Scientific & Technological Innovation Partnerships for Clean Energy Development

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PURDUE ENGINEERING Think Impact.

Alianza de Energía y Clima de las Américas

ECPA

Únase a nuestra iniciativa hemisferica!

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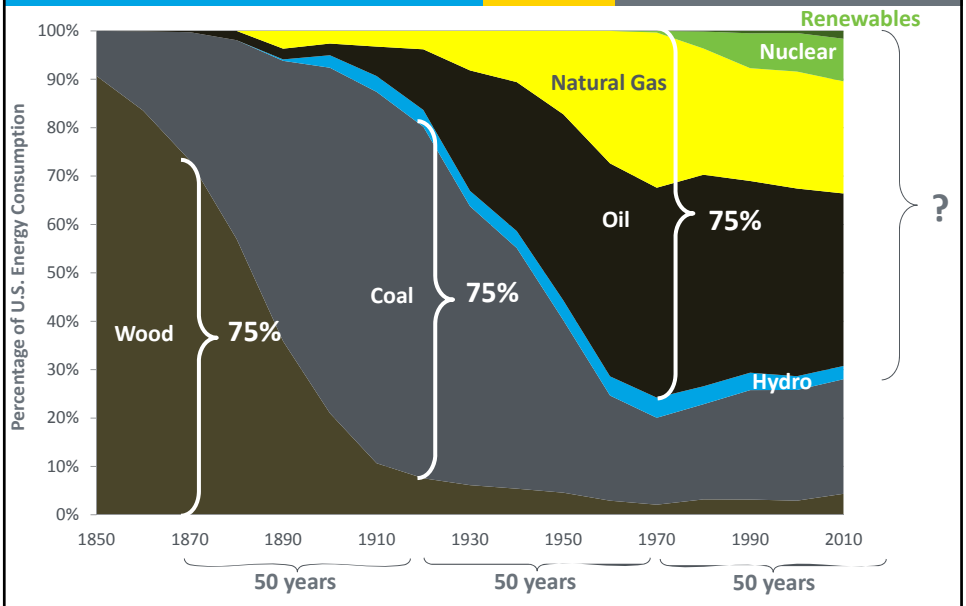
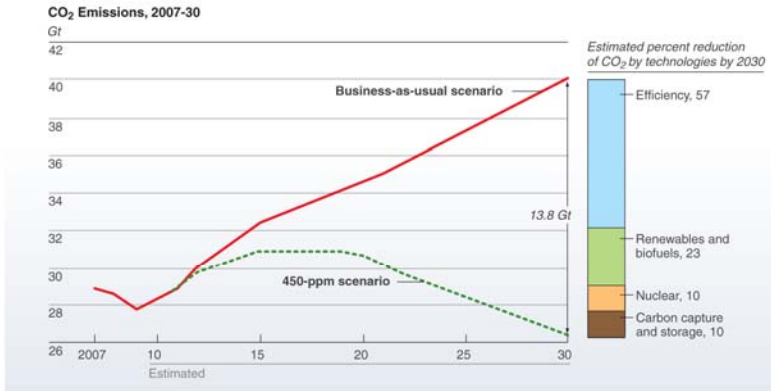
History of Energy Use



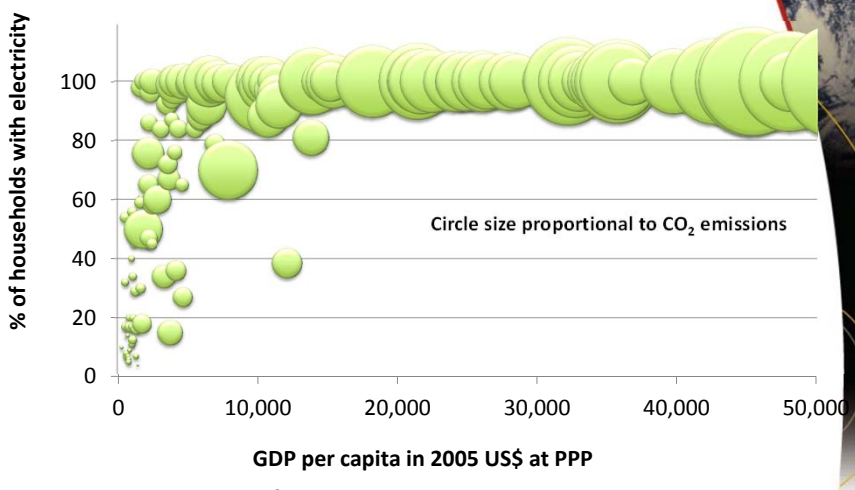
Sources: EIA, *Annual Energy Review: 2008* and EIA, *Annual Energy Outlook: 2009 with Recovery Act Update*

Steep Drop in CO_2 Emissions Required To Meet Long-Term Climate Target

To hold CO_2 in the atmosphere to 450 parts per million (ppm), the International Energy Agency (IEA) estimates that global CO_2 emissions in 2030 would need to be about 14 gigatons (Gt) below business-as-usual projections.

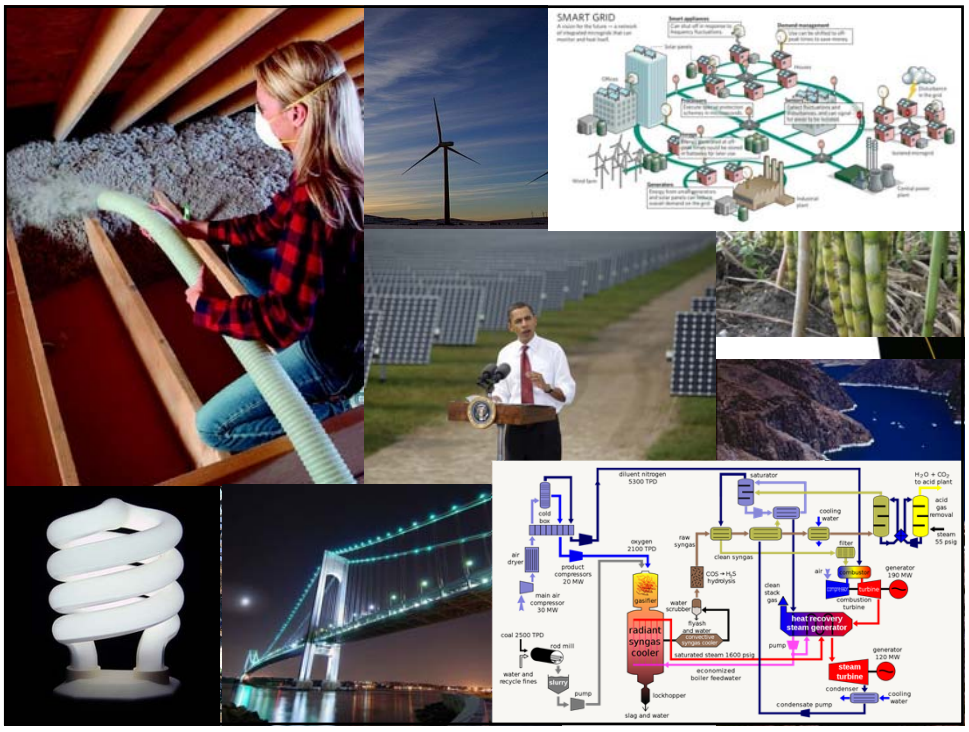


per capita Emissions Track Energy Access



Saturation in electrification reached early in GDP growth, but emissions keep rising past this point

L Monari, World Bank



Challenges with Renewables

- Energy density (except for nuclear)
- Intermittency and variability (storage)
- Grid integration and distribution
- Scalability
- Siting and land-use
- Ecological effects
- Complexity
- Cost

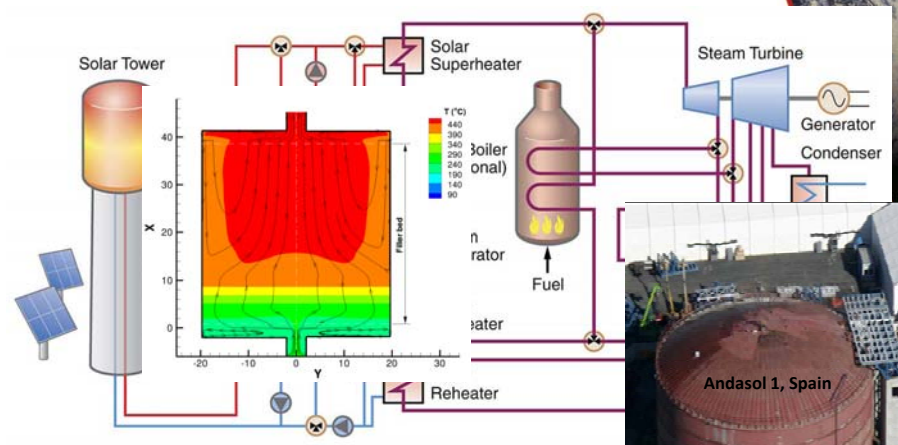
Three Examples from Purdue Research

- Energy storage in solar thermal plants
- Waste heat recovery from power plants
- Energy efficiency in information technology applications

"I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait 'til oil and coal run out before we tackle that."

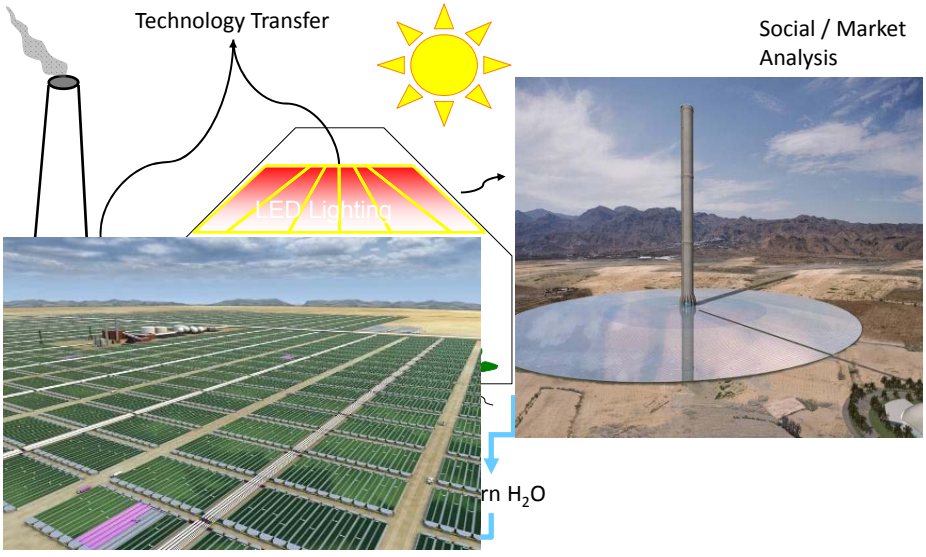
Thomas Edison, 1847-1931

Energy Storage for CSP Plants



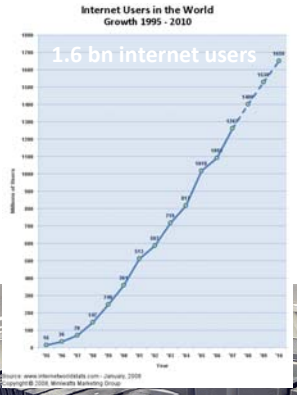
Yang & Garimella, *Solar Energy* 2010

Waste Heat Recovery in Power Plants

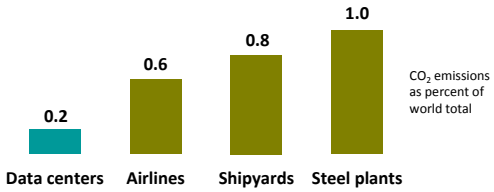


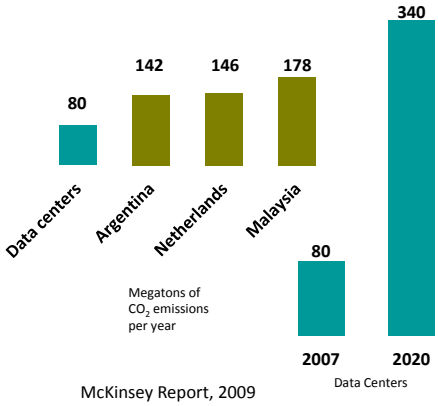
Leffler, Bradshaw, Groll & Garimella, *Appl. Energy* 2011

Need for Energy Efficiency in Electronics



A Chicago data center for Microsoft is 17 football fields in size





McKinsey Report, 2009

Sustainable Development via Public-Private-Academic Partnerships

PURDUE UNIVERSITY Discovery Park

PURDUE'S DISCOVERY PARK IS:

Purdue's hub for interdisciplinary and translational research, conceived as a place where scholars from all disciplines could work together to define whole new areas of research and solve grand challenges.

PURDUE UNIVERSITY Discovery Park

- Bindley Bioscience Center
- Birck Nanotechnology Center
- Burton D. Morgan Center for Entrepreneurship
- Discovery Learning Research Center
- Global Sustainability at Purdue
  - Center for the Environment
  - Energy Center
  - Purdue Climate Change Research Center
  - Center for Global Food Security
  - Water Community
- ACCESS: Advanced Computational Center for Engineering and Sciences
  - Cyber Center
  - Rosen Center for Advanced Computing (ITaP)
- Oncological Sciences Center
- Regenstrief Center for Healthcare Engineering

Burton D. Morgan Center for Entrepreneurship

Birck Nanotechnology Center

Bindley Bioscience Center

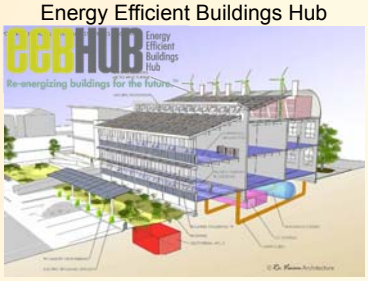
Gerald D. and Edna E. Mann Hall

Hall for Discovery and Learning Research

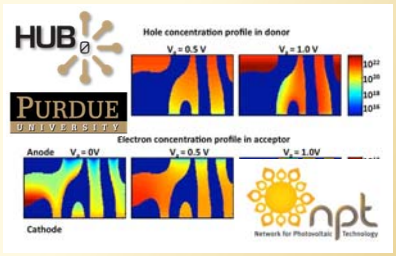
PURDUE UNIVERSITY Discovery Park

Large Energy Programs

Energy Efficient Buildings Hub



Network for Photovoltaic Technology



Hoosier Heavy Hybrid Center of Excellence

Center for Catalytic Conversion of Biomass to Biofuels

PURDUE UNIVERSITY

2011 Independent Study Reports:

- $1.3 billion annual economic impact on Indiana.
- 4,000 Indiana jobs.
- Top 20 private employer in Indiana.
- $63,000 average annual wage.
- $48 million contributed to state and local taxes.
- $49 million in Federal grants for startups since 1987.
- Park companies fund $2.5 million annually in sponsored research at Purdue University.

PURDUE UNIVERSITY Discovery Park

Impacting Our World

ENTREPRENEURSHIP ACADEMY

Established in 2007

- 228 graduates.
- 53 Indiana counties participated.
- 57 students received tuition vouchers.
- 65% attending Purdue.
- 80% interested in creating a startup.

Purdue's Global Engagement for Sustainable Development

- **West and Central Africa – Hermetic grain storage bags saving farmers hundreds of millions of dollars annually (supply chain, training)**
- **Afghanistan – educational programs in agriculture, engineering, education (with USAID)**
- **Kenya – health care delivery, diabetes treatment, water resources**
- **Brazil – 30 year Purdue involvement in Cerrados, opportunities for Indiana Agribusiness**

Engineering Projects in Community Service (EPICS)

EPICS Goals:

- Prepare students for professional practice through authentic experiences
- Address compelling community needs through long-term partnerships with community organizations

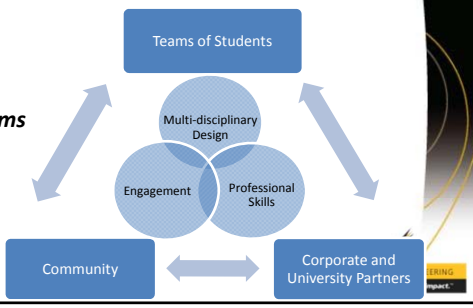
Environment

Access and Abilities

Education

Human Services

- ***20 Universities with EPICS Programs***
- ***Purdue is EPICS Headquarters***
- ***Networking/support of EPICS programs***
  - ***Collaborate for funding***
  - ***Share resources***
  - ***Broaden Impact***



Engagement with Colombia

To work with the Colombian universities, government and industries for a partnership in focus areas at a scale that leads to significant impact with a financially sustainable model

- **To have a significant impact on S &T capacity in Colombia**
  - **Training critical mass of pre-doc, doc, postdocs in focus areas**
  - **Improve collaboration between Purdue and Colombian faculty in focus areas by pre-doc, doc, postdoc, nanohub training**
- **To have significant Economic & Social impact in Colombia**
  - **Strong focus on tech commercialization, industry partnerships**
  - **Service learning, engineering education, EPICS partnerships**
- **To have impact in Indiana and Purdue**
  - **Connect Colombian companies to Indiana business and policy makers**
  - **Bolster our research enterprise**

http://engineering.purdue.edu/cpiasr

Emerging Engagement with Costa Rica

Program Elements:

- TEC faculty pursuing PhD degrees at Purdue
- Research and commercialization, with focus on clean energy, information technology/visualization, nanotechnology, biotechnology.
- Joint educational programs

Clean Energy Partnership: Trinidad

Deployment of Distributed Solar and Solar/Thermal Energy Systems Through Academic-Public-Private Partnerships in the Caribbean Region

Sponsored by ECPA Clean Energy Program, US Dept. of State

Purdue University
University of the West Indies (UWI)
Partners of the Americas

Key Goals:

- **Solar energy demonstration site at UWI**
- **Regional symposium on clean energy.**

Roof-top site for solar panel installation – at UWI- St. Augustine

Thanks for your attention…

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