New Energy

Energy demand

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Marginal change moves markets

Marginal change is the driver of markets.

It is marginal change, not systemic change that moves markets. Thus, the impact of the shift from fossil fuels to renewables will start to be reflected in stock prices within five years.

Key judgments

- **How marginal change works.** As soon as a new energy source supplies all growth in energy demand, demand for the old energy source starts to fall, whereupon prices are dragged down and the industry faces disruption.

- **Recent changes in energy markets.** Marginal change has recently transformed the global coal and European electricity markets. As demand growth slowed, commodity prices fell, share prices slumped and those industries were disrupted.

- **This has happened before.** The historical record is replete with examples of the rapid impact of marginal change on incumbents. UK demand for coal for transport began to fall in 1913 when oil had a market share of 2%, and UK demand for gas for lighting began to fall in 1907 when electricity had a market share of just 2%.

- **Solar and wind are driving rapid marginal change.** In 2015, 51 per cent of incremental energy supply already came from non-fossil sources (mainly solar and wind). At current growth rates, fossil fuel demand will stop rising by 2020. The implication is that the disruptive change already seen in parts of the energy sector will spread across the entire energy complex.

- **What should investors do?** Investors should reduce their weighting to the incumbent energy sector as a whole, and prefer those companies that embrace change (by for example running their business for cash) over those that reject it.

Important information
Please see disclaimer ⓘ

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Introduction

In previous notes (see, for example, Fossil fuels: The beginning of the end, published on 20 April 2016) we set out the transition path from fossil fuels to renewables in detail. The argument is simple: that at current growth rates (20 per cent for solar and wind supply, 1 per cent for global energy demand and 2 per cent for nuclear, hydro and biomass supply), there will be no incremental demand for fossil fuels after 2020.

In this note, we look in more detail at the question of why the end of growth matters for incumbent energy producers.

Most of the literature on energy transitions focuses on the question of how long it will take for a new energy source to obtain a significant share of the market, variously defined as 25 per cent, 50 per cent or more. Excellent work has been done in this area by such academic luminaries as Vaclav Smil, Roger Fouquet or Benjamin Sovacool. The answer to the question is, inevitably, a very long time. Total energy transitions are measured in decades.

However, equity investors are focused on a very different question: how long will it take for change to have an impact on the incumbent energy companies. These companies make up around 15 per cent of global equity indices and 25 per cent of global bond markets. The answer – as we explain below – is that incumbent energy companies are impacted by marginal, not total, change. And marginal change can happen when the challenging technology is only a small part of the system. The implication is that investors cannot rely upon the narrative of slow change of the entire energy system over decades; they need to focus on the rapid marginal change taking place right now.

The theory

It is axiomatic that markets are moved by marginal change rather than by total change. Commodity prices react to changes in the balance of supply and demand, and stock prices react before those changes as markets seek to anticipate. Moreover, once management teams can see that future prices will be lower than current ones, they maximize production and find new markets. This speeds up the process of change.

Charts 1-3 below show the kind of framework – prices, total volumes and incremental volumes – that we would expect to see as new energy technologies replace old ones. We deliberately lay out the argument in the three charts in stylized form. Our intention is not to give precise forecasts but to illustrate the process of change.

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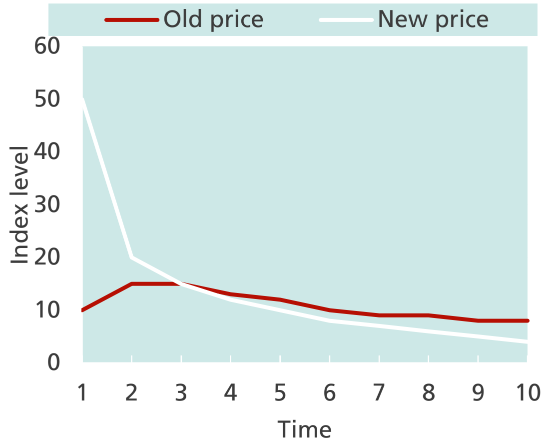
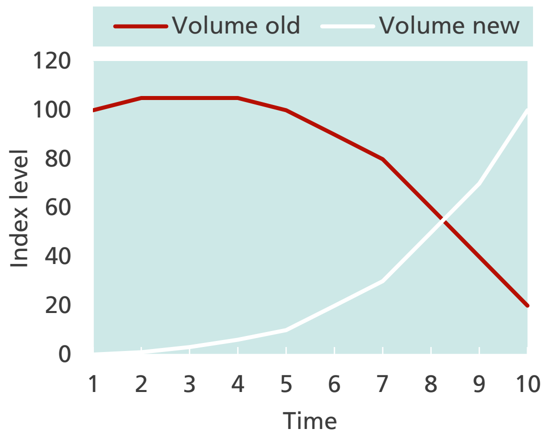
Chart 1: Pricing



Source: TSRP.

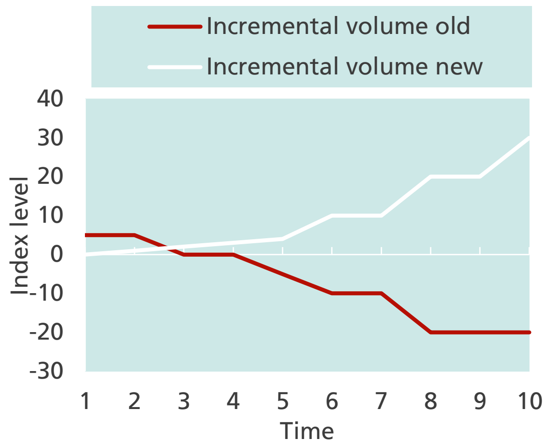
New technologies tend to be taken up by early adopters at high prices. As the price falls, the take-up increases; and even before the price cross-over point is reached, the demand for the old technology is already falling. The old technology is able to cut costs and reduce prices for a while (the "sailing ship effect"), and prices may fall to match those of the new technology. However, the technical limits of the old technology are eventually reached; and in the meantime, the new technology costs keep on falling to levels that the old technology cannot achieve. At this point, demand for the old technology declines very rapidly.

Chart 2: Total volume



Source: TSRP.

Chart 3: Incremental volume



Source: TSRP.

What is important to note in this type of framework is:

- Price is the key driver.
- The lack of infrastructure for the new technology is not an insurmountable impediment.

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- The old technology stops growing when usage of the new technology is still very small. Growth can stop even before prices are the same because the new technology is seen to be superior.
- The old technology frequently reduces costs in order to survive.
- This cost reduction enables the old technology to maintain demand for a few more years, but it cannot prevent the old technology's ultimate demise if new technology costs continue to fall.
- Demand for the old technology remains high for many years. On the one hand, this gives a false sense of security. On the other hand, it means that providers of old technology can make a good return provided they run themselves for cash.

Recent examples from the energy sector

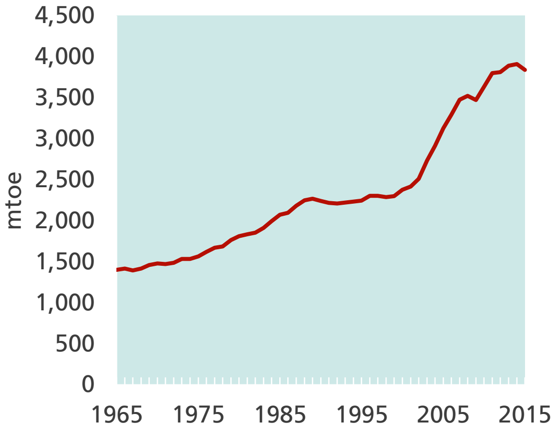
Recent history is replete with examples of the power of marginal change in the energy sector. We highlight global coal and European electricity.

Coal

Coal demand rose rapidly during the 2000s, punctuated by the financial crisis, and coal prices were high. As soon as demand stopped rising rapidly in 2012, prices started to fall. And coal equities anticipated the fall in coal prices by around six months.

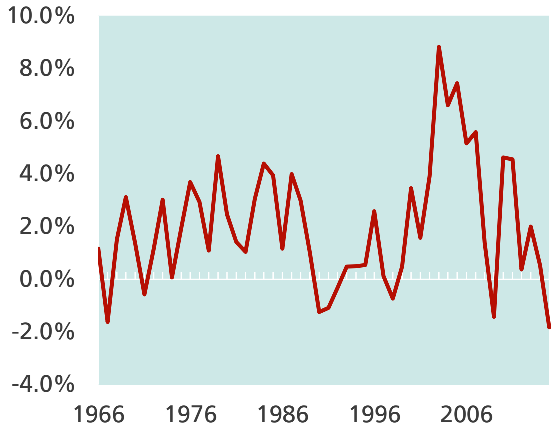
It is notable that the fall in coal prices and the bankruptcy of the top end of the global coal cost curve took place when coal demand was still near record highs.

Chart 4: Coal demand



Source: BP.

Chart 5: Coal demand growth



Source: BP.

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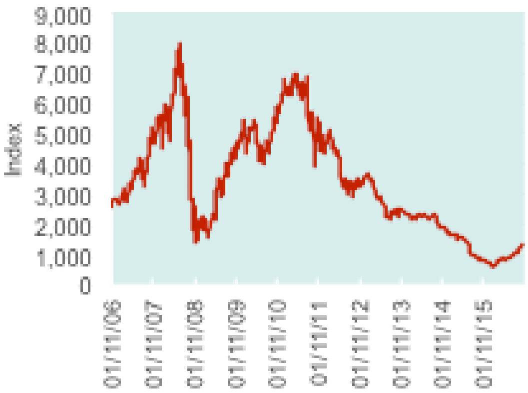
Chart 6: Coal price

Source: Bloomberg based on Newcastle coal.

Chart 7: Coal equity index



Source: Bloomberg.

European electricity

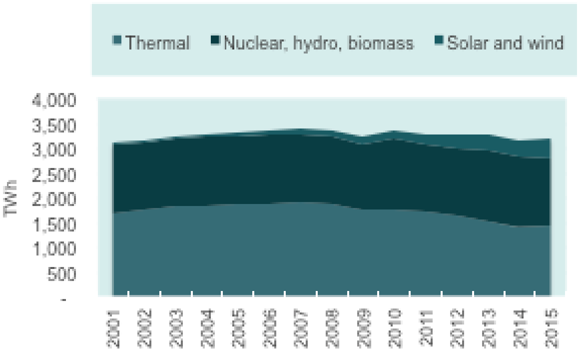
For many years, the business model of the European electricity sector was to produce increasing amounts of electricity from fossil fuels to meet ever-growing demand. However, two developments challenged this cosy world after 2007:

- Electricity demand stopped rising; and
- Renewable supply carried on growing.

Fossil fuel-based generators were squeezed in the middle, facing rising competition and falling demand for their products. Electricity prices peaked in mid-2008 and equity prices peaked some six to nine months before this. Eight years later, the industry leaders are undergoing radical restructuring.

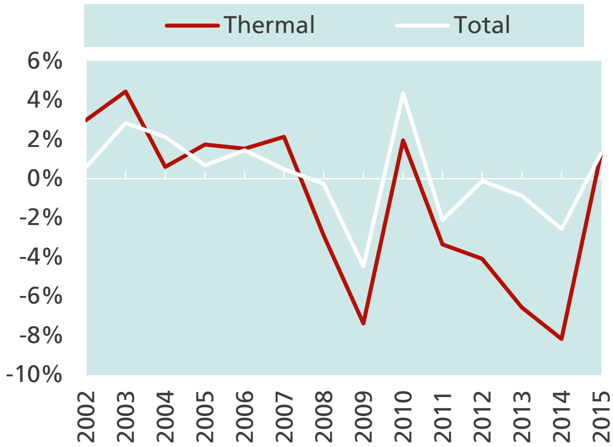
The comparison between European electricity a decade ago and global oil today is easily made.

Chart 8: European electricity supply



Source: BP.

Chart 9: European electricity supply growth



Source: BP.

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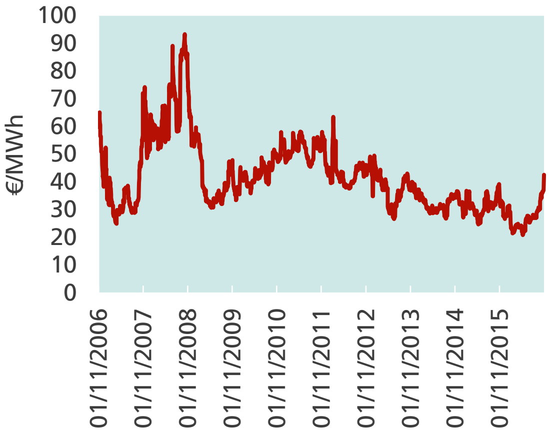
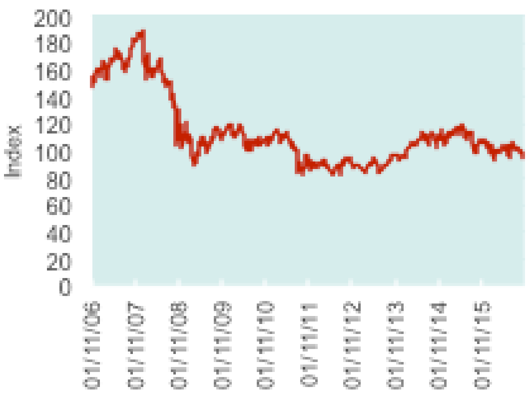
Chart 10: German electricity price



Source: Bloomberg.

Chart 11: European electricity stock index



Source: Bloomberg.

Marginal change in history

In a paper written in 2010 ("The slow search for solutions" published in *Energy Policy*), Fouquet argued that total energy transitions have speeded up, but still take 50 years. Earlier this year, Sovacool published an interesting review of energy transitions in Energy Research ("How long will it take?"), in which he identified a number of instances of rapid energy system change in areas as diverse as nuclear power in France and gas stoves in Indonesia.

However, both Sovacool and Fouquet think in terms of systemic change – how long it will take for a new energy source to achieve a large market share. We are concerned with a different issue – how long does it take to impact the incumbent energy providers.

There are so many energy transitions that it is easy to find examples to prove most arguments. However, we believe that it is possible to find an overarching framework that is accurate for the UK, as below. This helps us find the proper context for the historical examples we then show.

There are four main uses of energy – for heat, light, power and transport. And in broad terms there have been three main energy transitions – from biomass to fossils (mainly coal) in the eighteenth and nineteenth centuries; from fossils to modern fuels (oil, gas and electricity) in the twentieth century; and from modern fuels to renewables, a phenomenon of the current century.

At the time of the first transition, energy consumption per capita was still very low and demand grew rapidly. As new energy sources entered into the mix, the former energy sources did not decline in size, but they either stagnated or grew only slowly. One example would be the transition from wood to coal in heating; the use of wood did not fall, but demand was broadly flat.

At the time of the second transition, energy consumption per capita was significantly higher and total demand growth was low. As a result,

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when new energy sources entered into the supply mix, demand for the old energy sources fell rapidly. One example would be the transition from coal to oil as the primary transport fuel.

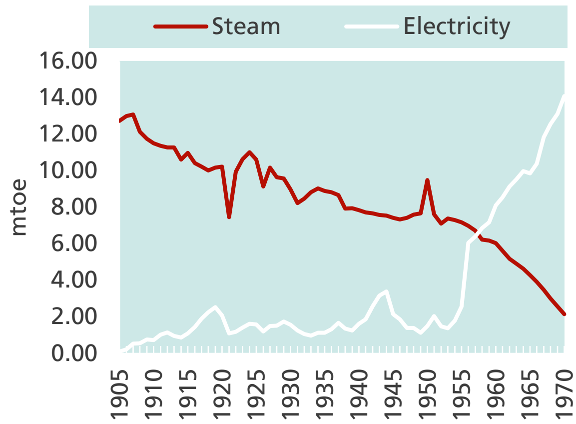
We set out below examples of the second transition in the UK for the four main energy uses of heat, light, power and transport, based on data presented in Roger Fouquet's excellent book Heat, Power and Light. In every case, demand for the old energy source stopped growing very shortly after the new energy source reached critical mass, and when the new energy source was only between 2% and 6% of the total energy supply.

The conclusion then is that the impact of the second energy transition on incumbents was highly disruptive. Demand rapidly fell, and prices with it.

Power

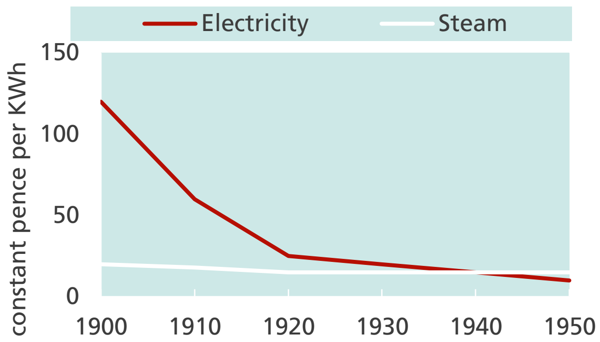
In 1900 most stationary power came from steam turbines powered by coal. Electricity started as a niche technology with high costs which required huge infrastructure. However, UK steam power demand peaked in 1907 at 13 mtoe, at a time when the supply of power from electricity was 0.5 mtoe, accounting for just 3 per cent of the total.

Chart 12: Energy for power in the UK



Source: Roger Fouquet, *Heat, Power and Light, 2008*

Chart 13: Price of energy for power in the UK



Source: Roger Fouquet, *Heat, Power and Light, 2008*

The price of steam-based power initially dipped, but was unable to compete with the continued fall in the price of electricity. By the time the price of power from electricity had fallen definitively below that of steam – which was as late as the 1940s – steam was already in terminal decline.

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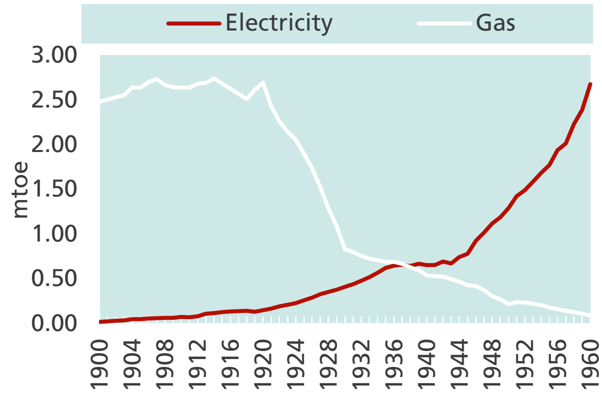
Light

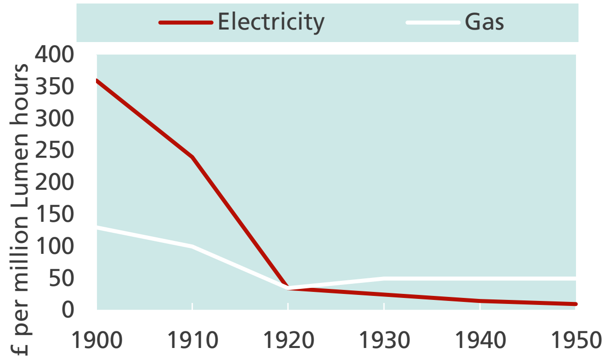
Gas demand for lighting in the UK peaked in 1907 when the share of electricity in overall power demand was just 2 per cent. Thereafter gas demand remained flat for a number of years as the price of gas fell and the fuel was still able to compete. However, around 1920, the price of electricity fell definitively below that of gas, after which gas demand fell rapidly.

Chart 14: Energy for light in the UK



Sources: Roger Fouquet, *Heat, Power and Light, 2008,*

Chart 15: Price of light in the UK

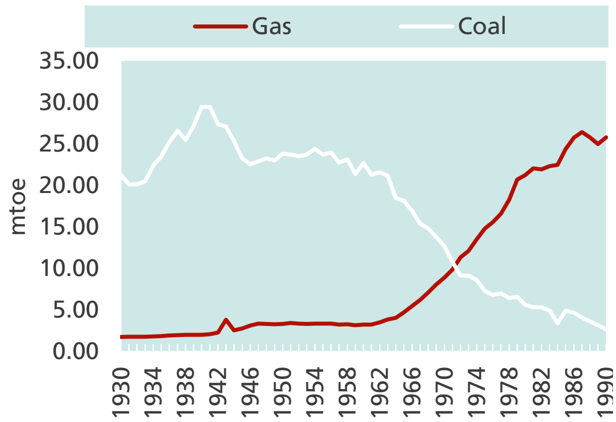


Sources: Roger Fouquet, *Heat, Power and Light, 2008,*

Heat

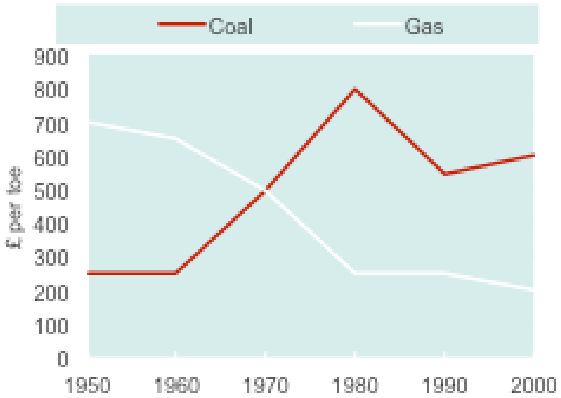
The shift from coal to gas for heating was a more protracted story because the price gap was much larger. Coal demand for domestic heating peaked in 1940 when gas had a market share of 6%. However, coal demand remained stable in the 1950s, and it was not until the relative prices started to converge that coal demand dropped rapidly.

Chart 16: Energy for UK domestic heating



Sources: Roger Fouquet, *Heat, Power and Light, 2008.*

Chart 17: Price of effective heating in the UK



Sources: Roger Fouquet, *Heat, Power and Light, 2008*

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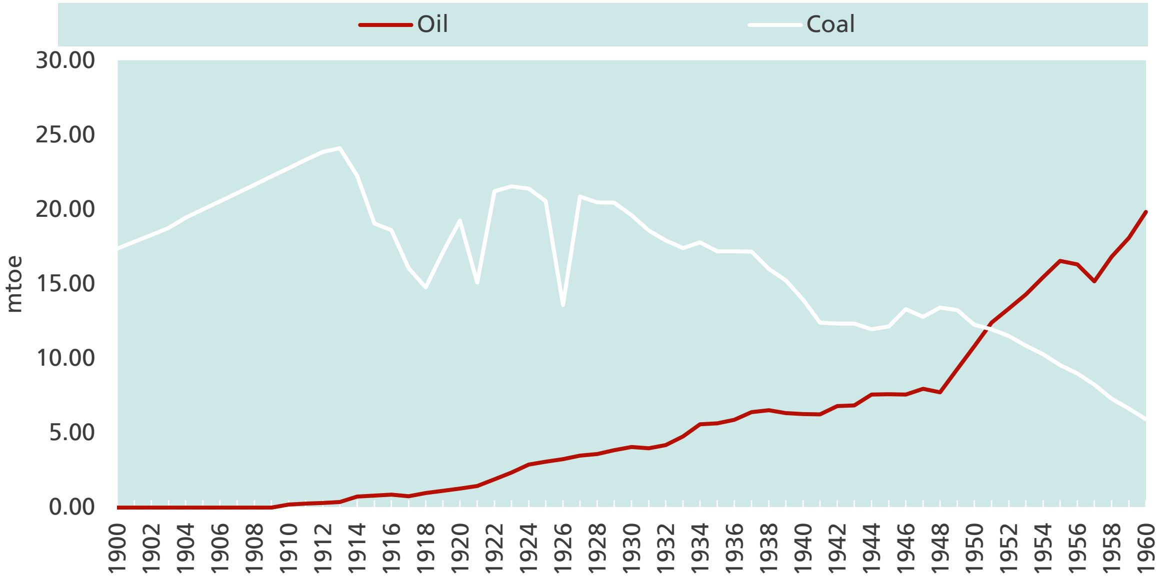
Transport

Coal demand for transport peaked in 1913 at 24 mtoe, and when it had a market share 94% of transport fuel. Oil supply at that stage made up only 2% of total transport fuel.

Chart 18: Energy for transport in the UK



Source: Roger Fouquet, *Heat, Power and Light, 2008*

Conclusion

The final question is – will the current energy transition resemble the first or the second. The answer is that it will of course be unique, but we expect that the impact on the incumbents will more like the impact felt in the second transition. Global energy demand growth is relatively low, and governments are inclined to reduce the use of fossil fuels where possible in order to reduce negative externalities from global warming and local pollution.

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