As Always, a little Quiz…

- In 1990, fossil fuels provided just under 82% of global primary energy.

- By 2015, this had fallen to:
  - 80%
  - 75%
  - Just above two thirds
  - More than 81%
More of an opinion poll…

- In 2013, coal provided some 42% of global power
- By 2040, this will fall to
  - Around 38%
  - Around a third
  - About a quarter
  - No more than 15%
Tipping the energy world off its axis

- 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

Change in energy demand, 2016-40 (Mtoe)

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.
Growth in energy-related CO₂ emissions varies by country and region; the slowdown or decline in some countries is offset by growth in others.
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
The future is electrifying

Electricity generation by selected region

- **China**
- **United States**
- **India**
- **European Union**
- **Southeast Asia**
- **Middle East**
- **Africa**

Graph shows electricity generation in TWh for 2016 and growth to 2040.

**Sources of global electricity demand growth**

- **Industrial motors**
- **Electric vehicles**
- **Large appliances**
- **Connected & small appliances**
- **Cooling**
- **Other**

**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.**
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
A three-stage decoupling is taking place in power, separating economic growth and the growth of electricity demand, fossil-fuelled generation and fossil-fuel use.
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

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.
The United States is switching already to become a net gas exporter, and is projected to become a net oil exporter in the late 2020s.
Shale gas is at the heart of US gas production prospects; its share of US gas output rises from 60% in 2016 to 80% in 2030
Many Basins involved, but Marcellus!!
The United States becomes a heavyweight in the global LNG market, providing more than a fifth of traded volumes in the long term.
Asia leads the growth in global gas trade; outside China, new pipeline trade routes find it hard to advance in a market with LNG readily and flexibly available.
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.
In Asia, US LNG sparks a transition of LNG pricing away from strict oil price indexation.
As power decarbonises, transport becomes the main driver of CO₂ emissions growth; among fuels, gas takes the lead as it expands its share in the energy mix.
The Sustainable Development Scenario reduces CO₂ emissions in line with the objectives of the Paris Agreement, while also tackling air pollution and achieving universal energy access.
The Sustainable Development Scenario in 2040

- **875 million** electric vehicles
- **3,250 GW** global solar PV capacity
- **580 bcm** additional gas demand
- **2 times** more efficient than today

*Only 15% additional investment is required to 2040 to achieve the Sustainable Development Scenario, with two-thirds of energy supply investment going to electricity generation & networks.*
Firstly, a little history
While the economy continued to grow strongly in 2014-2016, the implications for energy demand and CO₂ emissions were radically different than in previous years.
China has an immense presence in global energy across a range of fuels and technologies.
The legacy of China’s precipitous economic rise is a system heavily skewed towards coal and energy use in industry.
Growth in energy demand has slowed, coal (probably) has peaked, developments suggest that China’s energy future may look quite different from its past.
Since 2013, the majority of capacity additions to China’s power system have come from wind, solar PV, hydropower and nuclear.
China energy supply investments

Low-carbon electricity supply and networks are driving energy investment in China
Turning to the Outlook
As China enters the next phase of development, the focus shifts from industry-led towards services-led growth with a focus on energy efficiency and electricity use.
China industry energy mix and related output by sub-sector in the New Policies Scenario

Rebalancing industrial activity increases energy efficiency and changes the fuel mix; chemicals becomes the main industry source of energy demand growth.
Passenger car fuel use diversifies and peaks in 2030 as growth in the car stock slows in the East and Central regions and electric cars make inroads.
Policies to limit car ownership and new mobility concepts could reduce the size of the future car pool and cut oil use, especially if electrification happens faster.
Traditional biomass for heating and cooking purposes gives way to more efficient fuels to satisfy rising demand.
Installed power generation capacity in China in the New Policies Scenario

Low-carbon technologies comprise 60% of total capacity in 2040 and overtake fossil fuels by 2030
Low-carbon sources of electricity generation expand to over 50% by 2040 from a 29% share in 2016
The Northwest region becomes the major exporter of electricity, supplying a mix of renewables-based and fossil-fuelled generation to other regions.
China’s energy-related CO₂ emissions reach a peak in 2028, driven by declining coal use in the industry sector; all sectors except transport peak before 2040.
China’s many small mines are high cost and often have poor safety records, and are the primary target of the coal industry restructuring and consolidation policy.
By the mid-2020s, most of the capacity cuts are achieved and the installed capacity operates at a 90% utilisation rate.
Coal production from existing mines falls away sharply in the late 2020s, requiring strategic choices about reinvestment in China’s coal production capacity.
China’s coal mining industry improves its productivity, but it remains lower than in many other major producing countries.
Declines from mature fields and lack of new projects lead to a continued fall in production.
China’s crude oil import volume and associated import bill in the New Policies Scenario

China’s crude import needs rise to 11 mb/d by 2040 and the import bill grows even faster
Natural gas demand in China and production by type in the New Policies Scenario

Production growth in China is underpinned by unconventional gas as conventional output stagnates, but production cannot keep up with soaring demand.
China’s gas imports grow strongly and supplier diversity increases as new pipeline projects come online and new LNG exporters enter the market.
China shows a diminishing appetite for coal and oil, and a growing appetite for low-carbon technologies and natural gas.
Foregone benefits of a slower transition in China in Current relative to New Policies Scenario, 2040

Foregone benefits of a slower economic and energy transition have important ramifications beyond GDP
Air quality significantly improves in the Sustainable Development Scenario
Supply investment is re-directed to low-carbon power in the Sustainable Development Scenario, demand investment rises and fossil-fuel import bill falls.
Conclusions from the WEO 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
World Energy Outlook 2017

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