



Future Challenges to Power Markets

*Karim Anaya
Geoffroy Dolphin
Michael Pollitt
David Reiner*













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Section 1: Introduction

Background

- Work for IFC with Jevgenijs Steinbuks (WB ex EPRG) looking at the prospects for power markets in IFC client countries for a chapter in a major new report on the Future of Power Markets.
- We look at trends over the next 10 years in the areas of supply (2), demand (3) and climate policy (4) which will impact electricity markets.
- We draw some conclusions for regulators, utility owners and investors.
- We give just a flavour of the rich set of information we have looked at.

Organisational context: lot of variety

| Legal Structure | Ownership <i>Public</i> | <i>Private</i> | <i>Mixed</i> | <i>Total</i> | <i>Example</i> |
|---|----------------------------|----------------|--------------|--------------|---|
|  | 1 | 1 | 2 | 4 | Japan  |
|  | 6 | 2 | 1 | 9 | Philippines  |
|  | 8 | 0 | 2 | 10 | Kenya  |
|  | 12 | 18 | 4 | 34 | UK  |
|  | 23 | 13 | 2 | 38 | Nigeria  |
|  | 67 | 5 | 5 | 77 | Indonesia  |
| Total | 117 | 39 | 16 | 172 | |

T=Transmission, D=Distribution, G=Generation, R=Retail

172 countries: Largest DSO in each country.

Type of ownership is categorised as "mixed" only if the private or public shares represent less than 85% of the total

Source: Anaya, Arroyo and Pollitt, 2020, with inspiration from Trimble et al., 2016.

Demand context: different rates of growth

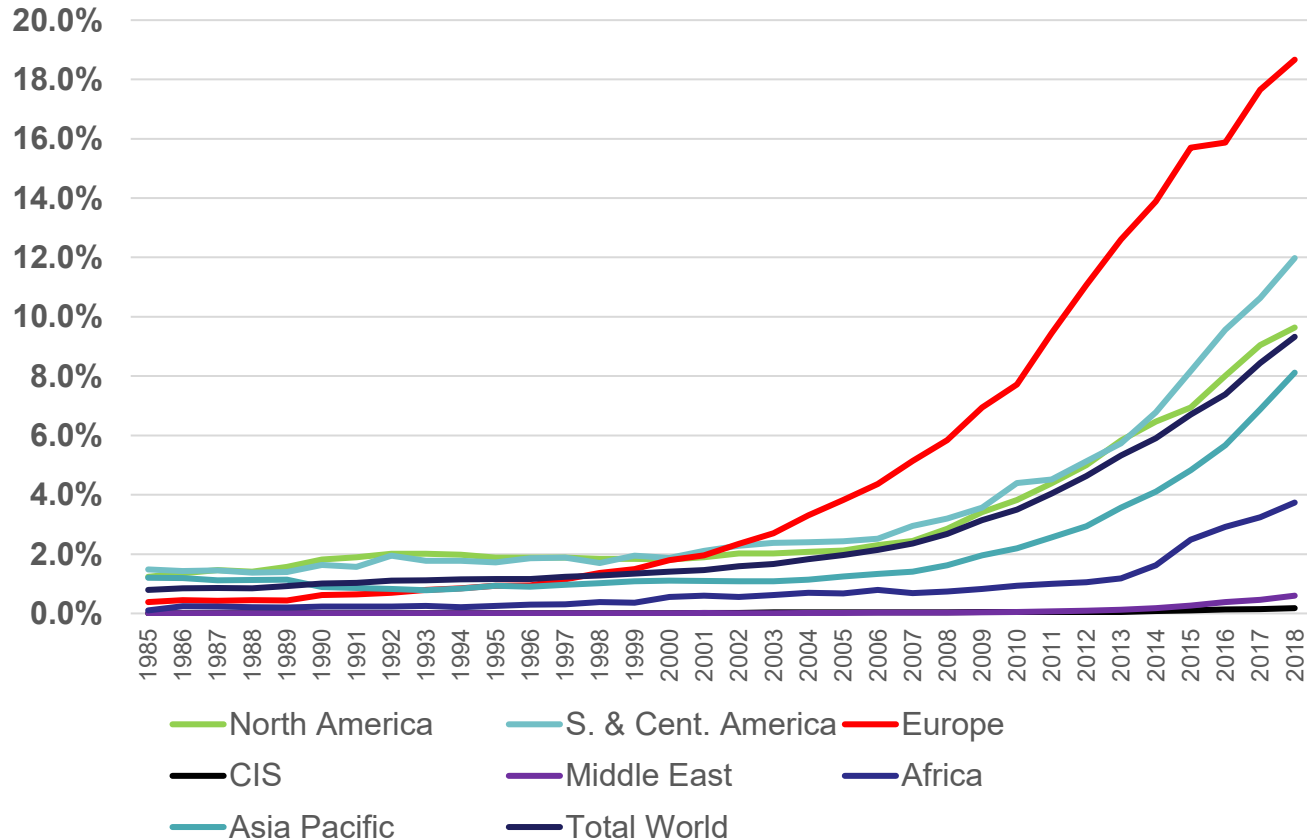
| <i>TWh Generated 2007-17 p.a.</i> | | <i>TWh Generated 2007-17 p.a.</i> | |
|-----------------------------------|--------------|-----------------------------------|-------------|
| World | 2.5% | Middle East | 5.2% |
| of which: OECD | 0.1% | Iraq | 11.2% |
| Non-OECD | 4.9% | | |
| EU | -0.3% | Africa | 3.1% |
| | | Egypt | 4.9% |
| North America | -0.1% | | |
| Mexico | 2.3% | Asia Pacific | 5.2% |
| US | -0.3% | Bangladesh | 9.1% |
| | | China | 7.2% |
| S. & Cent. America | 2.4% | India | 6.3% |
| Chile | 3.0% | Indonesia | 6.0% |
| | | Pakistan | 2.6% |
| Europe | - | Philippines | 4.7% |
| Turkey | 4.5% | Sri Lanka | 4.2% |
| | | Thailand | 2.2% |
| CIS | 0.9% | Vietnam | 11.6% |



Source: BP Statistical Review of World Energy, 2019, p.54.

Supply context: growth of RES

Share of Non-Hydro Renewables in Electricity Generation



Source: BP Statistical Review of World Energy, 2019, p.55.

Climate policy context: some ambition

Table 1.2 Annual Emissions in 2010 and under high INDC target for 2030 (selected countries and regions)

| <i>Annual emissions (million tonnes CO2e)</i> | <i>Historical Data</i> | | <i>INDC Scenario : (High Condition Targets)</i> |
|---|------------------------|-------------|---|
| | | <i>2010</i> | <i>2030</i> |
| <i>EU</i> | | 4275 | 3126 |
| <i>Japan</i> | | 1282 | 1008 |
| <i>Mexico</i> | | 755 | 623 |
| <i>Turkey</i> | | 390 | 929 |
| <i>Brazil</i> | | 2760 | 1172 |
| <i>China</i> | | 10501 | 12810 |
| <i>India</i> | | 2781 | 6509 |
| <i>South Africa</i> | | 506 | 398 |

Source: Boyd et al., 2015, p.40.

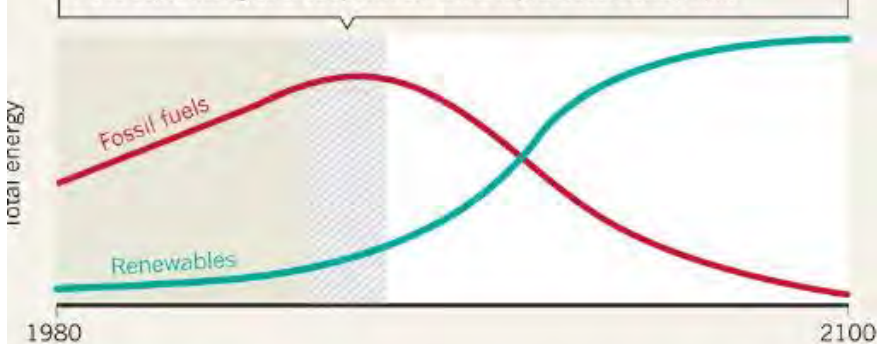
Background of high policy uncertainty...

FOUR FUTURES

Geopolitics in the next decade (hashed regions) will dictate whether or how fast energy from renewable sources will outpace that from fossil fuels, as these four scenarios depict.

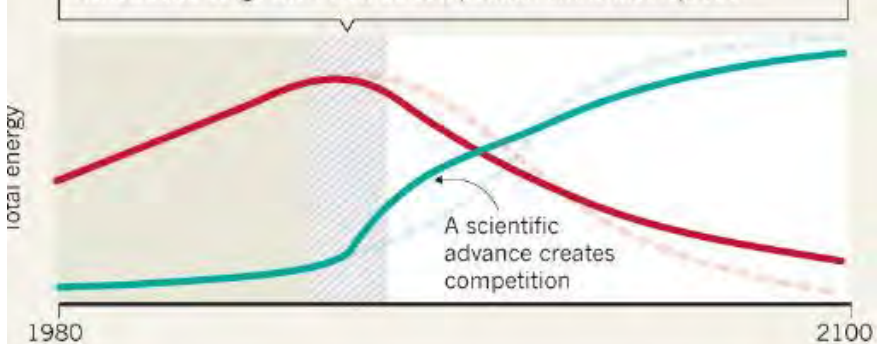
BIG GREEN DEAL

Policies, funding and cooperation drive rapid decarbonization.



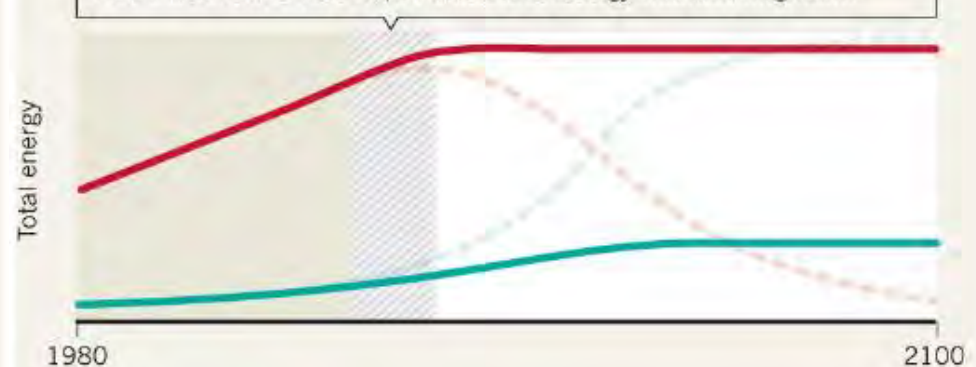
TECHNOLOGY BREAKTHROUGH

Renewables surge then slow as competition limits their spread.



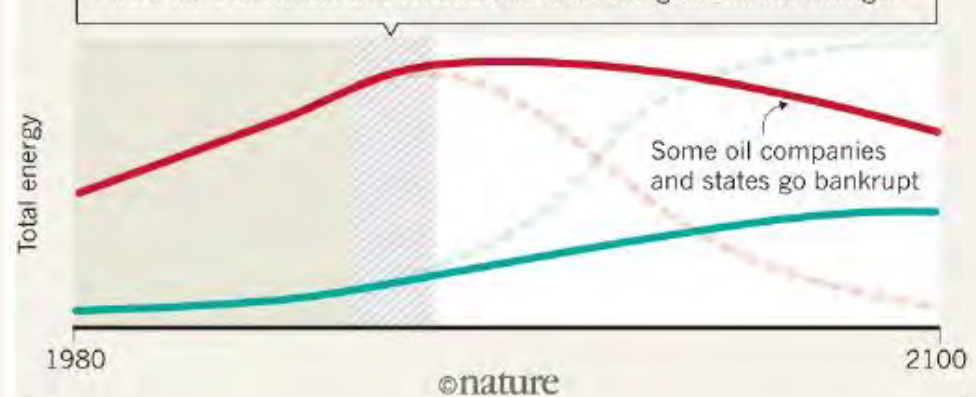
DIRTY NATIONALISM

Fossil-fuel industries are protected and energy markets fragment.



MUDDLING ON

Fossil fuels dominate and renewables fail to mitigate climate change.



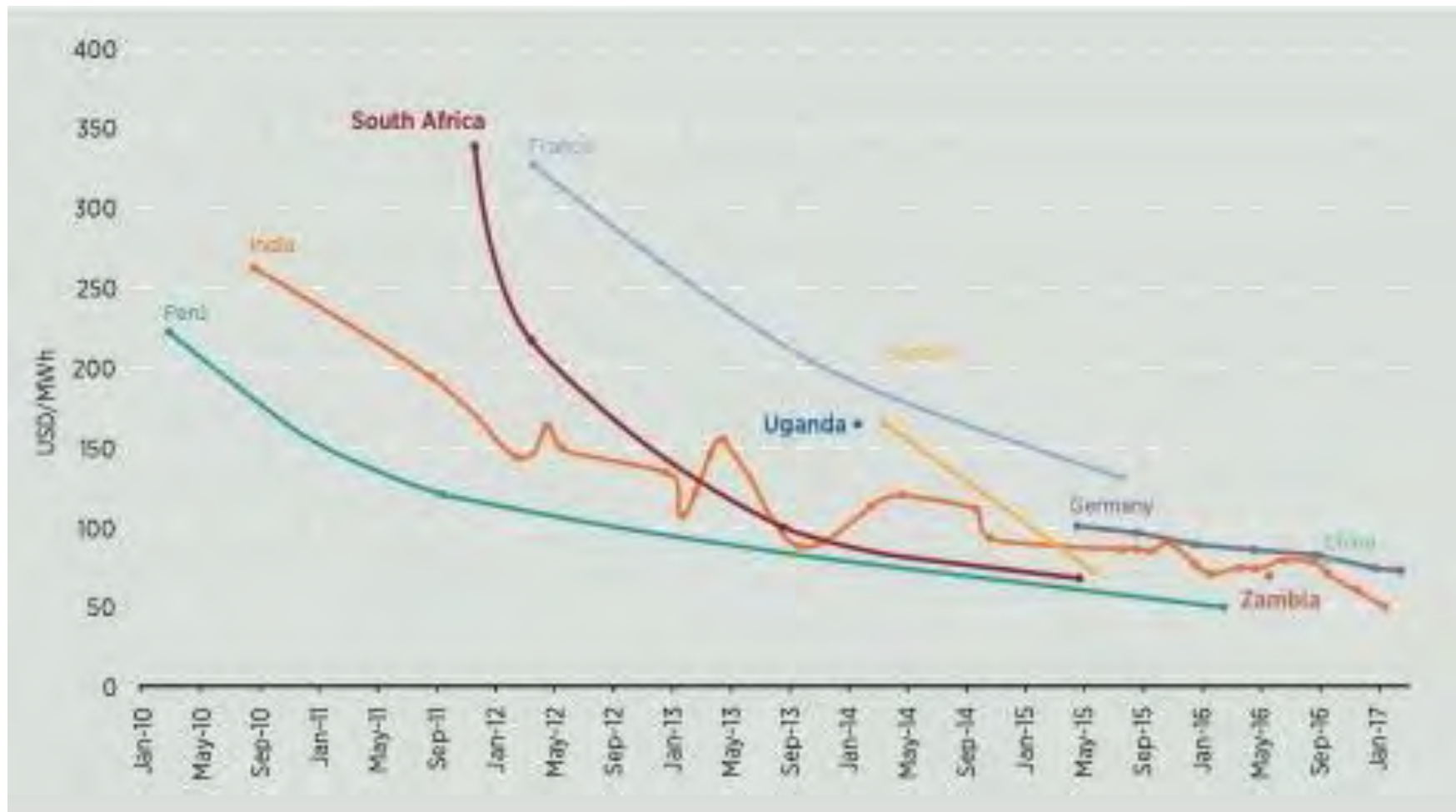
Source: A. G. et al.

Source: Goldthau et al. (2019, p.30), <https://www.nature.com/articles/d41586-019-01312-5>

Section 2: Supply Trends in Power Sector

VRE costs are coming down in developing countries

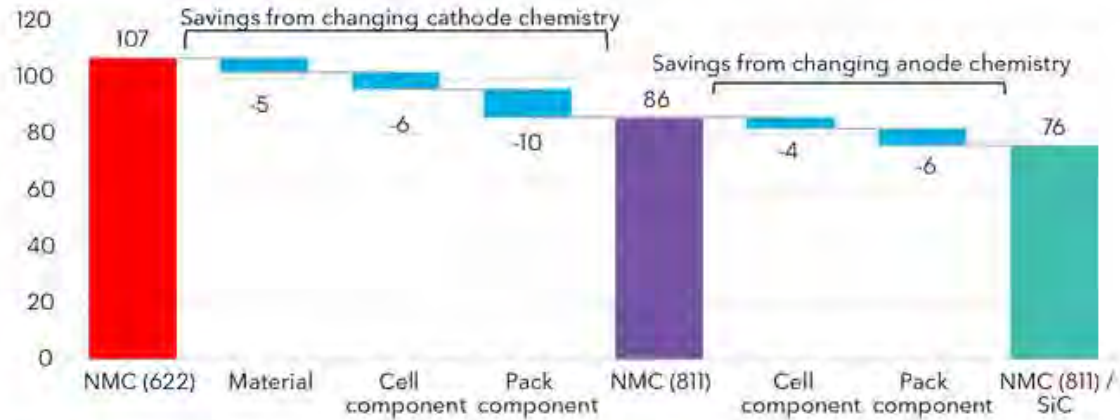
Utility-scale (> 5 MW) solar PV: Average bidding tariff (USD/MWh), 2010-17



Source: [IRENA \(2018\)](#)

But storage developments remain important...

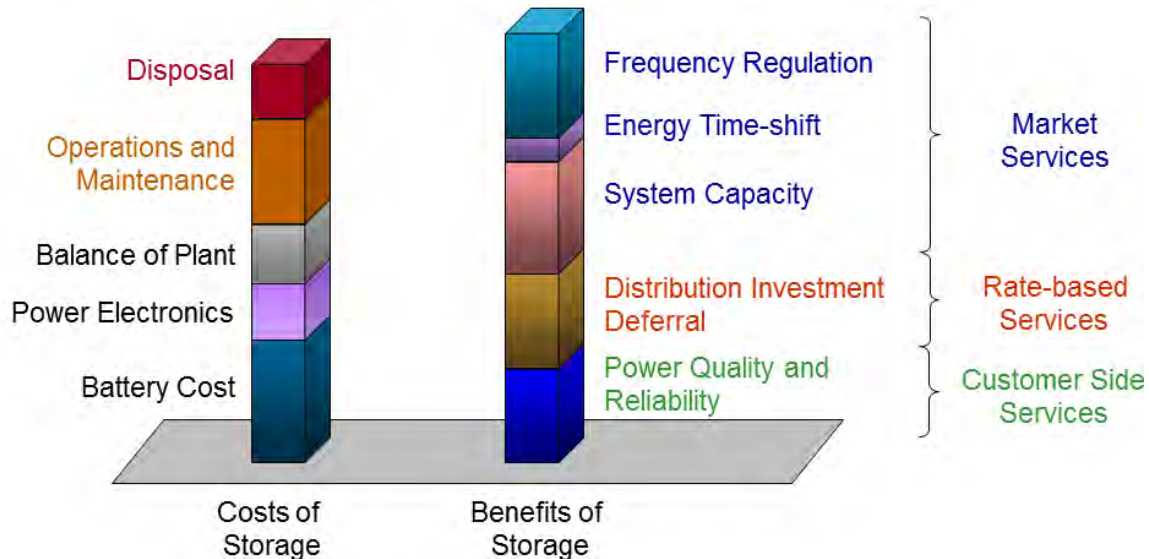
Figure 42: Savings to the bill of materials of a lithium-ion battery pack
\$/kWh



Source: BNEF NEO 2019

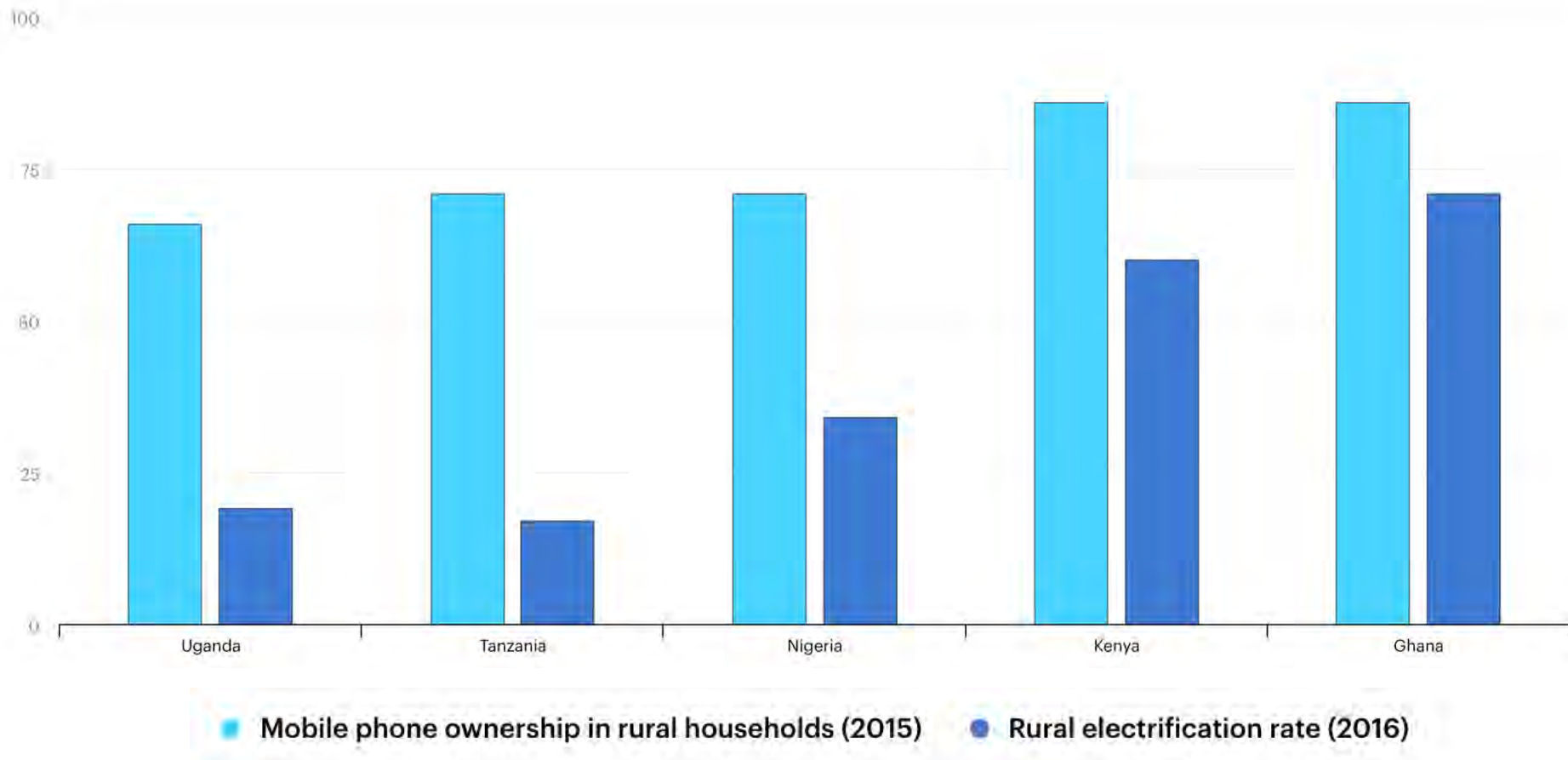
Source: BloombergNEF

Source: [EPRI \(2015\)](#)



Significant innovation possible through digitalisation

Mobile phone ownership and electricity access in selected sub-Saharan African countries, 2015-2016



Source: [IEA \(2017\)](#) Energy and Digitalisation

Section 3: Demand Trends in Power Sector

Population and GDP will drive demand...

- Lower-middle income countries with the largest population share by 2030 (42%, 3.6b).
- The SSA region with the highest rate of annual population growth (2.6% average, 2010-2030).

Fig. 3.2: Average annual population change (%)

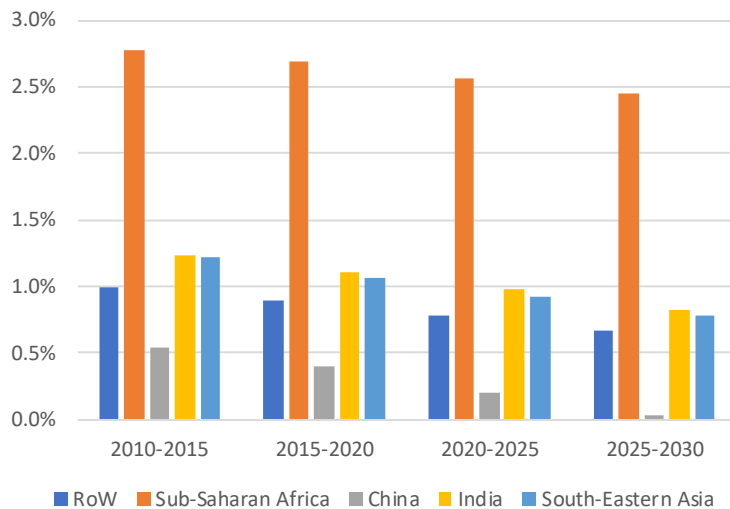
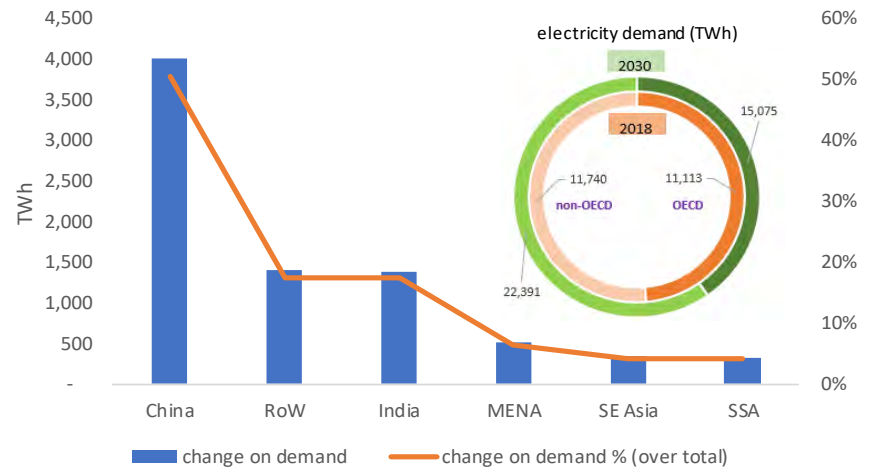


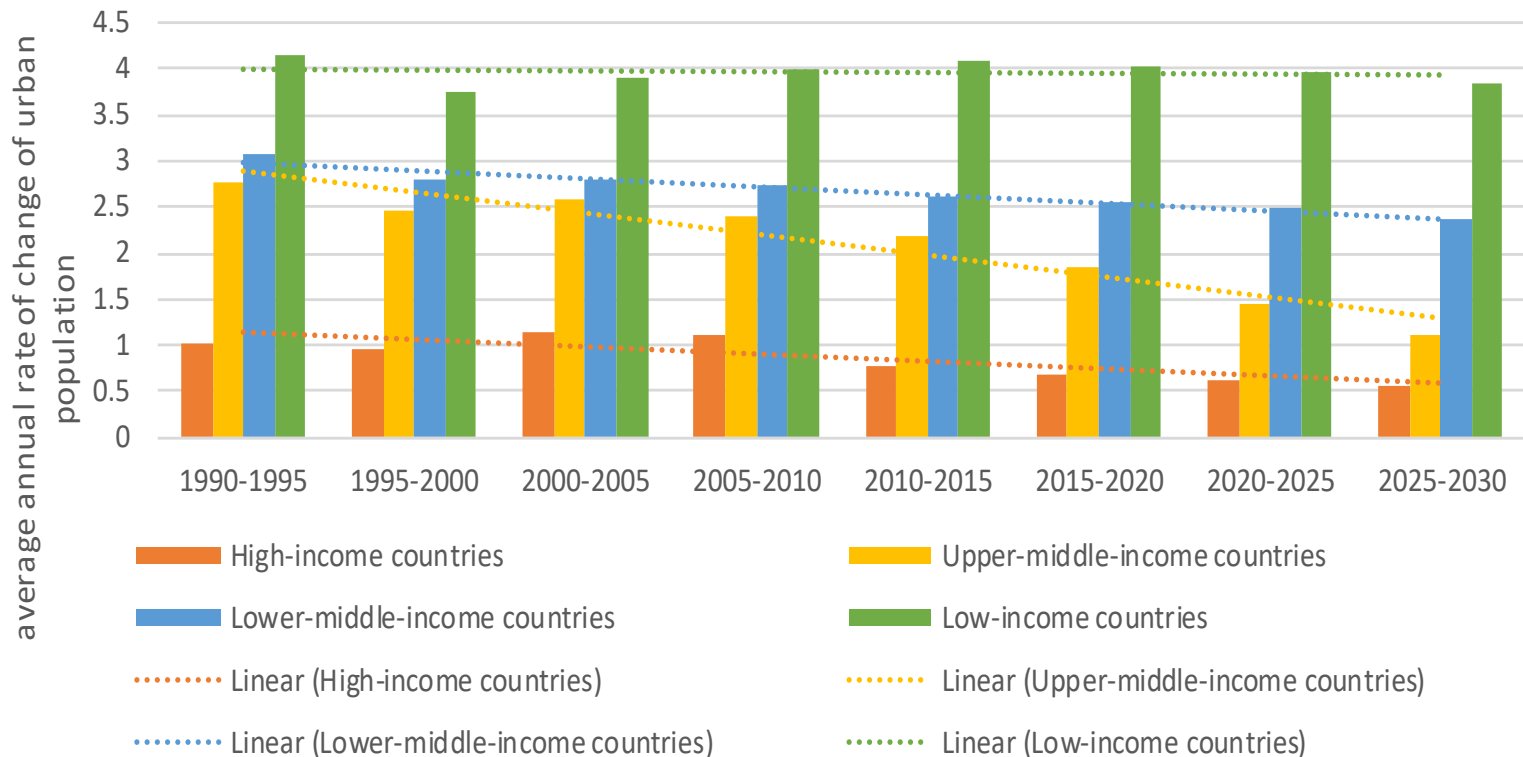
Figure 3.1: Electricity demand change (2018-2030)



Source: BNEF (2019)

As will urbanization...

Figure 3.3: Percentage of population residing in urban areas per type of income



Source: United Nations (2019)

And possibly digitalization...

Figure 3.4: Smart grid index (75 utilities in 35 countries)

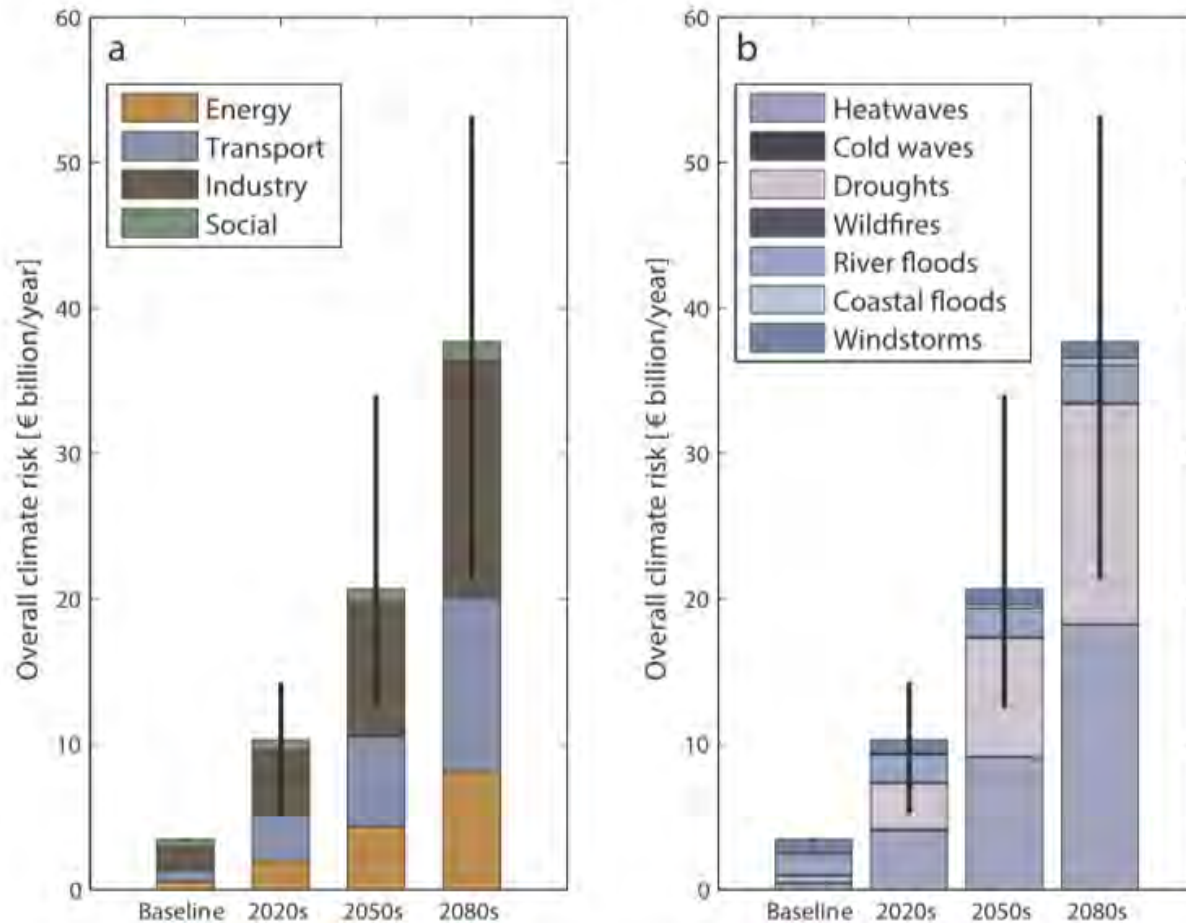


Source: SP Group (2019)

**Section 4: Improving
resilience to climate
change impacts and
[readiness] for
emissions reductions**

Energy infrastructure is vulnerable to climate change...

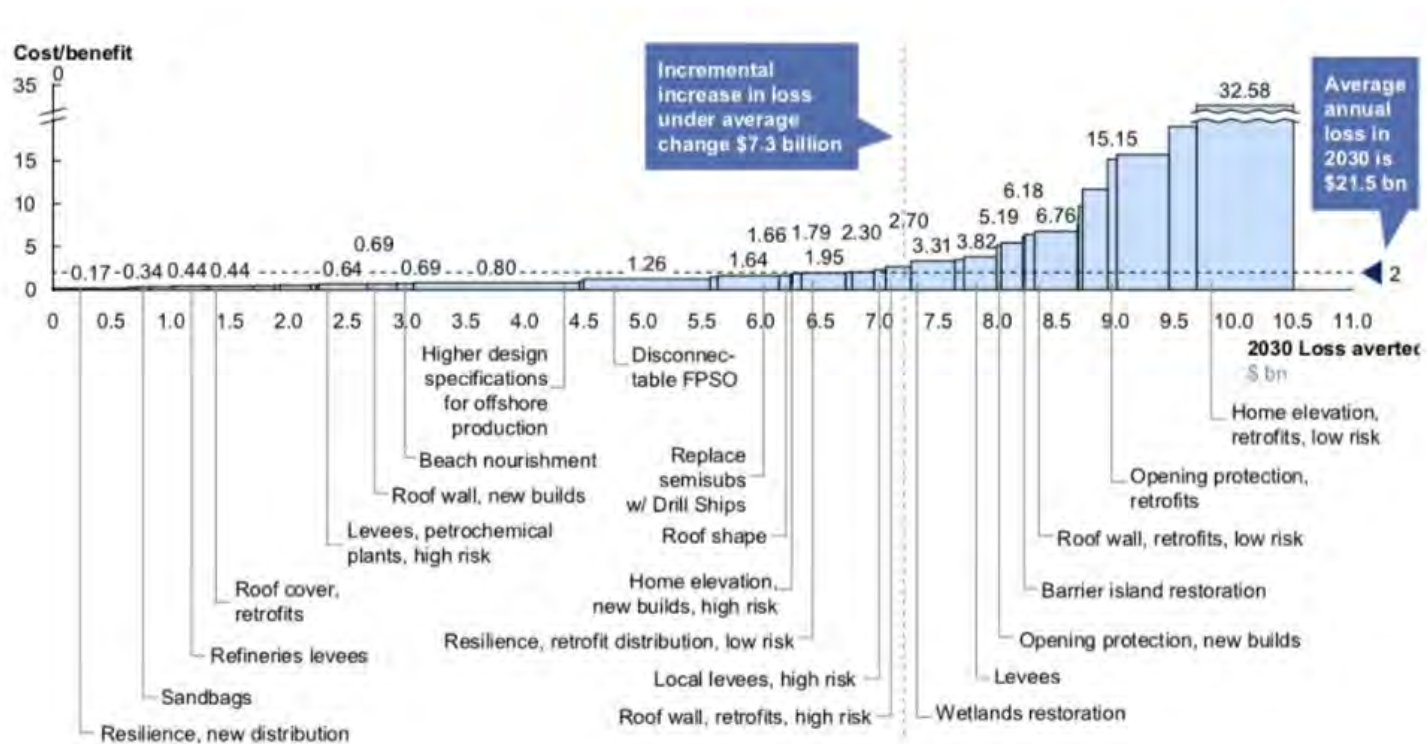
An increase in the frequency of extreme-weather events will lead to more frequent damage to power supply infrastructure, **raising the value of Expected Annual Damage (EAD)** to asset operators and insurers.



Source: Forzieri et al. (2018)

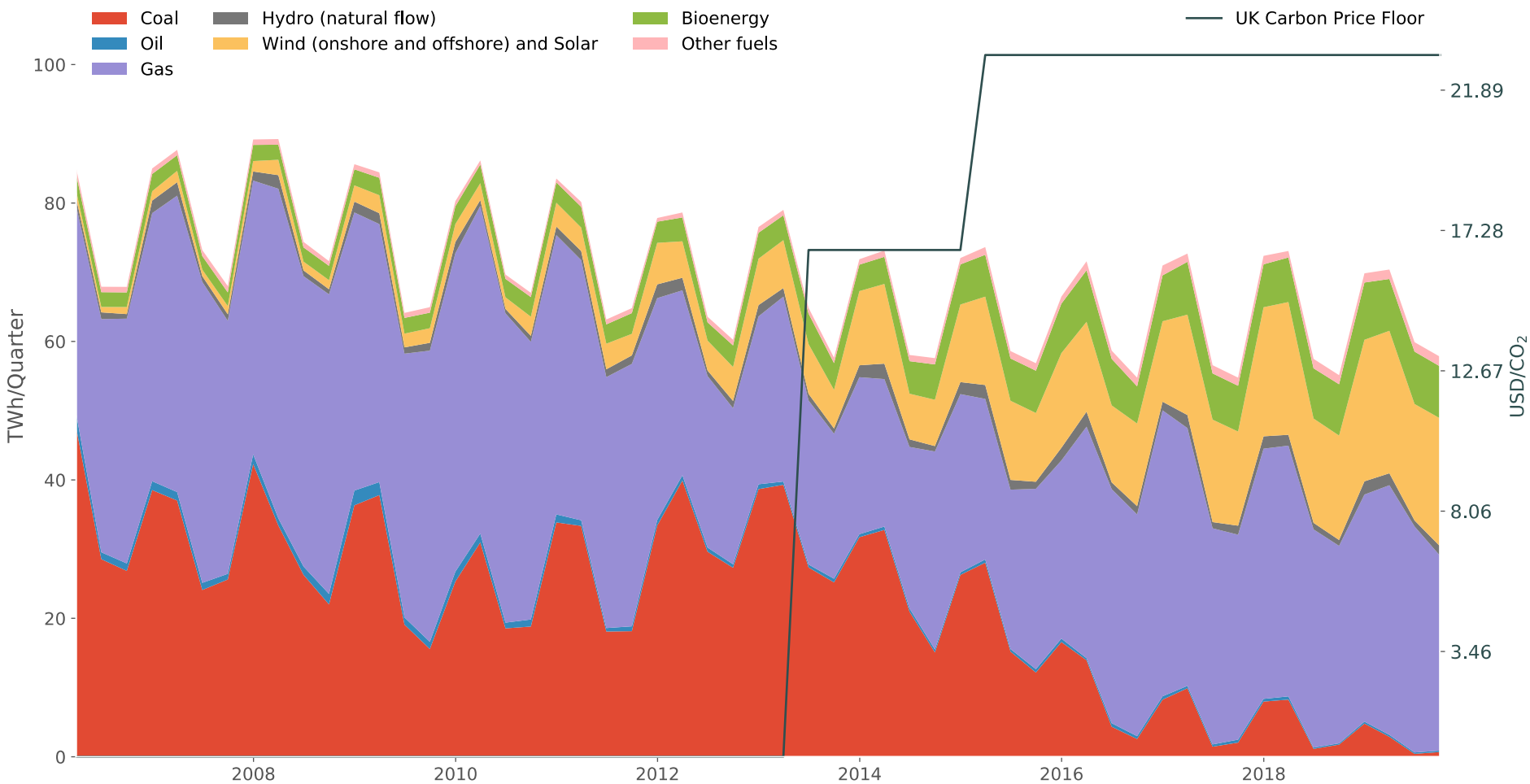
Adaptation will incur additional costs...

Figure 4.3 Climate change adaptation options in the energy sector



Source: Building a resilient Energy Gulf Coast (2012)

Market instruments can help: the case of carbon pricing in GB...



Source: Ofgem (2020), Dolphin et al. (2019)

Section 5: Concluding thoughts

Concluding thoughts

- *Recommendations for regulators:*
- Supporting revenue recovery for the electricity sector remains a key issue.
- Digitalisation can bring consumer benefits but these usually require wider market reforms to be in place to be realised.
- Use of market mechanisms can significantly reduce costs and promote resilience.
- Governments and their regulators must give clear direction on climate policy.

Concluding thoughts

- *Recommendations for utilities/their owners:*
- Focus on learning, coverage and improving revenue recovery.
- Co-operate with third parties to extend access.
- Many utilities will continue to be large and government owned, causing problems.
- Privatisation and extension of private involvement may be beneficial in some countries with good general governance.

Concluding thoughts

- *Recommendations for Investors:*
- Equipment/input markets also benefit from liberalisation.
- Investors should encourage governments to create well-designed energy and climate policy frameworks.
- Regional electricity and carbon markets good for investment and should be encouraged.
- Climate risk needs to be explicitly accounted for in project finance.