FUNDAMENTALS

The renewable revolution

A **renewable revolution** is taking place in the way we produce and consume energy and it presents an enormous opportunity for investors.

Nick Stansbury joined LGIM in 2013 and is a fund manager on the Inflation Plus team within Active Equity. He joined LGIM from Revelation Capital, an equity hedge fund focusing on special situations.

THE WRONG QUESTION

Investors, analysts and policy-makers are asking the wrong question about renewables. The question is no longer 'can renewable energy sources economically compete with traditional electricity generation?'

Economies of scale, technology improvements and the move to large-scale installations (both larger wind turbines and larger solar farms) have delivered cost improvements exceeding even the most optimistic forecasters' predictions. The dream of 'grid parity', the point at which renewables are cost competitive with traditional fossil fuels, has arrived in many countries.

We have already seen this shift domestically. The first subsidy-free solar power plant was built earlier this year in Flitwick, providing enough power for 2,500 homes in the UK.

When it comes to the renewable revolution, investors should instead be asking:

- What are the investment opportunities?
- What are the risks?

INVESTMENT OPPORTUNITIES

Renewable energy

Revolutionising the global energy system requires an inordinate amount of capital. Estimates vary but the total investment required could be as high as US$30 trillion between now and 2050.

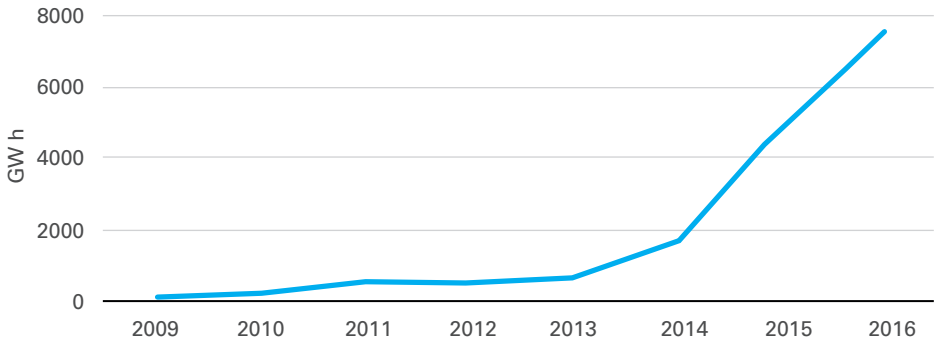
This represents an immense investment opportunity, as the required capital will have to be provided by global capital markets. In developed markets, particularly the UK, the ongoing requirement for fresh capital should ensure the regulatory regime will continue to support existing renewable capacity.

Legal & General
INVESTMENT MANAGEMENT

Batteries

In markets further along in the renewables revolution, it is increasingly important to find an effective storage solution. In Germany, an abundance of renewable supply at certain parts of the day means the current price of electricity is one of the lowest in Europe. However, a lack of adequate storage means an enormous amount of energy is 'discarded', costing millions of euros in lost power and higher household energy bills (Figure 1).

Figure 1: Discarded renewable production (Germany)



Source: LGIM estimate

If the power generated by renewable sources cannot be stored for periods of time, unlike barrels of oil, they cannot be relied upon to be a constant source of energy.

Studies suggest that when renewables are providing most of the world's energy, storage facilities will need to potentially accommodate up to **16 weeks** of total demand. For context, the total available (pumped) storage capacity in the US (the most affordable format of large-scale energy storage available) today is equal to approximately **40 minutes** of total demand.

As a result, we believe large-scale investment in batteries will be necessary. This means significant long-term opportunities for investing in the suppliers of the raw materials required for mass storage solutions. This will, however, take time. What about the near term?

What about going nuclear?

Historically, most mainstream forecasters modelling the energy transition have assumed a substantial increase in the use of nuclear power. By far the cleanest source of power, nuclear produces less CO2 on a like-for-like basis than even solar or wind. A scalable and easy to dispatch source of near-zero carbon energy, there is a lot to like about nuclear power.

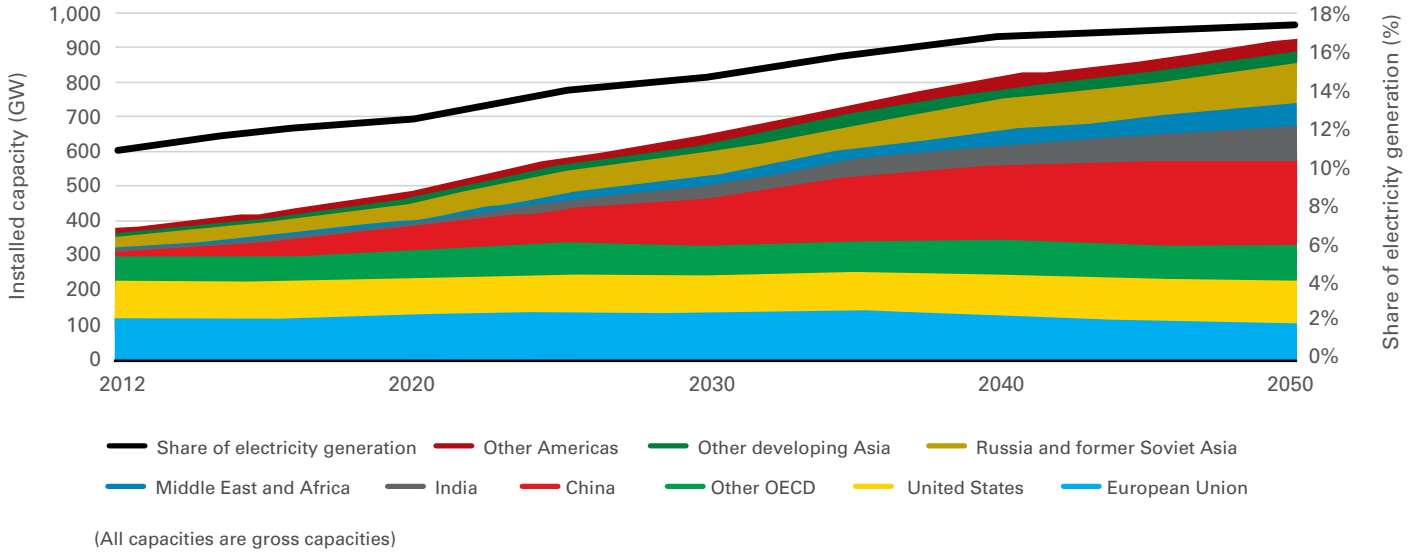
Nuclear faces two existential threats, however. The first is public perception. The Fukushima-Daiichi disaster in 2011 was the most serious nuclear incident since Chernobyl in 1986. With thousands of people displaced and a significant number of deaths resulting from the evacuation, the disaster has had a dramatic impact on public perception. Opposition to nuclear power intensified both within Japan and internationally in countries such as South Korea and Germany, which is planning to close all nuclear reactors by 2022.

The second threat is economic. Nuclear power stations need long-term stable pricing to generate positive economic returns. The volatility of electricity pricing has increased dramatically as more renewable sources are adopted.

We believe there is a clear opportunity to reduce nuclear operating costs through standard-isation. Here in the UK, Hinkley Point C—one of the most expensive nuclear power stations being constructed globally is one example. A long-term price guarantee of £92 per megawatt hour (Mwh) pan nuclear compares poorly with offshore wind projects struck at a headline level of £57/Mwh. Nuclear can be built much more cheaply than this.

A renewable revolution that does not make use of nuclear will likely be much more expensive and challenging. Without a change to policies, much existing nuclear capacity is at risk of closure and the price of potential additions would likely deter would-be investors.

Figure 2: Nuclear capacity and share in a 2°C scenario



(All capacities are gross capacities)

Source: LGIM estimates

INVESTMENT RISKS

Plugging the gap

While the supply side of the renewable revolution may be constrained, 'demand-side management' can help alleviate some of the volatility. Consumer demand is not evenly spread across all hours of the day or months of the year. In warmer countries, we see a summer demand spike as people turn on their air conditioners. In the UK, as seen in Figure 3, the early morning demands for hot water is minimal compared to the evening spike in cooker usage.

However, early evidence suggests domestic consumers will move their demand patterns to adjust to the cost of electricity. When the cost of electricity is higher at a certain time of the day, demand will shift to a more manageable period. Demand-side management is not the only response, but we are optimistic that the rapid evolution of smart-grid technology can make a meaningful contribution in this area.

Stranded assets

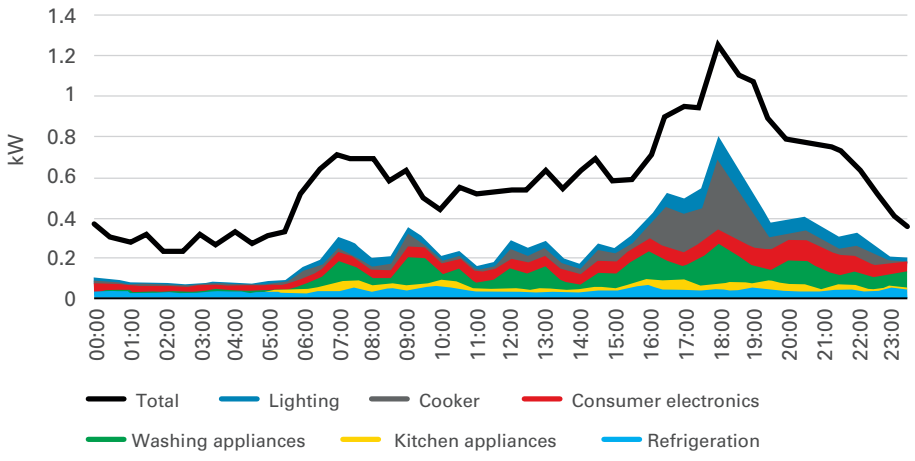
Companies and investors unprepared for the current transition to renewable energy face a real risk of value destruction. In order to meet the challenge of just a 2°C temperature rise, a significant volume of fossil fuel reserves cannot be extracted and burned.

Yet large investments are continuing to flow into long-term fossil fuel assets whose economic viability is increasingly uncertain.

Renewables are and will continue to compete against nuclear and natural gas on the basis of price, and against coal on the basis of societal pressure over air pollution.

This is not to say fossil fuels are at immediate risk of redundancy. We will continue to require fossil fuels

Figure 3: Domestic power demand for key appliances



Source: Customer-led Network Revolution

for some time to come. However, investors and energy companies need to plan for the transition and allocate capital accordingly.

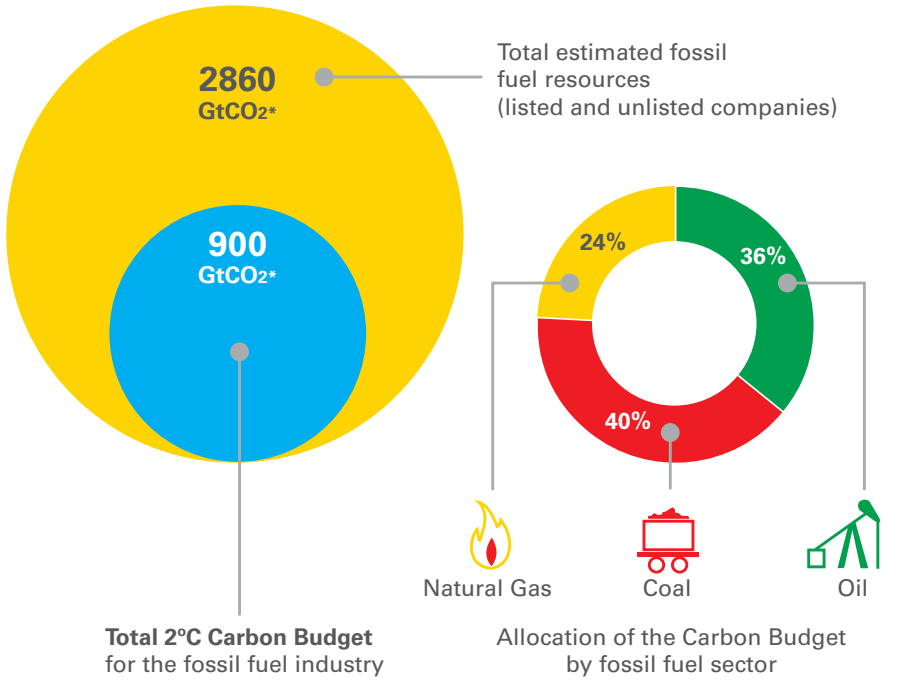
LGIM has committed to addressing climate change on behalf of our investors by engaging directly with the largest companies in the world. The companies will be assessed rigorously for the robustness of their strategies, governance and transparency in relation to climate change.

Implications for global productivity

There is another implication of the renewable revolution that is less frequently discussed. The global economy is built on the foundations of our energy system: the ability to gather and convert energy efficiently into economic activity. In other words, how much energy does it cost to mine coal, transport and burn it compared to the cost of assembling and running a solar panel or wind turbine?

A way to measure this efficiency is the ratio of energy return on energy invested – how much energy we receive after putting the energy in. This metric is highly subjective and the subject of significant academic debate. However, while the consensus is that the headline cost of renewables today is reasonable, the actual return on energy invested is extremely low compared to sources like coal and gas.

Solar power compares particularly poorly, with wind not far behind. Producing polysilicon, the building block of modern solar panels, and steel for wind turbines are very energy intensive processes, often using coal.



Total 2°C Carbon Budget for the fossil fuel industry

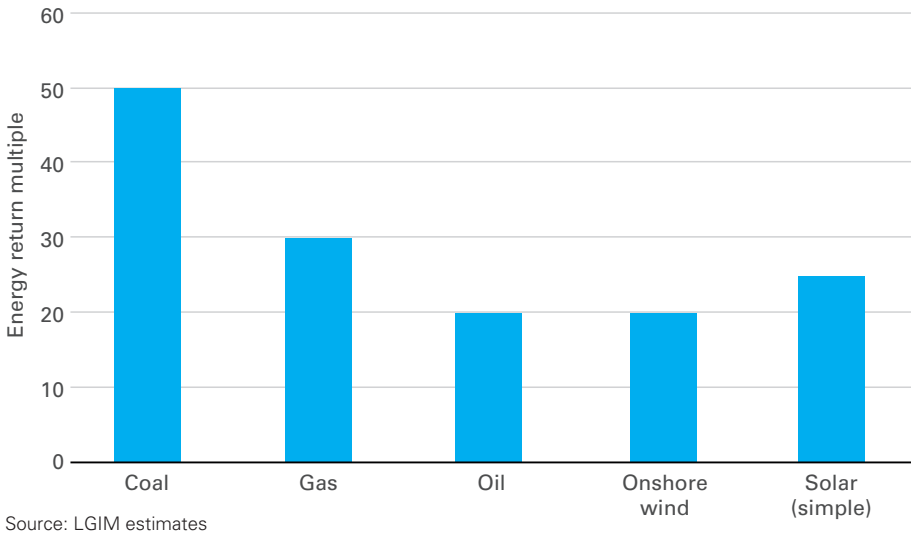
Allocation of the Carbon Budget by fossil fuel sector

Source: Carbon Tracker, Unburnable Carbon 2013
*Gigatonnes of carbon dioxide

Renewables are also significantly more labour–intensive than conventional power generation. This is often considered an 'advantage' of renewables, as lobbyists argue the renewable revolution will 'create' many millions of new jobs. In reality, a higher labour intensity implies a negative drag on economic productivity and therefore a lower return on energy invested.

Today's renewables are supported by our conventional power system. As we transition to a world without that support, it is far from clear what the productivity implication will be.

Figure 5: The energy return of renewables versus traditional fossil fuels



Source: LGIM estimates

CONCLUSION

THE KEY ROLE OF CAPITAL MARKETS

What does this all mean for the future? Despite a lot of unanswered questions, the central implication of global policy is clear: capital markets will need to fund a generational investment programme to rebuild the entire global energy system. We believe the need for substantial capital investment will lead policy makers to create and maintain a constructive investment environment.

Renewables are likely to play a growing role in long-term investors' equity and credit portfolios. Alongside the investment opportunities, the energy revolution poses significant challenges. The impact on energy markets of peak demand is (extremely) uncertain but likely to bring about increased volatility. Investors should take the risks of stranded assets seriously and revaluate the risks in investing in the countries and companies most dependent on carbon-intensive economic activity.

The answers are complex, but many investors are still stuck asking the wrong questions. The revolution has already started – are you ready for it?