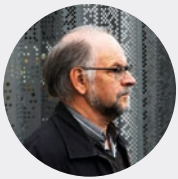


Looking back, and forward

From micro-breweries to in-store bakeries to 3D printing—distributed, modular production is taking over. It's all part of the shift to a low carbon future, says Alan Pears.



- Alan Pears, AM, is one of Australia's best-regarded sustainability experts. He is a senior industry fellow at RMIT University, advises a number of industry and community organisations and works as a consultant. He writes a column in each issue of Renew magazine. you can buy an e-book of Alan's columns from 1997 to 2016 at shop.renew.org.au.

Wow, 150 issues of *Renew* (and its predecessor, *Soft Technology*). I feel like a Johnny-come-lately, having written my first column for issue 59.

When I looked back at issue 1, I was amused to see an article on DIY hydrogen, by ATA/Renew stalwart Mick Harris. The cycles of life, and energy. And an advertisement for Going Solar, an important contributor to Australia's progress on clean energy and sustainability, which is still operating out of the 60L Green Building in Carlton.

This magazine has been a unique and essential part of our path towards a sustainable energy future. It has evolved with the sector, guided by the ATA/Renew team and some great editors. It has been a privilege to make my small contribution to its success. I look forward to another 150 issues!

This issue is also marked by a significant farewell. I would like to wish Donna Luckman well as she leaves Renew for new challenges. I have benefitted greatly from her talents over her 16 years with the organisation, as editor of this magazine, then as a supportive and friendly CEO. Her enthusiasm and hard work have shaped the organisation's success over a period of astounding change. And her pioneering role as a female in a senior role in a traditionally male-dominated sector has been a wonderful example.

Appliances and our ongoing under-performance

Appliance energy efficiency is a much under-recognised contributor to financial savings and emission reductions. The review of our appliance efficiency program was recently published at energyrating.gov.au/document/report-independent-review-gems-act-final-report. It received no media attention as far as I could find. Indeed, the whole review process was low key, with only 19 publicly available submissions to the discussion paper, of which mine was one of very few community contributions (bit.ly/34avSrr and supplementary submission to the draft report, one of 14 public, bit.ly/AP-gems).

The outcome of the process was disappointing. It will mean that Australians continue to waste billions of dollars

each year while unnecessarily emitting millions of tonnes of greenhouse gases.

The report states (p. 16): "In 2018, the net savings of GEMS regulations to the Australian economy ranged between \$1.13 and \$2.15 billion with greenhouse gas emissions savings of between 4.8 and 7.6 million tonnes. That is the equivalent of half of Queensland's annual household emissions. *The Department estimates that GEMS regulations to date have provided emissions abatement at a negative cost of around \$200/tonne [my emphasis].*"

A negative cost means that it is saving rather than costing money for emissions abatement. Compare this to other emission reduction measures such as the Emission Reduction Fund, which is costing around \$15 per tonne of emissions avoided. Indeed, an effective program should save us a lot of money.

To put the situation in context, I have updated some work I did in 2014, comparing average appliance energy use to outcomes if best products on the Australian market and reasonable householder behaviour were achieved (see Figure 1). There is still a lot more potential to improve new appliance performance and to encourage importers to bring more efficient products available elsewhere to Australia.

In my submission, I outlined a comprehensive approach to appliance efficiency. Some key elements could deliver substantial savings quickly. Appliance action is pathetically poorly resourced and funded, with little local research to support action.

We know that there are many faulty or poorly maintained appliances in the field, in commercial and industrial sectors as well as homes. Emerging data analytics techniques now provide the opportunity to cheaply and quickly identify problem equipment. Clearly this should be repaired or replaced.

We need more stringent performance standards (MEPS, mandatory energy performance standards) covering a wider range of equipment. New appliances and equipment should have smart diagnostics to tell us if performance is falling short.

We're not just shifting to a low carbon energy future

Most people, businesses, the energy industry and even politicians now realise we are moving towards a low carbon energy future. What they don't seem to realise is that fundamental shifts across the whole economy in business models and human experience are occurring. Production is being reframed. Virtual services are replacing physical activity. Modular, distributed and diverse technologies are replacing large, centralised technologies.

Many of these changes are impacting on demand for energy, yet they are largely unrecognised by energy specialists. That's why energy forecasters are struggling to predict energy trends. The Australian Energy Market Operator's forecasts have been adjusted downwards in recent years. Their forecast scenarios show a 'high' demand trend more than 50% higher than the 'low' trend. And they are our best forecasters!

Production that used to occur in the manufacturing sector now occurs anywhere from the point of harvesting of a resource (which could be recovery of 'waste') to the point of delivery to a consumer.

Food processing on the farm or nearby is replacing large-scale processing at a large plant located where a cheap supply of gas was available. Micro-breweries, hot bread shops and in-store bakeries can out-compete large breweries and bakeries. 3D printers in office back rooms can replace traditional manufacturing plants. Online shopping and virtual delivery of entertainment, health and education services are replacing physical movement, buildings and products. Data analytics and machine learning are driving new levels of accountability, optimisation and system management.

These kinds of changes have disruptive impacts on the energy system.



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What used to be safe investments across business are now risky. And what used to be risky investments in emerging businesses are still risky at an individual level, but diversified investment in emerging sectors may be becoming safer. Lumpy investments in projects that take several years to implement are now riskier than modular and incremental alternatives that can learn faster, deliver cash flow sooner and be located more flexibly.

These powerful trends are broadly consistent with a lower carbon economy. But they are reframing work, business, politics and daily life. They have implications for unions, workers and businesses. There will be winners and losers. If governments fail to introduce adequate consumer rights, support for workers and economic transition strategies, the pain and tensions will be greater than necessary.

Materials, energy and carbon emissions

A significant part of the global energy and carbon footprint is due to demand for materials sourced from mining and energy-intensive

processing. This has grown as population, wealth and economies have grown.

But things have to change. One study found that, if developing countries continue to build using concrete and steel, 30% to 60% of our Paris global carbon budget will be used up providing those materials by 2050. My analysis of the Australian situation found that embodied energy in construction is now comparable to the energy used when heating and cooling those buildings. So building policy that focuses just on operating energy is failing to consider the bigger picture.

If we look beyond buildings to appliances and renewable energy, the situation is more complex. For most renewables, the energy payback period is now quite short. For appliances, large improvements in operating energy efficiency mean that you can recover the impact of manufacturing the replacement fairly quickly. But increasing production can undermine the savings.

The life cycle climate impact of very efficient equipment can be very small in comparison with the products they replace. For example, Apple's estimate of the life cycle emissions from an iPad is 87kg of CO₂ compared with 494kg for a 21.5" iMac. But 70% of the iPad's life cycle carbon impact is in production, compared with 49% for the iMac.

We must increase our focus on replacing physical activities with virtual services, dematerialisation, recovery/recycling/reprocessing, life extension (through design, adapting, maintaining and renovating), reuse, and adoption of 'enoughness'.

Just as efficiency and renewable energy undermine demand for traditional energy solutions, these changes undermine demand for traditional mining and resource processing, and the asset values of mineral resources and mines.

Prediction of future demand for materials is complicated by population and lifestyle trends. Inertia and the power of incumbent industries and cultures slow change. But innovation and cultural change can accelerate the process. There will be winners and losers, and the losers have a lot to lose.

Miners must use their knowledge to underpin 'mining' of stocks of materials in existing landfills instead of new mineral deposits. The recovery and recycling industries must develop more sophisticated ways of extracting and enhancing value of materials from 'wastes'. And designers and businesses must create ways of delivering services using less materials, and shifting to use of recovered and recycled material, while improving durability and repairability. Our 'war on waste' is in its early days.

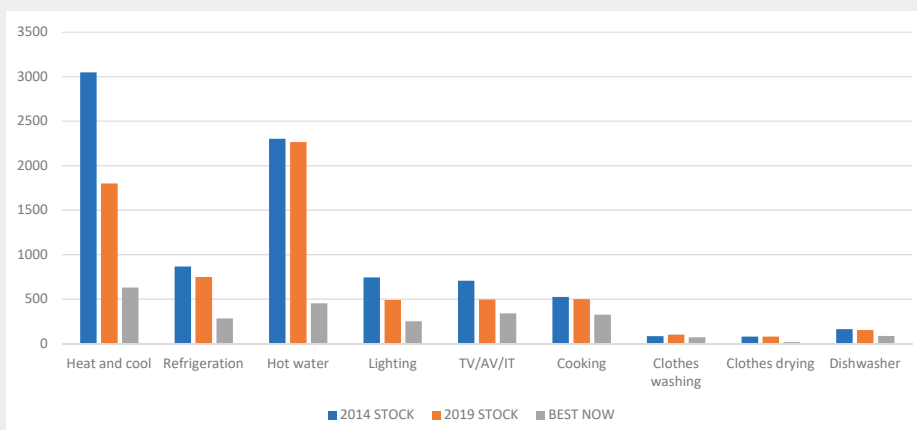


Figure 1. Indicative annual electricity use (kWh) in a two to three person all-electric home for the mix of appliances installed in Australia in 2014 and 2019, compared to the best available appliances on the Australian market now.