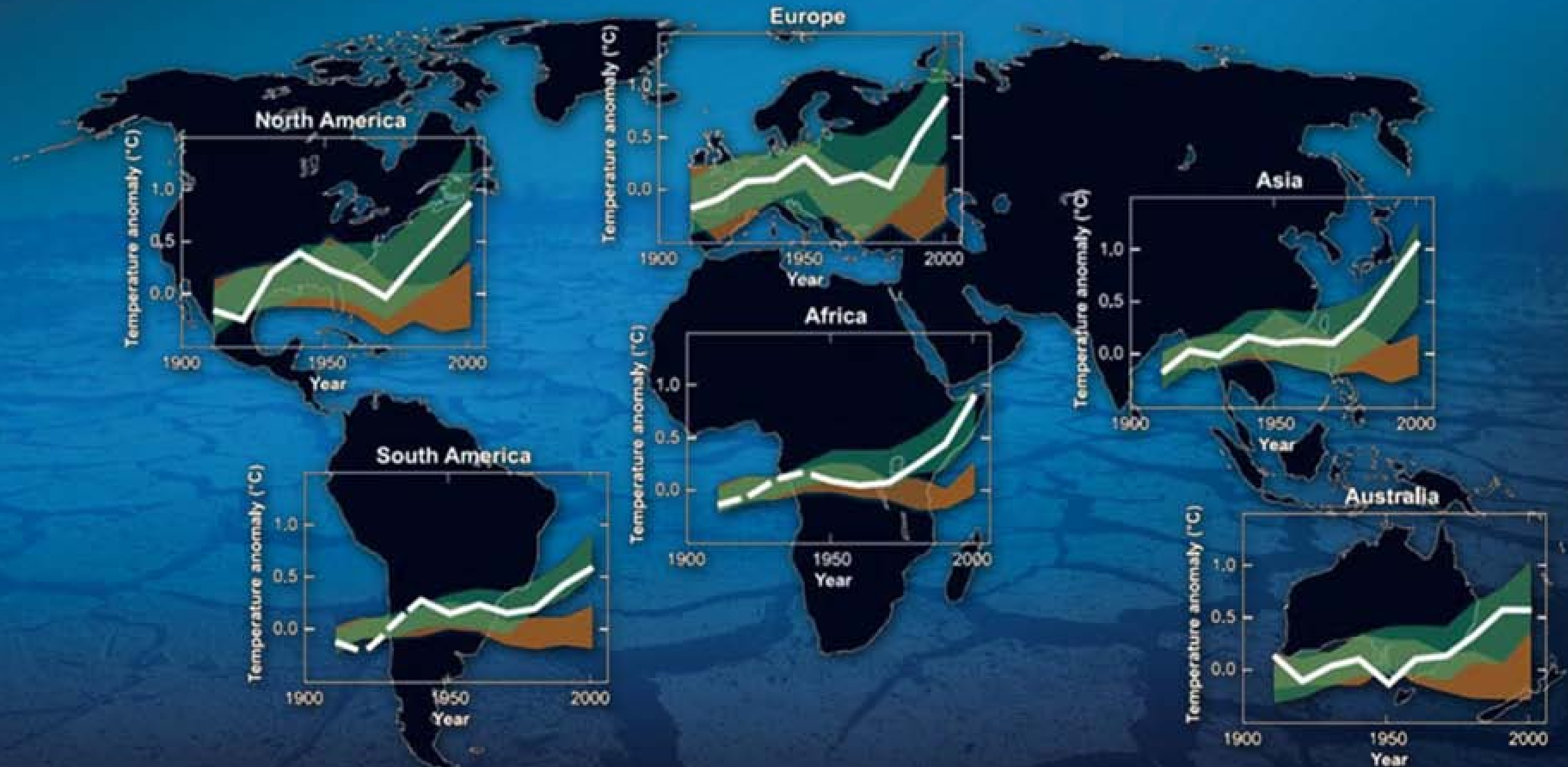




Empowering Personal Energy Management

The Global Climate Continues to Warm

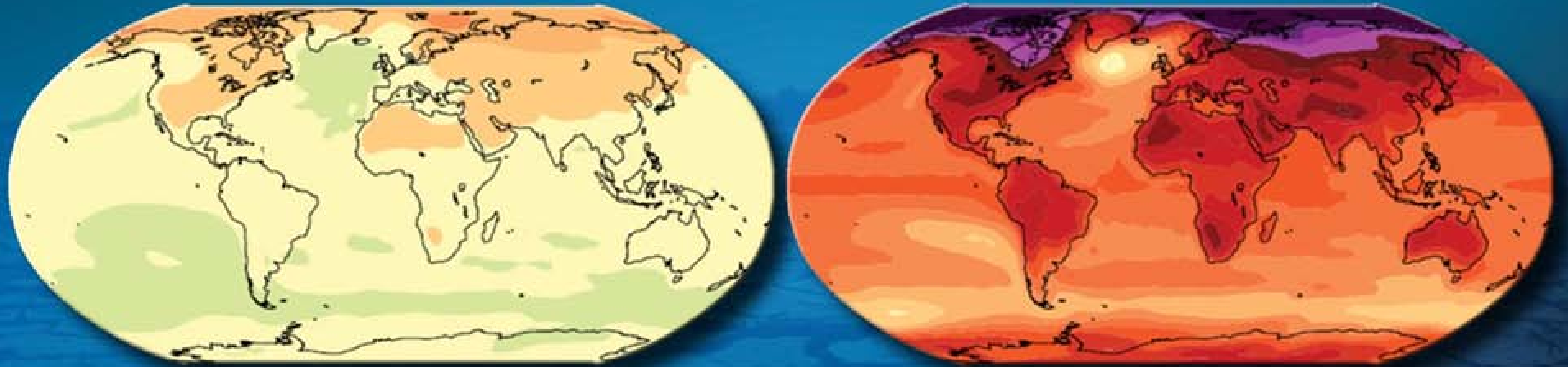


Source: Intergovernmental Panel on Climate Change (IPCC, 2007, Figure WGI-SPM-4)

Growing Impact of Greenhouse Gas Emissions

2020-2029

2090-2099

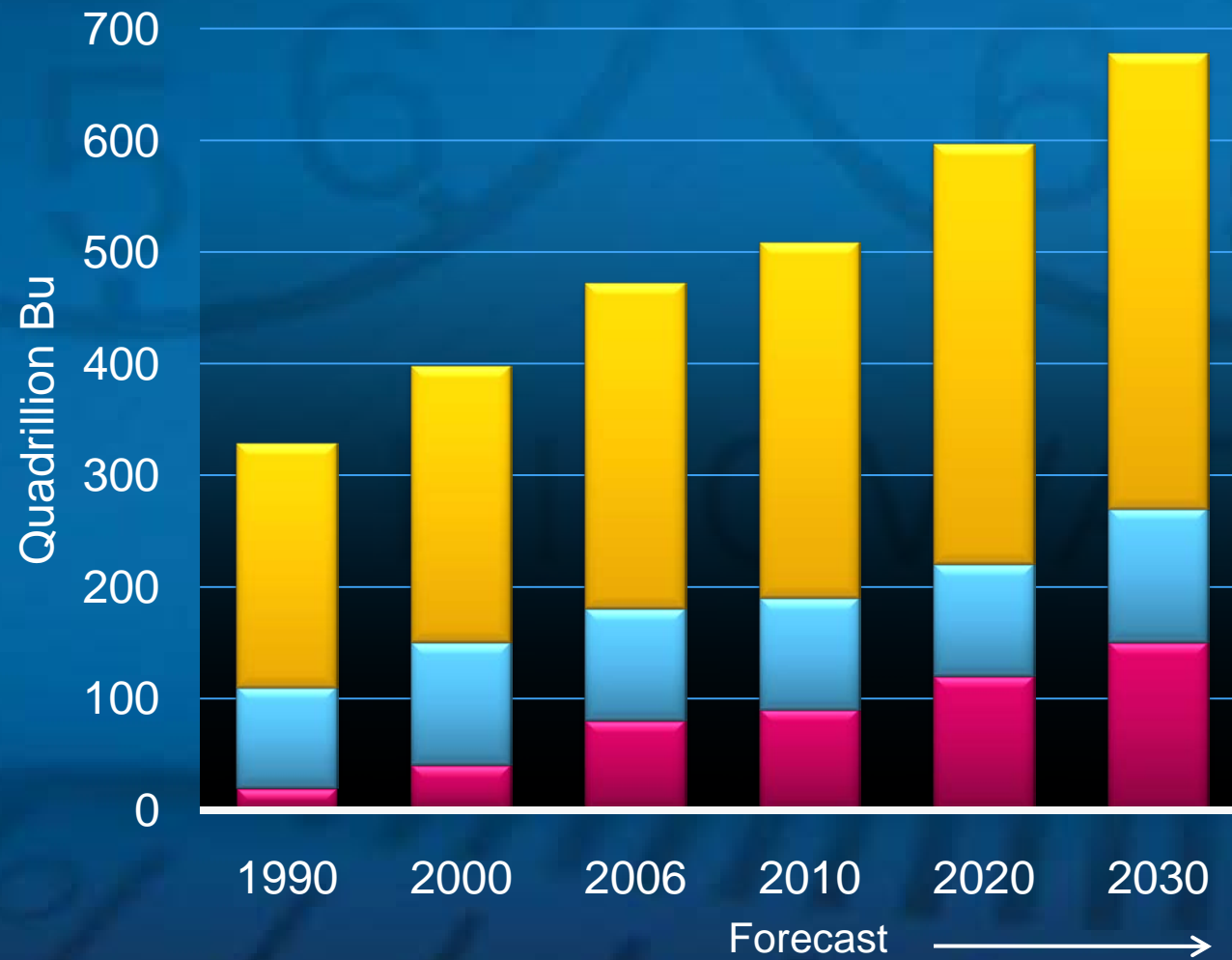


0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5

Change in Temperature (Celsius)

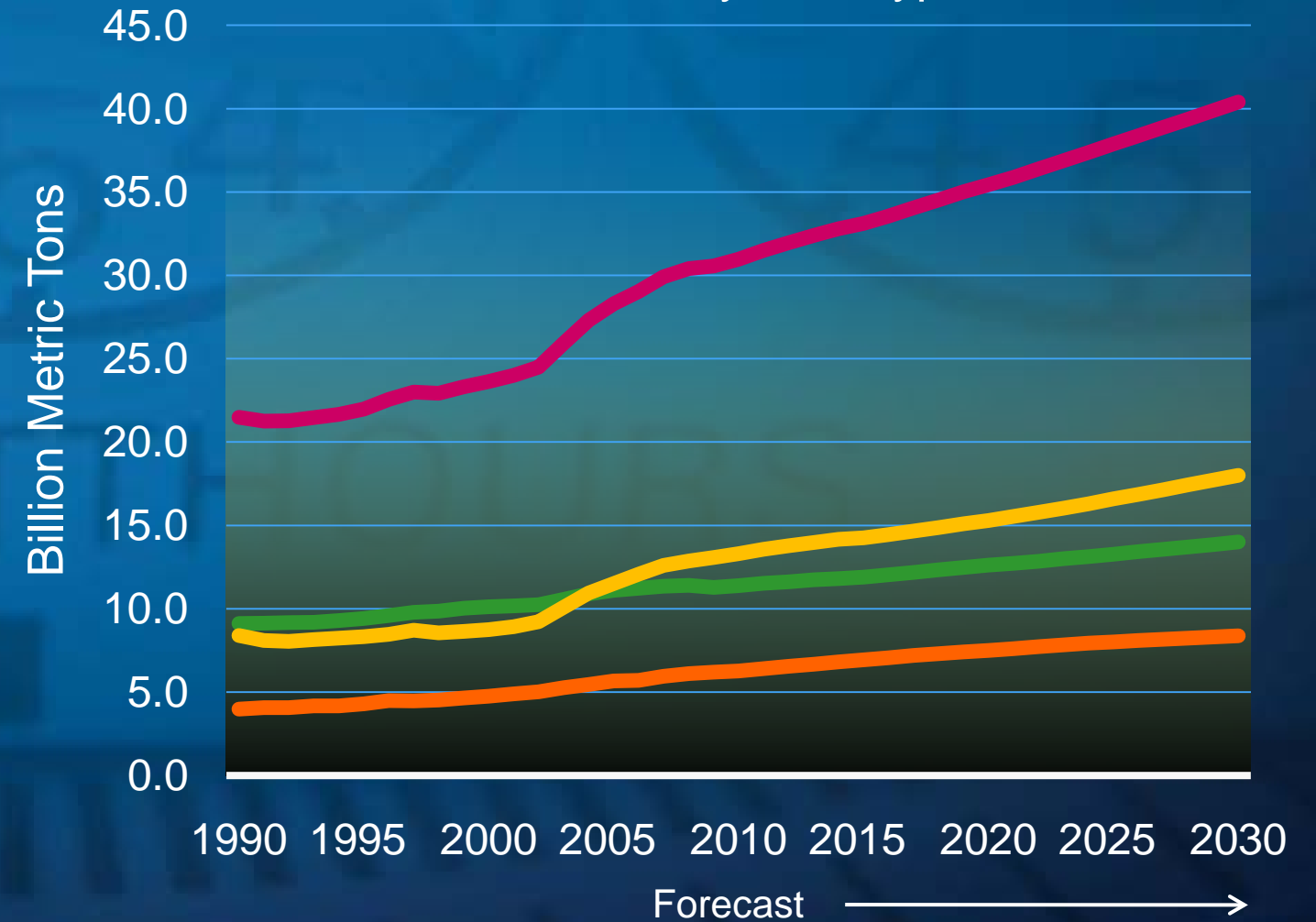
Energy Demand Drives Greenhouse Gases

Marketed Energy Use by Region



■ China and India
 ■ United States
 ■ Rest of World

World Energy-related Carbon Dioxide Emissions by Fuel Type



— Liquids
 — Natural Gas
 — Coal
 — Total

The background is a deep blue gradient. At the top and bottom, there are horizontal bands of binary code (0s and 1s) in a lighter blue color. In the center, several glowing, wavy lines in shades of cyan and light blue sweep across the frame, creating a sense of motion and digital energy. The overall aesthetic is clean, modern, and tech-oriented.

The Need for Action is Clear

Modernizing the Infrastructure: Smart Grid



While Improved Infrastructure is Important,
Energy Consumers are Just as Important

The Impact of Consumers: United States



US Households: 113 Million
US Automobiles: 250 Million

Represent 35% of US Energy
Consumption Portfolio

The Impact of Consumers: China



China Households: 360 Million^{*}

China Automobiles: 76 Million^{*}

Represent 28%[†] of China Energy Consumption Portfolio

^{*}Source: National Bureau of Statistics of China, February 25, 2010, <http://www.stats.gov.cn>

[†]Source: Energy information administration (EIA), International Energy Annual Review 2007. www.eia.doe.gov

How can we use the power of consumers to change
how we manage energy?

Personal Computing Empowered the Consumer

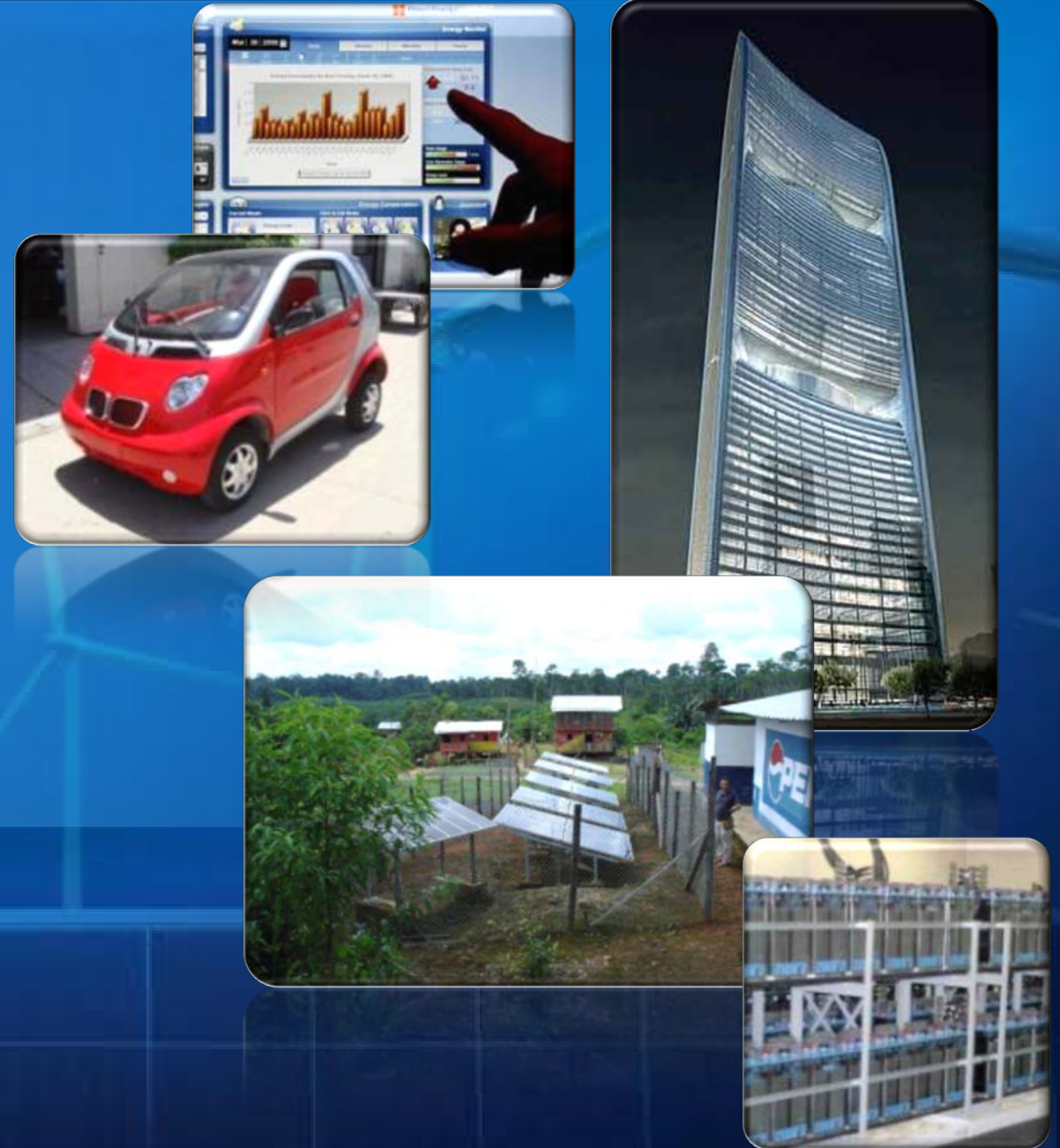
30 Years Ago, Computing
Was Far Less Personal
Far Away From Users
Not Easily Accessible
Professionals Did It

Today, Computing Is
Always At Our Fingertips
Everywhere We Go
Part of Our Lives
Everyone Does It

From Smart Grid to Personal Energy Management

Focus on Consumers of Energy

- Use technology to inform consumers and change their behavior
- Aggregate millions of small contributions
- Drive a significant change in CO₂ output



Informed Consumer Impact



"If the EPA would mandate [fuel consumption displays] in every car, [we] would save 20 percent on fuel overnight..."

—Wayne Gerdes (hypermiling authority)

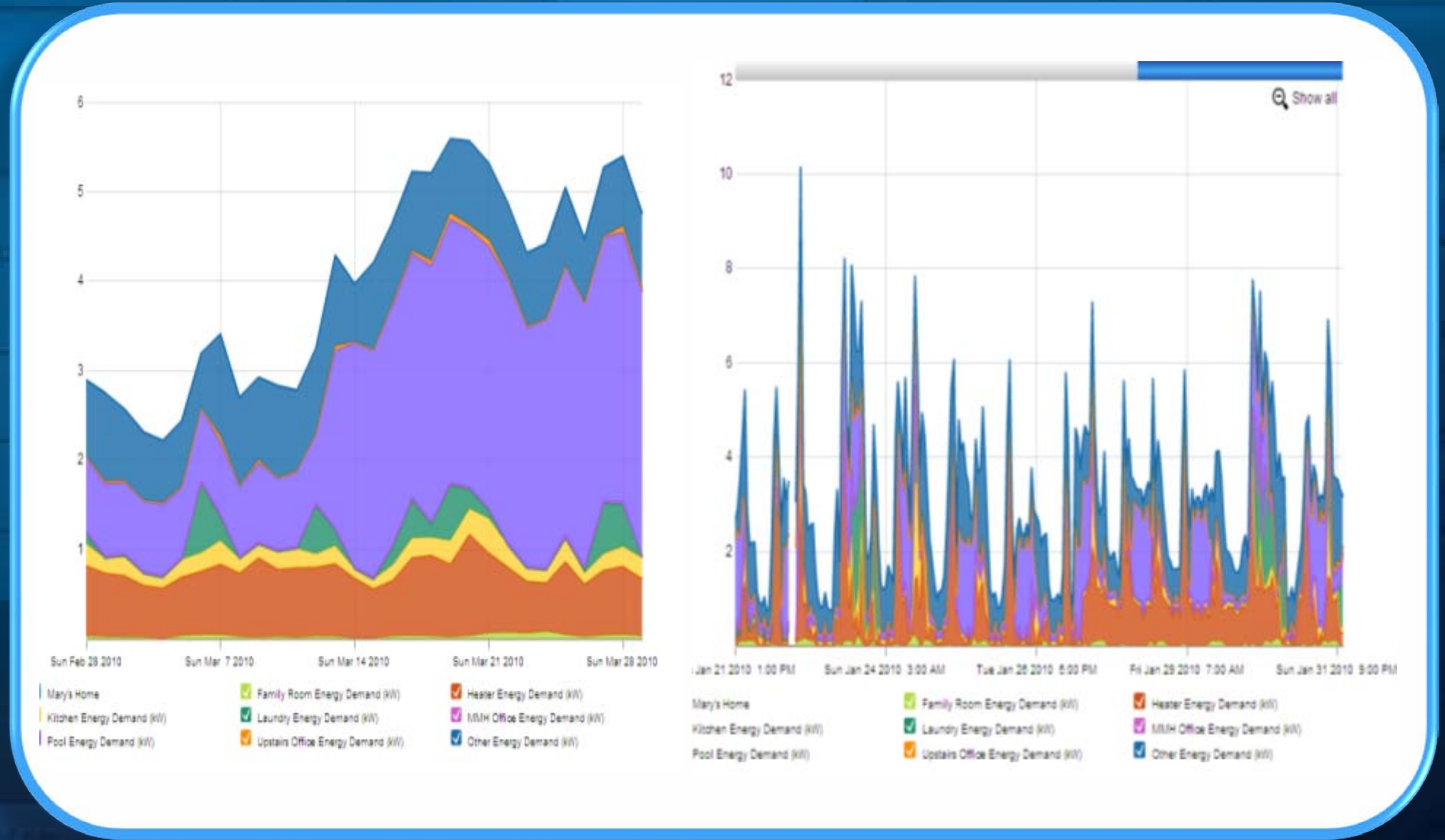
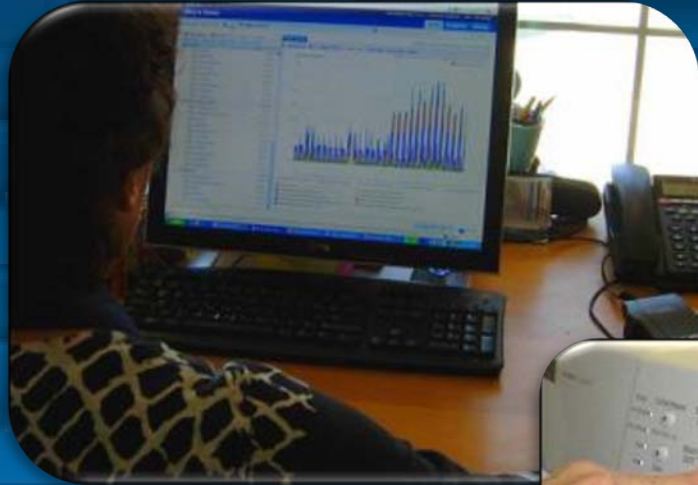




Living with a Personal Energy Management System

Mary Murphy-Hoye
Senior Principal Engineer
Embedded Computing Group
Intel Corporation

The Power of Information



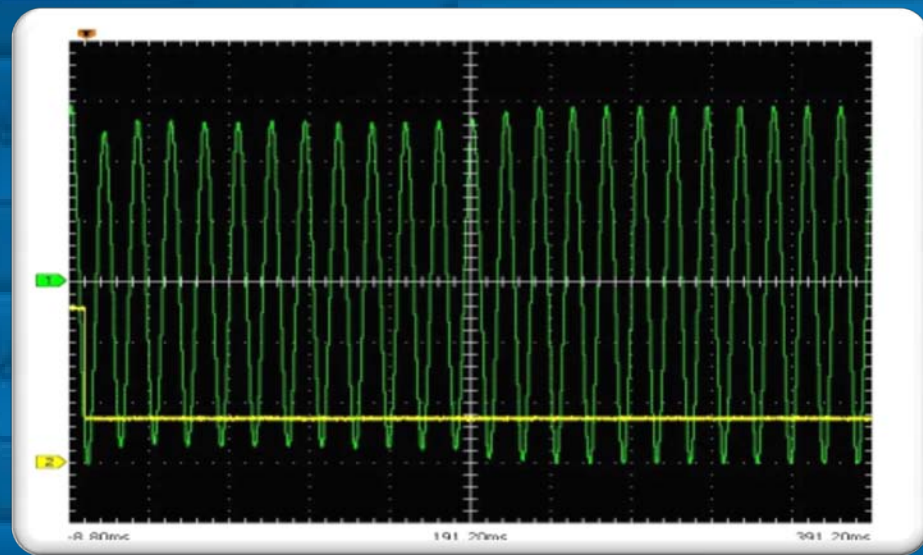


Bringing Smart Energy Sensing to the Masses

James Song
Research Scientist
Energy Systems Lab
Intel Labs

Low-Cost Energy Sensing

Using Computational Signal Analysis To Extract Load Information



Infer Appliance Operation by Sensing AC Line Signals



Simple, Low-cost Wireless Sensor Anyone Can Install



Compute Detailed Home Energy Consumption from Only One or Two Sensors

Intel's In-Home Energy Display Research

Key Ideas

- Monitoring energy alone is not enough of a motivation for people
- To behave more energy efficiently, people need support
- To keep people engaged the system needs to evolve with them



Impact of Empowering Consumers



Average US household could:

- Reduce energy consumption by **15-31%**
- Save up to **\$470** per year in electricity costs

What if 1% of US households realized this savings?

- Reduce annual coal demand by **371,000 tons**
- Eliminate need for **two 675 MW** coal-fired peak power plants
- Reduce carbon emissions by **2.4 million metric tons**
- Equivalent of taking **535,000 cars** off the road

Empowering the Neighborhood: Microgrids

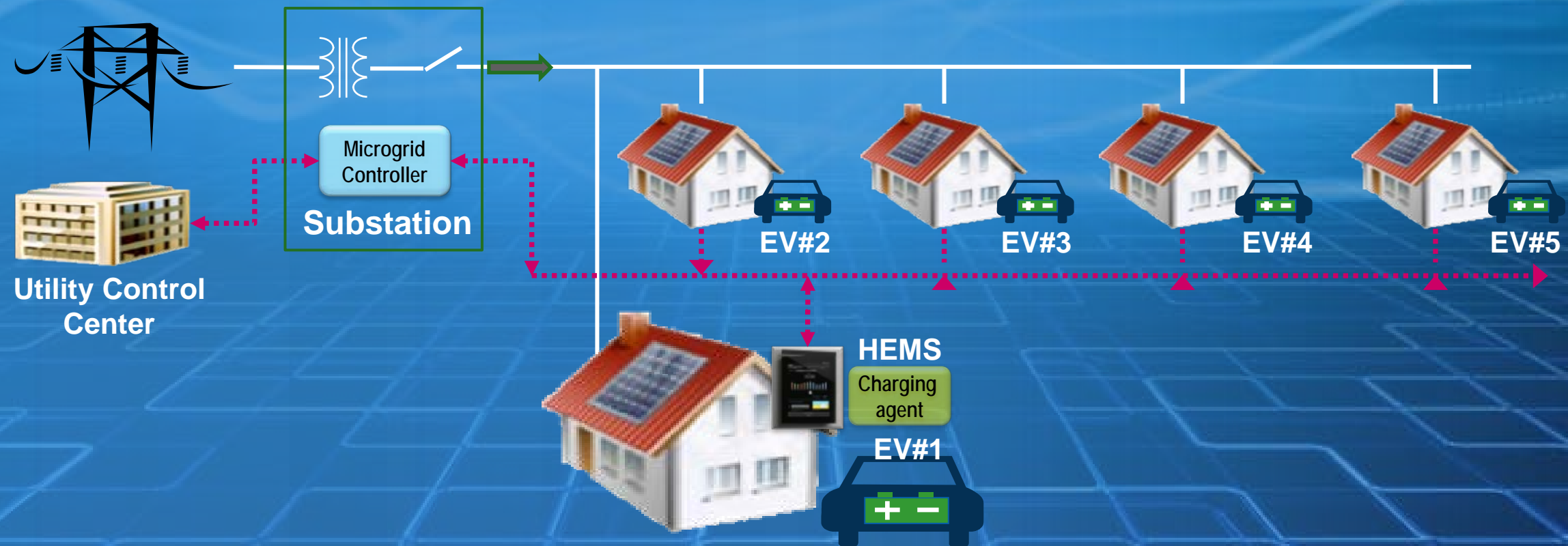


- Neighborhood of the Future
 - A self-sustaining community managing local generation, storage and grid connectivity
- Benefits to the Smart Grid
 - Faster path to innovation and use of renewable energy sources
 - Low initiation barriers
 - Scalable and Reliable
 - Free up peak capacity

Goal: Enabling Net-Zero Energy Consumption Neighborhoods

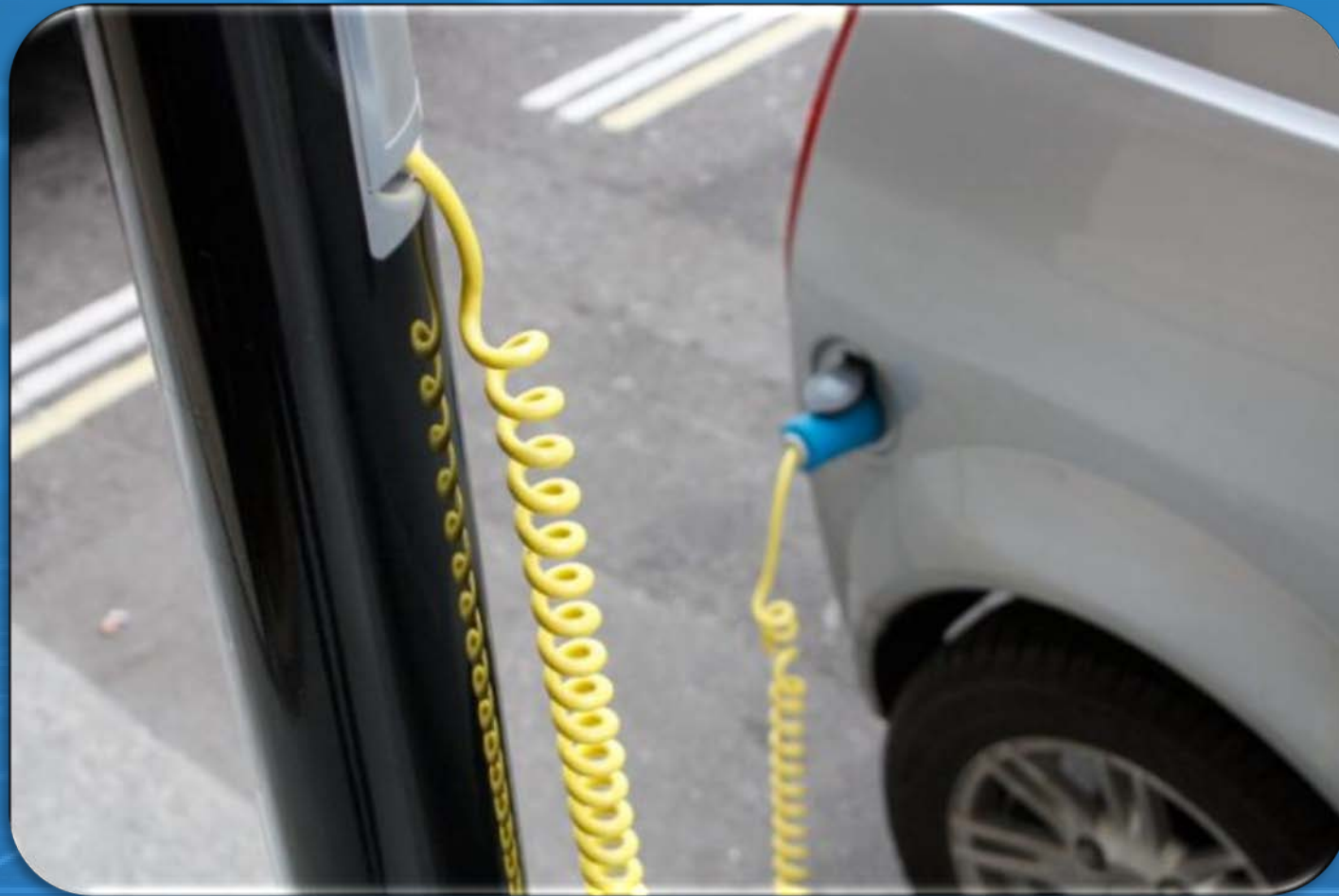
Integrating Electric Vehicles into the Microgrid

Transition to electric vehicles an important step for reduction of consumer energy consumption

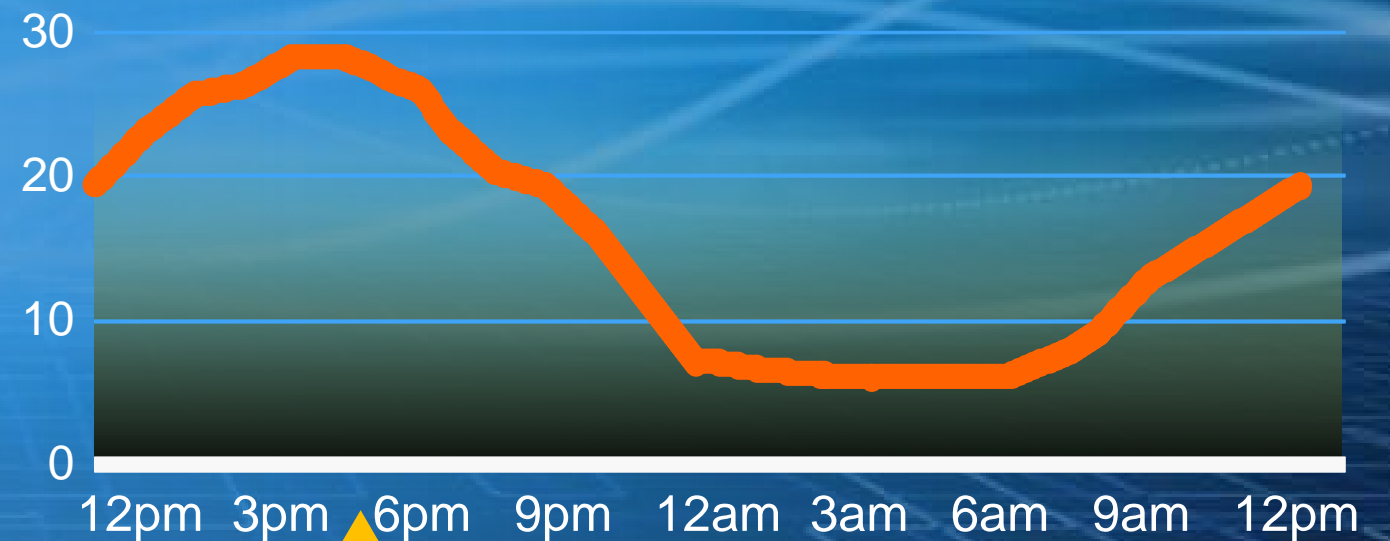


...But Large Scale Adoption Results In New Challenges

Power to Charge an Electric Vehicle: 6.6kW for 2-3 hours (AC Level 2)



Total Power at Community Transformer (kW)
without Electric Vehicles



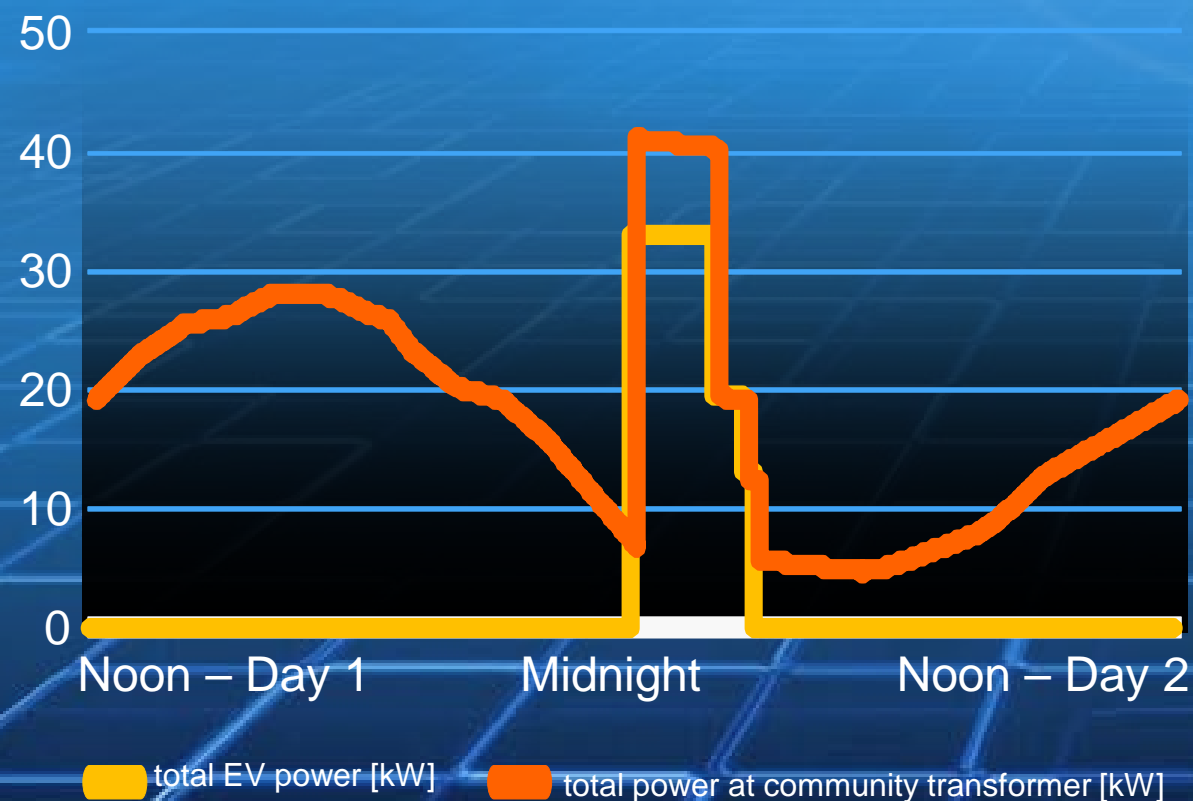
↑
Typical Time of Day for
Electric Vehicle Recharge

*Uncoordinated Charging of Electric Vehicles May Require
Significant Increase in Peak Power Generation*

“Personal” Electric Vehicle Charging to Reduce Peak Load

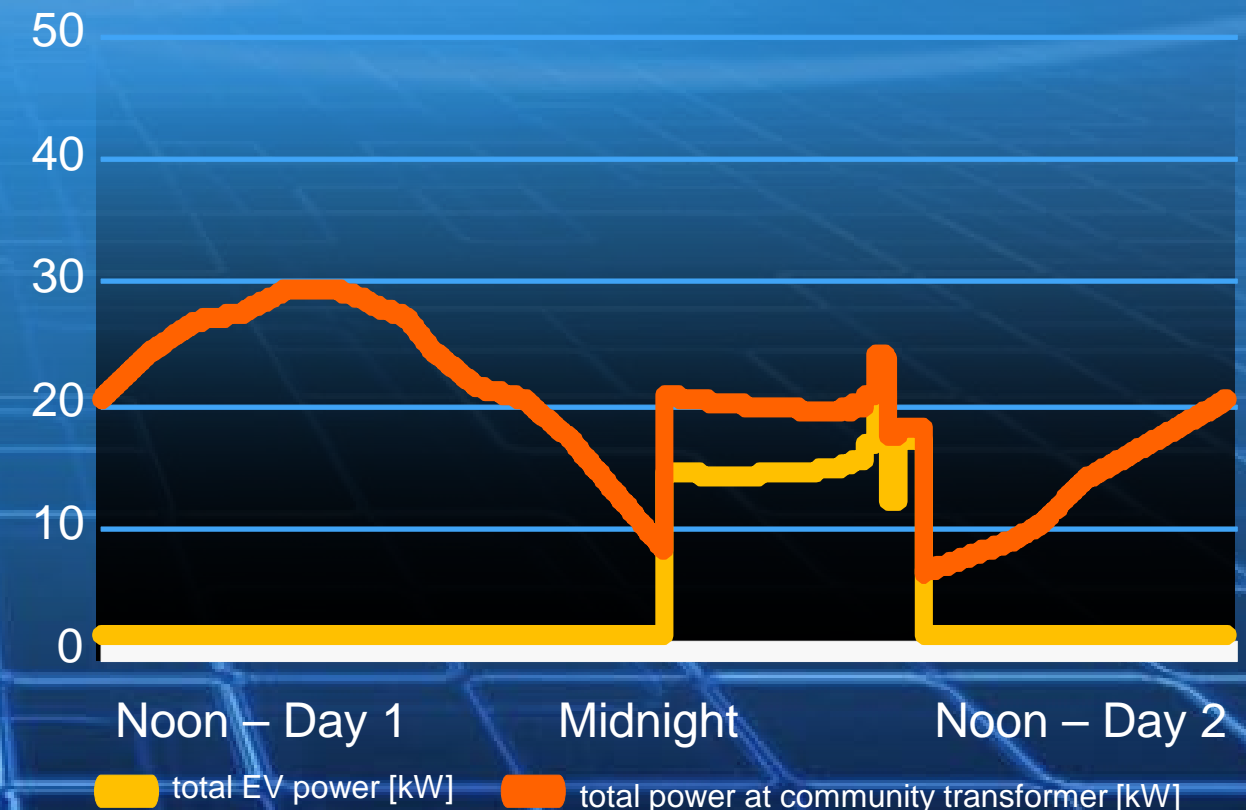
Shift Charging Start Time

- Charge during neighborhood minimum load
- ~41kW peak during EV charging



Apply “Personal” Charging Profile

- Use minimum power level to complete charge in time required
- ~20kW peak during EV charging

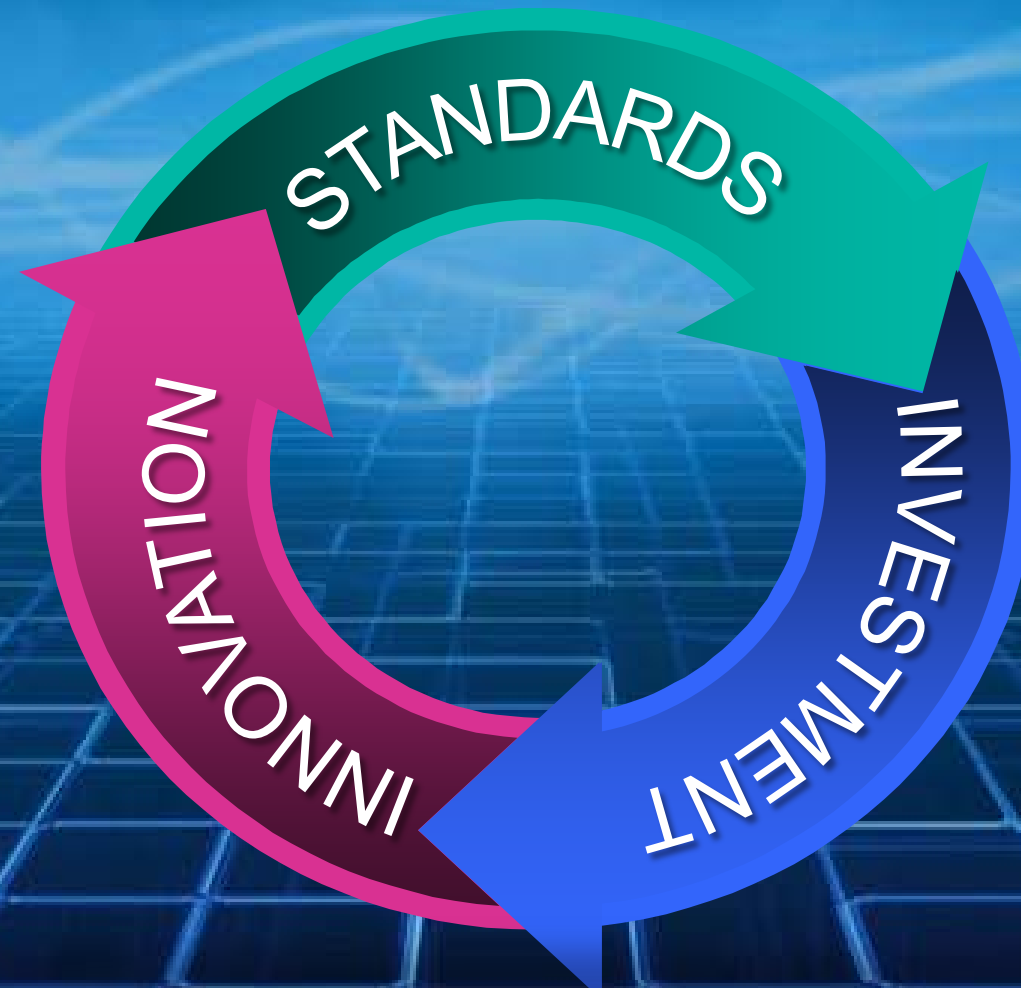


Microgrids Create a New Ecosystem



Standards Drive Ecosystems

Creating a Virtuous Cycle



As with PCs, Personal Energy Management Requires Standards



Preparing China's Power Grid for the Future



Fan Pengzhan

Senior Engineer & Technology
Manager

Smart Grid ICT Center
State Grid Information &
Telecommunication Co., Ltd

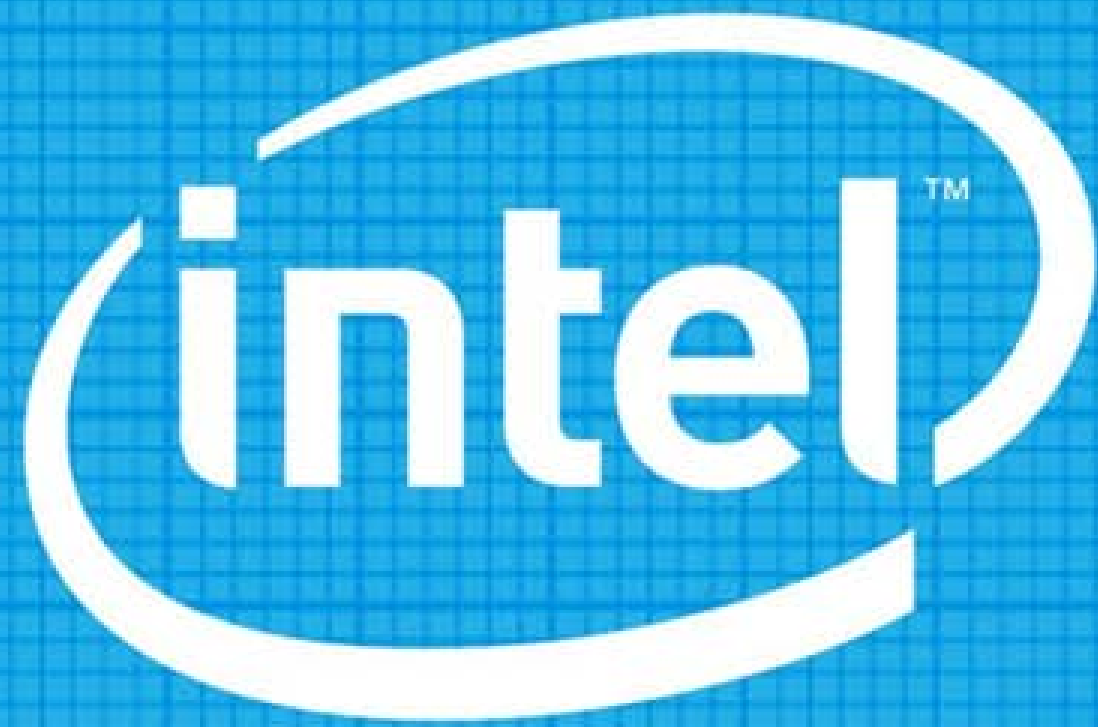
Empowering Energy Consumers

- Use technology to inform consumers and change their behavior
- Aggregate millions of small contributions
- Drive a significant change in CO₂ output



Abundant opportunities for developers in
Personal Energy Management

Get involved now and help save the planet!



Sponsors of Tomorrow.™

Legal Disclaimer

- INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL® PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER, AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL® PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. INTEL PRODUCTS ARE NOT INTENDED FOR USE IN MEDICAL, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS.
- Intel may make changes to specifications and product descriptions at any time, without notice.
- All products, dates, and figures specified are preliminary based on current expectations, and are subject to change without notice.
- Intel, processors, chipsets, and desktop boards may contain design defects or errors known as errata, which may cause the product to deviate from published specifications. Current characterized errata are available on request.
- Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance.
- Intel, and the Intel logo are trademarks of Intel Corporation in the United States and other countries.
- *Other names and brands may be claimed as the property of others.
- Copyright © 2010 Intel Corporation.

Risk Factors

The above statements and any others in this document that refer to plans and expectations for the first quarter, the year and the future are forward-looking statements that involve a number of risks and uncertainties. Many factors could affect Intel's actual results, and variances from Intel's current expectations regarding such factors could cause actual results to differ materially from those expressed in these forward-looking statements. Intel presently considers the following to be the important factors that could cause actual results to differ materially from the corporation's expectations. Demand could be different from Intel's expectations due to factors including changes in business and economic conditions; customer acceptance of Intel's and competitors' products; changes in customer order patterns including order cancellations; and changes in the level of inventory at customers. Intel operates in intensely competitive industries that are characterized by a high percentage of costs that are fixed or difficult to reduce in the short term and product demand that is highly variable and difficult to forecast. Additionally, Intel is in the process of transitioning to its next generation of products on 32nm process technology, and there could be execution issues associated with these changes, including product defects and errata along with lower than anticipated manufacturing yields. Revenue and the gross margin percentage are affected by the timing of new Intel product introductions and the demand for and market acceptance of Intel's products; actions taken by Intel's competitors, including product offerings and introductions, marketing programs and pricing pressures and Intel's response to such actions; defects or disruptions in the supply of materials or resources; and Intel's ability to respond quickly to technological developments and to incorporate new features into its products. The gross margin percentage could vary significantly from expectations based on changes in revenue levels; product mix and pricing; start-up costs, including costs associated with the new 32nm process technology; variations in inventory valuation, including variations related to the timing of qualifying products for sale; excess or obsolete inventory; manufacturing yields; changes in unit costs; impairments of long-lived assets, including manufacturing, assembly/test and intangible assets; the timing and execution of the manufacturing ramp and associated costs; and capacity utilization;. Expenses, particularly certain marketing and compensation expenses, as well as restructuring and asset impairment charges, vary depending on the level of demand for Intel's products and the level of revenue and profits. The majority of our non-marketable equity investment portfolio balance is concentrated in companies in the flash memory market segment, and declines in this market segment or changes in management's plans with respect to our investments in this market segment could result in significant impairment charges, impacting restructuring charges as well as gains/losses on equity investments and interest and other. Intel's results could be impacted by adverse economic, social, political and physical/infrastructure conditions in countries where Intel, its customers or its suppliers operate, including military conflict and other security risks, natural disasters, infrastructure disruptions, health concerns and fluctuations in currency exchange rates. Intel's results could be affected by the timing of closing of acquisitions and divestitures. Intel's results could be affected by adverse effects associated with product defects and errata (deviations from published specifications), and by litigation or regulatory matters involving intellectual property, stockholder, consumer, antitrust and other issues, such as the litigation and regulatory matters described in Intel's SEC reports. An unfavorable ruling could include monetary damages or an injunction prohibiting us from manufacturing or selling one or more products, precluding particular business practices, impacting our ability to design our products, or requiring other remedies such as compulsory licensing of intellectual property. A detailed discussion of these and other risk factors that could affect Intel's results is included in Intel's SEC filings, including the report on Form 10-Q.

Rev. 1/14/10