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Mandating AS4755 Ignores Households and Widely Supported International Solutions

Modern Demand Response Should Be Consumer-Centric, Data-Driven, and Verifiable

Executive Summary

No one questions the benefits of demand response.

As electricity supply continues to transition from fossil fuel-powered generators to renewable sources, the need for smart solutions that are able to balance variable energy supply with demand will only increase.

Demand response (DR) is one of these tools. Internationally numerous demand response standards and techniques exist giving households options to change their power consumption and manage onsite generation and storage to suit their needs.

An indication of the growing importance of demand response is its inclusion in Australia's national energy market (NEM). Commencing 24 October 2021, demand response service providers (DRSPs) will bid demand reductions of aggregated large loads into the wholesale market. The market operator can then choose to 'dispatch' the least expensive option of increasing generation or reducing demand.

Demand response is increasingly important in a high renewables system.

Currently DRSPs are only allowed to aggregate large (industrial) loads, but IEEFA and others hope that in future, households will also be allowed to benefit from participating in this emerging market.

In November 2019, Australian Energy Ministers decided various domestic appliances sold in the country must support demand response, including air conditioners (ACs), electric storage water heaters (resistive), pool pump controllers and electric vehicle (EV) charger/discharger units. The Ministers' decision problematically goes further, requiring appliances be compliant with a unique interface detailed in the AS4755 series of Australian Standards. The timeline for compliance is aggressive, requiring AC and hot water manufacturers offer AS4755-equipped appliances by 1 July 2023, swimming pool pump controllers by 1 July 2024, and EV chargers/ dischargers by 1 July 2026.

This paper outlines five fundamental issues with the Energy Ministers' decision to choose the interface described in the AS4755 series of standards:

1. Interactions with other policies and approaches to peak demand and minimum system load are unclear.
2. AS4755 is a very basic, out-dated approach to demand response.
3. The AS4755 series does not support interoperability.
4. Open interoperable international solutions are available.
5. The original decision regulatory impact statement (D-RIS), including the cost-benefit analysis, was flawed.

The chosen Australian standard has not been adopted anywhere in the world. AS4755 is only designed to allow DRSPs to send a very limited number of commands to appliances. The commands produce unpredictable results which cannot be validated or verified. Further, the standard allows the use of undefined protocols making independent compliance certification impossible.

By comparison, internationally recognised demand response standards offer the flexibility to support a range of different demand response markets. These international solutions recognise households own the appliances and need to retain flexible control. Designed to handle millions of connected devices, these standards support intelligent, responsive, and verifiable demand response programs based on data-driven approaches. Many of these standards are well supported, with manufacturers already able to offer independently certified compliant products in Australia.

The best practice solutions outlined in this report directly address consumer concerns about handing over control of their appliances to third parties.[1] Using two-way communications, these solutions ensure consumers retain control, including override, and event opt-in and opt-out. They also support future 'pay for response' demand response programs via real-time validation of demand response benefits.

Australia's Chosen Demand Response Standard Needs to be Rethought

IEEFA recommends the Energy Ministers rethink mandating a unique Australian appliance demand response standard.

Instead, we suggest consideration be given to legislating 'a DR capability' requirement for priority household appliances under the Commonwealth *Greenhouse and Energy Minimum Standards (GEMS) Act 2012*. This would leave manufacturers, and the market, free to offer a range of different solutions, rather than locking Australia into an unsupported solution which is already out-of-date.

[1] CutlerMerz for Energy Consumers Australia. Social Licence for Control of DER. December 2020.

Unlike AS4755, Energy Ministers should ensure offered solutions allow consumers to retain control (override), are certified to be interoperable, and support verification and validation over secure two-way communications.

Alternatively, if the Energy Ministers genuinely want to mandate a single standard, they should consider adopting an already widely supported international solution. High on this list should be IEEE 2030.5, especially given its successful use in Australia. Unlike the Australian standard, products supporting alternative standards are already available, so this option supports the aggressive timeline specified by Energy Ministers.

In this paper we also discuss particular circumstances in South Australia and the reasons why the South Australian government should *not* proceed with the proposed earlier solo adoption of AS4755.

With world-leading levels of rooftop solar uptake, Australian households are at the forefront of the energy transition. They deserve a modern, international best practice approach to demand response for household appliances.

Australian consumers deserve a modern, international best practice approach to demand response for household appliances.

Most importantly, adoption of international best practice solutions ensures consumers in Australia are well placed to maximise return on their investments in distributed energy resources, be they solar systems, battery storage systems, EVs (including vehicle-to-grid), home energy management systems, smart thermostats or new devices yet to be commercialised.

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Introduction

At the 22nd Council of Australian Governments (COAG) Energy Council meeting held on 22 November 2019, Energy Ministers decided certain domestic appliances must provide demand response capabilities.

Demand response (DR) offers better management of appliances by turning them down when energy demand threatens to exceed supply. It can also be used to address concerns about minimum system load through making smarter use of abundant solar by turning up household appliances in daytime peak sunshine periods.

The Ministers' new requirements applied to all air conditioners (ACs), electric storage water heaters (resistive), pool pump controllers, and electric vehicle (EV) charger/discharger controllers sold in Australia. An aggressive timeline was agreed to, with AC and hot water manufacturers required to offer appliances with DR capabilities by 1 July 2023, swimming pool pump controllers by 1 July 2024 and EV chargers/dischargers by 1 July 2026.

The Energy Ministers' decision only permits one Australia-specific solution.

While the benefits of DR are well understood, the Ministers' decision only permits one Australia-specific solution: AS4755.[2]

While the Ministers' decision appears straightforward and good for both consumers and networks, in practice however, there are a number of significant issues that will be outlined in this paper.

Overview of AS4755

The Australian developed AS4755 series of standards prescribes how certain electrical products must respond to a very limited number of DR modes (these are discussed below).

The Energy Ministers' 2019 decision requires products to conform either to the older AS/NZS4755.3 series or a proposed, and still unpublished standard, AS4755.2 (a draft was circulated for public comment in September 2019).

AS/NZS4755.3 describes a physical interface fitted to the outside of appliances. For an AS/NZS4755.3-compliant appliance to participate in a DR program, it is also necessary to install an external controller. The standard refers to this as a demand response enabling device (DRED). All DREDs must meet specific requirements detailed in a separate standard, AS/NZS4755.1. The draft standard AS4755.2

[2] Standards Australia. AS/NZS 4755.1:2017.

requires appliance manufacturers include DRED functionality inside the appliance.

Why Adopt AS4755?

The Energy Ministers' decision was informed by a Decision Regulatory Impact Statement (D-RIS) written in 2019. This is the second time a RIS had been prepared to justify the mandatory inclusion of AS4755. The first unsuccessful attempt was in 2013. Despite presenting virtually identical arguments, in late 2019 the Energy Ministers adopted the mandate.

The D-RIS suggests additional approaches to DR are 'needed to engage the great majority of consumers who do not face TOU (time-of-use) tariffs, do not have PV systems and are not in position to – or simply too busy – to actively manage their energy loads'.[3] It cites both the impact of peak demand events on network costs and minimum system load events as reasons for the importance of DR, and also mentions the potential for ancillary services and emergency DR. The financial analysis however only appears to value peak demand benefits – specifically stating the amount of demand reduction and the value of network augmentation.

Five Key Issues with AS4755

1. *Interactions with Other Policies and Approaches to Peak Demand and Minimum System Load Are Unclear*

DR is well supported and increasingly important to manage variable renewable supply. Yet, the Energy Ministers have chosen a single appliance standard as the best way to go about this.

The Australian Energy Market Commission (AEMC) supports the introduction of DR as a key part of Australia's future market. At the same time, it has excluded household consumers from the new wholesale demand response mechanism, in part, until health and safety concerns are addressed. The chosen AS4755 standard does not address this concern because it does not allow consumers to over-ride any demand response commands to air conditioners (see details below). Importantly, should the AEMC decide to include aggregated demand response from households in a future iteration of

AS4755 does not address AEMC's health and safety concerns.

[3] The D-RIS does not justify this claim. See Energy Rating. Consultation Paper: 'Smart' Demand Response Capabilities for Selected Appliances. 14 August 2019.

the demand response mechanism, it's unclear how or even if AS4755 appliances can meet the required standard of verification (see below).

Other AEMC initiatives include an overhaul of the demand management incentive scheme (DMIS) and demand management incentive allowance (DMIA), in theory providing distribution network service providers (DNSPs) with easier tools for managing network peak demand. How AS4755 supports these schemes is unclear, firstly because of potential ring fencing issues, but also because the standard does not consider multiple party control of appliances. Other standards would allow the same appliances to participate in several demand response markets, including those supporting distribution networks.

Historically, DR programs focussed on reducing peak demand by turning appliances off. In the rapidly evolving future energy market, the range of peak demand solutions could include commanding domestic battery storage and EVs supporting vehicle-to-grid (V2G) to send power to the grid. Minimum system load concerns can be addressed by reducing or even turning off generation, or by turning appliances on to increase demand.

Minimum system load concerns can be addressed.

Recently, the Australian Energy Market Operator (AEMO) announced plans for a 'minimum system load' mechanism (a parallel to the reliability and emergency reserve trader (RERT)) which is likely to significantly impact how demand is managed in the middle of sunny, low load days. The decision to adopt AS4755 was made prior to this thinking and so no thought has been given to how the proposed standard might facilitate or limit households participating under such a mechanism.

International DR standards support balancing supply and demand by offering commands to increase and decrease both loads and generation. Flexible commands ensure operators can determine what type of appliance is connected so that appropriate commands can be sent to balance supply with demand. This requires a two-way flow of data between operators and appliances. The AS4755 series does not support this minimum requirement.

It should be noted that while not a market, South Australia introduced a new 'solar sponge' network tariff on 1 July 2020. From 10am to 3pm, electricity network charges are 25% of the standard rate (3.6c/kWh vs 18c/kWh). This is aimed at encouraging increased energy use in the middle of the day when there is usually plenty of solar generation. While AS4755 can be used to turn on some appliances, this is not linked to the cheaper tariff.

International DR standards support both appliance control and price information, allowing consumers to minimise their energy costs. AS4755 does not support the provision of tariff information.

Dynamic operating envelopes (DOEs) set maximum export and import thresholds at the connection point, currently on a 1- or 5-minute basis and are expected to become the primary means by which DNSPs ensure energy flows remain within network constraints. It is unclear how or even if the AS4755 mandate interacts with DOEs. AS4755 was developed in isolation from this DNSP procedure.

2. AS4755 Is Crude and Outdated

At its core AS4755 is a very basic, out-dated approach to DR. As the Clean Energy Council said in its submission to the South Australian government, 'It is a control-based standard that is incompatible with development of price-responsive distributed energy resources (DER).'[4]

Both the existing and draft standards offer a very limited number of demand response modes (DRMs). For ACs, pool pump controllers and hot water heaters, the required DRMs are:

- DRM 1 – No load, or minimum load (turn off)
- DRM 2 – Restrict load to no greater than 50% of a reference value
- DRM 3 – Restrict load to no greater than 75% of a reference value
- DRM 4 – Commence operation or increase load

Several additional modes are defined for EV chargers/dischargers:

- DRM 0 – Disconnect, if equipped with a disconnection device
- DRM 5 – No discharge of energy to grid
- DRM 8 – Commence or increase discharge of energy to the grid.

It is relevant to note one crucial DRM is missing. The AS4755 series of standards does not describe a 'return to normal' command. The design philosophy has been once a command is sent it applies for a pre-programmed period of time - typically several hours. After the pre-programmed time, the DRED (external or internal to the appliance) returns the appliance to normal operation. Balancing supply and demand suggests the need for greater flexibility and unsurprisingly international demand response standards provide a full suite of commands, including a command returning appliances to normal operation (see below).

Appliance responses to the various AS4755 commands are unpredictable, not measurable, and not verifiable. Specifically, AS4755 is unable to determine if an appliance received the command. It also can't determine what mode the appliance was in when the command was sent or estimate the amount of response enacted if the command was received. As noted by the Clean Energy Council, these failings

[4] CEC Submission to the SA Govt Consultation on Demand Response Capabilities.

mean it cannot be used to calculate financial rewards for consumers offering their appliance into DR programs.

The D-RIS asserts that using AS4755 to turn down air-conditioners delivers significant benefits, however this is only an assumption. Government energy efficiency initiatives mean modern energy efficient AC units typically run well below their rated power. When an air conditioner receives a DR message, the demand reduction is unpredictable and dependent on multiple factors, including whether the unit was even turned on. AS4755 does not support any communication to understand the actual level of reduction in appliance energy use.[5]

Similar uncertainties exist for hot water heaters, where a command to increase demand results in an unpredictable amount of additional load, depending on the size of the tank, rated power, and current tank temperature - all of which AS4755 is ignorant of.

International DR standards recognise the need for estimation and verification. This starts by supporting the collection of information about appliances, for example, what type of appliance is connected, its power rating, etc. Then, when commands are sent, operators can confirm the appliance received the command along with information about its operation. Using known details about the appliance allows DRSPs to accurately estimate the amount of DR. After the DR event, some standards even support individual measurements of appliance energy use. Unlike AS4755, these international standards support 'pay for performance' where consumers are rewarded for delivered benefits (not invalid estimates).

International DR standards recognise the need for estimation and verification.

The claim made in the D-RIS that verification can be provided by smart meters has been shown to be false. In the ARENA-AEMO demand response RERT trials, estimates from smart meters proved inaccurate for weather-sensitive loads (which includes AC and hot water heating) and when loads were influenced by rooftop PV generation.[6] This finding should be concerning given almost 25% of Australian households already have a solar PV system, a number forecast to double over the next decade.

A broader consideration is smart meters only measure energy flow through the connection point - they do not make individual measurements of devices behind-the-meter. Using this single measurement to validate the response when multiple

[5] Refer Dr Martin Gill's critique. LinkedIn. Should SA go it alone and mandate AS4755?
[6] ARENA. Baselining the ARENA-AEMO Demand Response RERT Trial. September 2019.

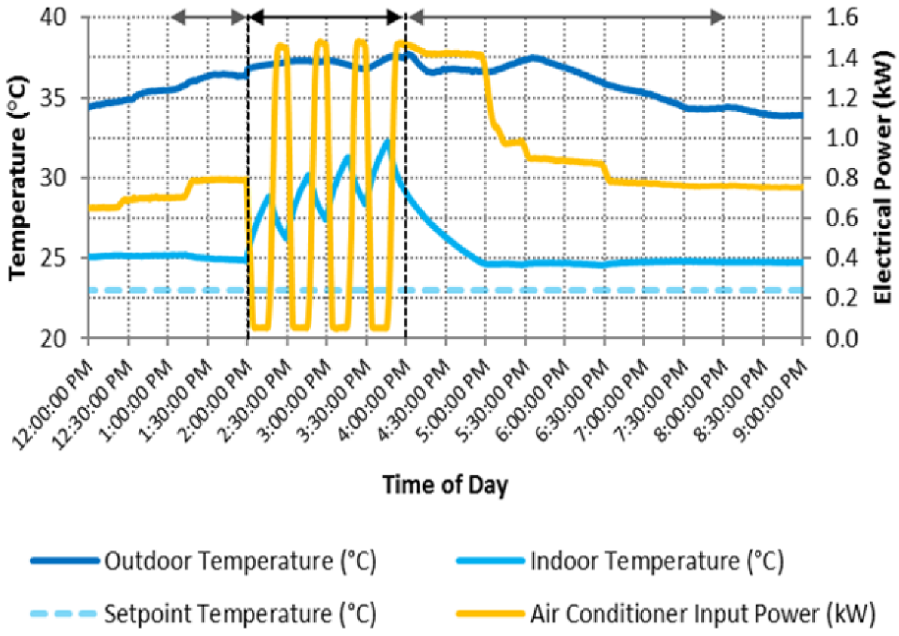
devices including both load and generation are participating in DR programs behind-the-meter has never been demonstrated. The accuracy of any estimate, especially given the unpredictable response of appliances to AS4755 commands, appears highly questionable.

In addition to solar ownership doubling over the next decade, EV ownership is expected to rise sharply with the majority of consumers indicating they intend to use their solar system and home charging.[7] As battery storage prices continue to fall, more households will choose to install them (battery storage systems are excluded from the DR mandate, and the internationally supported IEEE2030.5 standard is being used for their coordination in Virtual Power Plants (VPPs)). Climate change is likely to push AC ownership close to 100% and already 10% of households have swimming pool pumps. When some devices are increasing demand and at the same time others are decreasing demand, the single measurement provided by a smart meter will prove insufficient to accurately verify any specific appliance demand response.

There are also significant health concerns. The AS4755 standard does not require ACs support consumer over-ride. This means that once a consumer voluntarily enrols in a DR program, they may find they are unable to fully utilise their AC should a third party choose to control it (including by turning it off). This raises obvious health concerns as demonstrated in the following figure showing AS4755 being used to reduce AC demand. Without AS4755 the temperature is an acceptable 25°C but when AS4755 is used to reduce demand, the indoor temperature rises to an uncomfortable 32.5°C. The failure of AS4755 to address these health concerns jeopardises the inclusion of ACs in consumer DR programs.

[7] For an EV 90% of charging is done at home. See CarAdvice. How do you charge an electric car at home? 2 March 2020.

Figure 1: Laboratory Testing Using AS4755 to Control an Air Conditioner



Source: J. Wall and A. Matthews: Residential Air Conditioning and Demand Response: Status of Standards in Australia and Future Opportunities.

It is perhaps for these reasons and more, that while the AS4755 standards have been available for over a decade, they have not been adopted by appliance manufacturers. When the Energy Ministers made their decision, no manufacturer offered appliances able to meet the proposed mandated standards. There are still no pool pump controllers, hot water heaters or EV charger/dischargers supporting AS4755. There are air conditioners supporting the 2012 version of the standard, but the Ministers have asked for the 2014 version and no ACs comply with that standard.

3. The AS4755 Series Does Not Support Interoperability

The 2019 D-RIS discussion paper claims:

> *'There are no international or national standards in use elsewhere that provide equivalent open-access DR capabilities for ACs, pool pump controllers or electric storage water heaters. EV chargers are a different case in that "smart" charging capabilities are available through other standards.*
>
> *It should be noted that, while products would need to be DR-capable, it would always be up to consumers to decide whether they wish to contract with a Demand Response Service Provider (DRSP) to activate the DR capability in their appliances, in return for monetary, tariff or other benefits offered by the service provider.'*

The AS4755 series of standards does not support 'open-access', typically referred to as interoperability. Interoperability is the ability to use products offered by different vendors. The standards do not describe how operators send commands to appliances, leaving manufacturers free to use different and undefined protocols.

The AS4755 series of standards does not support interoperability and therefore cost-effective DR programs. For example, after a consumer purchases an appliance with the AS/NZS4755.3 interface, the DRSP must install a suitable DRED at additional cost. The failure of AS4755 to define a standard protocol for communications from the DRSP to DREDs means if a consumer chooses a different DRSP, the DRED must be replaced by a licenced electrician.

AS4755 does not support interoperability and therefore cost-effective DR programs.

While DRED requirements are detailed in AS/NZ4755.1, the reality is there is no such thing as a standard DRED. All DREDs are specialised pieces of electronics specified by the DRSP. The DRSP ensures the DREDs they purchase are compatible with their DR program including the communications technology and protocol used to send commands. Communications between the DRSP and DREDs can use a range of different and incompatible communications technologies and protocols.

The public comment draft of AS4755.2 shows all DRED functionality must be implemented in the appliance, including the communications technology and protocol. The result is the DRSP no longer gets to choose the communications technology or protocol - they instead have to hope they can use the method inbuilt to the appliance.

The public comment draft of AS4755.2 describes a range of different non-interoperable communications methods and protocols. The DRED, and therefore the communications method and protocol, is inbuilt to the appliance. The result is consumers may find they are unable to enrol their appliance in the DR program offered by their preferred DRSP. They may even find they are locked into a specific DRSP.

The result is the AS4755 series of standards allows each appliance in a household to use a different communications method and protocol. This lack of interoperability should be viewed as a significant barrier to the efficient orchestration of multiple behind-the-meter appliances. Defining a common protocol can avoid this issue.

AS4755 is inconsistent with modern best practice 'smart' DR programs.

This is particularly important given that energy efficiency and DR have evolved to

become communications- and data-based. Rather than working on one-way communications based on assumptions about appliance performance, modern energy efficiency and DR uses two-way communication and collects data to ensure the actual DR impact is as predicted. Such sophistication avoids inaccurate assumptions and helps mitigate the risk of gaming of DR markets.

In summary, AS4755 is inconsistent with modern best practice 'smart' DR programs.

4. Open Interoperable International Solutions Are Available

Multiple international DR appliance and home energy management solutions (HEMS) are available.

One of these standards is IEEE2030.5 'Standard for Smart Energy Profile Application Protocol', a well-supported international DR standard. IEEE2030.5 provides a standard for communications between external parties and consumers' devices: 'Information exchanged using the standard includes pricing, demand response, and energy usage, enabling the integration of devices such as smart thermostats, meters, plug-in electric vehicles, smart inverters, and smart appliances'.[8]

In addition to supporting all AS4755 DRMs, IEEE2030.5 encapsulates modern data-driven approaches to communicating and remotely managing DER.

The Interoperability Steering Committee (ISC), part of Australia's Distributed Energy Integration Program (DEIP), is currently testing the validity and compliance of an IEEE2030.5 Australian Implementation Guide. The Committee's workplan is as follows:

- **June 2021**: Engage with Standards Australia to facilitate the implementation guide being formally documented and endorsed by Standards Australia.
- **Mid 2022**: Publish a testing guide, use cases and data to allow stakeholders and vendors to validate conformance to the Australian Implementation Guide.
- **Ongoing once established**: Formally engage with the IEEE standards committee providing a pathway for updating the underlying IEEE2030.5 standard to accommodate Australian Extensions.[9]

In parallel, IEEE2030.5 is at the core of SA Power Networks' DOEs. And Energy Queensland has released a consultation paper discussing the need for IEEE2030.5. Such strong support highlights the need for AS4755 devices to support IEEE2030.5.

[8] IEEE Smart Grid Resource Center. IEEE 2030.5 (Smart Energy Profile 2.0): An Overview and Applicability to Distributed Energy Resources (DER) presented by Robby Simpson. October 2016.
[9] AEMO. DEIP Interoperability Steering Committee. 6 April 2021.

There have been claims that IEEE2030.5 can be used to manage AS4755.2 appliances. This claim is inaccurate. The public comment draft of AS4755.2 documents a mode of communications incompatible with the one specified in IEEE2030.5. IEEE2030.5 also requires two-way communications to devices, which is not required by AS4755.

IEEE2030.5 has independent test houses able to certify both devices and the back office application software required to operate connected devices. This certification testing supports interoperability by ensuring both devices and application software are implementing the protocol correctly. AS4755 does not define a protocol making independent device certification impossible. Further, AS4755 does not consider the need for application software.

AS4755 does not require two-way communications to devices.

IEEE2030.5 also offers the advantage of information interoperability. In addition to defining the format of commands sent to devices, it also defines the format of key data obtained from devices. This two-way information interoperability supports future data-driven DR programs. AS4755 does not define data formats so does not support information interoperability.

Government policy requires Australia to *not* use standards as barriers to trade. Many Australian standards therefore choose to adopt standards developed by the International Electro-technical Commission (IEC). The IEC standard IEC 62746-10-1 Open Automated Demand Response (OpenADR)[10] provides another example of an internationally supported DR solution. OpenADR has been incorporated into the British Standard PAS 1878 with the stated goal to 'enable standardized control […] of energy smart appliances […] such as electric vehicle (EV) charge points and electric heating, ventilation and air conditioning (HVAC) systems […] by shifting (in time) and/or modulating (increasing or decreasing) the collective electricity consumption or production of domestic appliances, in line with consumer preferences and agreement, in response to signals from grid-side actors'.

Almost a decade before AS4755 was first proposed, another suitable DR standard was proposed. The development of the EchoNet standard has continued and it provides interoperable DR supported by numerous manufacturers offering air-conditioners, hot water heaters, storage batteries, dishwashers, clothes dryers, etc.[11].

The AS/NZS4755.3 series of standards describes a physical appliance interface. An equivalent, but far more capable alternative, is CTA-2045. CTA-2045 is designed so that consumers can enrol products in a DR program by simply plugging in an adapter. While CTA-2045 supports all of the AS4755 DRMs, it is considered to be a

[10] About OpenADR
[11] Overview of the ECHONET Lite specifications | ECHONET

superior standard as it also supports two-way communications, automatic device registration and verification of responses.

International interest in controlled charging of EVs ensures there is a wide range of possible solutions for EV DR standards. Just a few of the possible options include the widely supported open charge point protocol (OCPP), ISO 15118 and IEC 61850. Each supports controlled charging of EVs - all with significantly more benefits than is possible if the unpublished AS4755.3.4 standard is adopted.

In conclusion, there is simply no need to force international manufacturers to modify their products to include a unique Australian standard when so many internationally supported standards are available. Mandating a unique Australian standard acts as a barrier to free trade, in violation of Australian government policy.

5. The Original D-RIS, Including the Cost-Benefit Analysis, Was Flawed

The Federal government's Office of Best Practice Regulation (OBPR) found the draft D-RIS was 'not adequate nor commensurate with the potential economic and social impacts of the proposal'.[12] The OBPR have many concerns with the D-RIS; we outline only the most significant below. Further detail can be found in Dr Gill's previously published submission to the South Australia government.[13]

AS4755 is just one of numerous different solutions.

One major OBPR concern was that the proposal did *not* demonstrate why there was a need to mandate AS4755. AS4755 is just one of numerous different solutions, all of which are capable of delivering the identified benefits.

Similarly, the OPBR critiqued the failure to adequately consider 'encouraging voluntary adoption of demand response appliances, given the likely ability of this option to achieve the same objective at much less cost to the community'.[14] Effectively, the D-RIS didn't compare the likely take-up of voluntary approaches to DR. A financial incentive, on its own, may be sufficient to support household appliance demand response. For example, Energex offers a rebate of up to $400 for ACs supporting AS/NZS4755.3.1 for its PeakSmart network demand response program. As a result, manufacturers are offering dozens of different compliant

[12] OBPR. Smart Demand Response Capabilities for Selected Appliances. 15 August 2019.
[13] Dr Martin Gill. Mandating AS4755 only in South Australia.
[14] OBPR. Smart Demand Response Capabilities for Selected Appliances. 15 August 2019.

models for purchase.[15]

The OBPR also noted differences between (modest) cost assumptions used in the D-RIS and those provided in feedback from stakeholders. The Office suggested there was a need to 'update cost assumptions in line with feedback from stakeholders or provide sufficient explanation why these are not valid'. In the most extreme example, the D-RIS estimates the additional cost of a compliant EV charger/discharger unit at $40. The Energy Ministers' mandate requires all domestic EV chargers support 'DRM 8 – discharge', more commonly referred to as vehicle-to-grid (V2G). The actual cost of a domestic V2G capable unit is currently around $10,000, or around $6,000 more than a quality unit only supporting EV charging. While these costs will inevitably reduce, they will never get down to the claimed $40. The size of this difference calls into question the credibility of the analysis presented in the D-RIS.

The D-RIS cost-benefit analysis also failed to include the costs of incentives paid to consumers to participate in DR, such as the $400 rebate in the PeakSmart program mentioned above.

We have discussed the impossibility of verifying actual demand response with AS4755. The OBPR was also aware of this issue and recommended that the RIS 'provide assurance AEMO would permit the verification method for demand response outlined in the RIS. If AEMO does not permit this method, the majority of the benefits associated with mandating compliance with the AS4755 would not materialise and the proposal would have a large net cost to the community'. As far as we are aware, this has not occurred.

Process Issues Impacting Mandating AS4755

The implementation of the Energy Ministers' decision is currently complicated by a process issue. When Ministers agreed to delegate implementation to the Senior Committee of Officials (SCO), they noted:

> *'Note that making legislative instruments to give effect to the new regulations recommended by the Decision RIS will be subject to legal advice and may require amendment to the Greenhouse and Energy Minimum Standards (GEMS) Act 2012.'*

Commonwealth legal advice is that DR requirements cannot be mandated under the current GEMS Act. As it stands, legislation will need to be passed through the Commonwealth Parliament to support a national mandate of AS4755. However, South Australia remains keen to go it alone.

[15] Energex. PeakSmart air-conditioner models.

The Situation in South Australia

In April 2021, the South Australian government published a consultation paper[16] which outlined speeding up the adoption of AS4755 by two years for each of the appliances agreed to by the Energy Ministers. Additionally, it proposed restricting the mandate to the unpublished AS4755.2 standard, therefore removing support for the physical interface described in the AS/NZS4755.3 series.

The consultation paper focuses on 'minimum demand' and the opportunity of abundant solar:

> *'Minimum net demand is an emerging challenge in South Australia. With the rapid uptake of solar panels in recent years, together with consumers energy needs being met by their own distributed energy resources (DER), the result, at times, is low energy demand from the grid. October 2020 saw a record minimum operational demand of 300 MW…*
>
> *Appliances with demand response (DR) capabilities can be used to* ***increase daytime operational demand*** *in response to commercial financial incentives or in an emergency circumstance. In addition, DR capable appliances, particularly air conditioners, can be used to address periods of peak summer demand.' [Emphasis added]*[17]

Such framing suggests AEMO would be able to turn up consumer appliances in the same way that South Australia has given AEMO the right to cut-off household solar exports via SA Power Networks. Cutting off household solar systems forces households to import electricity from the grid.[18]

Issues with Fast-tracking AS4755 in South Australia

As IEEFA highlighted in our recent paper on rooftop solar cut-offs, AEMO has stated that any minimum system load challenge is mitigated by the 800MW EnergyConnect[19] - connecting South Australia and New South Wales, with an added connection to north-west Victoria due to be completed by 2024. That means the EnergyConnect will be in place well before any appliance standard could make any substantial contribution to increased demand during periods of abundant solar and minimum system load.

Aside from the overall concerns with AS4755 listed above, it is unclear how mandating AS4755 would fit with the variety of other programs South Australia has

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[16] Government of South Australia. Consultation on: Proposed Demand Response Capabilities for Selected Appliances in South Australia and Proposed Amendments to Local Energy Performance Requirements for Water Heaters. April 2021.
[17] Government of South Australia. Consultation on: Proposed Demand Response Capabilities for Selected Appliances in South Australia and Proposed Amendments to Local Energy Performance Requirements for Water Heaters. April 2021.
[18] IEEFA. Gabrielle Kuiper and Steve Blume. Blunt Instrument: Uncompensated Solar Cut-Off Isn't the Only Solution to the Minimum Demand 'Problem. April 2020.
[19] ibid.

implemented. There is $30m for distributed energy – including $11m for DR trials (including a project on 'efficient targeting and automated control of residential air conditioning loads'), as well as:

- $50m for grid-scale storage
- $200m grants and loans for home batteries and VPPs
- Retailer obligation for smart energy retrofits.[20]

There is also no mention in the paper of the virtual power plants up and running in South Australia (which use the previously mentioned IEEE2030.5 standard) and what the interaction with any AS4755 mandate might be.

Recommendations to Support Household Appliance Demand-Response

IEEFA recommends that all Energy Ministers rethink the approach to an appliance DR standard. Mandating the AS4755 standard denies Australian consumers access to superior internationally-supported DR solutions. These solutions put consumers' needs front and centre, which is required to address concerns that the mandate intends to give AEMO/utilities control over consumer appliances.

The benefits of DR are not in question. However, analysis presented in the D-RIS does not show the benefits require any mandate, especially not a mandate of an unsupported uniquely Australian solution. It may be that voluntary approaches with appropriate incentives, for example, through the creation of a two-way market, may achieve the same outcome.

Significant questions remain about how AS4755 fits within Australia's energy market.

However, recognising that the creation of sufficient incentives is likely still some way off and that it would be helpful to have more modern demand responsive appliances available in Australia, we suggest consideration be given to legislating 'a DR capability' requirement for priority household appliances under the GEMS Act.

Energy Ministers should ensure offered solutions allow consumers to retain control (override), are certified to be interoperable, and support verification and validation over secure two-way communications.

[20] See South Australia Department for Energy and Mining. Growth and low carbon. 5 May 2021.

Such a requirement leaves appliance manufacturers and DRSPs free to offer a wide range of available technical solutions. It would also have the added advantage that as new solutions evolve, they could be immediately offered to Australian consumers.

If, instead, Energy Ministers genuinely want to mandate a single standard, then they could consider adopting IEEE2030.5. This standard has been used to support multiple successful Australian trials. An Australian IEEE2030.5 implementation guide is currently in development. IEEE2030.5 is far more widely supported, cost effective and capable solution, explaining why it is high on the list of standards being considered for adoption as the Californian flexible demand appliance standard.[21]

In parallel to any legislated requirement for specific appliances to be DR capable, Energy Ministers can do much more to fast-track the electrification of hot water with the ability to shift load to times of peak solar generation. This is a significant opportunity in South Australia where about half of the hot water systems are currently gas-fuelled and in Victoria, where about three-quarters of the systems are gas-based. Note that smart meter rollouts can also provide a highly cost effective means of controlling electric hot water heaters without any need for legislative change. Other ways of making the best use of abundant solar includes ensuring EV charging infrastructure is available in the middle of the day (e.g. in car parks), which also reduces overnight charging demand.

South Australia should abandon its misplaced commitment to AS4755. Numerous existing measures have reduced the urgent need for action; South Australia could instead use the lessons learnt from multiple funded DR trials. Solo action is likely to leave South Australia stranded and raise appliance costs for all South Australian consumers. We do support South Australia's continued efforts to electrify hot water and investigate building standards updates to support daytime EV charging.

South Australia should abandon its misplaced commitment to AS4755.

Technology is moving towards the orchestration of appliances behind-the-meter. In the near future, home energy management systems or external providers will be able to minimise household energy costs by automatically responding to tariffs including South Australia's solar sponge network tariff, while optimising the use of solar and batteries/EVs.

There is large potential for artificial intelligence to aid energy efficiency and demand response via digitisation and smart appliances. However, optimisation algorithms require knowledge of the capabilities of connected appliances and the flexible control of those appliances. In short, best practice DR standards require two-way

[21] Senate Bill 49. Flexible Demand Appliance Standards.

communications, automatic device registration and validation of responses. None of these services are supported by AS4755.

Ideally, Australian Energy Ministers would legislate and regulate for international best practice for demand responsive household appliances. Given the role households can play in supporting the energy transition, we suggest Australian households deserve a thoughtful appliance policy that serves consumer interests, as well as supporting the transition to a renewable grid.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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