Intelligent Efficiency as a Compliance Strategy Under EPA's Clean Power Plan

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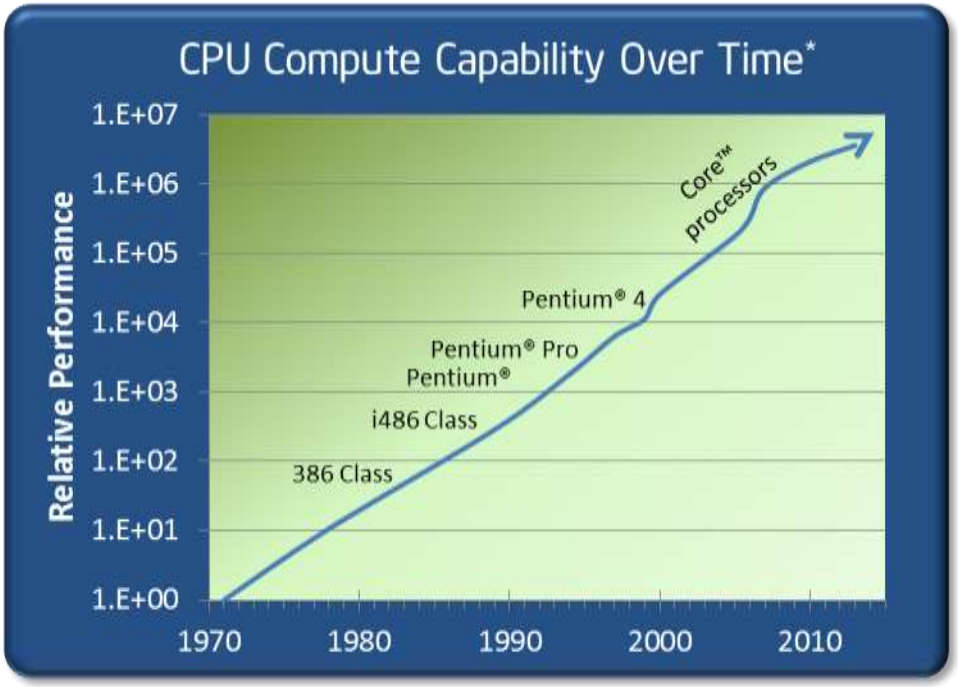
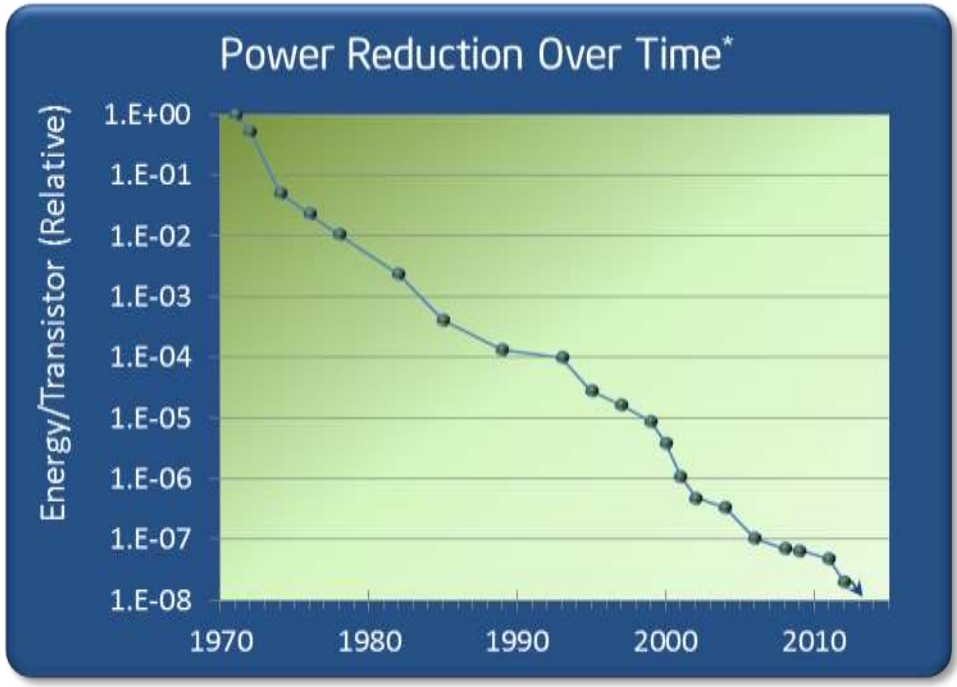
“Footprint” vs. “Handprint”

- ICT’s “footprint” = its own direct, negative contribution to the climate problem

- ICT’s “handprint” is how it enables much larger reductions in the footprint of other sectors

Moore's Law drives Energy Savings at the Silicon Level



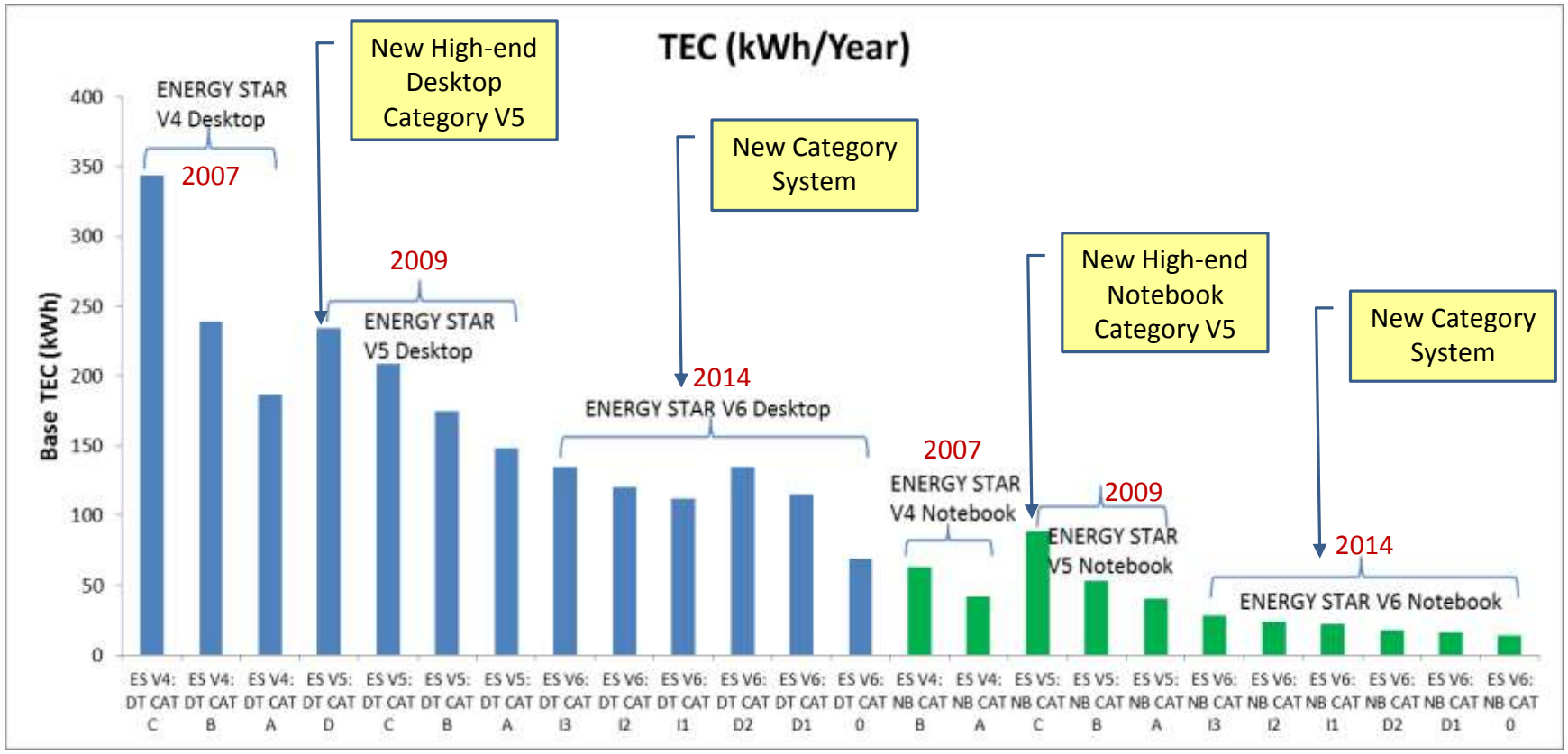


Source: Intel Corporation – January 2014. Relative performance chart estimates based on reported MIPS and SPEC CPU scores over this time period (as configurations and workloads change with time)

- Delivering great performance within power envelope
- Compute Energy Efficiency ➔ Positive Impact On Environment

Source: Intel Corp.

ENERGY STAR PC generational improvements (V4 through V6) (Lower Energy Consumption and Additional categories)



Voluntary program complementing market driven EE improvements

Source: Intel/US EPA

Framework for Intelligent Efficiency

(per ACEEE)

People-Centered Efficiency (Real-Time Feedback):
real-time information & management tools enable consumers, building operators, manufacturers, to lower their energy consumption in response to changing information.

Digital Energy Management (Automation & Optimization):
sensors, controls & simulations automate business processes or building operations to optimize energy use, bypassing need for people to respond.

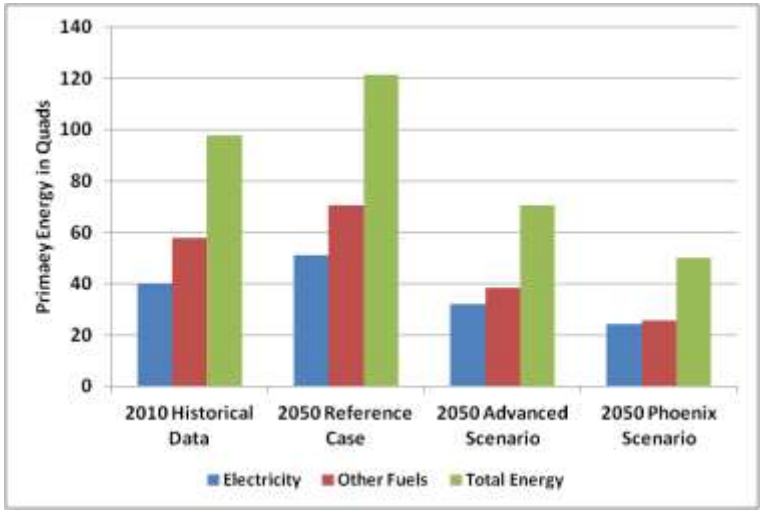
Substitution with Energy-Saving ICT Services (Dematerialization):
Shifting behaviors, services & markets in ways that displace more energy-intensive activities reducing energy use.

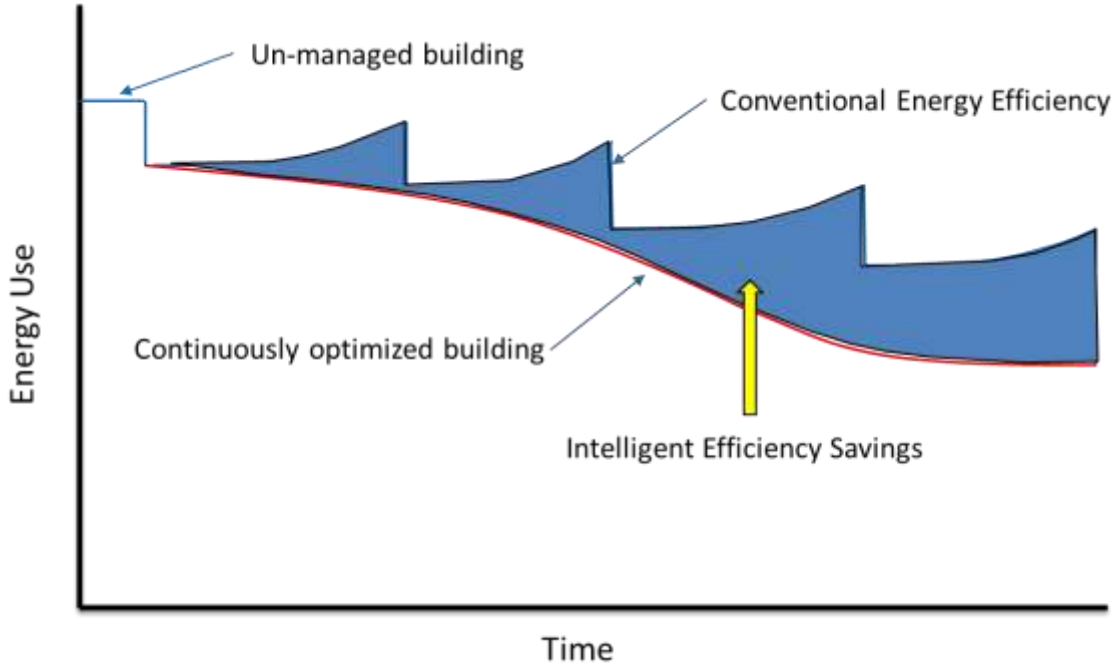
Crosscutting Intelligent Infrastructure:

ICT systems enable more integrated, smarter & more reliable infrastructure: intelligent grids, smart cities, smart transportation & communications networks

Intelligent Efficiency Savings Significant

- Intelligent efficiency savings:
  - ICT: 12% (WWF), 13-22% CO2 (GeSI)
  - Semiconductor-enabled: 27% (ACEEE)
  - 2050 energy efficiency: ~60% (ACEEE)
- ICT resource use vs. savings:
  - CO_2: 1 to 5 (GeSI); kWh: 1 to 10 (ACEEE)





- Intelligence enables using energy smarter
- Reduces waste
- Increases value from energy
- Enables expanded use of low-carbon energy sources
- Reduces overall carbon emissions

Key Potential for Intelligent Efficiency

- "Intelligent Efficiency" describes the application of information and communications technologies (ICT) to derive significant energy efficiency gains through specific applications like the smart grid, smart transportation, and building energy management systems.

- Numerous US and EU studies have shown the potential for IE to yield very significant and cost-effective energy efficiency savings.
  - Energy efficiency is the "first fuel" and IE is the most cost-effective variety of energy efficiency

EPA has allowed states to consider a number of technologies for 111d compliance

OTHER OPTIONS

Carbon capture and sequestration

Demand response*

Grid-connected renewables (offshore wind, DG, biomass, wave and tidal power)

Energy storage**

Zero-emitting fuel cells

End-use energy efficiency ESCOs, behavioral programs, appliance replacement, building energy codes, appliance codes

CHP, WHP, and cogeneration

New and incremental nuclear

T&D efficiency (VVO, CVR, smart grid)

BSER

Renewables (onshore wind, utility-scale solar PV and CSP, geothermal, hydro)

Coal-to-existing NGCC switching

Heat rate improvements

*Eligible to the extent it reduces net MWh end-use.
**Eligible to the extent it boosts renewable generation.

Source: AEE

The Market Potential

- End-use energy efficiency applications are heavily influenced by government incentives and other policies
  - State energy programs, PUC incentive programs
- Stringency of EPA's targets, and cost-effectiveness of energy efficiency = Clean Power Plan could be strongest market driver for Intelligent Efficiency ever
- **What's missing: Evaluation, Measurement and Verification (EMV) protocols that enable states and project sponsors to quantify savings of specific IE measures**
  - **States can only claim credit for what they can reliably count/quantify**

The IE Protocol Project

- Objectives:
  - Promote the creation of “deemed savings” EMV protocols for 10-20 Intelligent Efficiency applications
  - Ensure that the states include IE applications in their 111d implementation plans
  - Ensure that Clean Power Plan implementation creates powerful market driver for IE going forward
  - Ensure that IE EMV protocols developed in this project find applicability in EU, UN and other programs

- Two (concurrent) phases:
  1. Marketing: Reach out to states to let them know re Intelligent Efficiency potential and the development of protocols and include IE in their implementation plans; reach out to recruit companies to participate
  2. Technical: Promote the development of the EMV protocols, working with established expert groups and working based on existing uniform methods (International Monitoring and Verification Protocols)

- Project partners
  - ACEEE -- provide the technical lead in protocol development
  - C2ES - - provide “marketing” lead
  - DESSC – help with funding and marketing to companies (see Backup)

- Seed funding provided by the Energy Foundation, DESSC, Intel

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