Digitalization and its impacts for security

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IEA

Digitalization trends are truly astounding

KB	kilobyte	10^3 bytes
MB	megabyte	10^6 bytes
GB	gigabyte	10^9 bytes
TB	terabyte	10^{12} bytes
PB	petabyte	10^{15} bytes
EB	exabyte	10^{18} bytes
ZB	zettabyte	10^{21} bytes
YB	yottabyte	10^{24} bytes

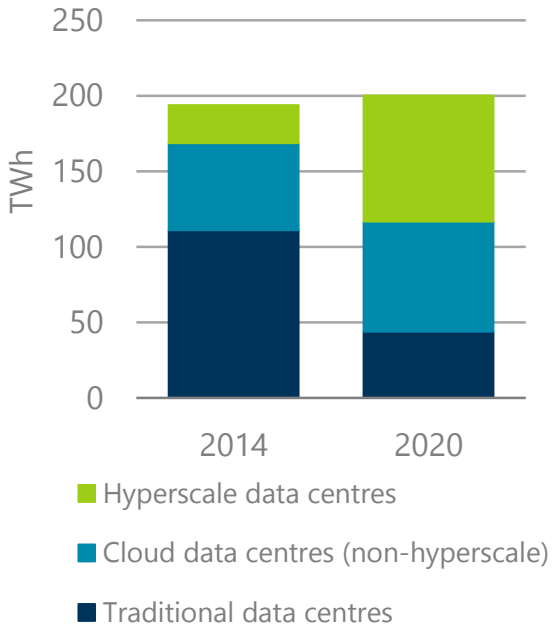
1987
2 TB

1997
60 PB

2007
54 EB

2017
1.1 ZB

Data centre electricity use



IEA analysis

Sources: Cisco (2017). The Zettabyte Era: Trends and Analysis June 2017; Cisco (2015). The History and Future of Internet Traffic.

Sustained efficiency gains could keep energy demand largely in check over the next five years, despite exponential growth in demand for data centre and network services

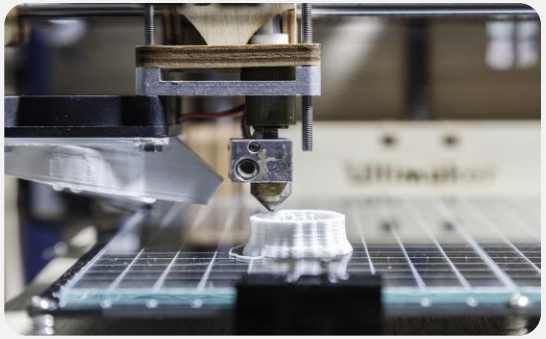
Impacts on demand sectors: transport, buildings and industry

Transport

- Key digital trends across all modes: connectivity, sharing, and automation
- Digital solutions for trucks and logistics could reduce energy use for road freight by 20-25%

Buildings

- Smart building controls will improve comfort and transform building energy use
- Energy use could be reduced by 10% to 2040, but rebound effects are uncertain

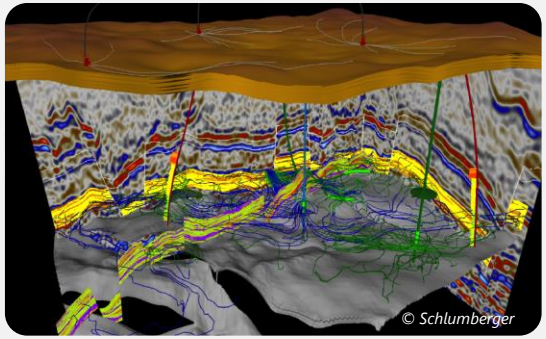


Industry

- Industry will witness increased productivity, reduced costs and improved safety
- Energy use can be incrementally reduced at plant level but broader impacts remain uncertain

Digitalization has the potential to reshape, modernise, transform demand-side sectors; policies are needed to maximise benefits and reap energy saving opportunities

Impacts on supply sectors: oil and gas, coal, and power



Oil and gas

- Increased productivity, improved safety and environmental performance
- Could decrease production costs by 10-20%; recovery could be enhanced by 5%.

Coal

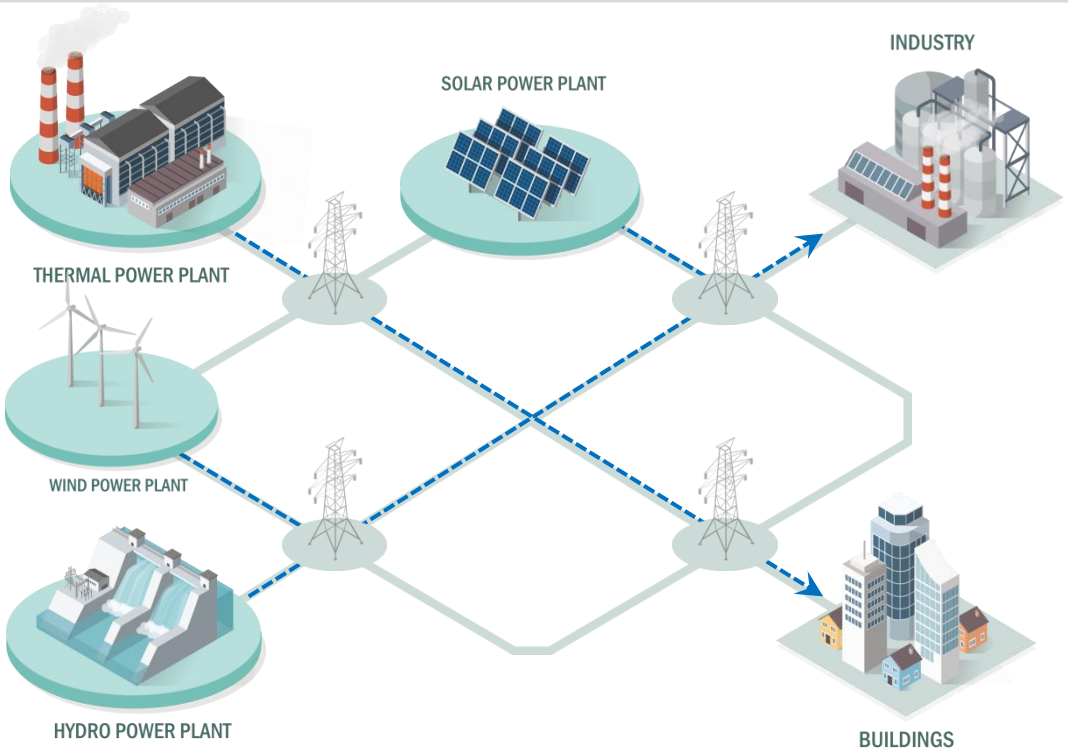
- Coal mining can expect to see improved processes and reduced costs as well as improved environmental performance

Power

- Power plants and electricity networks could see reduced O&M costs, extended life time, improved efficiencies and enhanced stability
- Savings of USD 80 billion per year

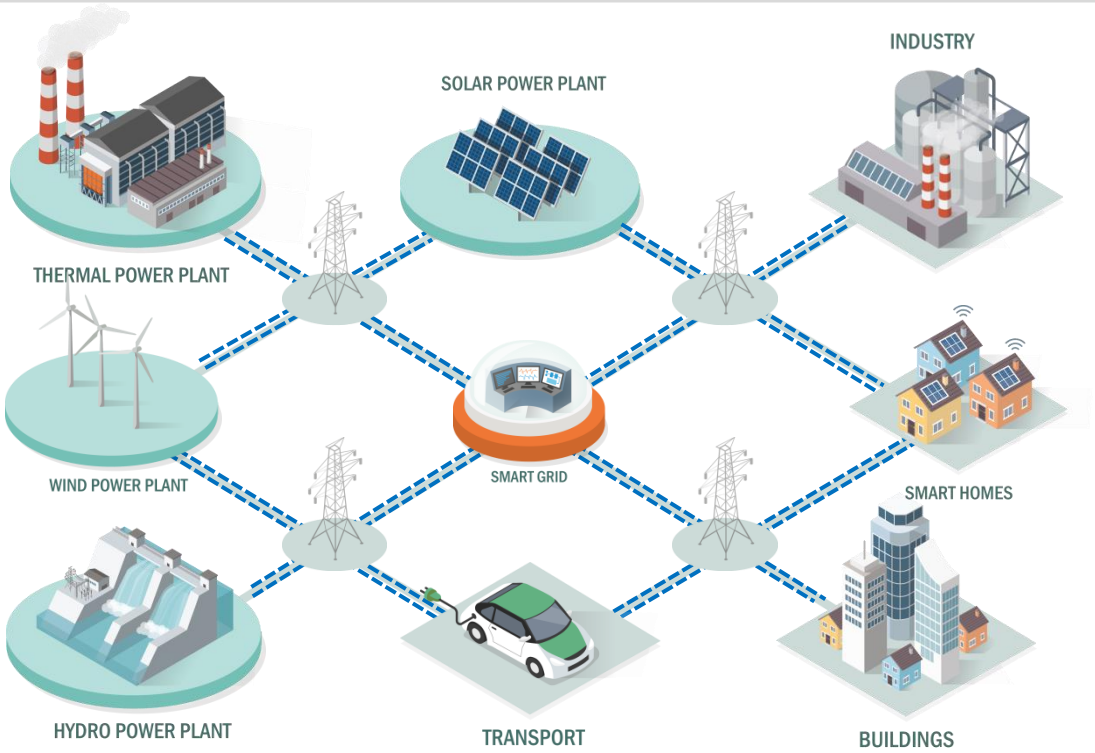
Energy companies have been adopting digital technologies for years, to increase productivity, reduce costs, improve safety and environmental performance

The digital transformation of the energy system



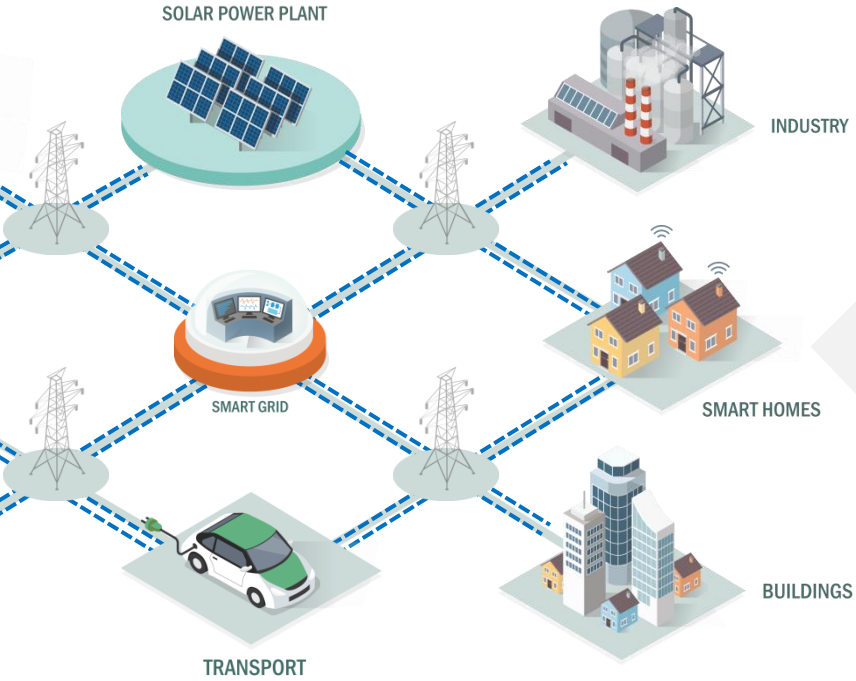
Pre-digital energy systems are defined by unidirectional flows and distinct roles

The digital transformation of the energy system



Pre-digital energy systems are defined by unidirectional flows and distinct roles; digital technologies enable a multi-directional and highly-integrated energy system

Smart demand response



Residential sector

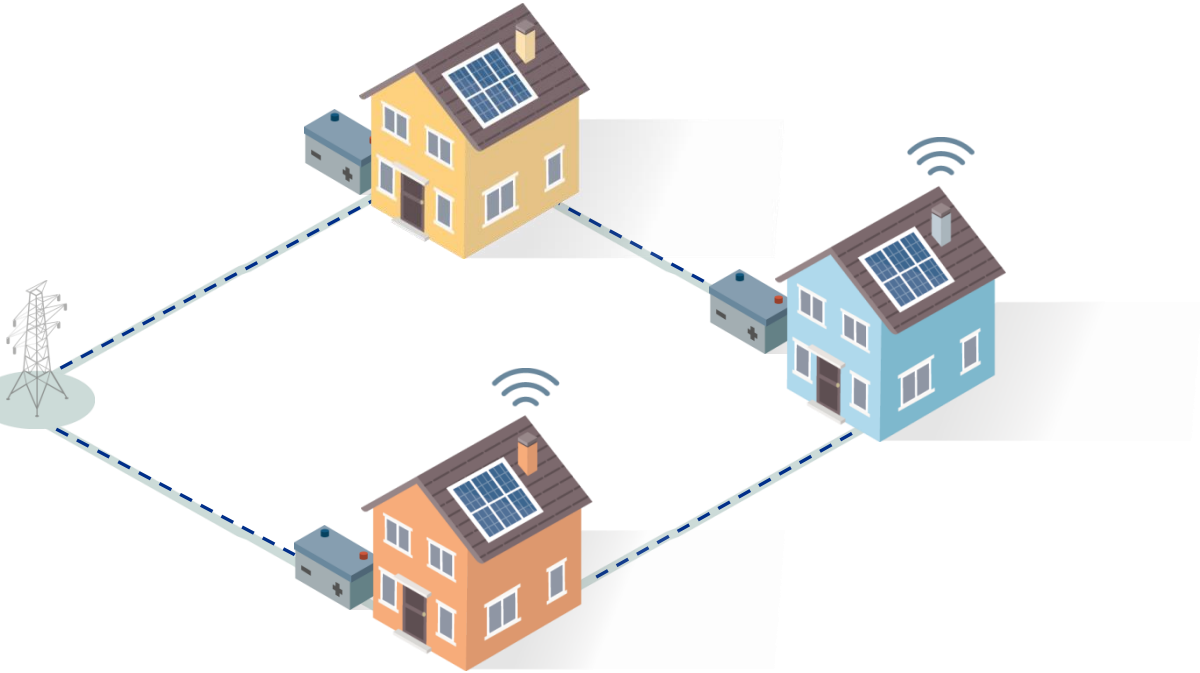
1 billion households and
11 billion smart appliances
could actively participate in interconnected electricity systems

Demand response programs – in buildings, industry and transport – could provide 185 GW of flexibility and avoid USD 270 billion of investment in new electricity infrastructure

Building digital resilience

- To date, cyber disruptions to energy have been small
- But cyber-attacks are become easier and cheaper – malware, ransomware, phishing / whaling, botnets
- Digitalization also increases the "cyber attack surface" of energy systems
- Full prevention is impossible, but impact can be limited:
  - Raising awareness, cyber hygiene, standard setting and staff training
  - Coordinated and proactive preparation by companies and governments
  - Design digital resilience in technologies and systems
- International efforts can help raise awareness and share best practices

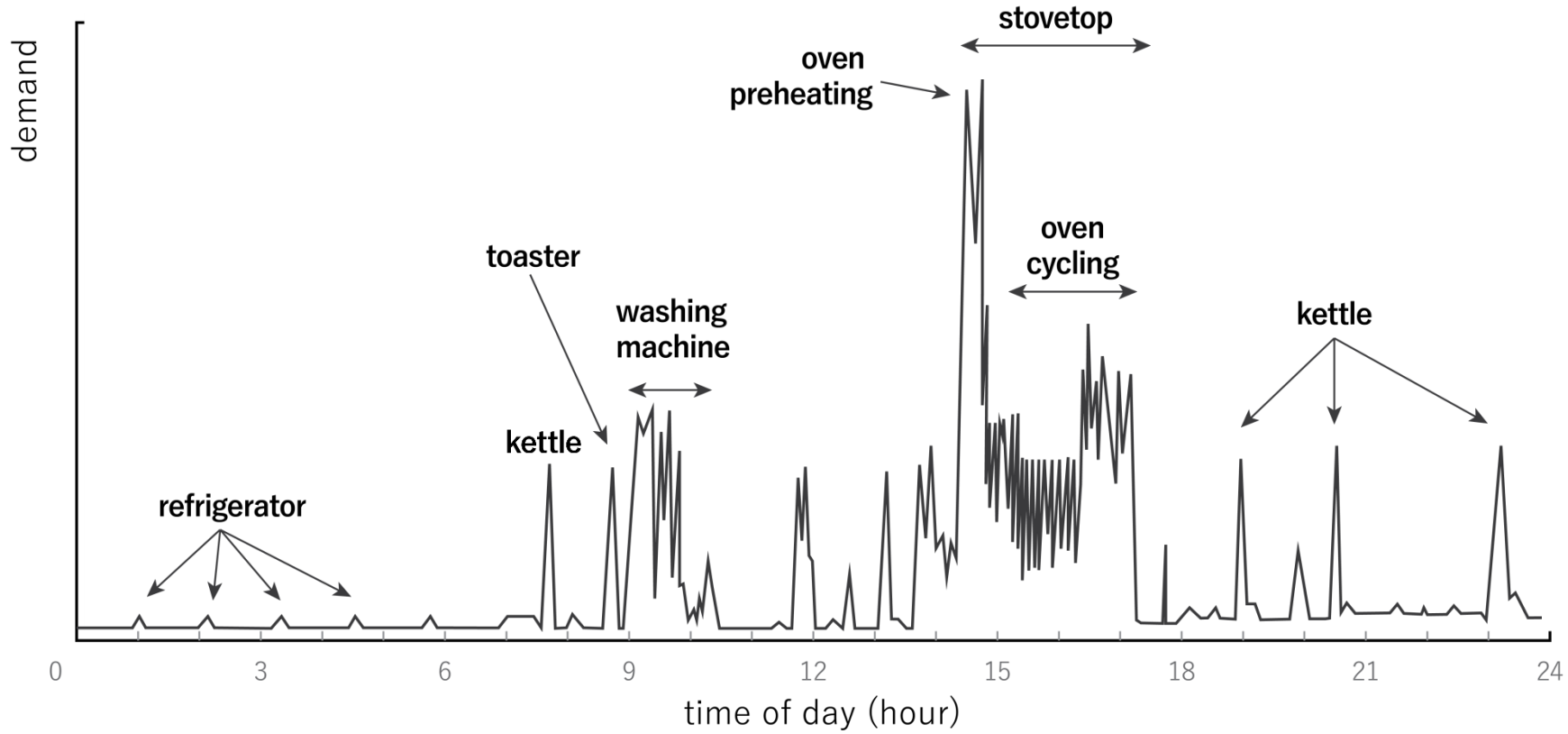
Distributed energy resources



Blockchain could help to facilitate peer-to-peer electricity trade within local energy communities

Digitalization can facilitate the deployment of residential solar PV and storage, making it easier to store and sell surplus electricity to the grid or locally

Managing privacy concerns



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

No-regrets policy recommendations

1. Build digital expertise within their staff.
2. Ensure appropriate access to timely, robust, and verifiable data.
3. Build flexibility into policies to accommodate new technologies and developments.
4. Experiment, including through “learning by doing” pilot projects.
5. Participate in broader inter-agency discussions on digitalization.
6. Focus on the broader, overall system benefits.
7. Monitor the energy impacts of digitalization on overall energy demand.
8. Incorporate digital resilience by design into research, development and product manufacturing.
9. Provide a level playing field to allow a variety of companies to compete and serve consumers better.
10. Learn from others, including both positive case studies as well as more cautionary tales.

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