COMMENTS ON AEMO FORECASTING OF DEMAND SIDE Alan Pears AM 12 May 2021

I attended an AEMO workshop on energy efficiency earlier this year, but I have not been invited to participate in any more recent events. However, Rob Murray-Leach from EEC told me today that you were seeking input on your scenarios. He sent me some documents from a workshop.

I have worked across all sectors of the economy, including on quite a few real sites. Due to a serious lack of funding and resources, we know very little about real demand profiles and the drivers of them in Australia.

As I mentioned previously, future levels and profiles of demand are a major risk factor for all investors in energy supply and storage. So I remain bemused that so little work has been done to understand this field. It may be that the recently created RACE for 2030 demand-side Cooperative Research Centre will support some work in this space, so maybe AEMO should engage with them. Indeed, RACE is at present conducting scoping studies on possible project directions in relation to the extent of flexibility in demand profiles through demand response actions, as well as looking at impacts on the electricity grid of electrification trends. I am involved in both of these.

With regard to demand-side action, including energy efficiency, demand management and demand response, a key challenge is that we don't have a good understanding of the present situation.

To assume that a higher star rating reduces peak electricity demand is risky. The star rating is based on an annual energy consumption estimate. In many parts of Australia, new dwellings have achieved 6 star ratings through measures that improve winter performance but actually make summer performance worse. The images below show results from a study of 100 homes in Victoria: the higher the star rating, the higher the cooling energy and the higher the average summer temperatures…… The second image shows a case study of two 6 star homes in Adelaide, one designed for summer and the other for winter…..

The future situation is further complicated, as 6 star homes are basically thermally quite good except that they lack window shading and may be poorly orientated – and people may leave windows open all the time for 'fresh air'. This means that retrofitting effective shading could dramatically improve their summer peak performance. The 2019 National Construction Code update included introduction of a new requirement in some climate zones to meet separate summer and winter cooling energy limits as well as the overall annual one. These limits are weak, but they are a first step towards recognising the summer performance problem that has been identified. My analysis flags that peak cooling demand can be heavily influenced by a strong, hot north wind, as well as air temperature, and cloud can impact on radiant heat loads as well as PV output. The timing of a cool change can also shape the daily demand profile quite significantly.

The commercial building sector has similar issues, as both NCC and NABERS focus on annual energy/emission performance, not peak demand.

More broadly, the emergence of real time data collection, data analytics, connection to multiple data sources, flexible process machinery (eg variable speed drives and electronic controls) means that the potential for demand-side distributed intelligence will have increasing impact on energy use. Electrification in many cases will be combined with greater flexibility and more 'point of use' technologies, modular factories, etc. We could see industry relocating when they no longer rely on access to a gas pipe. And often the decisionmakers will be driven by overall business productivity/profit or other outcomes for which energy cost is a minor factor.

All these factors create serious investment risks for the energy supply sector. When AEMO's demand forecasts 20 years out are like chalk and cheese, this risk should be obvious to investors. It may well drive them faster towards more modular energy supply, storage and management solutions as ways of reducing risk exposure.

Willand analysis of CSIRO data for Melbourne houses

Overheating occurs fairly often, not just on extreme days (Nicola Willand, PhD candidate, RMIT University)

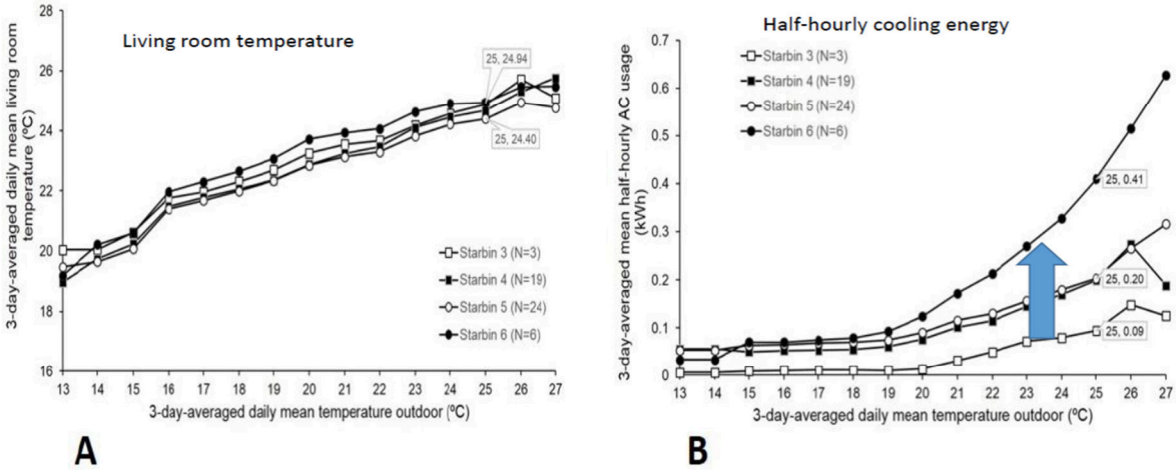

Figure 3 Relationship of three-day average running daily mean living room temperature to three-day average running daily mean meteorological temperature for the 52 homes for which air conditioner usage data was available (A) and differentiated by starbins (A) and relationship of three-day average running daily mean half-hourly air conditioner energy usage to three-day average running daily mean meteorological temperature for these 52 homes differentiated by starbins (B)

From Willand, N, Ridley, I & Pears, A 2016, 'Relationship of thermal performance rating, summer indoor temperatures and cooling energy use in 107 homes in Melbourne, Australia', Energy and Buildings, vol. 113, pp. 159-68

Impact of summer or winter-focused 6-star design on performance in extreme heat in Adelaide

Hatvani-Kovacs G (2019) *Heat Stress Resistant Residential Design in Australia* acumen.architecture.com.au/environment Issue 02

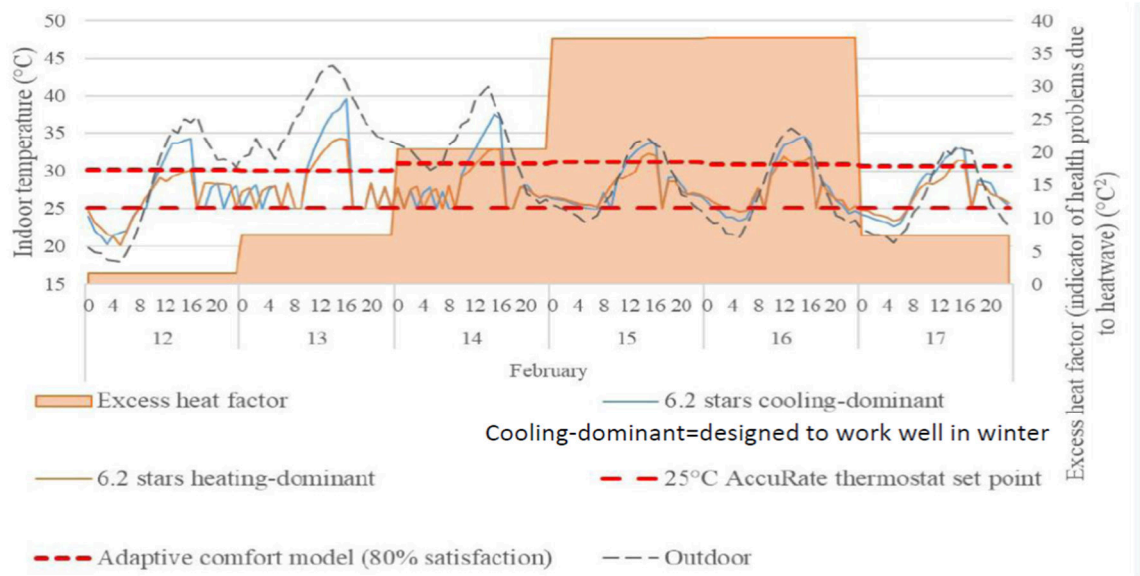

Figure 12. Overheating analysis of a north-facing bedroom during a medium heatwave period in Adelaide (Source: Hatvani-Kovacs et al. 2017). Note: The solid orange line represents the indoor temperatures simulated in a 6-star heating-dominant home compared to the solid blue line, representing the 6-star cooling dominant home. The metric of the excess heat factor is °C², and measured on the secondary vertical axis, referring to days with higher heat related health risks.