

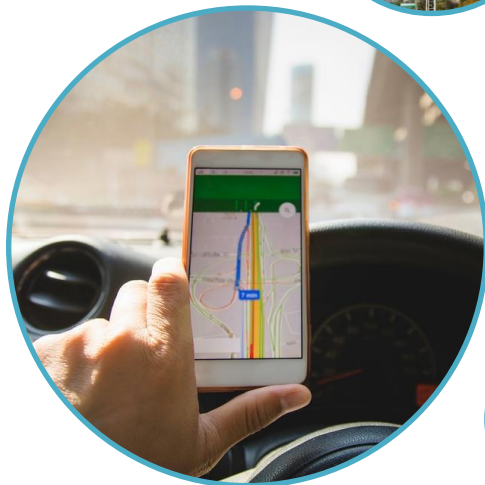


# Digitalisation and Energy: a spotlight on industry

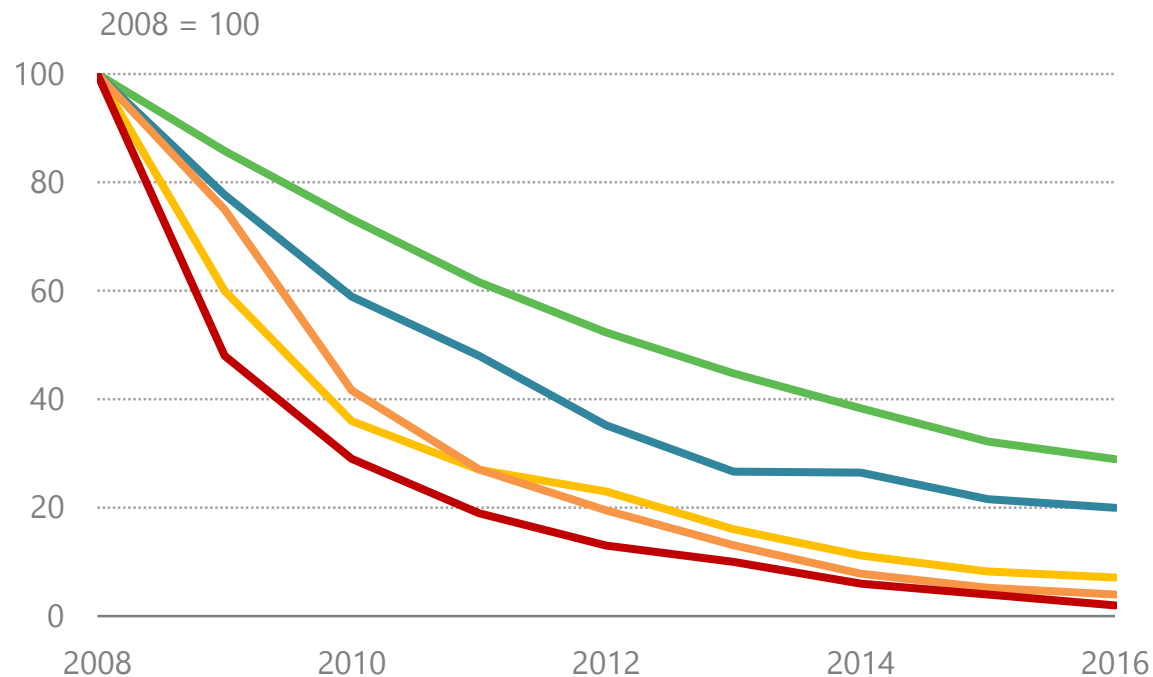
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IEA Workshop on Energy Management Systems and Digital Technologies  
Araceli Fernandez, 12 December 2017

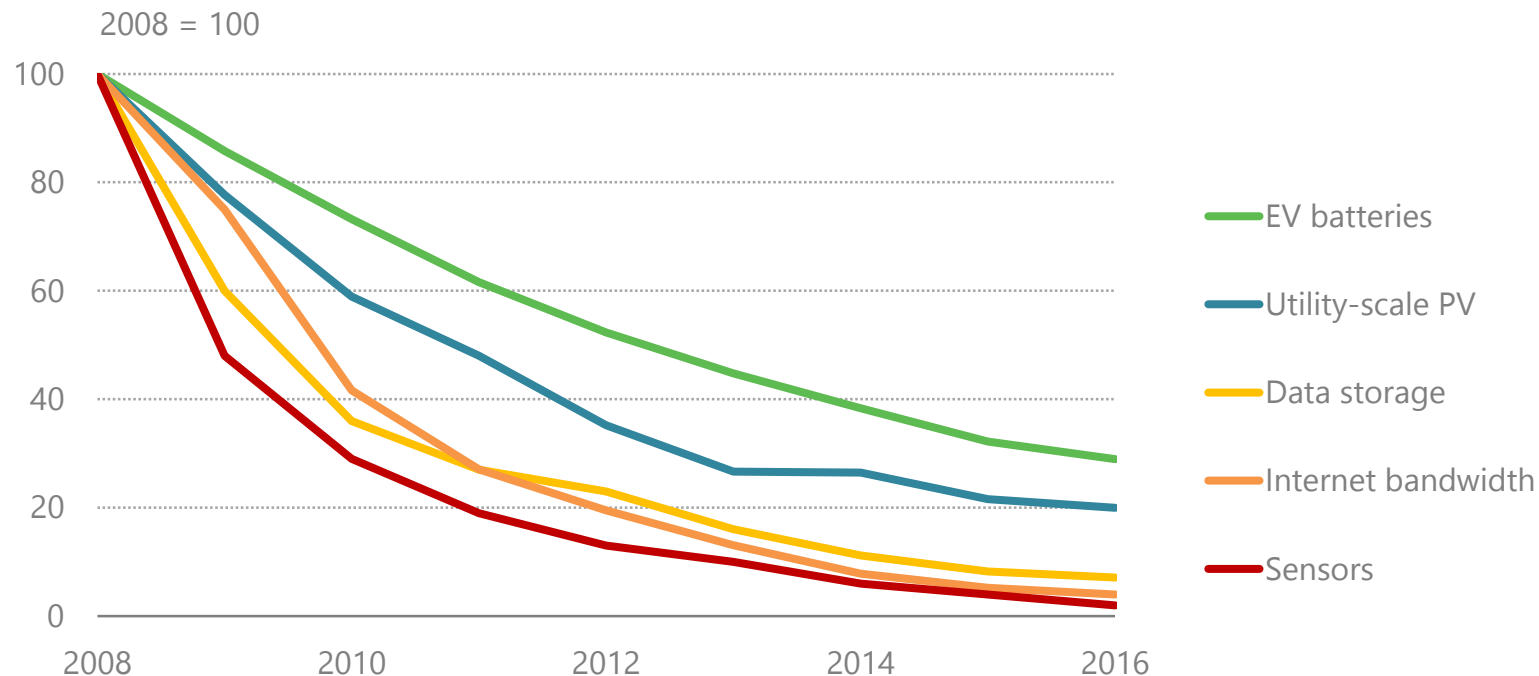
# Digital technologies are everywhere....



# Which line shows the cost decline of sensors?



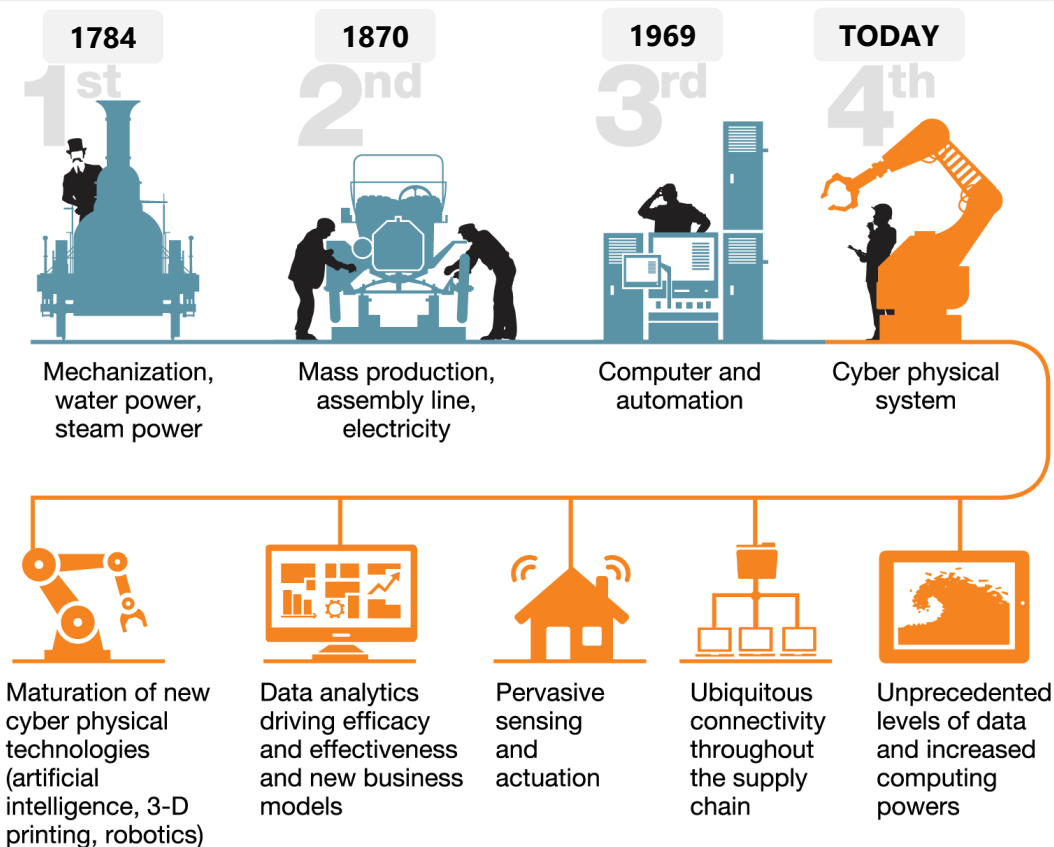
# Drivers of digitalization: data, analytics, and connectivity



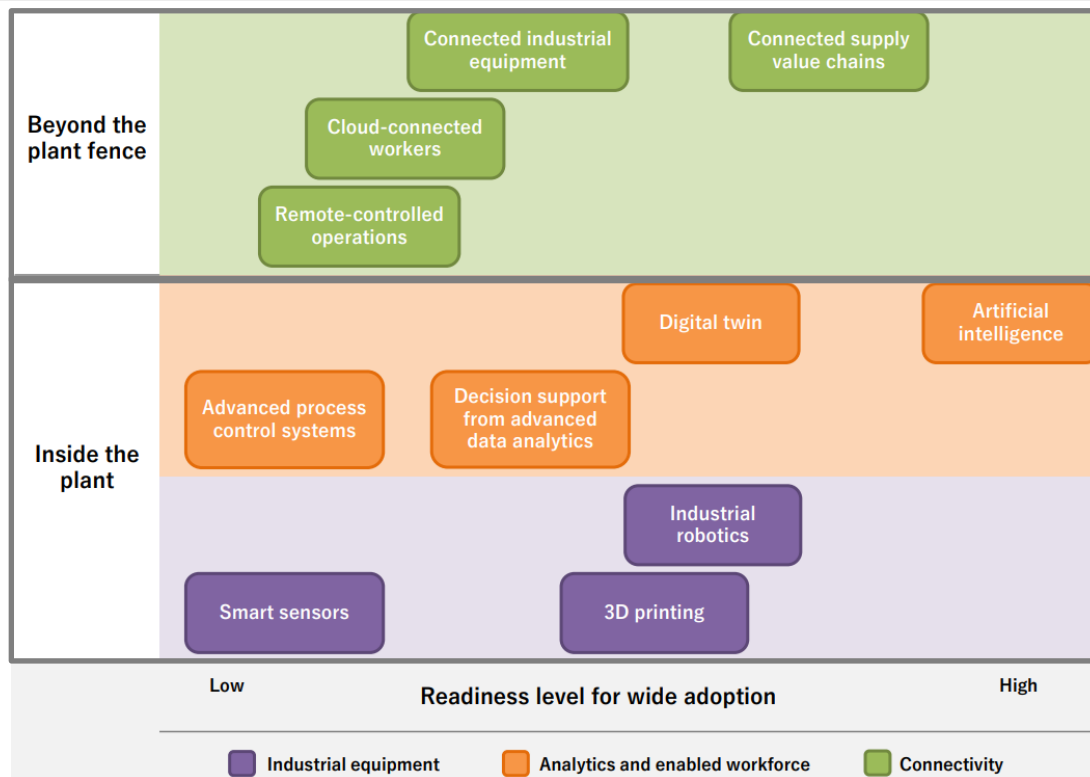
Sources: Based on BNEF (2017), Utilities, Smart Thermostats and the Connected Home Opportunity; Holdowsky et al. (2015), Inside the Internet of Things; IEA (2017), Renewables; Tracking Clean Energy Progress; World Energy Investment; Navigant Research (2017), Market data: Demand Response. Global Capacity,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

**Since 2008, data collection, storage, and transmission costs have declined by over 90%**

# Digital analytics enables the fourth industrial revolution



# Digitalization in industry can take diverse forms



**Digital technologies can enable sustainability improvements within industrial plants and beyond the plant fence**

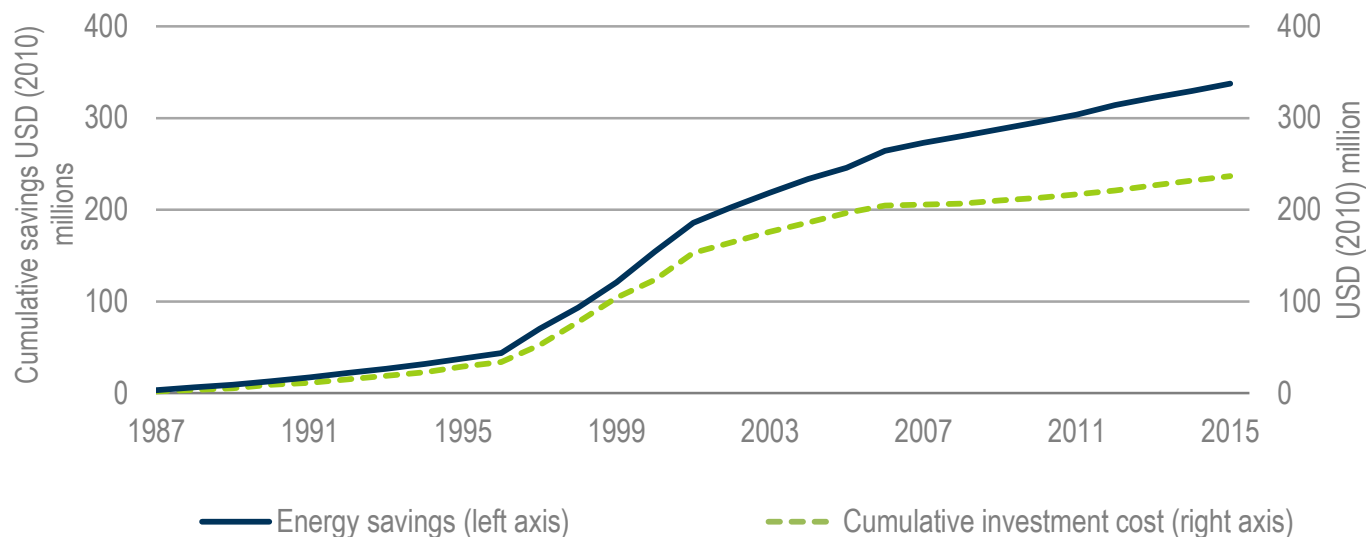
# Industry has a long history of using digital technologies



**Improving productivity and ensuring safety were the main initial drivers of digitalization in industry, which facilitated process optimisation and energy savings from coupling EMS with digital technologies.**

# Further energy savings remain from improving process controls in industrial processes

## Energy efficiency measures relating to improved process control in small to medium US manufacturers

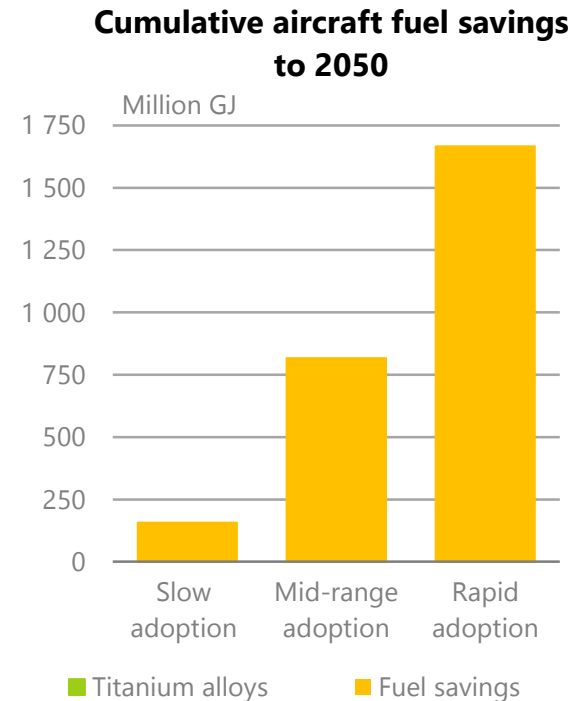
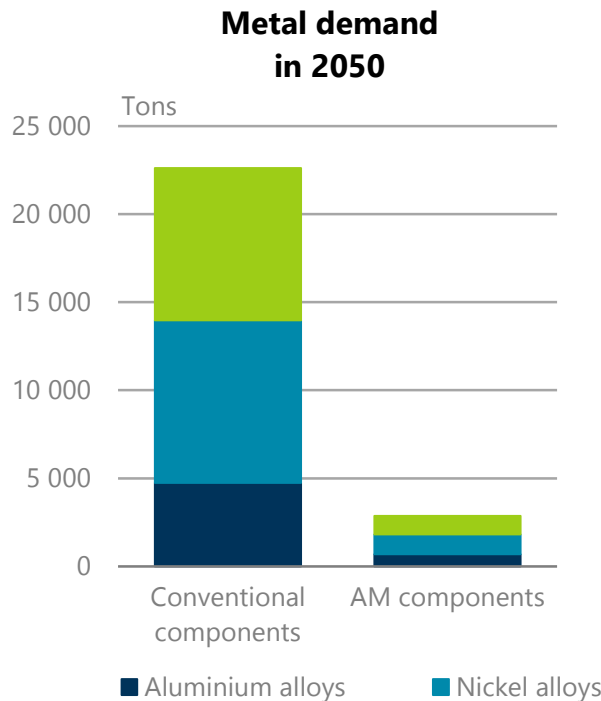
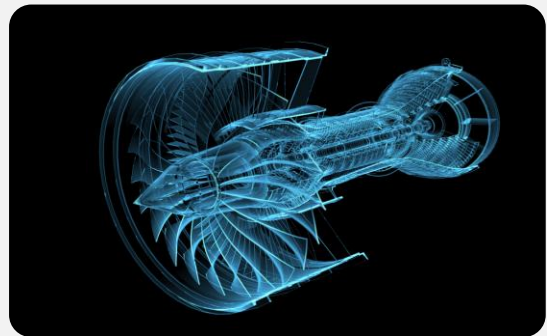
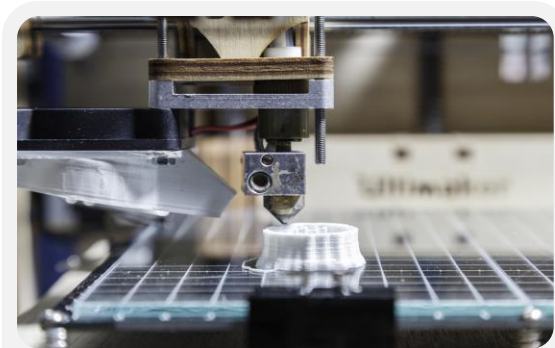


Source: IAC database

**Improvements to industrial process controls produce substantial energy and associated cost savings**

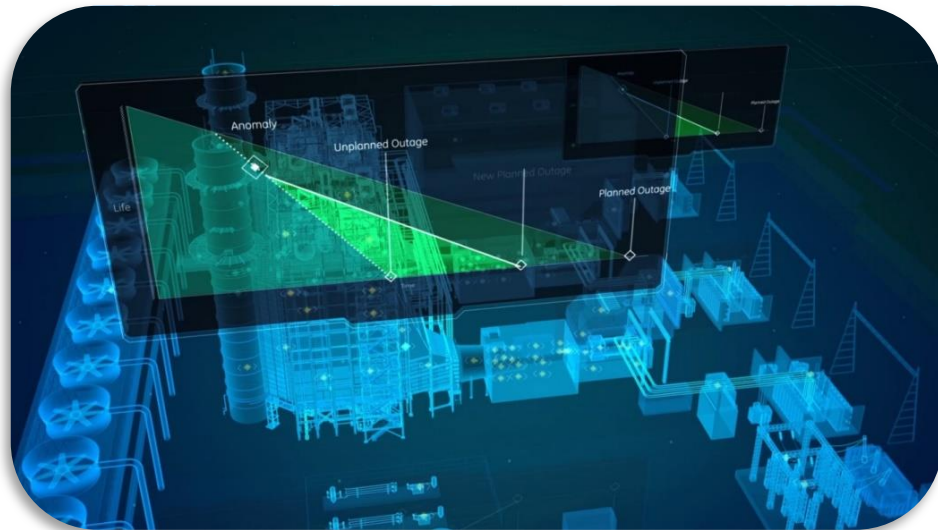


# Illustrative case study: aircraft component light-weighting



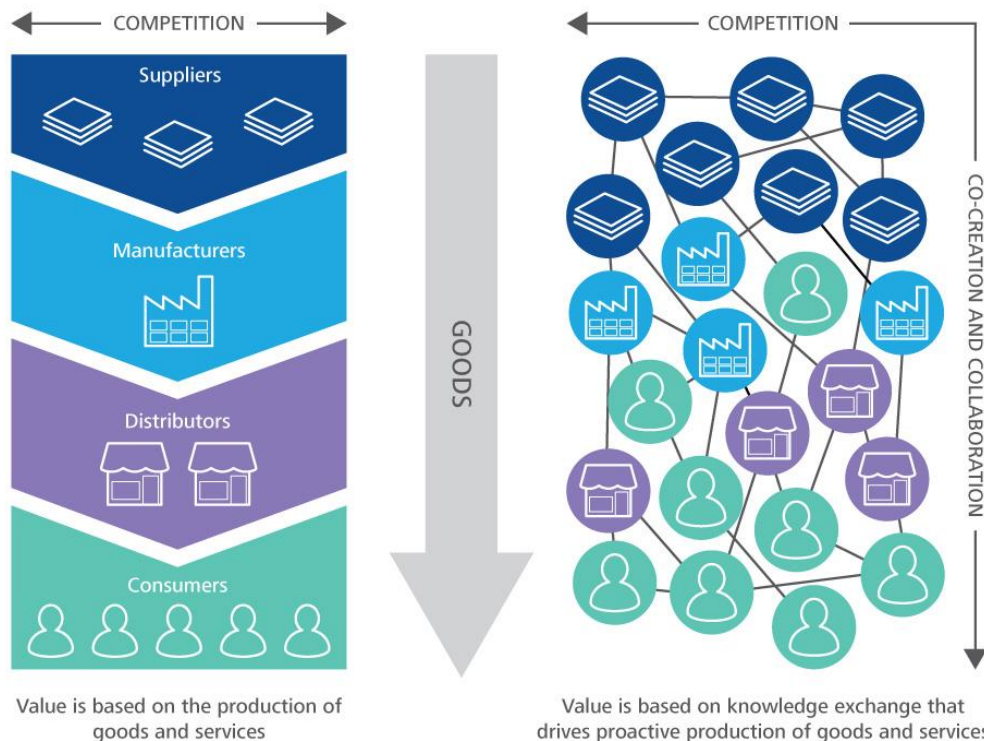
Source: Huang et al. (2016)

**The use of 3D printed components in commercial aircraft could lead to significant material demand and fuel savings**



**Virtual feasibility and durability testing of real process plants can accelerate the innovation cycle by saving time and resources**

# Connecting supply value chains

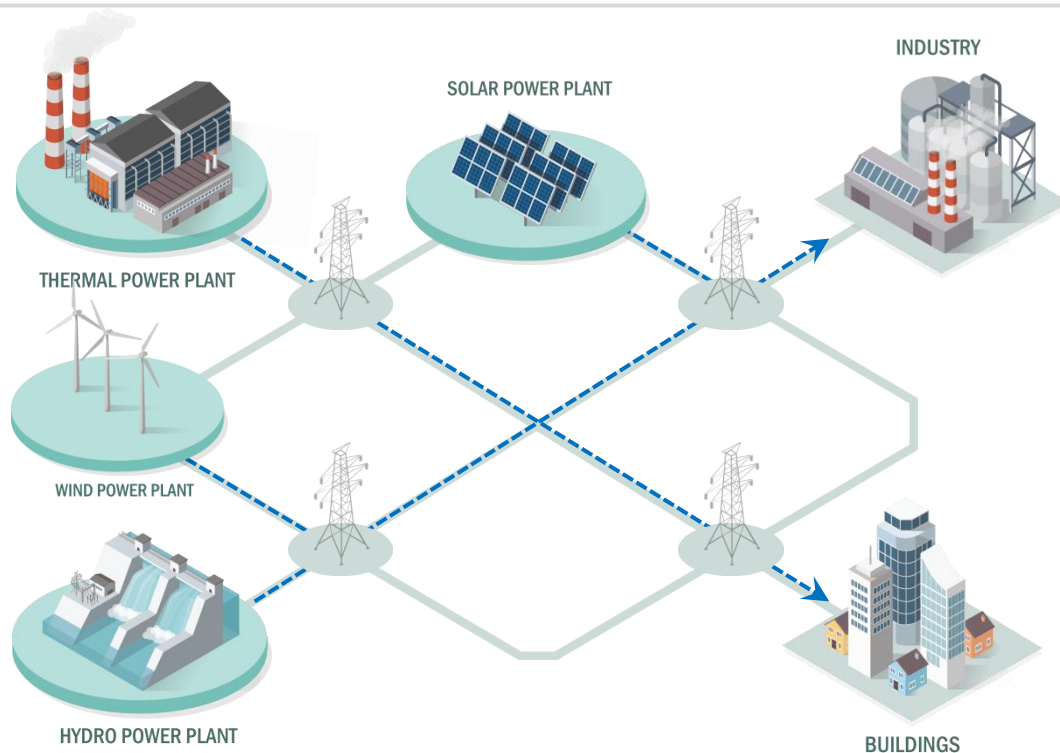


Source: Deloitte analysis.

Graphic: Deloitte University Press | DUPress.com

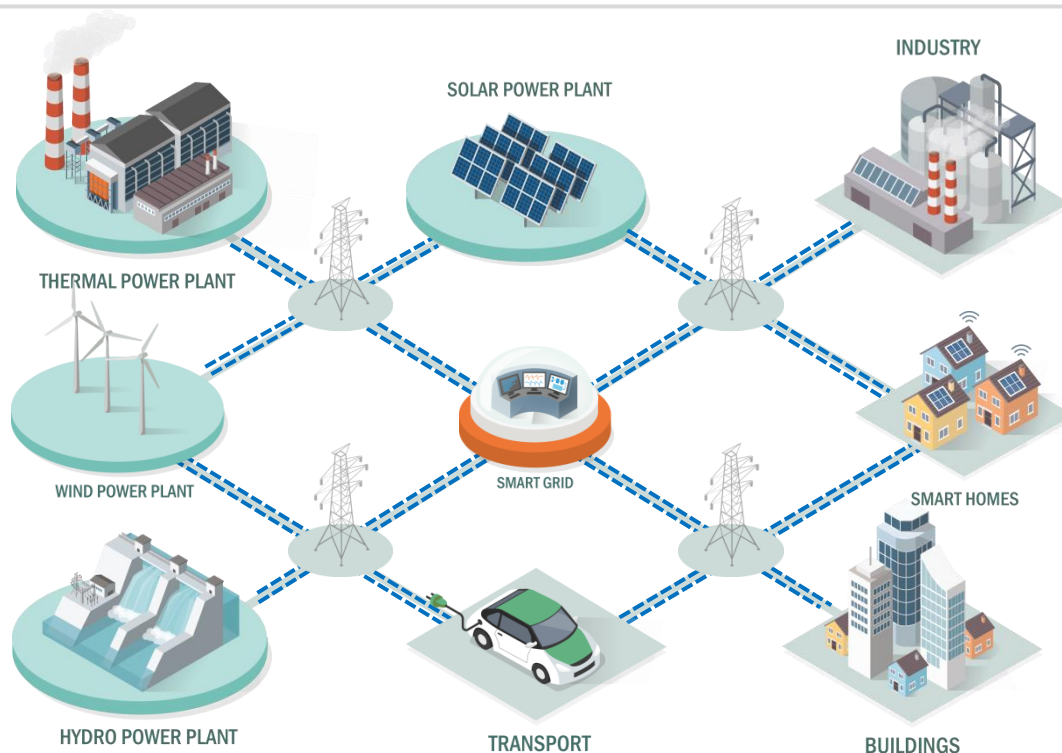
**Linear supply value chains are evolving into complex, dynamic and connected webs facilitating circular economy concepts.**

# The digital transformation of the energy system



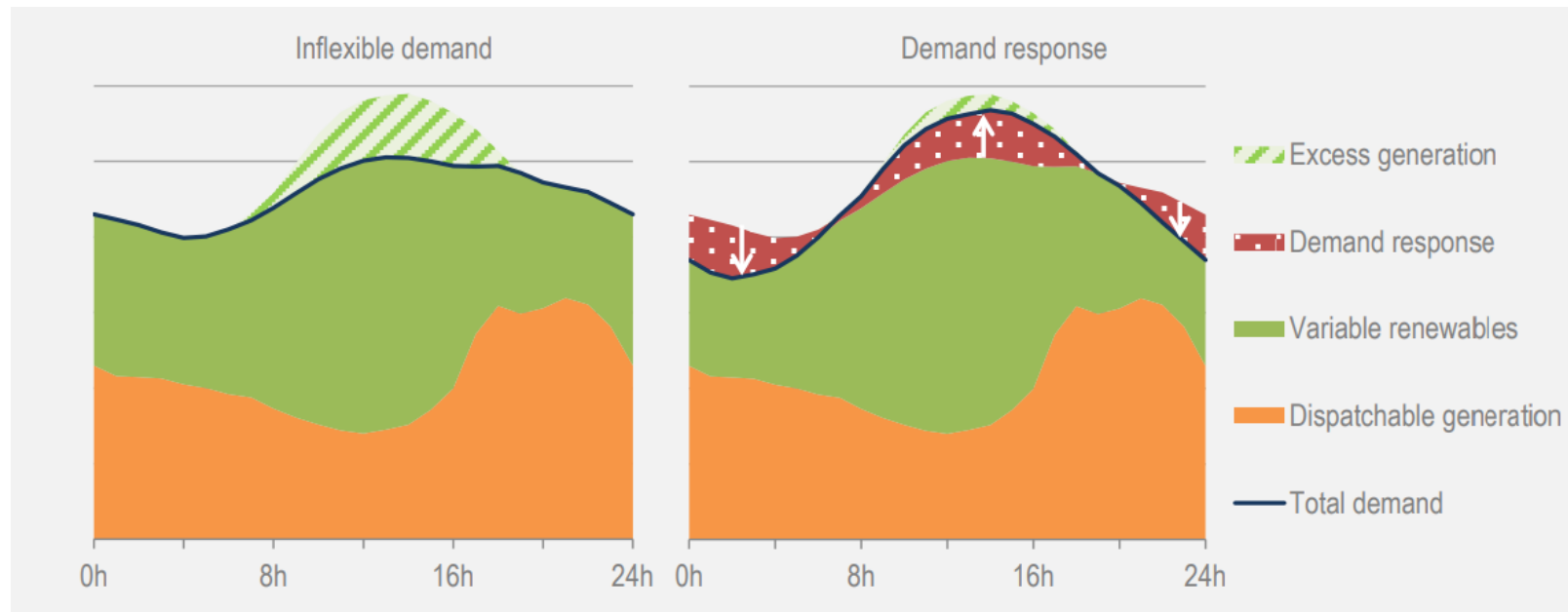
**Pre-digital energy systems are defined by unidirectional flows and distinct roles**

# 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**

# Providing system flexibility from the demand side



**Digitally-enabled demand response shifts electricity consumption to those hours with a surplus of supply. 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.**

- 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:
  - Raised 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

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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[digital@iea.org](mailto:digital@iea.org)

