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Delft University of Technology, 20 March 2019
Today’s energy context

- Mixed signals about the pace & direction of change in global energy:
  - North America has entered a new age of oil & gas wealth
  - Natural gas is on the rise: China’s rapid demand growth is erasing talk of a ‘gas glut’
  - Solar PV has the momentum while other key technologies & efficiency policies need a push

- For the first time, global population without access to electricity fell below 1 billion

- Electricity is carrying great expectations, but questions remain over the extent of its reach in meeting demand & how the power systems of the future will operate

- Policy makers need well-grounded insights about different possible futures & how they come about.
Global emissions increased in 2018 – again

CO₂ emissions rose for a second year in a row, after remaining flat for the three previous years
The new geography of energy

In 2000, more than 40% of global demand was in Europe & North America and some 20% in developing economies in Asia. By 2040, this situation is completely reversed.
The increase in demand would be twice as large without continued improvements in energy efficiency, a powerful tool to address energy security & sustainability concerns.
Our energy destiny rests with governments

Total investment in energy supply to 2040:

$42.3 trillion

More than 70% of the $2 trillion required each year in energy supply investment either comes from state-directed entities or receives a full or partial revenue guarantee.
US leads the way in global oil supply growth

US expansion is 70% of global growth. Gains in Brazil, Iraq, Norway, the UAE and Guyana. Main declines in Iran and Venezuela.
The United States accounts for a third of growth in global natural gas production to 2025 & two-thirds of anticipated growth in LNG exports
Europe will need to seek new gas imports

The European Union needs to find imports to cover one-third of its demand by 2025, due to sharp declines in the EU’s own production & the expiry of nearly 100 bcm of long-term gas import contracts.

Produced / contracted gas & additional import requirements in the EU, 2018-2025

Additional supply needed
LNG
Caspian
North Africa pipe
Russia pipe
Norway pipe
EU-28 production
Technology progress and competition have driven down prices to record-low levels in countries with good renewable resources, transparent policies and well-designed auction schemes.
Higher shares of variable renewables raise flexibility needs and call for reforms to deliver investment in power plants, grids & energy storage, and unlock demand-side response.

Phases of integration with variable renewables share, 2030

Integration phase

1. Mobilise existing power system flexibility
2. Targeted investment in flexibility needed
3. Germany
4. Europe
5. United Kingdom
6. India
Two directions for nuclear power

Without policy changes

- **United States**: 40 GW (2017), 80 GW (2040)
- **European Union**: 120 GW (2017), 160 GW (2040)
- **Japan**: 40 GW (2017), 80 GW (2040)

Growth markets

- **China**: 160 GW (2017), 80 GW (2040)
- **Russia**: 40 GW (2017), 20 GW (2040)
- **India**: 20 GW (2017), 40 GW (2040)

The contribution of nuclear power could decline substantially in leading markets, while large growth is coming, as China takes first position within a decade.
Coal plants make up one-third of CO2 emissions today and half are less than 15 years old; policies are needed to support CCUS, efficient operations and technology innovation.

Can we unlock a different energy future?
How is clean energy technology progressing globally?

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Out of the 38 technologies included in *Tracking Clean Energy Progress (TCEP) 2018*, only 4 are on track, 23 need improvement.
China was a remarkable success story for electrification, bringing access to hundreds of millions in record time; India achieved electricity access for all its villages in 2018; Today the challenge is concentrated in sub-Saharan Africa.
Conclusions

• The links between energy & geopolitics are strengthening & becoming more complex, a major factor in the outlook for energy security

• US emerges as the n.1 source of oil and gas growth in the next five years. Despite rapid deployment of electric vehicles, global oil demand shows no sign of peaking

• Electrification & digitalisation is creating new opportunities in the global energy system, but market designs need to deliver both electricity and flexibility to keep the lights on

• There is no single solution to our energy and climate challenges: renewables, efficiency & a host of innovative technologies, including storage, CCUS & hydrogen, are all required

• The future pathway for energy is open: governments will determine where our energy destiny lies