Energy Efficiency during peak demand

Purpose and Agenda

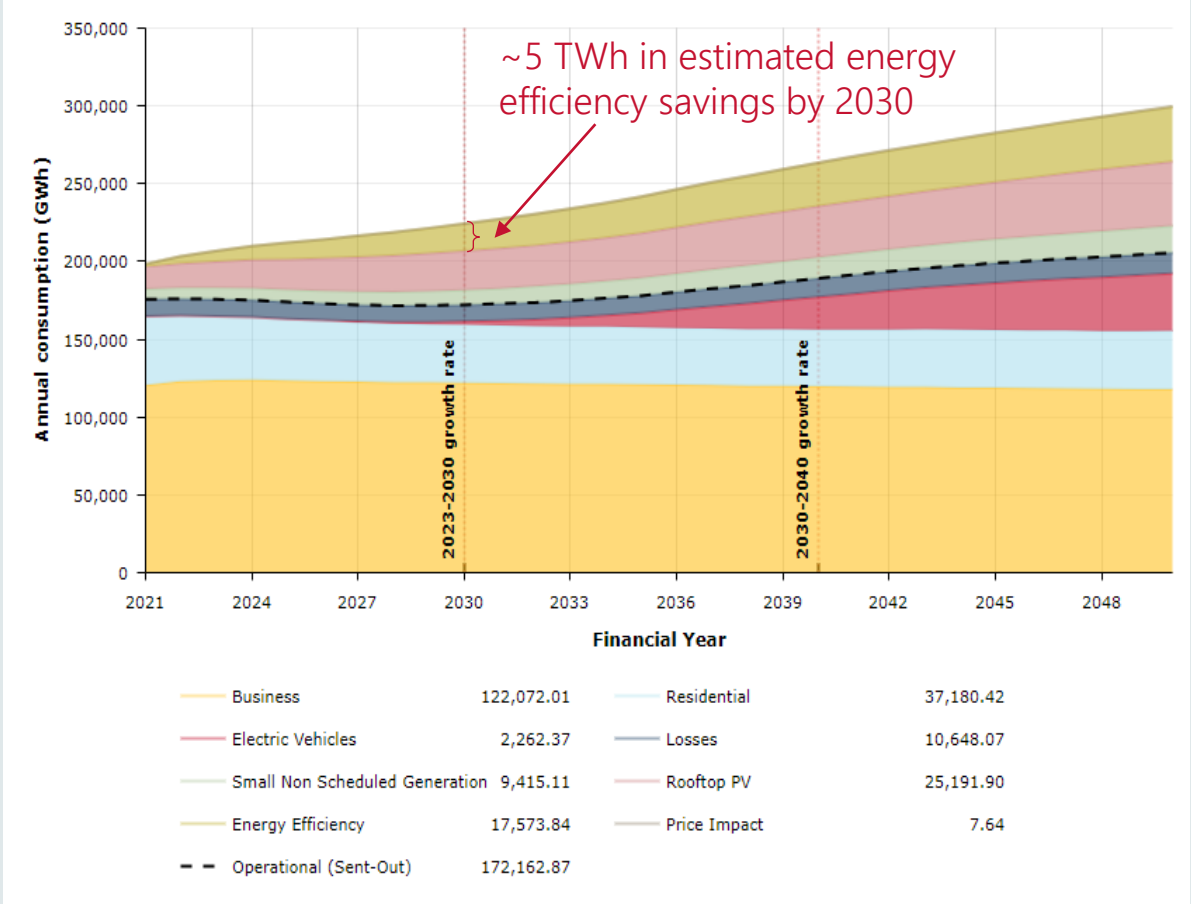
Purpose:

1. Discuss AEMO's methodology for accounting for energy efficiency at time of Peak
2. Gather ideas for improving AEMO's current methodology

In the activity later, AEMO will consider these for incorporation where possible within the current framework. If that's not possible AEMO will consider later as a future improvement

Annual consumption accounts for energy efficiency across the year

- The 2020 ESOO forecast a 5 TWh reduction in demand due to energy efficiency from 2020 to 2030
- These energy savings come from:
  - Mandates on building standards, appliance standards
  - Consumer information on energy usage (star ratings)
  - Incentive schemes
- These schemes can be split out by:
  - Temperature sensitive demand (cooling appliance vs heating appliances and insulation)
    - Different energy efficiency performance in winter vs summer and at different rates along the temperature/demand spline
  - Baseload appliances such as lighting, hot water, fridges, swimming pools



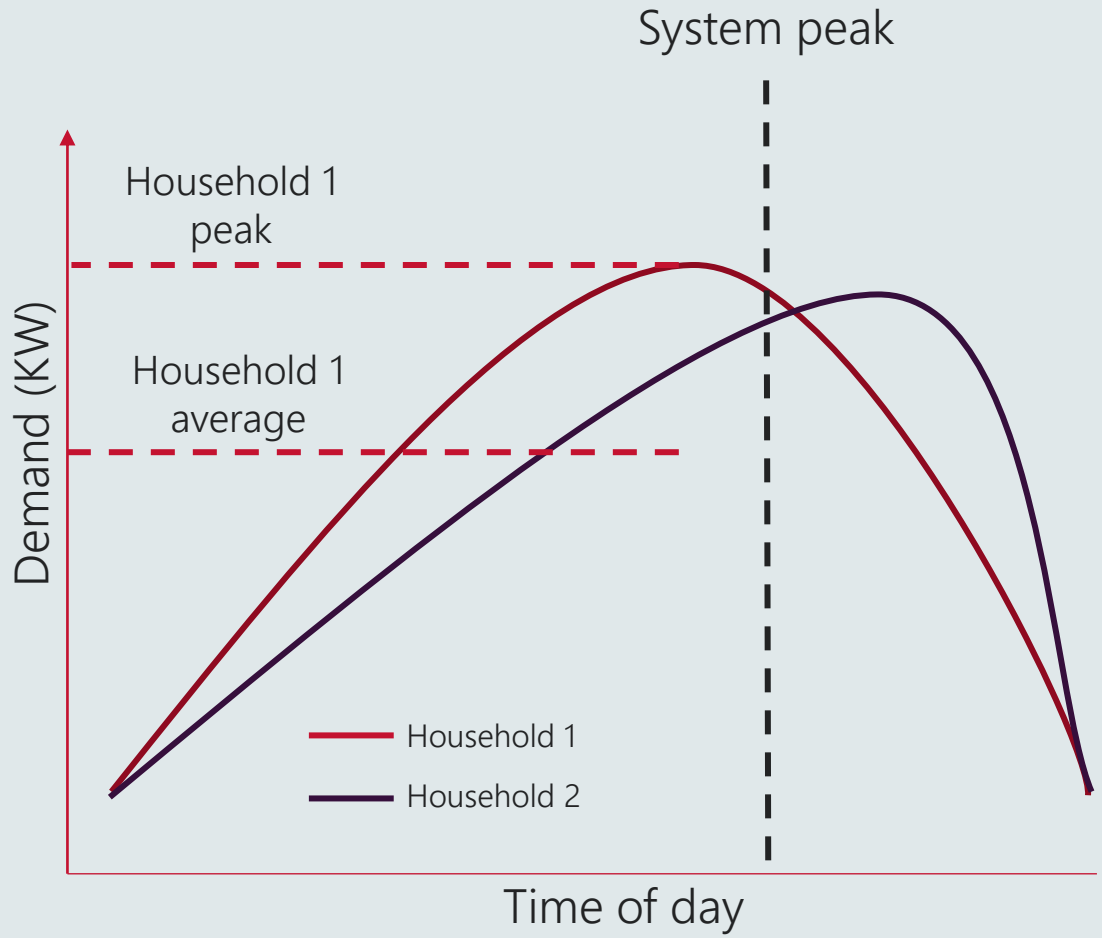
Energy efficiency during peak demand events

Energy vs Demand

- Energy Efficiency schemes generally focus on energy savings
- Building standards often tailored toward heating load savings in winter
- Appliance standards and star ratings are given at the appliance level whether heating, cooling or baseload appliances
- *What is the relationship between energy efficiency saving during average appliance usage vs peak appliance usage?*

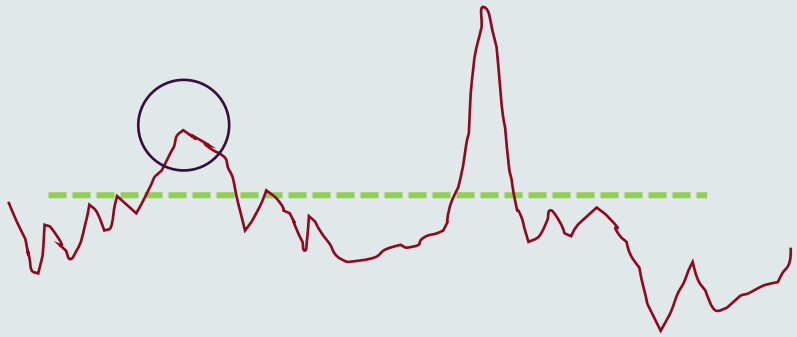
Appliance/household vs coincident region demand

- Energy Efficiency schemes are developed at the appliance or household level. Behaviour of these millions of appliances and millions of households during a specific point in time drives system demand peak.
- There are issues with a bottom up conservation load factor approach.
- *Should we adopt a composite™ load factor to account for system peak and the shifting in timing of system peak?*
  - *HOW: What proportional of appliances are operating average their average operating level vs peak operating level during system peak?*
  - *What is the diversity or the coincident behaviour of these appliance?*
- *The ultimate question: Do energy efficiency schemes experience diminishing effectiveness at times of system peak? if so how?*



Conservation load factors

Based on conservation load factor (CLF) methodology



$$CLF = \frac{\text{average power used}}{\text{peak power used}}$$

< 1	"peaky" profile
= 1	"flat" profile
> 1	device uses less at peak times than on average

CLFs for air conditioners have been estimated for Australia and are generally very peaky

Table 45: Estimated CLF factors for Summer Electrical Peak based on EES Simulation Modelling

Year	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
kW reduction / house	0.436	0.42	0.42	0.65	0.69	0.34	0.61	0.36
kWh reduction / house	206	60.6	231	225	250	8.5	669	76.7
Calculated CLF	**0.05**	**0.02**	**0.06**	**0.04**	**0.04**	**0.003**	**0.12**	**0.02**

Source: EES (2011)

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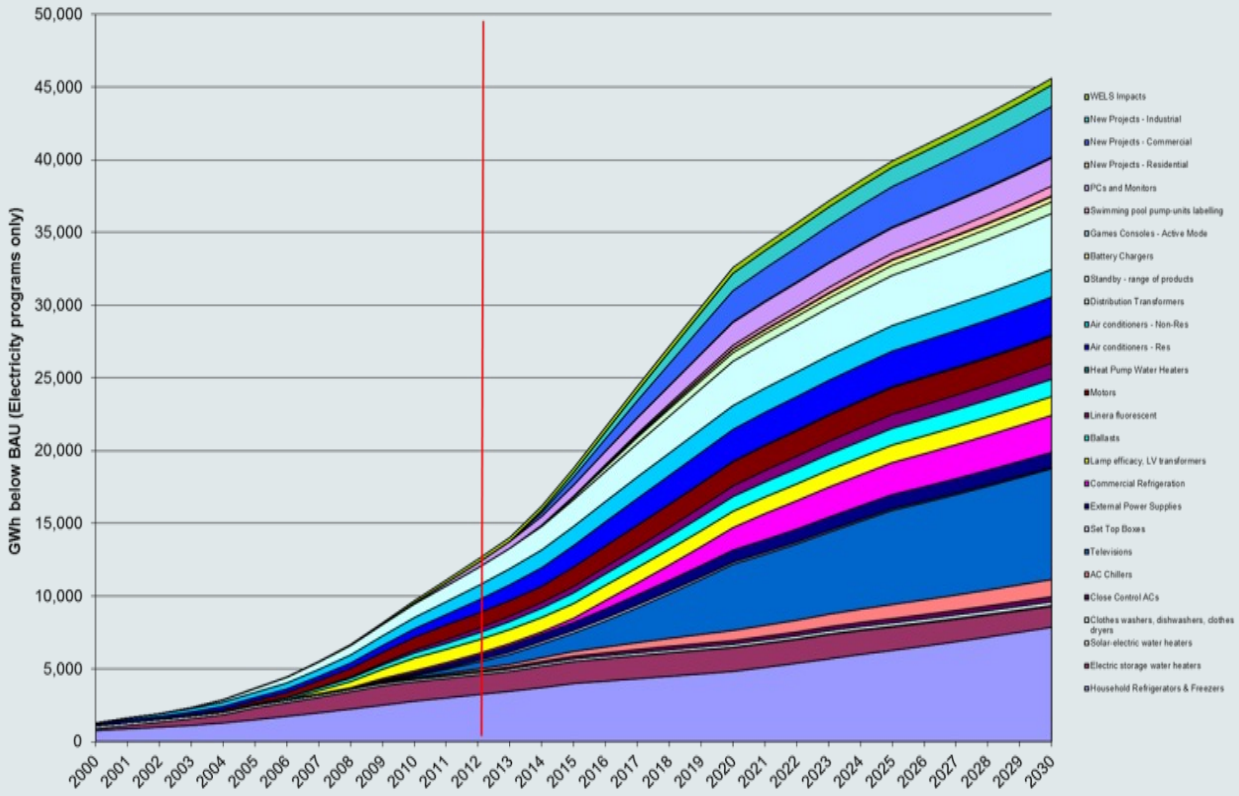
Conservation load factors (cont.)

- Using the CLF numbers for an individual appliance is problematic for a long term forecast as:
  - The CLF is only accurate for reasonably small changes
  - The timing of peak demand may change over time due to uptake of rooftop PV, batteries, EV and energy efficiency measures.
- Considering a wide range of technologies is covered by energy efficiency policies, using a composite load factor may be a reasonable alternative

Estimated savings from a range of different appliance types (2012 study)



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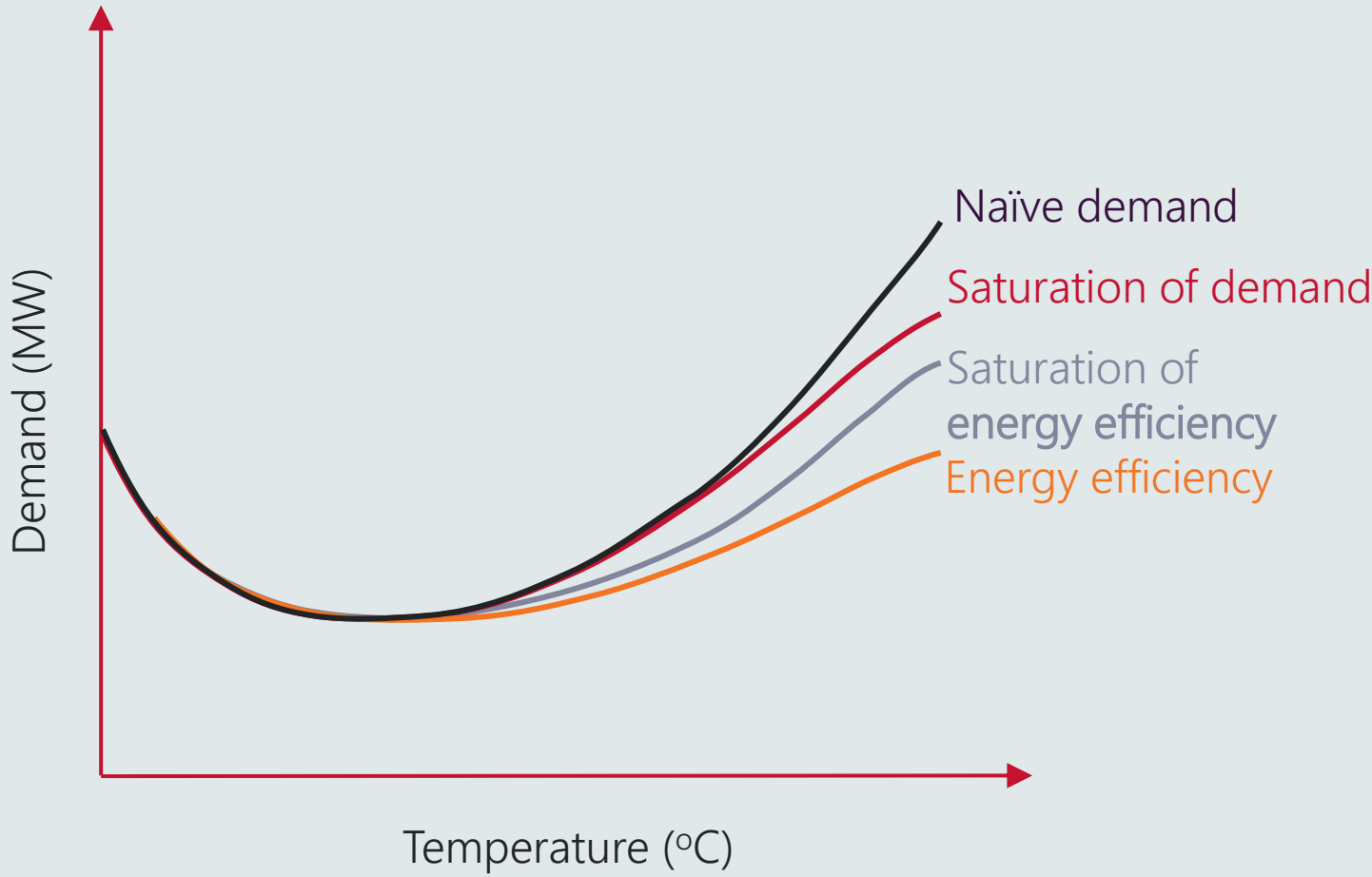
Energy efficiency during peak demand events

- The slide on the right shows the various considerations when forecast demand during high temperature events
- Naïve demand assumes consistent relationship between temperature and demand
- Applying average energy efficiency assumptions may assume to much energy savings
- Applying saturation of energy efficiency schemes as a function of temperature may be the right approach



Energy efficiency during peak demand events

- In 2019 we used the Housing profile model provided by SPR (Produced by Energy Efficient Strategies) to simulate different housing stock by star rating during average demand, peak demand and low demand conditions for Victoria
- Benchmarking the level of energy efficiency savings to a 2 star house we develop a average-to-peak EE ratio during peak demand events
- This average-to-peak EE factor switched on at high temperatures (35 degrees) and scaled over time to represent the gradual transition to high star rating housing stock

	2 star	4 star	6 star	Energy Efficiency as a ration of 2 Star	
Demand Events	Demand (MW)	Demand (MW)	Demand (MW)	4 vs 2 star	6 vs 2 star
TOP 10	3200	2332	1529	0.73	0.48
AVERAGE	2563	1748	1051	0.68	0.41
BOTTOM 10	1961	1273	656	0.65	0.33
TOP10/AVERAGE				0.94	0.86