International Energy Agency

Digitalisation opportunities for energy efficiency

Session 8

Kevin Lane, IEA; Peter Bennich, SEA – Pretoria, 15 October 2019

IEA #energyefficientworld

Overview of the appliance and equipment training sessions

Monday 14 October 2019		
0	Introduction and roundtable	☑
1	Planning energy efficiency programmes	☑
2	Selecting products for MEPS and Labelling programmes	☑
Tuesday 15 October 2019		
3	Assessing efficiency performance and setting MEPS	☑
	Special - Regional harmonisation	☑
4	Industry transformation	☑
5	Stakeholder involvement and communication	☑
6	The relationship between product efficiency and price	☑
7	**Modernising energy efficiency through digitalisation**	☐
Wednesday 16 October 2019		
8	Insights into energy labels	☐
9	Monitoring, verification and enforcement	☐
10	Evaluating policies and programmes	☐
	Special - Available resources U4E	☐
11	Roundtable discussion, review and report back	☐

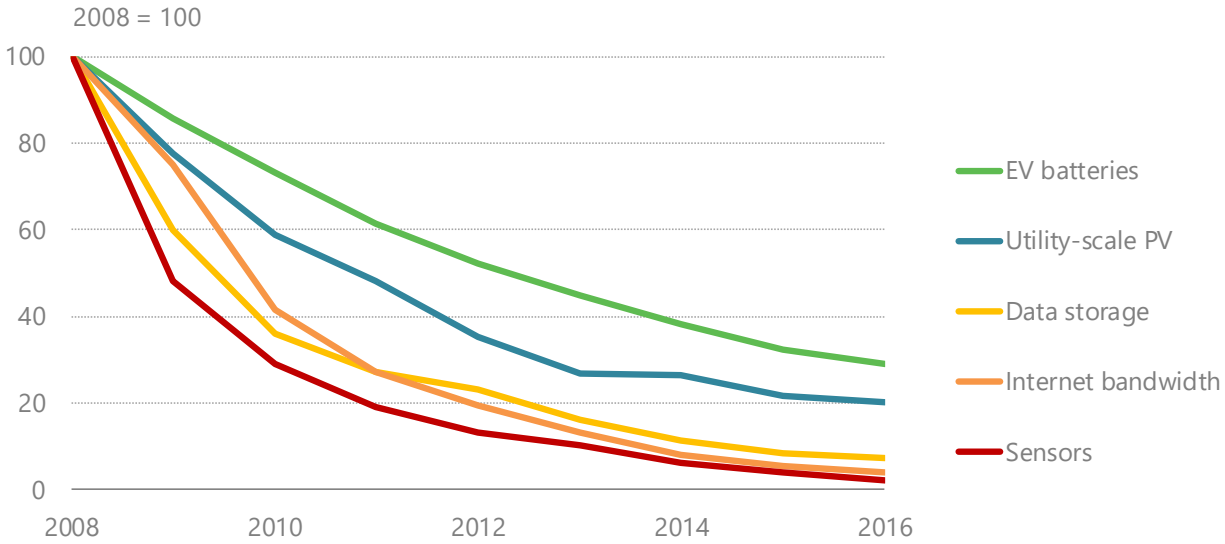
Scenario

There are special grants available to government departments for ‘smart’ initiatives that lead to reduced costs for business.

Which projects would you put forward?

Digital technologies are everywhere….

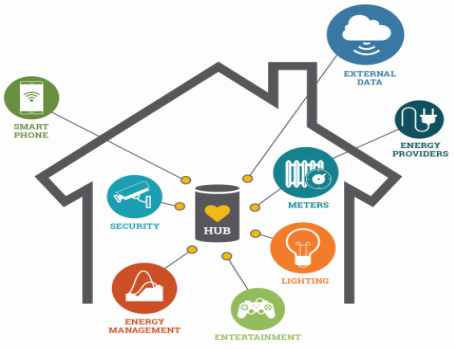
Drivers of digitalisation: data, analytics, and connectivity



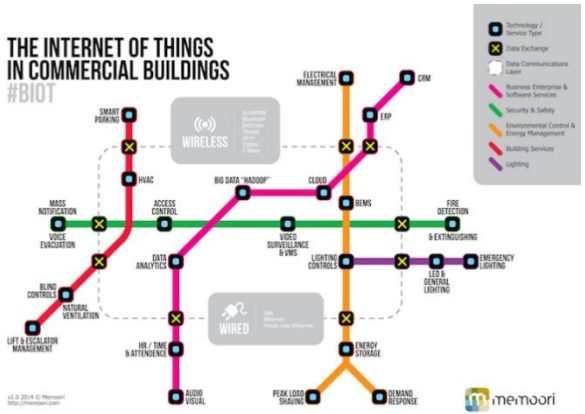
Sources: *Based on BNEF (2017), Utilities, Smart Thermostats and the Connected Home Opportunity; Holdowsky et al. (2015), Inside the Internet of Things; IEA (2017), Renewables; Tracking Clean Energy Progress; World Energy Investment; Navigant Research (2017), Market data: Demand Response. Global Capacity, Sites, Spending and Revenue Forecasts.*

Data collection, storage, and transmission costs have declined by over 90% since 2008

Smart homes, smart buildings, smart factories…



Source: IEA TCP 4E

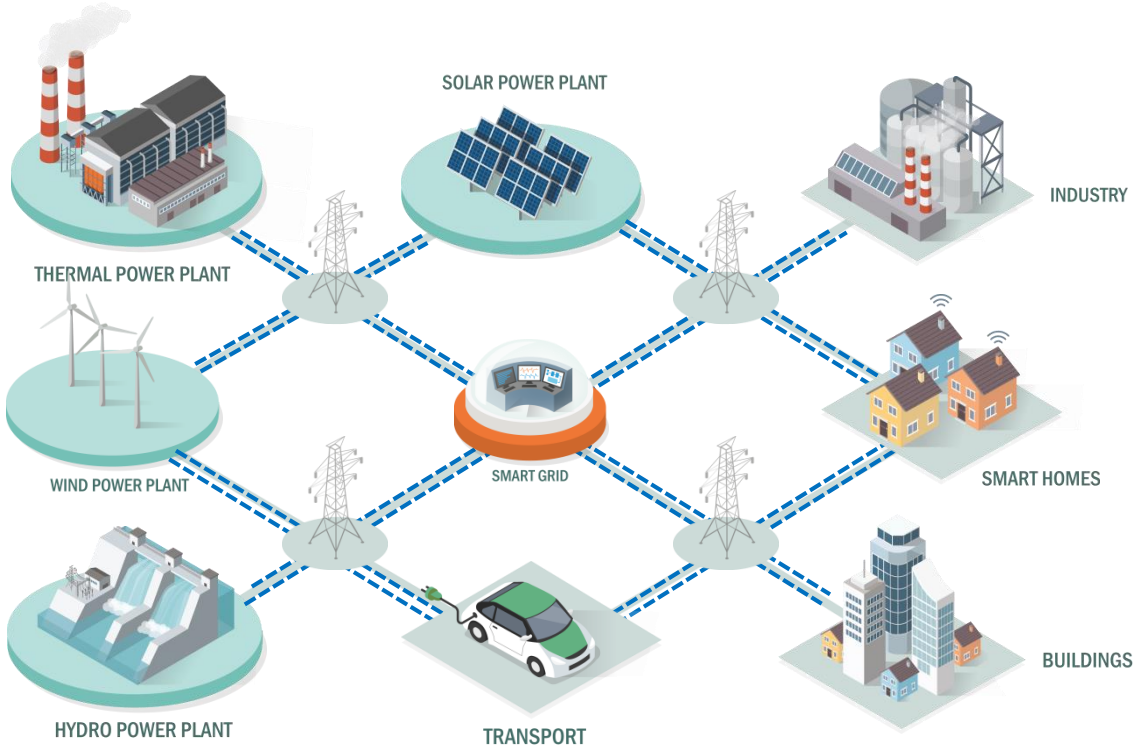


Source: Memori

Source: HAND

Irrespective of end-use, smart solutions are powered by data, analytics, control and automation

Smart energy systems

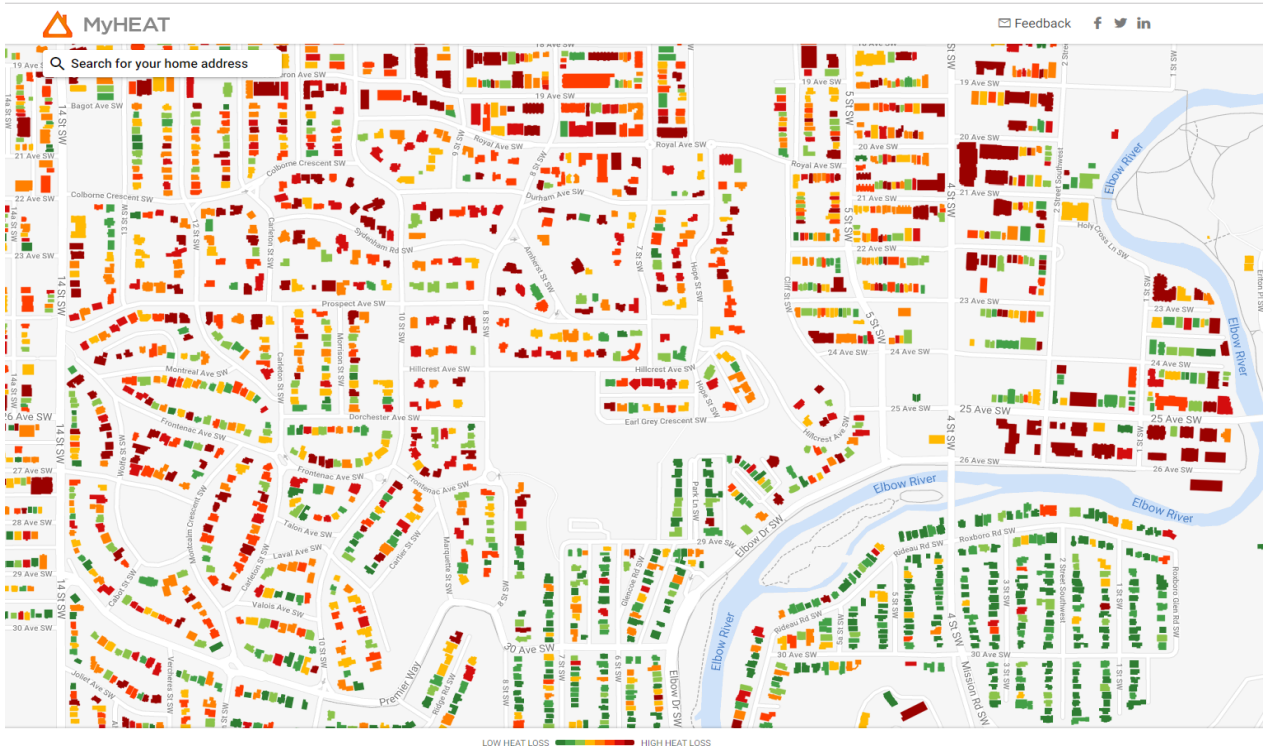


Digitalisation is enabling progress towards energy systems that are bidirectional, responsive and efficient

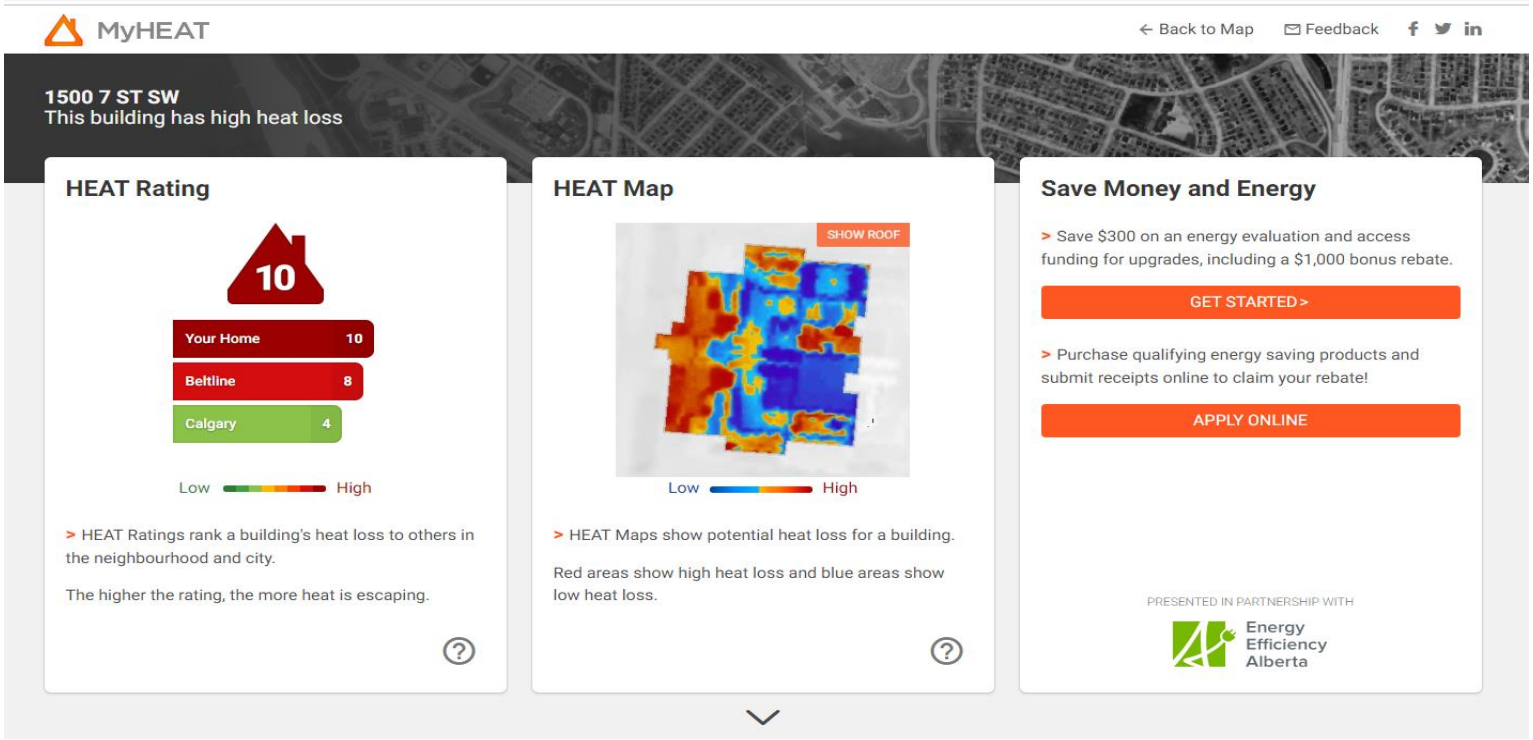
What are the energy efficiency opportunities of digitalisation?

- Smart homes and buildings could reduce global buildings sector demand by 10% (home level reductions up to 30%, building reductions over 30%)
- Smart factories could reduce onsite energy demand by 20 – 30%
- Demand response programmes – in buildings, industry and transport - could provide 185 GW of flexibility, and avoid USD 270 billion of investment in new electricity infrastructure
- Smart grids and smart cities can completely transform how energy is generated and how it is used

Heat mapping to identify energy efficiency opportunities



From heat mapping to action



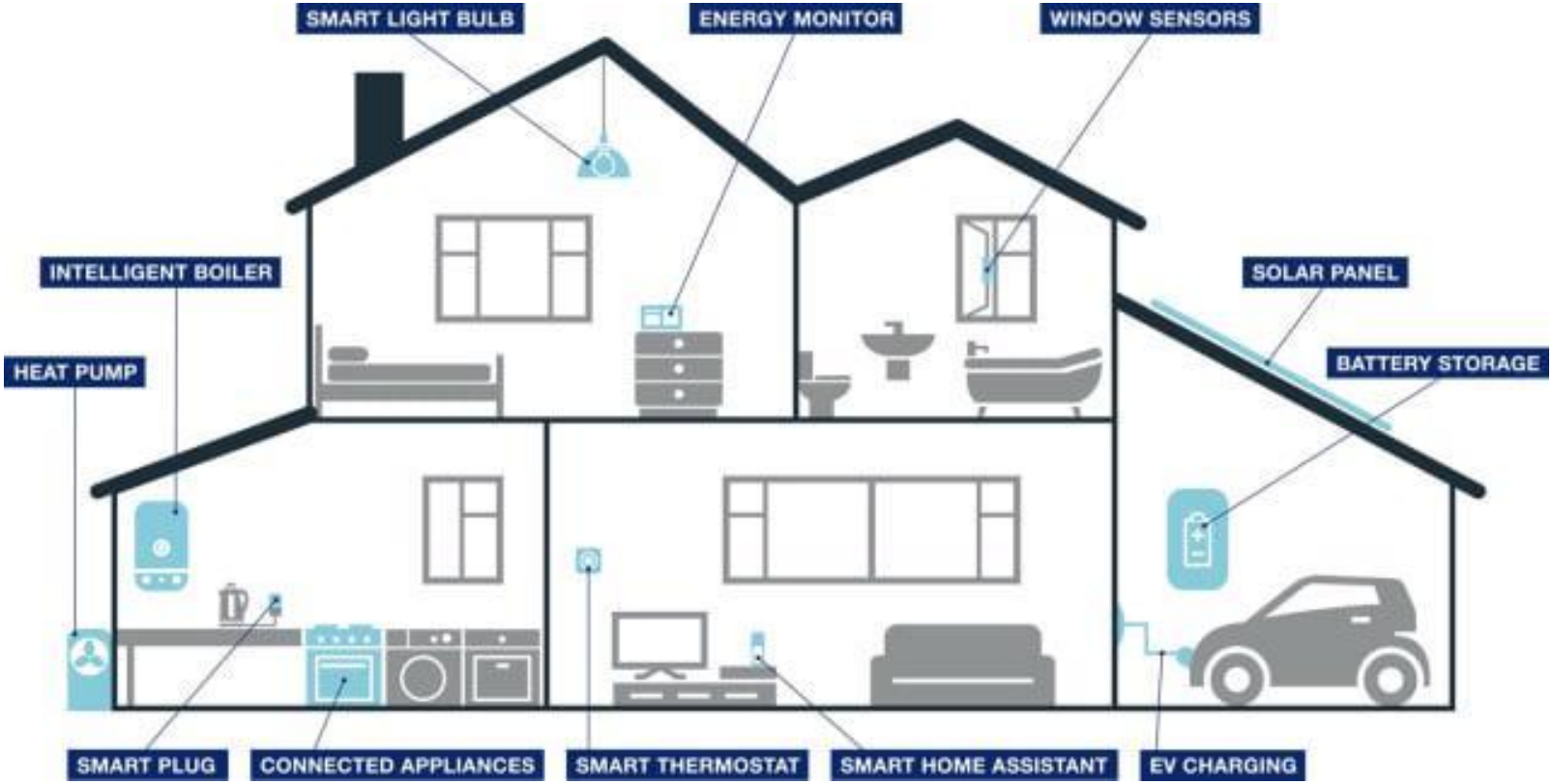
Why is this relevant for appliance and equipment policy makers?

- Standards and labels will improve the efficiency of appliances and equipment but will not make sure they are used efficiently
- Digital solutions can help end users optimise their energy use and cut energy waste
- Smart homes, smart buildings, smart factories, smart energy systems, smart cities are enabled by smart appliances and equipment
- Energy efficiency policy makers can take a proactive role in stimulating the development of and the market for smart efficient products
- Energy efficiency policy makers can enable demand response by requirements for appliances and equipment

Accelerating smart energy efficiency

Policies are needed to accelerate uptake of smart solutions for energy efficiency

Smart homes



Source: Centrica

Opportunities in residential buildings

Technologies	Benefit	Savings range
Smart thermostats	Heating and cooling can be controlled remotely	5-20% of heating/cooling energy use
Smart zoning	Allows individual rooms or zones to be heated/cooled to specific temperatures at specific times	10% of heating/cooling energy use
Smart lighting	Adjusts in accordance to occupancy and/or light levels	1-10% of whole home energy use
Smart window control	Controls the amount of light and can block heat or cold	10-20% heating/cooling energy use + lighting energy use savings
Home energy monitoring system	Provides users with information about how energy is used and provides recommendations or prompts	4-7 of whole home energy use
Smart HEMS (Home energy management system)	Provides ability to control energy use (incl. remotely) and can optimise energy use on basis of behaviour	8-20% of whole home energy use
Smart home	Combination of smart home technologies that provide measurement, monitoring, displays, management, control automation, zoning etc.	Up to 30% of whole home energy use

Opportunities in commercial and public buildings

Technologies	Benefit	Savings range
Smart plugs	Reduces power to appliances when not required for use	25- 60% of plug load use
Smart lighting	Adjusts in accordance to occupancy and/or light levels	Up to 45% of lighting energy use
Occupancy based wireless thermostats	Adjusts heating or cooling in accordance to occupancy	5-10%
Smart shading or smart windows	Reduces heat, glare, enables more optimal use of lighting	19-26% on cooling 48-67% on lighting
HVAC control	Adjusts in accordance to temperature (and occupancy)	24-32% of HVAC
Smart BEMS (Building energy management system)	Collects data on end-uses, provides information for building manager and enables automation	13-66% (whole building) average 23%

Opportunities in industry

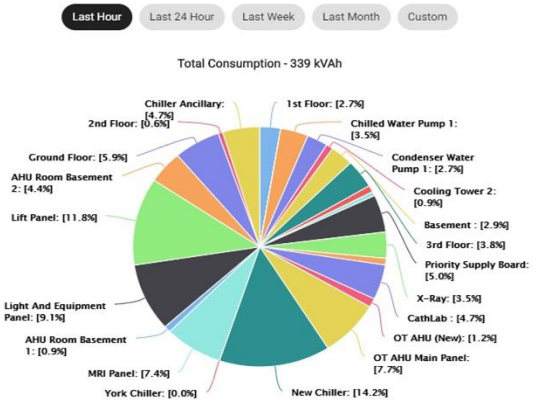
Technologies	Benefit	Savings range
Smart auxiliary processes (lighting, heating, cooling, ventilation)	Control in accordance to needs, occupancy, other relevant parameters	Up to 10% of total energy use
Smart motors	Data-driven control, load sensing, application optimisation	Up to 50% of motor system energy use
Smart process control	Data, control, optimisation, automation	Around 20% energy demand of process
Smart Energy Management System	Collects data on end-uses, provides information for manager and enables optimisation and automation	Up to 30% of total energy use

Note: significant variations in achievable savings depending on size and sector

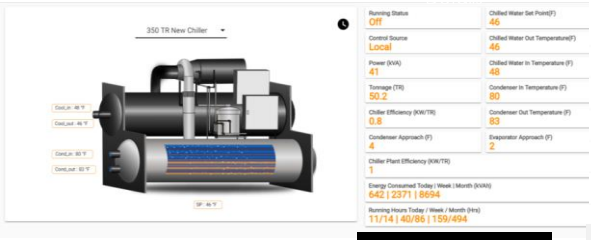
How does smart energy management work?

Example: Indian company Smart Joules

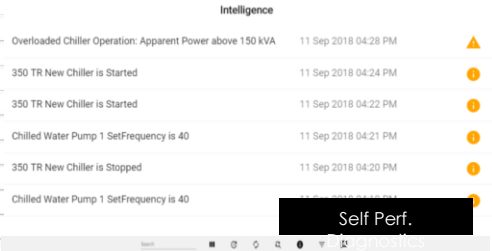
Saving Outcomes



Equipment



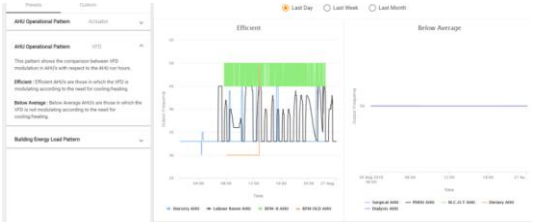
Operational



Self Perf.

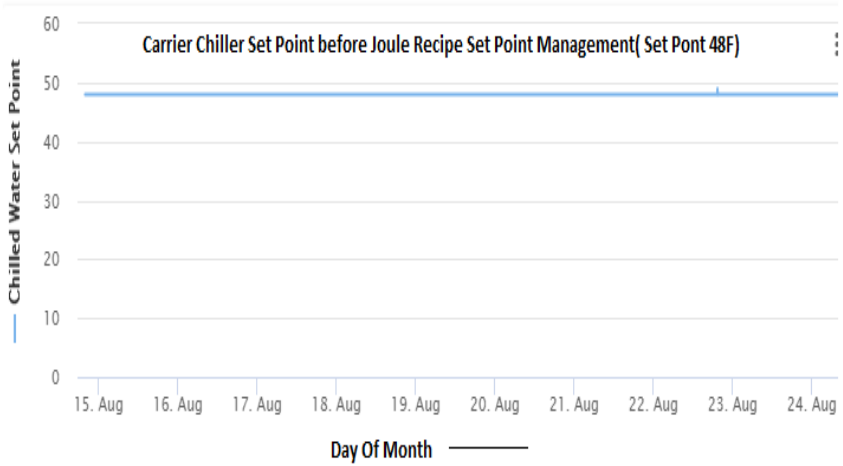
Energy Analytics

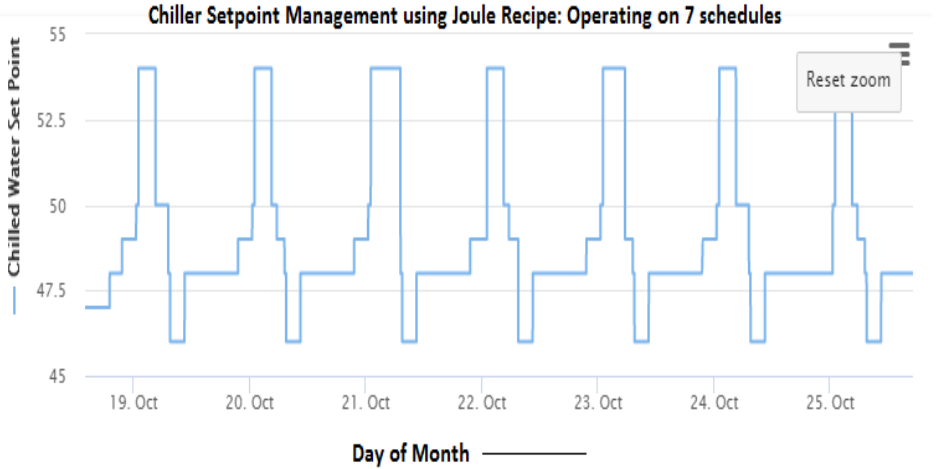
Asset



Aligning energy use to actual needs

Example: Indian company Smart Joules





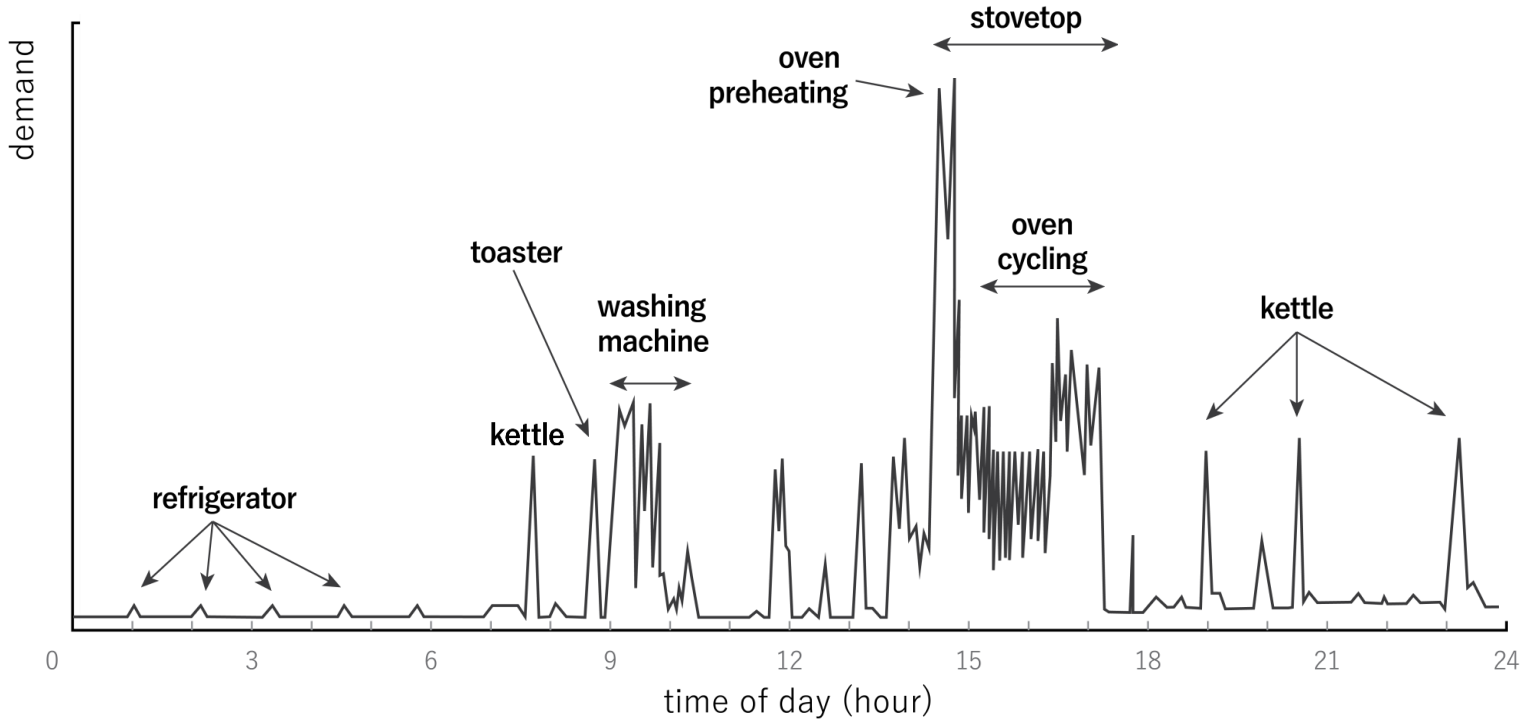
What are some of the policy options?

- Raise awareness
- Capacity building (retailers, technicians, installers, energy service companies)
- Promote international standardisation and interoperability
- Lead by example (e.g. smart & energy efficient public buildings)
- Make sure that energy efficiency is a priority in “smart projects” e.g. smart cities
- Provide incentives for energy management
- Require energy management (via e.g. building codes)

Enabling demand response and smart energy systems

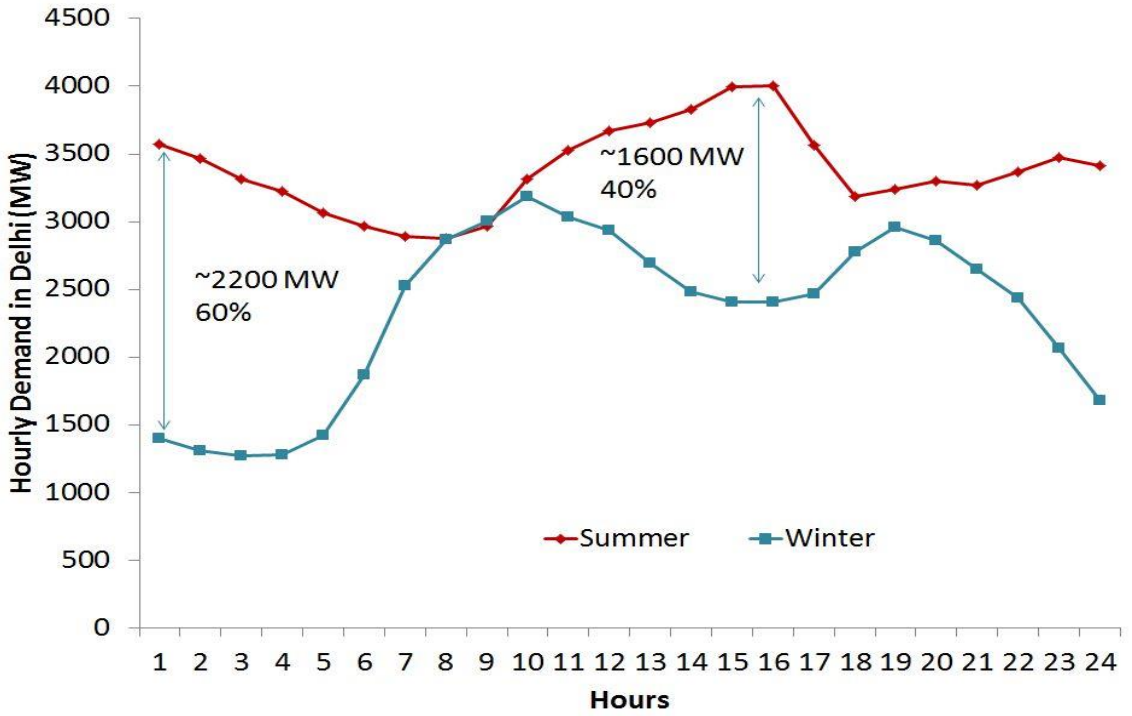
Policies are needed to make sure that consumers, appliances and equipment can participate in demand response and smart energy systems

Digital solutions enable us to understand demand



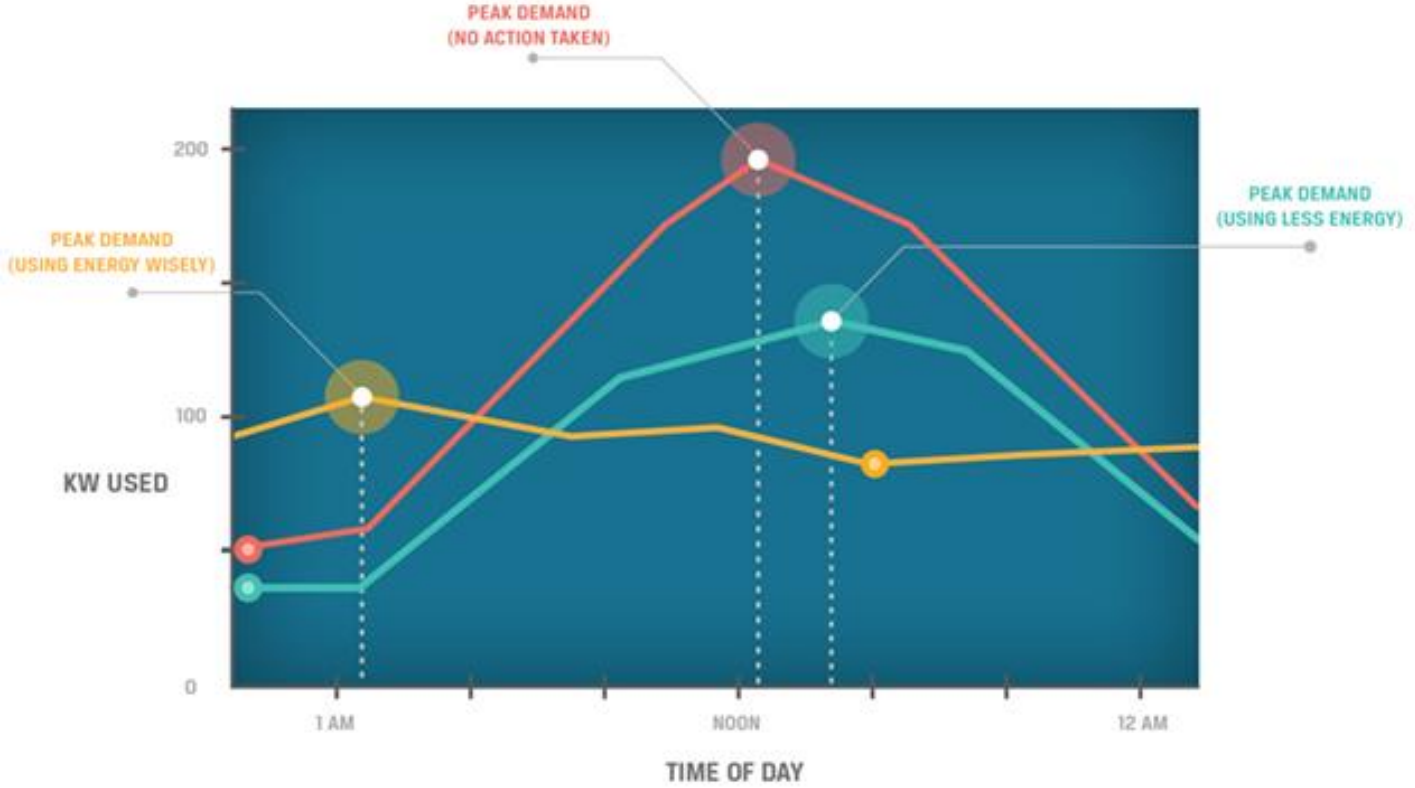
Source: *Newborough and Augood (1999), "Demand-side management opportunities for the UK domestic sector" (reproduced courtesy of the Institution of Engineering and Technology).*

Aggregating data into demand curves



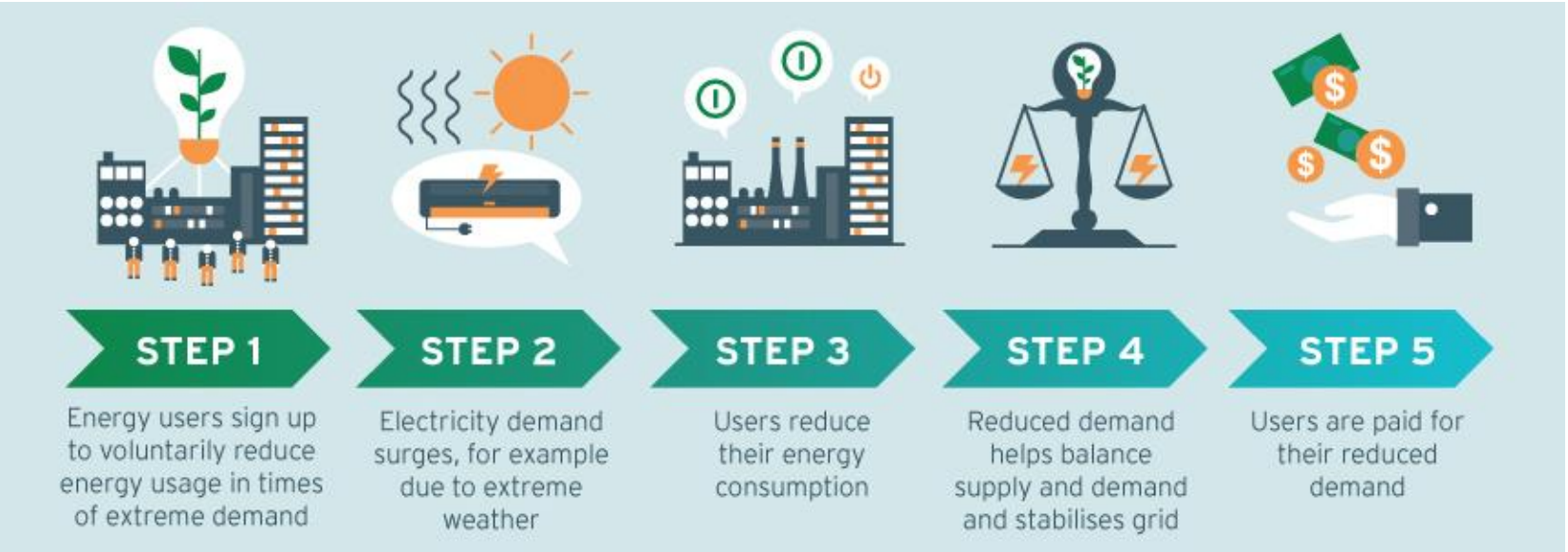
Source: DSLDC

Tackling peak demand

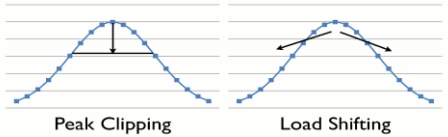


Source: PSE&G

What is demand response?



Source: ARENA



Source: Stanford University

Example: PeakSmart

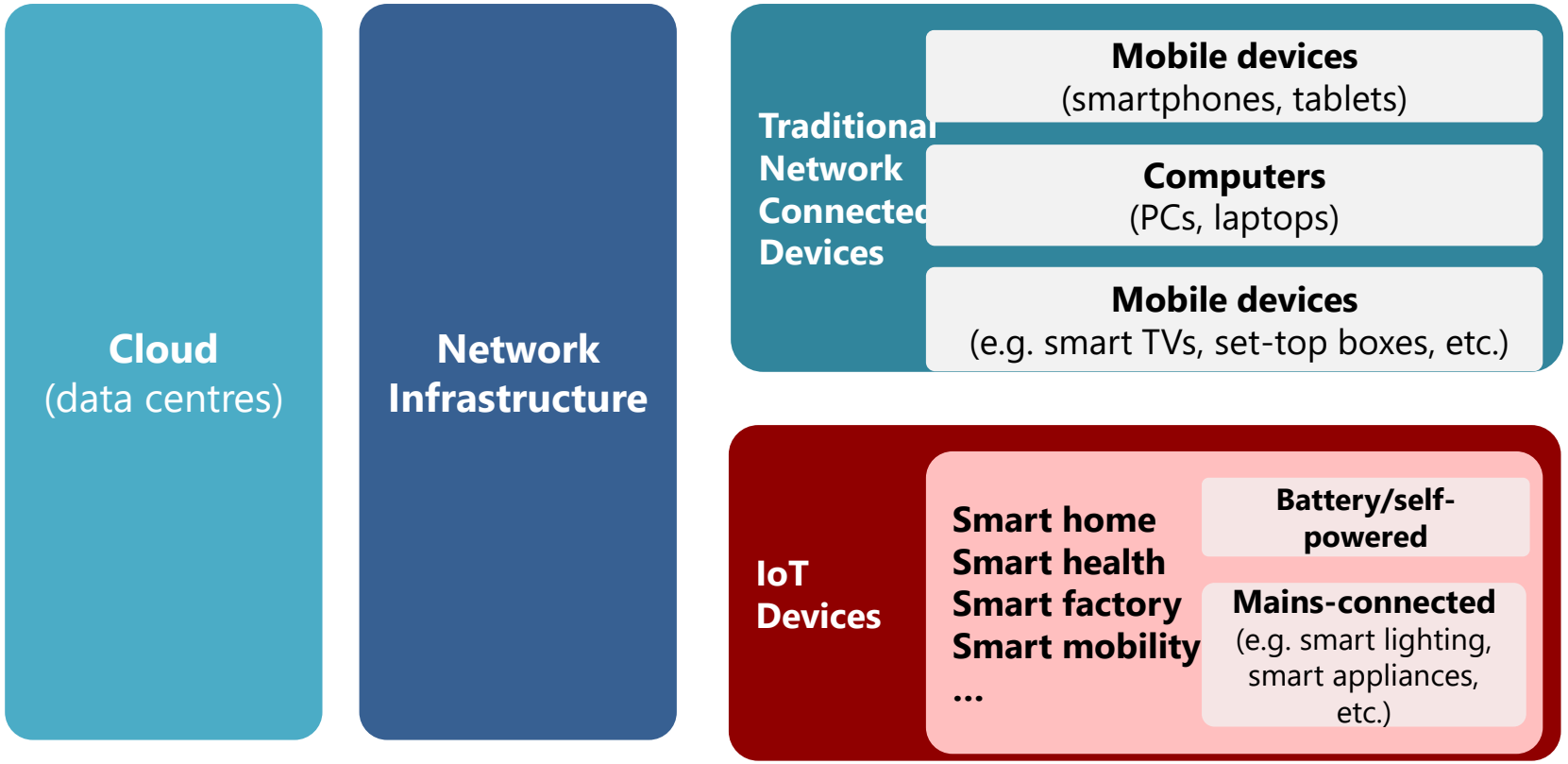
What are the policy options?

- Connect energy efficiency with demand response
- Awareness raising
- Promote standardisation and interoperability
- Promote capability and use labels
- Include smart capabilities and controllability in specifications or requirements,
- Offer subsidies, rebates or other incentives
- Incentives and technical assistance for consumers investing in energy management controls that also enable demand response

Digital solutions also use energy

Policies are needed to ensure that they are as efficient as possible

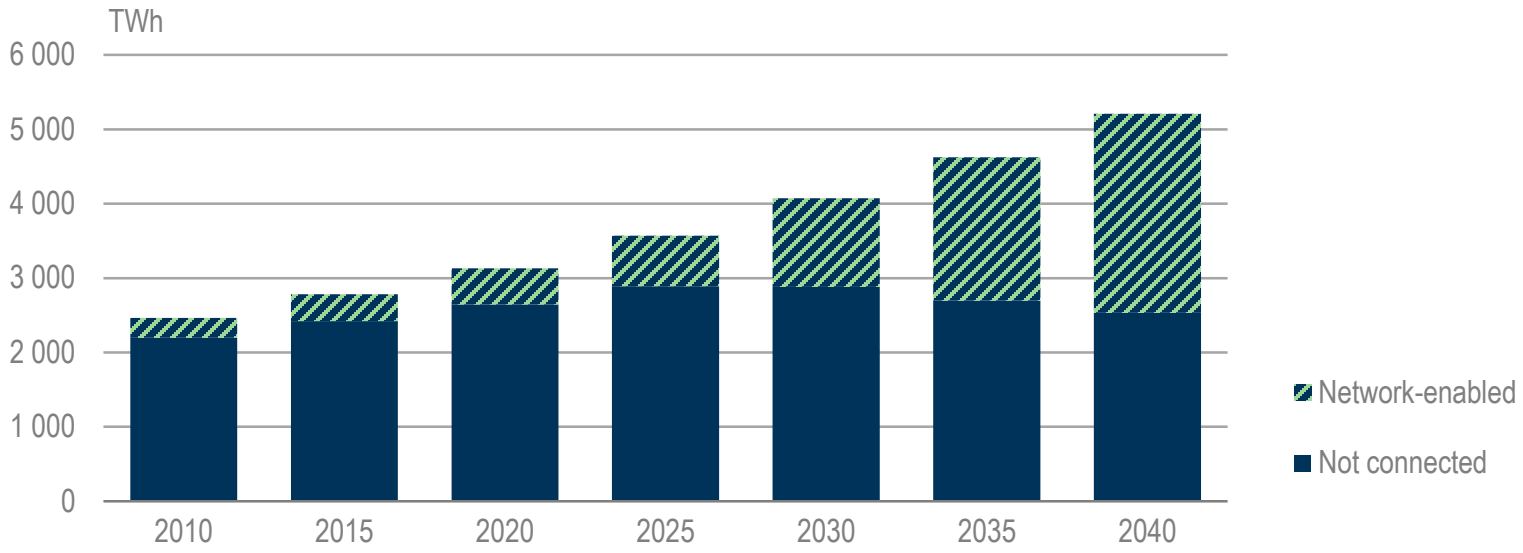
Energy use by digital technologies - overview



Source: 4E TCP (2016) Energy Efficiency of the Internet of Things

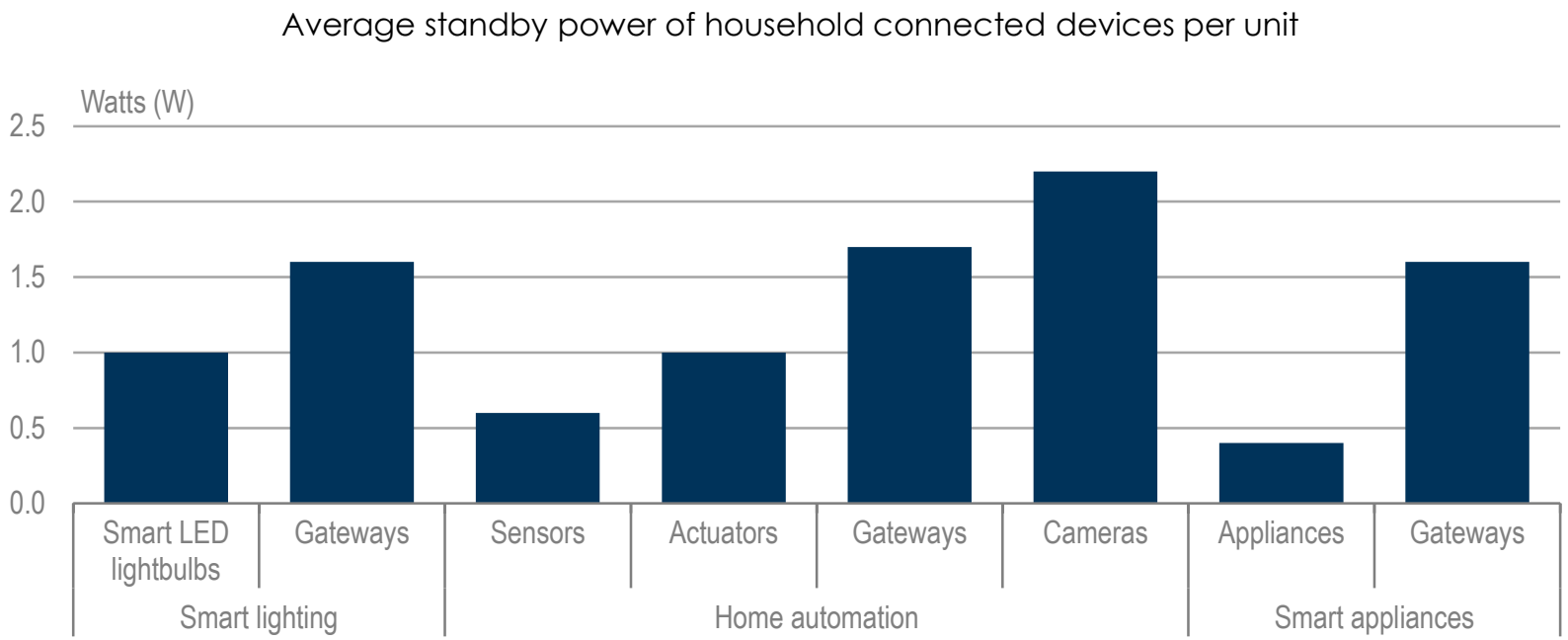
A greater share of appliance electricity use is network-enabled

Household electricity consumption of appliances and other small plug loads



The growth in network-enabled devices presents opportunities for smart demand response but also increases needs for standby power

Connected devices come with a hidden energy price tag



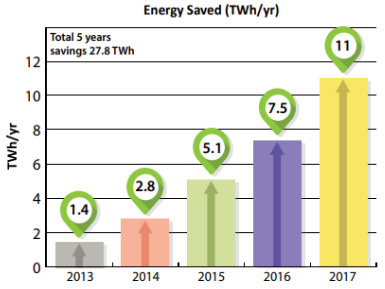
Networked standby, the energy used to maintain the device's connection to the wider network, is also often a connected device's biggest draw on power.

What are the policy options?

- Regulations:
  - European Union Ecodesign network standby
  - Korea e-standby program
- Voluntary approaches
  - US and Canada voluntary agreements
  - EU Codes of Conduct
  - CDA Voluntary Principles for Energy Efficient Connected Devices
- Research and development
  - Super efficient devices
  - Energy harvesting
- Awards
  - Super Efficient Appliance Deployment Initiative Connected Efficiency Award

Annual energy saved by US voluntary set top box agreement

Source: D+R International



Source: University of Washington

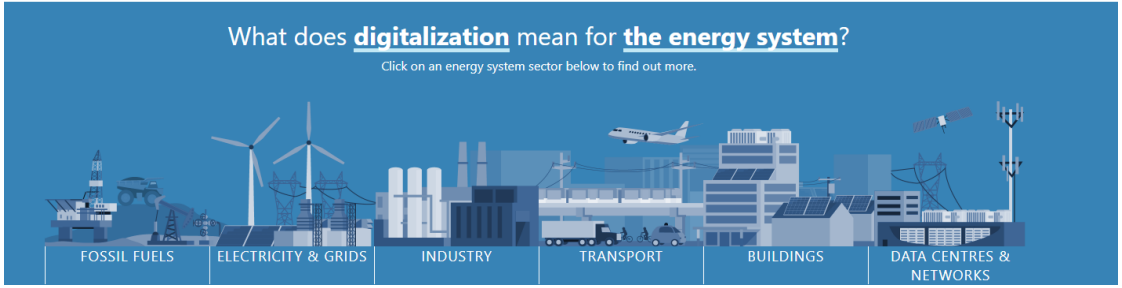
Resources

IEA resources
https://www.iea.org/digital/

IEA Technology Collaboration Programme
https://www.iea.org/tcp/

IEA Technology Collaboration Programme: 4E Electronic Devices & Networks
https://edna.iea-4e.org/about

IEA TCP 4E, Connected Device Alliance
https://cda.iea-4e.org/



Other resources

- Appliance Energy Calculator App
- PocketWatt tool