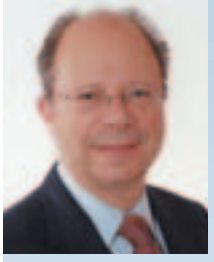
The real cost of fossil fuels

The risk of fuel price rises means that electricity from fossil fuels costs more than is generally acknowledged, argues a prominent economist. This is good news for wind energy, but making best use of wind power will require changes to the grid and to electricity marketing mechanisms.

Man with a mission



Dr. Shimon Awerbuch is a financial economist who specialises in utility regulation, energy and the economics of innovation and new technology. Currently Tyndall Centre Visiting Fellow at SPRU, University of Sussex, UK, he has previously been a Senior Advisor for Energy Economics, Finance and Technology with the International Energy Agency in Paris, Chief, Economic and Policy Studies at the Utility Intervention Office of the New York State Executive Department, and a consultant with Ernst & Young.

Awerbuch has 30 years of experience in regulatory and energy economics, advising Fortune 100 multinationals, energy ministries, the European Commission, the UN, the World Bank and environmental advocacy groups. He is Editor of Elsevier Topics in Global Energy Economics, Regulation and Policy. His current research focuses on portfolio approaches for enhancing energy security and valuing renewables.

www.sussex.ac.uk/spru/profile154800.html

"Suppose you are making a fruit salad," says Dr. Shimon Awerbuch, a financial economist at SPRU, a research institute at the University of Sussex, UK. "You go to the market and you notice that strawberries are expensive today, so you know that if you want strawberries in your fruit salad, the salad will cost more."

"Now imagine you're planning the country's energy strategy. You look at the various generating technologies and fuel types, and you decide that electricity from wind is more expensive than electricity from natural gas. So adding wind power to the mix will increase the cost of electricity, right? Well, it isn't that simple."

The missing part of the puzzle, explains Awerbuch, is the risk attached to fuel prices. At the market, you know exactly how much you will pay for your apples and your strawberries. When you build a power station, many of the costs are much less clear. How much will natural gas cost in ten years' time, for instance? "No-one really knows the answer to that," says Awerbuch.

Companies and governments plan their investments using "discount rates" – nominal interest rates that allow today's money to be compared with future money. It is common to use the same arbitrary discount rate, often in the range 5 – 10 per cent, for every part of every energy project. That may have worked reasonably well for comparing similar fossil technologies a long time ago, Awerbuch says.

But traditional arbitrary discount rates do not apply where risk is an issue, as with the future cost of fossil fuels. Risk costs money, as people who invest on the stock market well know. That is why risky bonds, which promise high annual returns, are often priced the same as "safe" government bonds with much lower interest rates.

"People want to minimise risk as well as maximise their income," says Awerbuch, "which is why most investment portfolios include 'safe' investments like government bonds, as well as higher-yielding but riskier investments. A portfolio like this is proven to perform better, on average, than a collection of high-risk stocks."

The true cost of risk

Like stock market investments, says Awerbuch, power generation benefits from a portfolio approach that allows for risk when seeking to minimise cost.

It is not as if these risks are small. Volatility in fuel prices costs governments dearly, he says, through their effects on economic growth and jobs, especially when high oil prices coincide with, and aggravate, economic depression. The 1973 oil crisis is estimated to have cost the US economy $350 billion; other sources suggest that fuel price volatility has cost an average of $33 billion a year over the last 30 years. Whatever the exact figures, they are far greater than the costs of changing to renewable sources.

Even if renewable energy costs a little more than fossil power – and even this is debatable, Awerbuch says – its costs are more certain. "To put it another way, fossil power becomes much more expensive if we allow for risk." Conventional analysis of US power costs typically assesses electricity from natural gas at around $0.03/kWh, against wind power at $0.04/kWh. Allowing for risk, he says, the true price of power from gas should be much higher, at $0.05-0.07/kWh.

Awerbuch says that though risk-based portfolio management techniques have been used for decades by financial economists, they have not been widely adopted in energy policy. "Other industries consider many of the models used in the energy industry to be out-of-date, and abandoned them," he claims.

Power portfolios

In a 2003 study of energy use in developing countries carried out for REEEP (Renewable Energy and Energy Efficiency Partnership), the United Nations Environment Programme and the British Foreign Office, Awerbuch found that increasing the share of wind and other renewables significantly lowered overall generating costs. One of the countries examined in the study was Mexico. The "business as usual" energy scenario projects that by 2010 Mexico's electricity would be supplied 75 per cent by fossil fuels, with nuclear power making up most of the balance, and would have an average cost of $0.05/kWh. Lowering the fossil share to 60 per cent, increasing geothermal generation to 11 per cent and wind power to 9 per cent would cut real energy costs by almost a third, to $0.036/kWh, Awerbuch claims. This is despite a higher assumed generating cost for wind: $0.05/kWh as compared to $0.036/kWh for gas.

In the UK, the government's plan to reduce carbon emissions from power generation involves a shift towards natural gas – a relatively risky fuel – as well as an increase in wind power. The current target is 11 per cent of electricity from wind by 2010. Awerbuch's calculations show that the UK could reduce generating costs by 17 per cent,

without increasing risk, by using three times as much wind (31 per cent). Using five times as much wind (54 per cent) would cost no more than the current plan, but would considerably reduce risk – as well as being better for the environment.

In the USA, the current policy of increasing gas use raises risk considerably while providing only a small reduction in cost, Awerbuch says. A mix containing 18 per cent of wind power would reduce risk by 23 per cent without increasing costs, even when wind power is assumed to cost 70 per cent more than gas.

The intelligent grid

The spread of renewable energy could be helped by new ways of distributing and marketing electricity, Awerbuch continues. "Wind is the lowest-cost electricity source for the foreseeable future, and it could provide half our electricity. But the existing grid is 100 years old, and new energy technologies need new support systems," he says.

Sources of renewable power tend to be distributed: they are more widely scattered than conventional power stations, and smaller in scale. Some renewable sources, notably wind power, are also intermittent: they are not available at all times. "Making the best use of wind depends on how much electricity demand can be shifted away from periods when the wind is not blowing, and how much information can successfully be transmitted and processed by the grid," says Awerbuch.

The traditional view of the grid as a bulk transport system is not helpful in the new world of distributed energy sources, he says: "We treat electricity as a single, mass-produced product, when really it's subject to millions of separate transactions." Instead, trading arrangements need to recognise that power is worth different amounts to different customers at different times: "Someone who wants to watch an important football game will pay more for electricity than a guy who's just mowing the lawn."

"Right now we're asking intermittent technologies to supply wholesale power, but they weren't designed to do that. Instead, we should match intermittent generation with intermittent loads, like pumping water or running refrigerators – if the wind dies down, these jobs can wait for a few hours. We need an intelligent or 'informated' grid to accommodate this."

Some liberalised electricity regimes already give customers more control over where their power comes from, but even these do not go far enough, Awerbuch claims: "Here in the UK, I can contract with a wind farm to buy electricity. You would think there were just two parties in the contract, but that's not so, because if the wind stops blowing, the grid will still supply me with electricity from another source.

"I'd like a system where if the wind stops, I must either obtain my power on a separate backup contract, or go without. That way I could run my computer on conventional power, and use cheaper wind energy for less-critical jobs." Letting electricity users make informed choices is the future, Awerbuch says – and that is good news for wind energy.