4E

Energy Efficient End-use Equipment
International Energy Agency

ENERGY EFFICIENCY POLICY BRIEF

Energy Management Protocols

EDNA16

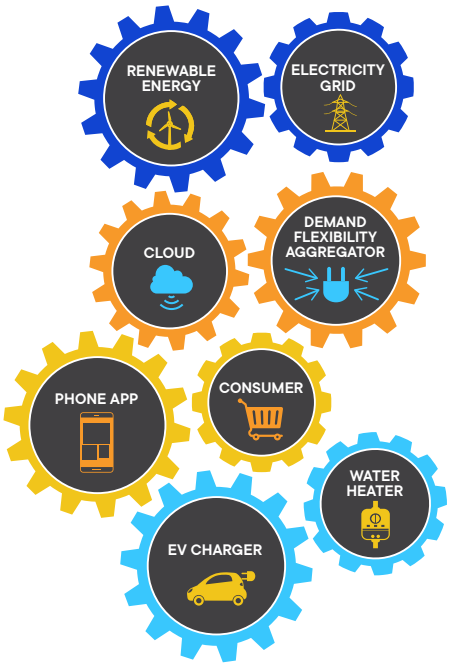
The Efficient, Demand Flexible Networked Appliances (EDNA) platform of 4E provides analysis and policy guidance to members and other governments aimed at improving the energy efficiency and demand flexibility of connected devices and networks.

This briefing summarises the EDNA ***Guide to Energy Management Protocols*** which is a resource for policy makers. Energy management protocols provide the signals to end-use devices and appliances for optimising energy consumption and providing demand flexibility to the electricity grid. The guide gives an overview, description and categorisation of protocols, their relevance to energy management, and details of market uptake.

Observations for Policy Makers

- The efficiency of the electricity system can be greatly improved by smart and 'demand flexible' appliances. For example, the energy consumption of a building can be reduced if the equipment is controlled by sensors and smart algorithms. Demand flexible appliances can respond to variations in the supply of electricity from renewable energy sources or the electricity grid.
- To realise the benefits of smart devices, they need to be able to communicate using energy management protocols. Residing in the 'application layer' of the protocol stack, these protocols provide a common language between devices. They are not to be confused with protocols that reside in the lower layers such as WiFi, Bluetooth and Zigbee.

PROTOCOL STACK	
Application Layer	← energy management protocols
Presentation layer	
Session layer	
Transport layer	
Network layer	← WiFi, Bluetooth, Zigbee, etc.
Data Link layer	
Physical layer	



- Energy management protocols carry information (in both directions) to command and control: e.g. increasing or decreasing device energy consumption, scheduling device operations, providing electricity price information, reporting operating states, etc.
- Protocols currently exist that directly support demand flexibility, such as OpenADR, IEEE 2030.5, EEBUS and ANSI/CTA-2045. The landscape is however evolving rapidly, including for protocols that address a range of specific sectors.
- Energy management protocols should be 'open' in order that devices are 'interoperable' - able to communicate with third party applications and other equipment.
- It is important that energy management protocols include robust cybersecurity, so that devices cannot be accessed for malicious purposes.

MORE INFORMATION

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The EDNA **guide** and **further information** is available from the EDNA website and by contacting the EDNA operating agent at **steve@beletich.com.au**

Key Findings

Categorisation of energy management protocols

The key energy management protocols for demand flexible appliances are listed and categorised in the table below. Note however that standards are not included here, and that the landscape is continuously evolving.

Protocol	Author	Purpose	Open	License required	Market presence	Cybersecurity
DEVICE ENERGY MANAGEMENT PROTOCOLS						
OpenADR	OpenADR Alliance	Load control	Yes	No	Established	Yes
IEEE 2030.5	IEEE	Load control	Yes	No	Growing	Yes
EEBUS	EEBUS Initiative	Smart grid	No	No	Implemented by range of manufacturers	Yes
ANSI/CTA-2045	CTA	Load control / hardware interface	Yes	No	Implemented by range of manufacturers	N/A
ELECTRIC VEHICLE CHARGING PROTOCOLS						
OCPP	Open Charge Alliance	Aggregated control of EV chargers	Yes	No	De-facto open standard	Yes
OSCP	Open Charge Alliance	EV charger details for OCPP	Yes	No	Association with OCPP may help uptake	Yes
BUILDING, INDUSTRIAL AND HOME AUTOMATION PROTOCOLS						
BACnet	ASHRAE	Building automation	Yes	No	Substantial	Yes
Modbus	Modbus Organisation	Device monitoring and control	Yes	No	Substantial	Yes
Matter	Connectivity Standards Alliance (CSA)	Home automation	Yes	Yes	Developing	Yes
KNX	KNX Association	Home automation	Yes	Yes	Substantial	Yes
INTERNET OF THINGS (IoT) PROTOCOLS						
CoAP	IETF	Low-power machine -2-machine IoT	Yes	No	Established	Yes
MQTT	OASIS	Small microcontroller IoT	Yes	No	Established	Yes

Cybersecurity

Cybersecurity for smart and demand flexible appliances is currently the subject of considerable attention by governments, standards bodies and industry associations. Devices that don't implement data encryption, access control and other cybersecurity requirements risk allowing access by malicious parties. In the United States, the National Renewable Energy Laboratory have developed the Distributed Energy Resource Cybersecurity Framework. The United States National Institute of Standards and Technology cybersecurity framework also helps organisations better understand and improve their management of cybersecurity risks. Singapore has introduced the Cybersecurity Labelling Scheme for IoT devices and the United States has announced a similar intention.

Interoperability

Using open protocols for interoperability of devices is key to the success of demand flexibility. This is the subject of a **separate EDNA report and policy brief**.