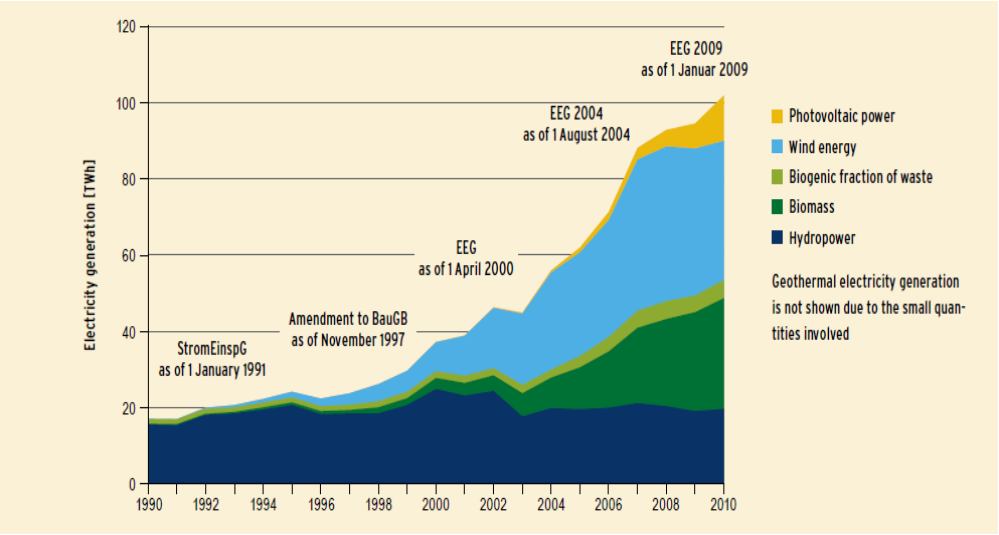
Case Study: Germany at the forefront.

Germany had made radical changes to its energy economy over the last decade. The bedrock of this has been a huge push into renewables, which has seen a massive 40GW increase in installed capacity. In 2000, Germany produced 6.4% of its power from renewables. In 2011, this was 20.1% (Bundesamt). At the same time Germany has managed to reduce energy consumption by 7.3%, whilst increasing the volume of its exports by 40%. This is only the beginning.

Germany's Renewable Build Out 1990 to 2010



Source: German Environmental Ministry

The German government intends to generate 35% of its power needs from renewables by 2020, and reduce energy consumption by 20% over this period (Federal Ministry for the Environment, Renewable Energy Sources in Figures, 2012).

Germany's Energy Plan

		2020	2030	2040	2050
Climate	Greenhouse gases (vs. 1990)	- 40%	- 55%	- 70%	- 80 to - 95%
Renewable energies	Share of electricity	35%	50%	65%	80%
	Overall share (Gross final energy consumption)	18%	30%	45%	60%
Efficiency	Primary energy consumption	- 20%	••••••••••••••►		- 50%
	Electricity consumption	- 10%			- 25%
	Energy consumption in buildings	20% heat demand			80% primary energy

Source: German Environmental Ministry

Germany has no choice but to be a leader in the next energy revolution.

Germany has very limited quantities of oil and gas and has to import approximately 60% of its energy needs. This amount has been steadily increasing since the early 1970s and is a clear risk to the German economy. Germany is an economy built around designing and producing products which require significant energy inputs for both manufacturing and distribution. It must take its energy German citizens not only own renewable power installations individually. There are also a huge number of localised distribution initiatives that socialise energy supply. This includes the current initiative in Berlin to buy the power distribution network from the utility Vattenfall. There has been a rapid expansion of their community energy systems. Germany's industrial players - such as Bosch, Infineon, Siemens, VW, BMW - are at the forefront of the current energy revolution and the German government has been quick to put in place innovative legislation (such as feed in tariffs) to push forward the transformation. In the summer of 2011, the German government passed eight new pieces of legislation, all designed to push different aspects of that transformation.

Germany's 2011 decision to close all its nuclear power stations was greeted with a mixture of shock and disbelief across much of the world. This should not have been a surprise. Germany would have preferred to have made the decision 25 years earlier, after the Chernobyl accident, but it did not have alternative solutions. Today it does. The solution has come in the form of digital power. Use less energy (and renewable sources) and use this energy more intelligently. Current projections of new nuclear electricity costs, above wholesale power prices, make this policy change all the more coherent.

A 'game change' in energy thinking.

Part of Germany's success, in building out renewables, has been the use of feed-in-tariffs (FiTs) rather than other support mechanisms such as grants, tax incentives and renewable obligations. FiTs have brought forward a new class of investors to promote the growth of renewable energy. They have done so eagerly. Utilities, in contrast, have not led the building out of renewables because such projects do not generate the double-digit financial returns they require.

Today, some 22GW of German renewable power capacity is owned by private individuals; twice the total UK renewable capacity. Meanwhile, the big four German utilities own a mere 4 GW of capacity in their domestic market (Trend:Research, 2011). In fact, the largest German utility, E-On has built more renewable assets over the last decade in the UK than in Germany. The reason is undoubtedly because returns on UK renewable projects are higher than in Germany. This is not a surprise, given the UK's reliance on Renewable Obligations. As a result, cost estimates for the UK onshore wind market that are markedly higher than in Germany, despite the UK having 25% more wind.

According to a study done for the British energy ministry (DECC) the levelised cost of UK onshore wind will be close to £90/MWh for projects starting in 2013 (MacDonald, 2010). In contrast, Germany's FIT is below those levels at €90/MWh. Even more dramatic is a comparison with Ireland, which has similar wind conditions to the UK. It offers a 15 year feed in tariff of €57-59/MWh and has managed to install 2GW of onshore in the last decade; at least half what the UK has achieved over the same period.

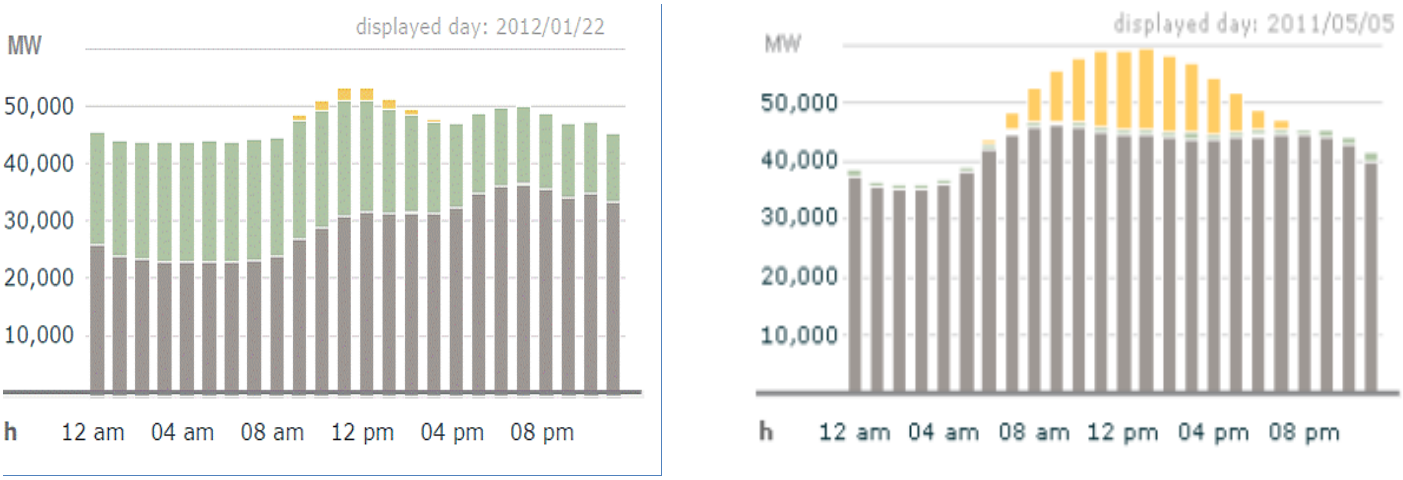
Germany has also been unafraid to take on its Utilities.

Despite utilities having huge lobby groups with considerable resources, the German government has put considerable pressure on its utilities. This has not just been in the decision to exit nuclear (which will remove

billions of subsidies a year). The FiTs legislation, and the decision to give priority grid access for all renewables, means that German solar and wind energy are the first power sources fed in to the energy system. It leaves incumbent power providers to alter their energy mix and output to ensure a balance between power demand and supply.

The result of this change is that German utilities no longer control energy supply as they once did. Moreover, their price-setting power has also been diminished by the fact that renewable sources drive down peak demand (and peak prices).

Renewables in the German energy mix - Solar (yellow), Wind (green)



. *Source ;EEX*

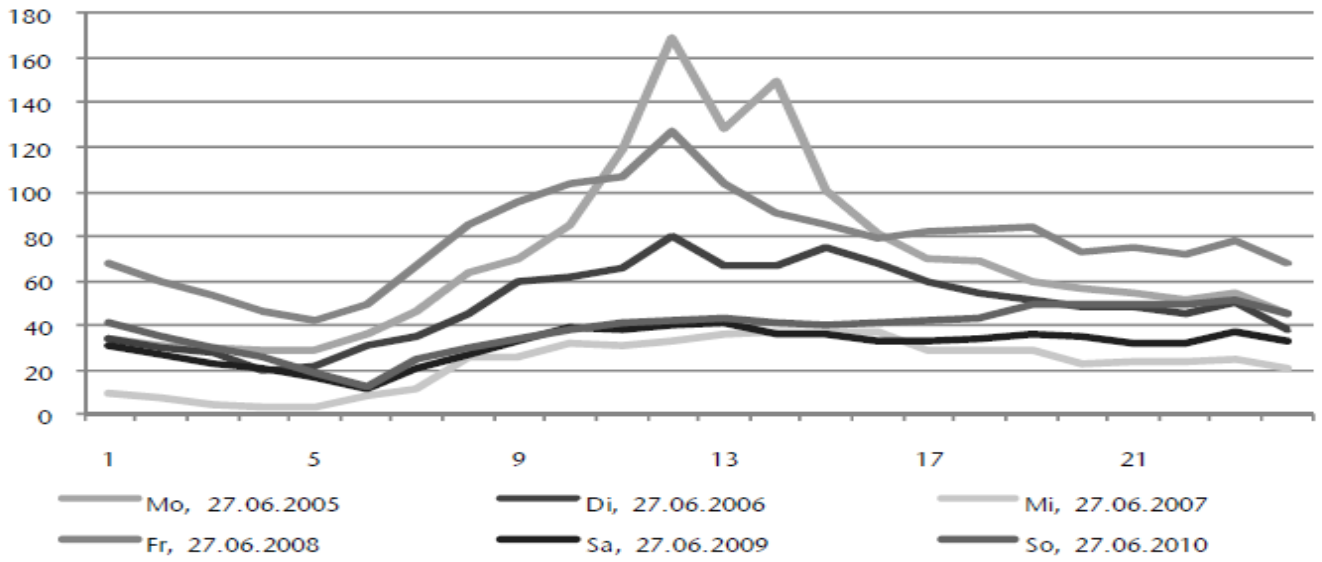
German utilities have progressively lost credibility with the public as well as with government. One year ago, the German utilities were threatening to sue the German government over its decision to exit nuclear, while at the same time screaming about the increased risk of blackouts and higher power prices. The result was the exact opposite.

German power prices, after a brief rise last April, have fallen to a five year low, thanks mainly to ramping up renewable energy capacity. This saw 9.5GW (including 7.5GW of solar) installed on the grid in 2011. Moreover, Germany remains a net exporter of power, especially during the day, when low priced power is exported across the EU (inc to the UK).

German Future Power Prices *Source: EEX*

As continental power markets became increasingly connected, power prices in France, Poland and other surrounding countries have also fallen. Furthermore, if renewable generating capacity is in any way correlated with peak power needs, the bearish impact on electricity prices can be significant. This is clearly the case with solar. Even in Germany, which is not always blessed with much sun, this can be clearly observed on an average summer's day. This is bad news for utility businesses, as the margin between peak and baseload prices has contracted to an almost all time low. Peak load pricing is when utilities generate their highest margin. This 'bad news' for energy utilities has, however, been very good news for German industry.

Germany's peak power pricing on a particular day



Source: EEX

The future is about flexible power.

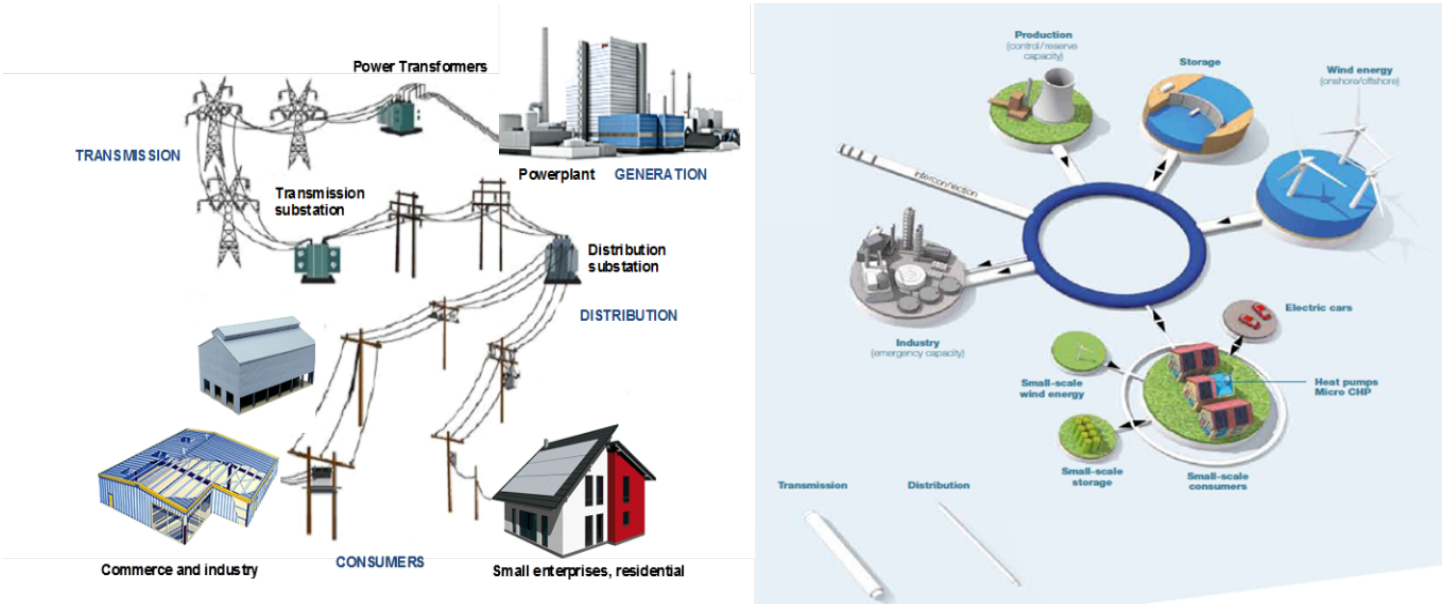
One of the major criticisms of renewable power is intermittency; that it cannot provide baseload power operating 24/7. The sun does not shine at night and the wind does not blow all day long. But there are baseload renewable resources such as geothermal, hydro and biomass power stations. There are also smarter solutions available for dealing with intermittency issues.

First and foremost, combine intermittent renewables with more flexible power (such as natural gas, hydro plants and high efficiency coal plants) as well as energy storage facilities (including pumped and hydrogen storage). Second, simply move the electricity from where it is generated to where it is needed. Fundamentally, we need to move away from our obsession with base-load power and peak-load power. We may have thought this way for over 100 years but, with today's technology, we do not need to have power stations running 24 hours a day. What we need is some intelligence built into our energy systems. This requires different thinking about the investment going into the heart of our power system, the grid.

The electricity grid, as it stands, is a senseless mass of wires, transmission lines, transformers, controllers and substations, which delivers electricity from power plants to the user. It is an ageing system, over fifty years old in most of the western world. Due to planning permission difficulties surrounding transmission lines, it can take many years to build new ones. The solution is to use the grid we have and simply make it smarter.

Smarter grid technology will make the grid more stable and flexible. It will also mitigate the risk of power outages. This is the nature of tomorrow's energy grid. It is where Germany has been investing heavily.

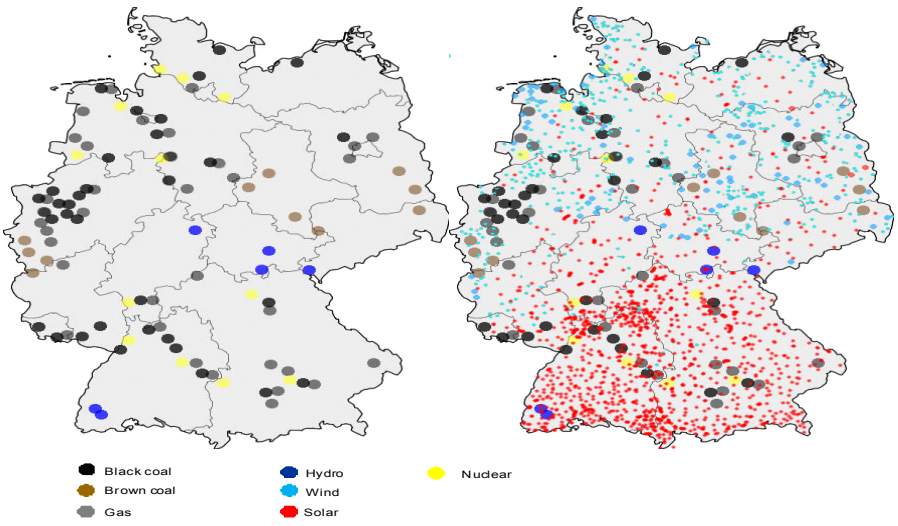
The Grid is changing, becoming decentralised after a century of one way traffic



Source: Alexa Capital

Advanced, low-cost, renewable energy is, much like the internet, highly distributed. It requires 'uploading' of energy on a decentralised and intermittent basis. Uploading this new energy is forcing new (and different) investment in the grid. The German grid is the most reliable in Europe, with the average consumer experiencing only 19 minutes of downtime in 2009. This was despite the fact that the German grid now copes with the stresses and strains of its 20% of renewable energy capacity (RWE, 2011). A combination of intelligent simulation tools, good control systems, solid engineering and innovative power electronics has allowed the German grid to achieve this stability and strength.

Germany's power landscape from 1990 to today, with over 1m power producers

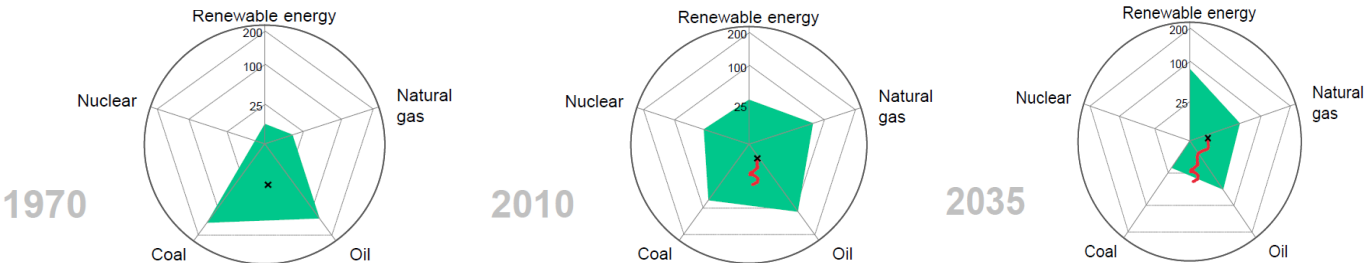


Source: Alexa Capital

From a weakness to a strength

In the face of a growing dependency on energy imports, and the associated risks to its economy, Germany has been assertive in embracing modern solutions to transform its energy infrastructure. Not only has the government been bold in decommissioning its nuclear fleet and supporting the build out of renewable energy technologies, it has also recognised the importance of decentralising its energy infrastructure at an early stage. As a result, Germany boasts one of the world's most reliable grid infrastructures. This is only at the beginning of its transformation into a truly smart grid. Forward thinking in shaping its energy policy has left Germany in the enviable position of being able to increasingly meet its energy needs and supply its laggard neighbours with energy surpluses from its renewable portfolio.

Germany's changing power mix 1970, 2010, 2035



Source: Alexa Capital

More than ever, energy holds the key to progress and prosperity. Energy is no longer about fossil fuels, or the ideal renewable energy technology. Energy doctrine must address how energy is produced, distributed, consumed and managed at all levels.

Germany's energy transformation will continue to take time and further investment, but its trend towards decentralisation is clear. So too is its commitment to an energy future that is rooted in becoming lighter, brighter, technology driven, more secure and renewable. It provides a blueprint for others to follow and improve upon.

This is a transformation that begins from a clear energy vision rather than a set of current market fixes. Fundamentally, it is what all countries will have to address.

Alan Simpson