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How much does electricity cost?
By Walt Patterson

How much does electricity cost? How do you know? If you're using it, you pay by the unit, by the measured kilowatt-hour; and the unit price is what concerns you. That's what shows up on your bill. But do you realize just how arbitrary that unit price is? If you've been paying attention since the advent of electricity liberalization, you know that the costs and charges for networks have been controversial ever since. But most of the cost of a unit of electricity delivered to your meter is the cost of generation; and you will have seen umpteen confident pronouncements about what generation costs. Gas-fired combined cycle stations produce the cheapest electricity. Photovoltaics are much more expensive. Wind power is now almost competitive with combined cycles - and so on. The cost of output from these different technologies is routinely cited as, say, '2.1 cents per kilowatt-hour' or '4.7 cents per kilowatt-hour', sometimes even to three significant figures. Does this make you uneasy? It should.

Shimon Awerbuch, a senior advisor in the Renewable Energy Unit of the International Energy Agency, has produced a draft report demonstrating just how untrustworthy and tendentious these comparisons can be. His analysis is so unnerving that the IEA is sitting on it, refusing to publish it or even to allow Awerbuch to speak about it on public platforms. Awerbuch's report is called *Estimating Electricity Costs and Prices: The Effects of Market Risk and Taxes*. His thesis is straightforward, if complex to demonstrate. He declares that the traditional approach to estimating the cost of electricity from a particular generator is based on engineering economics rather than financial economics. Engineering economics fails to apply a premium to account for the risk that over the life of the generator fuel prices and taxes may vary from those used to estimate the cost. So long as alternative generating options have broadly similar risks, and those risks move in the same direction with contingencies, the effect on choice of generating technology may be modest to trivial. However, between technologies with dramatically different risk profiles, failure to account for risk may seriously skew the comparison of costs.

Consider, for instance, comparing fuel-based generation with non-biomass renewable generation - say, a gas-fired combined cycle station with a wind farm. An investor trying to choose between putting money into one or the other will be aware that the price of natural gas may rise unpredictably during the operating life of the combined-cycle station. The investor will therefore require a higher return, to compensate for the risk that the station output may not be as profitable as anticipated. That in turn will increase the cost of generating a unit of electricity. For the wind farm, however, no such fuel-price risk arises. Apart from small and predictable running costs for maintenance, the entire cost of the wind farm is the initial capital investment, known at the outset and unvarying over the operating life of the wind farm. Using well-established techniques of financial analysis, Awerbuch shows that adding risk-free renewable generation to a generating

portfolio otherwise based on fossil fuels reduces the risk for an equivalent return, or alternatively increases the return for the same risk.

Again, an increase in fossil fuel prices appears to be strongly correlated with a downturn in overall economic activity, reducing demand for electricity and aggravating the problem of higher electricity cost. Risk-free renewables, however, whose costs are mainly servicing capital charges, may actually benefit from the economic downturn, if interest rates fall. Adding renewables thus diversifies the portfolio and reinforces its robustness against unwelcome surprises. The prevailing assumption is that official support for renewables, especially in Europe, is making electricity cost more. The financial reality, however, may well be that adding risk-free renewables should reduce the overall investment cost of generation on systems.

The International Energy Agency was set up in 1974, in response to the first oil shock. Although it now also tracks electricity, renewables, efficiency and other aspects of energy policy, its focus of interest has always been first and foremost fossil fuels. Awerbuch's research demonstrates that, compared with fossil fuels, renewables for electricity generation may look better than governments and policymakers have hitherto believed. This finding, downgrading the importance and economic advantages of fossil fuels in a key role, cannot be entirely welcome to senior IEA management. Awerbuch's report has been circulating in draft for comments since early this year, and has been appropriately revised. For whatever reason, however, the IEA has declined to publish it, and will not renew Awerbuch's contract when it terminates late this year. Other major organizations, nevertheless, are now known to be talking to Awerbuch, with a view to pursuing the implications of his work for electricity investment and electricity business.

For the moment, while Awerbuch's report awaits a publisher, those who wish to examine his analysis at first hand can reach him at <Shimon.AWERBUCH@iea.org>, or call him on +33 1 40 57 67 81 or mobile +33 6 82 84 03 44. Apart from the draft report itself he has also prepared portfolio analyses of generation on electricity systems, notably for Europe, and may be able to respond to direct inquiries.

The Awerbuch analysis is an early manifestation of a significant shift from traditional fuel and electricity policy to real 'energy' policy. Fuel-based generation is still preoccupied with batch transactions and unit prices. Renewable generation, however, is infrastructure generation, converting natural energy flows that are not themselves measured or metered. Electricity is already beginning to evolve. From a pseudo-commodity delivered and paid for by the batch, it is going to become more and more a function of infrastructure, delivering services as desired. We need new policy tools to cope with the profoundly different implications of infrastructure generation and infrastructure electricity. Awerbuch's work is a significant step in the right direction.