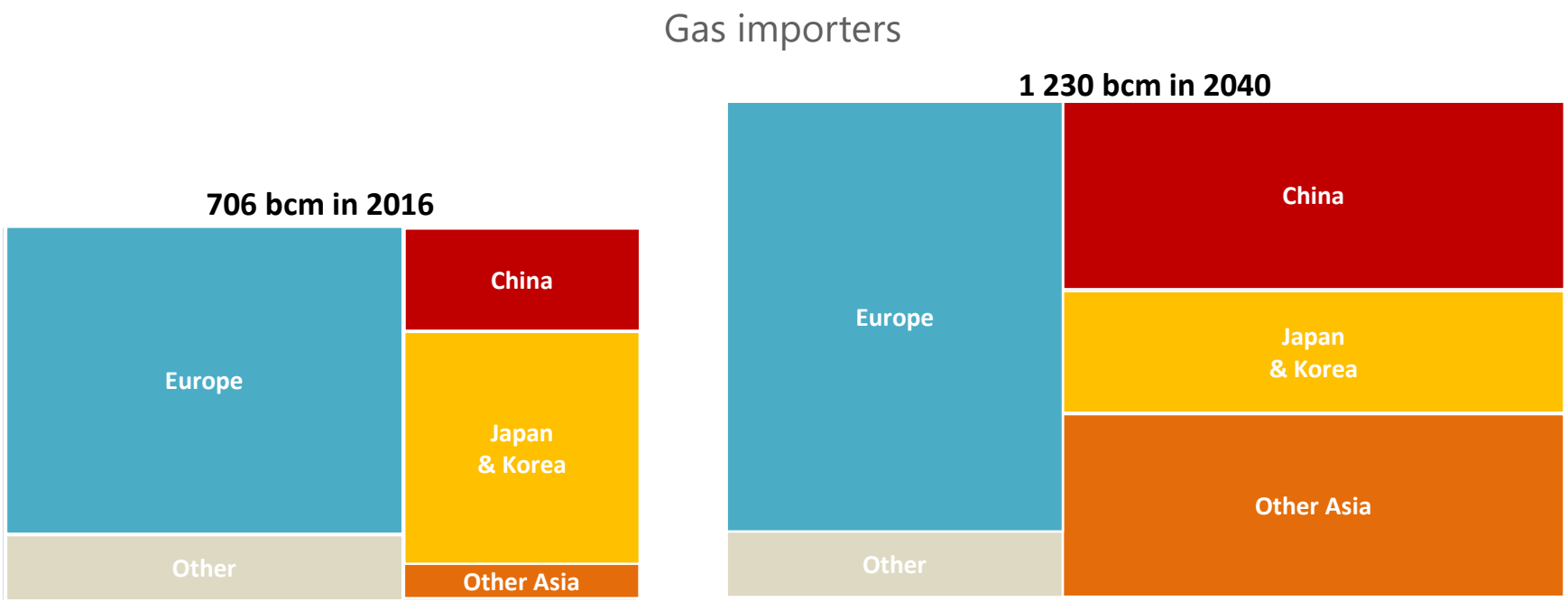
US becomes undisputed leader of oil & gas production

World Energy Outlook 2017



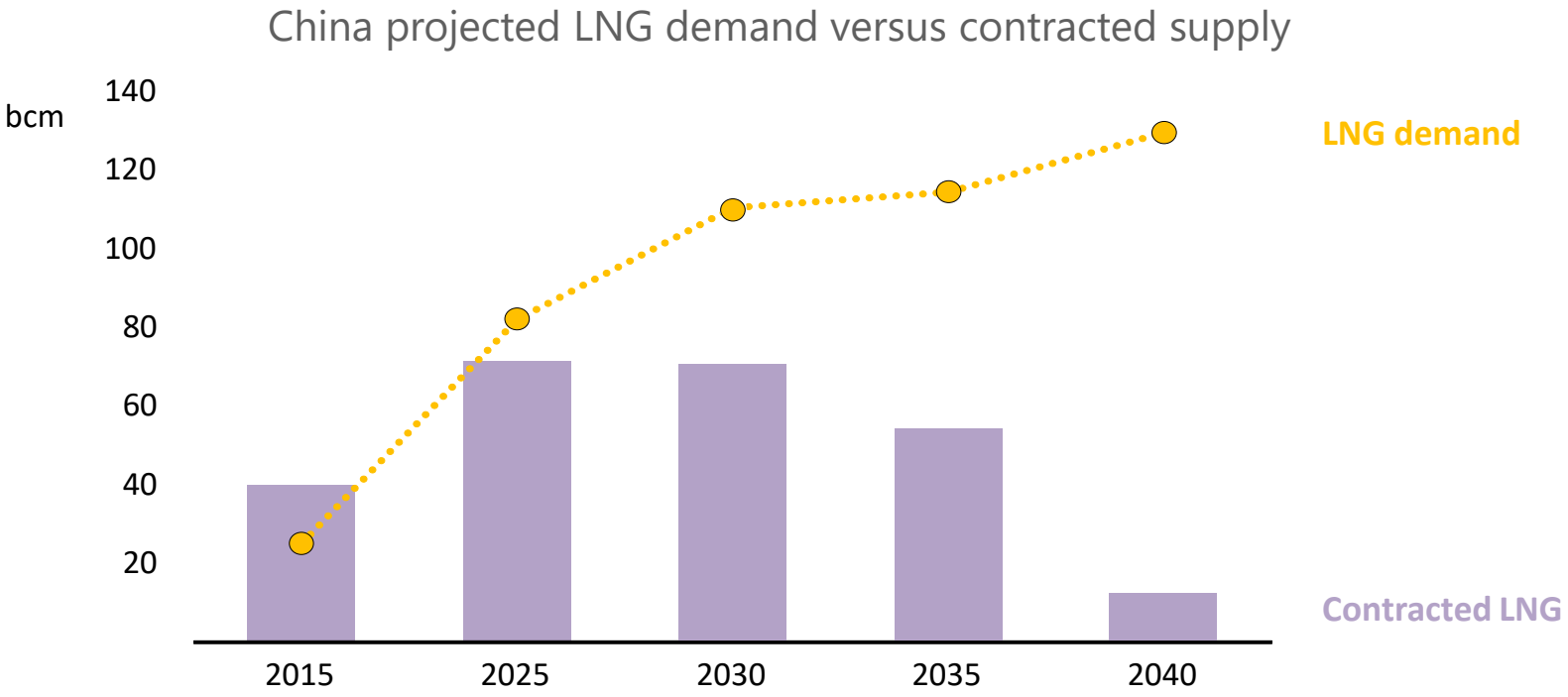
The US is already switching to become a net exporter of gas & becomes a net exporter of oil in the 2020s, helped also by the demand-side impact of fuel efficiency & fuel switching

LNG ushers in a new global gas order



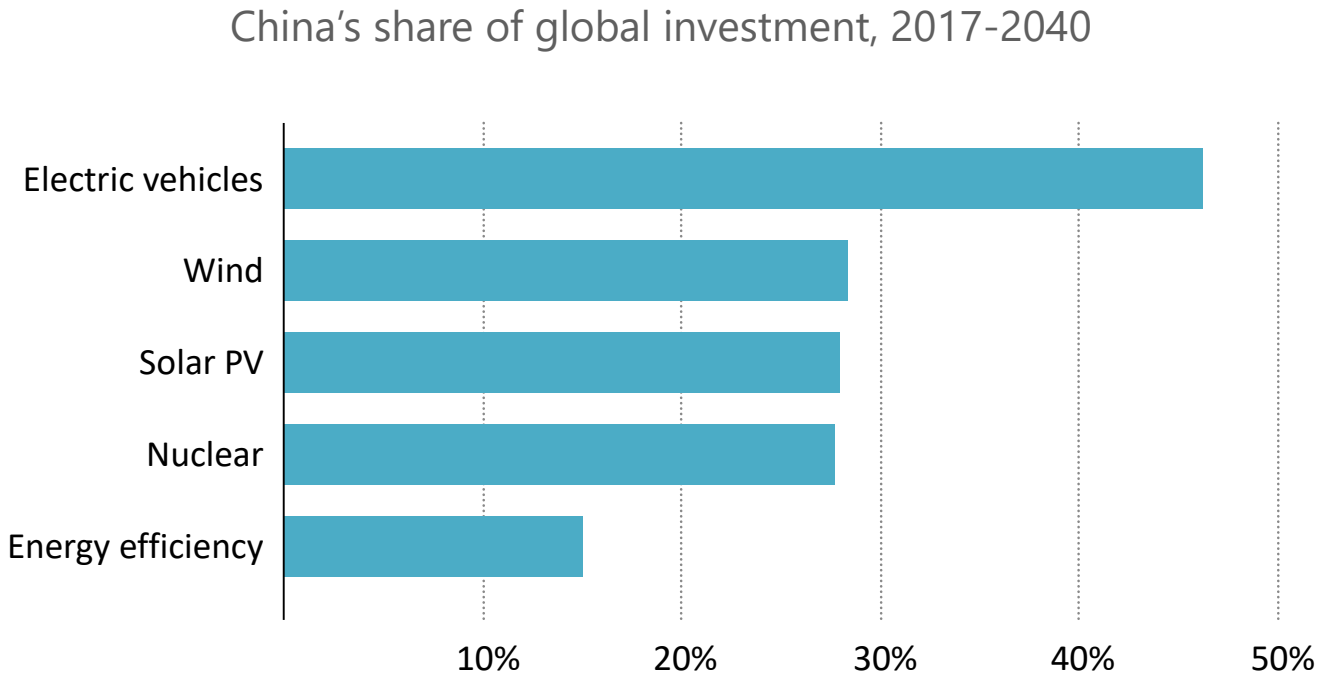
Asia's growing gas import requirements are largely met by LNG, with exports from the US accelerating a shift towards a more flexible, liquid global market

China a major force in global gas markets



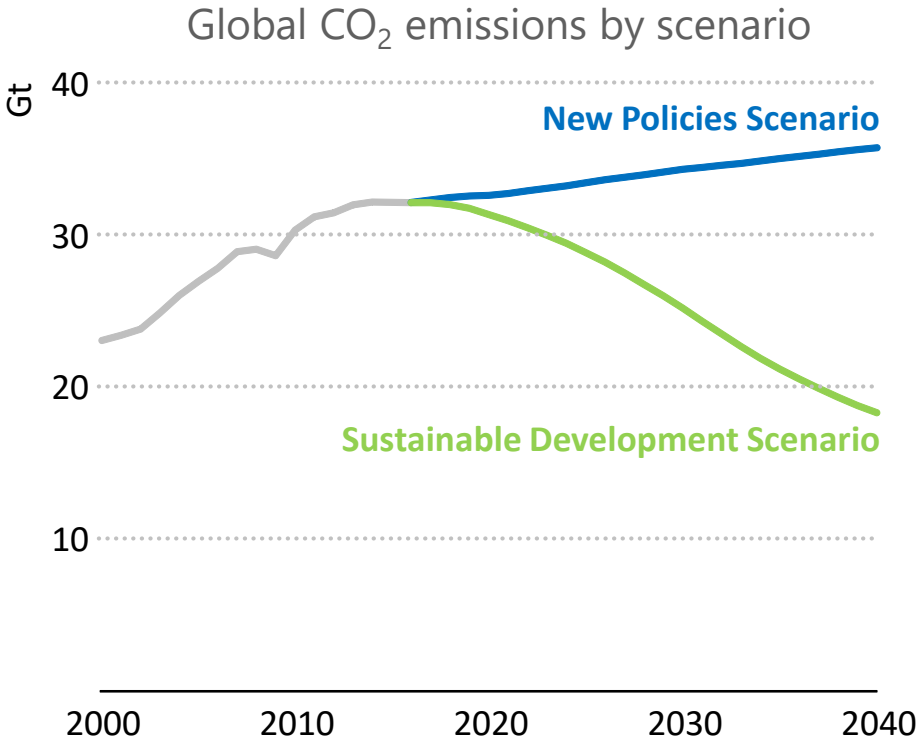
Industrial gas demand leads the way as China accounts for one-quarter of global gas growth to 2040; China's growing import needs become a major spur for investment in new global supply

China leads the push for clean energy technologies



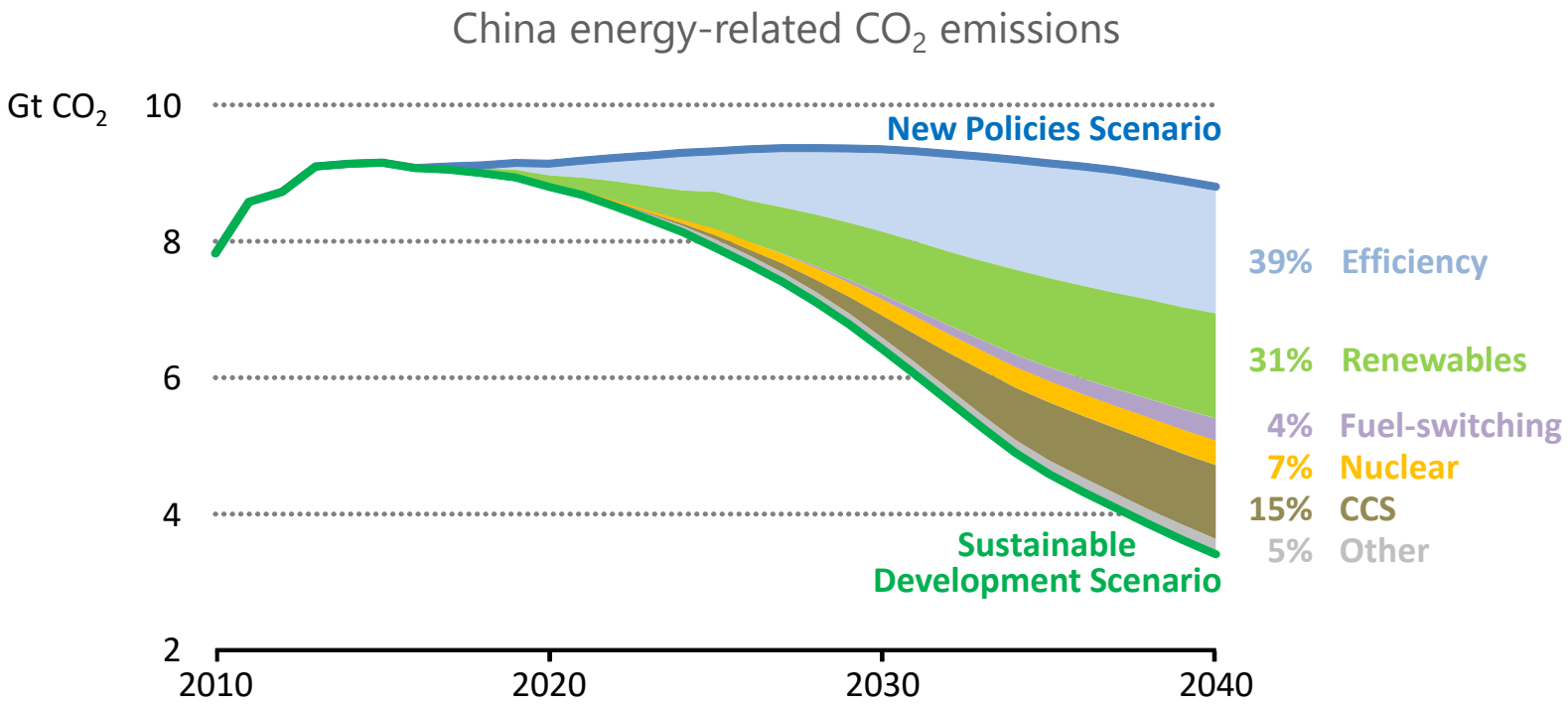
China is the leading global investor in power generation and end-use sectors; its emphasis on clean energy investment is a driver of the global clean energy transition

A new strategy for energy & sustainable development



The Sustainable Development Scenario reduces CO_2 emissions in line with the objectives of the Paris Agreement, while also tackling air pollution and achieving universal energy access

Achieving CO_2 reductions while meeting air quality and energy access goals



Energy efficiency is central to the steep decline in emissions seen in the Sustainable Development Scenario

Rethinking the energy sector

World Energy Outlook 2017

The Sustainable Development Scenario in 2040

875 million electric vehicles

2 times more efficient than today

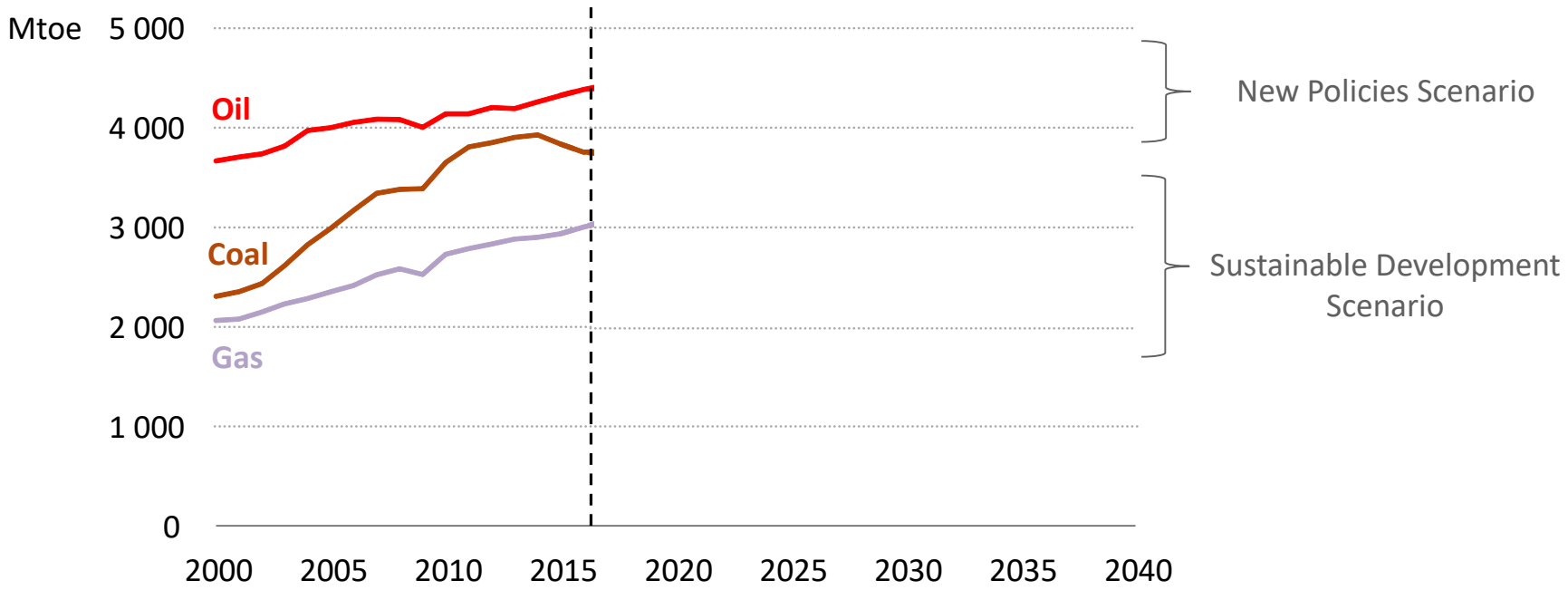
3 250 GW global solar PV capacity

580 bcm additional gas demand

Achieving the three targets of the Sustainable Development Scenario simultaneously requires a step change in the pace of delivering a clean energy transition

Natural gas is the only fossil fuel to grow in the Sustainable Development Scenario

Fossil fuel demand in the New Policies Scenario & Sustainable Development Scenario

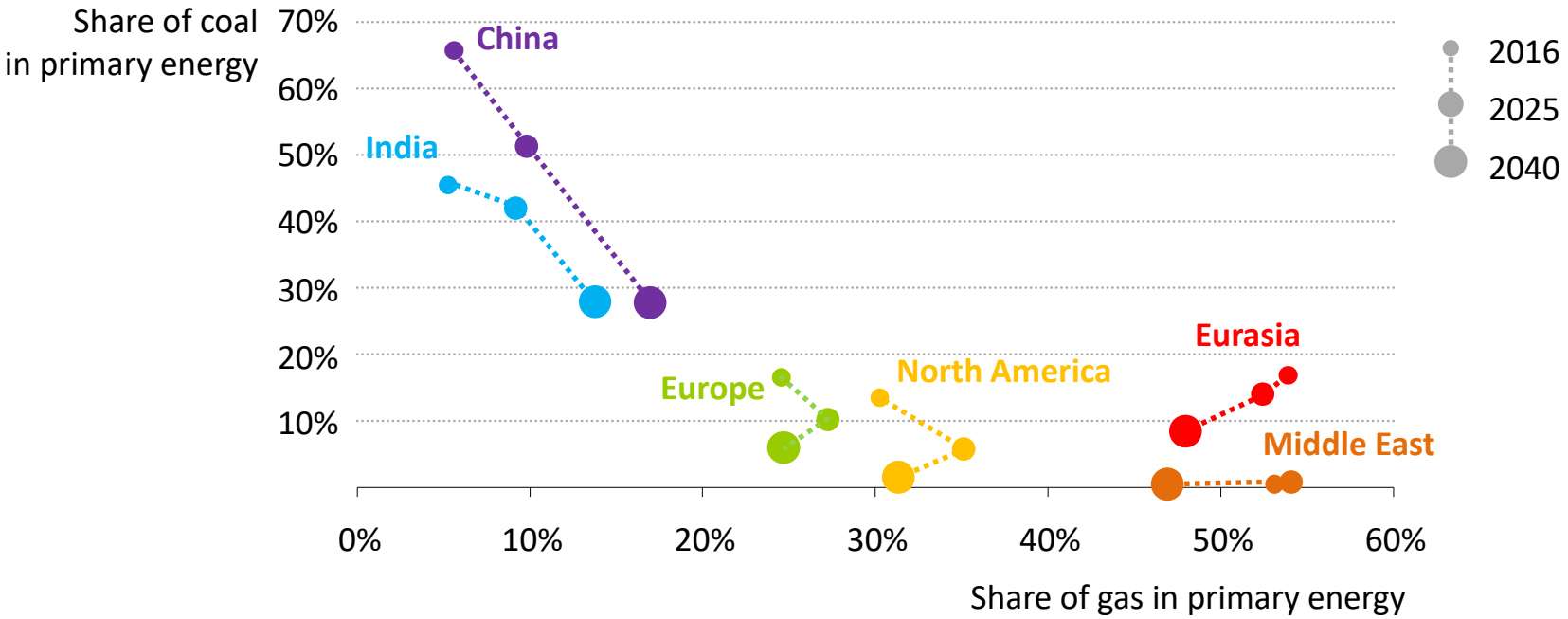


Coal & oil demand drop in the Sustainable Development Scenario. Gas becomes the largest fossil fuel by 2040 alongside the rapid expansion of low-carbon technologies & improvements in efficiency

A complex picture for gas, a clear downward path for coal

World Energy Outlook 2017

Share of coal & gas in energy demand in selected regions in the Sustainable Development Scenario



The share of coal in total primary energy demand falls across all regions in the Sustainable Development Scenario, but opportunities for gas vary by country, by sector and over time

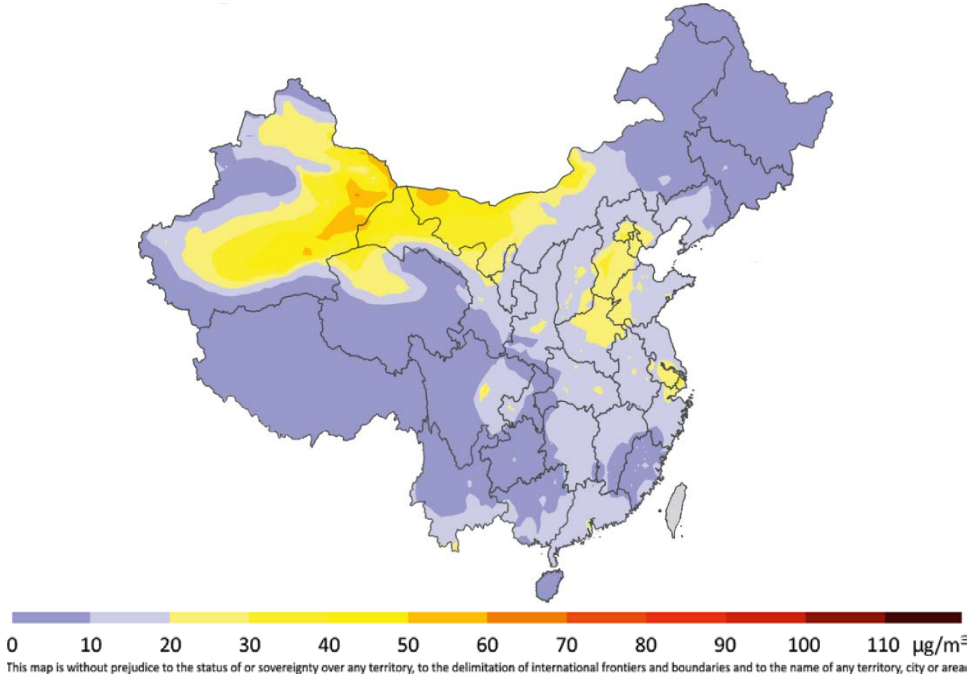
Air quality is an energy issue

World Energy Outlook 2017

Concentration of fine particulate matter in China

Today

2040: New Policies Scenario

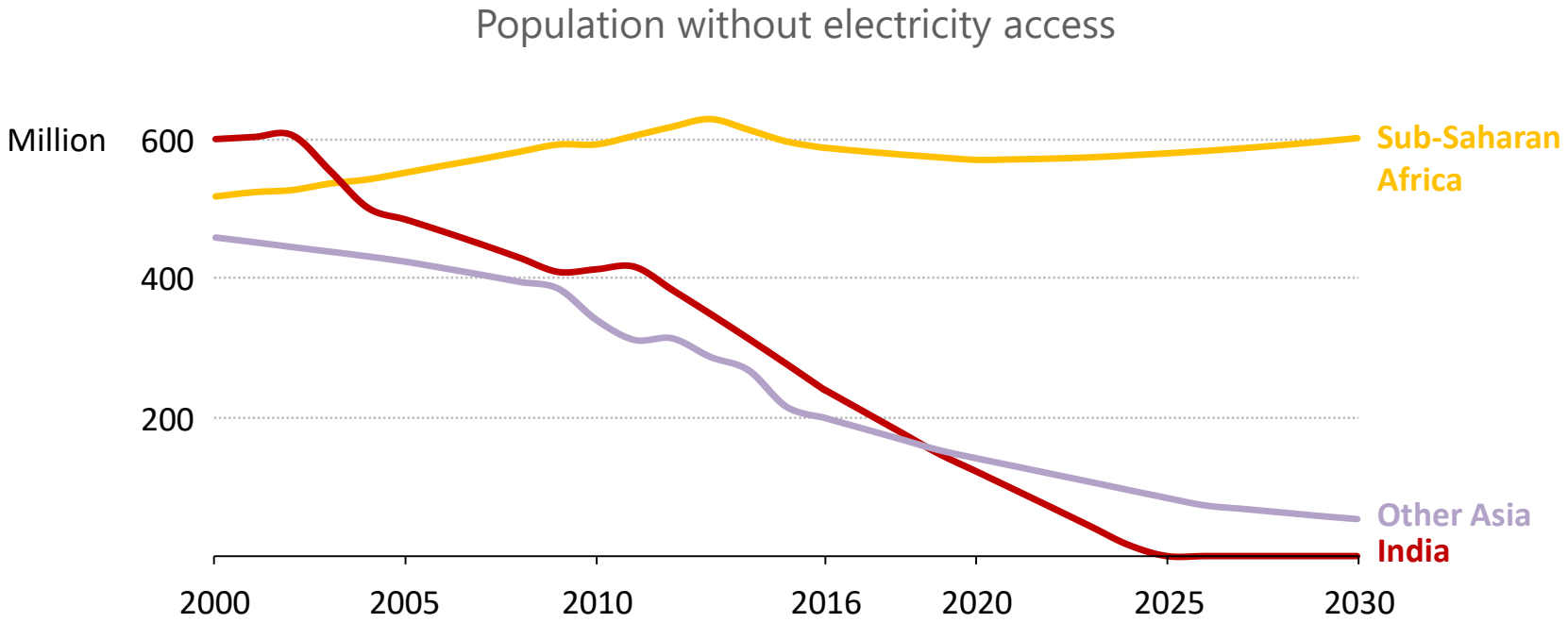


2040: Sustainable Development Scenario

Source: WEO analysis, IIASA

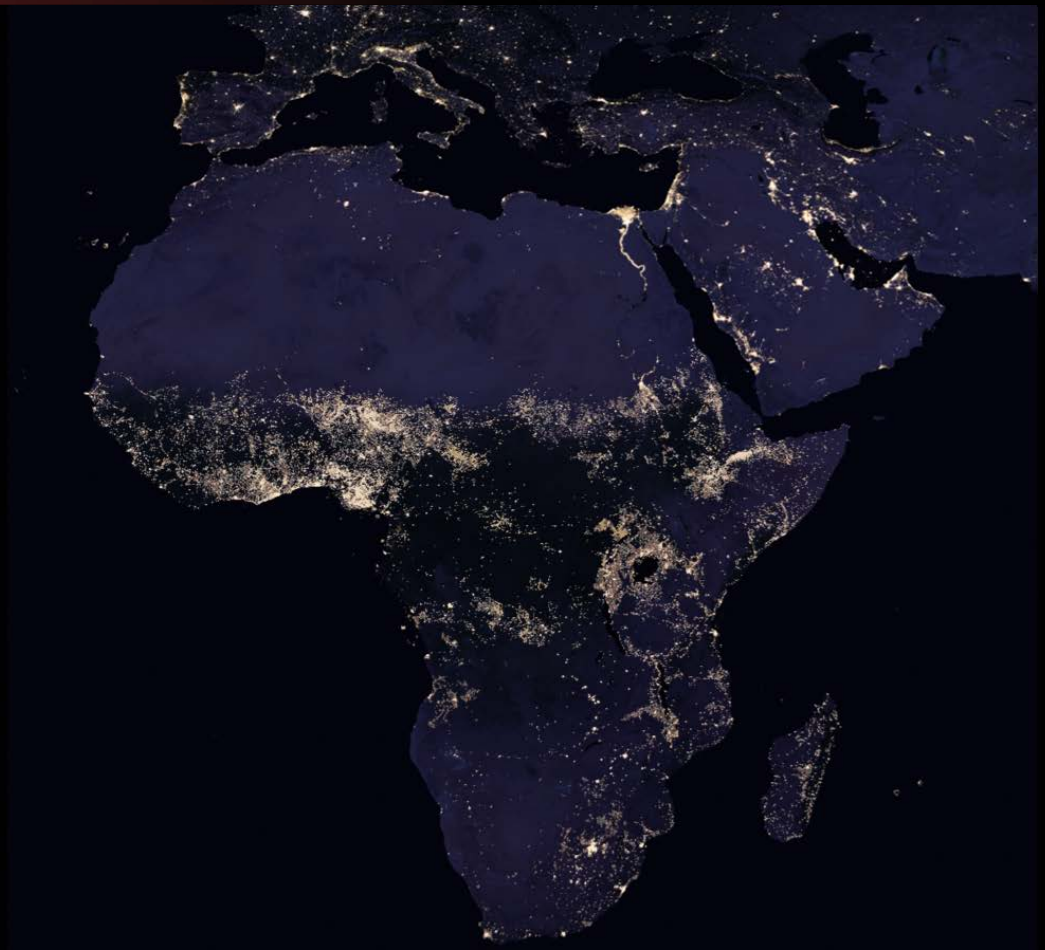
Urbanisation & an ageing population increase vulnerability to health impacts in China, but a clean energy transition cuts pollutant emissions considerably

Electricity access makes progress in all regions, but sub-Saharan Africa lags behind

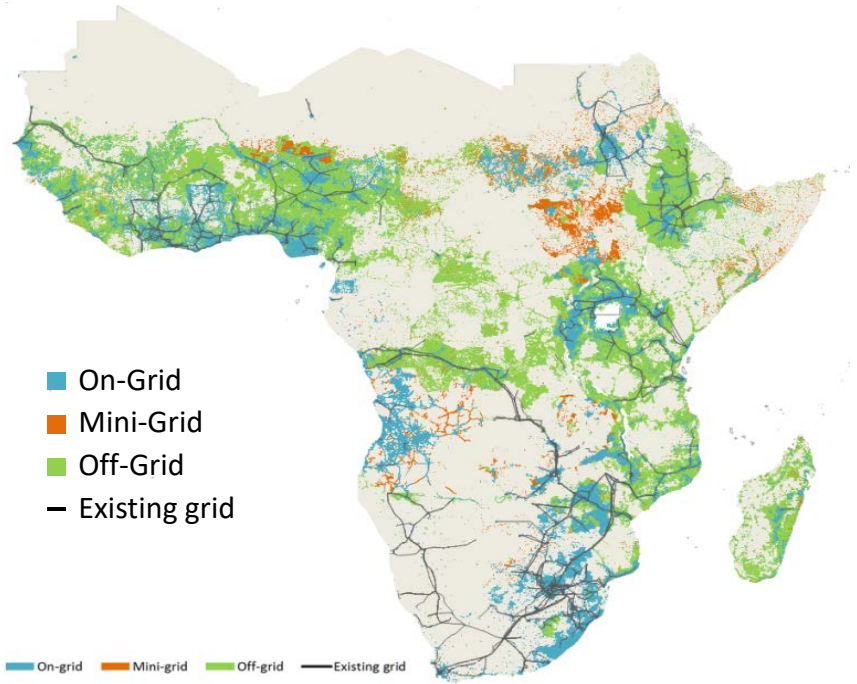


Many countries, led by India, are on track to achieving full electrification by 2030, but – despite recent progress – efforts in sub-Saharan Africa need to redouble

Achieving access for all by 2030



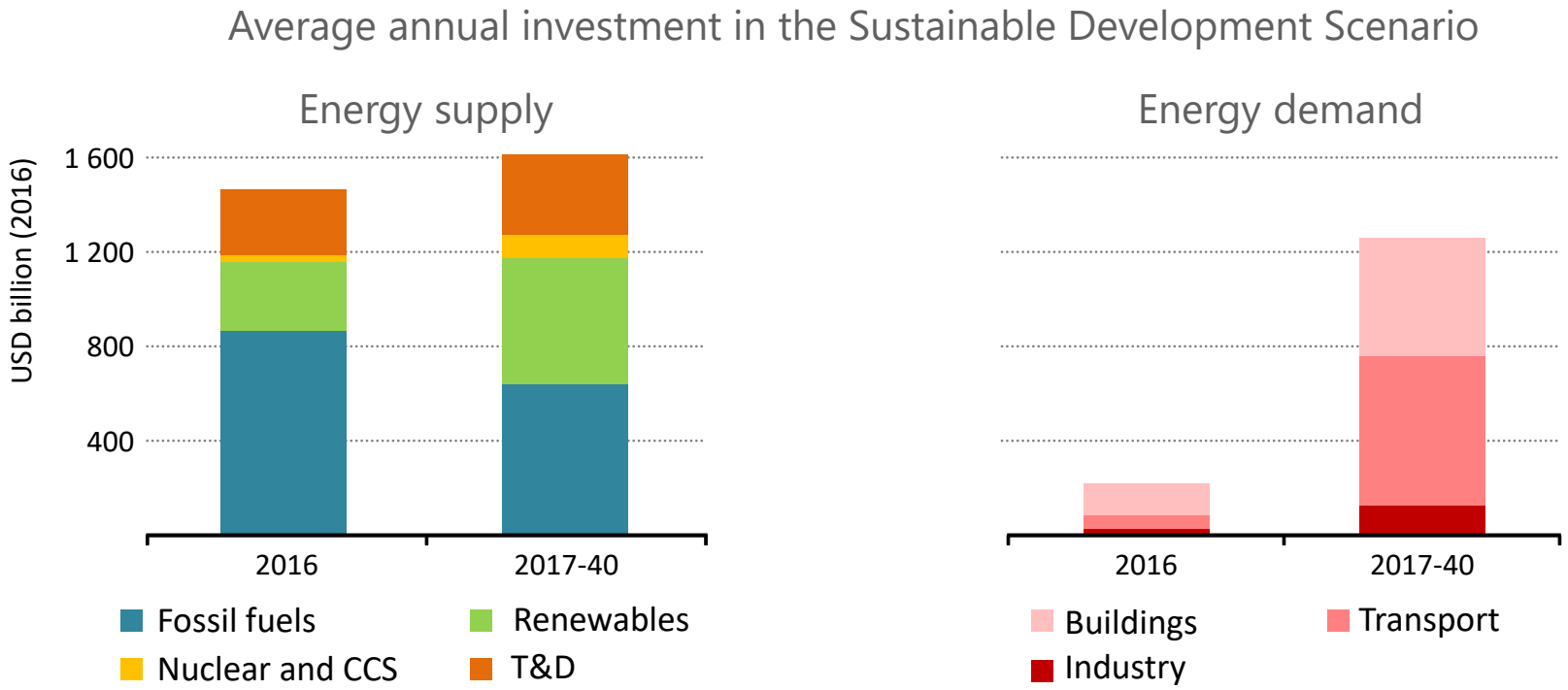
Achieving universal energy access is not in conflict with climate goals



- Grid extension for 150 million additional people, with hydro accounting for the lion's share
- Decentralised solutions, mainly solar PV, for the remaining 450 million people in rural areas
- An additional $26 billion per year is needed in electricity generation and grids

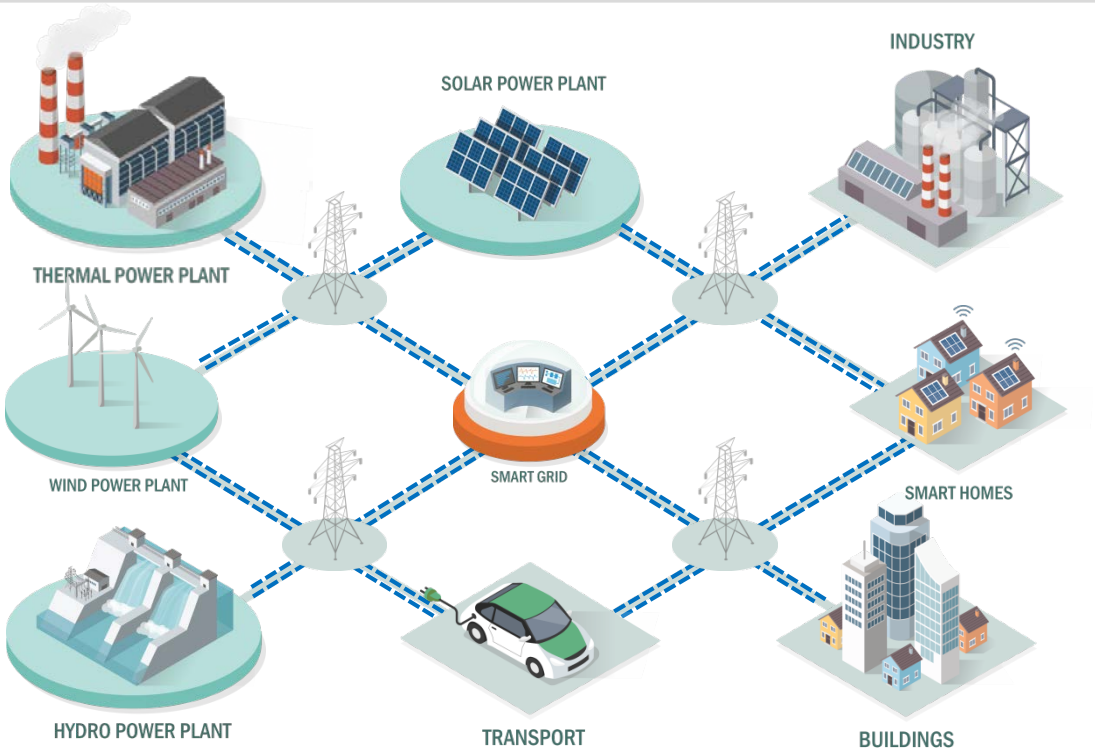
Policies of the Sustainable Development Scenario achieve universal energy access by 2030, improving human health and supporting the achievement of climate change goals

Sustainable investment needs



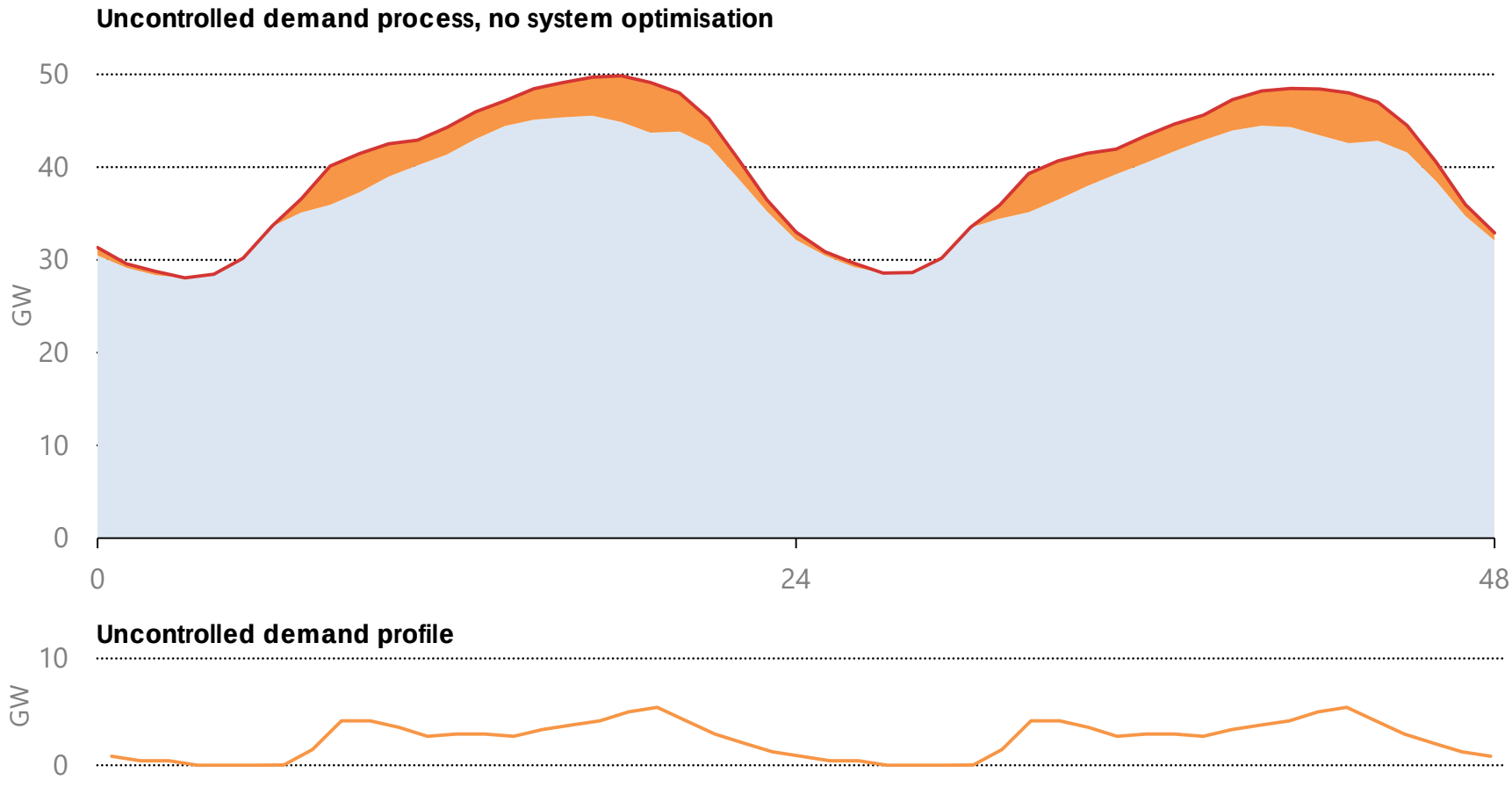
The Sustainable Development Scenario requires 15% additional investment to 2040; two-thirds of energy supply investment are needed for electricity generation & networks

The digital transformation of the energy system

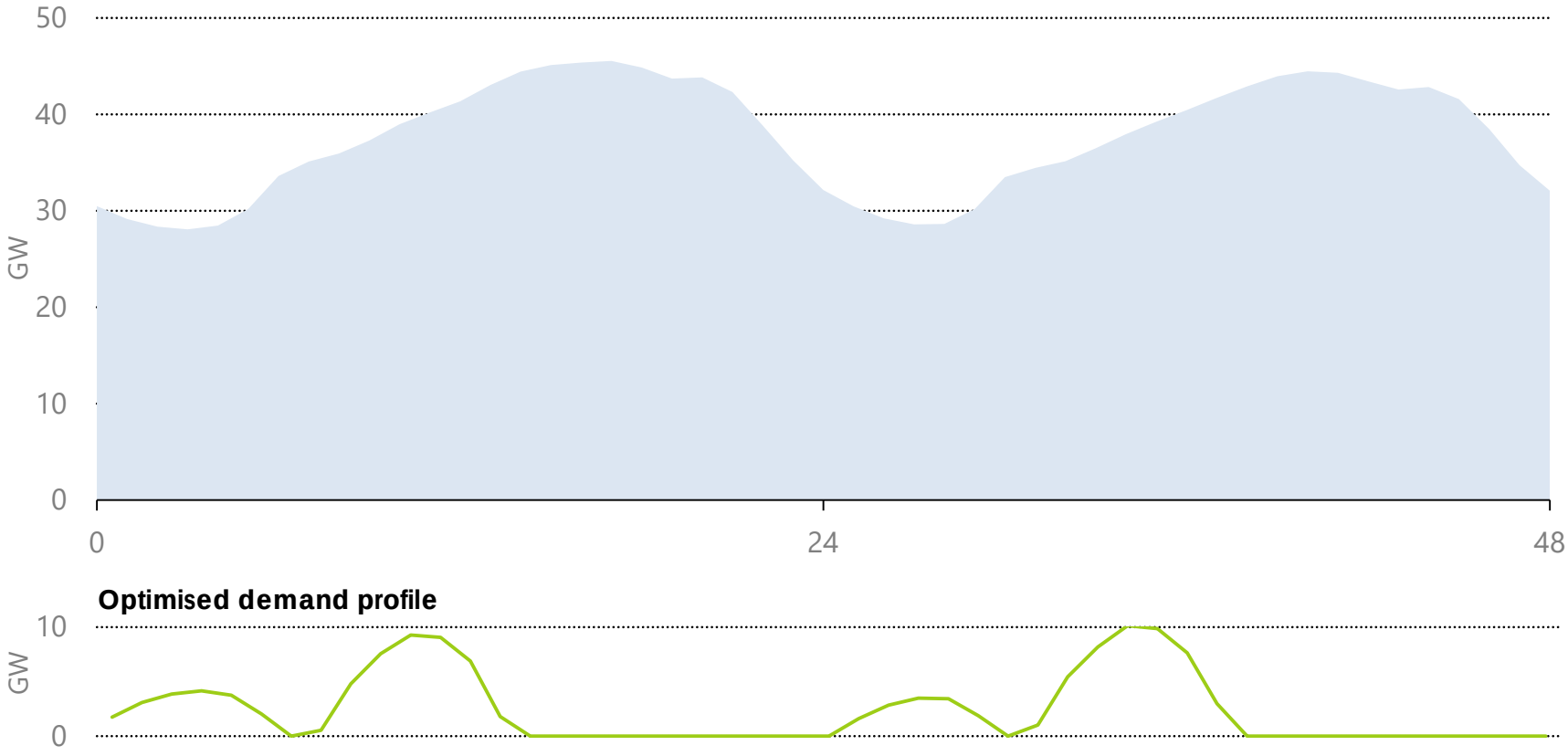


Pre-digital energy systems are defined by unidirectional flows and distinct roles, digital technologies enable a multi-directional and highly integrated energy system

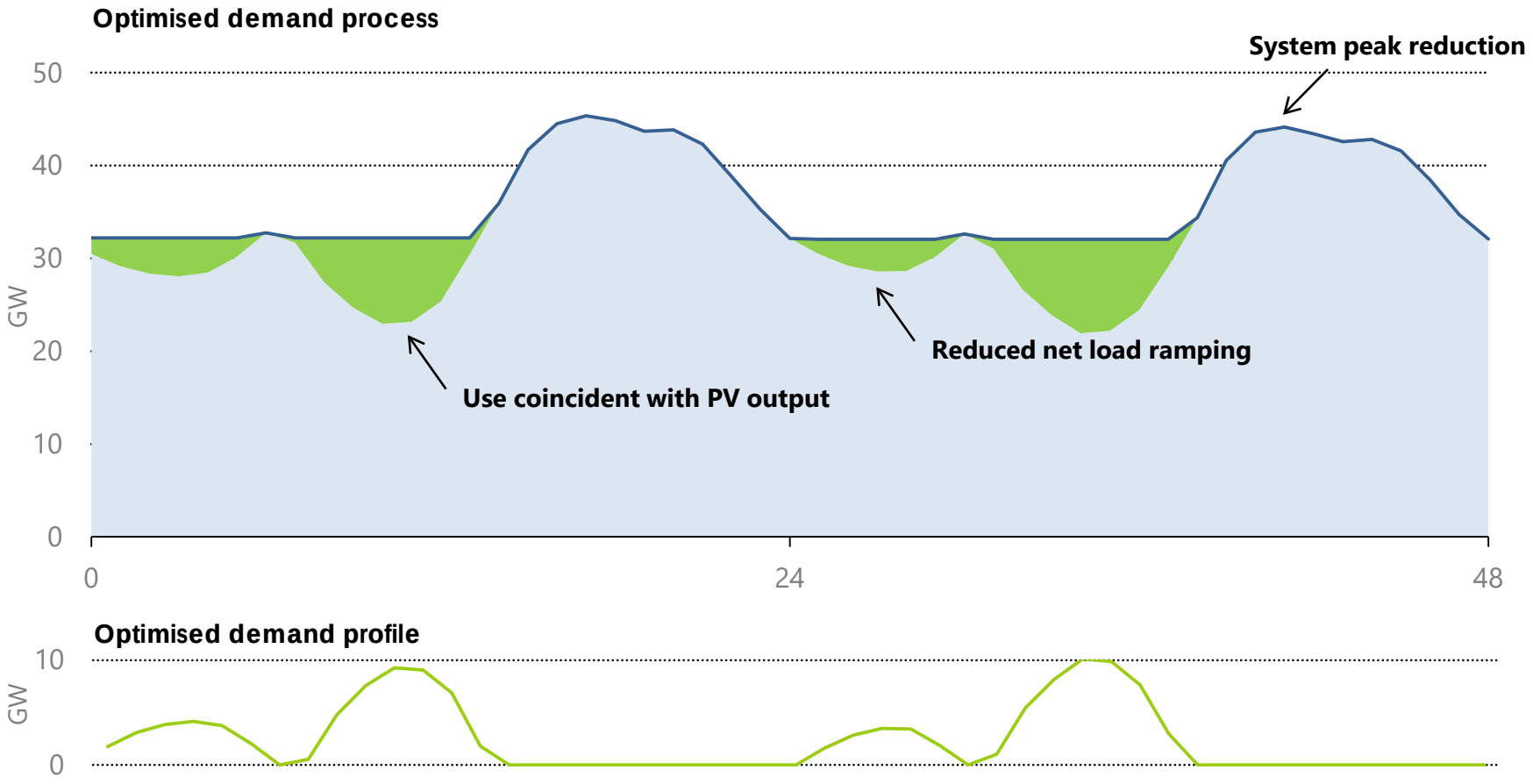
Providing system flexibility from the demand side



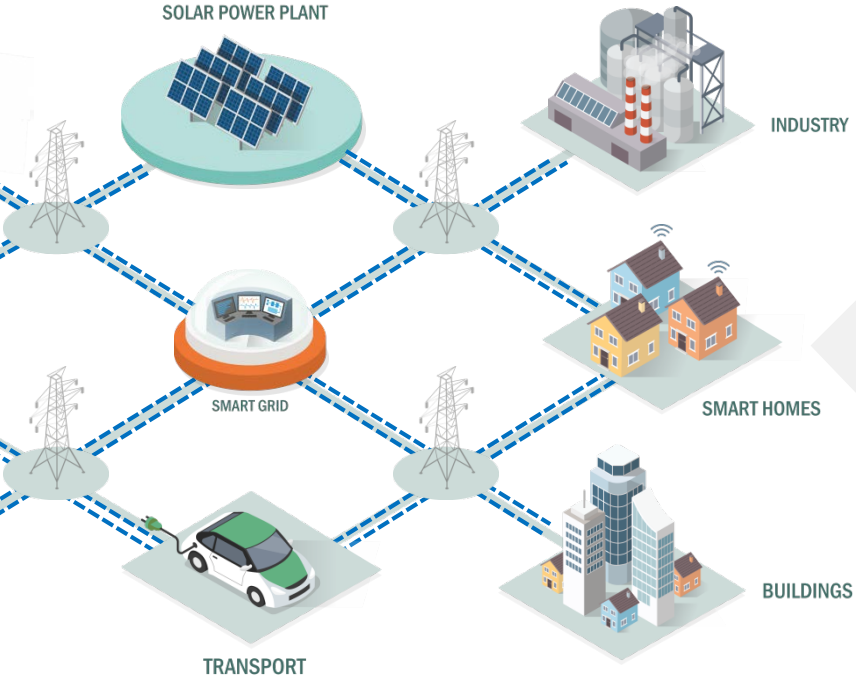
Providing system flexibility from the demand side



Providing system flexibility from the demand side



Smart demand response



Residential sector

1 billion households and
11 billion smart appliances
could actively participate in interconnected electricity systems

Demand response programs – in buildings, industry and transport - could provide 185 GW of flexibility, and avoid USD 270 billion of investment in new electricity infrastructure

Conclusions

World Energy Outlook 2017

- The oil & gas boom in the United States is shaking up the established order, with major implications for markets, trade flows, investment & energy security
- The versatility of natural gas means that it is well placed to grow, but it cannot afford price spikes or uncertainty over methane leaks
- China continues to shape global trends, but in new ways as its "energy revolution" drives cost reductions for a wide range of clean energy technologies
- Our strategy for sustainable energy shows that concerted action to address climate change is fully compatible with global goals on universal access & air quality
- Electrification & digitalisation are the future for many parts of the global energy system, creating new opportunities but also risks that policy makers have to address – **WEO 2018 will focus on electricity**

World Energy Outlook 2017

iea.org/weo