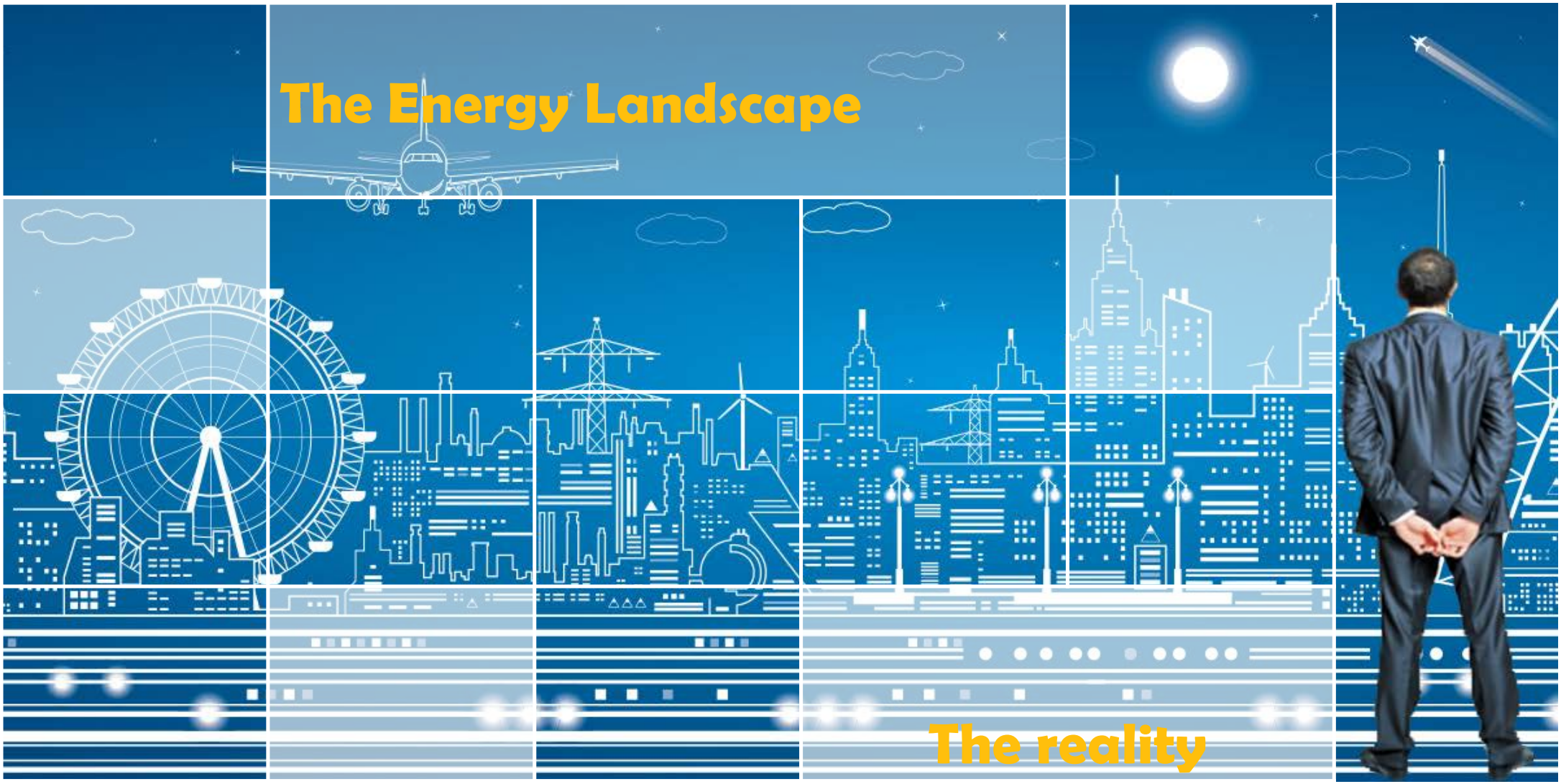
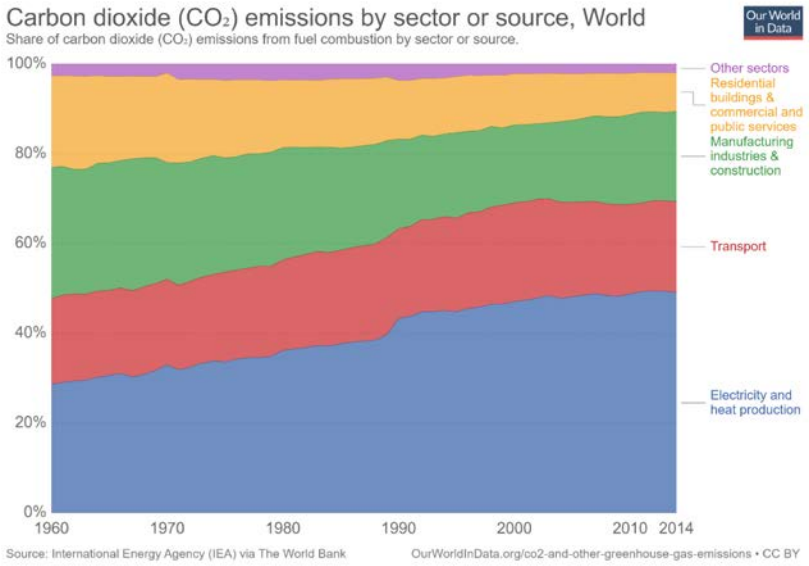
The Energy Landscape

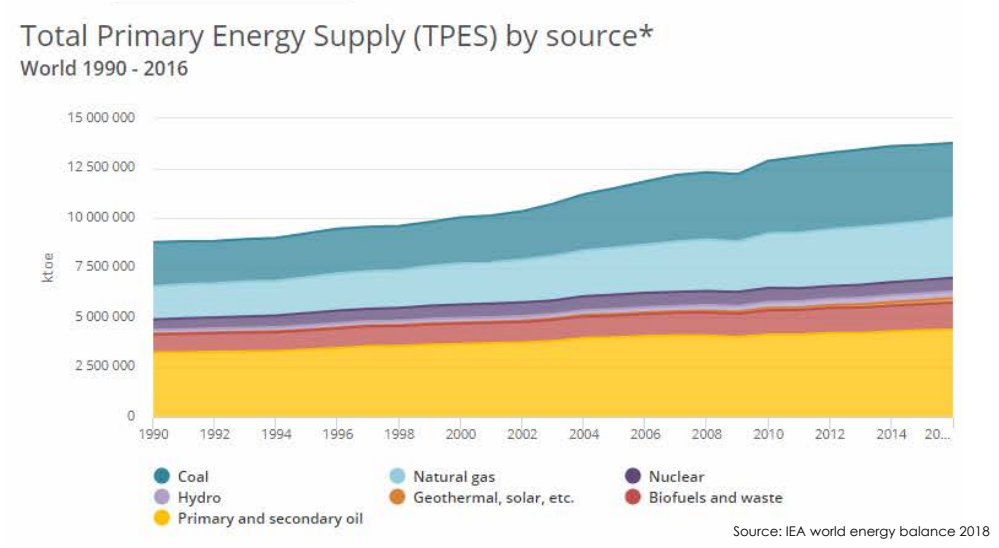


The reality

The need for Energy transition

- Energy consumption and production represents around two-thirds of the global GHG emissions and 81% of the global energy mix is still based on fossil fuels, the same percentage as 30 years ago.



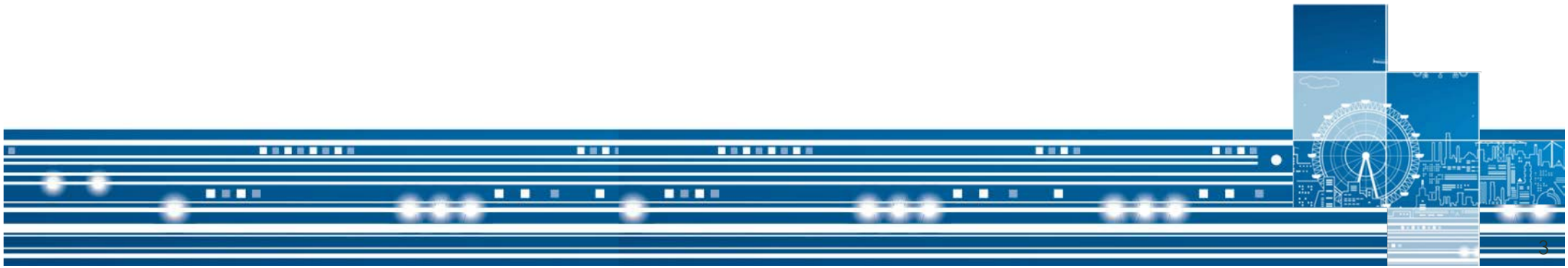


Source: IEA world energy balance 2018

The need for Energy transition

- A transition is needed 9.

- The energy transition is a pathway toward transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century. At its heart is the need to reduce energy-related CO2emissions to limit climate change. **Renewable energy and energy efficiency measures can potentially achieve 90% of the required carbon reductions**. (IRENA : https://www.irena.org/energytransition)



The Landscape

Energy Source: 100% Renewable

Date : tomorrow

2050 UAE Energy Mix: What

Achieve 50% Clean Energy in Capacity Mix

44% Renewables

6% Nuclear

15% Clean Energy in Primary Mix

10% Nuclear

5% Renewables

Diverse Energy Mix

Gas-Coal-Nuclear-Solar-Biomass-Wind

40% Demand Side Management

2050 UAE Energy Mix: Why

UAE Energy Index

Energy Security and Reliability

- % of Imported Fuel used in Total Energy Mix
- Number of energy sources

Energy Affordability

- Average Cost of electricity production
- Total investment for capacity additions

Sustainability

Clean Energy and Emissions

- CO2 emissions per GDP
- Share of clean energy in generation mix

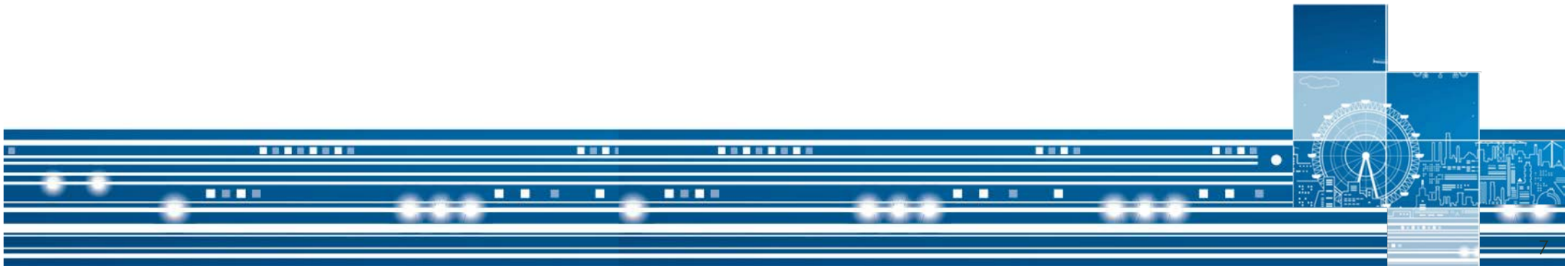
Energy Efficiency and Productivity

- Electricity use per capita
- GDP Per Unit of Primary Energy Use

Happiness

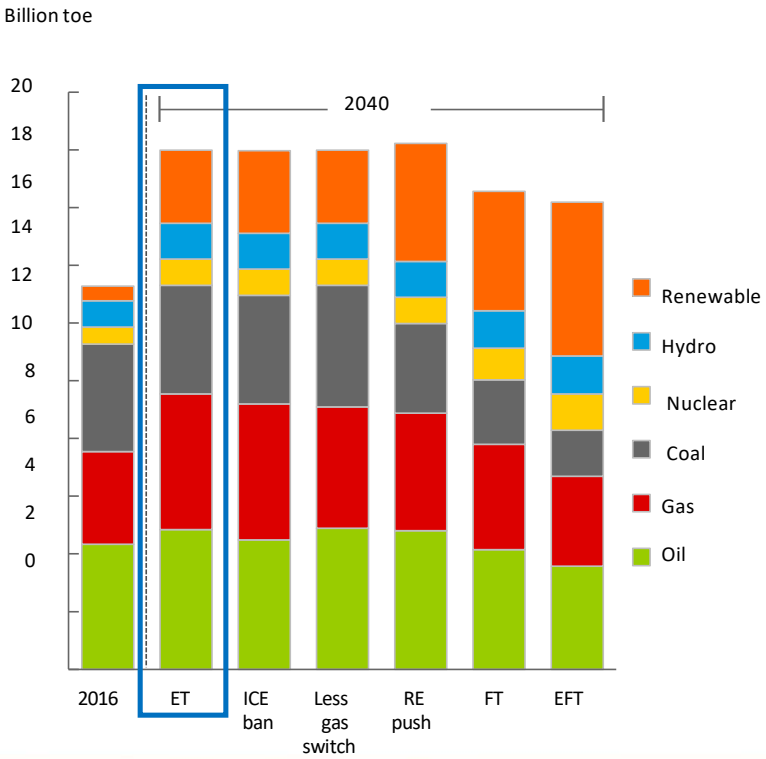
- Difference in Cost of Production from 2013
- Total emissions for electricity sector

The Energy outlook

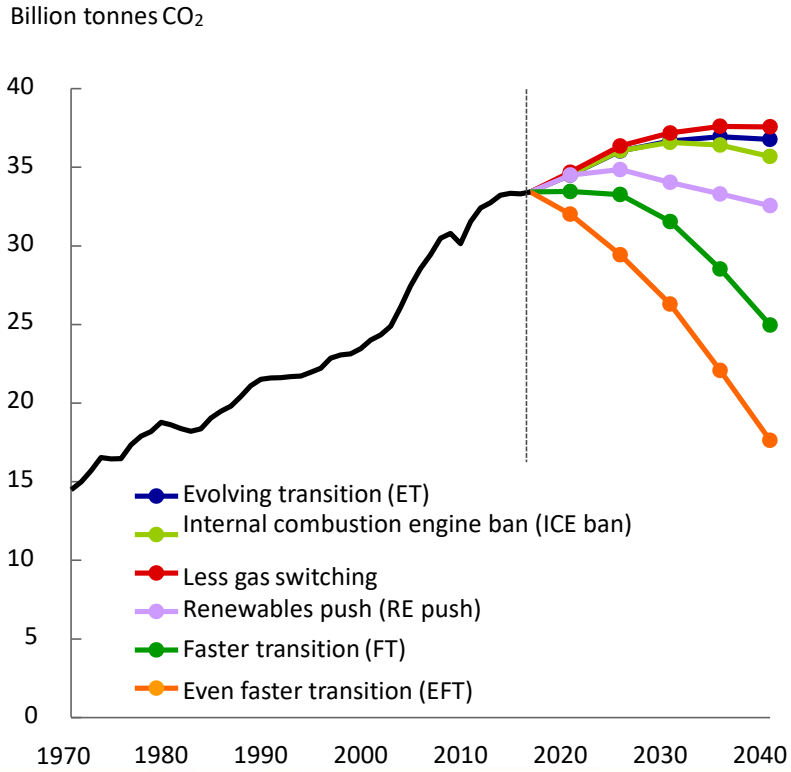


The BP Energy Outlook

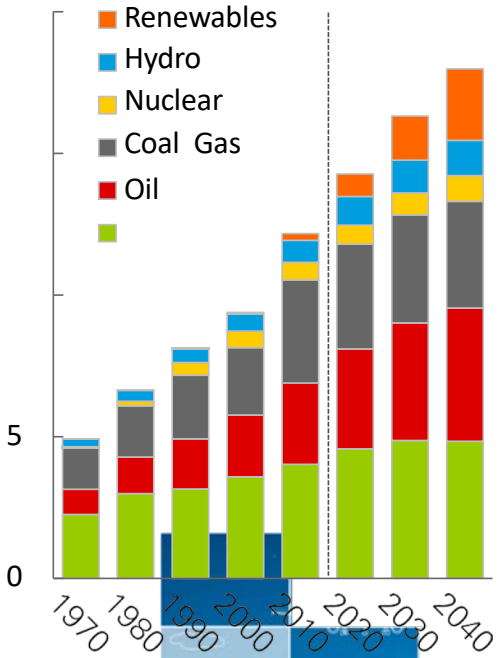
Primary energy consumption by fuel



Carbon emissions

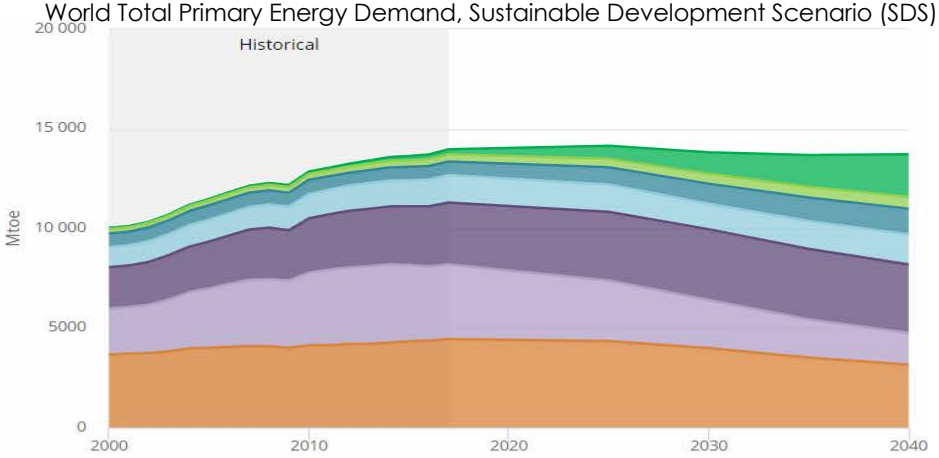


Evolving transition (ET)

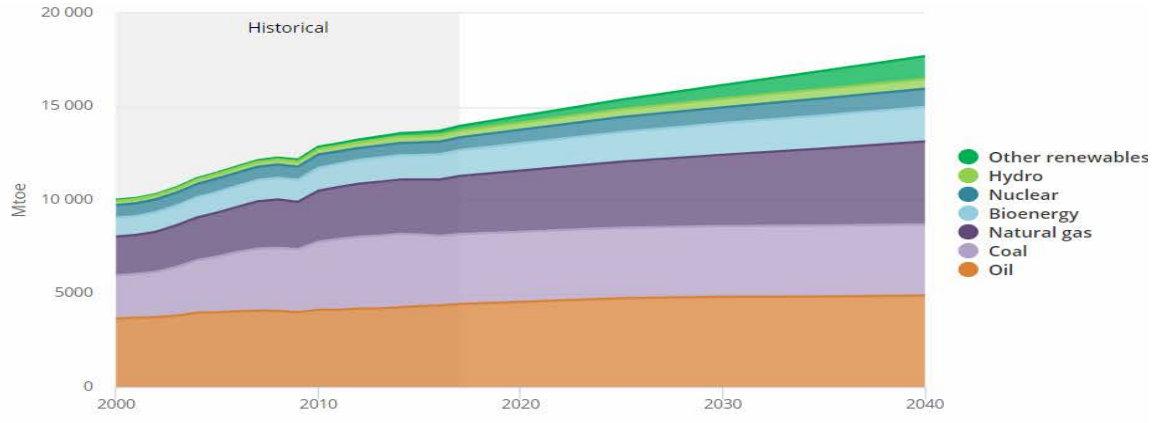


World Energy Outlook By IEA

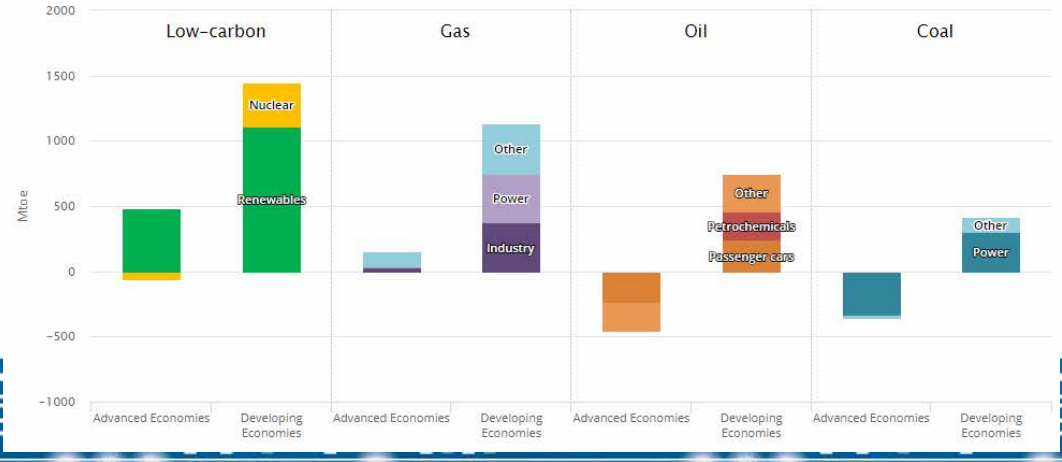
World Total Primary Energy Demand, Sustainable Development Scenario (SDS)



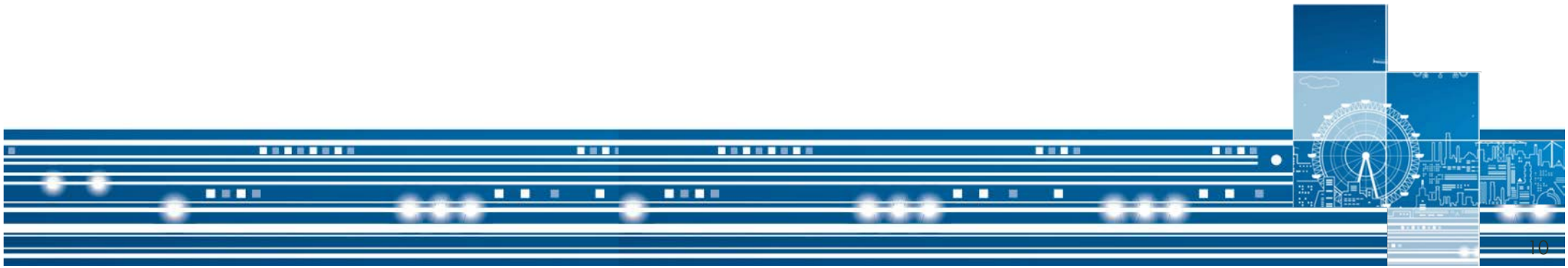
World Total Primary Energy Demand, New Policies Scenario (NPS)



Change in total primary energy demand, 2017-40 in the NPS



Real Challenges ……..



Real Challenges ……..

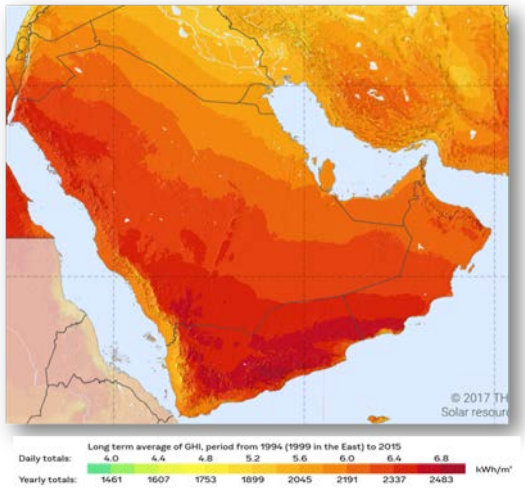
Energy Security and Reliability

- Limited resources.
- Storage technologies.
- Interconnection limitation
- Flexibility
- Transport.

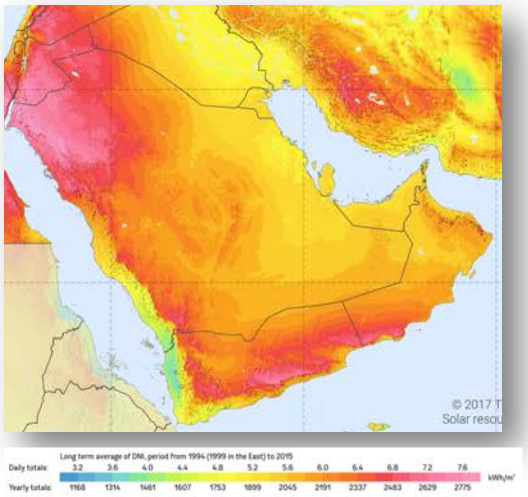
Limited Renewable Resources in the region:

Solar:

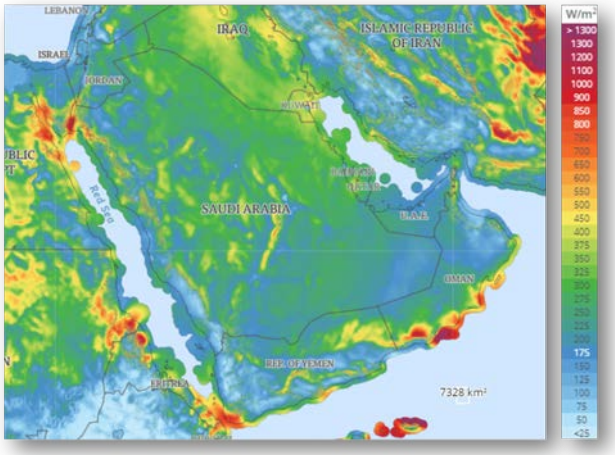
GCC - Global Horizontal Irradiation



GCC - Direct Normal Irradiation



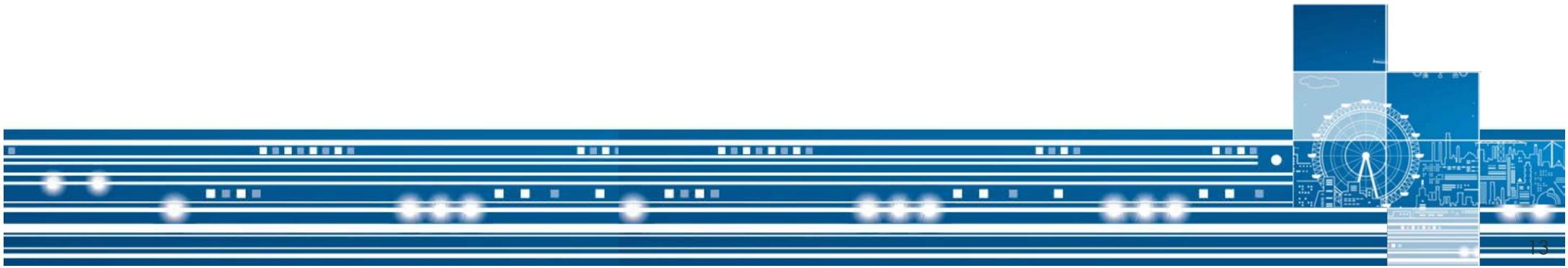
Wind:



Impact of the 100% Renewable scenario

- **Fundamental changes in grid operation and power electronics:**

- The need for balancing services.
- The impact on capacity compared to demand.
- Need for transmission grid expansion and/or storage capacity requirements

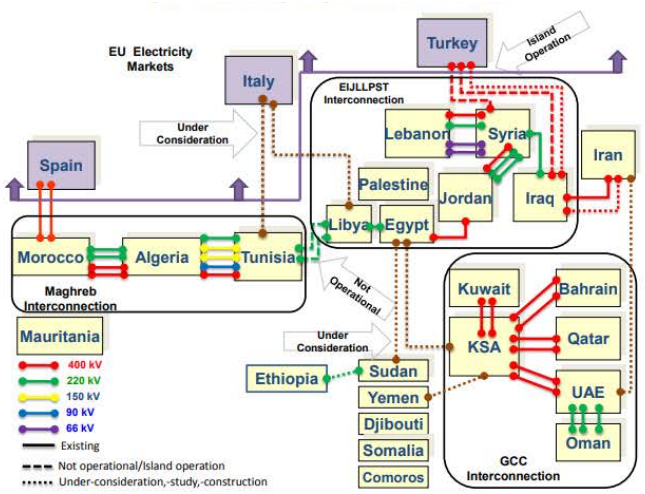


Impact of the 100% Renewable scenario

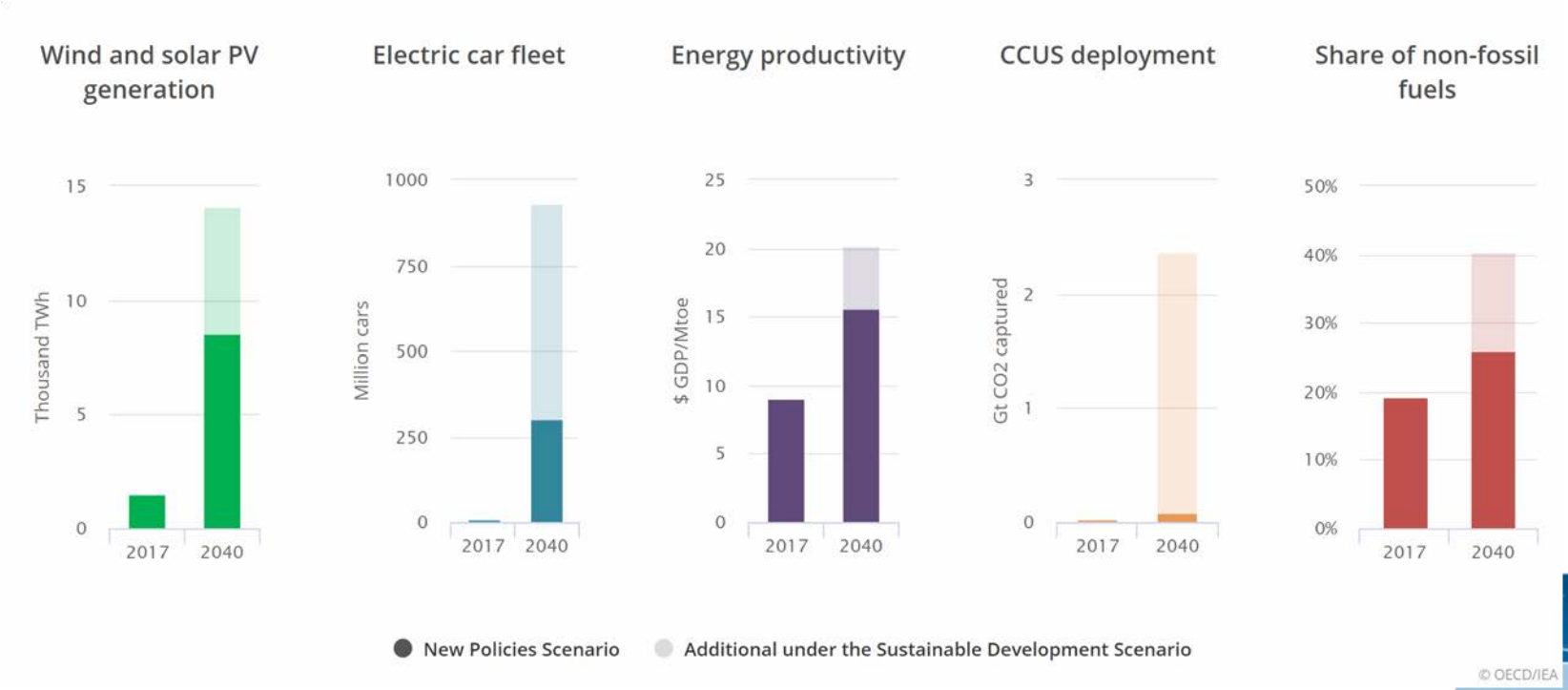
- **Regional and global Interconnection:**

GCC INTERCONNECTION

Pan-Arab INTERCONNECTION
(Planned)

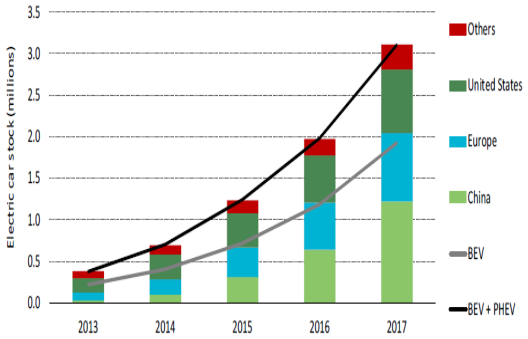


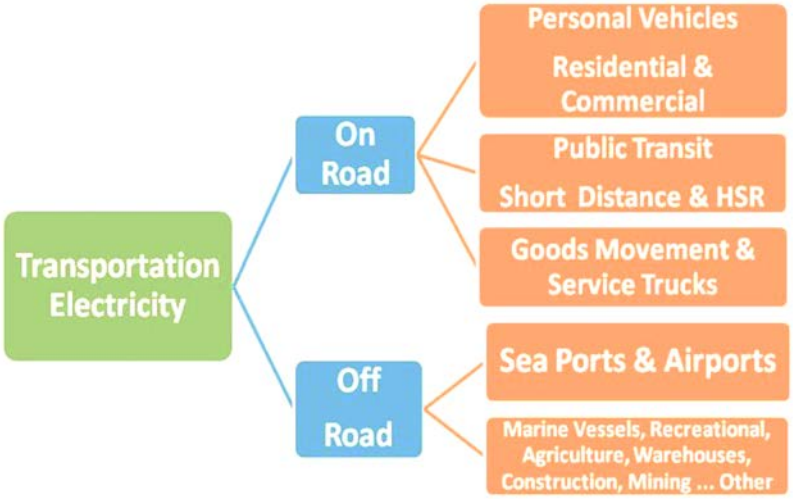
What advances in technology will aid the transition

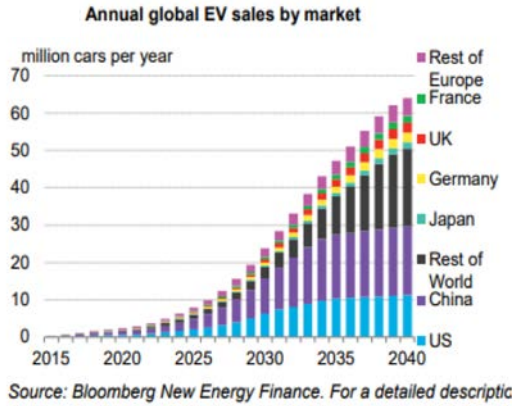


What advances in technology will aid the transition

- **Electrification of transport sector:**



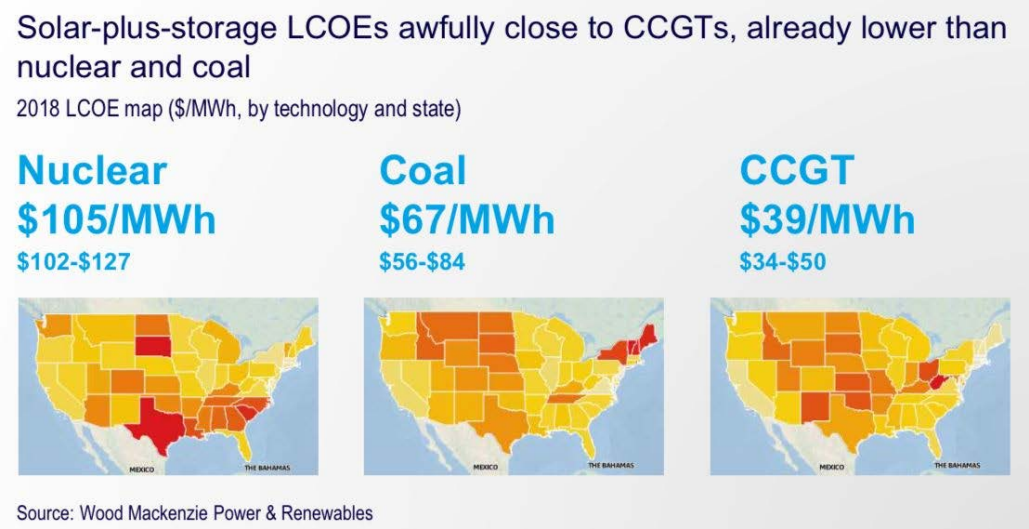




Source: Bloomberg New Energy Finance. For a detailed descriptic

What advances in technology will aid the transition

- **Storage for Upscaling Solar PV**

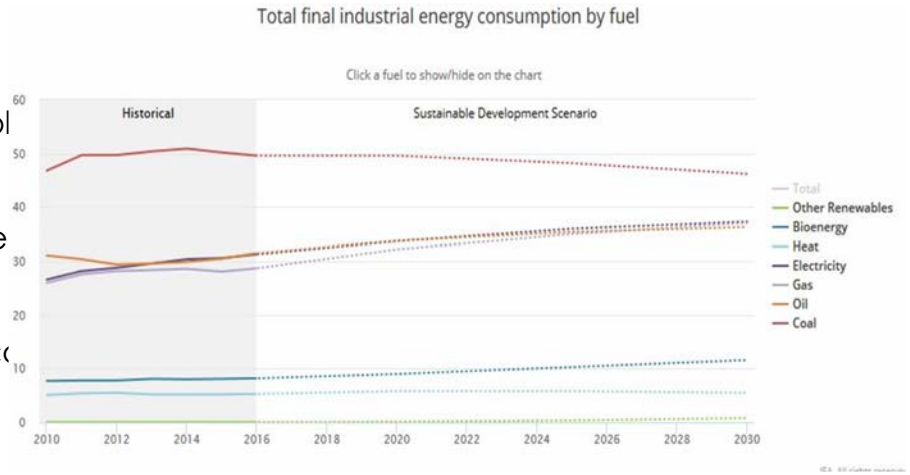


But, could energy companies struggle to access the storage they need?

1. Regional demand for battery storage
2. Automotive versus stationary battery storage
3. Second life batteries

Industry

- Energy is used in the industrial sector for a wide range of purposes, such as process and assembly, steam and cogeneration, process heating and cool and lighting, heating, and air conditioning for buildings.
- Some of these energy uses can be converted to electricity, however, some remain necessary.
- This is because industrial sector energy consumption includes basic chemic feedstock.
- Natural gas feedstock is used to produce agricultural chemicals.
- Natural gas liquids (NGL) and petroleum products (such as naphtha) are both used for the manufacture of organic chemicals and plastics, among other uses.
- As per the IEA, since the industry sector is hard to electrify, the focus should be on energy efficiency to improve the environmental sustainability of the sector.
- Efforts in optimizing industry processes can have a significant effect on increasing industry energy productivity and reducing energy demand .

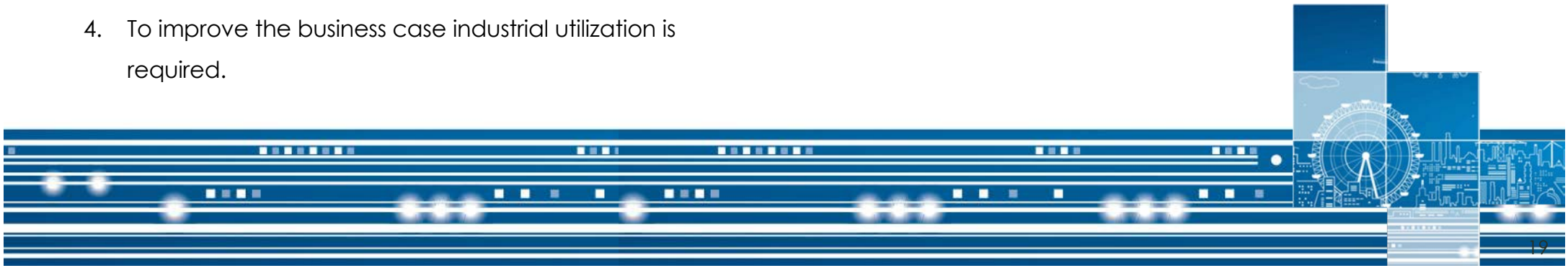


What advances in technology will aid the transition

- **Clean fossil technologies:**

- Carbon capture , Utilization and sequestration (CCUS)

1. CCS lowers the total societal cost of addressing climate change by approximately 30%
2. CCS will not be widely used until carbon dioxide is regulated.
3. Implementing CCS means a new industry must emerge on a large scale to capture, store and inject carbon dioxide deep underground. It's not as simple as adding a device to a plant.
4. To improve the business case industrial utilization is required.



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