Demand Response Capabilities for Selected Appliances

Public Consultation Sessions, August 2019 New Zealand

Craig Walker

On behalf of the E3 Committee

A joint initiative of Australian, State and Territory and New Zealand Governments.

Agenda

Speaker	Agenda Item/Topic	Timeframe
Craig Walker	Welcome and Background	11:30-11:40
Dr George Wilkenfeld GWA	Consultation Paper Discussion – Demand Response Capabilities for Selected Appliances	11:40 – 12:30
EECA to chair	Q&A	12:30 – 13:20
Craig Walker	Wrap Up & Next Steps	13:20 – 13:30

Background / History

- A Consultation Regulation Impact Statement (RIS) on a similar proposal was published in 2013.
- New Zealand was initially part of the analysis, but chose not to participate in the proposal
- The proposal, at the time, received a generally positive response during public consultations (37 submissions from corporations, associations government agencies).
- Feedback from this session was incorporated in a draft Decision RIS, which was developed in 2014.
- However, this draft Decision RIS was never finalised, nor submitted to the COAG Energy Council for decision.

2018 COAG Energy Council Decision

- In December 2018, the COAG Energy Council agreed that the 2013/14 work should be revisited, updated and reconsidered for regulation through the Greenhouse and Energy Minimum Standards (GEMS) process.
- South Australia proposed this work to the COAG Energy Council in December 2018.
- South Australia is Project Lead for this work on behalf of the Energy Equipment Efficiency (E3) Program.
- Particular interest in Demand Response (DR), and the opportunities that DR can provide for reducing customers' energy costs (amongst other things).

Work So Far in 2019

- Established an E3 Reference Group to input and steer this project whilst developing the Consultation Paper.
- Was agreed by the E3 New Zealand Representatives that New Zealand should be included within the scope of this work too (with regard to air conditioners, water heaters & EV chargers – not pool pump controllers)
- Entered into a contract with George Wilkenfeld & Associates, following a competitive tendering process.
- Agreed and recorded the scope, options and deliverables for this work – in conjunction with the E3 Reference Group.
- Updated the modelling and analysis of the 2013/14 work.
- Assessment and approval from the Office of Best Practice Regulation (OBPR), and the wider E3 Committee for Consultation Paper to be published.

Other Relevant E3/GEMS Work Programs

- Any recommended demand response requirements will need to be integrated with other E3/GEMS work streams, eg
  - Determinations for Pool Pumps (different from controllers)
  - Determinations for Air Conditioners
  - Policy Roadmap for Water Heaters - led by New Zealand.

Demand Response Capabilities for Selected Appliances

Consultation Paper, August 2019

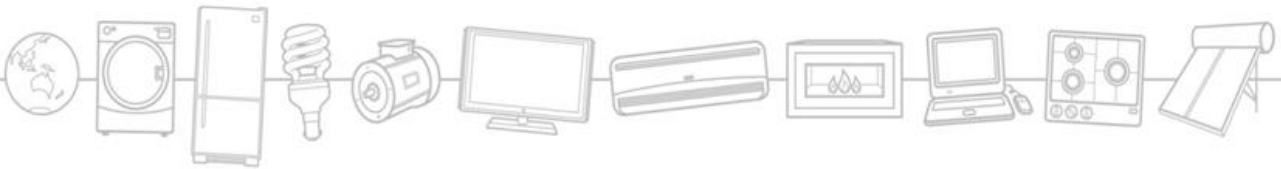
Dr George Wilkenfeld

On behalf of the E3 Committee

A joint initiative of Australian, State and Territory and New Zealand Governments.

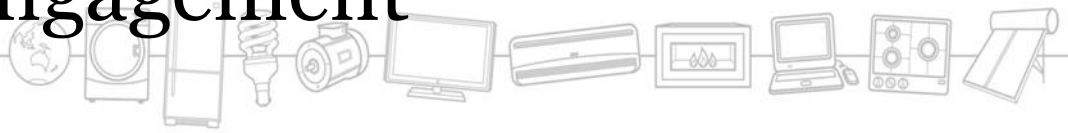
This Session

- Why this proposal now?
- Various types of DR and how they coexist
- The proposal: compliance with AS/NZS 4755
- Projected costs and benefits
- Relationship to international standards
- Consumer benefits and safeguards
- Implementation and timing



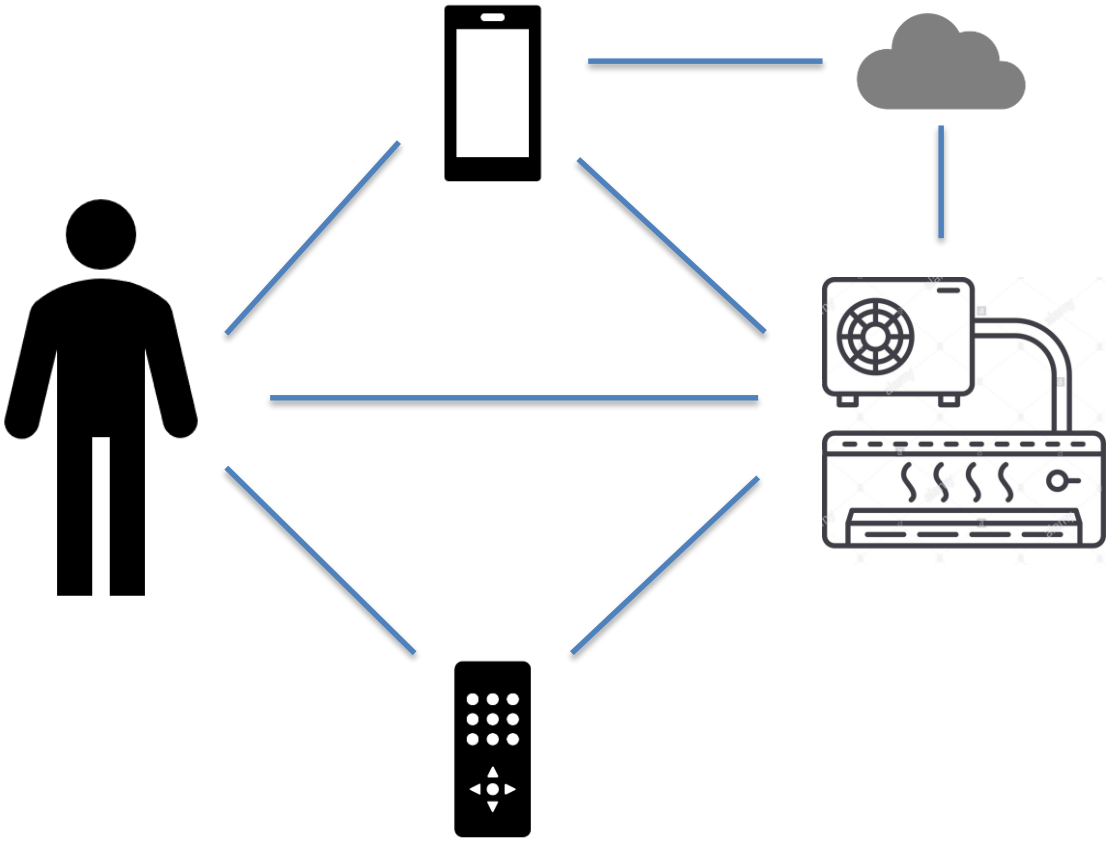
Why now?

- COAG Energy Ministers requested review
- Local network constraints still a problem
- Wholesale generation costs still a problem
- With PV & wind, minimum demand a growing problem in Australia
- DR identified as necessary but undeveloped
  - AEMO, ENA, CSIRO, AEMC, ACCC, Finkel report
- AEMC rule changes moving toward small consumer engagement

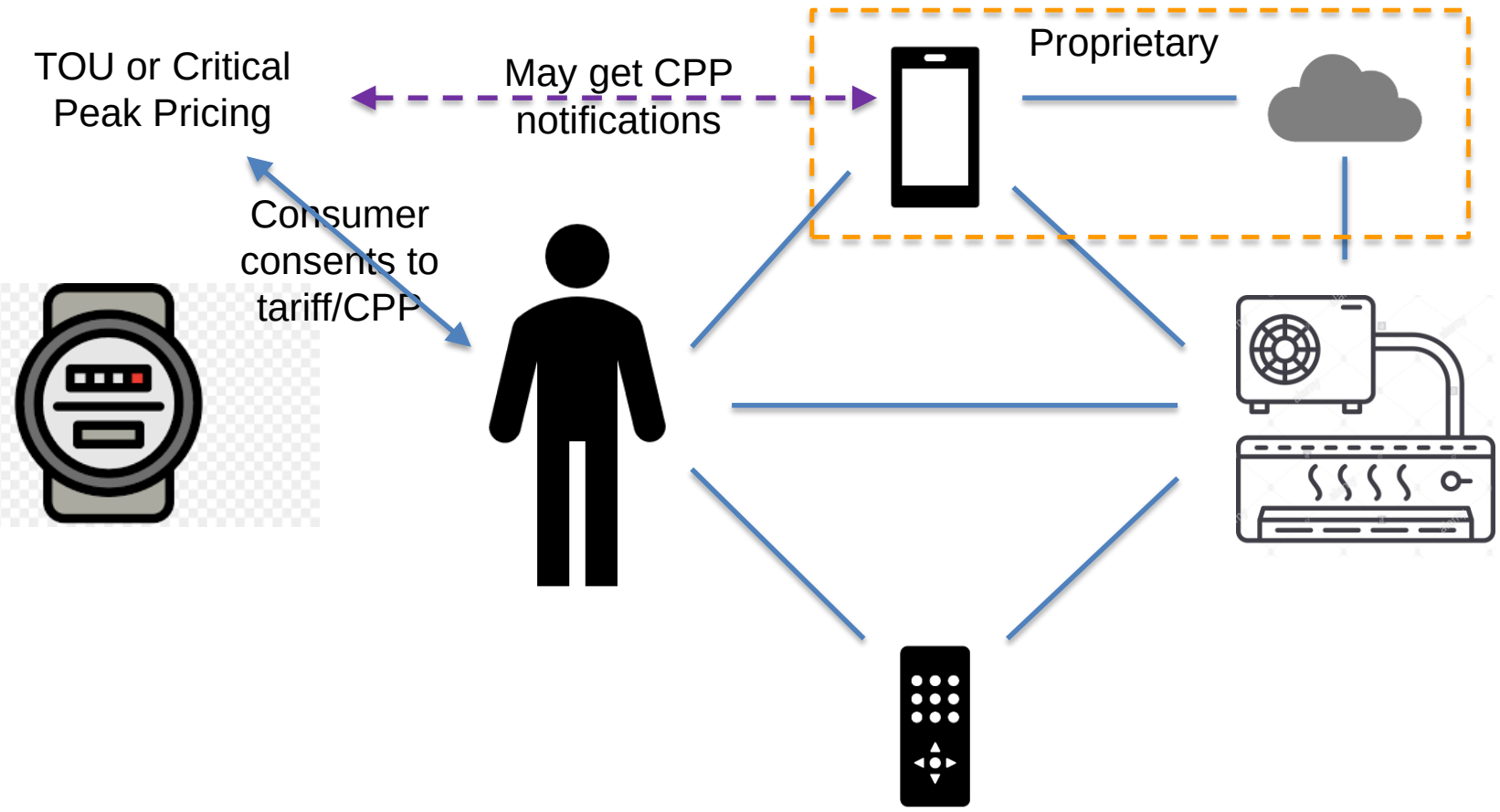


Default air conditioner use

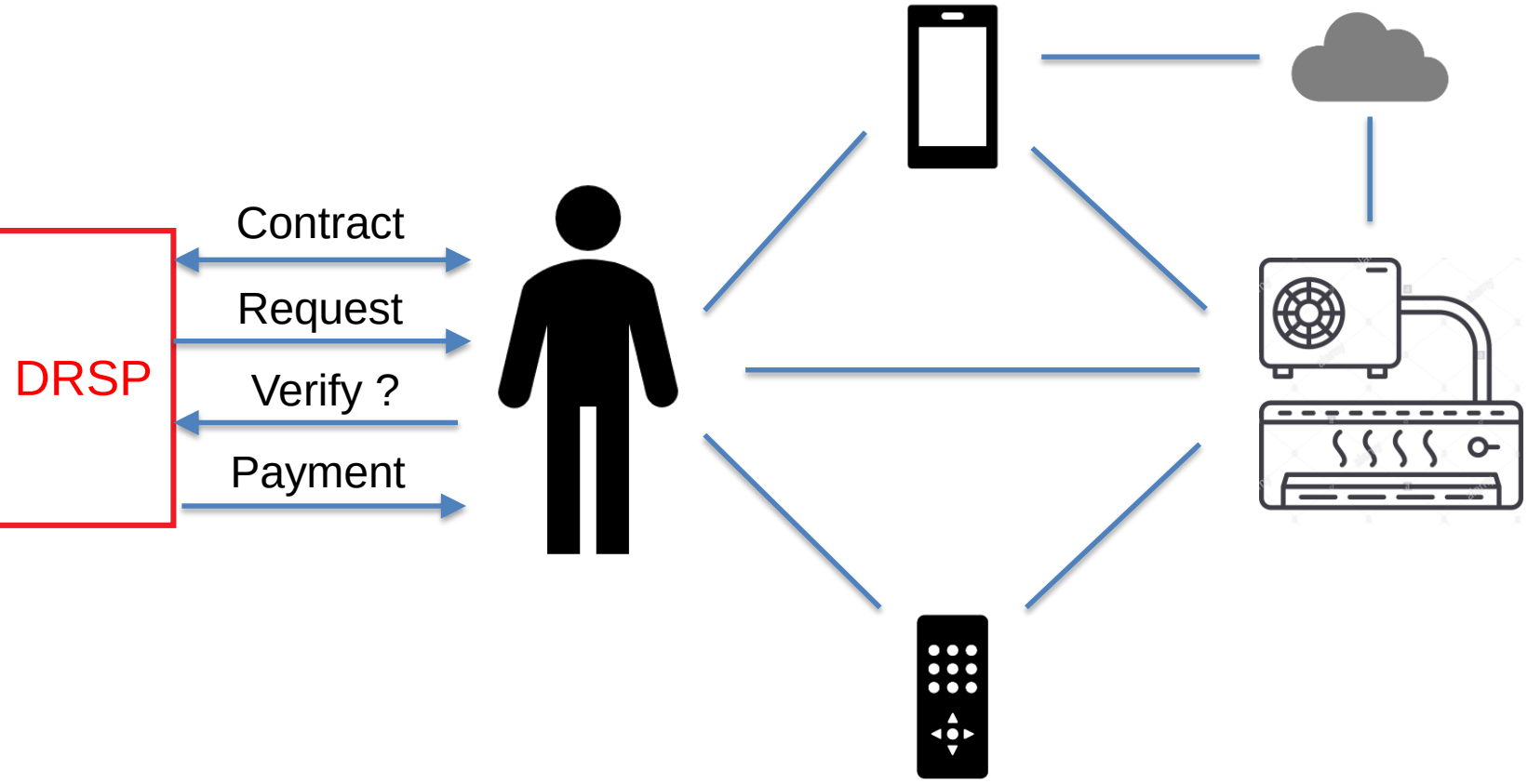
Unaware of price and/or on flat tariff



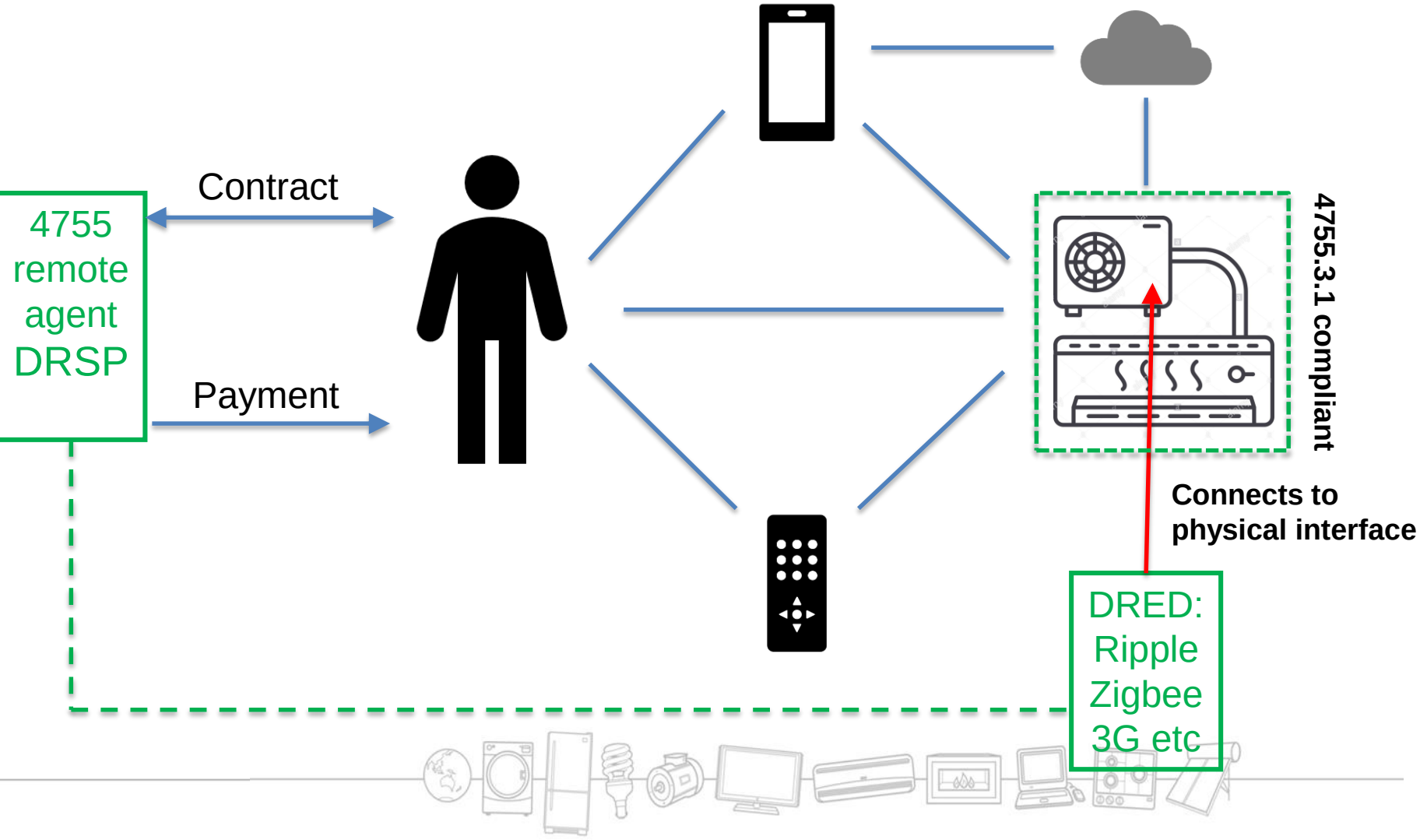
Price-driven demand response



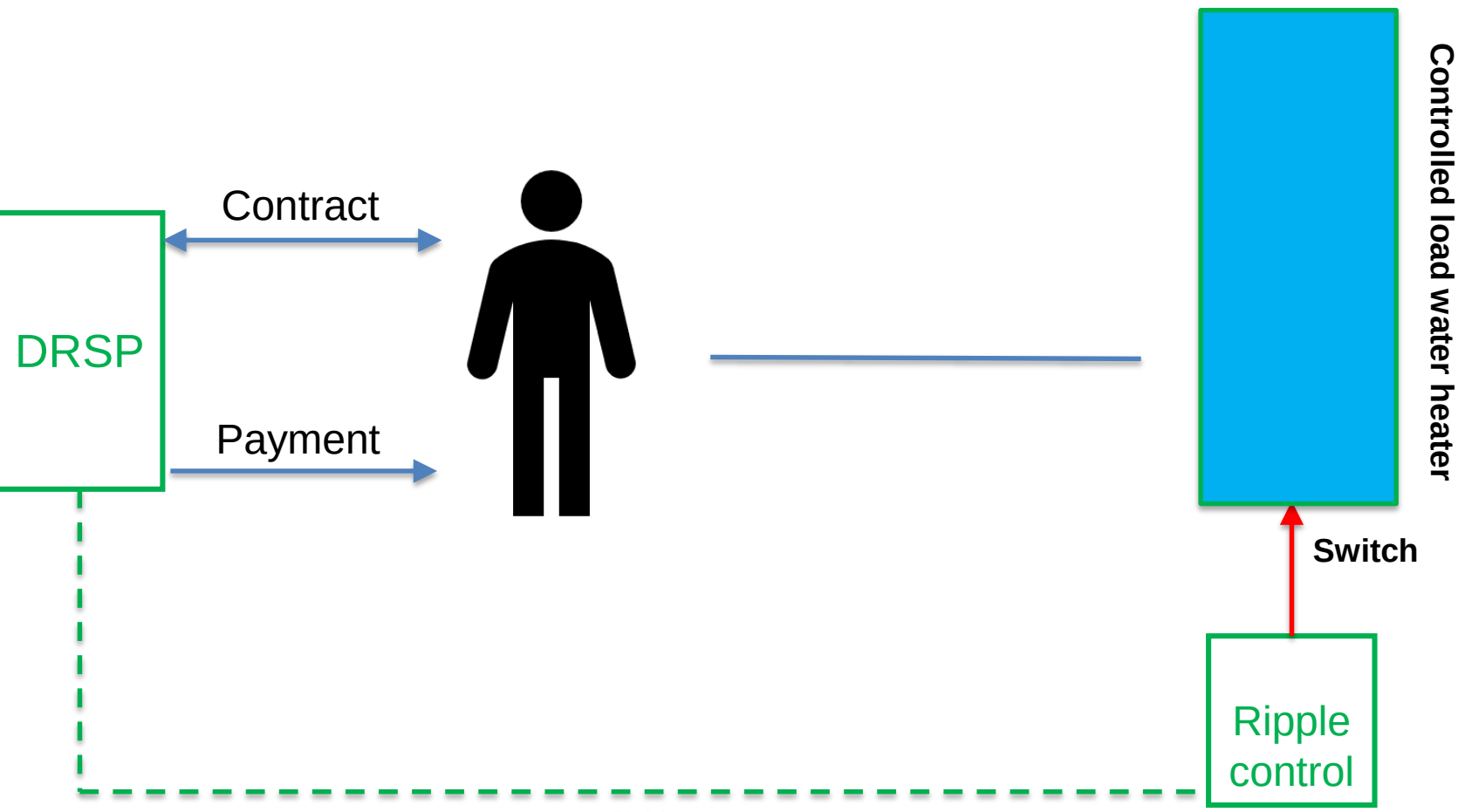
Behavioural demand response



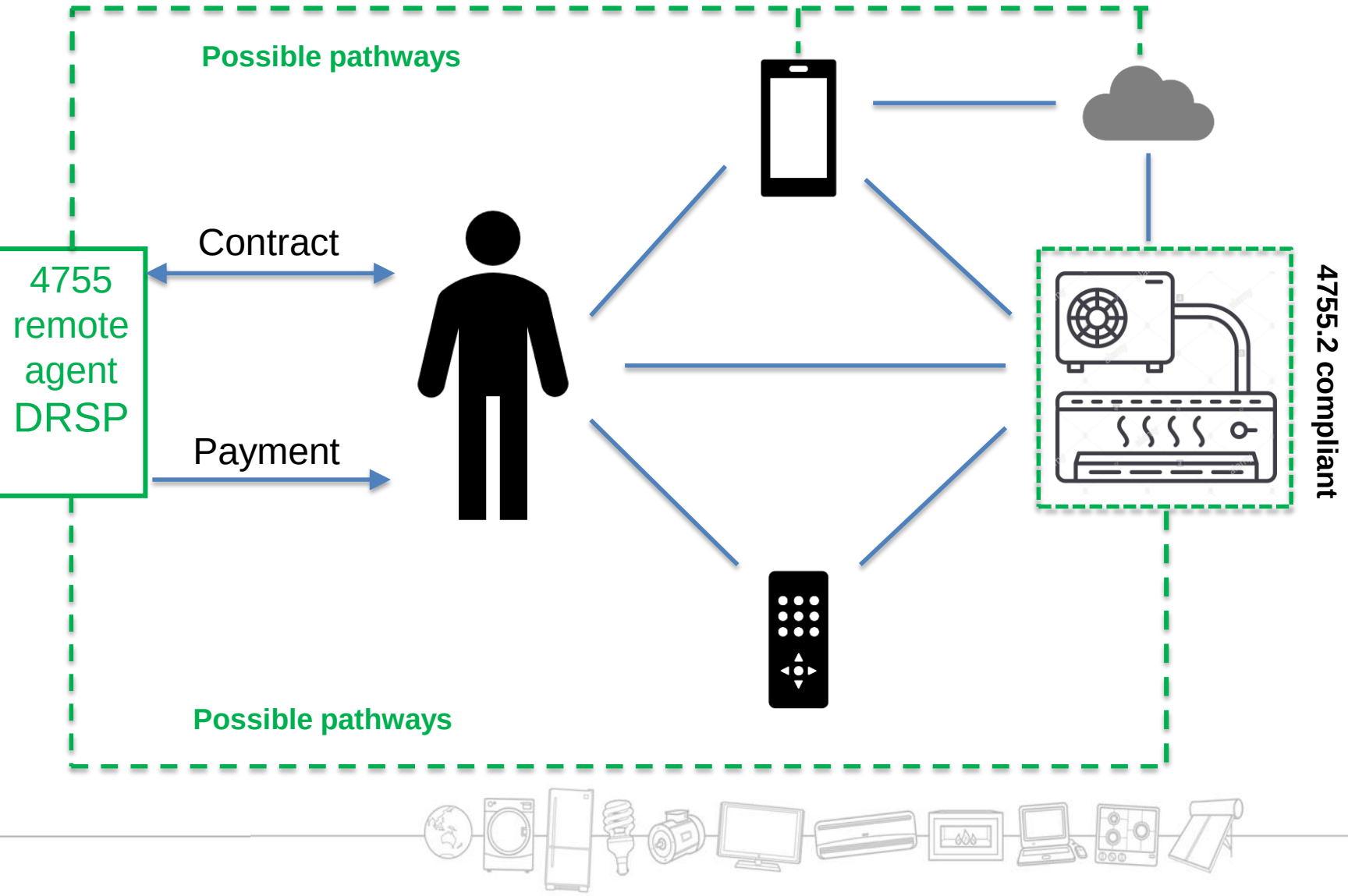
Demand response with AS/NZS 4755.1



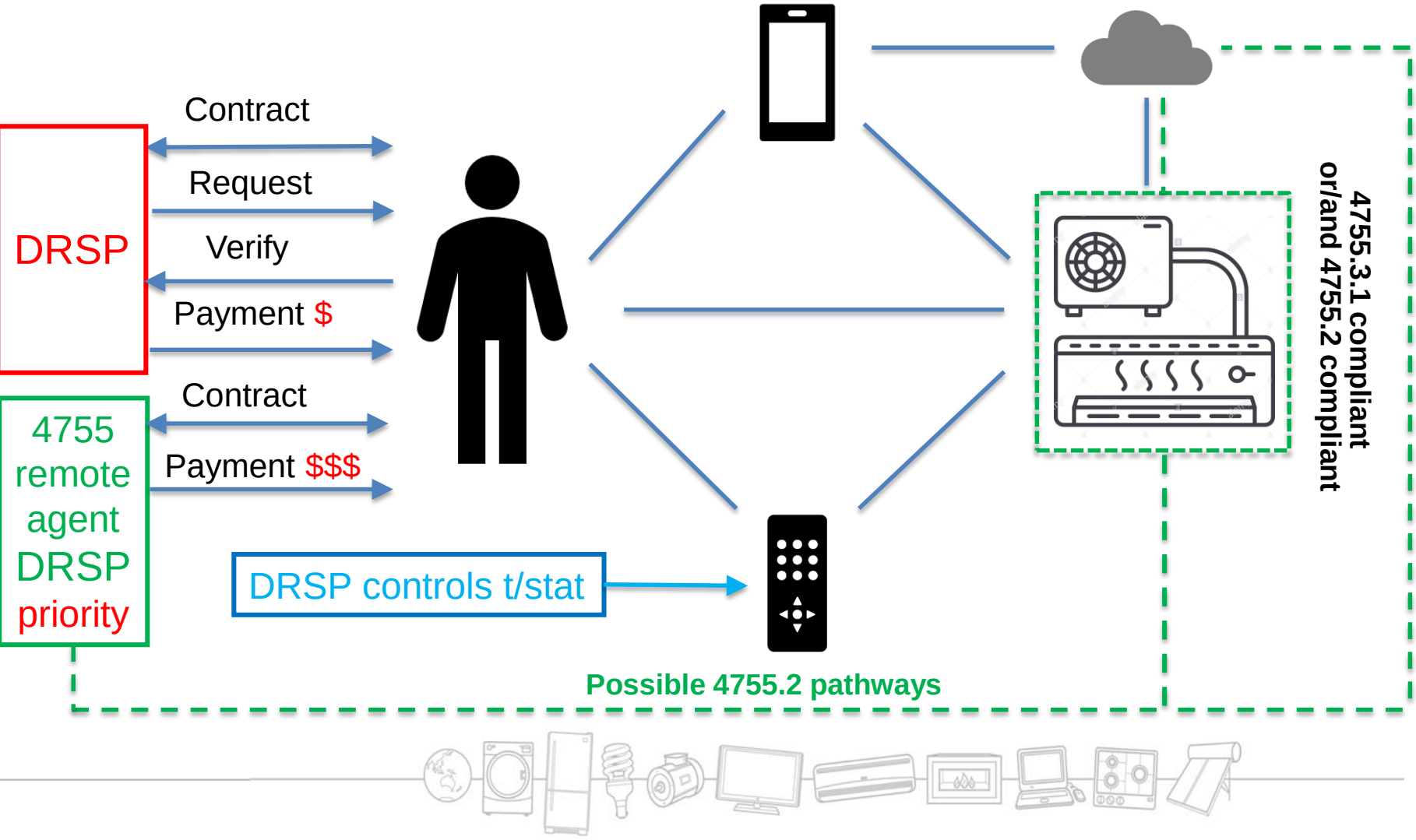
Similar to ‘legacy’ load control?



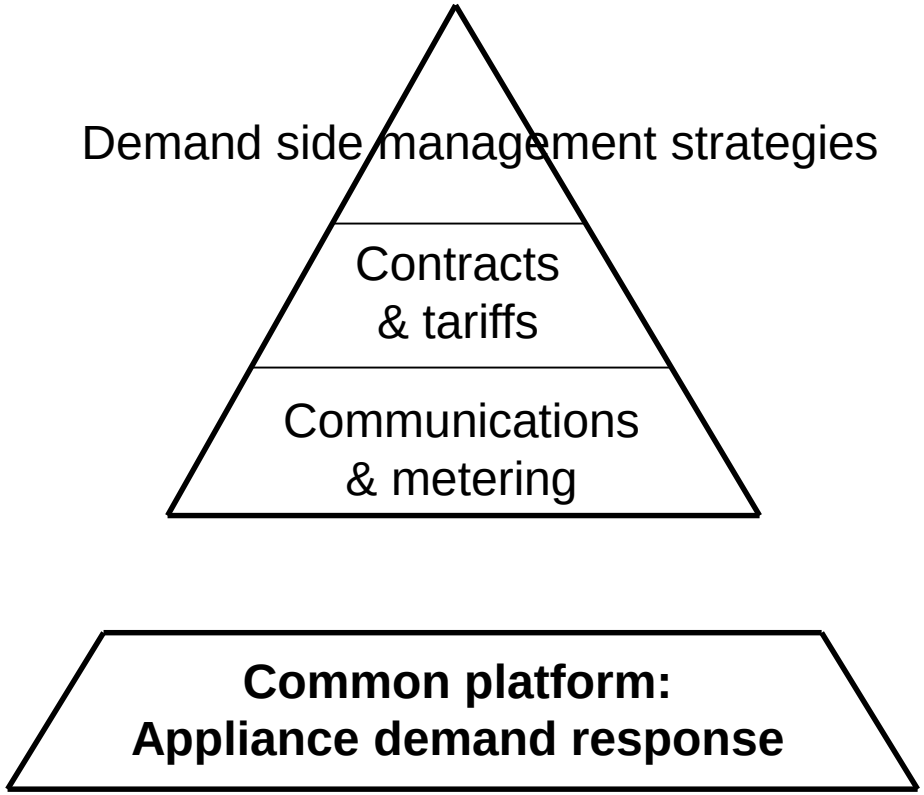
Demand response with AS 4755.2



Multiple DR pathways can coexist



Appliance DR is bedrock of residential sector demand side load management



Air Cond load management trials, 2005-12

State	Entity (type)	Location	Period	Participants
SA	ETSA Utilities (D)	Adelaide	2005-09	2,000
Qld	Ergon (D)	Townsville, Magnetic Is	2008-09	NA
Qld	Energex (D)	Brisbane	2008-10	3,500
WA	Western Power (D)	Nedlands, Perth	2008-11	Up to 2,200
NSW	Endeavour Energy (D)	Blacktown, Sydney	2008-12	2,500
SA	ETSA Utilities (D)	Adelaide	2010-12	1,000
WA	Western Power (D)	Perth	2011-12	380
Qld	Energex (D)	Brisbane	2011-12	200
ACT	ActewAGL (D)	Canberra	2011	NA

Trials involving AS/NZS 4755 products. Other trials involved breaking into the air conditioner controls.

ARENA-supported Res DR Trials, 2017-2020

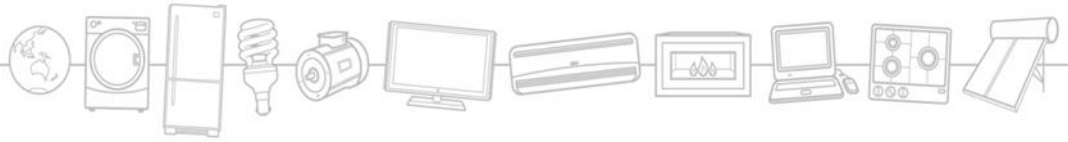
States	Entity (type)	Notify/ behaviour	Direct load management	Comment
Vic, SA, NSW	EnergyAustralia (R)	✓	✓	AC, PP, Batt; Problems with load control device
Vic	United Energy (D)			Voltage reduction
Vic	Powershop (R)	✓	✓	Battery & PV
SA, Vic	Zen Ecosystems (A)	✓		
NSW	AGL (R)	✓	✓	AC, EV Too few AS/NZS 4755 compliant products among participants

Available AC DLM programs

State	Entity (type)	Program	Technology	Since	Participants
Qld	Energex (D) Ergon (D)	PeakSmart	AS/NZS 4755	2013	108,000 – pay on AC purchase
NSW	Endeavour (D)	CoolSaver	AS/NZS 4755	NA	NA – pay per summer + free AC service
Vic	Powercor (D)	Energy Partners	Sensibo (t/stat adjust)	NA	NA – pay per event

Conclusions – DLM programs

- DLM has proven effective in Australia
  - Up to 50% load reduction achievable & acceptable
- Over a decade experience with AS/NZS 4755
  - Most states, several utilities have trialled
  - Where programs did not proceed, other reasons
- No other comparable standard or technology has emerged (in Australia or elsewhere)
- Permits “behavioural” DR outside 4755 events
- Reduces risks to consumers of TOU/CPP



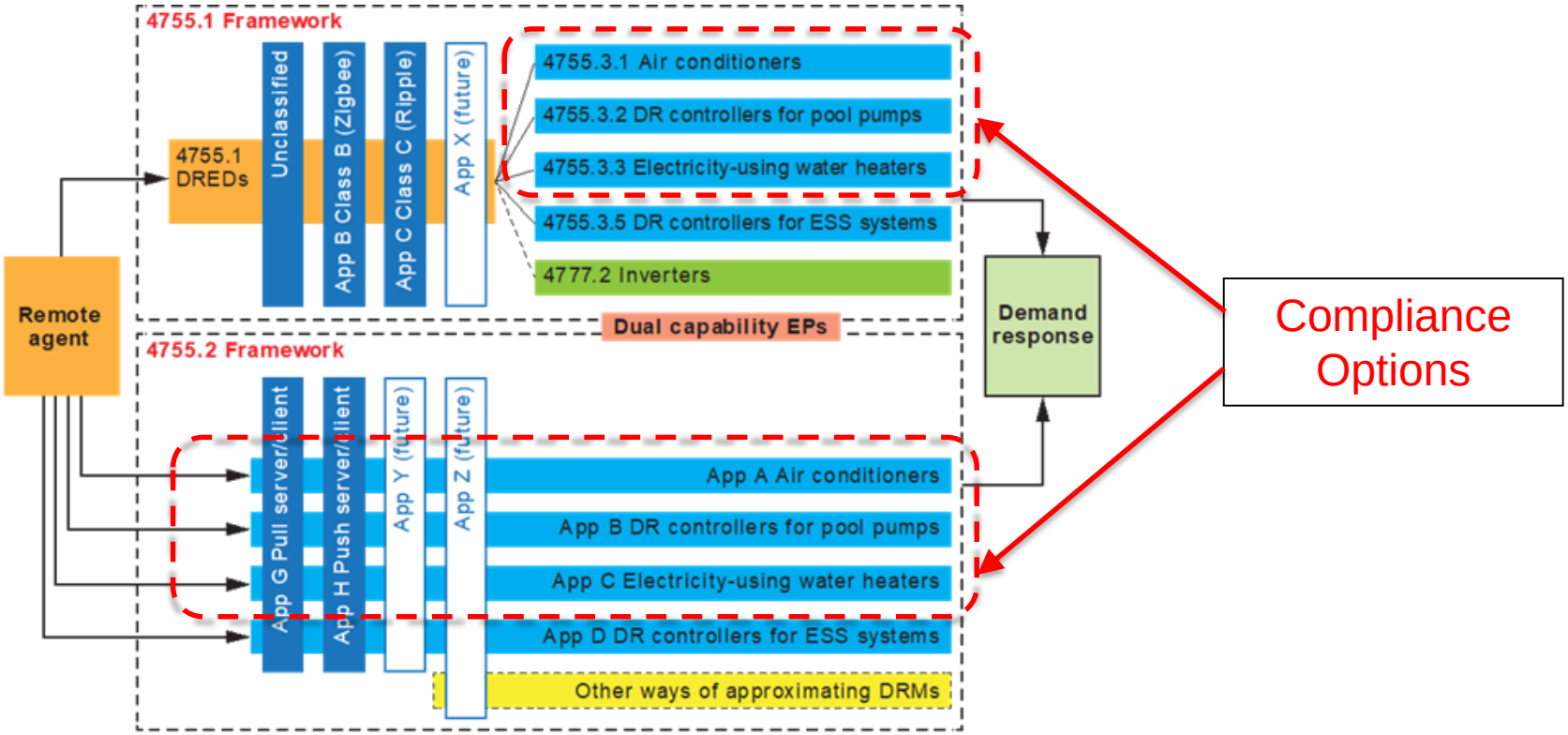
Options considered in Consultation Paper

1. Business as Usual
   - Voluntary compliance with AS/NZS 4755.3.1
     - About 33% of AC models, ?% of sales; no other products
   - Energy efficiency measures continue
2. Encourage voluntary adoption
   - Labelling DR capability and cash incentives
   - Labelling for DR has been tried and abandoned
   - Cash incentives work but COAG cannot dictate
     - If all products meet common standards, less $$ needed
3. Mandating compliance most effective option

The proposal

- Mandate compliance with relevant part of AS/NZS 4755 for 4 types of electrical products
  - Only affects *new* product sales, after target date
- Require all DRMs, not just DRM1
- Activation, contracts etc will be up to the market
- Intention is to create a common platform for DR
  - So consumers can change DRSPs without stranding their investment (and DRSPs can engage consumers at low cost)
- Value lies in greater economic efficiency of grid
  - How that value is shared is up to the market

Proposed AS/NZS 4755 compliance options



Origins of AS/NZS 4755

- Standards Committee EL-054 set up in 2005
  - Manufacturers, electricity utilities, govt, CSIRO, consumers
- AS4755:2007 *Framework for demand response capabilities and supporting technologies for electrical products* (superseded by AS/NZS 4755.1)
- Key to progress was separating comms from the appliance
  - AS/NZS 4755.3.1 (ACs) issued 2008, revised 2012, 2014
  - AS/NZS 4755.3.2 (PPCs) issued 2012, revised 2014
  - AS/NZS 4755.3.3 (WHs) issued 2014
  - AS/NZS 4755.3.5 (Electric energy storage) issued 2016
  - AS/NZS 4755.1 (DREDs) issued 2017
  - Draft of AS/NZS 4755.3.4 (EV chargers) not published
- AS 4755.2 at public comment stage – target early 2020

Air conditioners (Part 3.1/Part 2)

Part 3.1 Demand Response Enabling Device

Part 3.1 Connection point (RJ45 socket or screw terminal)

Note: Product shown as illustration of type only. Does not indicate that this model complies with AS/NZS 4755

Pool pump controllers (Part 3.2/Part 2) NOT NZ

Note: Product shown as illustration of type only.
Does not indicate that this model complies with AS/NZS 4755

Water heaters using electricity (Part 3.3/Part 2)

Note: Products shown as illustration of type only. Does not indicate that these models comply with AS/NZS 4755

Electric vehicle charger/discharge controllers (DRAFT Part 3.4)

Note: Product shown as illustration of type only.
Does not indicate that this model complies with AS/NZS 4755

AS/NZS 4755 Demand Response Modes

Product	Standard Part (either option)	Minimum load/Off	Operation permitted at reduced load		Request Load on	No dis-charge to grid	Discharge to grid permitted at reduced rate		Request dis-charge to grid
			Limit to 50%	Limit to 75%			Limit to 50%	Limit to 75%	
Air Conditioner	3.1:2014 or Part 2	DRM 1	DRM 2	DRM 3	NA	NA	NA	NA	NA
Pool pump controller	3.2:2012 or Part 2	DRM 1	DRM 2	NA	DRM 4	NA	NA	NA	NA
Electric water heater	3.3:2014 or Part 2	DRM 1	DRM 2	DRM 3	DRM 4	NA	NA	NA	NA
EV Charge Controller	Draft 3.4 ??	DRM 1	DRM 2	DRM 3	DRM 4	DRM 5*	DRM 6	DRM 7	DRM 8

Mandatory

* DRM 0 also mandatory for models capable of discharge to grid

What the proposal is NOT

- It will *not* be mandatory for customers to participate
  - They can choose to, e.g. in order to avoid high-price periods or to gain cash incentives
- Proposal does *not* depend on smart metering
  - There are several alternative activation pathways
- Proposal does *not* depend on TOU Pricing
  - Trials so far have not used TOU; makes TOU less risky
- Proposal is *not* an energy efficiency measure
  - But will increase economic efficiency of electricity supply and lower bills, through less investment in poles & wires
  - Allows energy to be used/stored when renewables are high

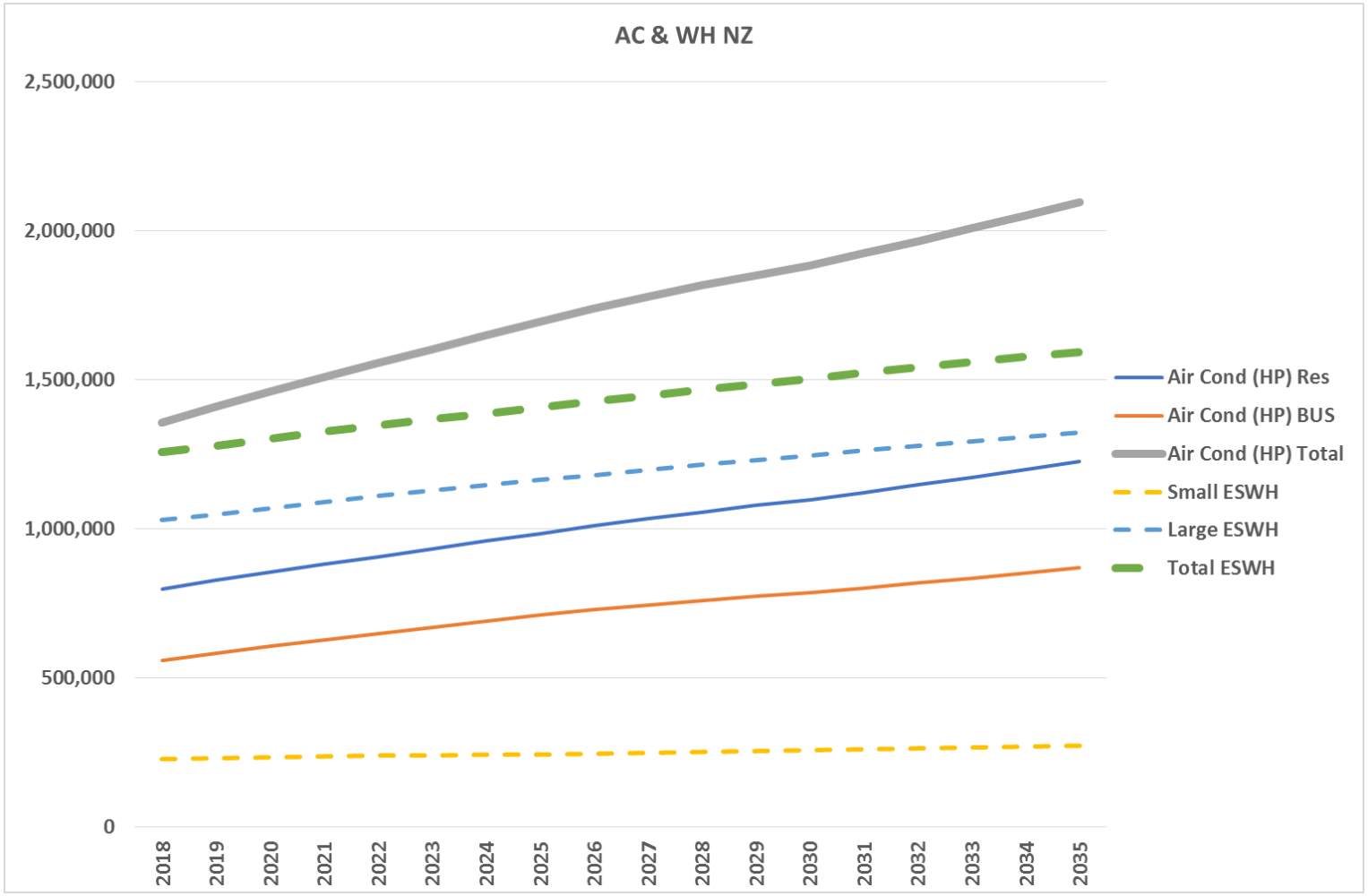
Valuing Costs

- Compliance adds about $30 per appliance sold
- Activation costs: Range $75 - $180
  - Incurred only once when appliance first activated
- Participation costs:$25/participant/year
- Constraint on energy services during DR events
  - e.g. room temperatures slightly higher
- Payments to consumers are transfers, not costs
  - But can be lower, so helps DRSPs business case
- DRSP monetizes its aggregated DR capability
  - Sells into wholesale DR, RERT, FCAS, to DNSPs

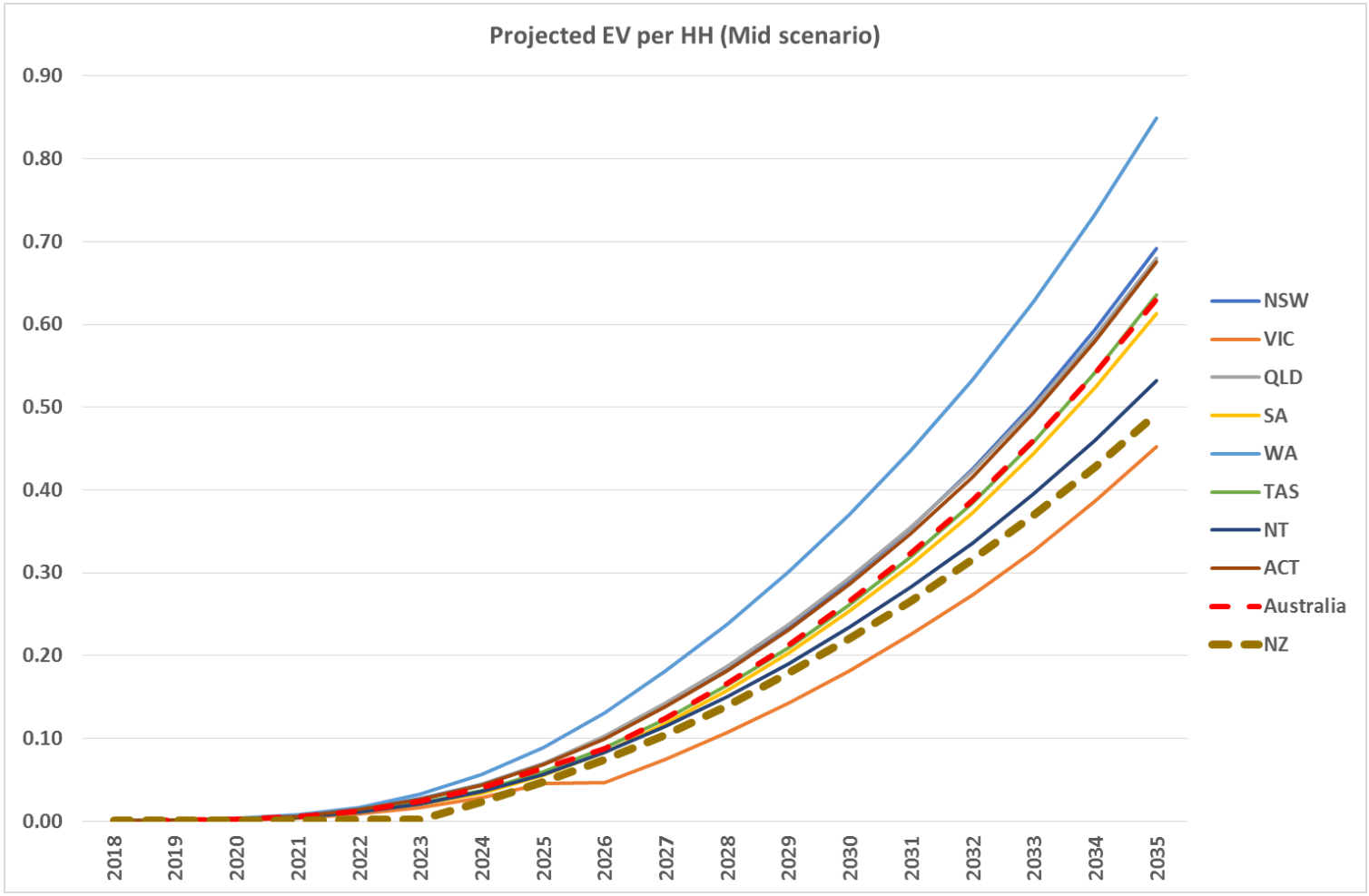
Valuing benefits

- Reduction in network peak demand
  - Aust $ 200-3,600 per firm kVA (NEM av. $1,800)
  - NZ $ 1,940 (NPV of $200/kVA/yr, 15 yrs, 6%)
- Wholesale price savings ($100/MWh)
  - To DLM program participants
  - To all energy users during DLM events
- Emergency management (RERT market)
- Shifting load into minimum demand events
- Grid support (supply, VARs) – not quantified

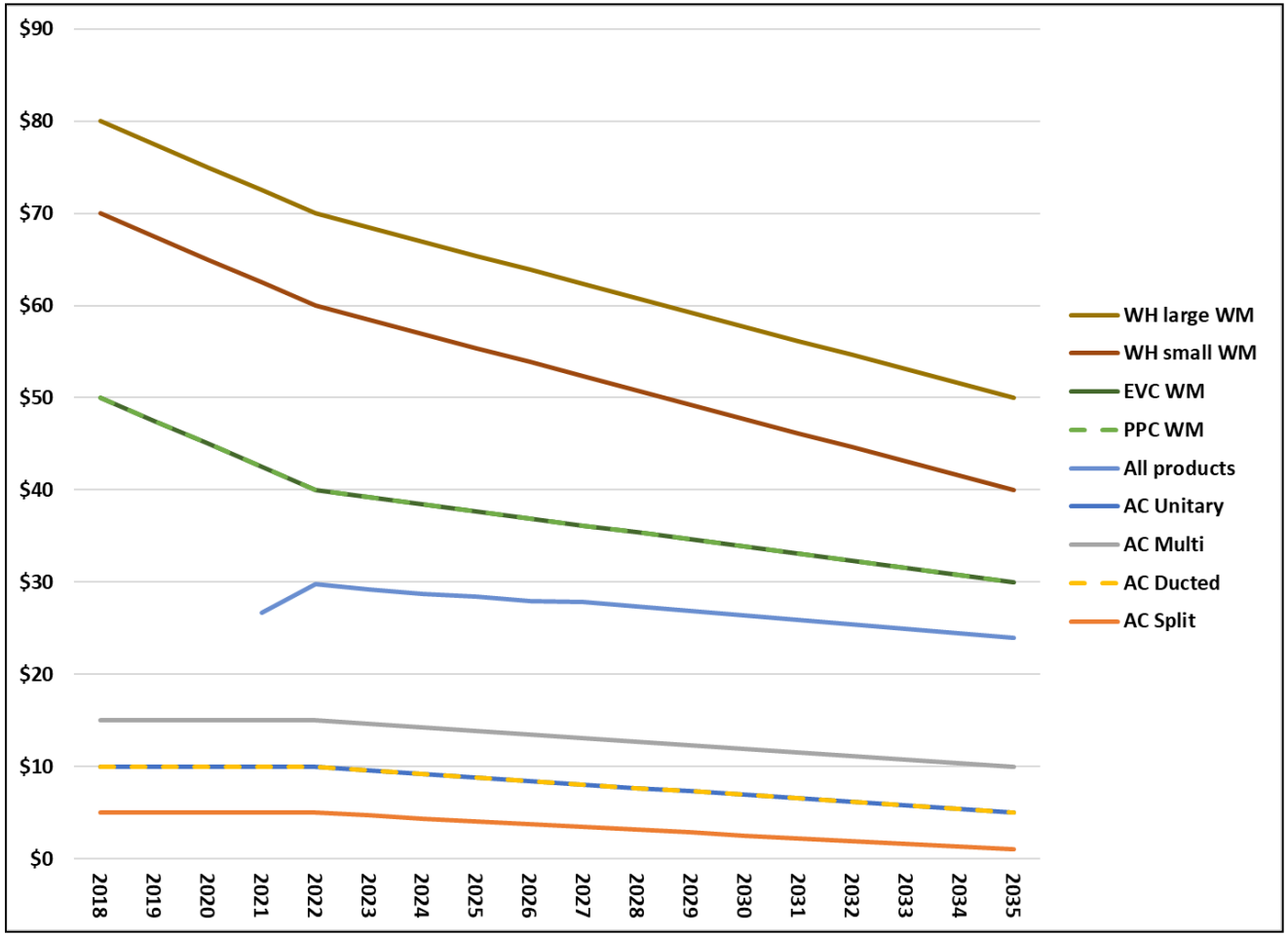
Air conditioners & electric storage WHs



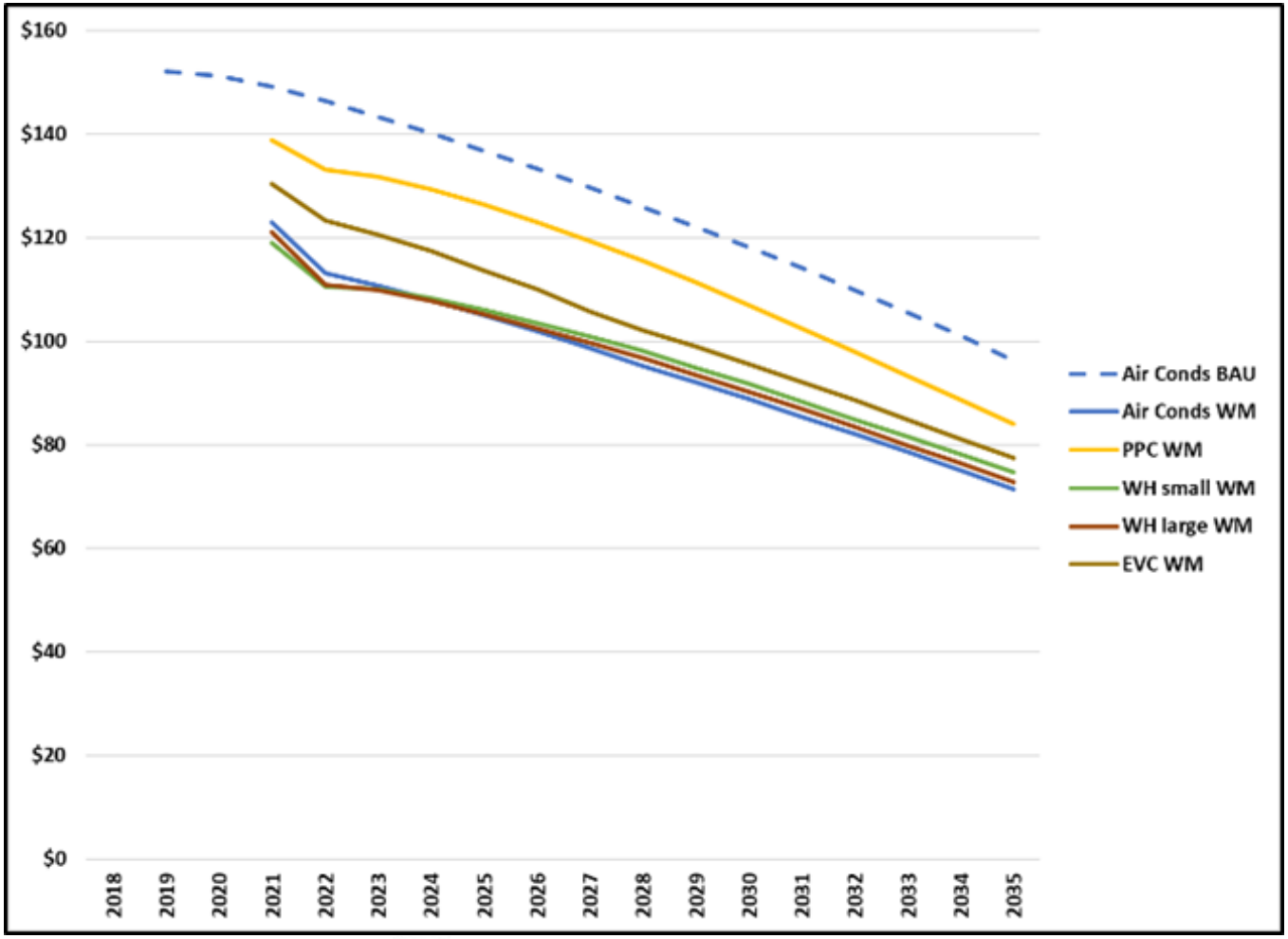
Electric Vehicles per household



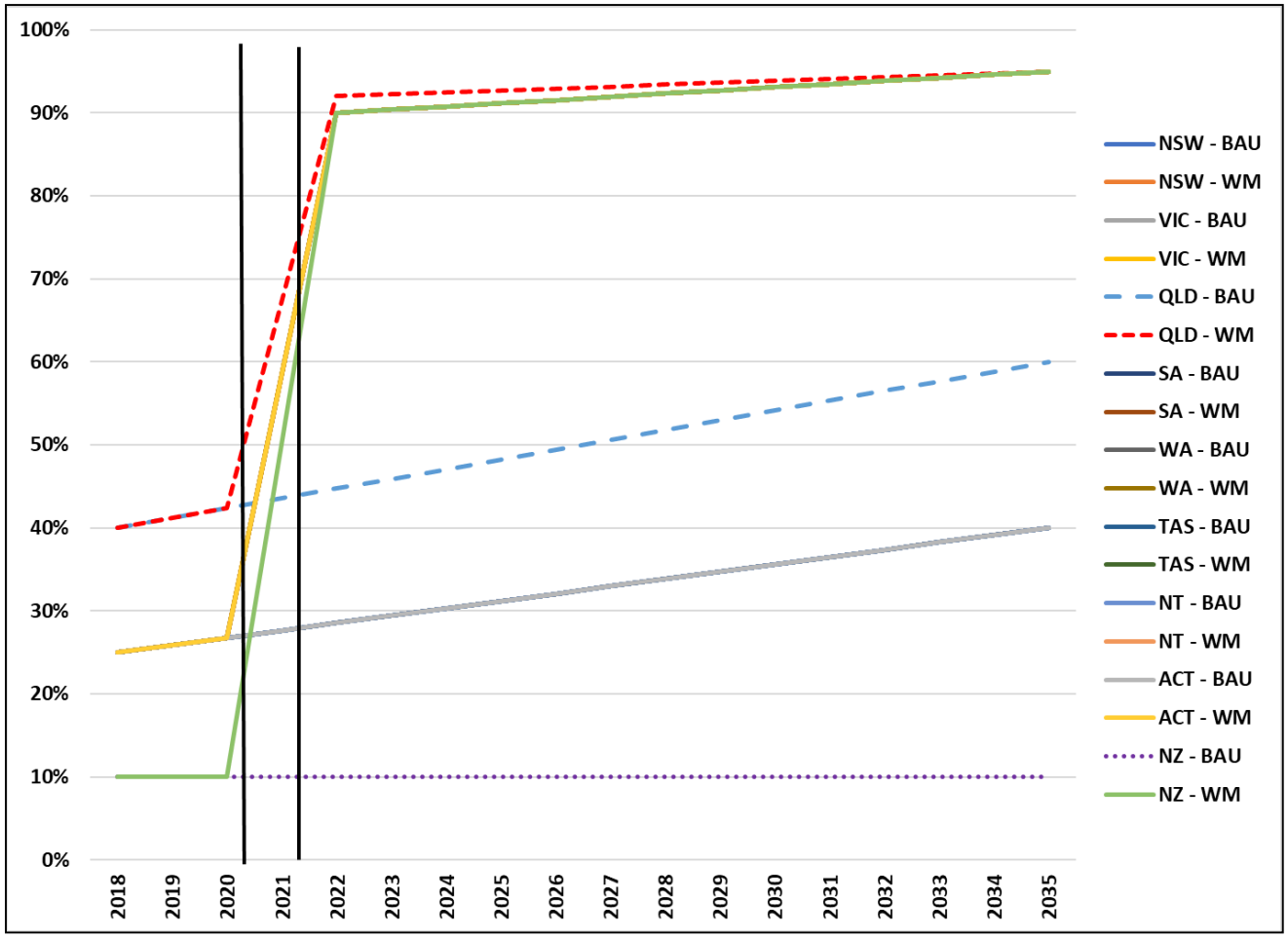
Increase in retail price



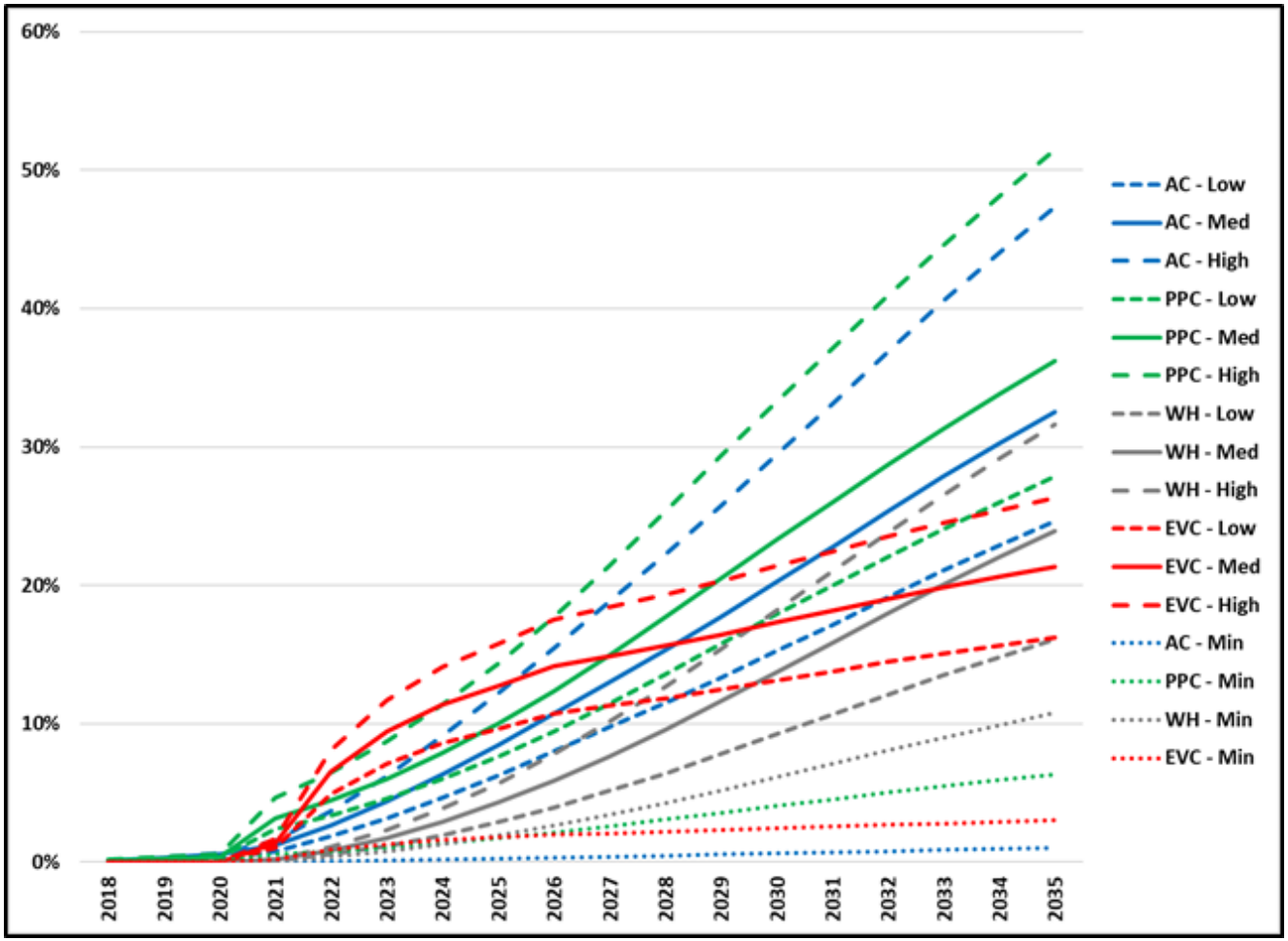
Activation costs



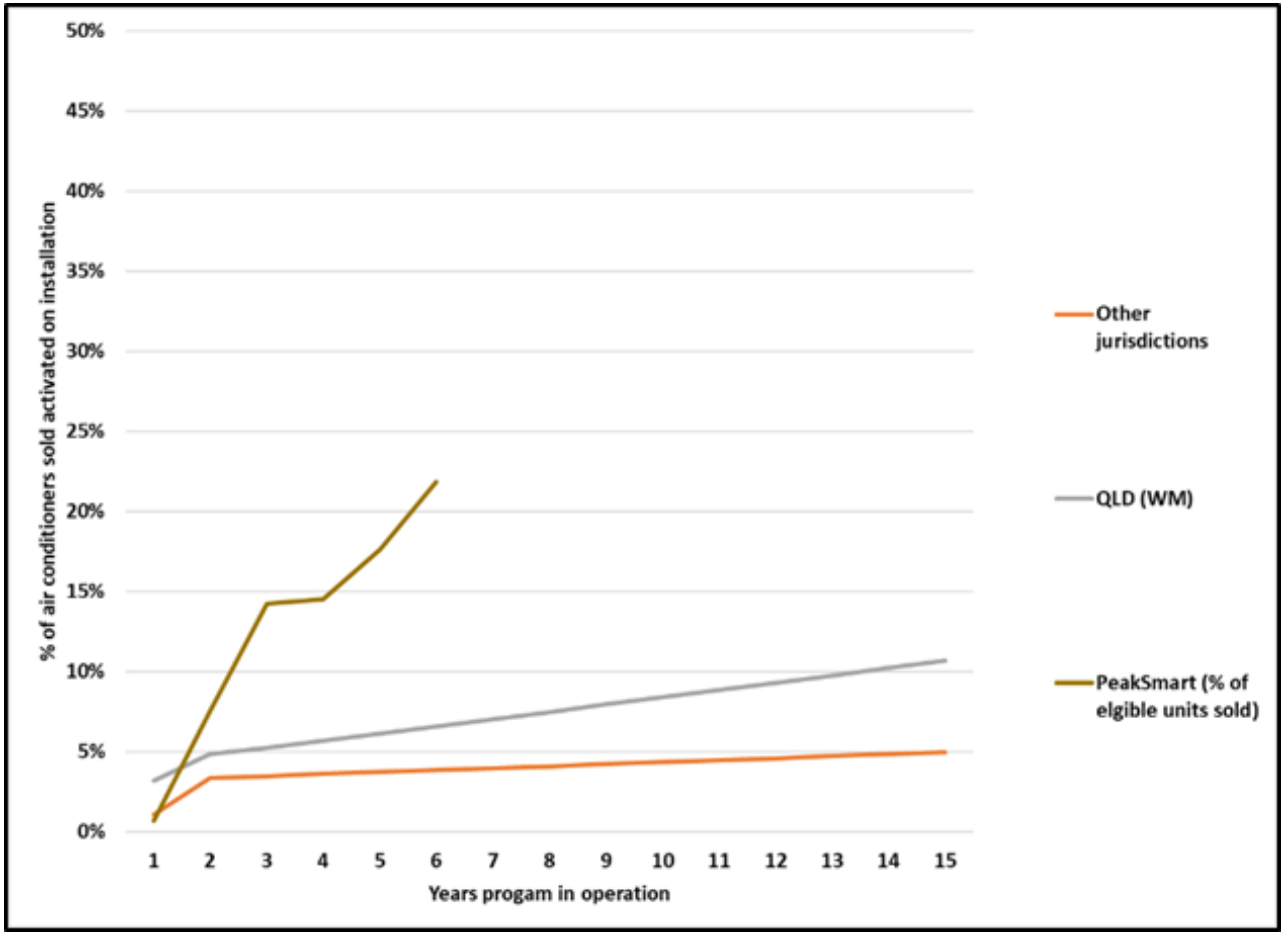
Compliance Rates, BAU/With Measures



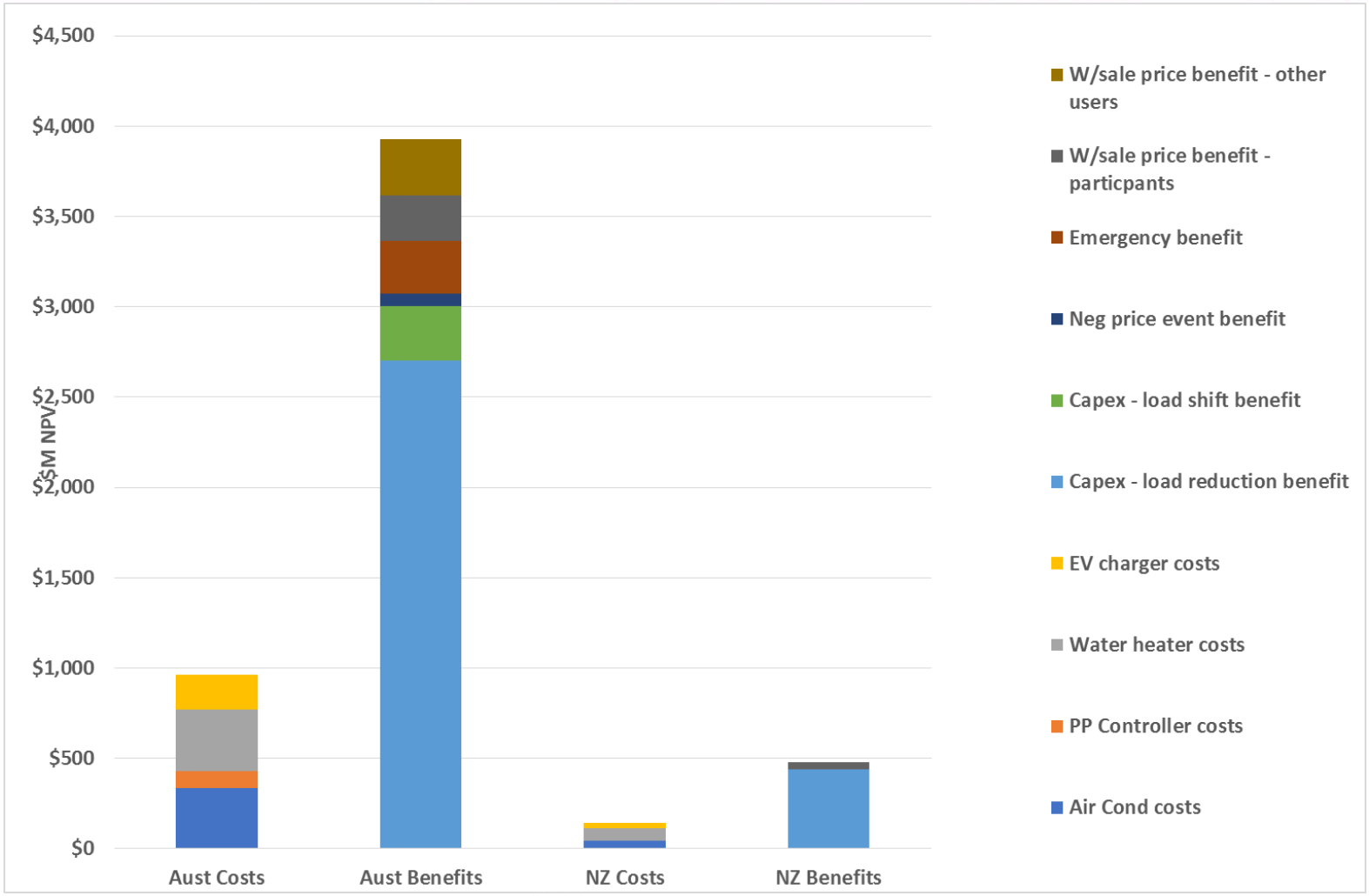
Activation rates (at-install + post-install)



Actual at-install activations (Peaksmart)



NPV costs and benefits, 2019-35



By appliance, Australia (Med Activ)

	Routine DLC Reduction available SMD 2035, MWe (a)	Costs $M NPV (b)	Benefits $M NPV (b)	Net Benefits $M NPV (b)	% net national benefits	B/C ratio	Without whole-sale price benefit	
							Net benefit	B/C ratio
Air Conds	2164	$335	$2,167	$1,832	61.8%	6.5	$1,511	5.5
PP Controllers	354	$94	$266	$172	5.8%	2.8	$160	2.7
Water heaters	467	$341	$642	$301	10.2%	1.9	$288	1.8
EV chargers	637	$191	$851	$660	22.2%	4.5	$446	3.3
All products	3621	$960	$3,926	$2,965	100.0%	4.1	$2,405	3.5

By appliance, NZ (Med Activ) - Previous

	Routine DLC Reduction available SMD 2035, MWe (a)	Costs $M NPV (b)	Benefits $M NPV (b)	Net Benefits $M NPV (b)	% net national benefits	B/C ratio
Air Conds	228	$43	$195	$152	72.2%	4.5
PP Controllers	NA	NA	NA	NA	NA	NA
Water heaters	139	$71	$146	$75	35.7%	2.1
EV chargers	12	$28	$12	-$17	-7.8%	0.4
All products	379	$142	$353	$211	100.0%	2.5

By appliance, NZ (Med Activ) – EV revised

	Routine	Costs	Benefits	Net	%	B/C
	MD 2035	$M NPV	$M NPV	Benefits	benefits	ratio
Air Conds	228	$43	$195	$152	45.0%	4.5
PP Controllers						
Water heaters	139	$71	$146	$75	22.2%	2.1
EV chargers	112	$28	$139	$111	32.8%	5.0
	479	$142	$481	$338	100.0%	3.4

Benefits per household (mid-point)

- For Australia, NPV of $A 2,970 million is equivalent to net benefit of about $300 for each household
  - Net value after all costs
  - time-discounted and inflation-adjusted
  - Averaged over all HH: greater to participants
- For New Zealand, NPV of $NZ $210 million is equivalent to net benefit of about $185 (was $ 115) for each household

Why mandate compliance?

- Addresses market failures:
  - Lack of energy price signals leads to over-investment in supply and networks – bills higher than necessary
  - Will make TOU tariffs more acceptable to consumers
  - 'Positive externality' – no stakeholder can gain enough of the value to risk introducing standard
- Non-mandatory options (e.g. labelling) not effective
  - Cost of retrofitting DR capability prohibitive
- Common platform reduces stranded investment risk
  - For manufacturers, DRSPs, consumers
  - Consumers not tied to one DRSP
- Benefits can also accrue to non-participants

Why AS/NZS 4755?

- Programmable communicating T/stats only suit ducted systems, thermally pre-conditioned spaces
  - 'NEST' type PCTs do not work with split unit ACs
- Compatibility with Japanese Echonet standard
  - Most 4755-compliant models also meet Echonet
- IEC DR standards at early stage (Aust was involved)
  - Europeans concentrating on DR for whitegoods
- 4755 responses can be verified at the appliance level
  - Independent of temp/thermal mass of conditioned space, etc
- 4755.2 designed to permit future interworking

Number of models certified to DR standards

Product category	US EPA Energy Star "connected" criteria	Australia/New Zealand Standard AS/NZS 4755	Japan Echonet Lite
Air conditioner – window-wall	✓ 7	✓ 0	✓
Air conditioner – split unit		✓ 990	✓ 26 families (a)
Air conditioner – central/ducted		✓ 113	✓
Electric resistance heating			✓
Pool pump controller		✓ 0	
Water heater – heat pump		✓ 0	✓ 11
Water heater – resistance		✓ 0	
Refrigerator & freezer	✓ 41		✓
Clothes washer & washer-dryer	✓ 0		✓
Clothes dryer	✓ 2		✓
Dishwasher	✓ 0		
Light fixtures	✓ 241		✓
Connected thermostat	✓ 47		✓
Energy battery storage system		✓ 5	✓ 46
Electric vehicle charger (EVSE)	✓ 0	✓ (b)	✓ 1
Photovoltaic/battery inverter		✓ (c)	**✓ 23**
Controller for other devices		✓ 0	**✓ 213**

Consumer benefits

- All appliance owners can participate in DR market
  - Via DNSPs and retailers now, via DRSPs if AEMC permits
- Does not prevent other forms of DR participation
  - Whether or not the 4755 capability is activated
- Monetary benefits to participants
  - If they do not see them as adequate, will not participate
- Monetary benefits to non-participants as well
  - Lower wholesale prices, higher value for PV owners, lower network charges than otherwise
- Ultimate benefit is reduced risk of blackouts for all
- No other options with similar benefits on offer

Consumer safeguards

- Activation of DR capability is a free choice
  - Informed consent will have to be given; vulnerable households advised not to participate (see contracts offered by Powercor, Energex etc – limited no. of events)
  - Projections assume only 32% takeup for ACs by 2035
- Consumers can withdraw from contracts
  - For Energex, only 0.2% of 108,000 have chosen to do so
  - Products can be deactivated (remotely, under 4755.2)
- Event overrides possible for PPCs, WHs, EVs
- Appliance must revert to normal operation in case of comms failure or conflicting commands

Timing and implementation

Now

Target for AS 4755.2

Target for 4755.3.4?

	2019	2020	2021	2022	2023
AC, WH	GEMS Determination >		Lead time	Compliance	
PPC, EV	GEMS Act amended		GEMS Determination >	Lead time	Comp

Some jurisdictions with imminent network issues requiring more controllable devices in the system may consider an earlier implementation using local regulation.

Possible additional products

Battery charge controllers
AS/NZS 4755.3.5

PV Inverters
AS/NZS 4777.2

Home Energy
Management Systems
No standard yet

THANK YOU – ANY QUESTIONS?

Q&A

- We invited questions to be submitted in advance of the public consultation sessions by 23 August 2019.
- We also welcome questions today as part of this session.
- Your questions will be recorded as part of the minutes for this session and will also feed into the analysis of responses once the consultation closes.

Wellington Questions

- Why DRED – Why not Ripple Control? (for electric storage HW)
  - Obviously there is benefits for the network operators for using DRED instead of Ripple. However Ripple has "got the job done" for many years in New Zealand. Other than the technical benefits, is there a financial benefit of using DRED over ripple in the NZ context? If so, how much?
- NPV calculated for the New Zealand market almost insignificant
  - You have quoted the NPV for the proposed intervention to be $115 NZD for NZ households. However according to Powerswitch, an average North Island household could save $195 each year merely by changing power companies. If the NPV is truly this low it doesn't make financial sense for the market to invest in this technology – especially when there are much better interventions available for saving money. Can you provide some further clarification to this point?

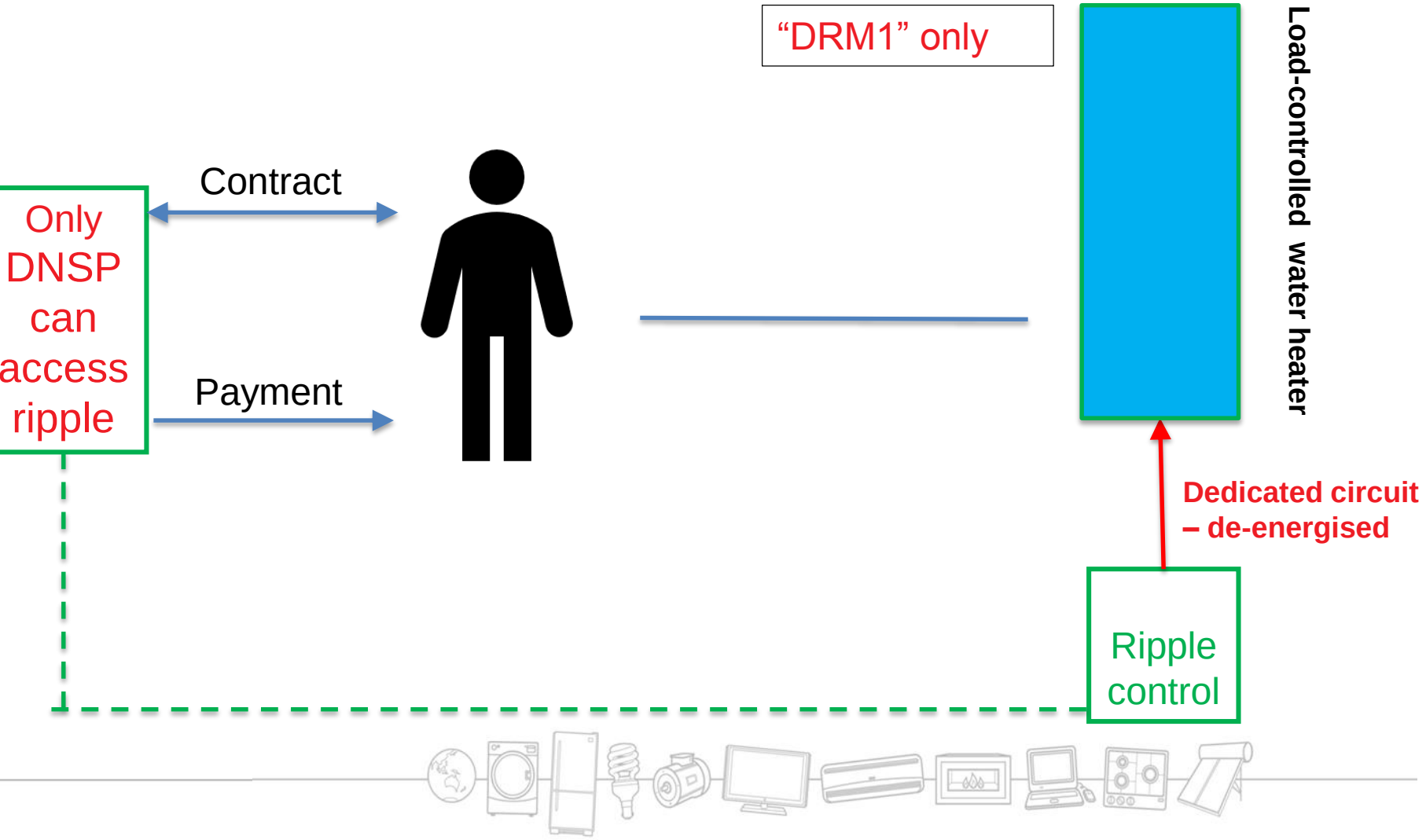
Wellington Questions

- DRED vs Smart / two way controls
  - We have not been able to review AS/NZS4755 in detail. However from a brief review, one of the main criticisms of ripple control, which is customers running out of hot water because the network operator has switched off their hot water cylinder for a bit too long (for whatever root cause) could also be levelled at the proposed “standard” technology. Why is a more “smart” intelligent option that leaves the user some control over their cylinder not on the table?
- Application of the change
  - Regarding the statement “The proposal would apply to all new heat pumps, electric hot water cylinders and electric vehicle chargers sold in NZ, whether manufactured here or imported into the country. It would not apply to appliances already in existence.
  - Can you clarify if “existing appliance” are the models that are already available in the market, or the products that are already installed in peoples homes?

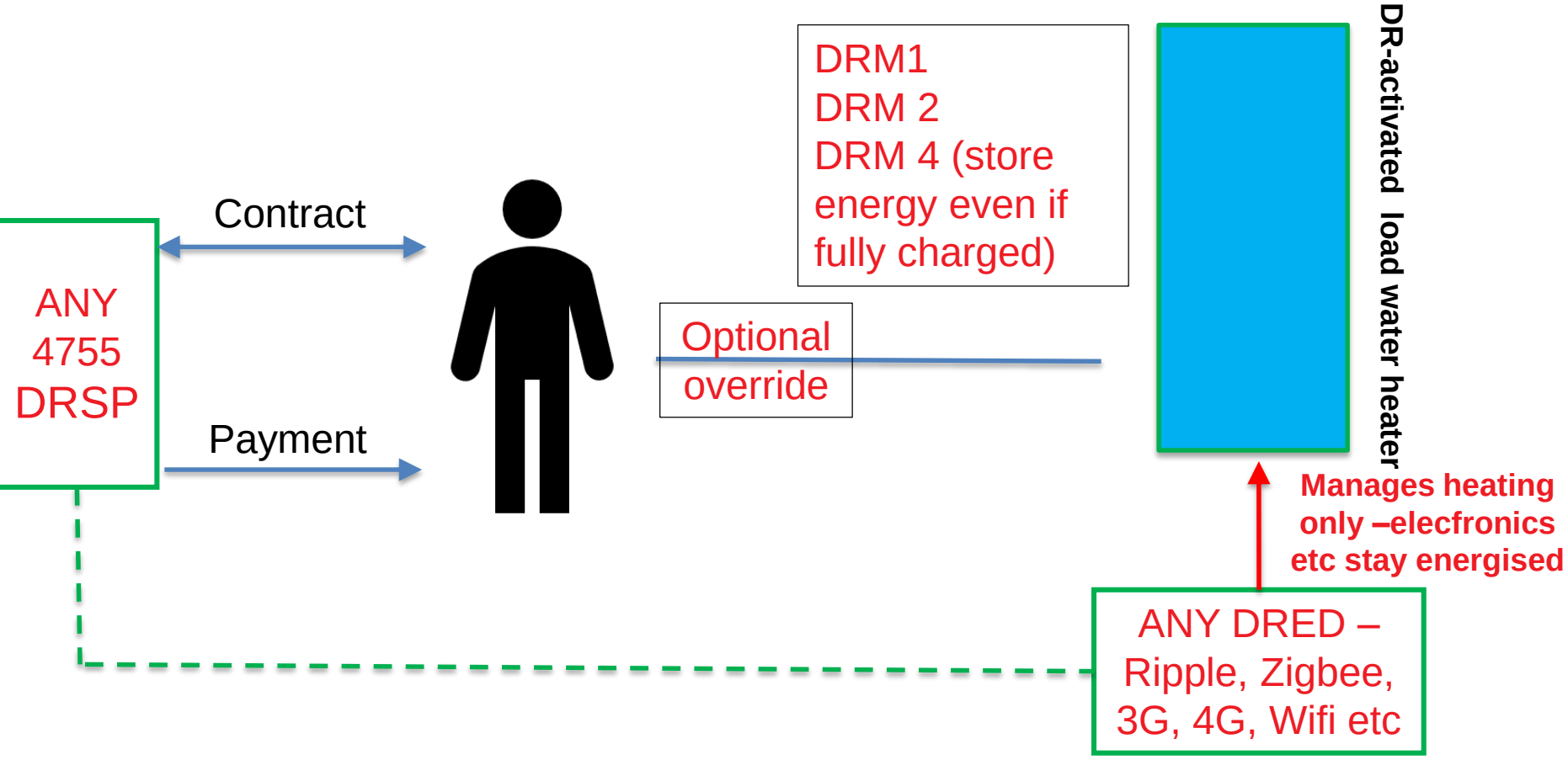
Wellington Questions

- Exempting only installed products
  - This would be a drastic change for NZ homeowners with indoor HWC's. Considering the capacity statement mentioned above, people would have to work out how to fit larger capacity cylinders when existing cylinders fail. Switching to larger cylinders could mean moving them to another location (ie outside).
  - Also what do townhouses and apartments do?

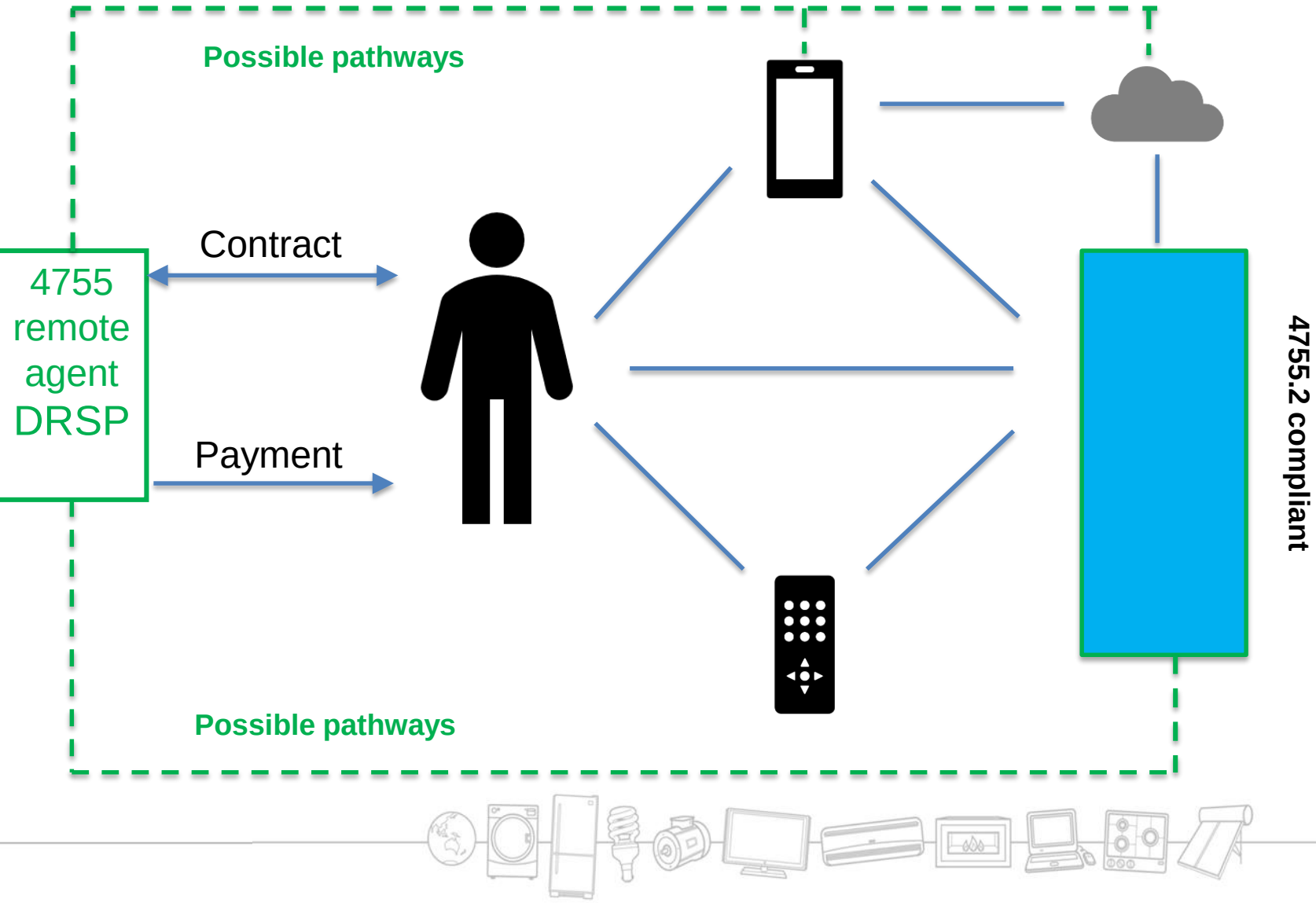
‘Legacy’ WH load control



4755.1 - much more flexible

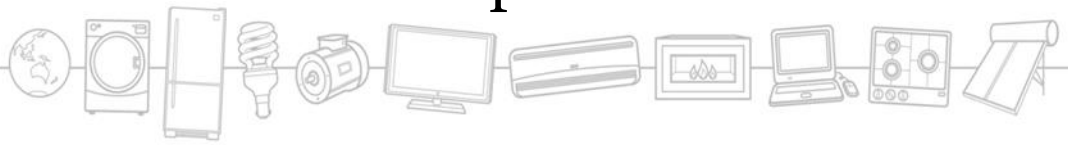


4755.2 – No DRED needed



Sydney Questions

- Please expand on the reference to a requirement for an “open standard” for DR capability. Does this relate to compliance with 4755 DRM commands, or relate to the ability to control the appliance?
- Is the providing a “means to operate” with 4755 modes sufficient, or must manufacturers provide a capability for any third party to connect and operate their appliance?
- Have the regulators considered the unwillingness of manufacturers to honour product warranties given the uncertainty of how DRSPs may operate the appliance?
- Does the requirement for an open standard apply to both the directly connected device and the potential DRED?



Sydney Questions

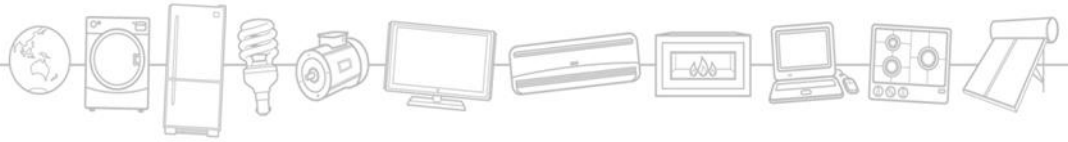
- Will the proposal require the appliance to provide feedback on its charge state? Ie – if the water heater has a low amount of stored energy, the DR event should not take place, as consumer amenity could be heavily impacted.
- The document excludes heat pumps and solar water heaters, however some models of these have an electric resistance element installed. Are these models with elements definitely excluded?
- Will there be any relaxation of MEPS heat loss requirements as an offset to these new requirements?
- Please expand on the requirement for DRM4 for water heaters. Is it possible that DRM4 could be replaced by a standard “operating” mode. “Overheating” as specified as DRM4 is likely to impact on the life of water heaters as it will increase the solubility of the enamel lining of electric water heaters.

Sydney Questions

- With reference to the nominated demand response standards for air conditioners.
- Example: the air conditioner is ducted inverter type of 15kW rated cooling capacity and 5kW rated input power. The end user has arrived home from work on a hot summer day to an uncomfortable house.
- The air conditioner is not operating prior to a demand response event and is started by an end user shortly after commencement of a demand response event of mode DRM2 or 50% normal operation. The air conditioner has not consumed any power except standby power during the half hour period before the event.
- Is the air conditioner restricted to standby power for the duration of the event?
  - If not, is the air conditioner restricted to approximately 50% of 5kW rated input power?
  - If not, how is the reference electrical energy determined by the air conditioner controller in order to limit consumption during the event?

Sydney Questions

- How is the SA governments stance on this different from the Other states?
- What changes are being proposed that will impact pool equipment we sell in SA? in Other States & Territories?
- What is the timing of the proposed changes?
- What will be the time frame for converting products over to new guidelines/standards?
- will it be compulsory to have the facility for this in any new products, and after What date?
- What are the warning triggers to the homeowner when the demand response will be instigated to the appliance on the day?

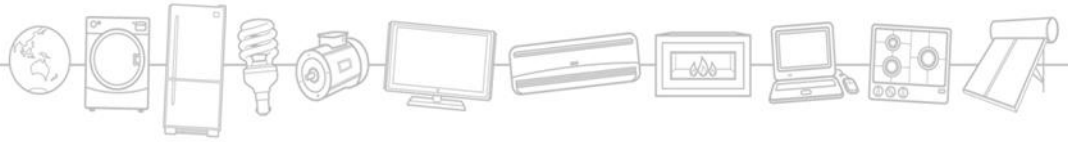


Sydney Questions

- There are an increasing amount of home devices designed to monitor and control home power. An alternative would be to offer incentives for these OEMS or service providers to create a landscape that encourages new markets for these players to attract more users. Would a government body or distribution company offer incentives to encourage such markets?
- Part of the solution requires consumers to be educated about demand response. What steps would be taken to provide adequate education to build mindshare amongst the community, similar to how batteries and solar have for the last 10 years, and seen as accepted solutions in the market place?
- Why are we limiting these to only select appliances? The standard should apply to ANY appliance that manufacturers can create to encourage more creative ways to enter the market but also to add more potential for load under control.

Sydney Questions

- Why are we restricting ourselves to such discrete values? (50%, 75%)? For appliances that conform to 4755.2, being an electronic form of communication should allow far richer set of instructions for more granular control of appliances.
- Do you have any knowledge or involvement with the up-coming Energex IPDRS trial starting later this year? How would the information being shared by this pilot be used to provide further data poin
- How would “smart device” manufacturers obtain access to government (ARENA) grants to help develop and position their products to the market? How could these products also gain exposure to all major players in each state in order to further prove their legitimacy?



Sydney Questions

- Have any studies been done, to gauge the affects of allowing more products to participate? This includes “micro-load” devices such as kettles, microwaves, lighting etc., all non-essential appliances, that together may tally to a significant portion of the potential amount under control.
- Are you aware of HEMS devices that enable DR capabilities for devices currently without DR functions. This would open up many more opportunities to enable DR for many product types (including retrofit options)
- Due to the inherent requirements for constant communications, there is an overhead to offer a continuous, quality service for DR requests. Will DR calls that protect the network integrity, offer rebates that also cover the overhead of 3G (or other) communications on the device.

Sydney Questions

- Will a reduction in network costs be handed downstream to consumers or DRSP's. How would this amount be quantified and what mechanisms would be setup to ensure this is regulated to offer fair returns for such services.

- In order to lower costs , access to reading data from the meter would greatly simplify the setup of a product. Have you considered allowing for a standard method of data collection from the meter? To allow such devices to directly measure their effects on power usage throughout a DR event.

- Have you considered different levels of incentives for regions where DR events have different levels of impact? Eg: extreme cold climates where DR events to turn off heating (for example) could create distress for occupants.

- Will devices that conform to more DR modes for the standard be considered to provide more value? And will that be reflected in the value of incentives offered for aspects of this proposal.

Melbourne Questions

- Will your program or system of control be compatible with Near Field Communication (NFC) technology found in mobile phones and apps?

Timing and implementation

Now

Target for AS 4755.2

Target for 4755.3.4?

	2019	2020	2021	2022	2023
AC, WH	GEMS Determination >		Lead time	Compliance	
PPC, EV	GEMS Act amended		GEMS Determination >	Lead time	Comp

Some jurisdictions with imminent network issues requiring more controllable devices in the system may consider an earlier implementation using local regulation.

Next steps

- Written comments on Consultation Paper
  - by 16 September, please
  - To: smartappliances2019@sa.gov.au
- Questions on p43 of Consultation RIS
- E3 will consider responses
- E3 will prepare a Decision RIS
- Ministers will then consider and decide

THANK YOU – ANY QUESTIONS?