



The political tipping point

Why the politics of energy will follow the economics

Analyst Note

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About Carbon Tracker

The Carbon Tracker Initiative is a team of financial specialists making climate risk real in today's capital markets. Our research to date on unburnable carbon and stranded assets has started a new debate on how to align the financial system in the transition to a low carbon economy.

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1 Key Findings

The political tipping point is coming. The falling costs of renewables are driving a political tipping point where politicians move from expensive support for renewables to embrace the sector and to tax fossil fuel externalities. This is a key driver of the Inevitable Policy Response show-cased by the UN PRI.

The old thinking. Renewables are expensive, hard to deploy, and need subsidy. Only rich countries can afford to think about the pollution and global warming externalities.

What changed. New energy technologies are cheaper than fossil fuels for electricity and will soon be cheaper for transport. Engineers have increased the feasibility ceiling of renewables to far above the current penetration levels in most countries. Meanwhile, there is rising global concern about local pollution and global warming.

The new reality. Renewables solve the energy trilemma because they are cheaper than fossils, cleaner than fossils, and enhance energy security. They provide local jobs and improve the balance of payments. They reduce local pollution and are popular with voters. They enable technology leadership and enhance energy independence and global power.

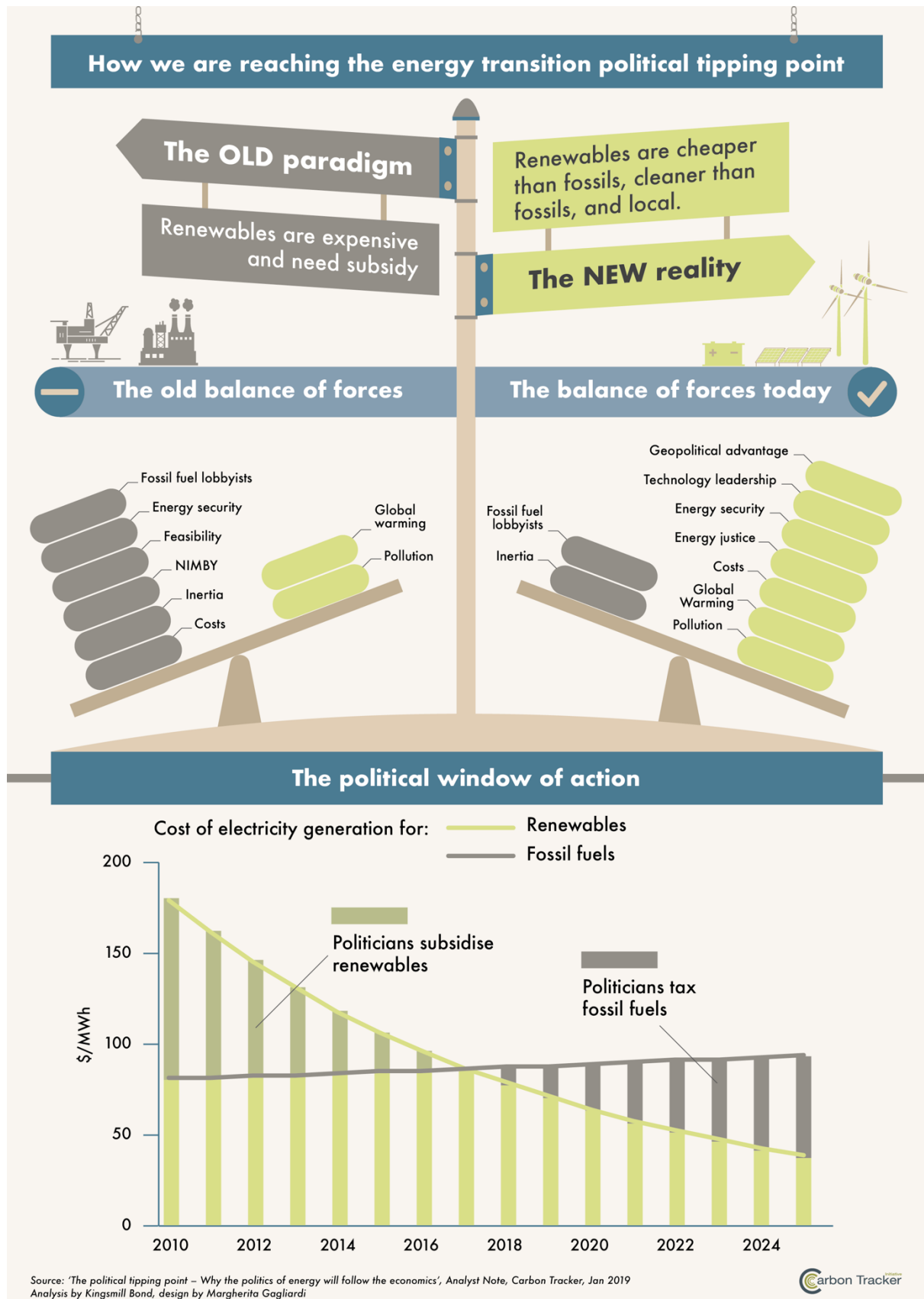
The window of opportunity. This opens up a political window of opportunity as it is now possible to legislate in favour of renewables and to go with the grain of economics. Politicians can simultaneously reduce pollution, reduce costs, gain votes, and enhance national influence.

What is stopping change. The main impediments to change are now inertia and fossil fuel lobbying. Given that fossil fuels are still 80% of primary energy supply and generate rents of 3% of global GDP, this is still a powerful force.

What will politicians do. In those countries where they are able to escape the influence of the lobbyists, they will pursue two routes. On the one hand, they will stop subsidising renewable energy sources directly, and focus on establishing a system in which these can flourish. On the other hand, they will start to tax the fossil fuel sector for the externalities that it imposes on the rest of society.

Who will lead. The political pressures vary widely by country and sector. Leaders will be those that have large fossil fuel imports, major pollution issues, excellent renewable resources, limited corruption, low costs of capital and rising demand. And laggards will be those with large fossil fuel exports, limited pollution problems, electricity sectors fuelled by domestic sources, high levels of corruption, high costs of capital and stagnant demand.

2 Infographic



3 The old framework

We set out below the old framework for the energy debate between fossil fuels and renewable energy.

3.1 The energy trilemma

The energy trilemma is the framework of reference for many institutions, such as the World Energy Council. It is the need to balance energy security, environmental equity and social equity. Or, in more prosaic terms, energy security, pollution and costs.

When renewable energy costs were high, the options for policymakers in broad terms were:

- Renewables, which had a lower carbon footprint and less local pollution but were expensive (and so required incentives), hard to install, and might require the import of foreign technology.
- Fossil fuels which were cheap but had a high carbon footprint and more local pollution. For some countries they were imported, and for others they were local.

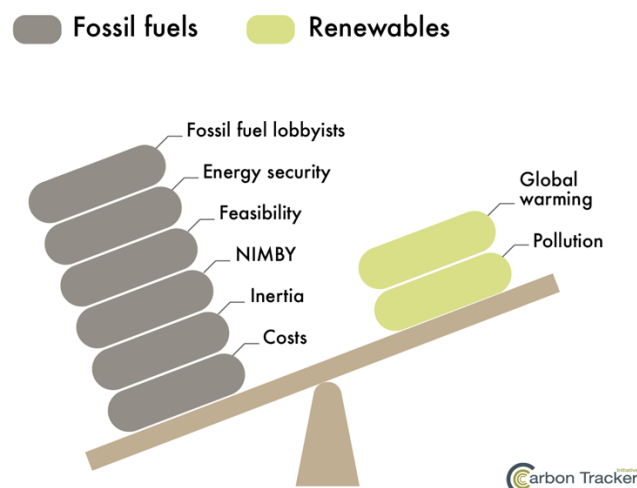
3.2 The balance of forces

The reasons to stick with fossil fuels included lower costs and the difficulty of implementing renewables at scale. Where renewable energy was installed without local support, it encouraged opposition from people who felt it damaged the local landscape, known as the NIMBY (not in my back yard) phenomenon. In addition, the longstanding drivers of inertia and fossil fuel lobbyists encouraged policymakers to favour fossil fuels.

The reasons to move to renewables were less compelling. There were concerns about global warming (mainly a rich European phenomenon), and concerns about local pollution.

Meanwhile, issues such as energy justice and energy security were not especially clear. Higher renewable costs meant that people could argue that coal was needed as an energy source for the poor. And if politicians taxed fossil fuels, the costs simply were passed on to consumers. Some countries had local sources of fuel (such as coal) and were not anxious to replace that with imported renewable energy equipment.

The old balance of forces



The debate was largely one between the cost of the externalities from fossil fuels, and the apparently lower costs of the fossil fuel sector. The approach of politicians was therefore to subsidise the growth of renewables, to increase efficiency, and to tax the worst aspects of fossil fuel pollution. Renewable subsidies caused their own problems, such as inefficiency, high costs and public resistance to bearing higher costs.

3.3 The cost of the externalities

There are two principal externalities arising from the burning of fossil fuels – pollution and global warming. There is little dispute that there are costs – the question has long been how large they are.

- Pollution. The World Health Organisation calculates that air pollution causes 7 million deaths per year, of which 4 million are from outdoor air pollution. They note that 9 out of 10 people breathe polluted air. The OECD, in their report on the economic consequence of outdoor air pollution, calculated that the costs of outdoor air pollution were over \$3tn in 2015, which works out at around \$100 per tonne of CO₂. The costs include deaths, healthcare and lost productivity.
- Global warming. The costs include more severe weather, a higher burden of disease, and sea level rise. There are many calculations on the cost of global warming per tonne of CO₂. The Obama administration used a cost of \$45 per tonne of carbon dioxide as the social cost of carbon, while the Trump administration using different assumption has much lower costs, however a recent paper in Nature Climate Change argued that the cost was over \$400 per tonne.

The problem with the externalities was that they were often paid for by other people and by future generations. Moreover, for many years there was enough uncertainty about how to calculate them that lobbyists were able to muddy the waters of the debate. They admitted that there were some costs involved, but argued that these costs were uncertain and were overwhelmed by the lower costs of fossil fuels compared to renewable energy.

Politicians were more concerned with voters and this generation. So even if the cost of the externalities was clearly higher than the cost advantage of fossils, there were not that many countries which were prepared to take up-front costs in order to make the shift. And then there was also the question of justice - why should people in developing countries pay for the global warming externality when they had not contributed to it.

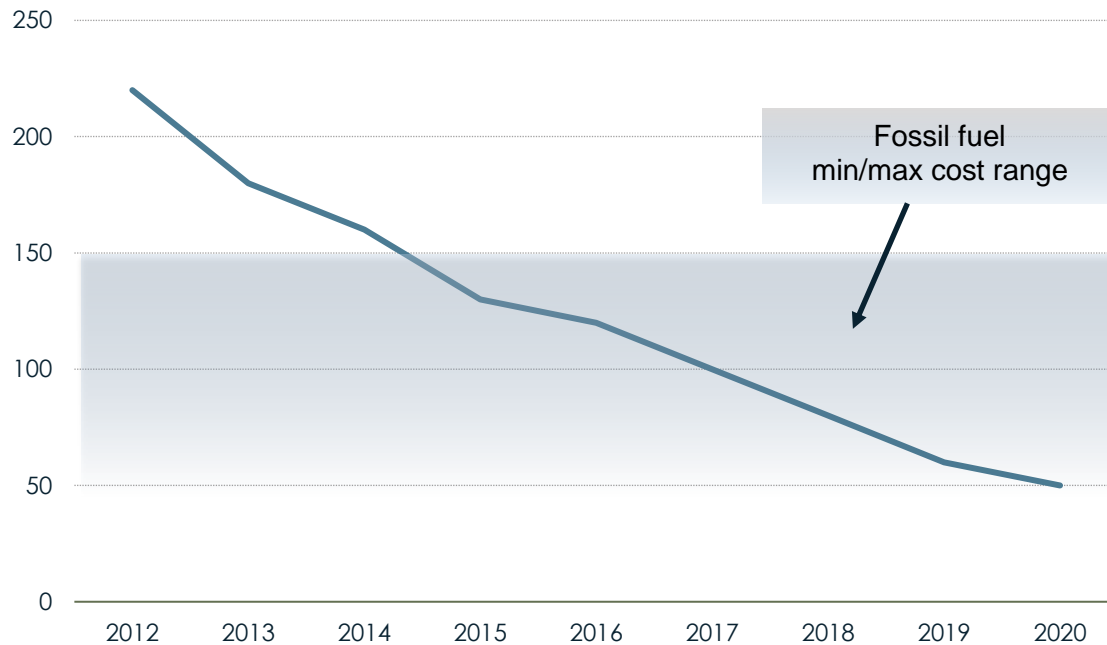
4 What has changed?

Costs have fallen, feasibility issues have been solved, and public perception has changed.

4.1 Fall in costs

The cost of electricity generation from renewables has fallen to below that of fossil fuels. As highlighted by IRENA's work on power generation costs, which we illustrate below with regard to solar costs.

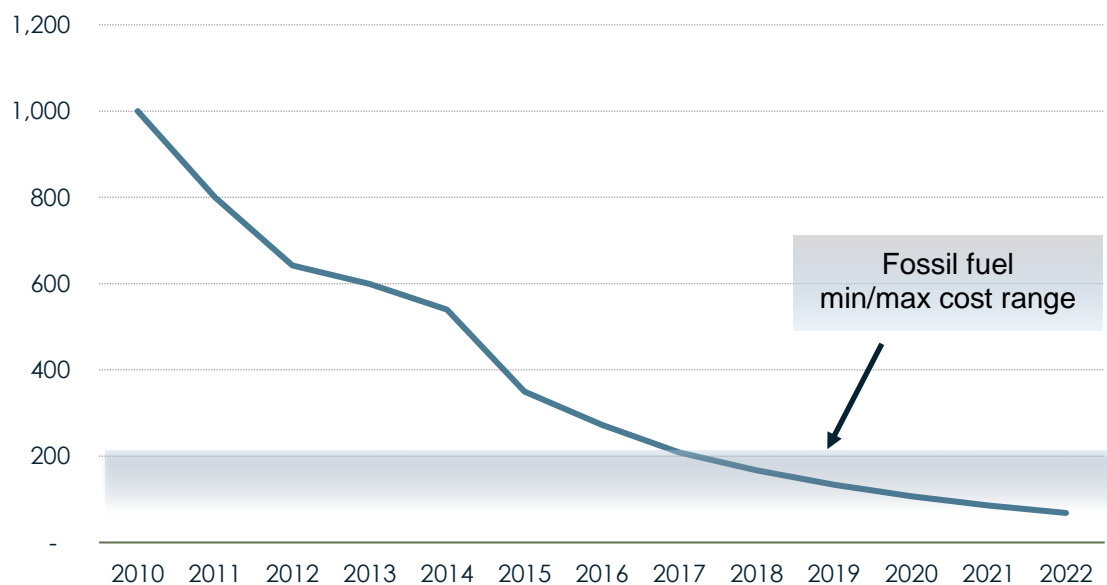
FIGURE 1 – SOLAR ELECTRICITY GENERATION COSTS \$/ MWH GLOBAL AVERAGE



Source: IRENA

And the price of batteries has fallen almost to the level where electric vehicles can compete with conventional cars. As highlighted by BNEF's New Energy Outlook.

FIGURE 2 - BATTERY COSTS \$/ KWH



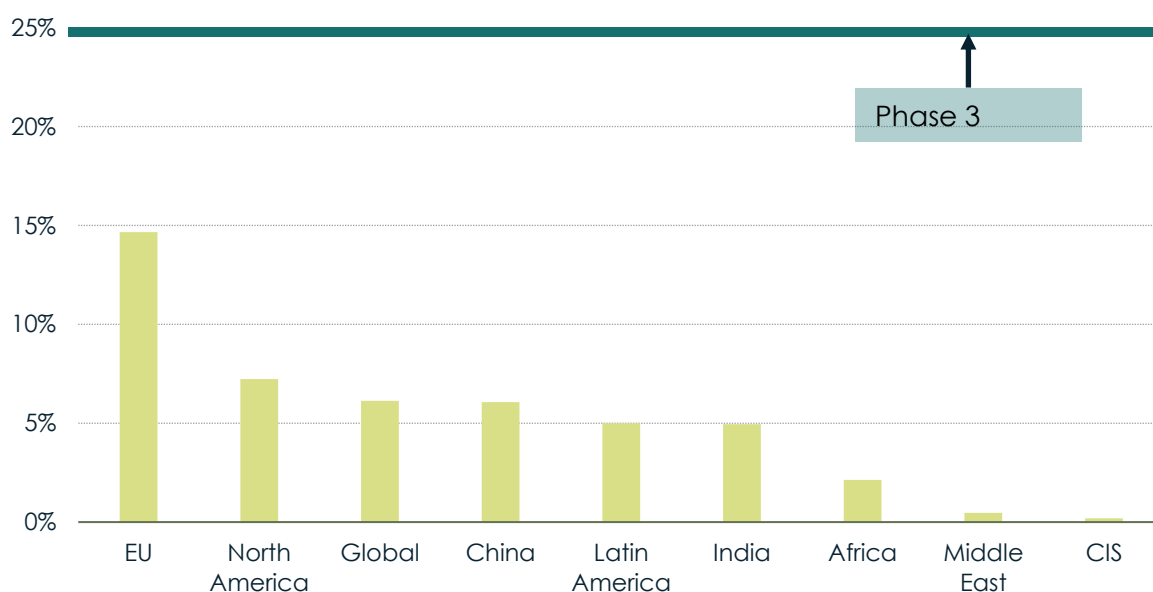
Source: BNEF, CTI estimates

4.2 Feasibility ceiling raised

Much of the debate about the growth of renewables focuses on how to get to 100% renewables. However, this is a rather academic discussion when renewables make up only 10% of global primary energy supply and variable renewables are only 3%. The much more important issue is how much new energy technology can be implemented today. In two specific sectors – electricity (43% of primary energy demand) and light transport (10% of primary energy demand) – the ceiling of economically reasonable technical opportunity lies far above the reality of what has been done in most countries.

For example, in the electricity sector, there are many countries where variable renewables make up over 20% of electricity supply, and the IEA notes that it is feasible to get to 25% solar and wind (what they call phase 3 of the electricity transition) without dramatic changes to the electricity system. And yet the global average is just 6%. So, before the cost of storage becomes an issue, there is much that can be done.

FIGURE 3 - THE FEASIBILITY CEILING. SOLAR AND WIND AS SHARE OF ELECTRICITY GENERATION 2017



Source: BP, IEA

In the transport sector, EV make up half of car sales in Norway, thanks to the Norwegian regulatory and tax structure. And yet in the world they were only 2% of sales in 2018, implying a huge upside as costs fall to a level where EV no longer require subsidy.

Meanwhile, the automotive sector has transformed itself in the last three years, with a plan to spend over \$300bn on electric vehicle platforms and to make many more EV models available. Most notably, four times as much spending will be in China as in the US according to data from Reuters.

4.3 Rise in public concerns about global warming and local pollution

Awareness of and concerns about the health costs of pollution are rising. It is notable for example, that the World Health Organisation (WHO) in 2018 held its first ever conference on the health impact of air pollution, and made a major and noticeable contribution to the COP24 in Katowice. In 2019 the WHO made air pollution and climate change the top of their ten threats to global health.

Meanwhile, an increasing number of cities and governments are putting in place bans on internal combustion engine vehicles and signing pledges to reach carbon neutrality.

This has been accompanied by a rise in concerns about global warming. Both because the physical consequences of warming have become more evident in 2018 and because of the work of the IPCC and other organisations.

5 The new reality

5.1 The impact of fossil fuel taxation on consumer prices

As the price of renewables falls below that of fossil fuels, it follows that regulators can tax fossil fuels without the tax increasing the energy price to the end consumer. Provided of course there are enough new renewable energy sources to meet demand.

To illustrate this, consider the example of a gas-powered generator selling electricity at \$60 per MWh. If the price of solar is \$50 per MWh, then the price of the gas-powered generator will have to fall to \$50 in order to compete.

If regulators impose a \$5 per MWh tax on the gas-powered generator, then the gas provider or the electricity generator will have to absorb this in order to compete. Eventually it will be the gas provider that has to reduce their prices. The impact of taxation in an environment where renewables are plentiful and cheaper than fossil fuels is that the rents of the gas provider will fall, and the tax take of the government will rise.

5.2 What happens to those who fail to change?

For those countries that fail to change, they will face:

- Higher costs for consumers. Carbon Tracker for example has calculated that most coal plants in Europe, the US and China are now loss making, meaning that it is costing either companies or consumers to keep them open.
- Stranded assets from building fossil fuel infrastructure that will be superseded by cheaper renewables.
- More deaths from pollution.
- International opprobrium for failing to reduce their carbon emissions.
- Technology obsolescence as they are leapfrogged by superior technologies.

5.3 How renewables outcompete fossil fuels

The changes outlined above create a completely different framework for the debate between fossil fuels and renewables. As we set out below, this is not simply a question of lower costs, but there are

now other forces such as energy justice and energy security where it is possible to say that renewables are clearly superior to fossil fuels.

- Cost. Costs are lower in the electricity sector and about to be lower in light transport.
- Feasibility. As noted above, the main feasibility issues for renewables have been solved for the time being. Meanwhile, it is much easier to put up a solar panel than a thermal coal plant, a railway, a grid and all the other paraphernalia of the fossil system.
- Pollution. Renewable energy produces much less pollution than fossil fuels.
- Energy security. Renewable energy enables people in countries that import fossil fuels (80% of the global population) to enhance their energy security.
- Global warming. Renewables enable countries to reduce their carbon emissions.
- Energy justice. Renewables offer to the poor lower costs, easier access, less pollution, and less global warming.
- Technology leadership. As matters stand, global leadership in industries such as automotive lies largely with developed market companies such as Toyota, VW or GM. The switch to electric drive trains offers an opening to new companies to obtain global leadership.
- Geopolitical advantage. Energy is power, so those which lead the energy systems of the future can expect to enhance their global power and reach¹.

5.4 The balance of forces today

5.4.1 Fossil fuels

The primary forces remaining which wish to maintain the fossil fuel system are fossil fuel lobbyists and the power of inertia. It is unwise to underestimate the power of these forces, which includes:

- Money. Fossil fuels still produce 80% of global primary energy and generate rents of 3% of global GDP. They have a built asset infrastructure of \$25,000 bn, and that means a lot of vested interests and significant financial firepower to resist change.
- Intellectual inertia. Most analysis of the future of the energy sector is in fact done by oil experts and oil companies. It is not surprising that they see only continuity.
- Physical inertia. For systems already running on fossil fuels it is easy to continue to use them.

Meanwhile, the force of NIMBYism has been blunted by the rising concerns about local pollution and global warming noted above. Moreover, governments have become more skilful at locating renewable energy installations and have worked harder (as in Germany) to involve local people. It is much easier to tolerate a wind turbine down the road if you are earning money for each turn of the blade, and the authorities have closed down your local coal fired power station.

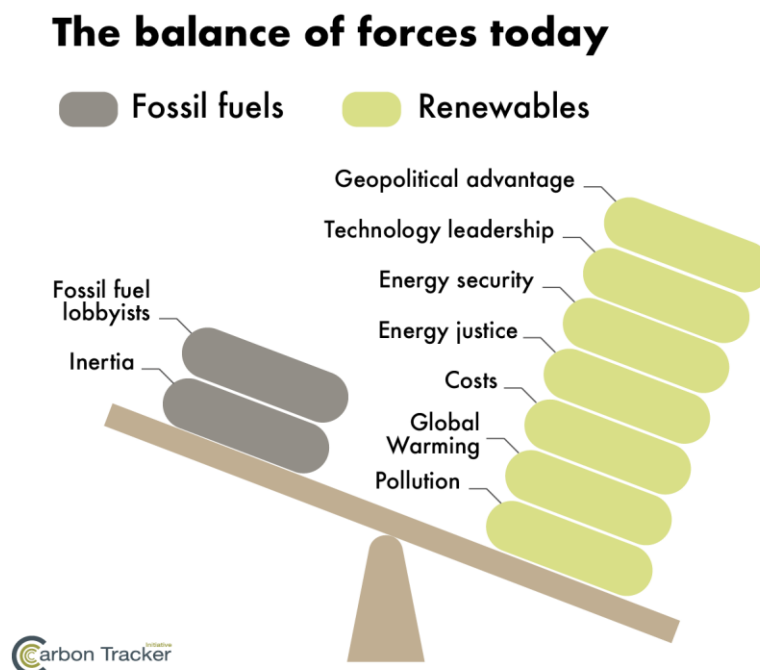
5.4.2 Renewables

Forces in favour of renewables are now a coalition of lower cost, greater energy security, rising concerns about health, and rising concerns about global warming. Added to the mix are the drivers of energy justice, technology leadership, and geopolitical advantage.

¹ *A New World. Commission for the geopolitics of the energy transformation. 2019*

Investors are increasingly aware of the financial risks of investing in fossil fuel companies, as highlighted by the recommendations of the Task Force on Financial Disclosure (TCFD). In turn, they have been successful in encouraging fossil fuel incumbents to transition their strategy.

The balance of forces is in the graphic below.



6 The political tipping point

We believe that the changes outlined above will lead to a series of political tipping points. First in countries such as Denmark or India where the drivers come together. And much later in countries such as Saudi Arabia or Russia where incentives to change are considerably weaker.

This idea of an Inevitable Policy Response has been outlined by UN PRI² in collaboration with Energy Transition Advisers and Vivid Economics. They argue that policy makers will take action during the 2020s in order to close the gap between business-as-usual and the requirements of the Paris Agreement. Part of the analysis notes that developments in technology are necessary in order to enable a forceful policy response.

6.1 What is the political tipping point?

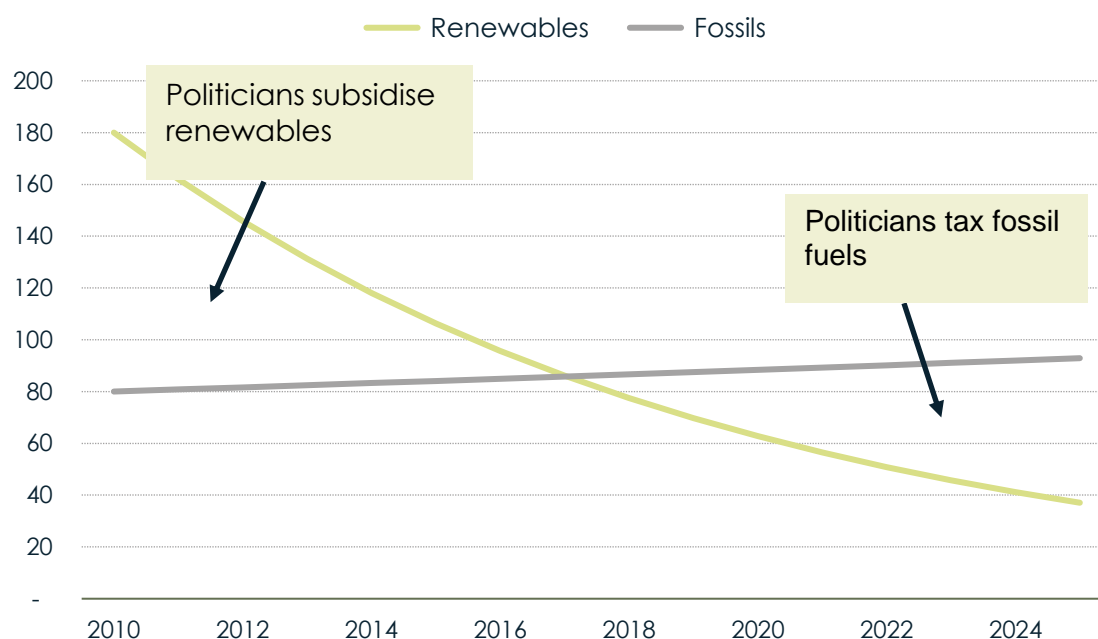
The political tipping point comes as each country realises that the advantages of renewables outweigh those of fossil fuels. At this point, the political calculus changes. In broad terms, politicians will be able to stop subsidising renewables, and will be able to tax fossil fuels.

We set out below the framework for this tipping point, centered around the economic tipping point. As the cost of electricity from renewables falls below the cost of electricity from fossil fuels, so a new framework opens up. This chart is of course a simplification of an extremely complex process

² 'The Inevitable Policy Response'. Vivid Economics for UN PRI. 2018

because the relative costs of renewables and fossil fuels vary in each country, so the tipping point takes place at varying dates. Nevertheless, it illustrates the change that is taking place.

FIGURE 4 - THE POLITICAL TIPPING POINT IN THE ELECTRICITY SECTOR \$/ MWh



Source: CTI

Depending on other factors – some countries (like Norway) will act before the economic tipping point, while others (like the US Federal government) have not yet reacted to the economic tipping point. As a rule, public policy is lagging behind technology and economic changes, and politicians have been quite slow to exploit the opportunity that is opening up. However, a new generation of politicians, such as Alexandria Ocasio-Cortez with the Green New Deal policy in the US, is starting to change this.

6.2 How the political tipping point differs by sector

The political tipping point will differ by sector.

- Electricity. The price of renewables has fallen to below that of fossil fuels in most countries, increasing the pressure for change. However, more countries have large coal or gas deposits, meaning that there is more domestic lobbying capacity. For example, Indonesia has a large coal sector, and struggles to transition to renewables.
- Transport. The cost pressure is only now starting to be felt, but when EV costs do fall below ICE costs, the forces for change are more powerful than in the electricity sector. Most countries import oil from abroad, and the cost of oil is a significant factor in energy imports.

6.3 What will politicians do as the tipping point is reached?

As the economic tipping point is reached, the opportunity for politicians to act is enhanced. They are able to remove subsidies for renewables, and start to tax the fossil fuel externalities. At this point, politicians are able to introduce policies that 'go with the grain' of economic reality. They can underpin cheaper and superior new energy technologies rather than having to subsidise technologies which are unproven and expensive and whose benefits are hard for the public to see.

The steps they can take have been laid out for example by IRENA in publications such as 'Towards 100% renewable energy', and include:

6.3.1 For fossil fuels

- Removal of fossil fuel subsidies.
- More taxation on fossil fuels.
- Ban on pollutive vehicles.
- More stringent regulation on power plant emissions.

6.3.2 For renewables

- Removal of subsidies.
- Renewable auctions.
- Invest in renewable technology solutions.
- Enhance grid flexibility.
- Build EV infrastructure.

6.4 Which countries will lead?

The balance of forces will play out differently in each country and sector, and it is difficult to reduce them to a simple formula. For example, Norway is one of the world's leading fossil fuel exporters and has limited energy demand growth and limited pollution problems. Nevertheless, it has a very well informed public with concerns about global warming and a government that realises the opportunity that comes with being a technology leader, and has become a leader in the EV transition. Equally, the United States is not even a net energy exporter, but has emerged as an unlikely champion of the fossil fuel sector.

Moreover, the drive for change is sector dependent. For example, Poland is a large importer of oil and so has every incentive to embrace a transport transition, but it generates most of its electricity from domestic coal, meaning that the incentive to change the electricity sector is limited.

We summarise below for subsequent analysis the main quantifiable forces of change and inertia. It is immediately clear that there is no country in which all the forces line up perfectly. For example, China fits most of the criteria for change, but has a large domestic coal sector providing electricity.

6.4.1 Forces of inertia

These include:

- Major fossil fuel exporter. For example, Russia or Saudi Arabia.
- Large domestic fossil fuel sources for electricity generation. For example, Poland or Indonesia.

- Denial about global warming. For example, parts of the US.
- Falling energy demand means a less urgent requirement for new capital stock. For example, much of Europe.
- High cost of capital. For example, much of Africa.
- High renewable costs. For example, Japan
- High levels of corruption. Which may enable certain incumbents to frustrate change. For example, countries which score poorly on the Transparency International corruption index.
- Industrial sector tied in to the fossil fuel system. For example, the Japanese coal equipment sector.
- Limited amounts of renewable energy capacity. For example, The Vatican.

6.4.2 Forces of change

These include:

- Major importer of fossil fuels. For example, small island developing states.
- Limited domestic sources of fossil fuels for electricity generation. For example, Spain.
- High levels of domestic pollution. For example, India.
- Well-informed public with concerns about global warming. For example, Norway.
- Low and rising energy demand. For example, Vietnam
- Wealthy. Rich enough to finance the capital costs of the energy transition. For example, Norway.
- Large low cost renewable resources. For example, Chile.
- Government which wants to lead in new areas of technology. For example, China.
- Government which is concerned about energy security. For example, Germany.

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