Nuclear and Renewables in Global Electricity
Reflections on Recent Developments & Future Outlook

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Legal Cautionary Note

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News surrounding the global nuclear industry is largely sobering unlike the “buzz” with renewables

News Headlines Around the World: Nuclear vs Renewables

Next-generation nuclear reactors stalled by costly delays
- Bloomberg, 2 February 2017

Toshiba is losing money on 2 nuclear plants it’s building in Georgia and South Carolina
- The Guardian, 16 April 2017

Will India say no to risky nuclear deals with bankrupt nuclear majors Westinghouse, Areva?
- Outlook India, 31 March 2017

Real cost of Fukushima disaster will reach ¥70 trillion, or triple government’s estimate: think tank
- The Japan Times, 1 April 2017

Unions warn Areva nuclear waste container fault shows safety flaws
- Reuters, 23 March 2017

China eyes trillion-yuan nuclear power market along One Belt and One Road
- China Daily, 18 April 2017

Renewables break records as wind and solar come online, International Renewable Energy Agency says
- CNBC, 30 March 2017

Cost of renewables fell in 2016, lowering global investment cost in clean energy
- UN News Centre, 6 April 2017

Rural electrification eyes $15 billion renewable lending push
- Bloomberg, 19 April 2017

Saudi Arabia pushes ahead with renewable drive to diversify energy mix
- Reuters, 17 April 2017

South Australia power crisis: Former ETSA chief says state needs nuclear power as renewable energy woes are being watched by the world
- The Advertiser, 24 March 2017

Offshore Wind Farms Offer Subsidy-Free Power for First Time – Dong Energy bid for German Power, Bloomberg 13 April 2017

Source: Internet search
The role of Gas, Nuclear and Renewables a given in a cleaner world?

Source: Shell Scenarios, IEA
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Fast electrification via non-emitting energy resources is critical in a transition towards a higher efficient and lower carbon world.
Nuclear remains an expensive capital-intensive technology when compared against rapidly falling renewable costs

Nuclear capital costs have been escalating at a time when renewable costs (particularly solar) have fallen significantly.

Source: Shell Scenarios
Global electricity capacity is likely to double over the next 20 years but total cost of new investment remains affordable

World Electricity Grid Capacity by Source (Base Case)

Cumulative Investment Cost for Global New Electricity

Source: Shell Scenarios, IEA
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In Europe, countries without nuclear have heavier reliance on intermittent renewable generation for decarbonisation.

### Electricity Generation Outlook: France

![Graph showing electricity generation outlook for France over the years 2017 to 2035.](image)

### Electricity Generation Outlook: Germany

![Graph showing electricity generation outlook for Germany over the years 2017 to 2035.](image)

### Electricity Generation Outlook: United Kingdom

![Graph showing electricity generation outlook for the United Kingdom over the years 2017 to 2035.](image)

### Electricity Generation Outlook: Netherlands

![Graph showing electricity generation outlook for the Netherlands over the years 2017 to 2035.](image)

Source: Shell, Baringa Partners LLP
“Missing money”: Capture prices vs. LCOE Onshore & Offshore wind and Solar
Offshore wind is the only type of renewables to capture prices above its LCOE in some scenarios

Onshore Wind
Offshore Wind
Solar

Source: Baringa Partners LLP 2017

Note: Missing money calculated on new build generation only
Concluding remarks

- Society’s drive for higher end-use efficiency and cleaner fuels with less CO$_2$ emissions means higher rates of electrification of energy use.

- Post 2020, renewables are expected to deliver the cheapest MWh across most parts of the world.

- Nuclear remains a relative expensive option, but some countries will continue developing new capacity for security of supply reasons.

- Electricity market reforms will be required to allow capital cost recovery of all technologies needed.