MEETING VICTORIA'S ENERGY REQUIREMENTS IN THE 21ST CENTURY

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Victoria has a remarkable richness and diversity of energy resources. Reserve estimates include some 430 billion tonnes of brown coal, in near-surface seams up to 230 metres thick; over 8 trillion cubic feet of as yet undiscovered gas; and perhaps 600 million barrels of undiscovered crude oil. To this may be added some of the best wind resources in the world, significant solar resources, the potential for geothermal energy resources, and significant bioenergy potential associated with Victoria's substantial agricultural and forestry industries. Victoria is also deeply enmeshed in the national grid, so provided that reasonable investment in network maintenance and security continues, and demand growth (including peak demand growth) is restrained by energy efficiency policies, network security should remain high. Setting aside temporary disruptions due to infrastructure failures, running out of energy is not a problem that Victoria will face during the 21st century, or perhaps ever. But does this mean that it faces no challenges in meeting the energy needs of Victorians?

Hardly!

There are at least two key major challenges. The first relates to the economic performance of the energy system, and the ability and willingness of Victorians to pay for what is becoming an increasingly inefficient, expensive and non-productive asset. The second is the environmental performance of the system, and the social acceptability of that performance. I review these briefly, in turn, below.

Figure 1, from the Productivity Commission's 2012 *Electricity Market Review*, shows that the rate of increase in both capital expenditure and of inputs such as fuel and labour in the National Energy Market (NEM) has been rising at an alarming rate, easily outstripping the rate of growth in output. This is also true in Victoria. As a result, the productivity of the electricity system has been falling almost continually – since the NEM began in 1997–1998. For students of history this is of course ironic, as the key justification for the NEM was that it would enhance productivity in the electricity sector.

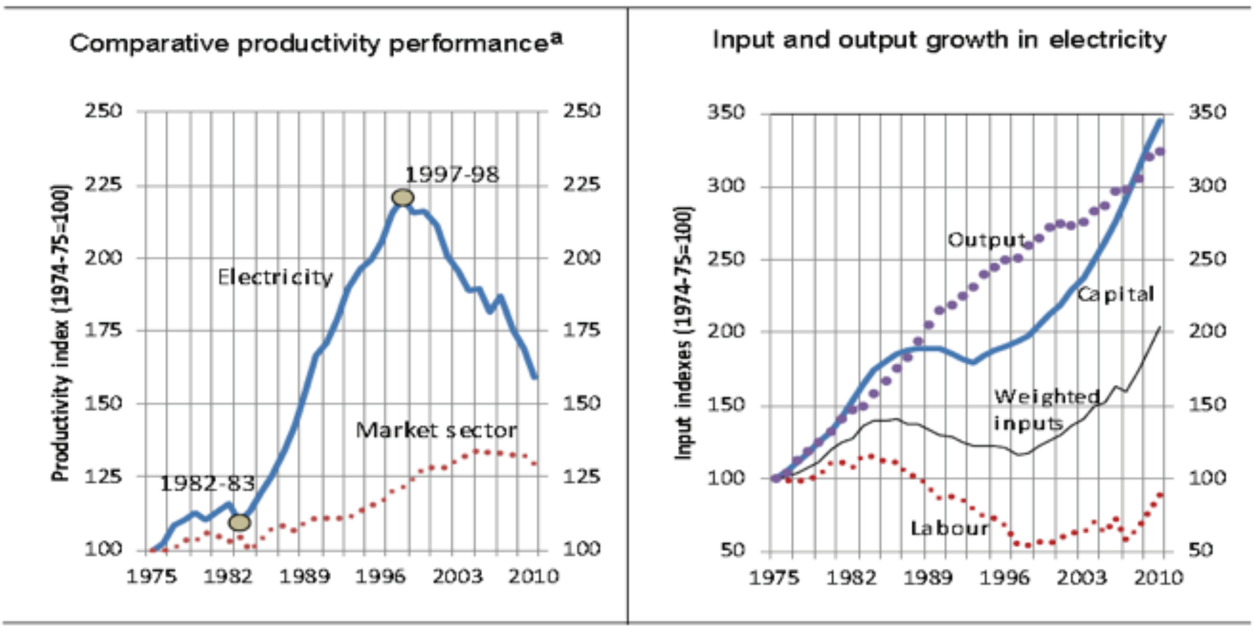


Figure 1: Input and output growth in the NEM, and comparative productivity
Source: Productivity Commission, Electricity Market Review, 2012

PERFORMANCE

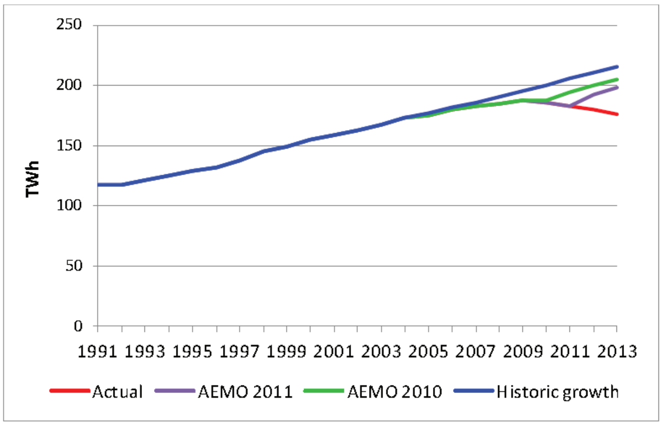
Why has this occurred? The key reasons relate to the nature of the regulatory environment created by the NEM designers, the development model pursued by the industry and regulators alike, and the pathological fear of the political consequences of electricity outages on the part of state governments.

The regulatory environment aimed to separate generation, transmission, distribution and retail, and to introduce competition into at least generation and retail (and some other services such as meter reading), based on a notion that competitive market outcomes could outperform the previously integrated (and largely state-owned) system. Clearly those who held this view had not inspected the Productivity Commission's figure above, otherwise they might have asked themselves what the problem was they were trying to solve: productivity growth in the state-owned and vertically-integrated electricity sector was extremely healthy – at least triple the market sector – until the NEM was instituted in 1997.

The NEM designers clearly failed to understand the enormous overhead costs associated with privatisation and competition – and with the dramatically increased need for regulation under this 'market-based' model. The alphabet soup of regulatory and market institutions in the NEM is legendary. In addition we must count the trading systems, IT systems, governance systems and review mechanisms. So far as I know, no-one has quantified the cost of this overhead to the NEM, but it would run into the hundreds of millions or possibly a lot more.

Second – and deliberately – the NEM designers abandoned the possibility of least-cost system design, the proven approach still used to this day in most of the United States, Europe and other countries. When a single 'intelligence', with accountability for the overall system performance, makes planning and investment decisions, they may not get it perfectly right, but they have the ability to eliminate gross error. Under the state-controlled systems, and still to this day in the segments of the market where this continues, a key 'market failure' is subcommercial investment decisions by state governments, such as the massive expansion of coal-fired generation in Queensland in the 1980s and 1990s, justified primarily, it would appear, by State-of-Origin pride and the desire to be a net exporter of electricity to NSW rather than the opposite. In the current 'market-based' system, similar functions of course still need to be carried out. The Australian Energy Market Operator (AEMO), rather than state electricity commissions, must forecast the demand for energy, in order to send signals to the market about required investments. Figure 2 summarises the AEMO's recent forecasting performance. It would appear that the growth bias that

Figure 2: Actual send out generation versus AEMO projections



Source: Power Down, Australia Institute, December 2013

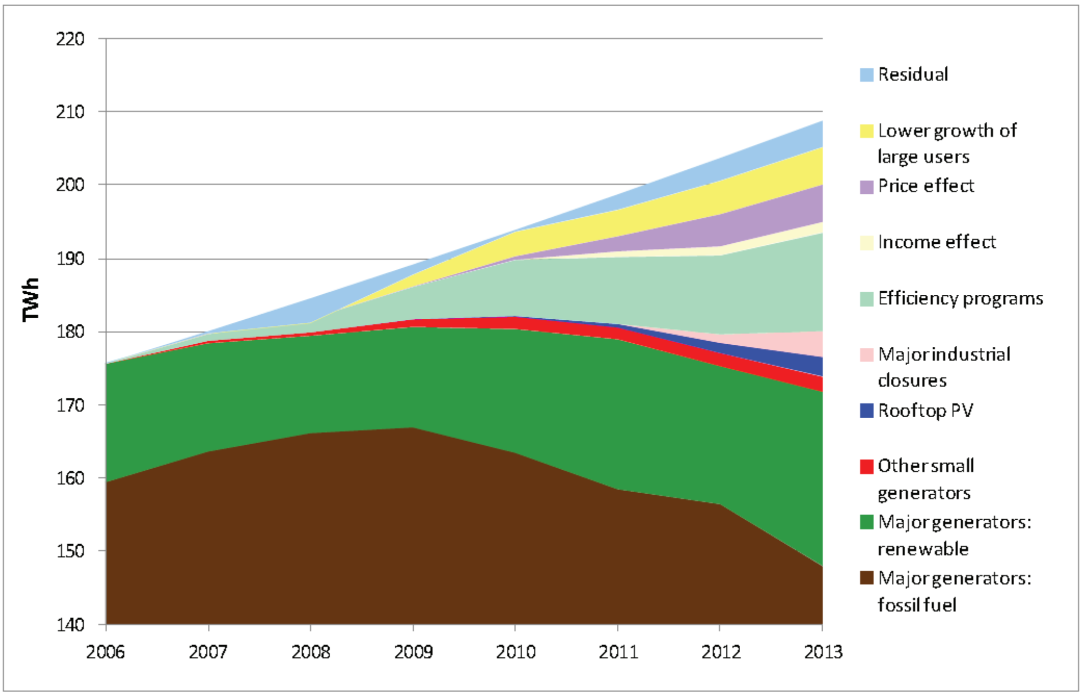
state electricity commissions were sometimes accused of is alive and well in the 'competitive' market.

The development model that has been pursued since 1997 is essentially the same as that which came before, but without the ability to optimise investments. Centralised and remote generation, long transmission lines, distribution networks designed for one-way power flow, and weak state interconnections – these reflect an industry-driven rather than customer-driven approach. More on this below.

Security standards – the arrangements designed to ensure that electricity networks are robust in the face of contingency, be they asset failures, fuel shortages, bushfires or other 'natural' disasters – do contribute to a need to invest in additional capacity relative to expected actual demand. These standards are sometimes blamed for creating over-investment and therefore increasing system cost. However, these security requirements are inherent to any complex and dynamic system: they were necessary before the NEM and are necessary now.

One of the key drivers determining the amount of investment in electricity networks is peak demand. This is in turn driven by the nature of investments in energy-using assets, including buildings, air conditioners, and so on, along with climate conditions. While I will discuss changing climatic conditions below, suffice to say here that an absence of integrated market planning – and an absence of integrated thinking on the part of policy makers and governments more generally – has seen a weak focus on energy efficiency standards, slow responses to market trends (like the growth in air conditioning) and, as a result, a sharp growth in peak demand (until recent years, as discussed below).

Figure 3: Contributions of various factors to falling demand for electricity in the NEM since 2006



Source: Power Down, Australia Institute, December 2013

This – along with the market's usual optimism bias – has led to a massive investment in electricity market infrastructure in recent years, just as demand for that electricity infrastructure started to fall.

Dr Hugh Saddler has carefully mapped the reasons why in *Power Down* (ibid). Figure 3 summarises the key results.

More than 50% of the decline has been driven by energy efficiency policies and the growth of photovoltaic (PV) panels – both of which were clear and deliberate outcomes of government policies (helped along greatly, in PV's case, by an approximately 90% reduction in PV panel prices in the last 6–7 years). A second key influence has been the direct consequences of past over-investment in electricity capacity, that is, rapidly rising electricity prices. It is also ironic that in our 'market-based' electricity system, we are surprised when consumers respond to a doubling of prices by reducing their demand for the overpriced commodity. This suggests a lack of basic economic literacy. In short, these effects could have been anticipated. Instead we have massively over-invested in electricity infrastructure, some of which may not be used for many years to come. In the meantime, however, it must be paid for, hence our high electricity prices and the poor system productivity.

To finish this section, I conclude that the current NEM model is badly broken. It is delivering poor economic outcomes for consumers and for Australia, including unnecessarily high prices and low productivity. Despite numerous analyses – of which the Productivity Commission and Australia Institute studies cited here are but two – there appears to be a low level of awareness of these issues. More concerningly, we hear from some quarters that more privatisation and deregulation – as noted, the primary causes of the poor outcomes now being experienced – is not the problem but in fact the solution, something that we need more of.

The second key challenge facing Victoria's energy system in particular, and Australia's more generally, is the environmental and social sustainability of that system. Victoria's electricity-related greenhouse gas emissions, at 1.35 kg CO_2-e per kWh on a full fuel cycle basis is among the highest in the world. This, of course, relates to the primary fuel source being brown coal with a very high moisture content. In a world where the evidence of accelerating, human-induced climate change is now unarguable – to all bar the wilfully blind – it is highly questionable whether this outcome should continue to be tolerated.

Whether for equity reasons, or environmental reasons, or social reasons (the 'social licence' of the industry), or eventually economic ones (for example, through the need for carbon pricing or any other form of carbon emission constraint), Victoria will have to end its reliance on the combustion of brown coal for electricity generation. It is only a question of how much damage we (as a society) are prepared to tolerate before we insist on this outcome. This threshold might be reached in a decade, or perhaps in a few years. Prudent governments would therefore be planning now how to shift Victoria's electricity system onto a fundamentally more sustainable footing, as rapidly as possible, in the long-term interests of Victorians as well as the global commons.

How this is to be done is another paper. There are many alternatives, particularly those using sustainable and renewable energy flows, which are both readily available and affordable. We must not fall into easy criticisms of these alternatives while turning a blind eye to the larger shortcoming of our existing system. No energy technology is free of social and environmental impact – we need to select between practical alternatives those which are both fit-for-purpose and least damaging. Above all, we must not imagine that it is simply inconceivable, or impossible, or impossibly expensive, to change – for none of these things is true, and change is the only certainly. Rather, we must accept the challenge of devising the most effective and efficient solution to this problem now, accepting that it will not be perfect, rather than choosing the morally bankrupt option of leaving it to future generations to determine what to do with their gift from this generation – a damaged 'operating space for humanity'.

There are no free lunches in energy systems. However, some of our lunching habits are proving remarkably expensive, as well as damaging for our health – broadly defined. We must learn to become more discriminating eaters.