



SUSTAINABILITY

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# Going Green – It's Not Just for Garden Plants

Sustainability at TI and for your home

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Sustainable Development Manager, Texas Instruments



# Outline



- What does sustainability mean?
  - Definition
  - Key elements and measurements
- Why is sustainability important?
- What are we doing at Texas Instruments?
- What can you do at home?

# What is sustainability?



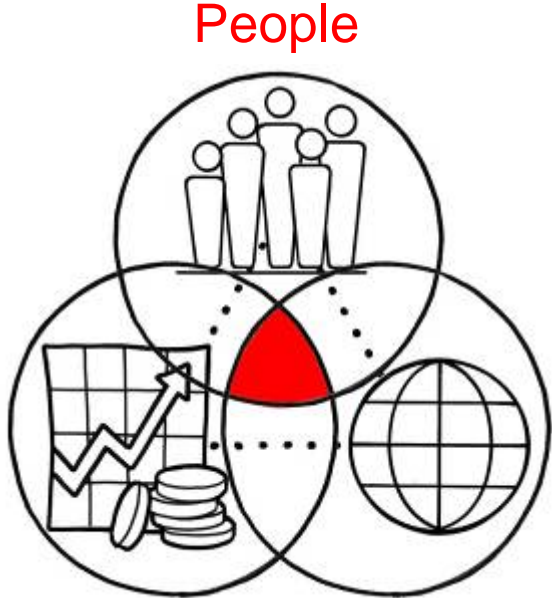
# Sustainability Defined

- Official Definition



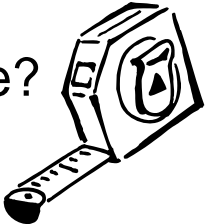
Brundtland Commission of the United Nations, 1987

Simply stated . . .  
The balance of people,  
profit, and the planet



# Measurement

- Does anyone have a sustainable measuring device?



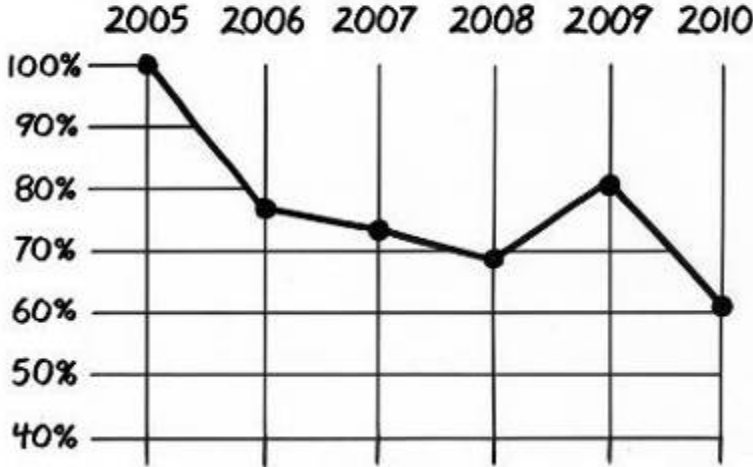
- Measurement is easier when broken into the major components:
  - Planet Factors

- Energy
- CO2
- Emissions
- Water
- Materials
- Waste



- Data can be normalized against square footage, units produced, weather, etc.
- Data is tracked over time and shared with employees to engage their assistance

**NORMALIZED ENERGY USE/CHIP**



# Measurement



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- There are many measurement systems for various areas:
  - LEED (Buildings) – Leadership in Energy and Environmental Design
    - Sustainable Sites, Water, Energy&Atmosphere, Materials, Indoor Air Quality
  - Green Seal
    - Certifies products such as cleaning materials, paints, coatings, recycled paper, etc.
  - Energy Star
    - Appliances, Lighting, Office Equipment, Computers, etc.
    - Buildings for energy use
  - Cool Roof Rating Council
    - Roofing
  - FSC (Forest Stewardship Council)
    - Wood
  - CRI Green Label Plus
    - Carpet
  - GreenGuard
    - Indoor air quality
    - Furniture



**Beware of greenwashing claims**

The only thing more powerful than an educated consumer is a critical mass of educated consumers

# Why is sustainability important?



# The Bottom Line - Cost

- Businesses exist to make money
- Being more resource efficient saves money and increases profit



# Productivity



# A Revolutionary Idea

## First Industrial Revolution:

People are scarce and nature is abundant – increase labor productivity

## Next Industrial Revolution:

People are abundant and nature is scarce – increase **resource** productivity

**Natural Capitalism: Creating the Next Industrial Revolution**  
by Paul Hawken, L. Hunter Lovins, Amory Lovins – 1999 [www.natcap.org](http://www.natcap.org)

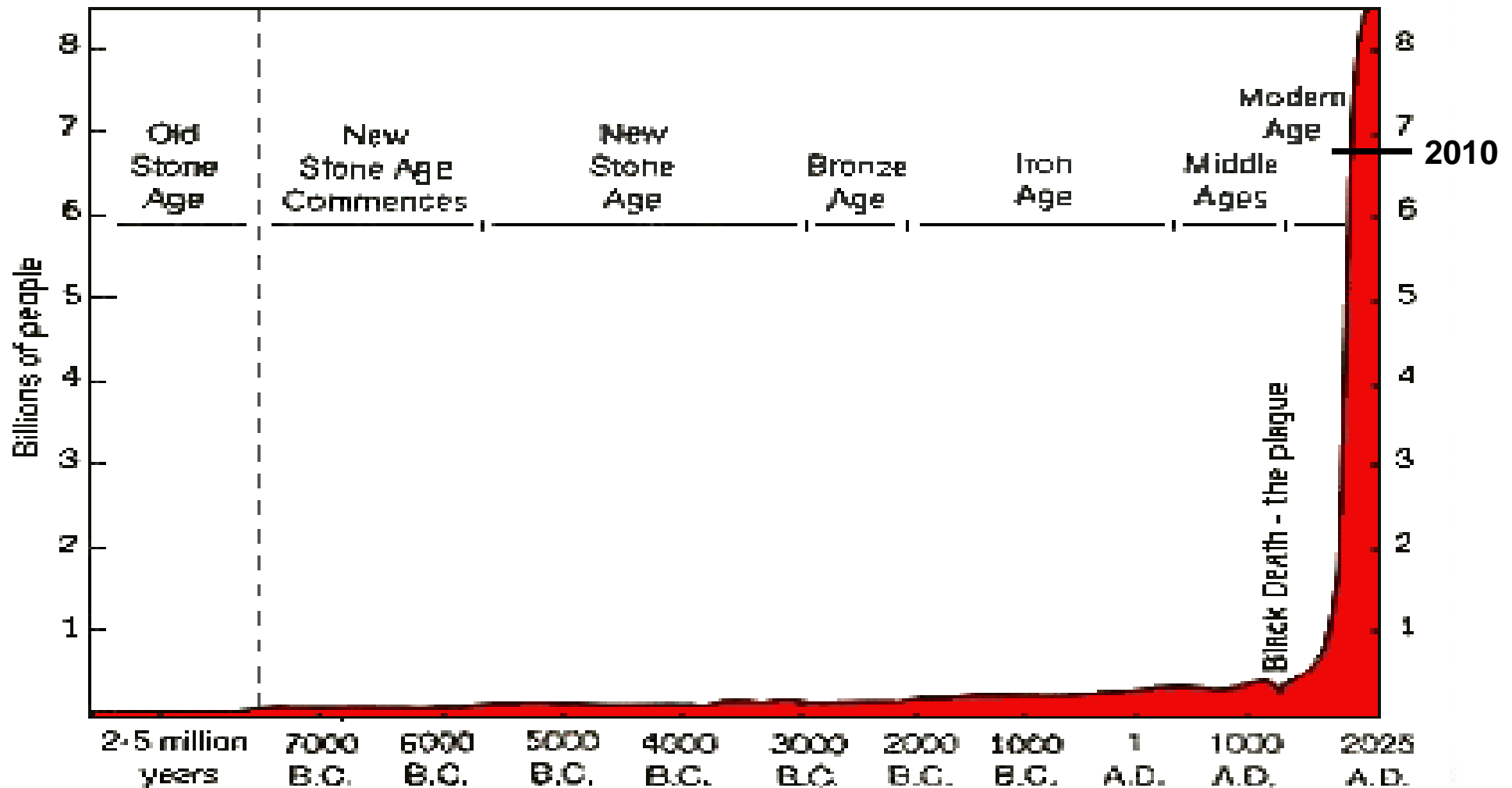
*REduce*  
*REuse*  
*REcycle*



# Climate Change + Resource Consumption



## World Population Growth Through History



# Good Citizen



- Corporations
  - Would you like to be the employer of choice?
    - Talent recruits your company
  - Would you like to be a good neighbor?
    - No one minds living near your facility – and shortening their commute
  - Would you like to have clean air and water?
    - You, your family, and your employees live in the community
- Individuals
  - "We do not inherit the earth from our ancestors, we borrow it from our children."

*It might be difficult to assign a cost to some of these things, but it's very easy to recognize the value.*

# Sustainability at Texas Instruments

# Mission Statement

- Texas Instruments helps customers solve problems and develop new electronics that make the world smarter, healthier, safer, greener and more fun.
- Which aligns pretty well with a quote from Paul Hawken’s Ecology of Commerce . . . “the purpose of business is to increase the general well-being of humankind through service, a creative invention and ethical philosophy.”

Recent Awards

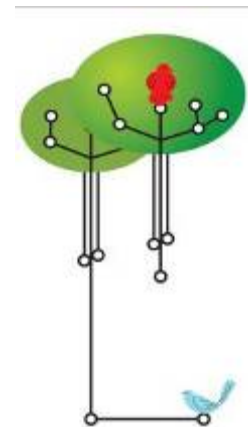
TI among 2011 "World's Most Ethical Companies" by Ethisphere Institute  
TI recognized again among world's "100 Best Corporate Citizens"  
TI recognized for sustainability leadership by Newsweek, others  
TI named a 2010 Working Mother best company, entered into Hall of Fame  
TI ranks No. 11 on Forbes magazine's 2011 list of America's Most Reputable Big Companies

# Environmental Stewardship



We take a multi-faceted approach to sustainability:

- **Innovation in product design**
  - Leader in low-power solutions
  - Enabling renewable energy, energy efficiency and reliability
  - Supporting efficiency standards
- **Industry leadership in environmentally responsible operations**
  - World's first semiconductor fabrication plant to receive a green building certification (RFAB LEED-Gold)
  - More than 10% of our global space is now LEED certified
  - Continuous improvement in energy, water, and waste metrics
- **Conscientious operations** include:
  - Energy conservation
  - Water conservation
  - Strategic material use
  - Waste management
  - Emissions reductions
  - Employee education

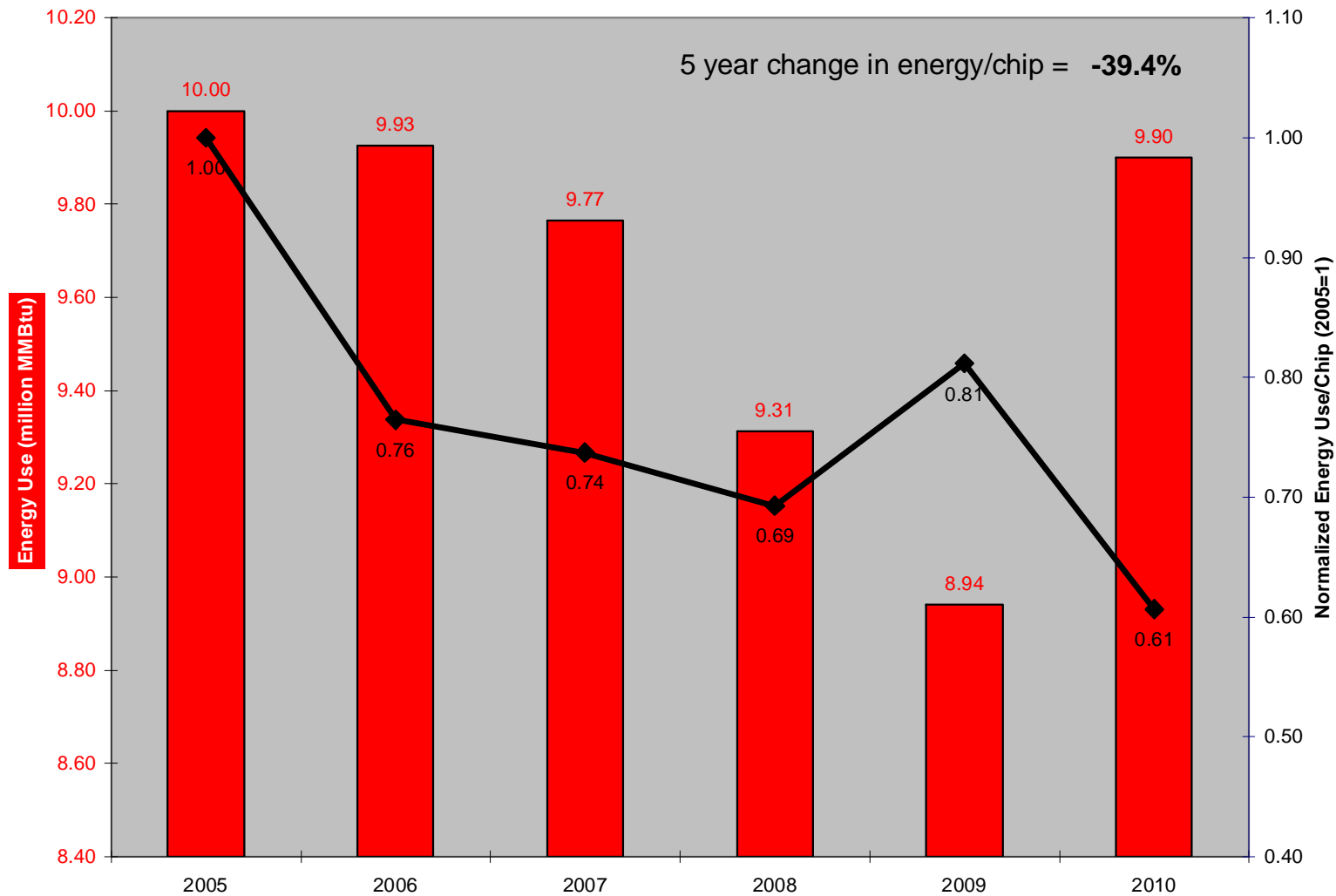


# TI Performance Metrics - Energy

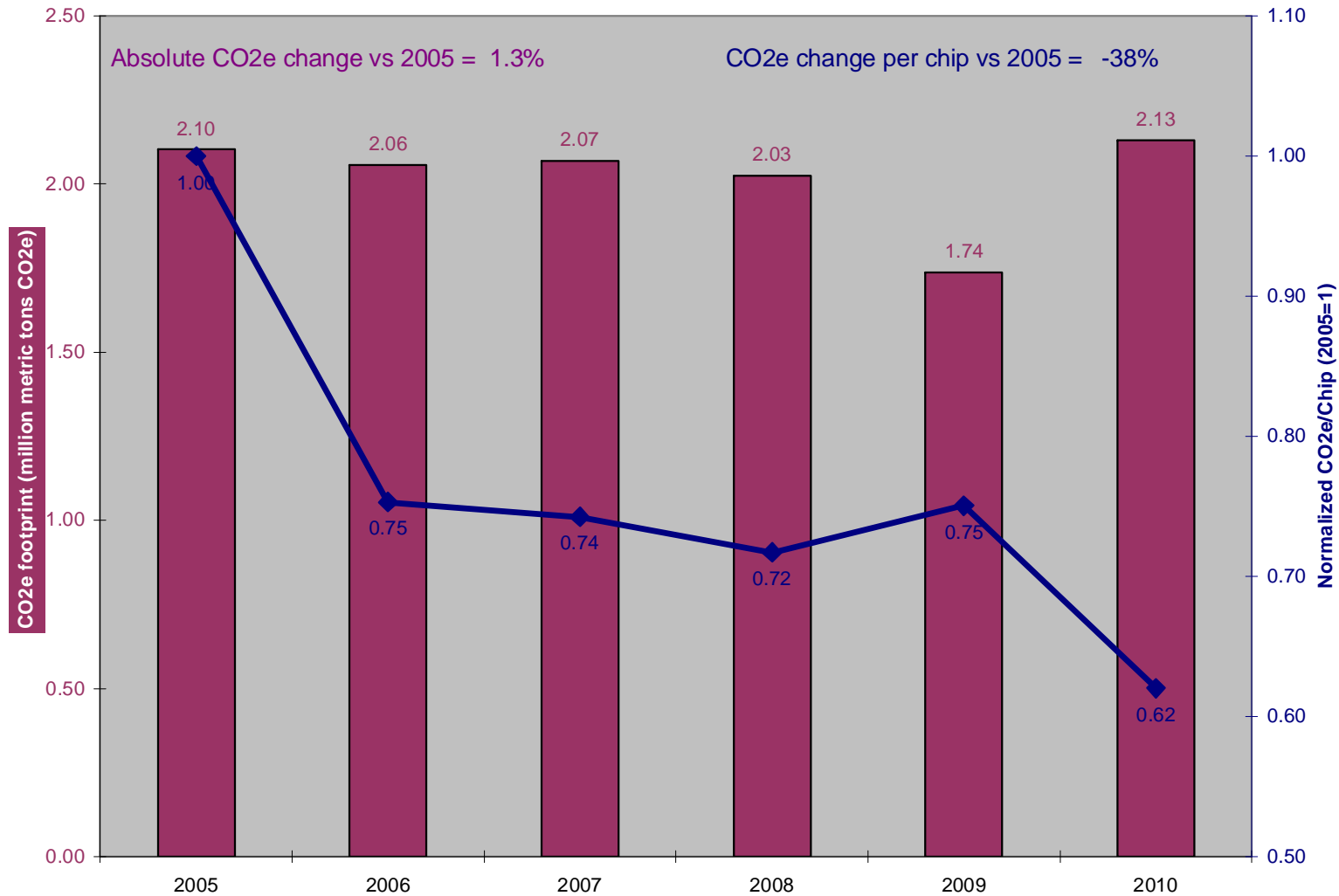


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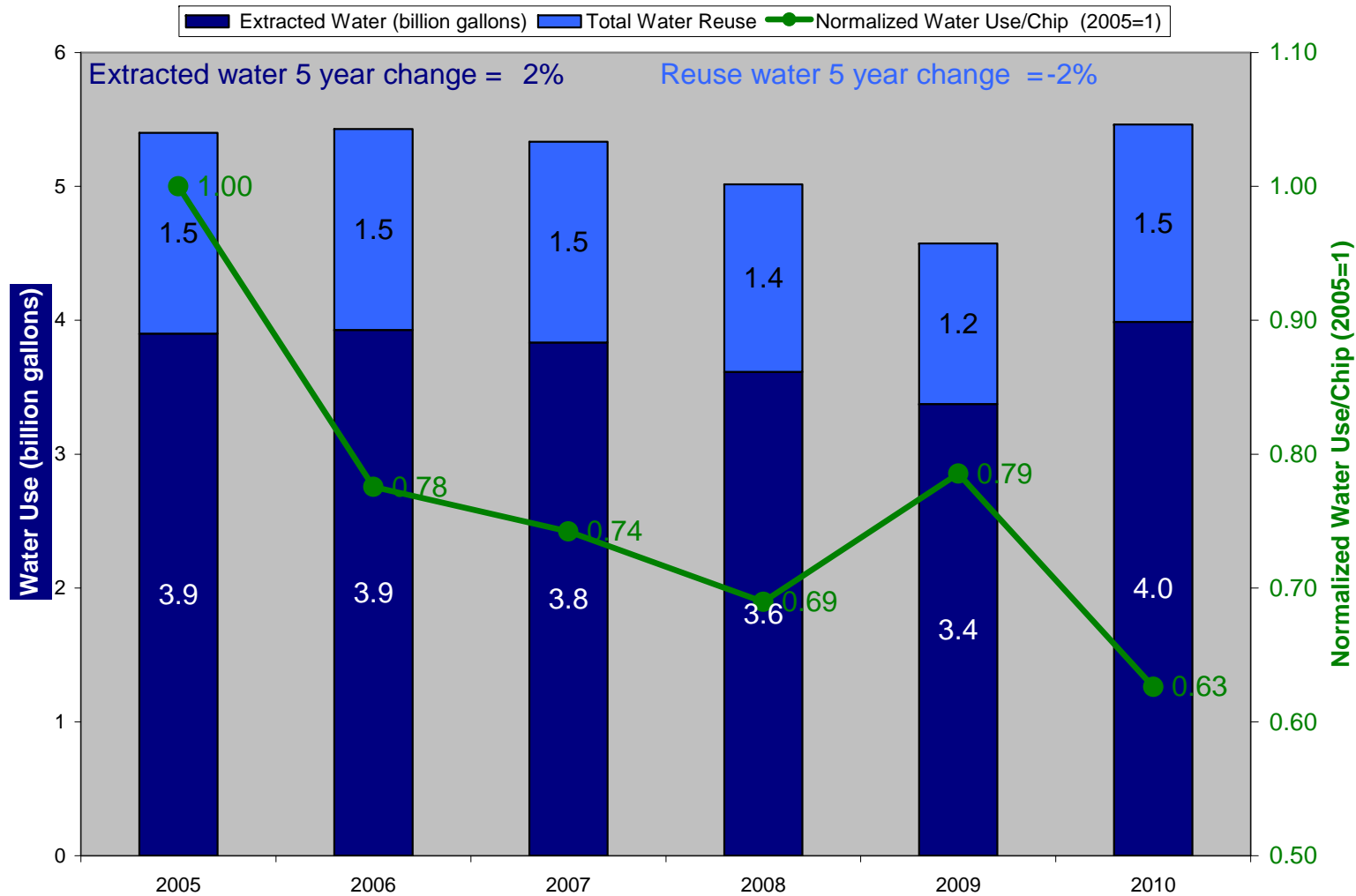
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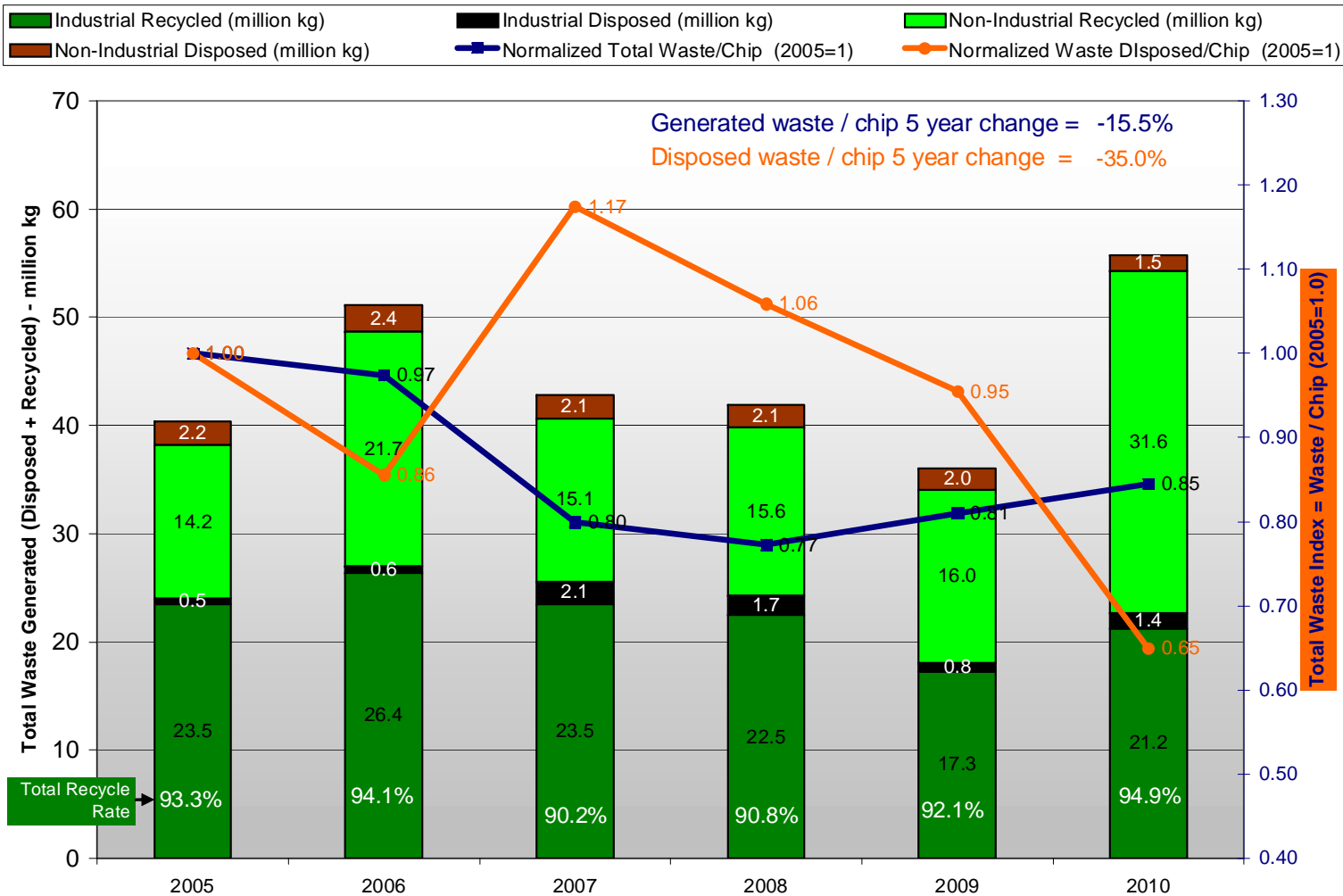
# TI Performance Metrics - GHG



# TI Performance Metrics - Water



# TI Performance Metrics - Waste



# Programs & Activities at TI

- First LEED-Gold semiconductor manufacturing facility (fab) in the world
  - RFAB in Richardson, TX
  - Cost to build was 30% less than our previous fab
  - At full build out, we will save more than \$4 million per year:
    - 20 percent energy reduction (>35% for facilities systems)
    - 40 percent water-use reduction
    - 50 percent emissions reduction
    - LEED Gold Certified Office and Fab
    - [www.ti.com/rfab](http://www.ti.com/rfab)



# Sustainability at RFAB



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Native Meadow Restoration



Rain Water Reuse Pond



Reflective Roof



Dark Skies Friendly Lighting



Exterior Shades



Day lighting



Efficient Lights



Solar Water Heating



Water Turbine Powered Faucet



Bicycle Parking



Efficient cooling system with waste heat recovery



# Programs and Activities



- All new major projects at TI will be LEED registered:
  - Building addition at our site in the Philippines (the first LEED-certified project in that country – Silver)
  - New assembly and test facility in the Philippines – Clark (LEED Gold Certified)
- We are integrating LEED-EB credits into our Best Practice Standards for our existing fabs and buildings
- We are allocating dedicated capital for utility savings projects
- TI provides vans for vanpools, subsidized DART passes, flexible hours, and many other incentives to help reduce commuting energy and cost
- TI releases an annual corporate citizenship report to align efforts and improve transparency in operations – [www.ti.com/csr](http://www.ti.com/csr)

# Energy Efficiency – TI Products

- **Continuous improvement in product design has reduced operating energy**
- The MSP430 is an ultra-low-power processor
  - Instant off and quick wakeup
  - Standby power is  $<1\mu\text{A}$  (a millionth of an amp)  AA battery would last  $>100$  years
  - Processing power is  $\sim 2\text{mA}$   AA battery would last 500 hours at full power
- **These processors are so efficient they can run on ambient energy harvested from the environment – no external power needed**
  - Vibration
  - Light
  - Sound
  - Thermal
  - Mechanical



Light harvesting

Mechanical (kinetic) energy harvesting

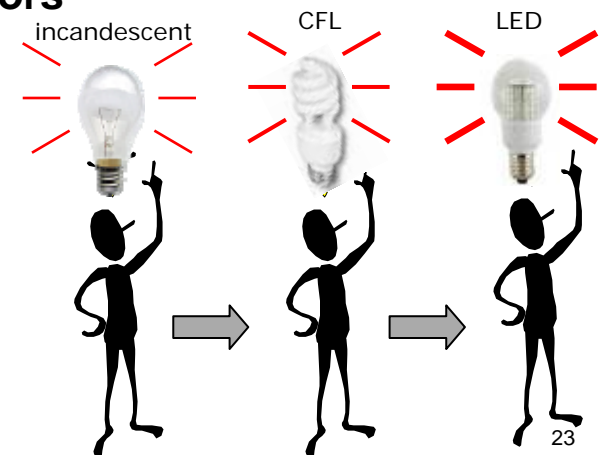


Vibration energy harvesting

# Energy Efficiency –Applications

Make It, Move It, **Use It** - efficiently

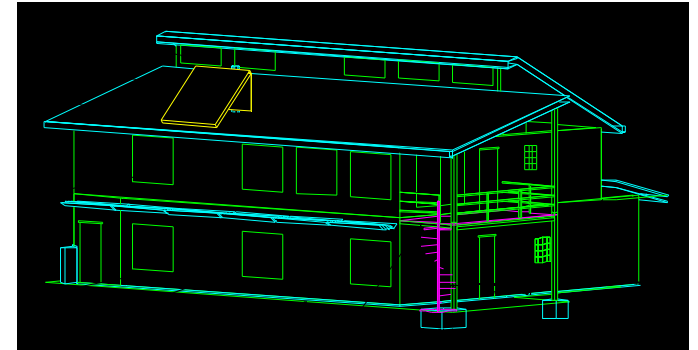
- **Electronics enable efficiency in many areas:**
  - **Solar / Renewable Energy**
    - Inverter electronics to convert the DC power to AC and synch with the grid
    - Battery charge controllers for efficient battery management
  - **Motor control (10 billion motors sold each year)**
    - Variable frequency drives (VFD) significantly reduce power consumption
    - Motor control
  - **Power efficiency**
    - Energy management devices and electronic components
  - **Power supplies, battery gauges, low power processors**
    - Power transformers
  - **Lighting control and LED lighting**
  - **HVAC systems**
  - **Controllers, actuators, sensors**
  - **Energy harvesting**
  - **Wireless, low power microprocessors**



# Sustainability at Home

# My House

- **Built in 1996 in Fairview, Texas**
- **I designed the house with four main goals:**
  - Resource efficiency
  - Low environmental impact
  - Long life / low maintenance
  - Cost effective
- **Major areas of focus**
  - Proper orientation for best solar control
  - Compact, efficient shape and layout
  - Well insulated shell / air-tight construction
  - Quality windows – in the right place, with the correct shading
  - Reflective roof
  - Solar water heating
  - Geothermal heat pump
  - Energy recovery ventilator
  - Natural day lighting / efficient lighting



# My House



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Westbrook House

# My House Performance



- **2,713 square foot all electric home, 2.2 acres, 3 people**
  - Average energy use: 825 kWh/month, \$84/mo - about 1/3<sup>rd</sup> the average
  - Average water use: 2,800 gallons/month, \$13/month – about 1/8<sup>th</sup> the average
  - No solar or other power generation, only solar water heating
- **Payback = 1 month**
  - Added \$13,000 to base house cost for upgrades
  - On a 15-year mortgage that added \$90/month
  - My utility bill was at least \$100/month less than other similar sized homes
  - I made \$10 in the first month, and even more as utility costs escalated
- **Notes**
  - Won the 1996 NAHB national Energy Value Housing Award for Innovative Design
  - Named the North Texas Municipal Water District 2009 Water Genius Award Winner
  - Toured over 1,500 people through the home via the National Tour of Solar Homes and other events

# Efficiency Can Be Beautiful



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# The NegaWatt

**NegaWatt (n)** - a measure of energy efficiency;  
a unit in watts of energy saved

Solar and wind may be sexy . . .



. . . but efficiency yields the best financial and  
environmental benefits

# Added Wind Generator in 2006



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# Tips for Existing Homes



- **Invest in a comprehensive energy audit of your house**
  - Each house is unique and an audit will identify YOUR home's specific opportunities in ranked order
  - You can tackle as many or as few as you wish
  - TexEnergy Solutions is one firm that performs audits - <http://www.texenergyaudit.org/auditcomprehensivete.htm>
  
- **Common areas noted for improvement**
  - **Insulation and infiltration**
    - Attic insulation is usually easy to add
    - Radiant barriers are effective at heat rejection
    - Caulking, sealing, and weather-stripping the perimeter
  - **Attic ventilation**
    - Continuous ridge vents and the small wind rotors are effective
    - Make sure you have adequate air intake under the eaves/soffits
    - One option is the insulate the underside of the roof an make it a semi-conditioned space
  - **Ductwork in the attic**
    - Flex ducts often have holes, sharp bends, or are detached from the supply register
    - Use duct with large straight runs, tight connections, and insulation

# Tips for Existing Homes



- **Common areas for improvement (continued):**
  - **Windows**
    - Add exterior shading on East/West windows (awning, solar screens, trees, . . .)
  - **Lighting**
    - Compact fluorescents or LED bulbs (also reduces cooling needed)
  - **Water Heating**
    - Well insulated water tank (I like the Marathon all-plastic units)
    - Set the temperature at the right level (<120 F)
    - Solar water heating can cover a large portion of the need in our climate
  - **Heating / Cooling**
    - Make sure you keep clean filters in the system
    - Use a programmable thermostat – and program it!
    - Use efficient ceiling fans
  - **Appliances**
    - Look for energy star rated appliances (tax free on Memorial Day weekend)
    - Unplug “wall warts” or put them on a power strip – turn off when not in use
  - **TIPS and Links listed at [http://enerjazz.com/house/index\\_existing.htm](http://enerjazz.com/house/index_existing.htm)**

# Not the Answer



Outlet wall – from Gadget Venue

## Power Bricks / Wall Warts

1.5 billion in US  
11% of US power use  
Efficiency of old units = 30%  
Current Energy Star IV = 70%+  
Current capability >94%  
Source: Energy Star



Energy

Vampire

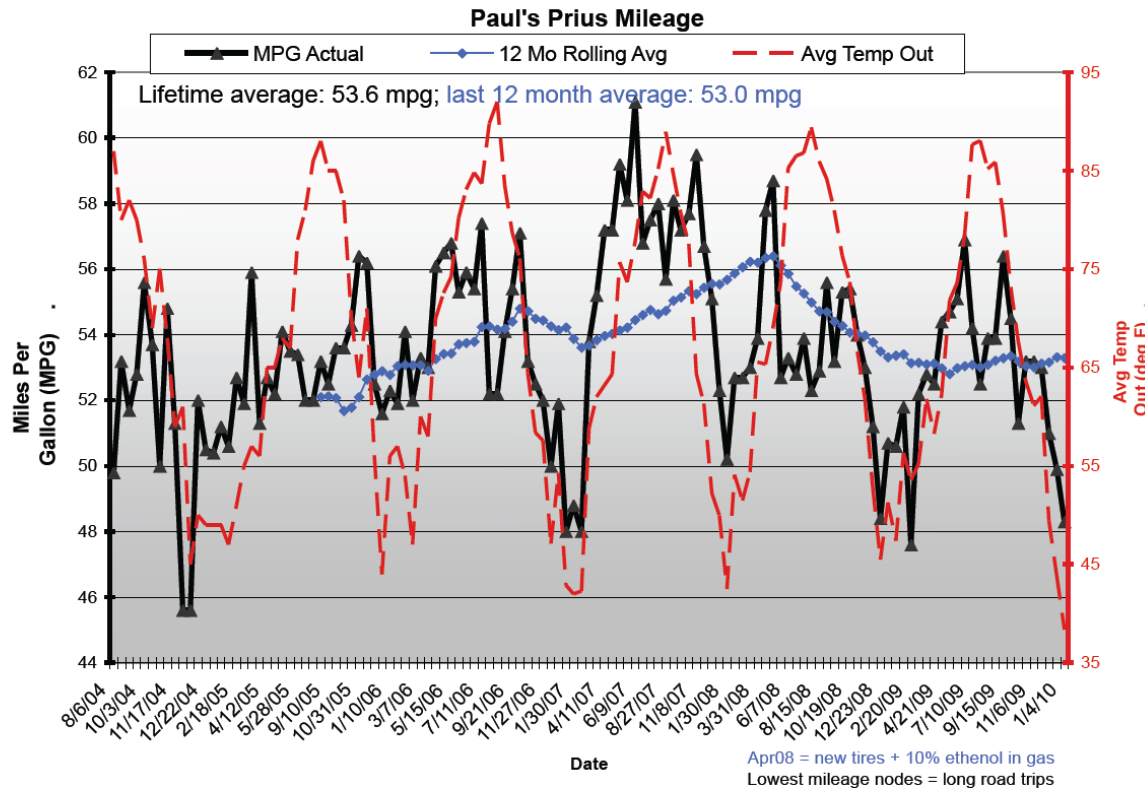


# My Car Performance

- Driven a Prius since 2004
  - Average mileage: 53.5 mpg
  - Annual average maintenance cost: \$160/yr total
  - Saved \$3,500 in gas vs. a 25 mpg car



We are a three Prius family



# Danger: Analysis Paralysis

- What is the payback of the following items?

Solar Water Heating



Leather Seats



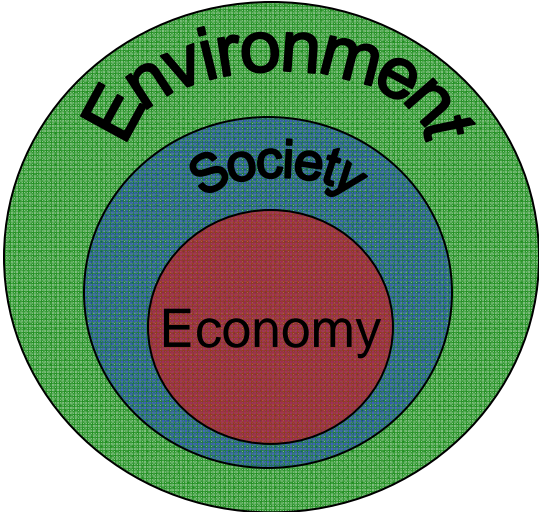
Crown Molding



- Chances are no one ever asks about payback on the last two, but the first one (which actually has payback) will get analyzed to death.

# Priority

*“The economy is a wholly owned subsidiary of the environment” –  
Gaylord Nelson, founder of Earth Day*



Make a pledge to make at least one small improvement in your resource consumption. If we all make the small changes it adds to big results.

# Thank You

Westbrook House – [www.enerjazz.com/house](http://www.enerjazz.com/house)

Westbrook Prius Data – [www.enerjazz.com/prius](http://www.enerjazz.com/prius)

Texas Instruments Citizenship Report – [www.ti.com/csr](http://www.ti.com/csr)