International Energy Agency

Modernising Energy Efficiency through Digitalisation

Webinar 6: Policy Guidance for Smart, Energy-Saving Consumer Devices

IEA Webinar, 2 June, 2020

Overview

- Introduction

- Webinar 6: Policy Guidance for Smart, Energy-Saving Consumer Devices
  - Steven Beletich is the principal of Beletich Associates, the Operating Agent for the Electronic Devices and Networks Annex (EDNA) of IEA's Technology Collaboration Programme (TCP) on Energy Efficient End-Use Equipment (4E)

- Questions and discussion

The presentation and the recording will be posted online, we will notify you when they are available on the IEA events page

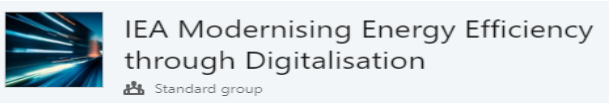
IEA Digitalisation & energy efficiency

How digitalisation can support & accelerate energy efficiency implementation:

- More effective policies and programmes
- Across end-use sectors (buildings, industry, transport)
- Supply side efficiency
- Systems efficiency including communities, cities and power systems (demand response, flexibility, optimised planning and operation)

https://www.iea.org/articles/energy-efficiency-and-digitalisation

Online community

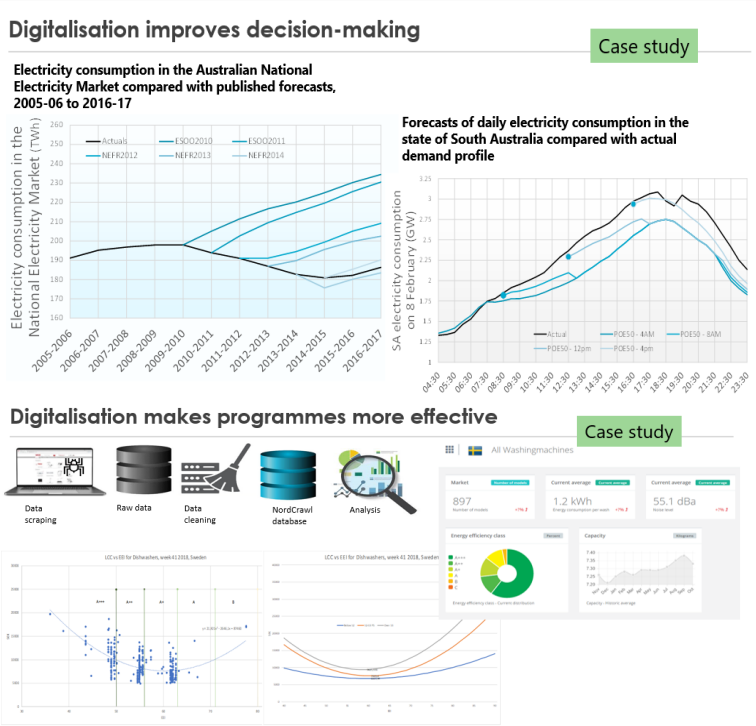


www.linkedin.com/groups/13700212/

Events

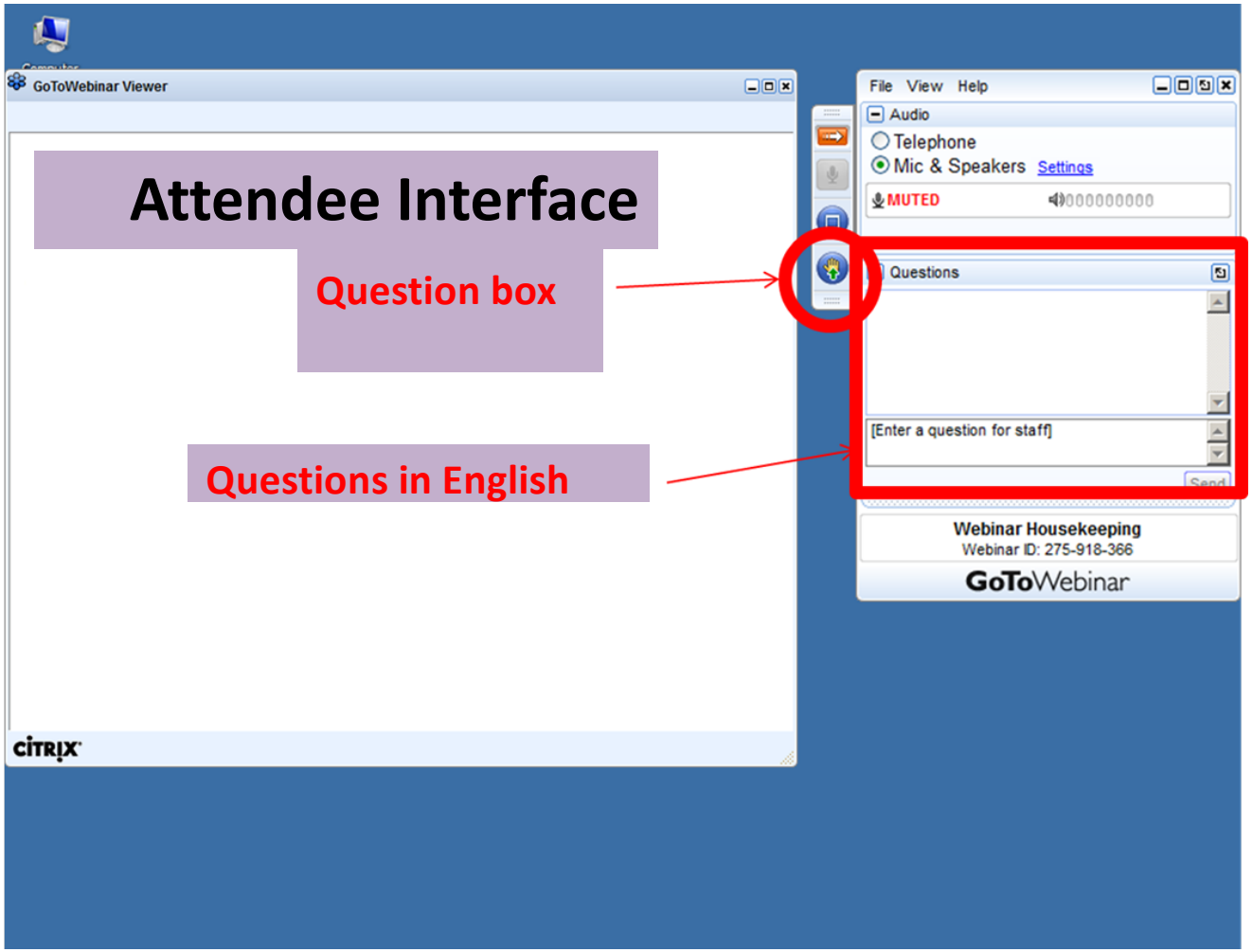
- Workshops
- Webinars

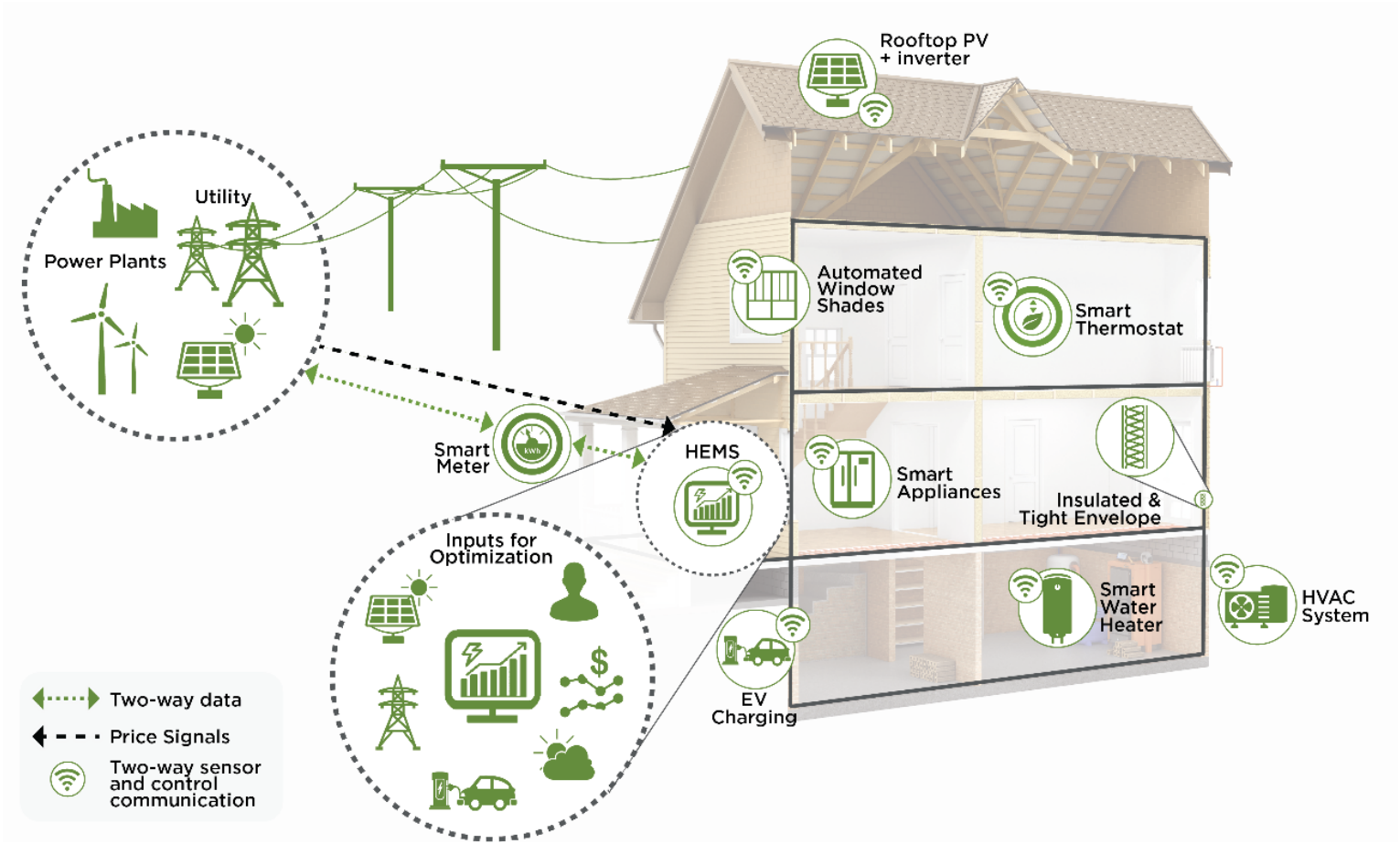
Case studies, lessons learned



Actionable policy guidance

How to ask questions





Policy Guidance for Smart, Energy-Saving Consumer Devices

Steven Beletich, Operating Agent for IEA-4E/EDNA

IEA Webinar, 2 June 2020

With Thanks to

- Vida Rozite and IEA colleagues
- Guidehouse Inc, author of report for EDNA
- https://www.iea-4e.org/document/448/policy-guidance-for-smart-energy-saving-consumer-devices

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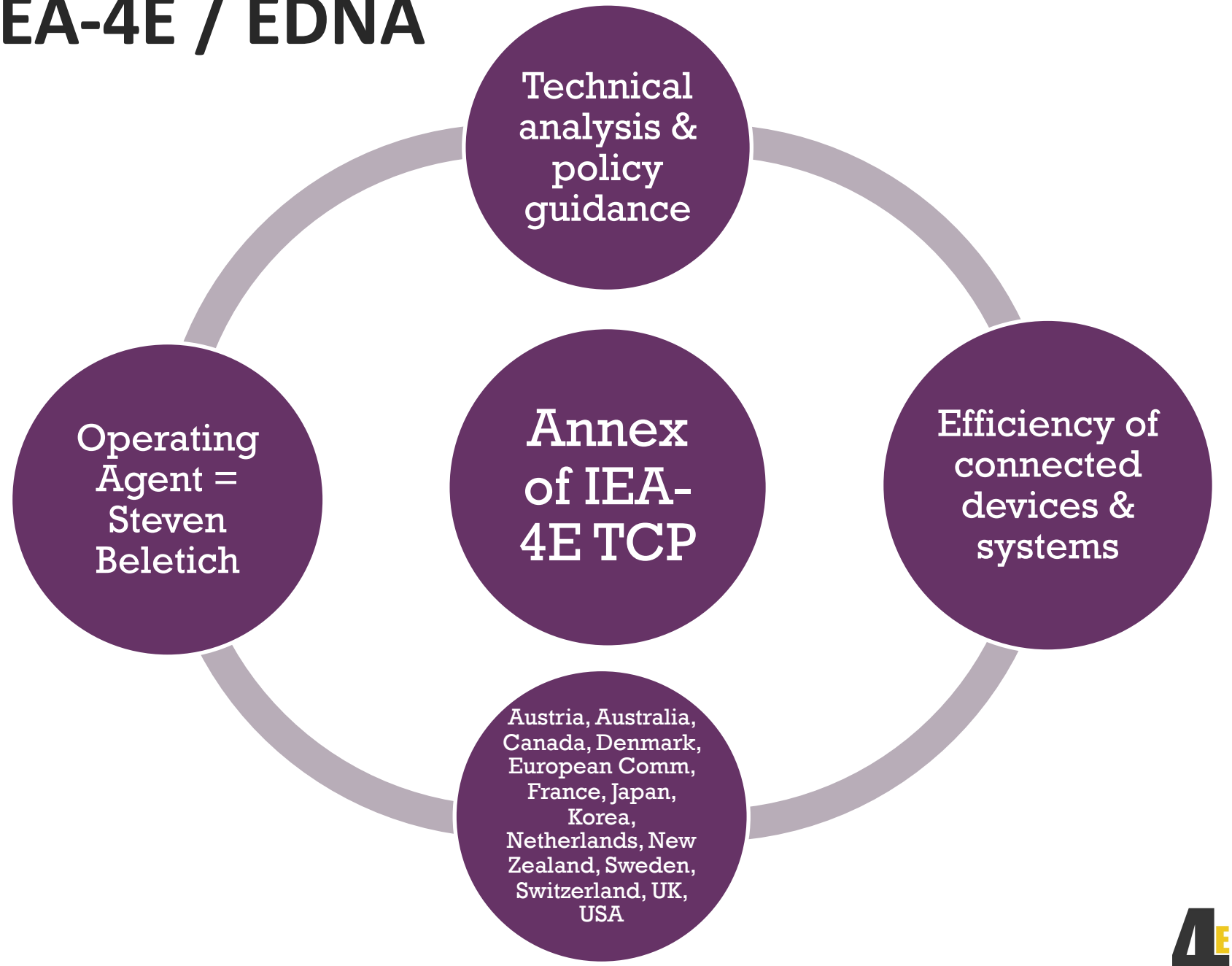
- Introduction
- Importance of devices
- Policy guidance for smart, energy-saving consumer devices

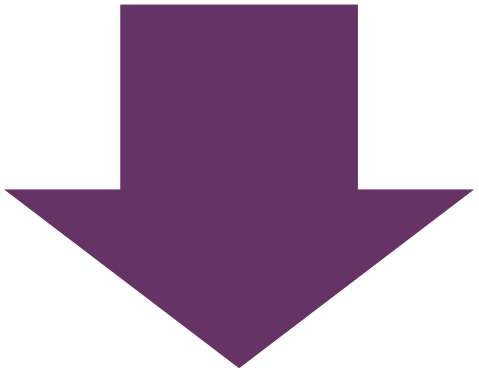
Introduction

IEA-4E / EDNA



Electronic Devices & Networks Annex
EDNA

Energy Implications of Connectivity

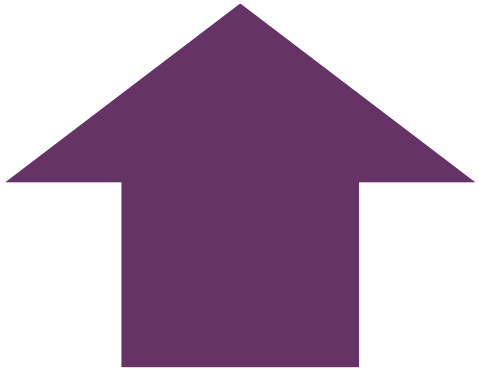


Energy Savings

- Intelligent efficiency (IE)
- Demand flexibility (DF)

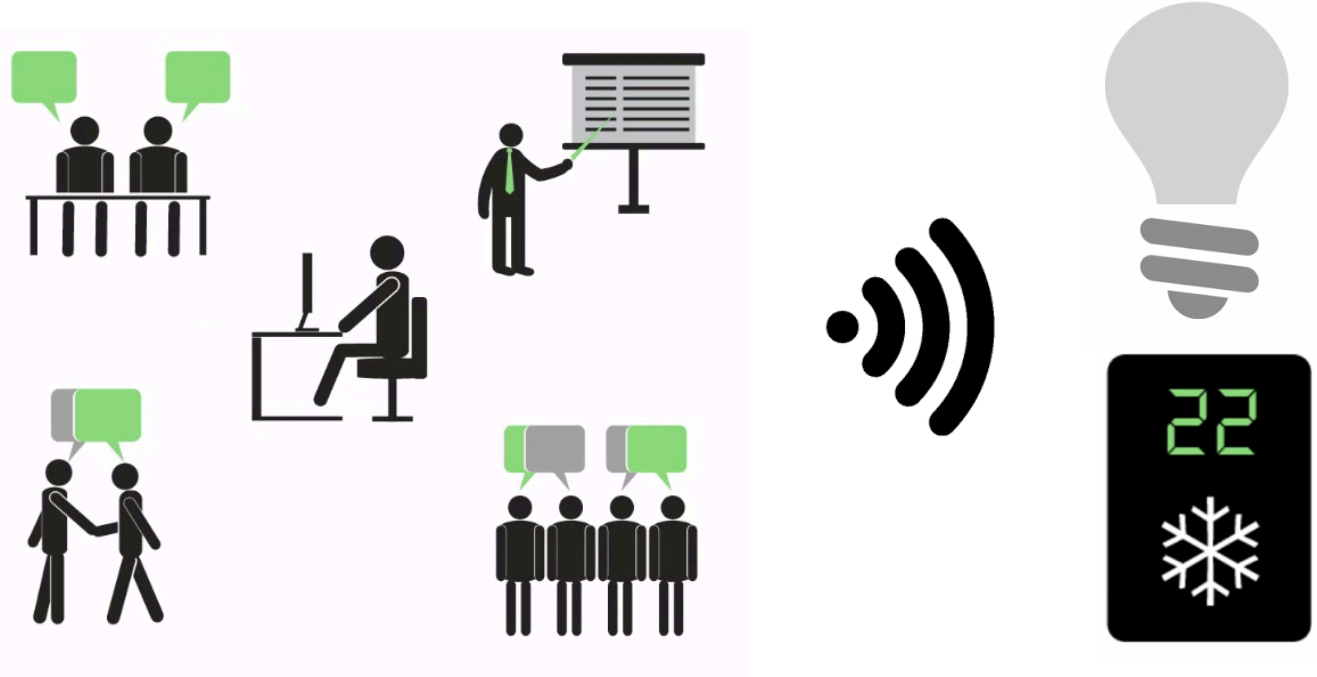
Energy Cost

- Network standby



Intelligent Efficiency (IE)

Operation of a system of connected devices so that they respond to changing conditions of the external environment, in order to maximise energy savings



IE Example


72
72
HEAT
MORNING 77°
72°F
08:38am Sat 10/31
COOLING
75
78
72°
Cooling
Heat Off Cool
Auto On
On Off

IE Potential

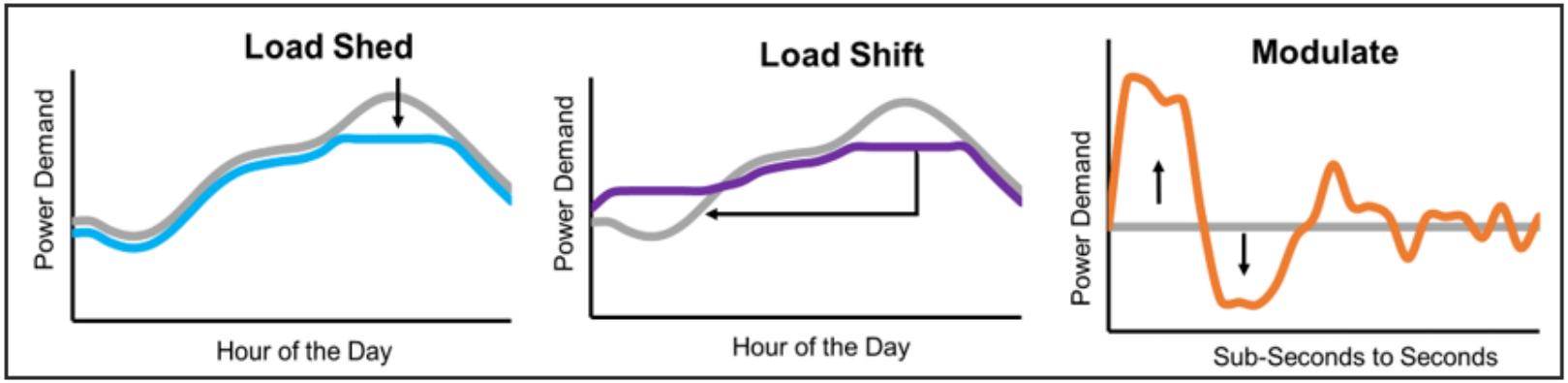
Table 4.1. Possible global benefits of digital technology

Sector	Description	Possible benefits
Buildings	Between 2017 and 2040, increased digitalisation of both commercial and residential buildings, including 1 billion connected buildings and 11 billion connected devices.	Up to 10% less energy used. Cumulative energy savings of 234 EJ.
Transport	In urban transport, between 2015 and 2050 digitally enabled innovative technologies, including teleworking, massive shared mobility and autonomous vehicles, significantly reduce passenger kilometres travelled.	More than 50% lower CO_2 emissions in 2050.
Industry	Estimated cumulative impact from combining a range of digital technologies and advanced software applications.	Up to 30% energy savings.
Flexible demand capacity	With increased policy action prioritising digital strategies and smart infrastructure, flexible demand capacity increases from 40 GW to 450 GW.	Ten times more flexible demand capacity by 2040.

Sources: IEA (2019), *Perspectives for the Clean Energy Transition: The Critical Role of Buildings*, www.iea.org/publications/reports/PerspectivesfortheCleanEnergyTransition; IEA (2018b), *World Energy Outlook 2018;* IEA (2017b), *Digitalisation and Energy*; Schneider Electric (personal communication); ITF (2019), *ITF Transport Outlook 2019*.

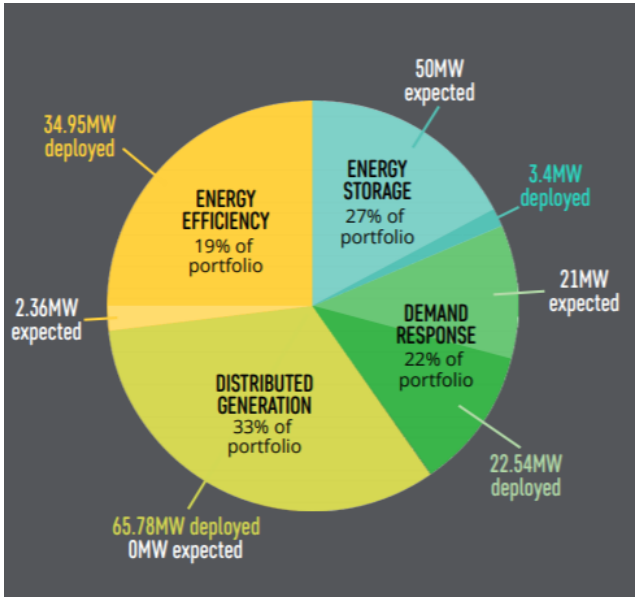
Demand Flexibility (DF)

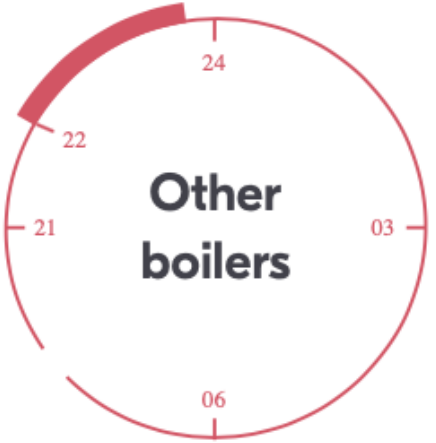
Changes in electricity usage by end-use customers from their normal consumption patterns in response to changing market conditions



DF Examples

- Finland: 1900 domestic boilers used to balance electricity supply
- Southern California Edison: 200 MW aggregated DF portfolio





https://energianseuranta.fortum.fi/report
https://www.sce.com/sites/default/files/inline-files/2019_PRP_AnnualReport.pdf

DF Potential (Residential)

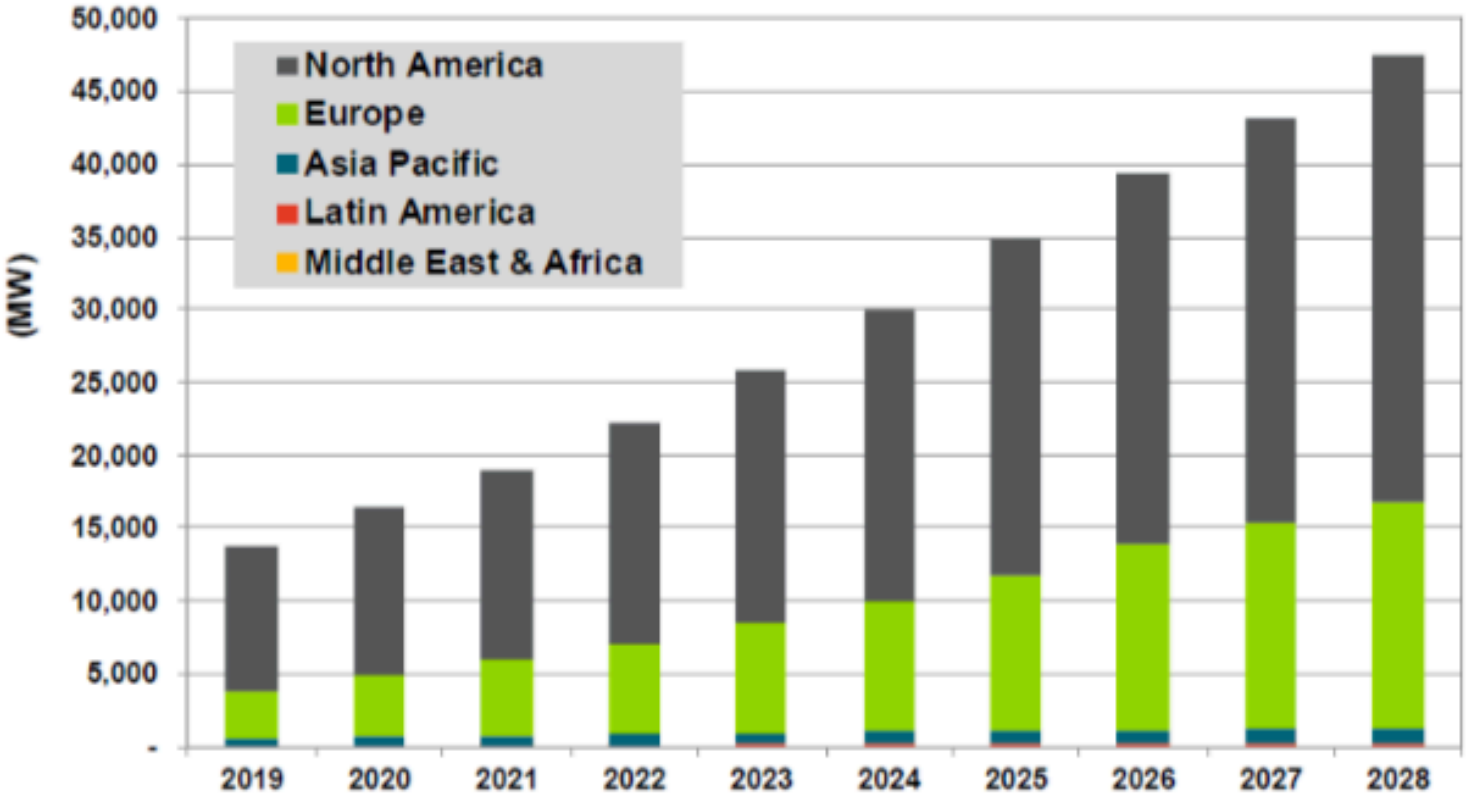


Figure 1-5. Global Residential Demand Response Capacity

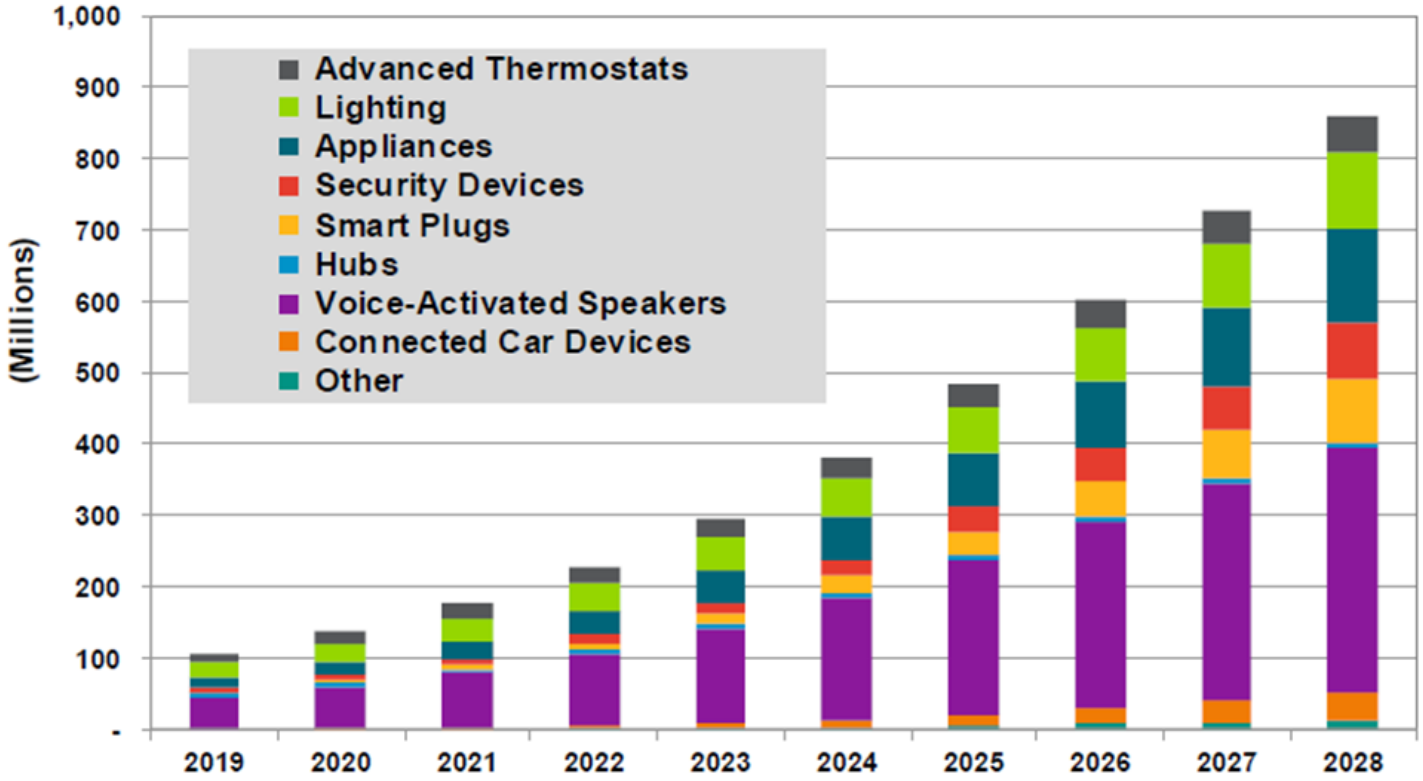
Source: Navigant Research[37]

Vision for a Digitalised Energy System

- DF: all major energy-using devices, batteries and EVs are able to perfectly match electricity demand with the supply of renewables
- IE: intelligent, adaptive systems of connected devices eliminate every last drop of energy wastage from households and businesses

Importance of Devices

Uptake of Connected Devices



Not All Devices Created Equal

- It’s one thing for a device to be connected to the internet
- Does not make it “smart”
- Does not make it ready to participate in DF and IE

We Need to Future-Proof Devices, Now

- DF and IE expected to gather momentum
- Devices can last 10, 15, 20 years
- Dumb devices can be “locked out” of a smart world

To Do This We Need Policies

- Government policy makers
- Manufacturers
- Utilities
- ICT industry
- Researchers / academia
- Industry associations
- Standards organisations

Policy Guidance for Smart, Energy-Saving Consumer Devices

1. Devise Product Scope

Table 9-1. Device potential with regard to demand flexibility

Sources: Flexibility potential adapted from US Department of Energy (2019)[84]

Product	DF Potential			Comfort Impact	Overall DF Potential
	Shed	Shift	Modulate		
Air Conditioners (ACs)	Low	High	Low	Medium-High*	**High**
Water Heaters	Low	High	Medium	Low	**High**
Thermostats	Medium	High	Low	Medium	**High**
Battery Storage (incl. vehicles)	None	High	High	None	**High**
Electric Vehicle Chargers	None	Medium	Medium	Low	**Medium**
Lighting	Medium	None	None	High	**Medium**
Refrigerators/ Freezers	None	Medium	None	Low	**Low**
Dishwashers & Clothes Washers	None	Medium	None	Low	**Low**
Clothes Dryers	Low	Medium	Medium	Medium	**Low**

* Comfort impact is dependent on the heating/cooling strategies and the available thermal storage capacity in the building envelope (walls, windows, and roof)

Table 2-1. Summary of ENERGY STAR Devices with Optional Connected Functionality Requirements

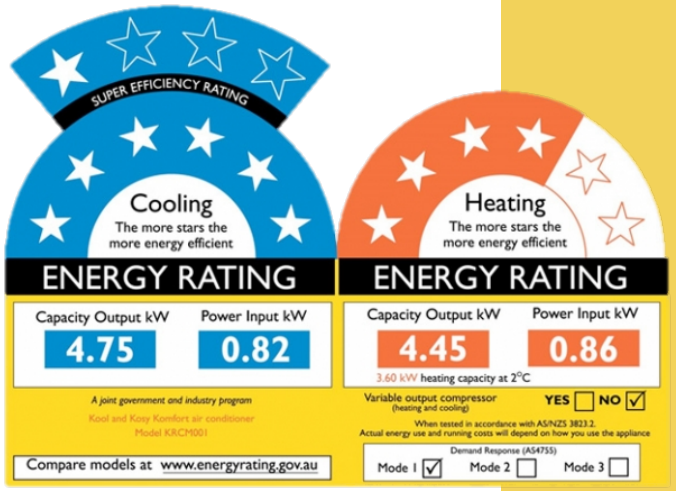
	Comm. Hardware/ Software	Energy Consumption Reporting	Operational Status Reporting	DR	DR Override by Consumer	Remote Management	Open Access	Open Comm. Protocol
Smart Thermostats	✓	✓	✓	✓	✓		✓	✓
Dishwashers	✓	✓	✓	✓	✓	✓	✓	✓
Room ACs	✓	✓	✓	✓	✓	✓	✓	✓
Refrigerators / Freezers	✓	✓	✓	✓	✓	✓	✓	✓
Clothes Washers	✓	✓	✓	✓	✓	✓	✓	✓
Clothes Dryers	✓	✓	✓	✓	✓	✓	✓	✓
Lighting	✓	✓	✓			✓	✓	✓
Pool Pumps	✓	✓	✓	✓	✓	✓	✓	✓
Electric Vehicle Supply Equipment	✓			✓	✓		✓	✓
Ceiling Fans	✓	✓	✓			✓	✓	✓

2. Define Functionality (Macro)

- A smart, energy-saving device is a product that has the capability to receive inputs, process these inputs and independently take action, for the purpose of one or more of:
  - Demand flexibility (DF)
  - Intelligent efficiency (IE)
  - Status reporting
- [paraphrased version – refer report for full]

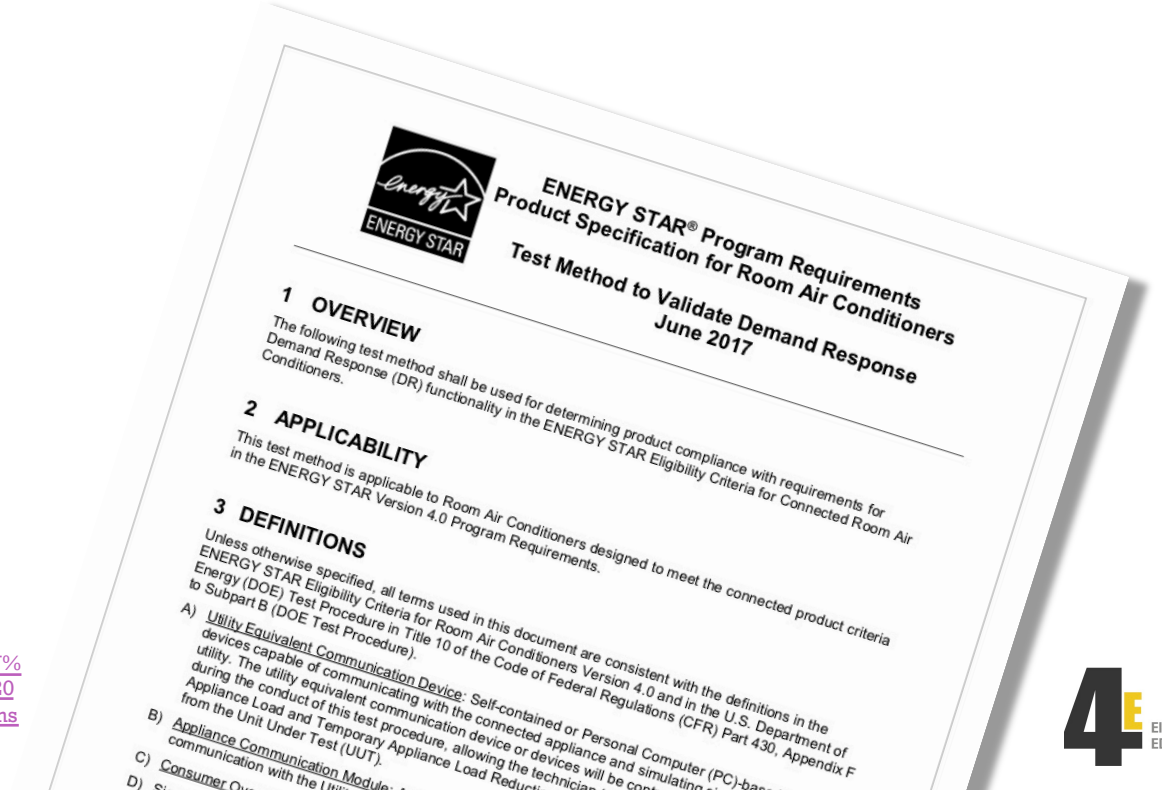
3. Define Functionality (Micro)

- Specific to device type
- E.g. Australia for ACs:
  - Mode 1 = capable of off / on
  - Mode 2 = capable of turning down by 50%
  - Mode 3 = capable of turning down by 25%
- Important not to lose comfort



4. Specify Test Methods

- To prove functionality
- e.g. Energy Star Specification for Room ACs
  - Test Method to Validate Demand Response Capability



ENERGY STAR® Program Requirements
Product Specification for Room Air Conditioners
Test Method to Validate Demand Response
June 2017

1 OVERVIEW

The following test method shall be used for determining product compliance with requirements for Demand Response (DR) functionality in the ENERGY STAR Eligibility Criteria for Connected Room Air Conditioners.

2 APPLICABILITY

This test method is applicable to Room Air Conditioners designed to meet the connected product criteria in the ENERGY STAR Version 4.0 Program Requirements.

3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in the ENERGY STAR Eligibility Criteria for Room Air Conditioners Version 4.0 and in the U.S. Department of Energy (DOE) Test Procedure in Title 10 of the Code of Federal Regulations (CFR) Part 430, Appendix F to Subpart B (DOE Test Procedure).

A) Utility Equivalent Communication Device: Self-contained or Personal Computer (PC)-ba
devices capable of communicating with the connected appliance and simulating
utility. The utility equivalent communication device or devices will be
during the conduct of this test procedure, allowing the technici
Appliance Load and Temporary Appliance Load Reduct
from the Unit Under Test (UUT).

B) Appliance Communication Module
communication with the

C) Consumer Ov

D) Si

https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Test%20Method%20for%20Room%20Air%20Conditioners%20to%20Validate%20Demand%20Response.pdf

5. Communications Protocols

- Consider requiring “open” communications protocols
- Network layer
  - The means of communication (analogy: telephone network)
  - Transmit and receive data
  - e.g. Wi-Fi, Zigbee, Bluetooth, Ethernet, etc.
- Application layer
  - Analogy: the “language” spoken
  - Determines which products/platforms the device can communicate with
  - Interoperability: give careful consideration to “vendor lock-in”
    - e.g. brand X and brand Y appliances controlled by one single interface
  - Standards aimed at facilitating openness
    - e.g. ISO/IEC 21823 - Interoperability for IoT Systems (framework)
    - e.g. Smart Electric Power Alliance Catalog of Standards
    - e.g. NIST Smart Grid Framework Tables 4.1 & 4.2
    - e.g. from NIST, IEC, ISO, IEEE, ITU, IETF, OpenADR

6. Consider Data Privacy and Security

- Address how private data is stored, accessed and used
  - e.g. data misuse - fridge data to health insurance provider
  - Regulations, e.g. European Telecommunication Standards Institute Cybersecurity Standard for Consumer IoT Devices
  - Regular, frequent revision
  - Communicate clearly to consumers*
- Require cybersecurity protocols
  - Prevent hacking of devices
  - e.g. NIST reliability and cybersecurity protocols
  - e.g. North American Electric Reliability Corporation's Critical Infrastructure Protection standards

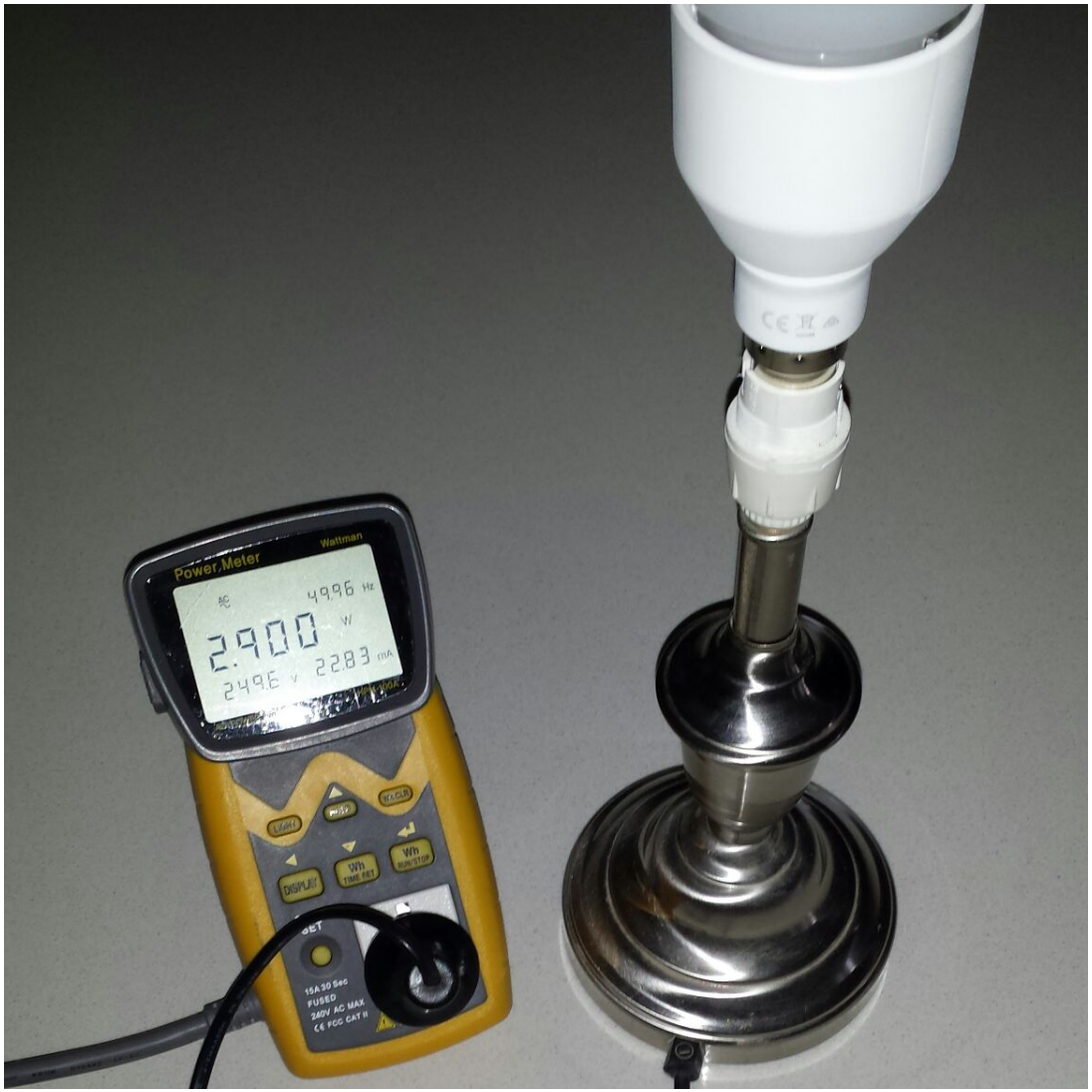
7. Consider Usability

- Requirements (or suggestions) for
  - Plug-and-play
    - Incl wireless setup
  - Straightforward to operate
  - User over-ride
    - e.g. Energy Star - consumers shall be able to override their smart thermostat's response to any grid request (max 72 hours)

8. Choose Your Policy Vehicle

- Mandatory – all devices?
- Mandatory – only connected (IoT) devices?
- Bolt on to device efficiency requirements?
- Consumer labelling
  - Include in existing mandatory energy label
  - Voluntary label
    - E.g. Energy Star connected criteria (optional)
- Financial incentives
- Industry self-regulation

9. Don’t Forget Network Standby



Summing Up ….

Summing Up ….

- DF & IE initiatives will gather momentum
- Need to ensure devices not locked out of this
- Policies required to encourage this
  - Multiple stakeholders
- There are many issues to consider!

Thank You

- Contact steve@beletich.com.au
- Report: Policy guidance for Smart, Energy-Saving Consumer Devices
  - https://www.iea-4e.org/document/448/policy-guidance-for-smart-energy-saving-consumer-devices
- EDNA publications edna.iea-4e.org/library