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

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<th>Monday 14 October 2019</th>
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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

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

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

HEAT Rating

10

Your Home: 10
Beltline: 8
Calgary: 4

Low  High

> HEAT Ratings rank a building’s heat loss to others in the neighbourhood and city.
The higher the rating, the more heat is escaping.

HEAT Map

Low  High

> HEAT Maps show potential heat loss for a building.
Red areas show high heat loss and blue areas show low heat loss.

Save Money and Energy

> Save $300 on an energy evaluation and access funding for upgrades, including a $1,000 bonus rebate.
> Purchase qualifying energy saving products and submit receipts online to claim your rebate!

GET STARTED
APPLY ONLINE

PRESENTED IN PARTNERSHIP WITH

Energy Efficiency Alberta
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

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

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

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<tr>
<td>Smart auxiliary processes (lighting, heating, cooling, ventilation)</td>
<td>Control in accordance to needs, occupancy, other relevant parameters</td>
<td>Up to 10% of total energy use</td>
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<tr>
<td>Smart motors</td>
<td>Data-driven control, load sensing, application optimisation</td>
<td>Up to 50% of motor system energy use</td>
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<tr>
<td>Smart process control</td>
<td>Data, control, optimisation, automation</td>
<td>Around 20% energy demand of process</td>
</tr>
<tr>
<td>Smart Energy Management System</td>
<td>Collects data on end-uses, provides information for manager and enables optimisation and automation</td>
<td>Up to 30% of total energy use</td>
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Note: significant variations in achievable savings depending on size and sector
How does smart energy management work?

Example: Indian company Smart Joules

Saving Outcomes

Operational

Equipment

Energy Analytics

Asset

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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?

**STEP 1**
Energy users sign up to voluntarily reduce energy usage in times of extreme demand.

**STEP 2**
Electricity demand surges, for example due to extreme weather.

**STEP 3**
Users reduce their energy consumption.

**STEP 4**
Reduced demand helps balance supply and demand and stabilises grid.

**STEP 5**
Users are paid for their reduced demand.

Source: ARENA

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Source: Stanford University
Example: PeakSmart

Get up to $200 when you purchase a PeakSmart air-con
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

- **Cloud** (data centres)
- **Network Infrastructure**
- **IoT Devices**
  - Smart home
  - Smart health
  - Smart factory
  - Smart mobility
  - …
  - Battery/self-powered
  - Mains-connected (e.g. smart lighting, smart appliances, etc.)

**Mobile devices**
- (smartphones, tablets)
- (PCs, laptops)
- (e.g. smart TVs, set-top boxes, etc.)

Source: 4E TCP (2016) Energy Efficiency of the Internet of Things
A greater share of appliance electricity use is network-enabled

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/

What does digitalization mean for the energy system?
Click on an energy system sector below to find out more:

- FOSSIL FUELS
- ELECTRICITY & GRIDS
- INDUSTRY
- TRANSPORT
- BUILDINGS
- DATA CENTRES & NETWORKS

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Other resources

- Appliance Energy Calculator App
- PocketWatt tool