Energy Research at Stanford
Energy Research Groups at Stanford

• Energy Modeling Forum (EMF)
• Energy and Natural Resources Program in SIEPR (ENREP)
• Global Climate and Energy Project (GCEP)
• Project on Energy and Sustainable Development (PESD)
• Precourt Institute for Energy Efficiency (PIEE)
• Hoover Energy Policy Task Force

• School of Engineering
• School of Earth Sciences
• Stanford Linear Accelerator Center
Precourt Institute for Energy Efficiency

- A research and analysis institute at Stanford
- Established in October 2006
- Initial funding by Jay Precourt
- Mission
  - To improve opportunities for and implementation of energy efficient technologies, systems, and practices, with an emphasis on economically attractive deployment
  - Focus on the demand side of energy markets
  - Energy efficiency: economically efficient reductions in energy use (or energy intensity)
Key Distinguishing Features of the Precourt Institute

• Focus on **significant short term** (no more than a decade to start paying off) solutions to global energy and environmental challenges

• Through **technological, entrepreneurial, and behavioral** improvements in energy efficiency

• That are **cost effective** in meeting whatever objectives policy makers feel they need to pursue
# PIEE Research Matrix

<table>
<thead>
<tr>
<th>Methods</th>
<th>Buildings</th>
<th>Transportation</th>
<th>Electricity System</th>
<th>Industry</th>
<th>Appliances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modeling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Current Emphasis**
- **Anticipated Additions**
More Information

http://piee.stanford.edu
Energy Efficiency: Overview

James L Sweeney
Three Public Policy Drivers for Energy Efficiency

- Environmental Protection
  - Global Climate Change

- Security
  - Oil/International vulnerability
  - Vulnerability of infrastructure to terrorism, natural disaster, or human error
  - Avoid funding of our enemies

- Economics (Public policy and private sector issues)
  - Prices of electricity, gasoline, natural gas
  - Price volatility: oil, natural gas, wholesale electricity
  - Oil Import Premium
  - Management for energy efficiency can be very profitable
Economically Efficient Energy Intensification

Energy Efficiency Improvement

Decreased Energy Use

Increased Economic Efficiency

Inefficient Energy Saving

Waste

Economically Efficient Energy Intensification
Global cost curve of GHG abatement opportunities beyond business as usual

- ~27 Gton CO$_2$e below 40 EUR/ton (-46% vs. BAU)
- ~7 Gton of negative and zero cost opportunities
- Fragmentation of opportunities
Diesel anti-idling
Fuel efficient tires for LDV

Fuel economy - medium/ heavy trucks
Fuel economy standards - Federal Energy Bill
Solar PV (CA Solar Initiative)
Utility Based Energy Efficiency
Huffman Bill (Primarily lighting)
Federal Standards and Title 24 Revisions
Fuel economy standards - Pavley Bill

Cement Production Efficiency
Petroleum Refining
Petroleum & Gas Production
Fly Ash Substitution for Cement

Smart Growth planning and others
Reduced venting/leaks in oil and gas system
Conservation forest management

Light duty plug-in hybrids
Conservation tillage

CHP Residential and Commercial: Aggressive

Industrial CHP (aggressive growth)

High-GWP gases: stationary source

Afforestation/ Reforestation
Recycling-Composting

CHP Residential and Commercial
Incentive: ITC (Investment Tax Credit) and PTO

Wind Electric
Cement Production Fuel Switching

Solar Thermal

Biofuels
Ethanol (Low Carbon Fuels)

Small hydro
Geothermal power

Other Materials Production
Why Do Negative Costs Persist?

- **Market Failures**
  - Pricing
    - No prices
    - Average Cost Pricing

- **Institutional Barriers**
  - Agency problems
  - Inability to capture benefit from next buyer
  - Outdated codes

- **Individual Non-optimization**
  - Knowledge
  - Ability to analyze
  - “Below the Radar”