Digitalization & Energy

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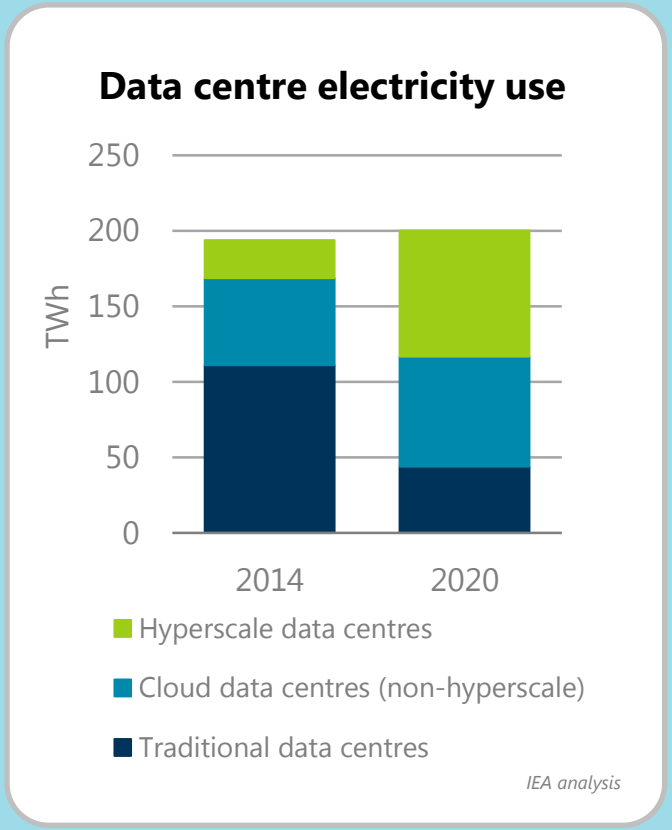
IEA

Digitalization trends are truly astounding

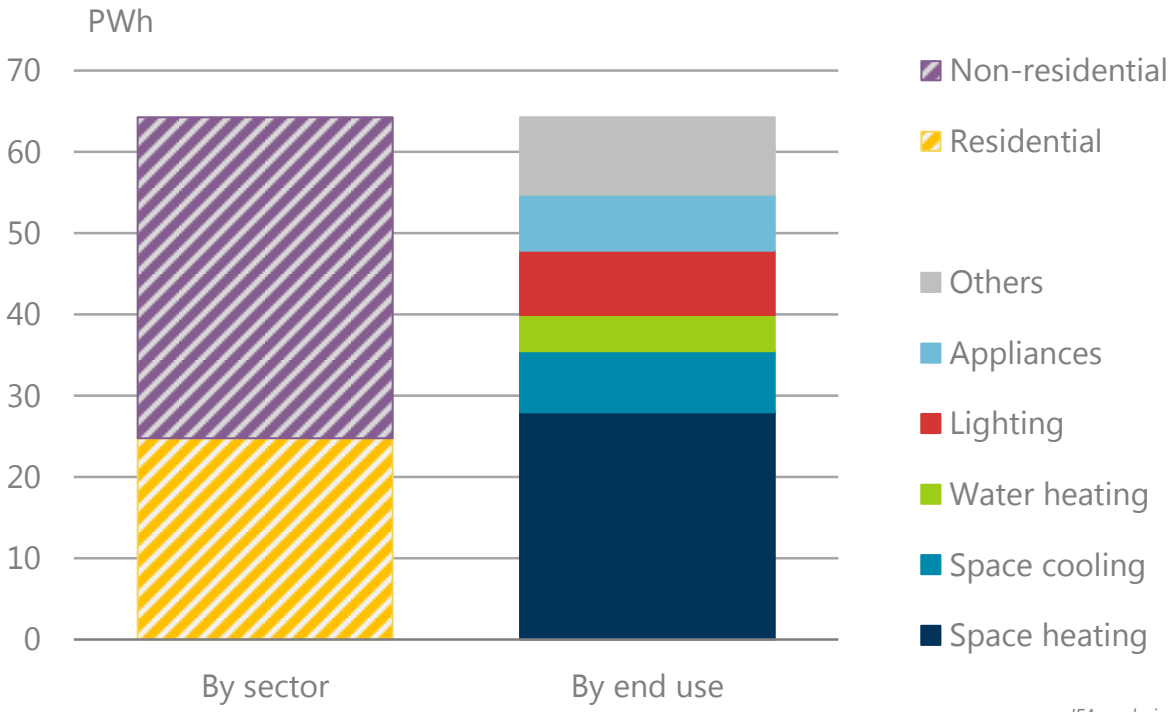
KB	kilobyte	10^3 bytes
MB	megabyte	10^6 bytes
GB	gigabyte	10^9 bytes
TB	terabyte	10^{12} bytes
PB	petabyte	10^{15} bytes
EB	exabyte	10^{18} bytes
ZB	zettabyte	10^{21} bytes
YB	yottabyte	10^{24} bytes



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

Buildings



IEA analysis

Widespread deployment of smart building controls could reduce energy use by 10% to 2040

Transport

Road freight

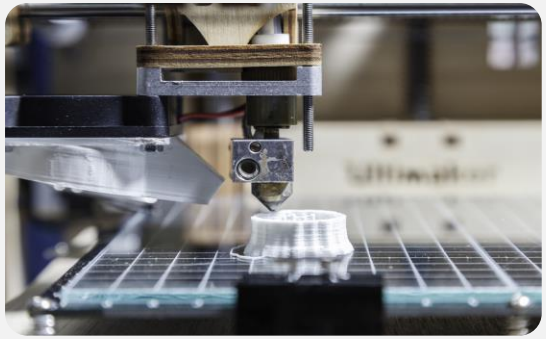
- Digital solutions for trucks and logistics could reduce energy use for road freight by 20-25%.
- Digital solutions include platooning, route optimisation, and data sharing across the supply chain

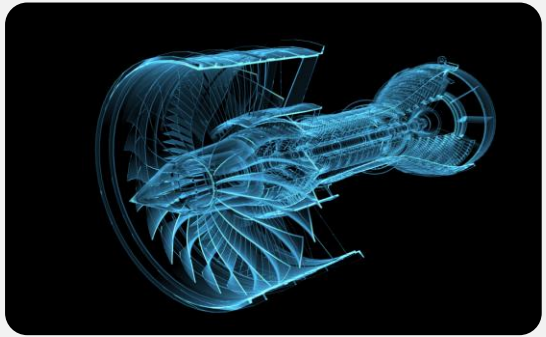
Road passenger

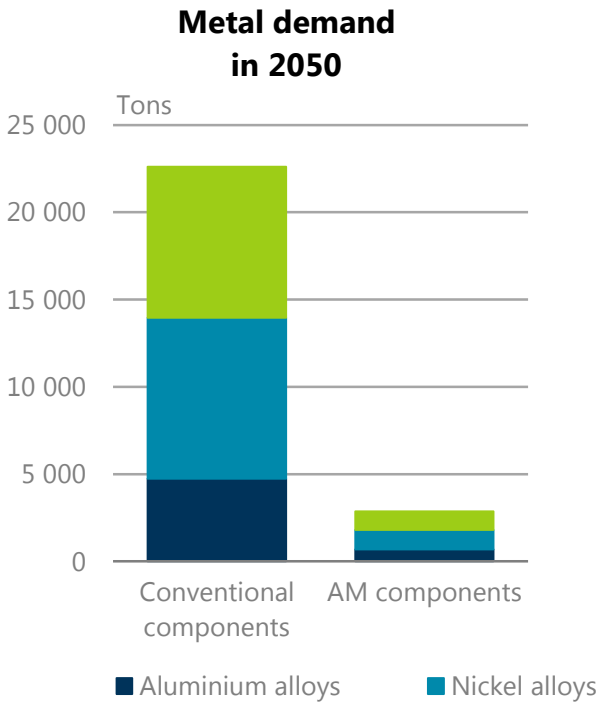
- Automation, connectivity, sharing, and electrification (ACES) to dramatically reshape road transport
- Impacts on energy demand difficult to predict
- Automation and connectivity could halve or double energy demand, depending on how technology, behavior, and policy evolve

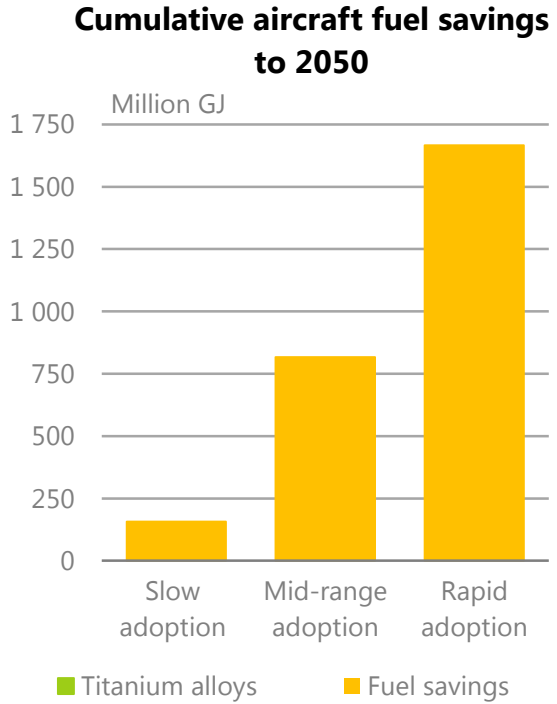
Intelligent transport systems are improving safety and efficiency of all modes, with the most transformative impacts expected in road transport

Industry





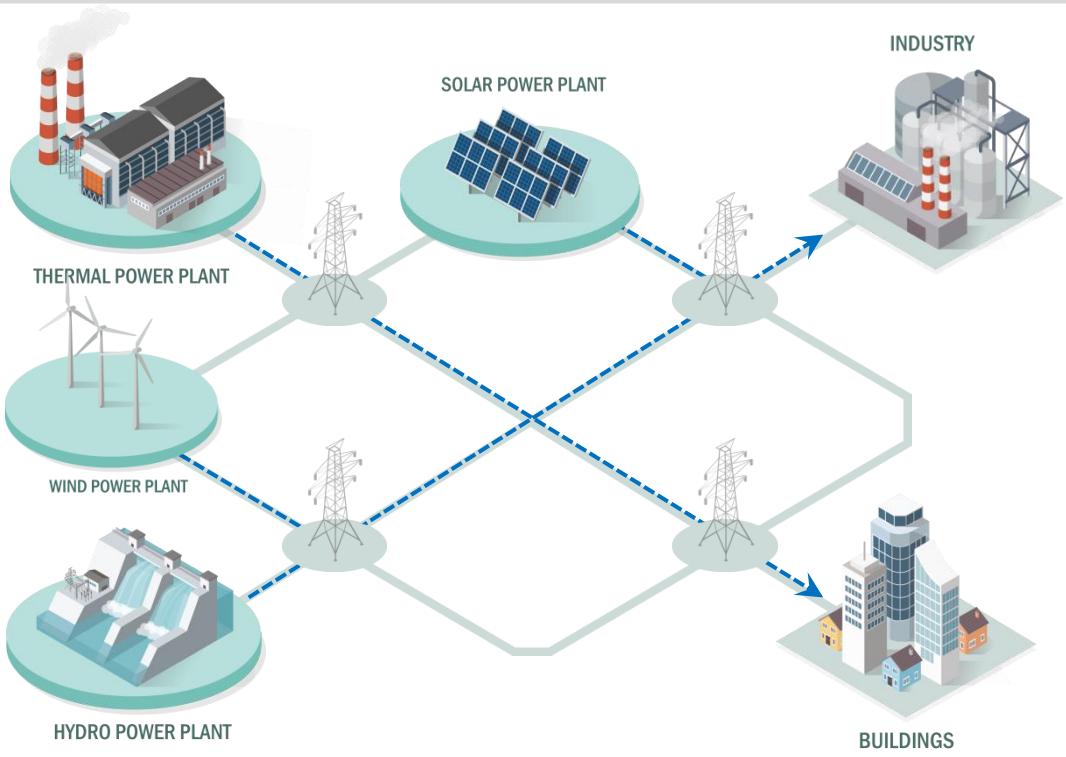




Source: Huang et al. (2016)

Energy use can be incrementally reduced at the plant level
but widespread use of 3D printing, AI and robotics could herald transformative changes

The digital transformation of the energy system



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

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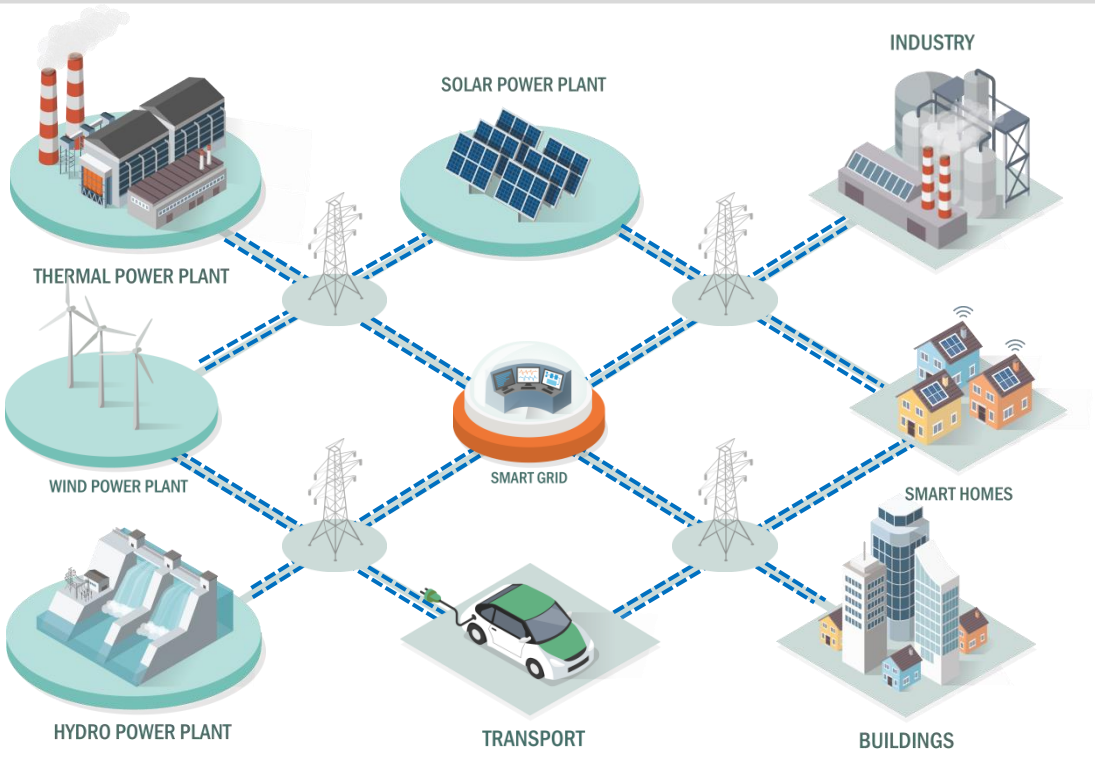
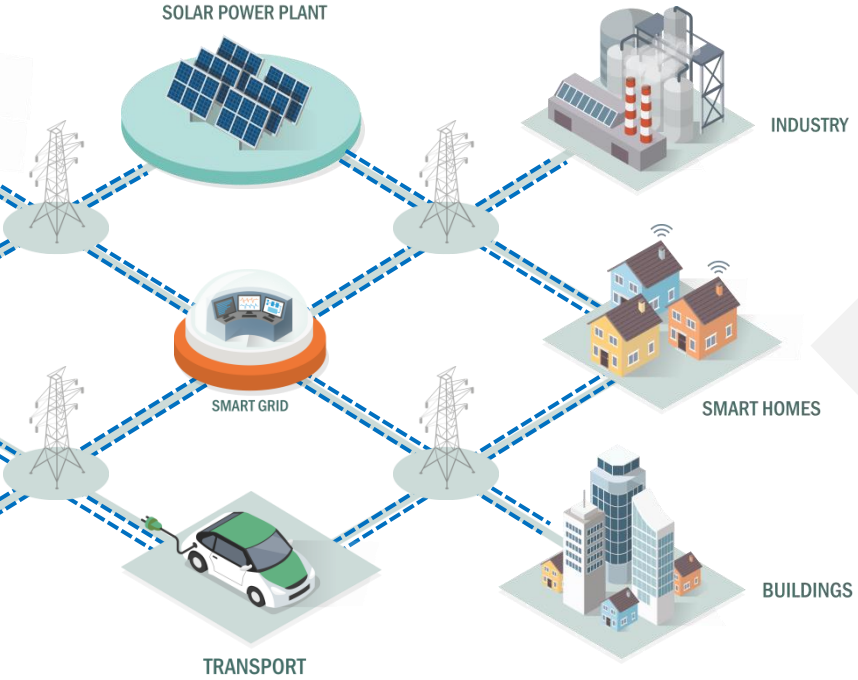


Pre-digital energy systems are defined by unidirectional flows and distinct roles, digital technologies enable a multi-directional and highly integrated energy system

Smart demand response

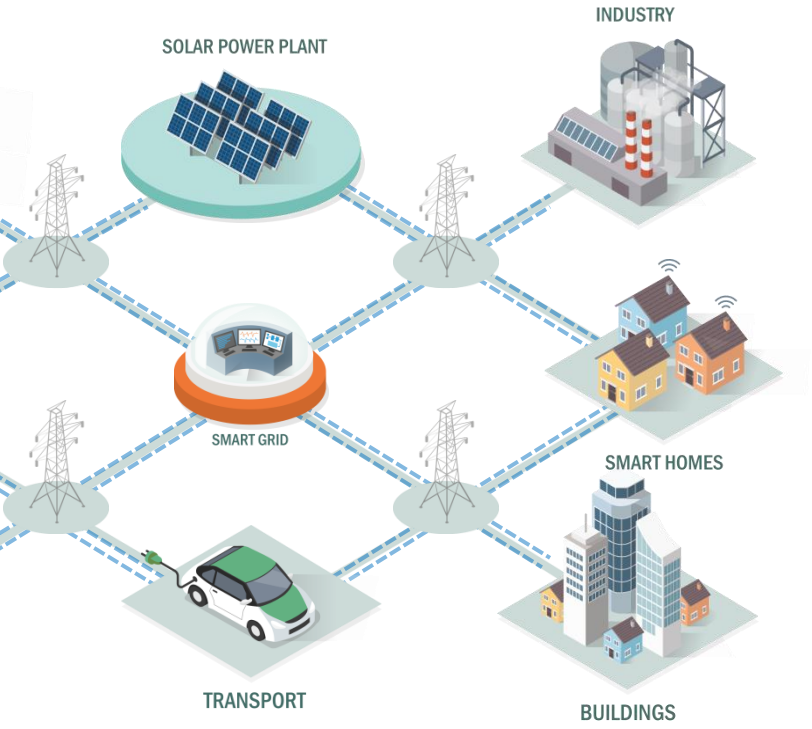


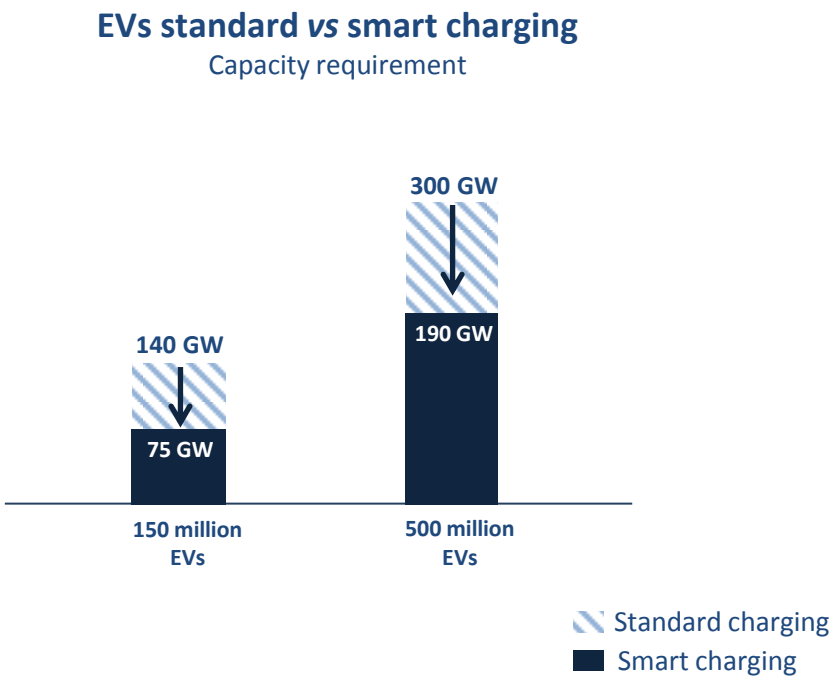
Residential sector

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

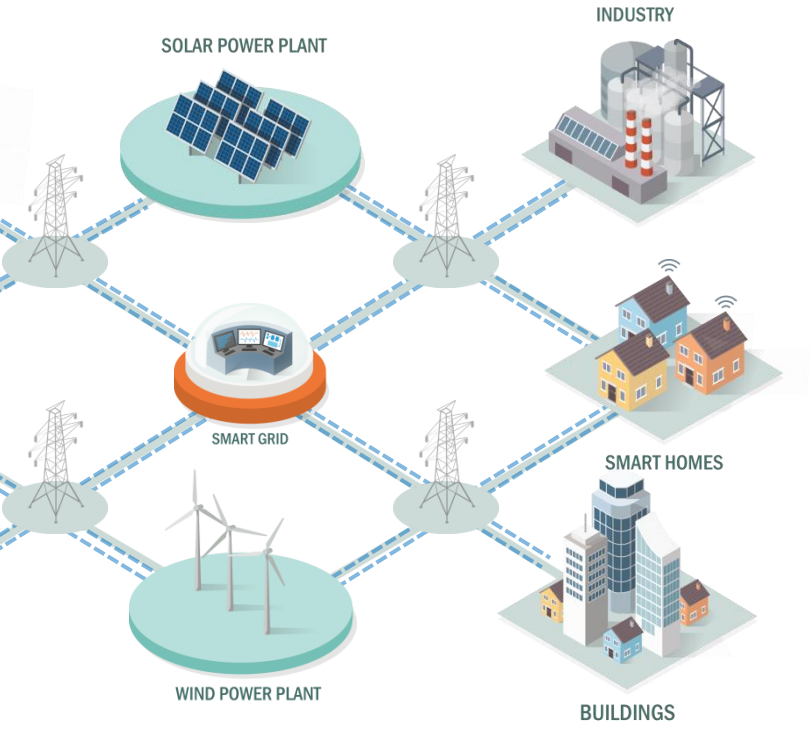
Smart charging of electric vehicles



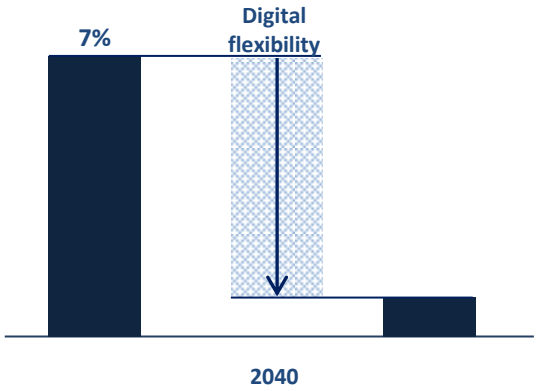


EVs smart charging would provide further flexibility to the grid saving between USD 100-280 billion investment in new electricity infrastructure

Integration of variable renewables

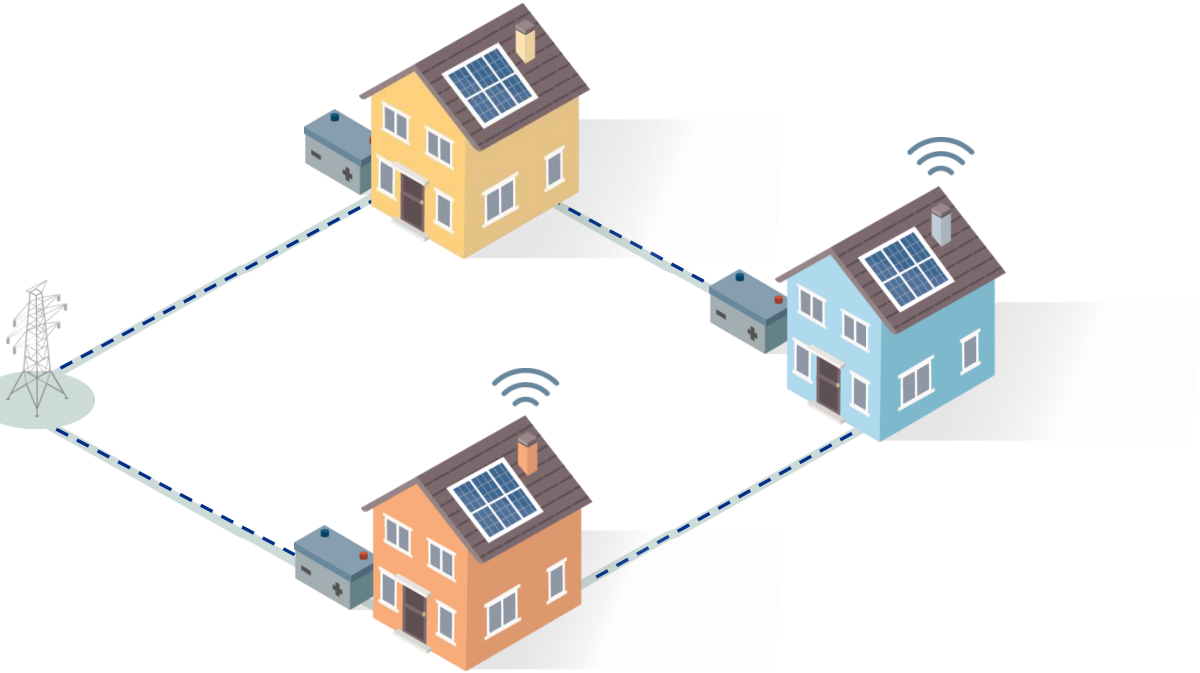


Curtailment of solar PV and wind



Digitalization can help integrate variable renewables by enabling grids to better match energy demand to times when the sun is shining and the wind is blowing.

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

Digitalization: A New Era in Energy

- The energy system is on the cusp of a new digital era
- This first-of-its-kind “Digitalization and Energy” report will help shine a light on digitalization's enormous potential and most pressing challenges
- But impacts are difficult to predict; uncertainty in technology, policy and behaviour
- Much more work needs to be done…
- Next steps for IEA, especially to focus on high impact, high uncertainty areas:
  - Automation, connectivity, and electrification of transport
  - Electricity and smart energy systems
  - Digitalization and decarbonisation

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