

Smart Grids

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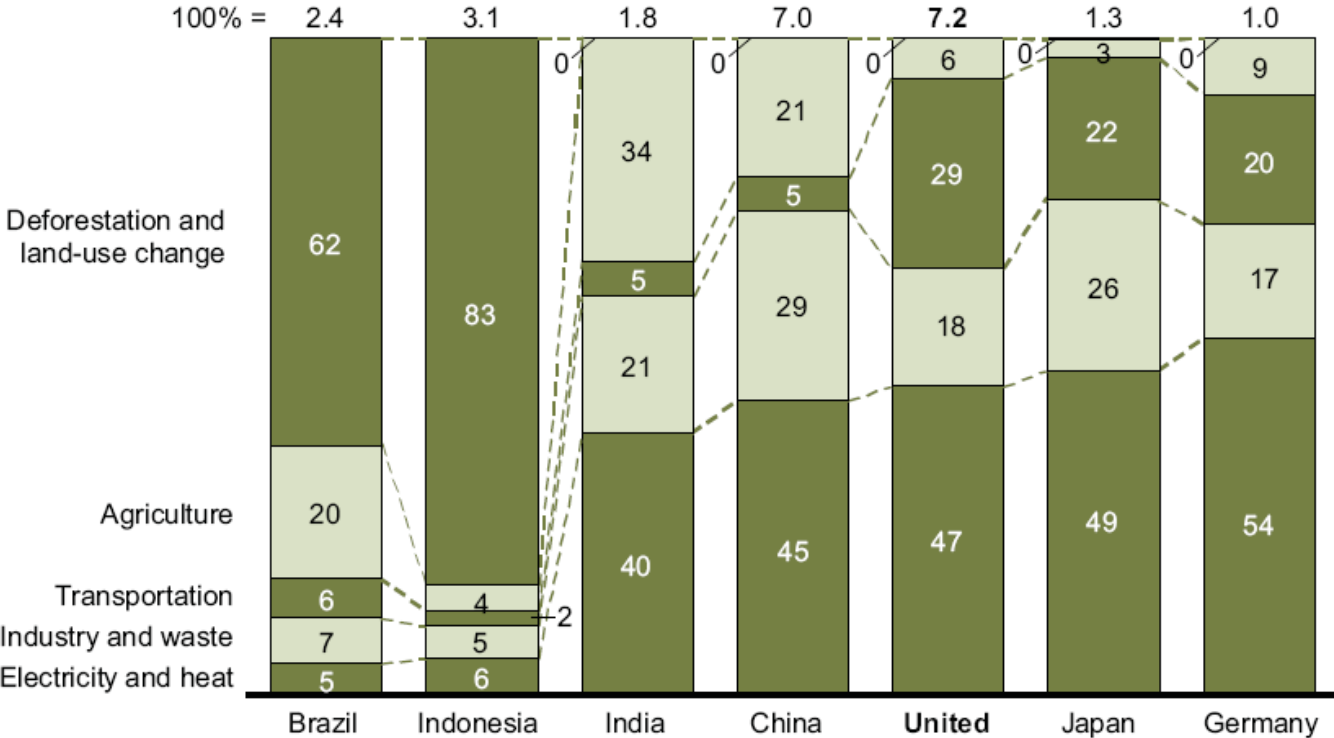
Vice President, Intel Labs



Green House Gases (GHG) Emissions

GHG EMISSIONS PROFILES FOR SELECT COUNTRIES – 2005*

Percent, Gigatons CO₂e



* Carbon sinks are not shown

Source: UNFCCC, WRI, IEA, EPA, McKinsey analysis



Green House Gases (GHG) Emissions

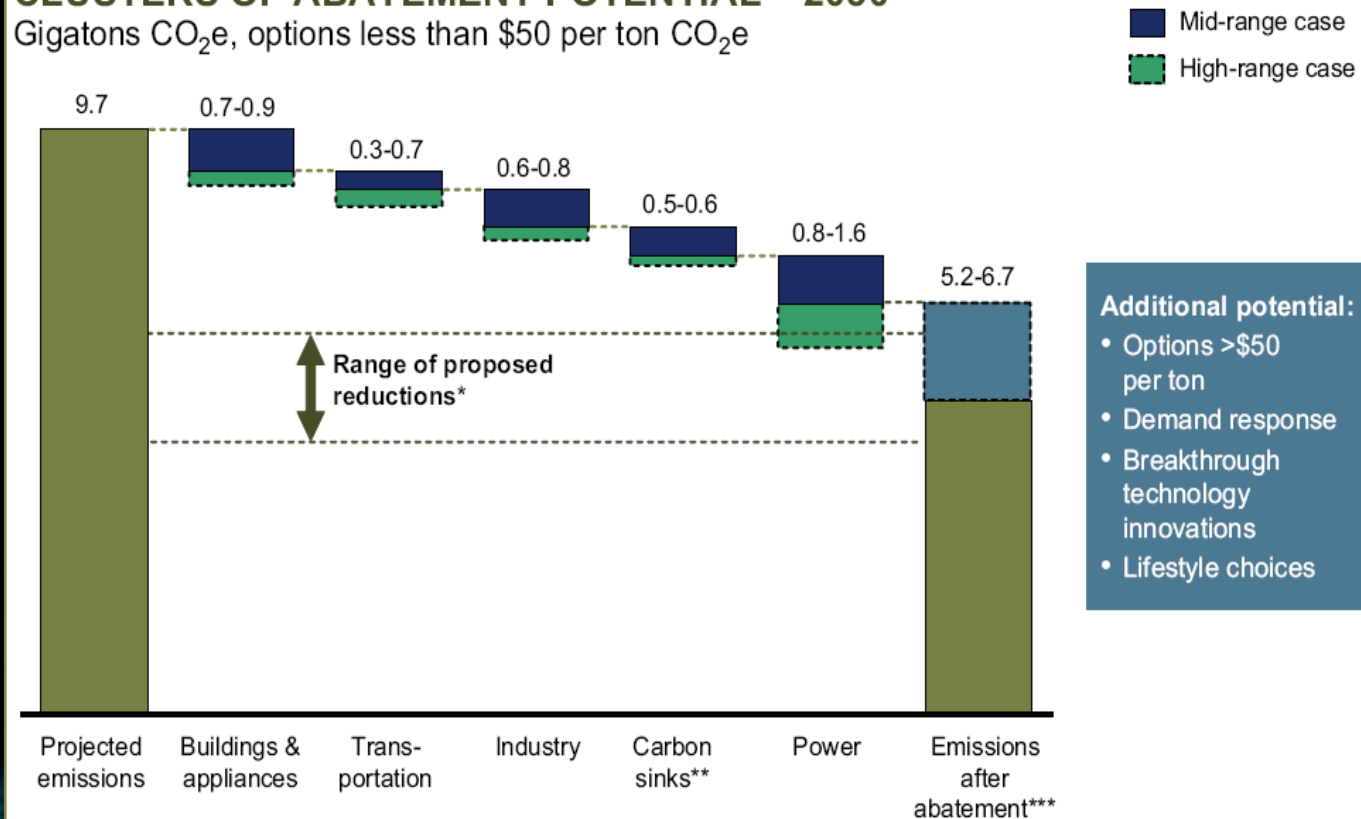
Various contributors:

Electricity & Heat, Transportation, Deforestation, ...

GHG abatement potential

CLUSTERS OF ABATEMENT POTENTIAL – 2030

Gigatons CO₂e, options less than \$50 per ton CO₂e



* Based on bills introduced in Congress that address climate change and/or GHG emissions on an economy-wide basis and have quantifiable targets; targets calculated off the 2030 U.S. GHG emissions of 9.7 gigatons CO₂e/year (reference case)

** Including abatement in the agriculture sector

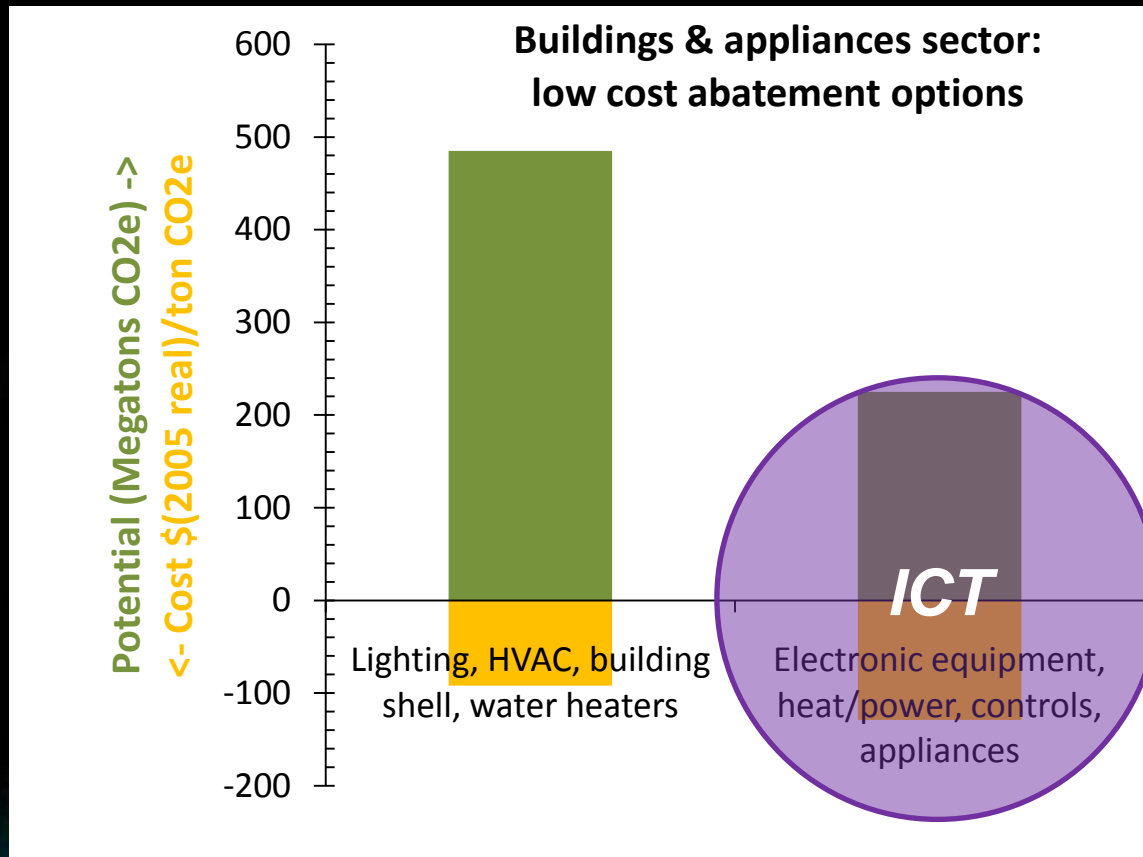
*** Adjusted for cumulative rounding errors

Source: U.S. EIA; EPA; USDA; McKinsey analysis

GHG abatement potential

Highest potential:
Power + Buildings & appliances

SMART buildings



Intergovernmental Panel on Climate Change, 2007:

*The buildings sector offers the **largest low-cost potential** in all world regions by 2030.*

Microgrid – the edgy SMART grid

- Philosophy
 - Local intelligence & management with ICT
- Inside a building
 - Energy efficient operation of appliances and equipment in home, office, factory, ...
- Across buildings
 - Local energy generation and consumption, energy storage for neighborhood, campus, complex, ...
- Across infrastructures
 - Energy efficient transportation of people, goods, services



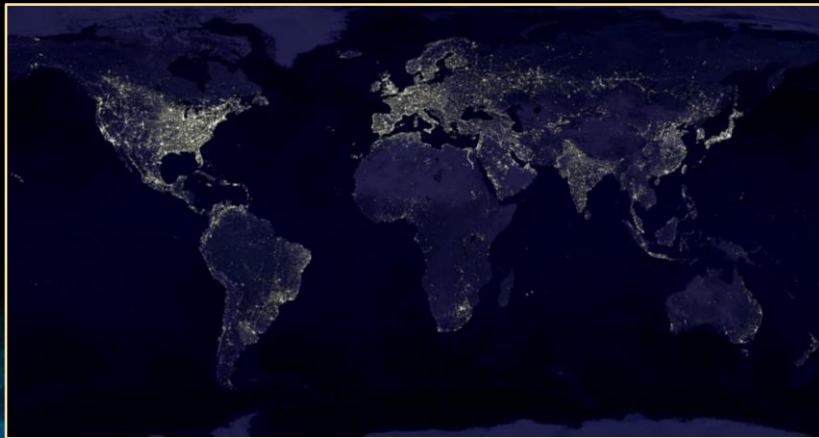
Vision



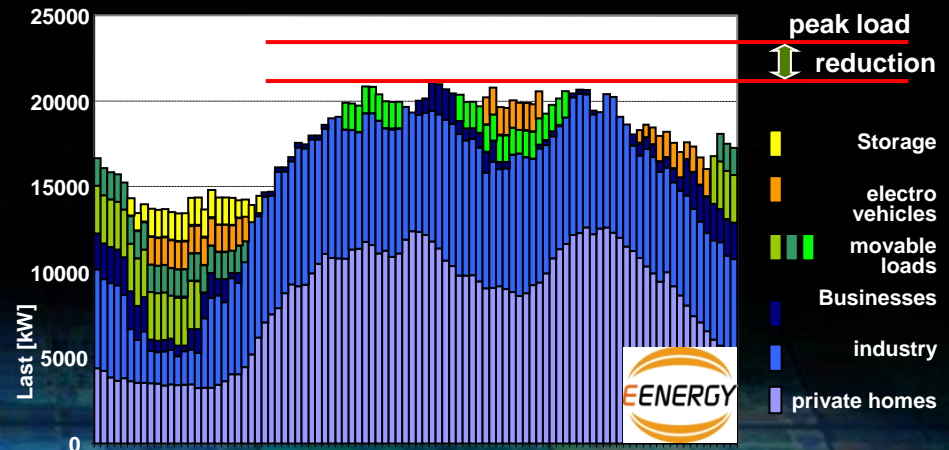
Save money, make money



Be energy independent



Banish blackouts



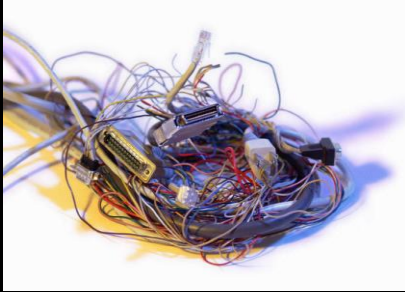
Reduce peak loads

Earth image owned by NASA, <http://visibleearth.nasa.gov/>

Peak Load reduction: *The German program to manage future power supply*, © Ludwig Karg, B.A.U.M Consult GmbH, Head of E-Energy Ancillary Research



Challenges



Billions of energy consuming devices

- Variety of devices, owners
- Cost, lack of control



Complex ecosystem, lack of standards

- Intersection of diverse industries
- Government regulations, globally variable



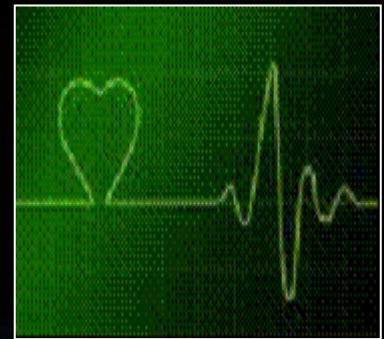
Technical

- Management across boundaries
- Privacy and security of data
- Affordable energy storage



Intel Labs Research

- Microgrids
 - Ensure security and privacy of data and devices
 - Distributed control and intelligence
 - Using storage to increase flexibility
 - Electric cars
- Intelligent control plane
 - Open protocols, APIs, measurement formats
 - Low power networking
 - Real-time monitoring and control
 - Time shifting: renewables, off-peak

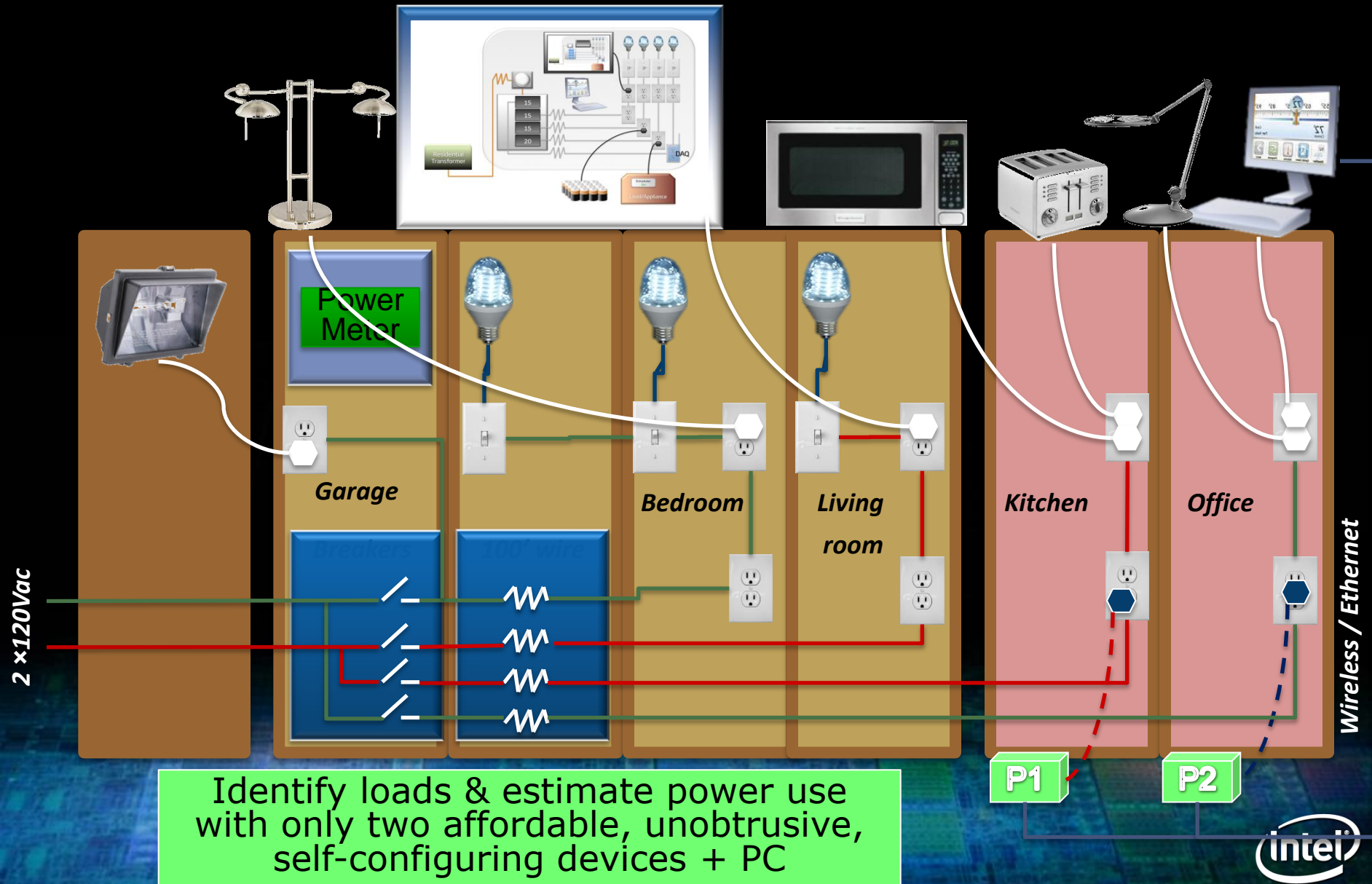


Intel Open Energy Initiative

- Objective: Accelerate the integration of intelligent renewable energy sources, Smart grids, Smart buildings, Empowered energy consumers
- Activities
 - Inform Smart energy policy
 - Leadership in smart grid standards bodies and consortia
 - Partnerships with utilities on smart grid pilots and deployment
 - Research & development of smart energy technologies
 - Strategic venture investment via Intel Capital



DEMO: Home Energy Monitoring



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