WELCOME TO ACEEE'S WEBINAR ON INTELLIGENT EFFICIENCY

Date: Tuesday, June 5th

Time: Noon EDT / 9 AM PDT

Dial-in: **+1 (877) 397-5980** or Toll: +1 (706) 645-7073

Enter Participant Passcode: **1075103 #**

(if required, your Conference ID is 86902923 #)

Tech Support if needed: **+1 (877) 283-7062**

Visit www.aceee.org to download ACEEE's new report on Intelligent Efficiency this afternoon after 1:30 PM EDT

Presenters

- **Neal Elliott,** Associate Director for Research, ACEEE
- **Paul Hamilton** Vice President, Government Affairs, North American Operations, Schneider Electric
- **Clay Nesler,** Vice President, Global Energy & Sustainability and Building Efficiency, Johnson Controls
- **Larry Plumb**, Executive Director, Emerging Issues and Technology Policy, Verizon
- **Arkadi Gerney,** Senior Director for Policy , Opower
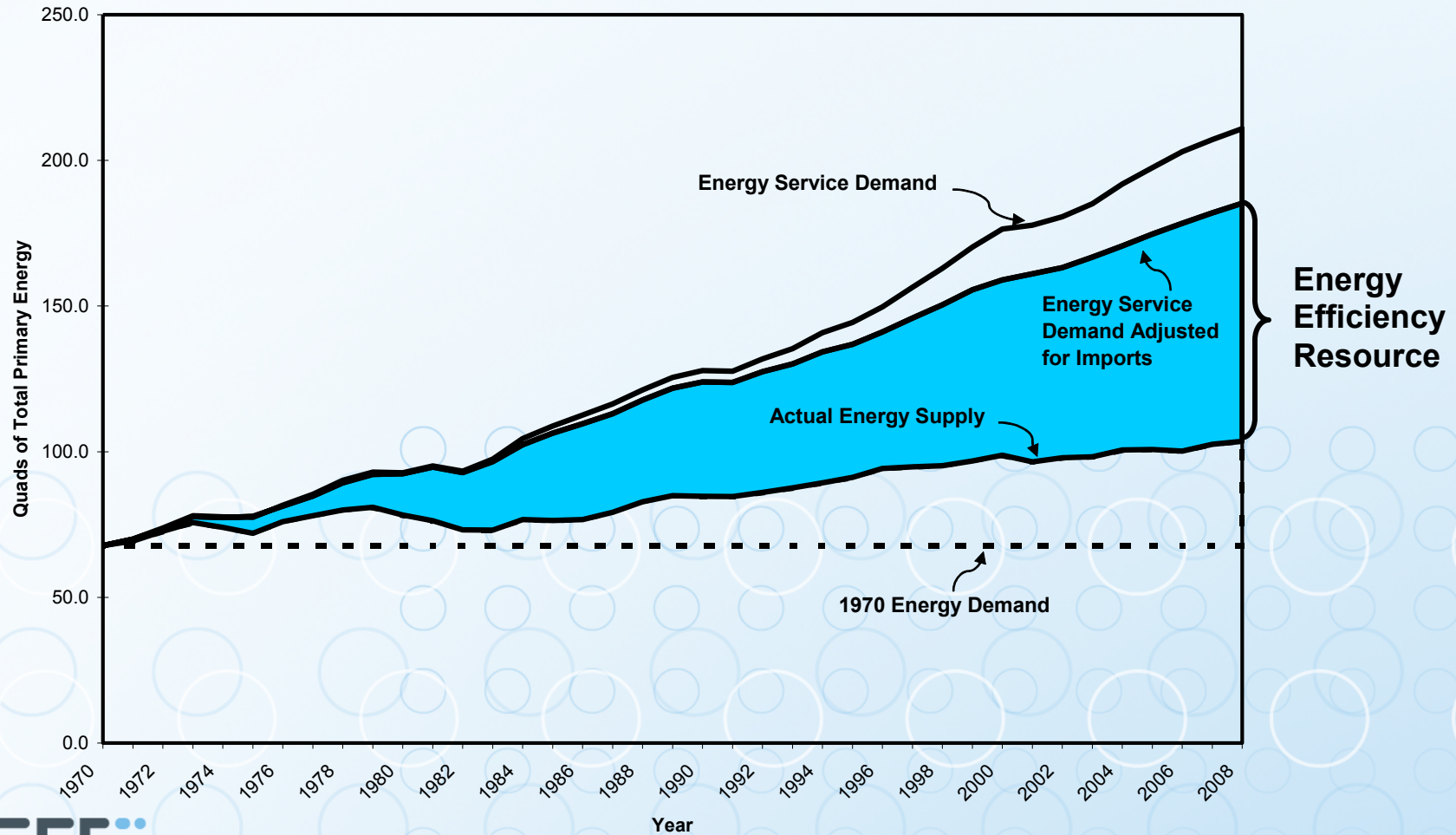- **Stephen Harper,** Global Director, Environment, Intel Corporation

A Defining Framework for Intelligent Efficiency

June 5, 2012

R. Neal Elliott, P.E., Ph.D.
Associate Director for Research
American Council for an Energy-Efficient Economy

Energy Efficiency's Past Role in Meeting US Energy Needs

U.S. Energy Use in Relation to GDP 1970-2008

Source: ACEEE

Future on Energy Efficiency—Moving Beyond Device Efficiency

- Big energy efficiency hits have come from device efficiency: cars, appliances & equipment

- Significant potential remains for device efficiency

- Even greater efficiency opportunity exists from systems—but this efficiency requires a different approach

ACEEE
American Council for an Energy-Efficient Economy

Device vs System Efficiency

- Devices are parts of systems—attacking efficiency of devices does not necessarily improve efficiency of the system

- Low-hanging efficiency opportunities already harvested—additional device-focus policies producing more modest returns—savings typically 2-5%

- Opportunities from optimization of energy-using systems huge—report fround 12-22% efficiency gain potential from ICT alone—more with network effects

- Computer, sensor & communications advances enable system efficiency opportunities

What is *Intelligent Efficiency?*

Intelligent efficiency is a systems-based, holistic approach to energy savings, enabled by information and communication technology (ICT) and user access to real-time information.

Intelligent efficiency differs from component energy efficiency in that it is adaptive, anticipatory, and networked.

ACEEE::
American Council for an Energy-Efficient Economy

![ACEEE - American Council for an Energy-Efficient Economy]

Intelligent Efficiency

*INTEGRATED, RELIABLE, and **SMART**.*

People-Centered Efficiency
Providing real-time information and management tools that enable users to lower energy consumption in response to changing information

Technology-Centered Efficiency
Using sensors, controls, and software to automate and optimize energy use

Service-Oriented Efficiency
Shifting behavior and organizational structures to reduce energy-intensive activities
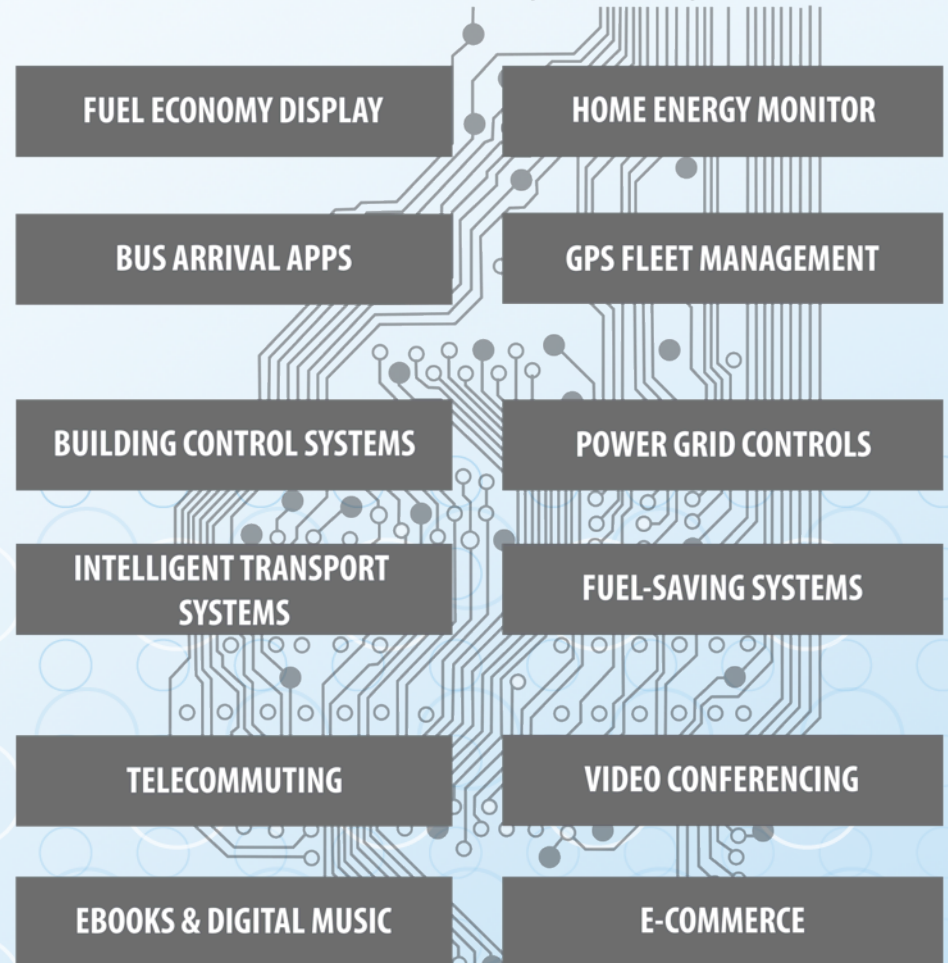
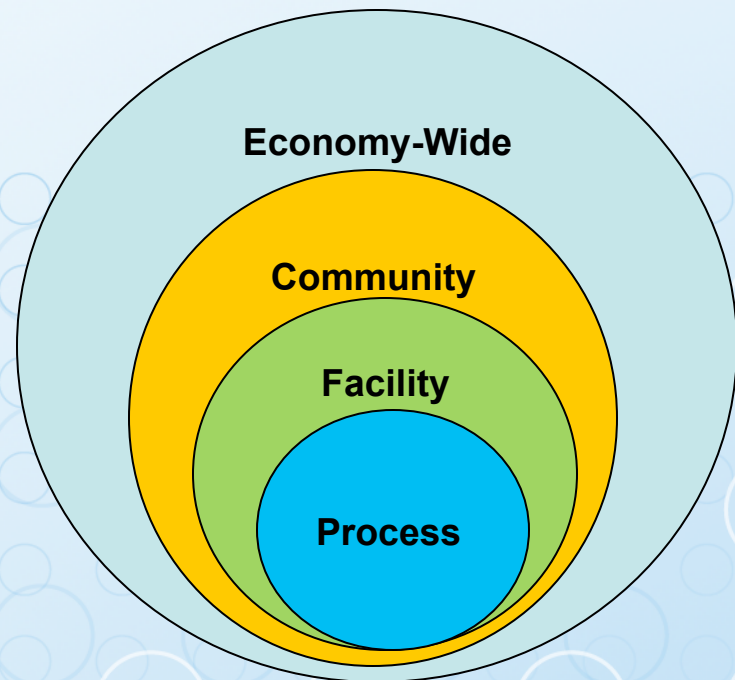|	
FUEL ECONOMY DISPLAY	HOME ENERGY MONITOR
BUS ARRIVAL APPS	GPS FLEET MANAGEMENT
BUILDING CONTROL SYSTEMS	POWER GRID CONTROLS
INTELLIGENT TRANSPORT SYSTEMS	FUEL-SAVING SYSTEMS
TELECOMMUTING	VIDEO CONFERENCING
EBOOKS & DIGITAL MUSIC	E-COMMERCE

Realizing System Efficiency through Intelligence

- Goal is optimization to meet users vary needs, not efficiency at a single point

- Requires different approach to implementation & evaluation from device efficiency

- Levels of system efficiency exist

- Expanding scope increases savings—increases complexity

- Current focus sectoral—future opportunities crosscutting

Economy-Wide

Community

Facility

Process

ACEEE::
American Council for an Energy-Efficient Economy

Policy Opportunities

- Recognition & awareness: lead by example in government & private sector

- Improving access to up-to-date, reliable & meaningful energy information

- Addressing privacy issues

- Performance-based energy efficiency codes, standards & incentives

- Alternative utility regulatory business models & alternative evaluation, measurement & verification (EM&V) apporaches

- Support enabling infrastructure, including broadband

- Encouraging innovation

ACEEE
American Council for an Energy-Efficient Economy
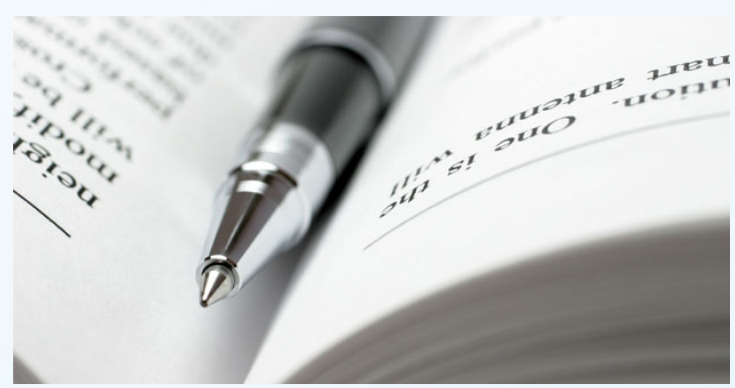
Intelligent Efficiency Advisory Group

- ARM
- California Institute for Energy & Environment
- Google
- IBM
- Information Technology & Innovation Foundation
- Information Technology Industry Council
- Intel

- Johnson Controls
- Lawrence Berkeley National Laboratory
- OPower
- Rockwell Automation
- Schneider Electric
- Southern California Edison
- U.S. Department of Energy
- Verizon

ACEEE::
American Council for an Energy-Efficient Economy

Understanding *Intelligent Efficiency* through Examples

Intelligent efficiency is:

- Complex and multidimensional

- Has been emerging for a decade

- Factors critically into business strategy of diverse group of companies.

- Best understood by examples, but the future not limited by what is happening today.

Contact Information:

R. Neal Elliott, Ph.D., P.E.

ACEEE

rnelliott@aceee.org

202-507-4009

Visit us on the Web at: www.aceee.org

Follow us on Twitter at: @ACEEEdc

Paul Hamilton
VP Government Affairs

Make the most of your energy™

Schneider Electric

Empire State Building Retrofit Project

Intelligent Efficiency in Action

Johnson Controls

JONES LANG LaSALLE®

Real value in a changing world

CLINTON FOUNDATION | CLINTON **CLIMATE** INITIATIVE

Rocky Mountain Institute

"The goal with ESB has been to define intelligent choices which will either save money, spend the same money more efficiently, or spend additional sums for which there is reasonable payback through savings. Succeeding in these efforts will make a replicable model real for others to follow"

- Anthony E. Malkin

Clay Nesler
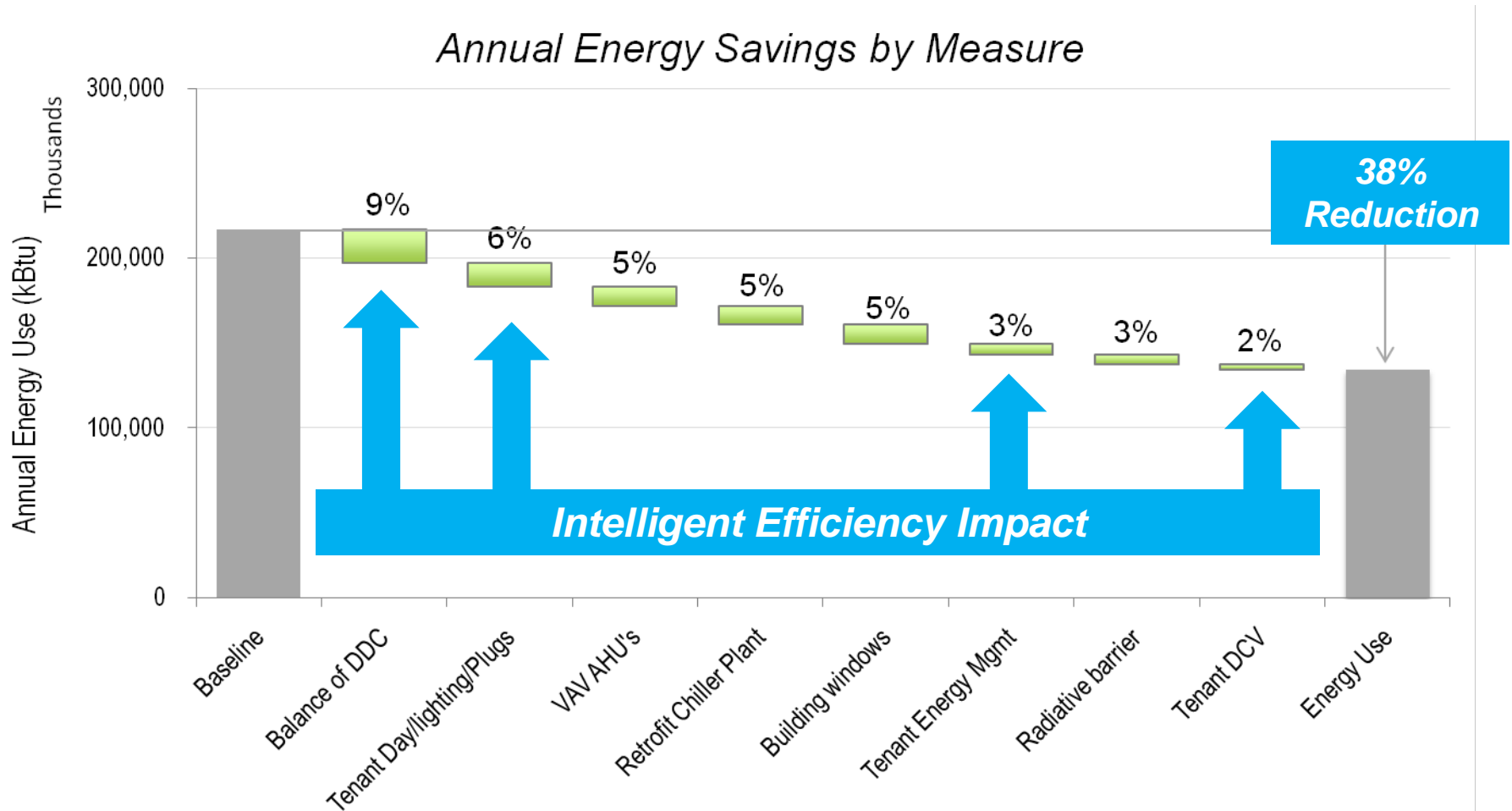
VP, Global Energy & Sustainability

Johnson Controls

05 June 2012

Johnson Controls

Eight Measures Result in 38% Reduction
Intelligent efficiency driving half the savings

Annual Energy Savings by Measure

38% Reduction

Intelligent Efficiency Impact

Johnson Controls
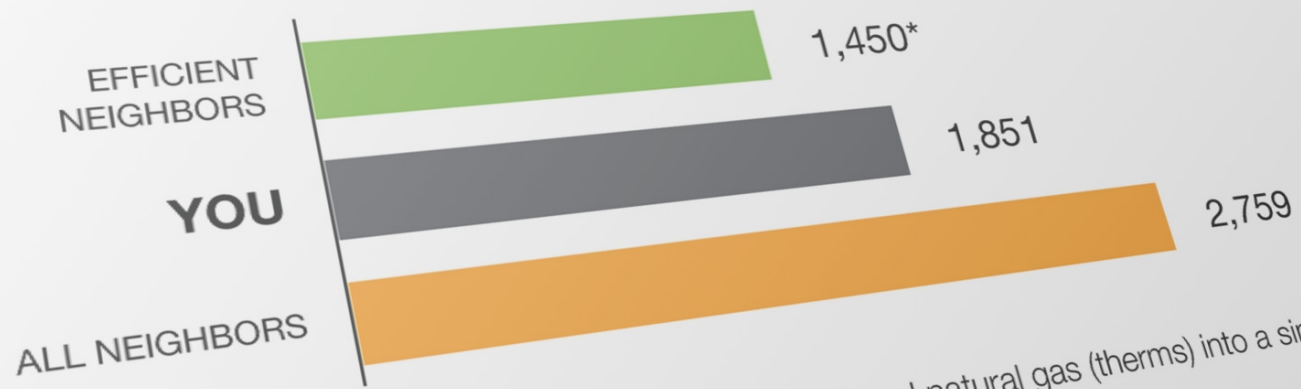
Empire State Building Retrofit Project
Intelligent Efficiency in Action

For more information about the Empire State Building Retrofit Project, visit:

www.esbnyc.com

November Neighbor Comparison

You used **28%** **MORE** energy than your efficient nei[ghbors]

GREAT

▶ **GO**[OD]

EFFICIENT NEIGHBORS — 1,450*

YOU — 1,851

ALL NEIGHBORS — 2,759

* This energy index combines electricity (kWh) and natural gas (therms) into a single measurement.

* This energy index combines electricity (kWh) and natural gas (therms) into a single measurement.

WHO ARE YOUR "NEIGHBORS"?

■ ALL NEIGHBORS
Approximately 100 occupied nearby homes that are similar in size to y[our]
(avg 2,023 sq ft) and have both electricity and natural gas service.

You used **74%**
This costs y[ou]

[Ne]ighbor Comparison

Opower's Utility Partners

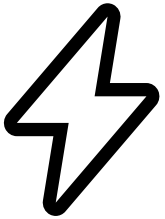**70+ Utility Clients, 10M+ Households on Platform, data from 40M homes**

Not Shown

CA	MN
»Anaheim	»MERC
»a	»Lake
»Glendale	Country
»Pasadena	Power
»Palo Alto	»Owatonna
CO	»Austin
»Loveland	»Rochester
IN	»Shackopee
»Hoosier	»Otter Tail
»NIPSCO	

1.5 – 3% savings.
It adds up across millions of homes:

>1 Terawatt-Hour (1bn kWh)
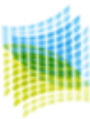**--> Enough to power 90,000 homes**

>1,520,210,000 lbs CO_2

>$100,000,000 saved on energy bills

Thank you

arkadi@opower.com

Envision Charlotte is a unique public-private partnership that will be a global model of environmental sustainability for measurable community and economic results.

Our goal is to drive dramatic reductions in energy and water consumption over the next five years, while reducing our waste and improving our air quality.

By doing so we will lower operating costs, and increase profitability for our building owners, improve the health and livability of our community, and solidify our position as a new energy capital.

Envision Charlotte is setting aggressive goals over the next five years.

Energy	Water	Waste	Air
20%	20%	20%	20%
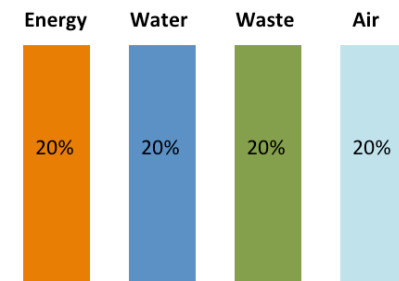
Have made an incredible start:

- Smart Energy Now, our energy efficiency program, is fully deployed

- Smart Water Now has begin execution and should be complete by Fall 2012.

- Over 98% of office building owners are participating, and more than 600 volunteer energy champions have been trained.

- We're drawing up plans for our waste and air programs for introduction later this year.

Taking a Strategic Approach to Intelligent Energy

Stephen Harper

Global Director

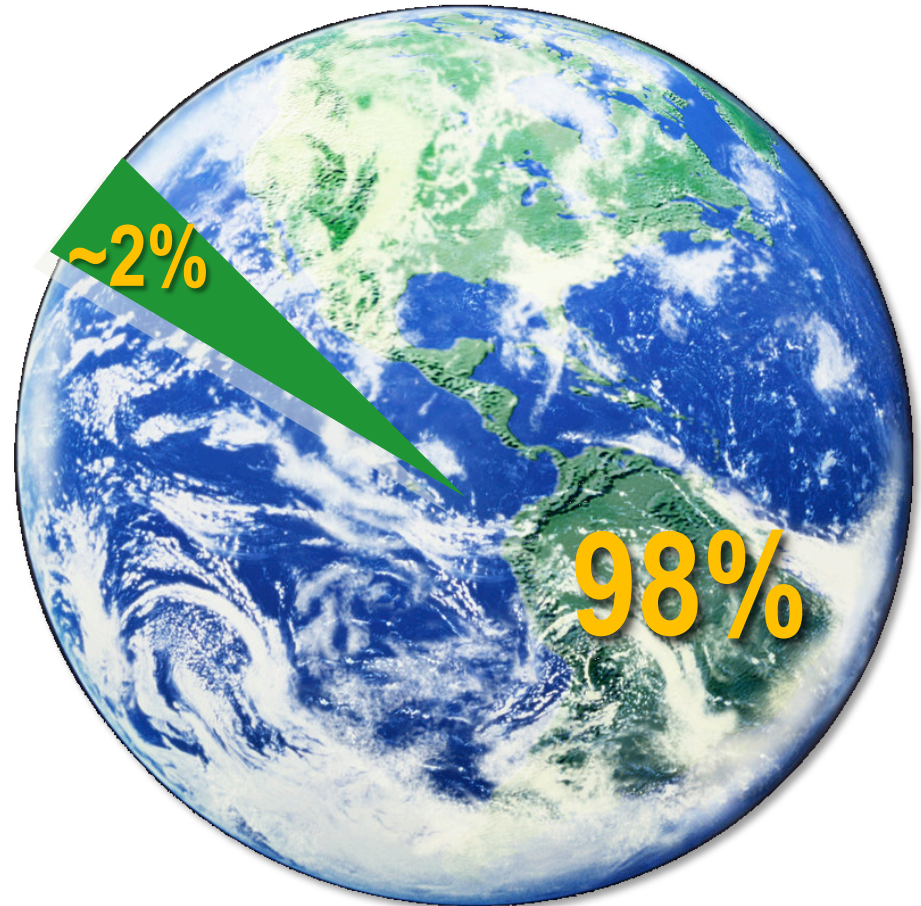Environment and Energy Policy

Intel Corporation

Technology for the Environment

2% Opportunity
Enable IT industry to be more energy-efficient

98% Opportunity
Use energy-efficient computing to help others reduce their own consumption and solve complex environmental challenges facing the planet
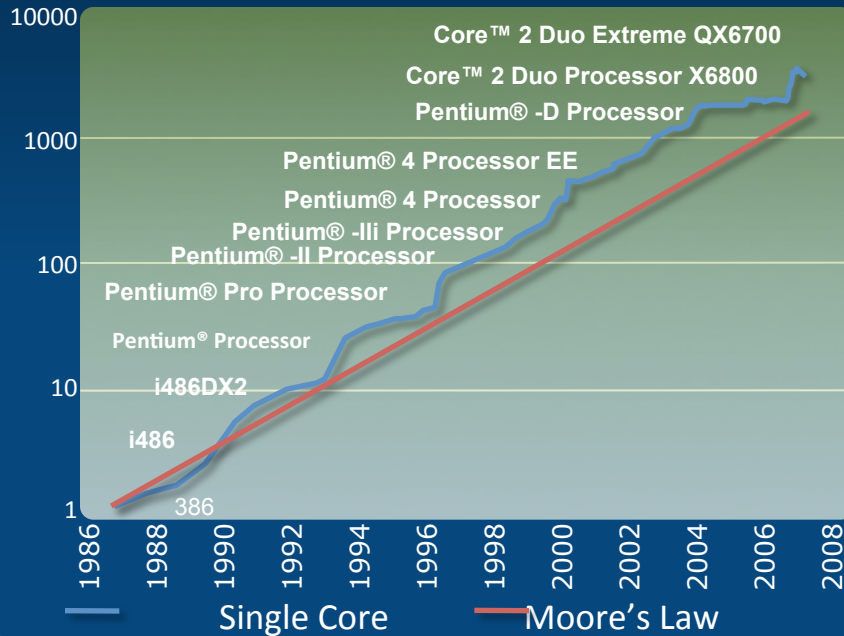
~2%

98%
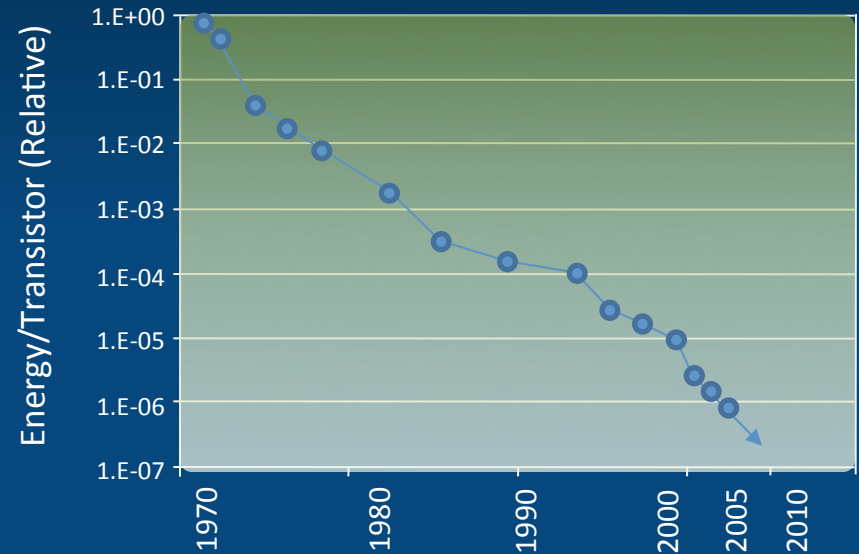
Shrinking the 2% - The "Micro Story"

- Keeping pace with Moore's Law

- "Going mobile" is inherently smarter and greener

- Greening the data center – The Green Grid

- Laser focus on energy productivity – driving <u>more</u> performance output for <u>less</u> energy input

Moore's Law pushes performance and power reduction

Core Integer Performance Over Time*

- Core™ 2 Duo Extreme QX6700
- Core™ 2 Duo Processor X6800
- Pentium® -D Processor
- Pentium® 4 Processor EE
- Pentium® 4 Processor
- Pentium® -IIi Processor
- Pentium® -II Processor
- Pentium® Pro Processor
- Pentium® Processor
- i486DX2
- i486
- 386

Single Core — Moore's Law

Power reduction Over Time*

Energy/Transistor (Relative)
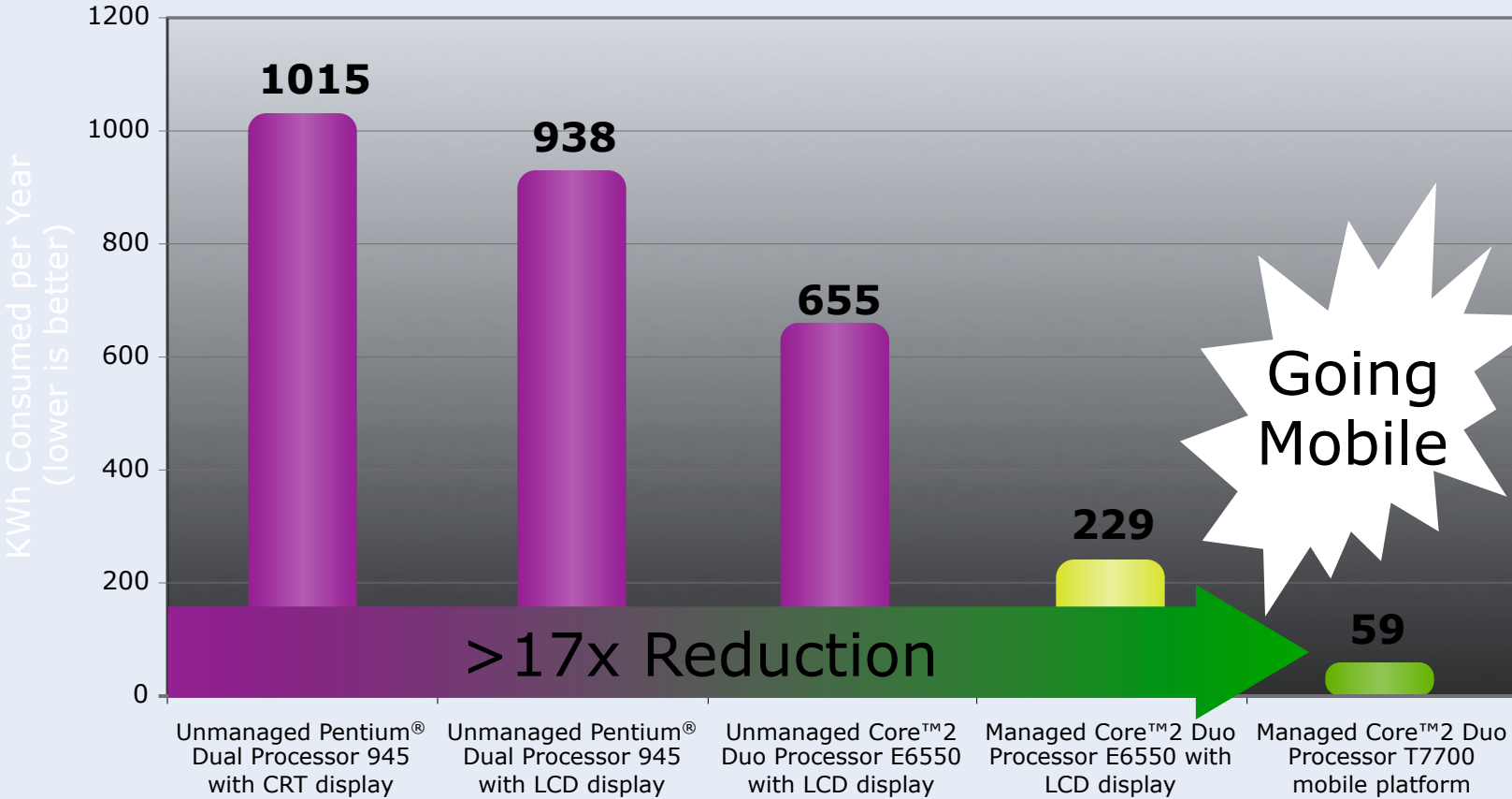
Each transistor in Intel's newest 45 nanometer processors uses 1/7000th of the power compared to our earliest transistors. If automobile fuel efficiency had improved at the same rate, today's cars would get ~100,000 miles per gallon.

4

The Micro Story at the System Level

Estimated Annual Energy Consumption

Bar chart showing KWh Consumed per Year (lower is better):
- Unmanaged Pentium® Dual Processor 945 with CRT display: 1015
- Unmanaged Pentium® Dual Processor 945 with LCD display: 938
- Unmanaged Core™2 Duo Processor E6550 with LCD display: 655
- Managed Core™2 Duo Processor E6550 with LCD display: 229
- Managed Core™2 Duo Processor T7700 mobile platform: 59
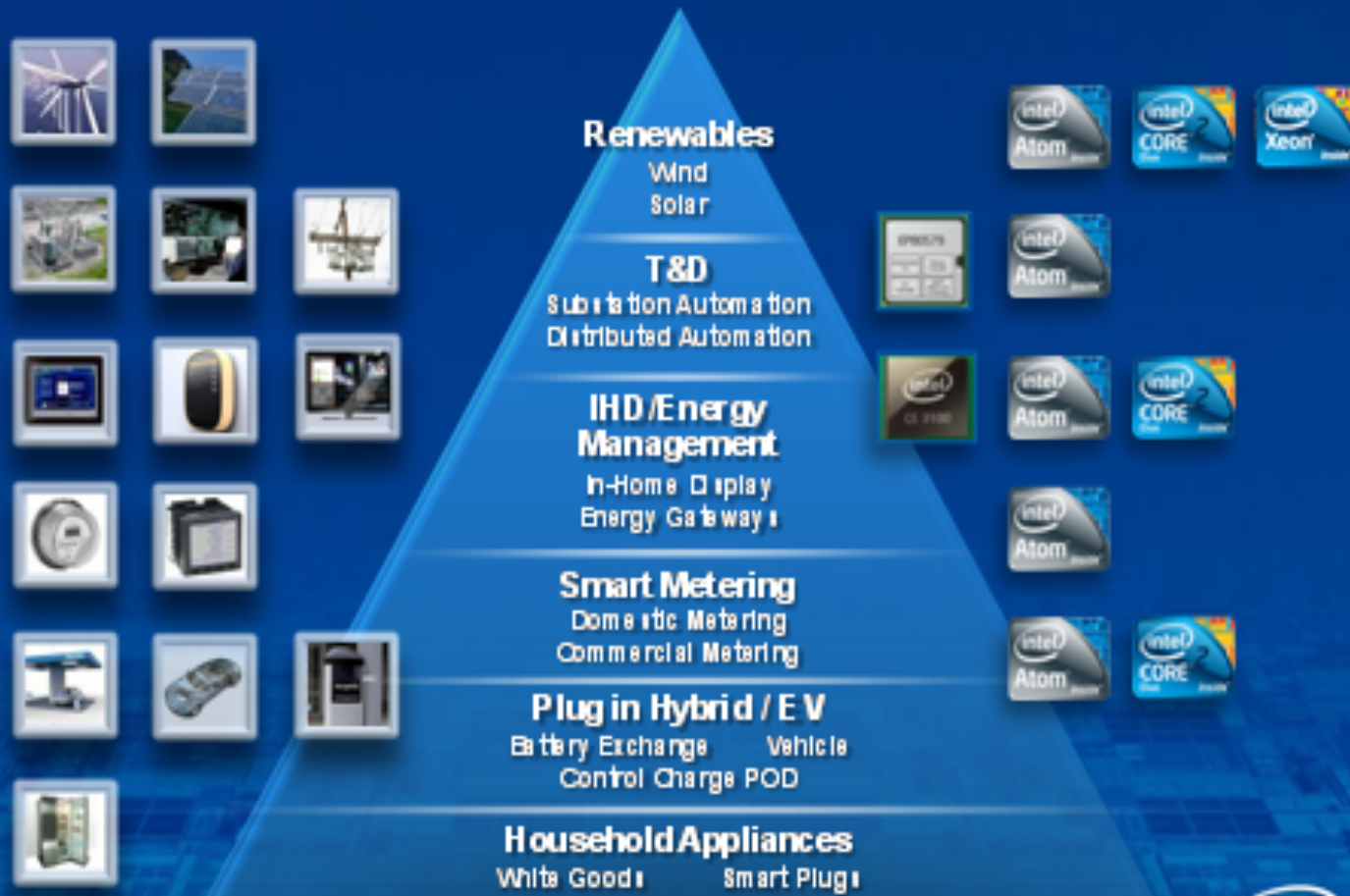
>17x Reduction

Going Mobile

Shrinking the 98% - The "Macro Story"

- Developing products for the proliferating "embedded" market

- Supporting the "cloud"

- Pilot new applications of intelligent efficiency

- Investing in intelligent energy through venture capital funding

- Partnering with government to develop and implement public policies that enable the growth of intelligent efficiency
  - Digital Energy and Sustainability Solutions Campaign (DESSC)

Embedded energy solutions

Emergence of "Smart" Sub-systems with Embedded Processors

Renewables
Wind
Solar

T&D
Substation Automation
Distributed Automation

IHD/Energy Management
In-Home Display
Energy Gateways

Smart Metering
Domestic Metering
Commercial Metering

Plug in Hybrid / EV
Battery Exchange   Vehicle
Control Charge POD

Household Appliances
White Goods   Smart Plugs

13

The "Cloud" as an Energy Efficiency Driver

- The Data Center and the network is at the center of the "macro story"

- The Carbon Disclosure Project (CDP) commissioned Verdantix to examine the impact of a broad US roll-out of Cloud Computing, based on extrapolation from existing case studies:
    - Huge CO2 emissions reductions
    - Huge financial savings
    - Strong positive financial ROI
    - Indirect benefits from increased business process efficiencies and organizational flexibility

SOURCE: The Carbon Disclosure Project/Verdantix: Cloud Computing: The IT Solution for the 21st Century

Intel Sustainable & Connected Cities Institute

The Concept: driving the computing continuum and inventing the city of the future
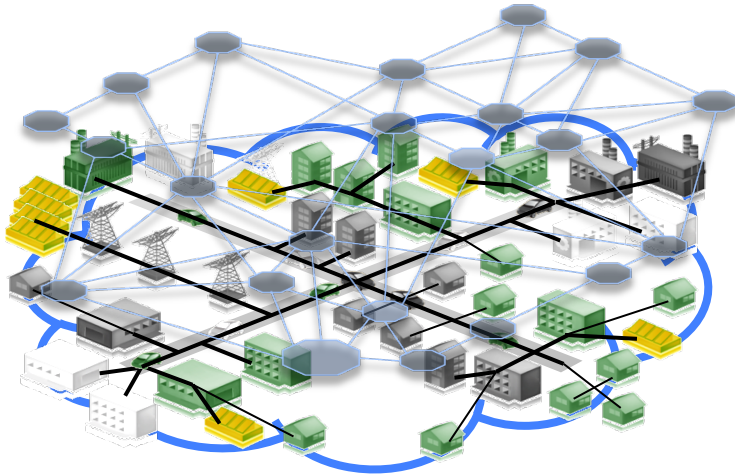
The Testbed: London

Imperial College London

UCL

The World-Class Research Universities: UCL & UCI

The Opportunity

- ➢ Create sustainable future city vision
- ➢ City of London offering test bed access
- ➢ Two world-class universities joining forces to lead the initiative
- ➢ Partnership with other fellow travellers

DESSC-US Partners

*ITI serves as the host organization for DESC

Q&A Session

To submit your question, click on **Q&A** on the top grey menu bar.

Type in your question and hit enter.

We will address as many questions as possible.

Polling questions go here

How to Contact Us

- **Please visit www.aceee.org to download the report this afternoon after 1:30 PM EDT**

- **We will e-mail you a link to access the webinar presentation slides and the audio recording**

- **Follow us on Twitter at: @ACEEEdc**

Thank you very much for participating in our webinar!

Please stay tuned for our future work on intelligent efficiency.