

# **An “update” on The Conn Center**

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Conn Center

# OUTLINE

- Motivation for renewable energy research
- Facility infrastructure & renovation
- Center organization & goals
- Research progress
- Going forward

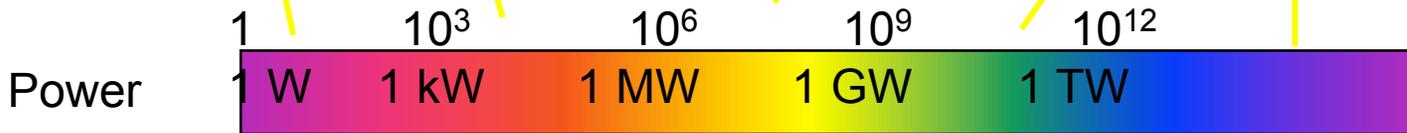
Materials manufacturing      Solar      Smart buildings  
Energy storage      Biofuels      Education

# Motivation – Why renewable energy research?

## Power Units: The Terawatt Challenge



Slide courtesy of Dr. Nate Lewis, CalTech



Energy  
1 J =  
1 W for 1 s

**Global energy demand is about ~20 TW and is expected to double by 2050 and triple by end of century.**

## MOTIVATION - GREEN CHALLENGE

To keep same CO<sub>2</sub> levels, need to produce 10 TW power by 2050 using carbon neutral sources (*Nature*, 395, 881 (1998))

### The solution – solar?

- Earth receives about 120,000 TW/yr of energy from Sun
- Need less than 0.16% of globe area to produce 20 TW power using 10% efficiency Solar cells – *N. Lewis, CalTech (2005)*

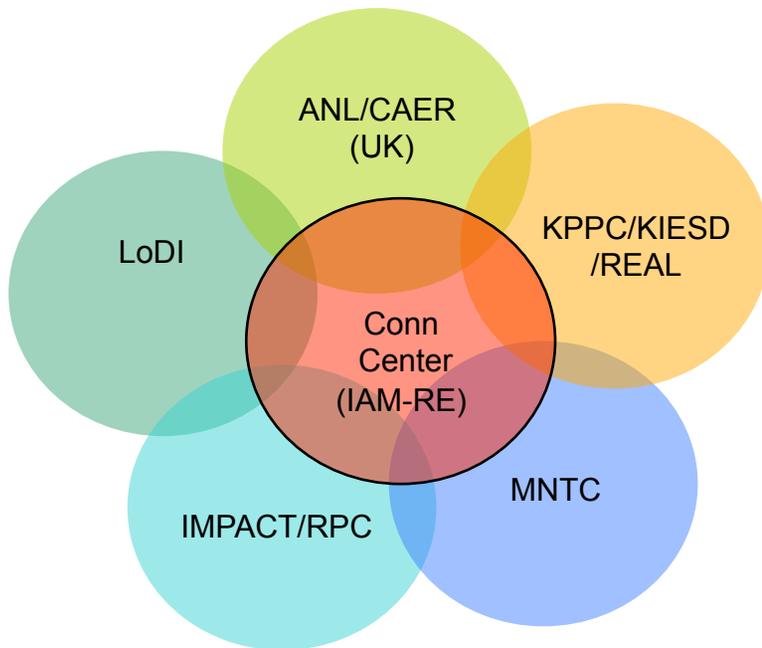
# CO<sub>2</sub>-reduction in the energy sector

- Energy efficiency - in production, **traffic, building sector**
- Nuclear energy - non-renewable feedstock, final storage not clear, dangers during operation: no good solution for the global energy problem
- Clean coal technologies - requires carbon sequestration, unproven technology, energy inefficient, may pose danger of accidental release
- Wind - fluctuating production, limited number of suitable sites
- Hydro - can be switched on instantaneously, suitable for storage, good sites limited, production should be maximized
- Biofuels - interesting as liquid fuel for traffic, production energy intensive
- Solar energy (**Photovoltaics, Solarthermal**) - unlimited energy source  
PV: continuous price reduction through savings of scale

*Courtesy of Dr. Eicke Weber of Fraunhofer Institute for Solar Energy Systems ISE*

# Conn Center

## *Goals for Conn Center (Tentative)*



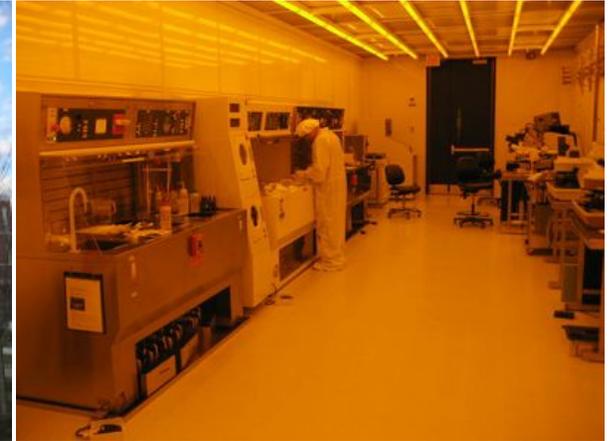
- **Transportation Fuels/Sector**  
Electric & Hybrid Electric Vehicles  
Alternate Fuels (ANL/CAER/ Industry/  
UofL Vehicle Research effort/RPC)
- **Economic Impact**  
Translational R&D center to attract  
manufacturing sector to KY in the  
area of renewables.  
(ANL/CAER, RPC, MNTC)
- **Smart Buildings for KY**  
Increase energy efficiency &  
use of renewable energy sources  
(KPPC, KIESD, REAL, MNTC, LODI)

### LEGEND

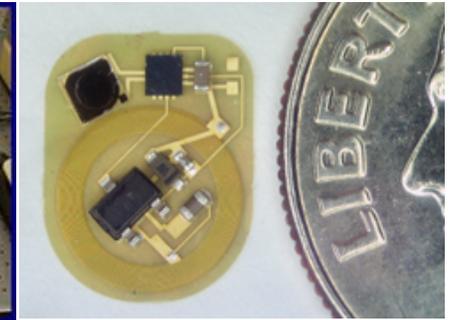
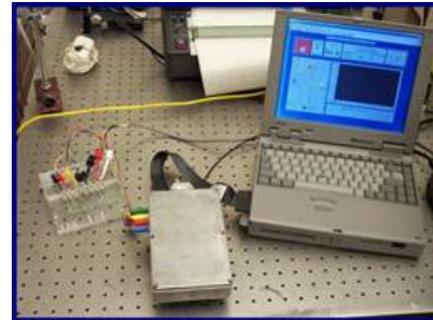
CCRERES – Conn Center for Renewable Energy Research and Env. Stewardship  
IAM – Institute for Advanced Materials  
KPPC – Kentucky Pollution Prevention Center  
ANL – Argonne National Lab National Battery Research Center  
LoDI – Logistics and Distribution Institute  
RPC – Rapid Prototyping Center  
MNTC – Micro/Nano Technology Center  
IMPACT - Vehicle architecture research  
REAL – Renewable Energy Applications Laboratory

# Micro/Nanotechnology Center (MNTC)

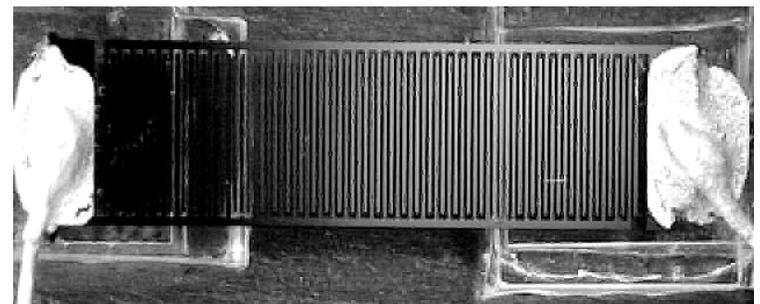
Houses 10,000 sq.ft cleanroom & associated labs for device packaging and testing.



**1. Energy efficiency:** Novel sensors and low/no power systems for energy reduction.



**2. Micro-energy and power sources**



# Research Progress

- **Infrastructure development (DOE, NSF, SMDC)**
  - Acquired materials characterization & solar test capabilities
  - Recruited Dr. Jacek Jasinski as the characterization theme leader
  - Rodica McCoy, temporary postdocs and students support it.
  - Recruited distinguished scientist, Dr. P. Ratnasamy, to develop biofuels theme
- **Renewable energy research (DOE-EPSCoR, KREC)**
  - *DOE-EPSCoR Cluster*: \$1M per yr, 10 faculty from UofL & UK (Solar-hydrogen; Solar-electricity; Thermionic) (2007-2010; 2010-2013)
  - *KREC Grants*: \$1.2M, 6 faculty from UofL (2007-2010) (Solar-electricity; Passive solar; Li ion Battery; Biofuels)
  - Currently organizing group proposals to NSF' RESTOR and SEED initiatives
- **Industry-university service center**
  - Facilities were used by industry researchers -> \$150K per yr
  - Sudchemie reported a successful catalyst due to the interaction.