Beyond the Energy Techlash:
The Energy & Carbon Footprint of IT

Colin Cunliff
Senior Policy Analyst

9 July 2020

Join the Conversation: Submit questions to the panel at
itif.org/energy-efficiency

@colin_cunliff

ITIF | INFORMATION TECHNOLOGY & INNOVATION FOUNDATION

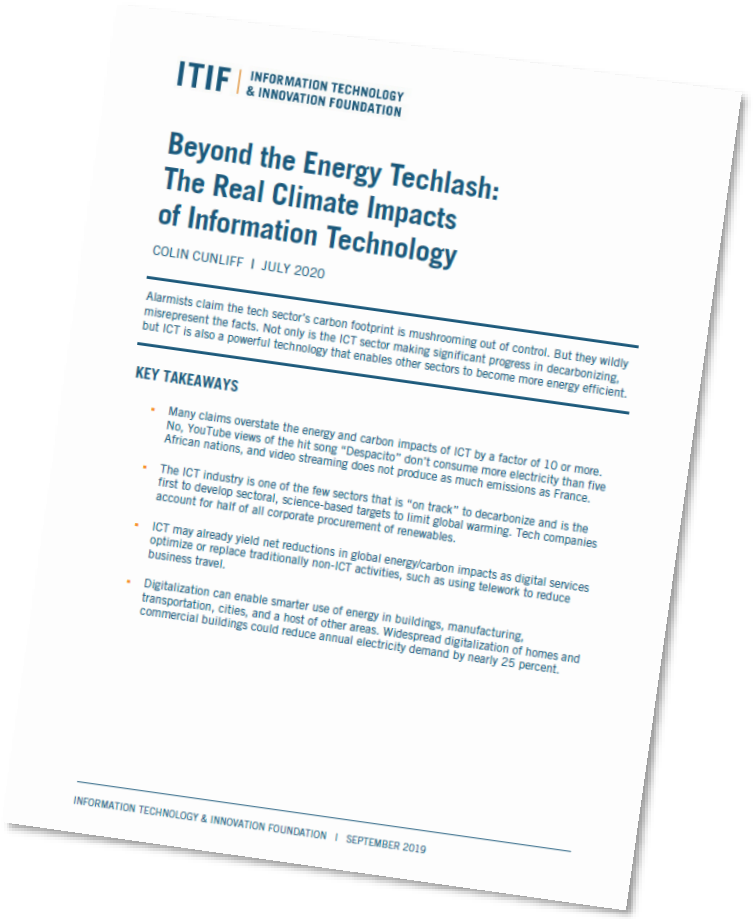
@ITIFdc

ITIF report: Beyond the Energy Techlash

1. What is the energy and carbon footprint of information technology?

2. How does integration of IT (aka "digitalization") affect energy use in other sectors?

https://itif.org/energy-techlash


ITIF | INFORMATION TECHNOLOGY & INNOVATION FOUNDATION

Beyond the Energy Techlash: The Real Climate Impacts of Information Technology

COLIN CUNLIFF | JULY 2020

Alarmists claim the tech sector's carbon footprint is mushrooming out of control. But they wildly misrepresent the facts. Not only is the ICT sector making significant progress in decarbonizing, but ICT is also a powerful technology that enables other sectors to become more energy efficient.

KEY TAKEAWAYS

- Many claims overstate the energy and carbon impacts of ICT by a factor of 10 or more. No, YouTube views of the hit song "Despacito" don't consume more electricity than five African nations, and video streaming does not produce as much emissions as France.
- The ICT industry is one of the few sectors that is "on track" to decarbonize and is the first to develop sectoral, science-based targets to limit global warming. Tech companies account for half of all corporate procurement of renewables.
- ICT may already yield net reductions in global energy/carbon impacts as digital services optimize or replace traditionally non-ICT activities, such as using telework to reduce business travel.
- Digitalization can enable smarter use of energy in buildings, manufacturing, transportation, cities, and a host of other areas. Widespread digitalization of homes and commercial buildings could reduce annual electricity demand by nearly 25 percent.

INFORMATION TECHNOLOGY & INNOVATION FOUNDATION | SEPTEMBER 2019

Sorry, wrong number! Fact-checking the headlines

- YouTube views of ‘Despacito’ consume as much electricity as five African countries

-- BBC, *The Guardian*, *Fortune*, Al Jazeera

Claim: 5 billion views of ‘Despacito’ consumes 1 TWh of electricity

Is this reasonable? No. For this to be true, YouTube would have to consume 930 TWh, more than 4x all data centers

Better estimate: 5 billion views ~ 0.005 TWh

Data services have grown exponentially, but energy demand has stayed flat

Between 2010 and 2018, data center:

- Storage capacity increased 26x
- IP traffic increased 11x
- Workloads increased 6.5x

But

- Computing efficiency doubled every 1.6 years
- Storage energy intensity decreased 90 percent
- Average PUE decreased 25 percent

Electricity Demand	2010	2018
Data Centers	194 TWh	205 TWh
World	17,900 TWh	23,000 TWh
Share	1.08 %	0.89%

Source: Masanet *et al.* (2020), IEA (2020)

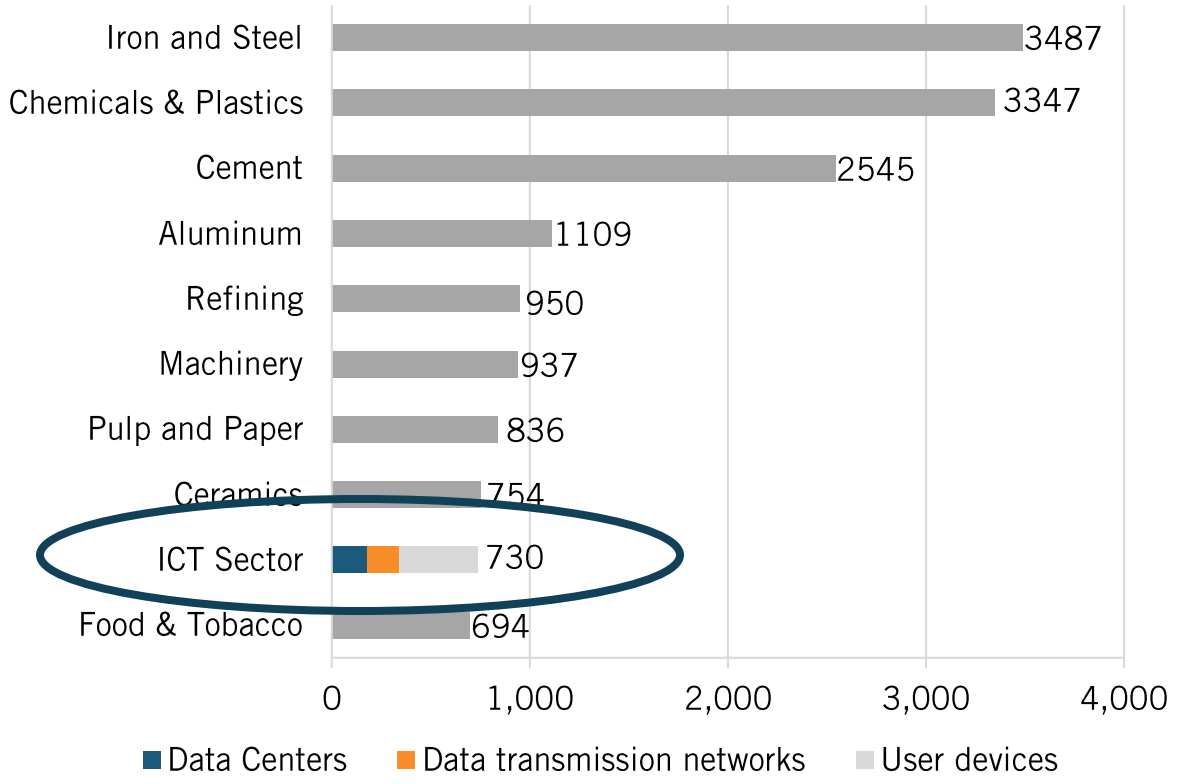
Carbon Footprint of the ICT Sector

Like all sectors, the ICT sector will have to do its part to address global climate change.

ICT accounts for

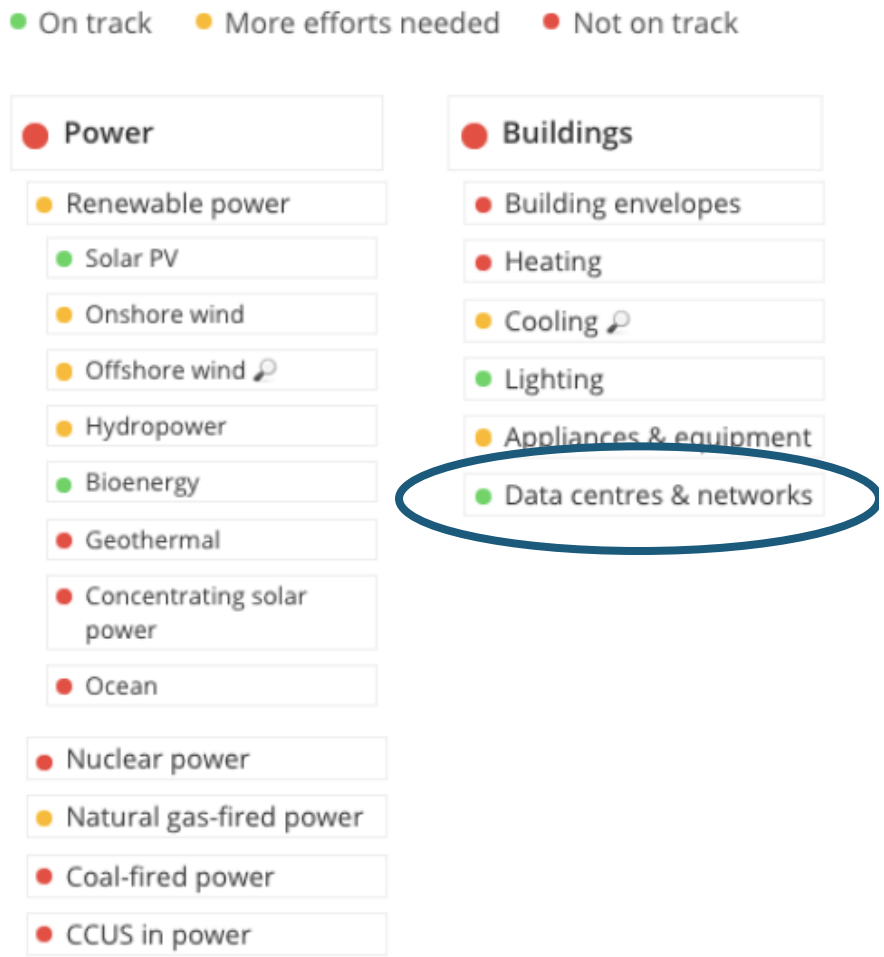
- 4 percent of electricity demand
- 1.4 percent of GHG emissions

Figure 5. Global GHG Emissions by Industry in 2014



Source: Malmodin (2018) and Rissman (2020)

Data centers and networks are “On track” for a 2 °C scenario

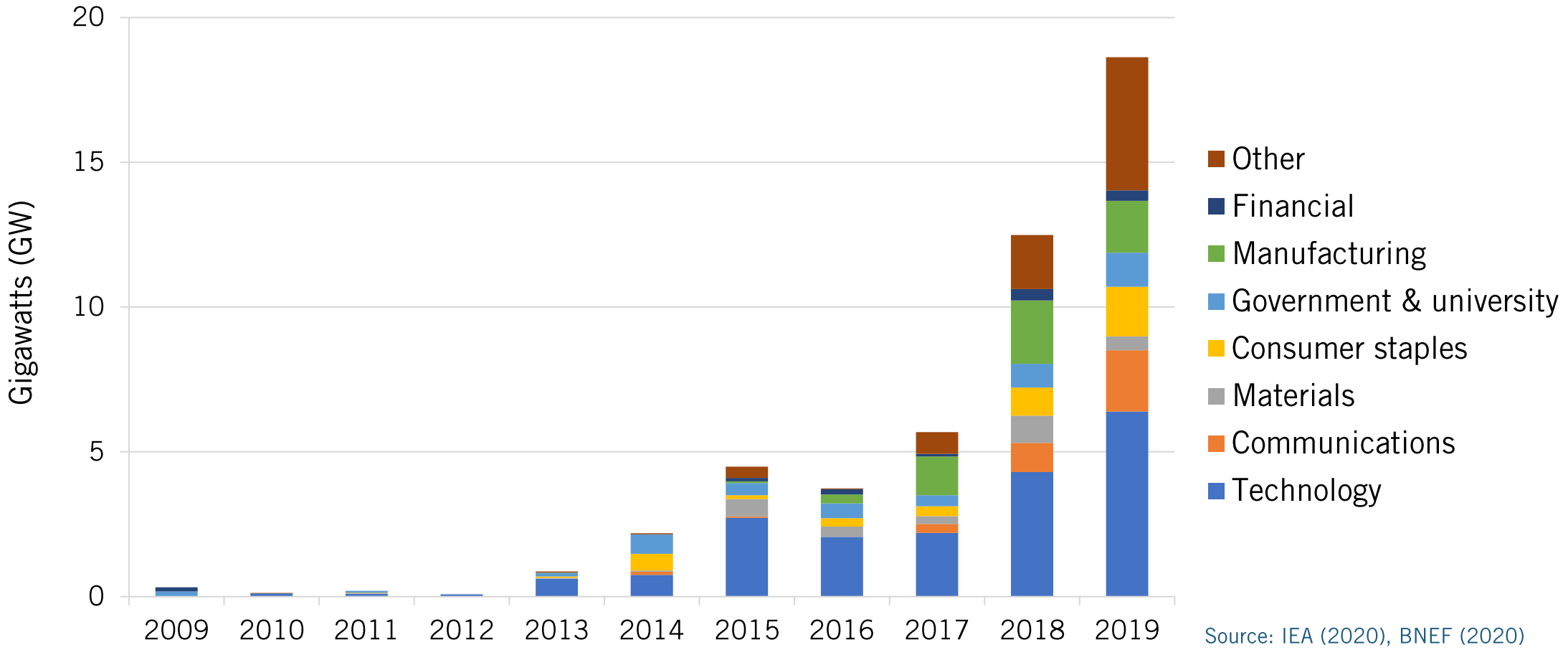


3 reasons the IT sector is “On track” to decarbonize:

1. Rapid improvements in efficiency have kept energy demand flat
2. Tech companies are decarbonizing their own electricity supply faster than the grid
3. ICT was the first industry to develop sectoral targets approved by the Science Based Target Initiative

Source: IEA (2020)

ICT companies lead in corporate procurement of clean energy



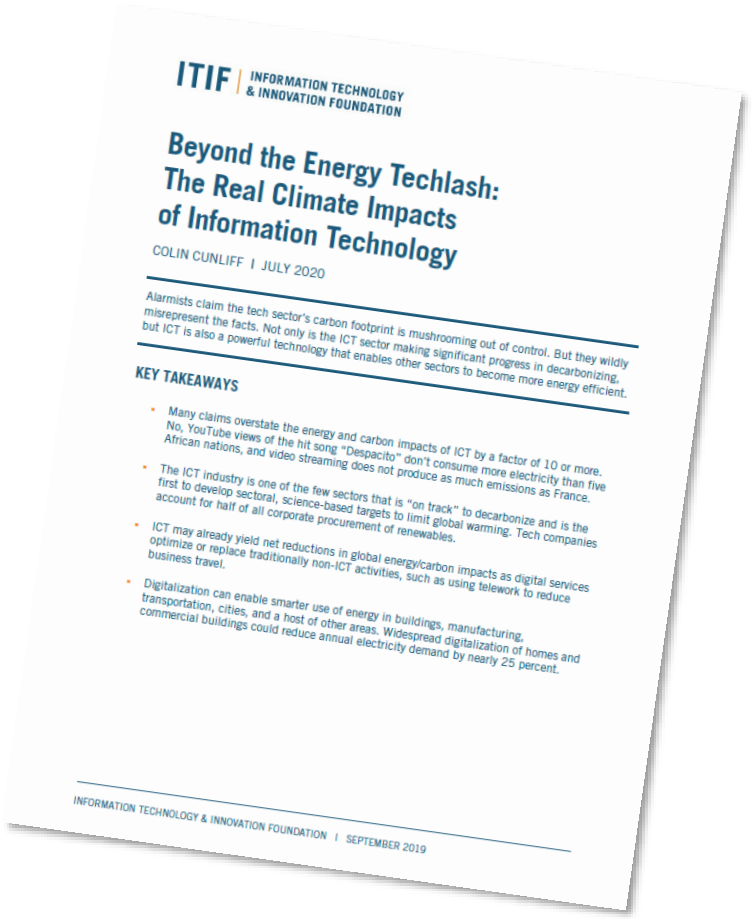
Source: IEA (2020), BNEF (2020)

ITIF report: Beyond the Energy Techlash

1. What is the energy and carbon footprint of information technology?

2. How does integration of IT (aka "digitalization") affect energy use in other sectors?

https://itif.org/energy-techlash


ITIF | INFORMATION TECHNOLOGY & INNOVATION FOUNDATION

Beyond the Energy Techlash: The Real Climate Impacts of Information Technology

COLIN CUNLIFF | JULY 2020

Alarmists claim the tech sector's carbon footprint is mushrooming out of control. But they wildly misrepresent the facts. Not only is the ICT sector making significant progress in decarbonizing, but ICT is also a powerful technology that enables other sectors to become more energy efficient.

KEY TAKEAWAYS

- Many claims overstate the energy and carbon impacts of ICT by a factor of 10 or more. No, YouTube views of the hit song "Despacito" don't consume more electricity than five African nations, and video streaming does not produce as much emissions as France.
- The ICT industry is one of the few sectors that is "on track" to decarbonize and is the first to develop sectoral, science-based targets to limit global warming. Tech companies account for half of all corporate procurement of renewables.
- ICT may already yield net reductions in global energy/carbon impacts as digital services optimize or replace traditionally non-ICT activities, such as using telework to reduce business travel.
- Digitalization can enable smarter use of energy in buildings, manufacturing, transportation, cities, and a host of other areas. Widespread digitalization of homes and commercial buildings could reduce annual electricity demand by nearly 25 percent.

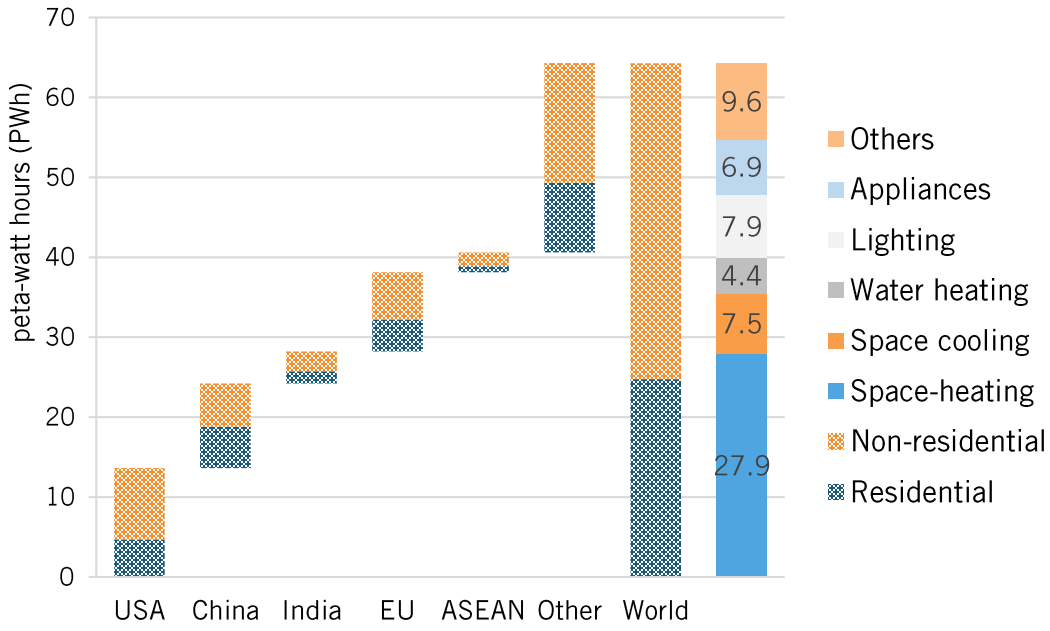
INFORMATION TECHNOLOGY & INNOVATION FOUNDATION | SEPTEMBER 2019

Digitalization enables efficiencies in buildings

Homes and commercial buildings account for 1/3 of global energy demand and 55 percent of electricity.

- Smart sensors and controls can enable peak demand reductions of 10-20%, saving U.S. consumers $18 billion in annual energy costs.
- Smart thermostats can reduce heating & cooling demand by 15-50 percent.
- ICT could reduce global annual building energy demand by 4.65 PWh (nearly 25 percent) by 2040, at an energy cost of only 275 TWh.

Figure 8. Cumulative energy savings in buildings from widespread digitalization (2017-2040)



Source: IEA (2017)

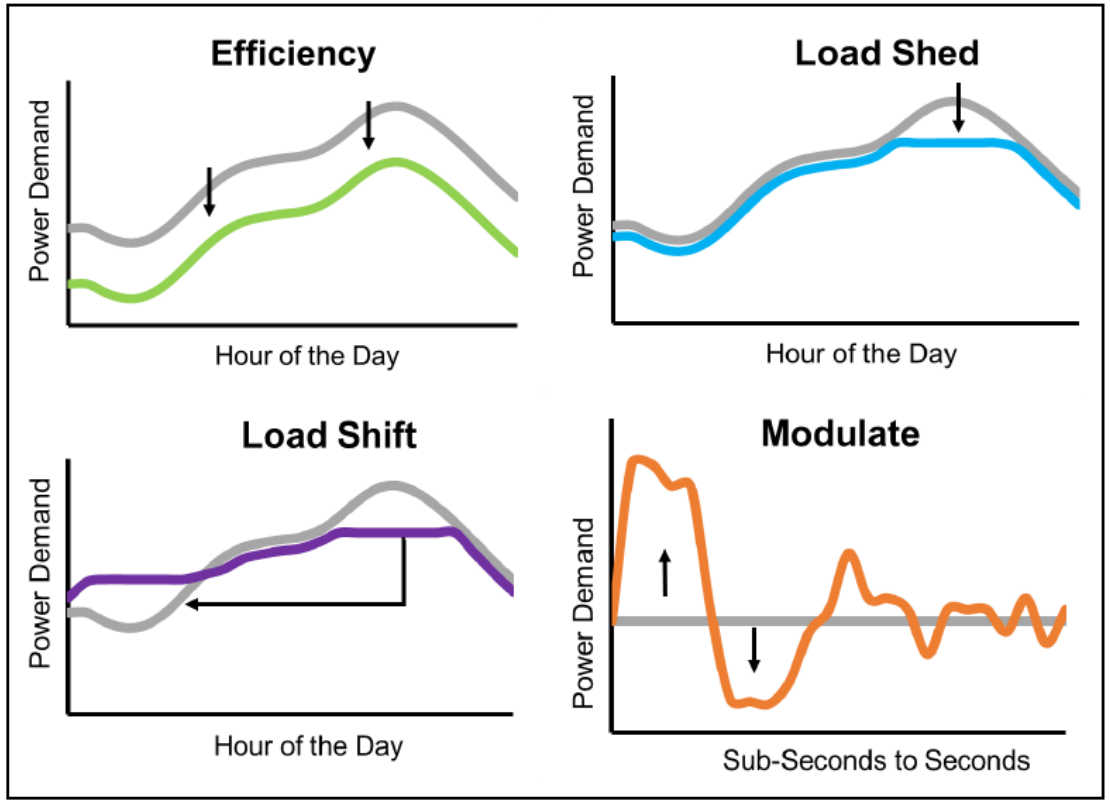
Grid-integrated buildings provide demand management benefits

U.S. DOE is launching a new initiative for grid-integrated efficient buildings.

Benefits:

- Improved reliability and resilience
- Greater demand response, reducing peak demand (and avoided capacity buildout)
- Avoided curtailment of wind and solar
- Optimized use of distributed energy resources (e.g. rooftop solar, storage)

Figure 9. Changes in building electricity demand as a result of demand-side management tools



Source: DOE (2019)

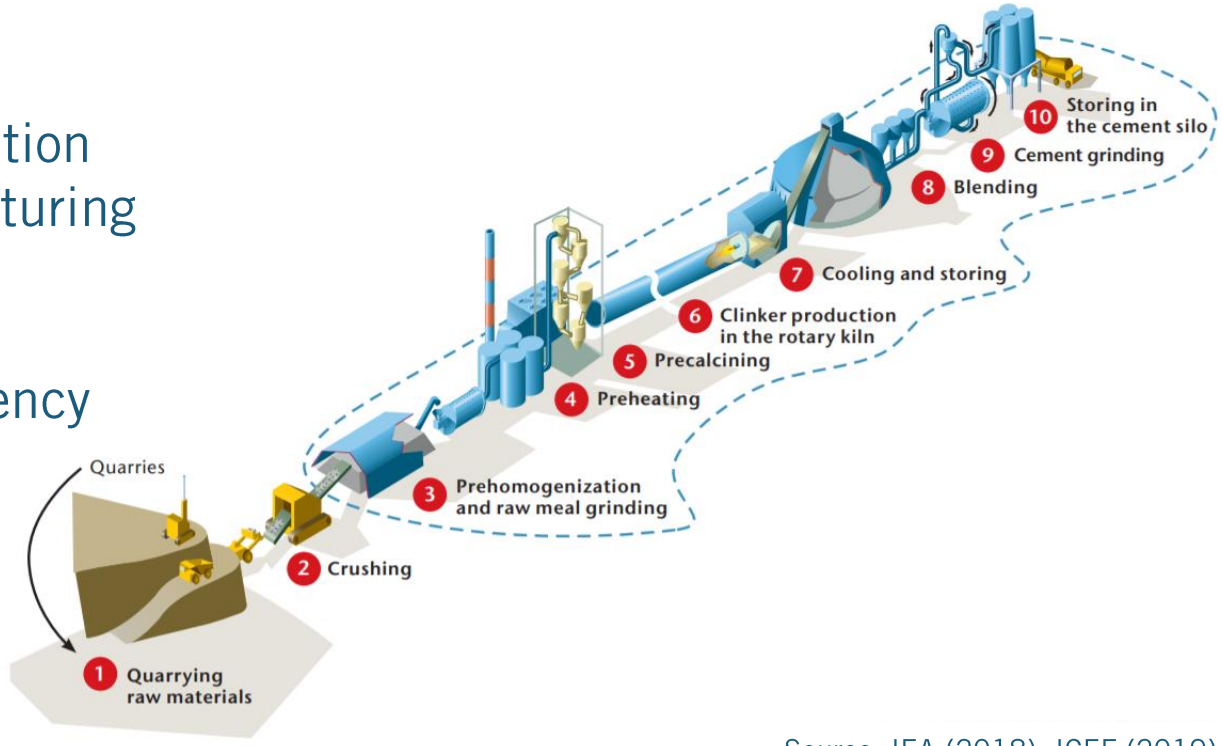
ITIF Digital Mfg. Reports

Digital Manufacturing Saves Energy

Industrial facilities account for 38 percent of global final energy consumption (32 percent of US energy).

U.S. Smart Manufacturing Leadership Coalition estimates that integrating ICT into manufacturing could yield:

- 25 percent improvement in energy efficiency
- 25 percent reduction in packaging
- 40 percent reduction in water usage

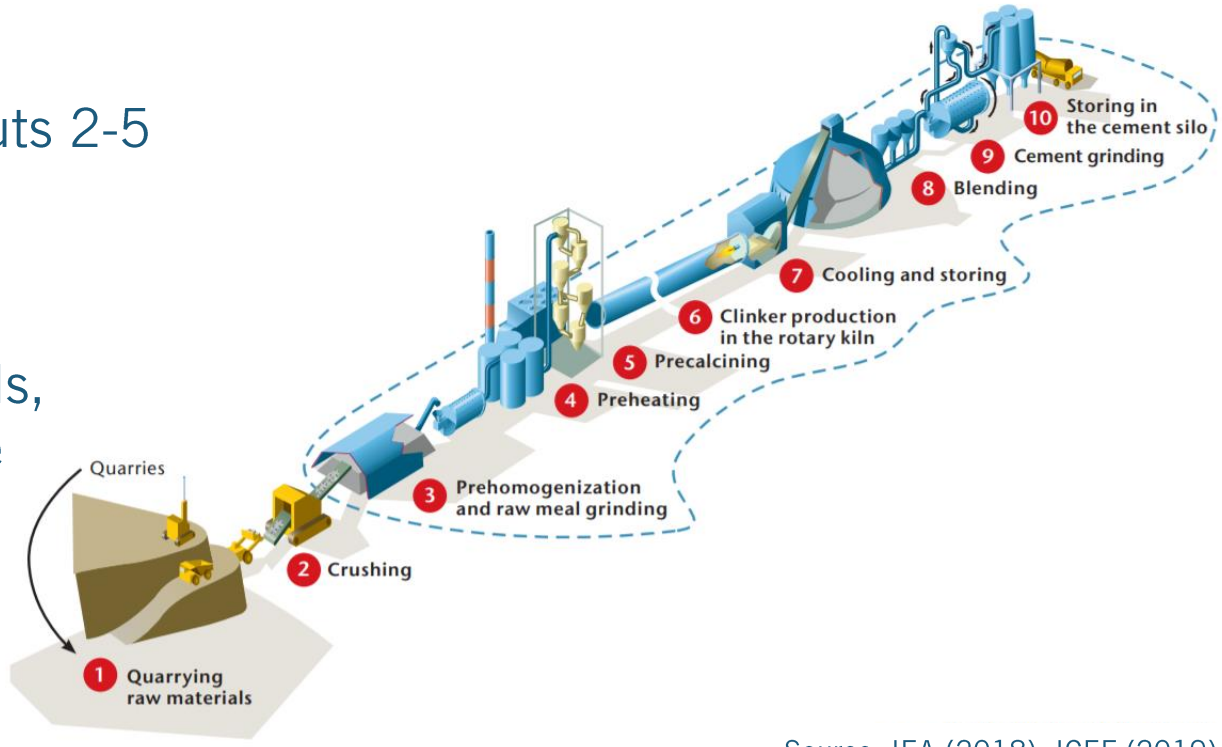


Source: IEA (2018), ICEF (2019)

Digital Manufacturing in the Cement Industry

Smart manufacturing is especially important for hard-to-abate sectors, such as cement, steel, and chemicals.

- Petuum – using AI to reduce energy inputs 2-5 percent and increase yields 2 percent
- Argos / DOE / University of Louisville partnership to integrate predictive models, data analytics, sensors, and AI to reduce energy intensity of clinker
- Lafarge Holcim – using "digital twins," automation, AI, and robotics to improve efficiency 15-20 percent

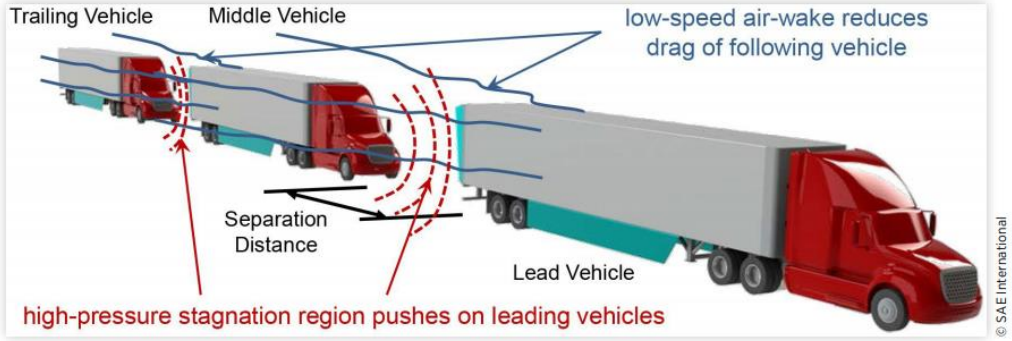


Source: IEA (2018), ICEF (2019)

Digitalization enables efficiencies in Transportation

Transportation accounts for 70 percent of petroleum use and 28 percent of U.S. GHG emissions.

- Adaptive traffic signals use signal timing to reduce congestion & idling, lowering emissions by 8.5 percent compared to "dumb" traffic signals.
- Platooning trucks can reduce fuel consumption by 10-17 percent.
- "Wake-energy retrieval" enables a plane to fly in the wake of another, reducing fuel by 5-10 percent (at 2 miles apart).



Source: NREL, NRCC (2018)

Source: Airbus (2016)

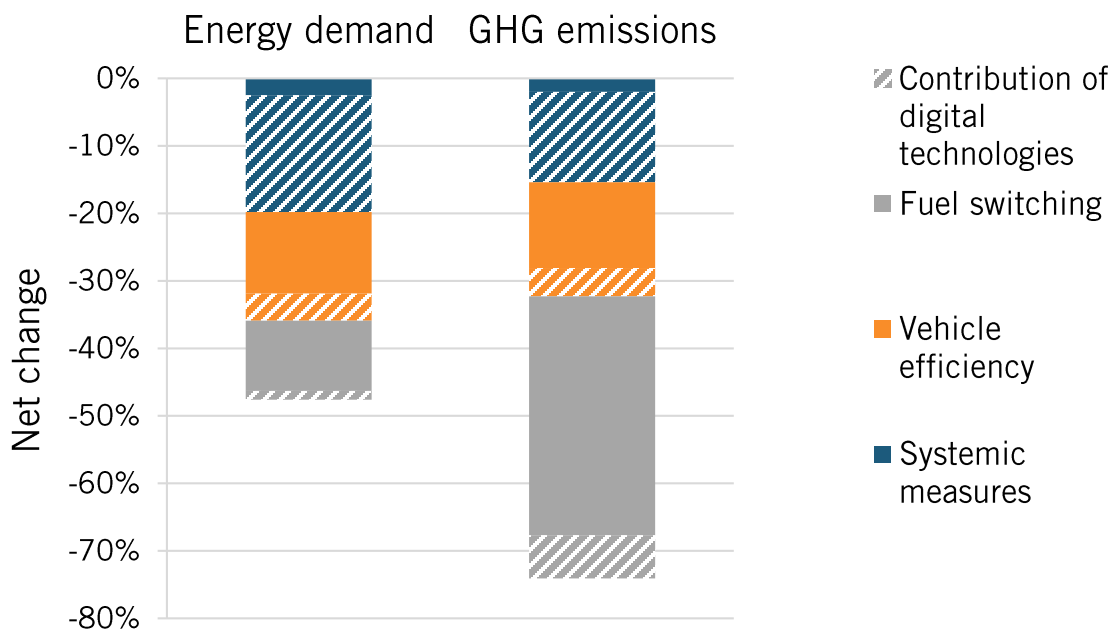
Digitalization enables efficiencies in Transportation

IEA's "Future of Trucks" identifies decarbonization opportunities:

- Systemic measures (e.g. platooning & route optimization)
- Improved vehicle efficiency (e.g. automatic tire pressure adjustment)
- Fuel switching to low-carbon fuels (including electricity)

Digital technologies can reduce trucking
- Energy demand: 23 percent
- GHG emissions: 24 percent

Figure 10. Digitalization's impact on energy use and emissions reductions in freight trucking



Source: IEA (2017)

Thank You!

Colin Cunliff | ccunliff@itif.org | @colin_cunliff