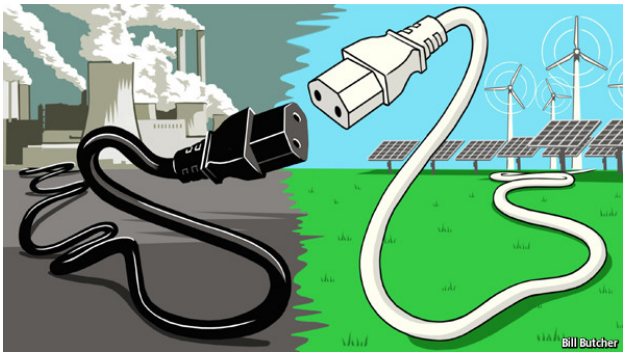
The Economist

European utilities

How to lose half a trillion euros

Europe's electricity providers face an existential threat

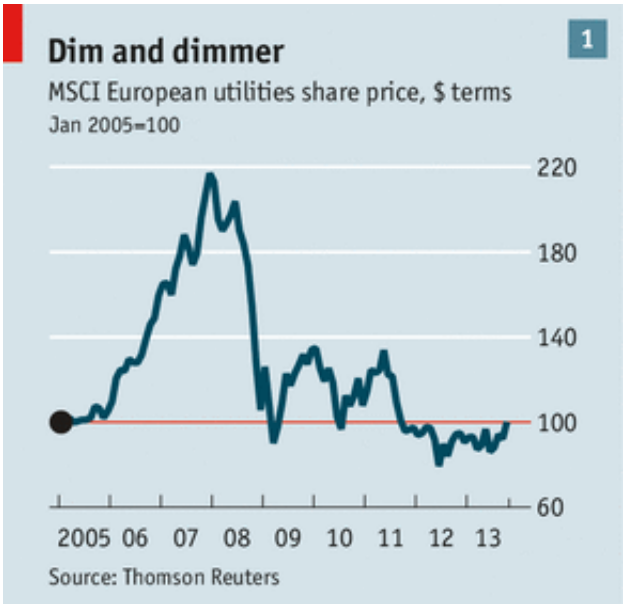


ON JUNE 16th something very peculiar happened in Germany's electricity market. The wholesale price of electricity fell to minus €100 per megawatt hour (MWh). That is, generating companies were having to pay the managers of the grid to take their electricity. It was a bright, breezy Sunday. Demand was low. Between 2pm and 3pm, solar and wind generators produced 28.9 gigawatts (GW) of power, more than half the total. The grid at that time could not cope with more than 45GW without becoming unstable. At the peak, total generation was over 51GW; so prices went negative to encourage cutbacks and protect the grid from overloading.

The trouble is that power plants using nuclear fuel or brown coal are designed to run full blast and cannot easily reduce production, whereas the extra energy from solar and wind power is free. So the burden of adjustment fell on gas-fired and hard-coal power plants, whose output plummeted to only about 10% of capacity.

These events were a microcosm of the changes affecting all places where renewable sources of energy are becoming more important—Europe as a whole and Germany in particular. To environmentalists these changes are a story of triumph. Renewable, low-carbon energy accounts for an ever-greater share of production. It is helping push wholesale electricity prices down, and could one day lead to big reductions in greenhouse-gas emissions. For established utilities, though, this is a disaster. Their gas plants are being shouldered aside by renewable-energy sources. They are losing money on electricity generation. They worry that the growth of solar and wind power is destabilising the grid, and may lead to blackouts or brownouts. And they point out that you cannot run a normal business, in which customers pay for services according to how much they consume, if prices go negative. In short, they argue, the growth of renewable energy is undermining established utilities and replacing them with something less reliable and much more expensive.

Power down



The decline of Europe's utilities has certainly been startling. At their peak in 2008, the top 20 energy utilities were worth roughly €1 trillion ($1.3 trillion). Now they are worth less than half that (see chart 1). Since September 2008, utilities have been the worst-performing sector in the Morgan Stanley index of global share prices. In 2008 the top ten European utilities all had credit ratings of A or better. Now only five do.

The rot has gone furthest in Germany, where electricity from renewable sources has grown fastest. The country's biggest utility, E.ON, has seen its share price fall by three-quarters from the peak and its income from conventional power generation (fossil fuels and nuclear) fall by more than a third since 2010. At the second-largest utility, RWE, recurrent net income has also fallen by a third since 2010. As the company's chief financial officer laments, "Conventional power generation, quite frankly, as a business unit, is fighting for its economic survival."

The companies would have been in trouble anyway, whatever happened to renewables. During the 2000s, European utilities overinvested in generating capacity from fossil fuels, boosting it by 16% in Europe as a whole and by more in some countries (up 91% in Spain, for example). The market for electricity did not grow by nearly that amount, even in good times; then the financial crisis hit demand. According to the International Energy Agency, total energy demand in Europe will decline by 2% between 2010 and 2015.

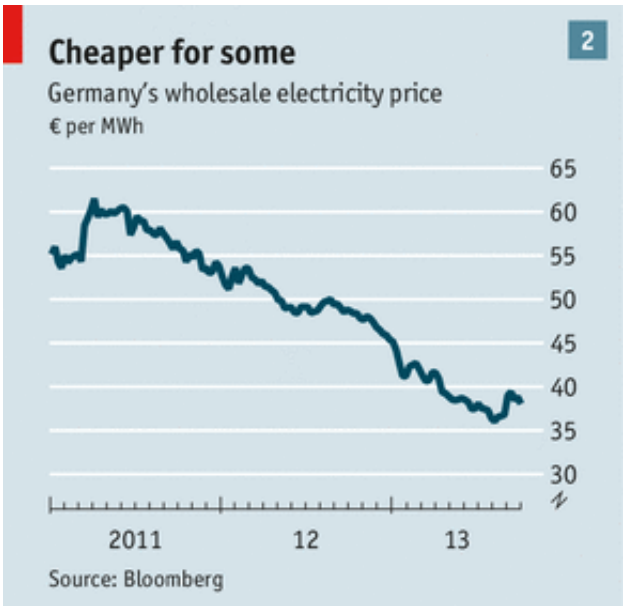
Two influences from outside Europe added to the problems. The first was the Fukushima nuclear disaster in Japan. This panicked the government of Angela Merkel into ordering the immediate closure of eight of Germany's nuclear-power plants and a phase-out of the other nine by 2022. The abruptness of the change added to the utilities' woes, though many of the plants were scheduled for closure anyway.

The other influence was the shale-gas bonanza in America. This displaced to Europe coal that had previously been burned in America, pushing European coal prices down relative to gas prices. At the same time, carbon prices crashed because there were too many permits to emit carbon in Europe's emissions-trading system and the recession cut demand for them. This has reduced the penalties for burning coal, kept profit margins at coal-fired power plants healthy and slashed them for gas-fired plants. Gérard Mestrallet, chief executive of GDF Suez, the world's largest electricity producer, says

30GW of gas-fired capacity has been mothballed in Europe since the peak, including brand-new plants. The increase in coal-burning pushed German carbon emissions up in 2012-13, the opposite of what was supposed to happen.

So the gas and nuclear bits of the utilities' business were heading for trouble even before the renewables bonanza, making the growth of solar and wind all the more disruptive. Renewables capacity (which is much higher than output) is almost half of electricity-generating capacity in Germany and roughly one-third in Spain and Italy. Total capacity, including renewables, is way above peak demand in all three countries. So renewables have added mightily to oversupply.

Excess supply plus depressed demand equals lower prices. Electricity prices have fallen from over €80 per MWh at peak hours in Germany in 2008 to just €38 per MWh now (see chart 2). (These are wholesale prices; residential prices are €285 per MWh, some of the highest in the world, partly because they include subsidies for renewables that are one-and-a-half times, per unit of energy, the power price itself). As wholesale prices fall, so does the profitability of power plants. Bloomberg New Energy Finance (BNEF), a data-provider, reckons that 30-40% of RWE's conventional power stations are losing money.



But that is only the half of it. Renewables have not just put pressure on margins. They have transformed the established business model for utilities. Michael Liebreich, BNEF's chief executive, compares them to telephone companies in the 1990s, or newspapers facing social media now: "It is an existential threat," he says.

Peak punishment

Back in the 1980s, providing electricity was a relatively simple affair. You guaranteed a constant supply of power by building plants that ran on coal, nuclear energy (if you wanted it) or hydropower (if you had it). You ran these full blast around the clock—for technical reasons, coal and nuclear plants cannot easily be shut down anyway. And that provided "baseload power" (the amount always needed). Then, to supply extra electricity at peak times (like lunchtime or early evening) you had plants that could more easily be powered up and down, such as gas-fired ones. If you imagine a chart of power provision during the day, it looks like a layer cake: the bottom layers are flat (nuclear, coal and so forth); the layer at the top (gas) is wavy.

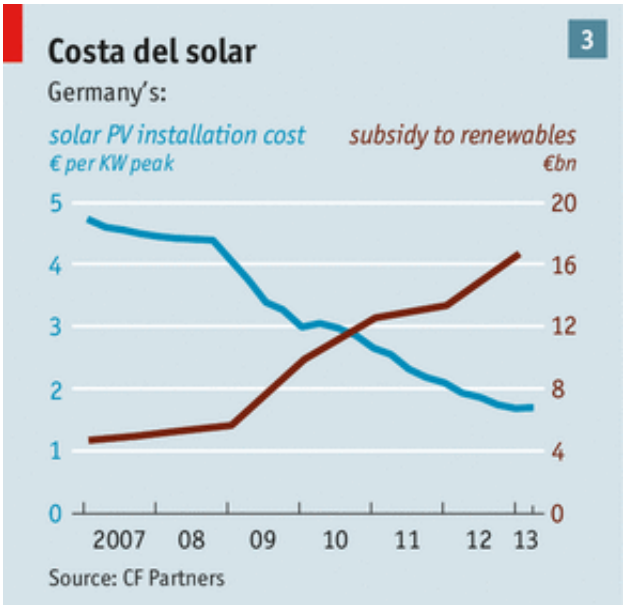
Deregulation swept away this tidy, ordered system, letting power plants produce according to the

marginal cost of electricity. The advent of renewable energy then speeded up the changes. Renewables have "grid priority", meaning the grid must take their electricity first. This is a legal requirement, to encourage renewable energy in Europe. But it is also logical: since the marginal cost of wind and solar power is zero, grids would take their power first anyway. So renewable energy slots in at the bottom of the layer cake. But unlike the baseload providers already in place (nuclear and coal), solar and wind power are intermittent, surging with the weather. So the bottom layers of the cake are wavy, too.

Now, when demand fluctuates, it may not be enough just to lower the output of gas-fired generators. Some plants may have to be switched off altogether and some coal-fired ones turned down. This happened on June 16th. It is costly because scaling back coal-fired plants is hard. It makes electricity prices more volatile. And it is having a devastating effect on profits.

Under the old system, electricity prices spiked during peak hours (the middle of the day and early evening), falling at night as demand ebbed. Companies made all their money during peak periods. But the middle of the day is when solar generation is strongest. Thanks to grid priority, solar grabs a big chunk of that peak demand and has competed away the price spike. In Germany in 2008, according to the Fraunhofer Institute for Solar Energy Systems, peak-hour prices were €14 per MWh above baseload prices. In the first six months of 2013, the premium was €3. So not only have average electricity prices fallen by half since 2008, but the peak premium has also fallen by almost four-fifths. No wonder utilities are in such a mess.

It will get worse. The combination of European demand and Chinese investment has slashed the cost of solar panels by about two-thirds since 2006 (see chart 3). In Germany, the cost of generating a megawatt hour of electricity with solar panels has fallen to €150, above wholesale prices but below the fixed price that renewables receive and below residential prices. This means solar generation may rise even if Germany's new government cuts subsidies to renewables. Their challenge to the old utilities will increase.



Moreover, in the past few years utilities have been hedging, selling two-thirds of their power one to three years ahead (ie, they are receiving 2010 prices for energy delivered today). This has insulated them from the full impact of recent price falls. Those contracts expire in 2014-15. As the chief executive of E.ON said recently, "For 2013 and 2014, no recovery [is] in sight."

Wood, wind section

Utilities are not powerless in the face of these problems, and they are not all affected equally. The big six British utilities, for example, have been sheltered by their long-term electricity-price agreement with the regulator, though their profit margins remain thin.

Some utilities have got into the renewables business themselves. Drax, which used to be Britain's largest coal-fired power station, is being converted to run on wood pellets. Other utilities are big investors in offshore wind power.

But by and large utilities have been slow to invest, especially in solar. Utilities own only 7% of renewables capacity in Germany, for example. The problem is that solar energy is so different from what they are used to. The old-fashioned utility has a big expensive power plant with, say, 1-1.5GW of capacity. The plant sits in the middle of a radiating web of wires down which the firm distributes power. Solar power is different. Photovoltaic panels are cheap, tiny (a medium-sized array may have a capacity of just 10MW) and arranged in a net, not as a hub with spokes.

Utilities may eventually get more serious about renewable energy, but at the moment change is slow. Instead, utilities are responding to their woes by shifting out of power generation and into "downstream" activities, such as trading and offering customers advice on energy use. In the past few months Vattenfall, Sweden's biggest utility, has written off 6% of its assets and three German firms, E.ON, RWE and EnBW, have announced capacity cuts of over 15GW. EnBW has gone furthest in outlining what the future might look like. It says its earnings from electricity generation will fall by 80% in 2012-20, offset by higher earnings from energy services and renewables. "We have to rethink what is our role, and our place in the energy sector," says its boss, Frank Mastiaux.

Clean break

For the companies, wrenching change and plunging share prices are obviously worrying. But should anyone else care? As Amory Lovins of the Rocky Mountain Institute, an American think-tank, points out, Germany has built a low-carbon energy business to the point where new solar power needs few subsidies; where wholesale energy prices are falling and threats to the reliability of the grid have not materialised. What's the problem?

There are several answers. First, utilities have suffered vast losses in asset valuation. Their market capitalisation has fallen over €500 billion in five years. That is more than European bank shares lost in the same period. These losses matter in their own right. For pension funds and other investors, they represent lost capital and lower future earnings. For employees, they translate into lower wages and lost jobs. The losses—many of which predate the boom in renewable energy—have come on top of the huge sums Europeans have also spent on climate-change policies. Subsidies for renewable

energy are running at €16 billion a year in Germany (and rising); the cumulative cost is around €60 billion.

Next, utilities have lost their investment role. Once they were steady, reliable and inflation-resistant, the US Treasuries of the equity markets. Pension funds need such assets to balance their long-term liabilities. But utilities no longer play this role, as evinced not just by collapsing share prices but by dividend policies. Until 2008 the yields of RWE and E.ON tracked German ten-year bonds. Since then, they have soared to around 10%, while government-bond yields have stayed flat. Renewables are not the only risky energy investment.

Most important, the decline in utilities' fortunes raises disturbing questions about the future of Europe's electricity system. To simplify: European countries are slowly piecing together a system in which there will be more low-carbon and intermittent energy sources; more energy suppliers; more modern power stations (replacing coal and nuclear plants); more and better storage; and more energy traded across borders. All this will be held together by "smart grids", which tell consumers how much power they are using, shut off appliances when not needed and manage demand more efficiently.

In such a world, the old-fashioned utilities play two vital roles. They will be the electricity generators of last resort, ensuring the lights stay on when wind and solar generators run out of puff. And they will be providers of investment to help build the grand new grid. It is not clear that utilities are in good enough shape to do either of these things.

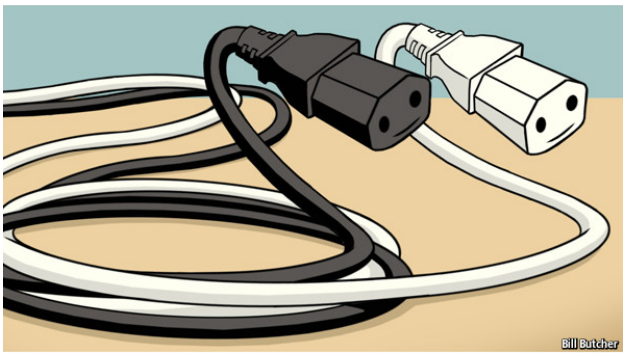
So far, it is true, they have managed to provide backup capacity and the grid has not failed, even in solar- and wind-mad Germany. In fact, the German grid is more reliable than most (countries run reliability indices: Germany has one of the highest scores in Europe). Greens therefore dismiss worries that renewables will undermine grid reliability, pointing out that, as wind and solar plants spread over the continent, there will be enough wind or sun somewhere to run some of them, at least during the day.

Maybe. But as the price swings in Germany show, it is getting harder to maintain grid stability. Utilities are not rewarded for offsetting the variable nature of wind and solar power. Instead, they are shifting out of electricity generation. And this is happening at a time when renewable energy supplies, on average, 22% of Germany's electricity demand. No one really knows what will happen when renewables reach 35% of the market, as government policy requires in 2020, let alone if they reach the national target of 80% in 2050. Almost everyone acknowledges that as the share of renewable energy rises, regulation of the grid will have to change.

The role of utilities as investors is also being threatened. The sums required to upgrade the grid are huge, as much as €1 trillion in Europe by 2020. Companies worth €500 billion cannot finance

anything like that amount. Instead, they are cutting capital spending. That of RWE (for example) has fallen from €6.4 billion to €5 billion since 2011, and most analysts expect it to fall to €2.6 billion by 2015. Of that, €1.6 billion will go on maintaining existing plants, leaving just €1 billion for development spending—half of present levels. In their current state, utilities cannot finance Europe's hoped-for clean-energy system.

And that has implications for the future. To make up for lack of investment by utilities, governments will have to persuade others to step in, such as pension funds or sovereign-wealth funds. But these entities have always invested in energy indirectly, by holding stakes in utilities, not directly. And for a reason: they dislike the political risks of owning projects in which governments play a role, either through planning or price-setting. In some countries there are also laws against owning assets both upstream (generators) and down (distribution).



Over the past 30 years European governments have been trying to deregulate energy markets, privatising state-owned companies and splitting electricity generation from transmission and distribution. The aims were to increase competition, boost efficiency and cut prices.

Those goals are now harder to achieve. Renewable energy has grabbed a growing share of the market, pushed wholesale prices down and succeeded in its goal of driving down the price of new technologies. But the subsidy cost also has been large, the environmental gains non-existent so far and the damage done to today's utilities much greater than expected. Europe in general and Germany in particular see themselves as pioneers of low-carbon energy. If they are genuinely to be so, they will need to design a much better electricity system that rewards low-carbon energy without reducing reliability and imposing undue and unnecessary costs.