THE NEW ENERGY ROI: RESILIENCE, OPTIONALITY, INTELLIGENCE

By Michael Liebreich

Chief Executive, Bloomberg New Energy Finance

Twitter: @MLiebreich

In March 2005, in one of my first ever New Energy Finance VIP Comment articles, I wrote the following:

"In 1934, Aldo Leopold, a young professor at the University of Wisconsin and one of the pioneering figures of the environmental movement, tried to recreate a prairie on a piece of disused farm-land. He discovered what countless others have discovered after him: that it is extremely difficult to design and assemble an ecosystem.

"Like a prairie, savannah or rain-forest, the new and renewable energy industry must also evolve to form a complete, stable and complex ecosystem.

"Sector-specific legislation, like the sowing of seeds of a particular strain of grass in creating a prairie, clearly has a role to play. Research grants, renewable obligations, portfolio standards, power feed-in tariffs and so on can all ensure at least temporary success of some species of new energy companies.

"On their own, however, can they ever be sufficient to create a sustainable new energy ecosystem? Or will we just end up with a hothouse collection of subsidy-supported exotics, dependent forever on the efforts of politicians to prune back the advances of the fossil fuel undergrowth?"

In other words, the global shift to clean energy is all about systems. And not just one system either. It interacts with politics, regulation and finance, as well as with adjacent industries such as transportation, real estate and telecoms.

One of the main implications is that analysis at the level of just one clean energy technology will only get you so far. That is why Bloomberg New Energy Finance set out from the very start to bring knowledge under one roof about as many elements of the transition as possible. The value of a solar rooftop in a world of electric vehicles is very different from the value of the same solar rooftop in a world without. The value of demand response is negligible in a world optimised around "baseload-plus-peak" generating capacity. The value of energy efficiency is negligible in a world of fuel subsidies. And so on.

We saw the weakness of reductionist thinking in a system world, in the responses to our recent analysis showing that wind power is now cheaper than coal on an unsubsidised, levelised-cost basis in Australia. There was outrage and disbelief – mainly from those closely aligned with the Australian coal industry – yet our analysis unequivocally showed that in an electricity system capable of absorbing all the power produced by a wind farm, the returns are better than from building a new coal-fired power station. It did not say you should dismantle existing power stations. It did not say you should never build anything but wind.

The problem with a levelised cost calculation is that it makes lots of assumptions, not least about capacity utilisation, and it does not include the cost of managing intermittency. What happens when you saturate the system with wind or solar depends on what you think is going to happen next with power storage, demand response, electric vehicles, mandated back-up and dozens of other factors. These are all highly dynamic because, of course, they are part of a complex system, and systems exhibit emergent behavior. You can spend a lifetime studying the construction of a single neuron, yet know little of what drives a nematode, let alone a human. Real-life systems exhibit unexpected population surges and crashes, periods of equilibrium punctuated by periods of shattering change, tipping points, phase changes, extinctions.

This is the reality of the world's energy transition: it is dynamic, complex, unpredictable and fraught with risk. And it is among these shifting sands that energy decision-makers must plant their feet. Not surprisingly, perhaps, some choose to cling to old certainties, heuristics that worked fine during a long period of strategy stability: demand stimulation, baseload-plus-peak, centralisation, scale, vertical integration, dispatch management, control, confidentiality. But a shifting environment means increasingly replacing dinosaur heuristics with mammal heuristics: efficiency, flexibility, responsiveness, open data, transparency, coalitions.

It is with this system approach in mind that we have designed the agenda of our upcoming sixth Bloomberg New Energy Finance Summit (which takes place in New York, on 22 to 24 April). We are focusing it on what we are calling the New Energy ROI: Resilience, Optionality and Intelligence, after three strategic elements which we think can be decision-makers' allies as they place bets in an energy environment characterised by risk and change.

RESILIENCE

The energy world is becoming more volatile. Energy systems need to be able to withstand larger shocks, from more

quarters than ever before. Technological change. Commodity price spikes. Climate-related extreme weather. Financial instability. Policy change.

Impacts on the energy system from any of these sources may begin gradually, but they do not end that way. Floodwaters rise gradually, but can jump from "within tolerances" to "catastrophic" with a marginal movement; intake water temperatures have forced the shutdown of nuclear plants in France and in the eastern US. So it is too with technological change. The reduction in price of solar between 2000 and 2010 made little impact on its viability. The same percentage reduction since 2010 has meant that huge markets for unsubsidised rooftop solar are now opening up. To borrow Ernest Hemingway's description in *The Sun Also Rises* of how a character lost his fortune, impacts happen "Gradually, and then all at once."

More than ever, therefore, decision-makers need to ask not just "what is the best expected outcome", but "what is the worst that can happen". Certain solutions are inherently better than others. Distributed beats centralised. Diversity beats a mono-culture. Consensus beats confrontation. Local beats distant. Resilience means power storage, to build in tolerance. It means smart grids, to match supply and demand. It also means future-proofing the design and location of assets; floodplains and valleys which provide cheap access to cooling and make-up water may be out of the money if they bring flood risk in future climate scenarios.

Financial firms may be ahead in this respect; after all, Thomas Edison's very first electricity plant in New York City served a single client – JP Morgan and Company. During Hurricane Sandy, one of the few fully operational buildings in Lower Manhattan was Goldman Sachs' headquarters.

Hurricane Sandy's impacts inspired Governor Andrew Cuomo to create the NYS2100 Commission "in response to the recent, unprecedented, and severe weather events experienced by New York State and the surrounding region." The executive summary of its recent draft report invokes "resilience" 36 times and demands that New York "rebuild smart: ensure replacement with better options and redundant systems".

OPTIONALITY

Optionality means thinking through the various scenarios that might follow a decision, not just Plan A, and placing appropriate value on possibilities opened up or shut down by each path. Breaking projects into elements has value. The ability to delay a capital commitment has value. Adding assets in smaller increments has value. Reducing capital intensity has value. The ability to hedge or insure outcomes has value.

A mine-mouth coal plant is only – and forever – that. Its options are limited. But an electric utility or a fuels distribution company is fundamentally a provider of energy and related services, and not just a coal generator or a gas burner. Optionality allows a company to embrace new opportunities first at the margin, but eventually at the heart of operations. Most century-old firms know this already, as do all technology companies. Today, IBM is a services company; Apple a consumer devices and services company. Asking the counterfactual "what would they be if they still made only mainframes or iMacs?" gives a simple answer: they would be out of business. Energy is a service to meet a need. As technical and societal needs change, so must the service, and that means portfolio options.

Some utilities hold fast to decades-old strategies and asset portfolios, but many of their bankers already think in terms of option pricing when analyzing new power generation. Investment banks are already pricing in risks for one-way fossil fuel bets that drive up the cost of new-build coal plants in Australia, as our recent research has highlighted – and try finding a major investment bank comfortable financing a new coal plant in the US.

For institutional investors, the question is much the same: "Are you comfortable allocating funds in a one-way bet without hedging against technology, policy, regulation, economics, or environment?" For long-term assets that may be exposed to unquantifiable risks, traditional models of analysis run out of oxygen. As Harvard Business School professor Martin Weitzman states in a recent paper, the assumption that risk-adjusted discount rates "decline over time towards the risk-free rate is very much dependent on the assumption that the project is *not* risk-exposed."

The gathering momentum of the movement to force divestment from fossil fuel companies is an example of this change in discourse. In a 1990 referendum, 52% of Harvard students voted to divest from South African firms, with a 38% turn-out. Last year in a first-of-a-kind referendum, 72% of Harvard students voted to divest its $30bn endowment from fossil fuels with a 55% turn-out. In response, the Harvard Corporation stated that it "is not considering divesting from companies related to fossil fuels," as most institutional investors would say on first instance. Are you prepared to bet that this generation of students will fail? What is your plan B?

INTELLIGENCE

Our third strategy to deal with the changing energy system is Intelligence, in all its forms. One example is up-to-date information on costs. Our own work on the cost of clean energy shows that power generation from PV has become anywhere from 35 percent to 55 percent cheaper, depending on which technology you choose, over a three-year period, while generation from onshore wind has come down by around 15 percent. (The cost of generation from offshore wind has meanwhile risen significantly.) And what about costs in the future? There is an underlying experience curve for PV, onshore wind and even offshore wind – that will produce further improvements over the medium term. Smart decision-makers need the best information about what the future will bring, and we look forward to continuing to provide the best possible information on future energy options.

Intelligence is also about collecting, analysing and harnessing data that is several orders of magnitude beyond what was available to energy companies in previous decades. GE chief executive Jeff Immelt recently referred to the emerging world of connected, sensor-imbedded machines and the processing power to analyse it as the "Industrial Internet". Energy efficiency software applications are allowing building owners to optimise consumption and control costs with greater granularity than ever before. Smart meters make possible the use of detailed information on which consumers use electricity when, and offer the opportunity to shape their consumption habits over time. Smart grid sensors and analytics software allow

utilities to pinpoint and correct faults, and optimise energy networks in response to real-time conditions. Opportunities for new intelligence range from managing grid losses to predicting renewable and distributed generation performance, from pricing strategies and maintenance schedules to arbitrage opportunities. Ultimately, new connected and intelligent capacities allow us to, in Immelt's words, to "find meaning where it did not exist before". And not only meaning: value.

Finally intelligence is about improving our ability to learn. The era of the internet and open data has made possible the rapid transmission of ideas and practices that might have taken many years to spread in the old days of centralised, conventional energy. A White Paper I co-wrote last summer with eight international policy experts on Open Source Software and Crowdsourcing for Energy Analysis, argued that open modeling efforts can improve the utility and accessibility of energy models, and lower the cost of data collection and management. This advance should make it far easier for developing countries, in particular, to make intelligent choices on energy – difficult choices, involving billions of dollars.

* * *

Energy decisions are not discrete units, divorced from context. They are instead *interactions* between many different factors and players, all with the ability to influence their own and others' production and consumption. Producing the perfect forecast is probably impossible. One has only to look at the gulf between what the IEA, EIA and others have forecast, and the out-turn just a few years later. In this world, resilience, optionality, and intelligence are your friends – a checklist by which to assess your decisions fitness to survive in the new energy ecosystem of volatility and dynamism.

These are the issues we hope to examine at our Summit in New York on 22 to 24 April. I hope that you will join me and my colleagues, along with 600 leading investors, policy-makers, technology pioneers, and energy producers to discuss the future of energy – its direction not just in the next weeks and months, but in coming years and decades.

(This article was co-written by Nathaniel Bullard, content director for the Bloomberg New Energy Finance Summit.)