Intelligent Efficiency / Internet of Things
Part of the Clean Energy Solution?

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May 12, 2016
Spiraling global temperatures

Paris Climate Agreement:
- Stay under 2°C
- Strive for 1.5°C

Climate Lab Book, https://t.co/YETC5HkmTr
86% reduction in GHG emissions by 2050 (below 2010)

- All sectors: transportation, industry, commercial, residential
- All fuels: coal, oil, gas, electricity…

How can Intelligent Efficiency be a key piece of the climate solution?

Benefits
- Energy savings
- Resource savings
- Behavior

Impacts
- Energy use
- Manufacturing
- Cloud
Residential examples: Resource savings from smart appliances

- **Smart thermostat**
  - Heating/cooling energy

- **Light bulbs**
  - Electricity

- **Refrigerator**
  - Food

- **Irrigation**
  - Water

- **Internet**
  - Dematerialization
Net benefits

Benefits

Impacts
More devices, more of them “smart”
NRDC study: Always-On = 23 percent of CA residential electricity use

- IOT devices always-on
- Always-on load represents 23 percent of residential electricity use in CA
Design IOT for low energy

- IOT devices can use more energy Off than On

- Two key low-energy design opportunities:
  1. Low-power connected standby
  2. Minimize active time

Energy use of hypothetical smart LED bulb

- On: 10 watts, 2 hours/day
- Off: 1 watt, 22 hours/day

Hypothetical power draws and duty cycle, for illustration purposes only
Energy-smart design AND use

**Energy-smart design**
- Low connected standby power
- Auto-power down from active

**Energy-smart use**
- Enabled end-to-end
- Enable energy efficient behavior
Under the hood of IOT

- IOT impacts beyond use phase
  - Manufacturing supply chain:
    - Raw material
    - Production
    - Transportation
  - “Data supply chain”:
    - Cloud data centers
    - Internet and cellular network

(* Hypothetical example for illustration purposes, varies depending on use. Sources: Goldstein D., Delforge P., ACEEE 2015, Apple (production, use), Koomey J. (network use), Google (cloud).
## IT enabling effect: benefits and impacts

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- Public policy ultimately determines whether technology is used for net positive or net negative impacts
Summary

- IOT / Intelligent Efficiency critical for transition to low-carbon society
- But much remains to be done for IE’s environmental promise to be realized
- IOT devices need to be designed and used to consume the least energy possible
- Public policy needs to guide the enabling effect to uses that benefit society
THANK YOU!