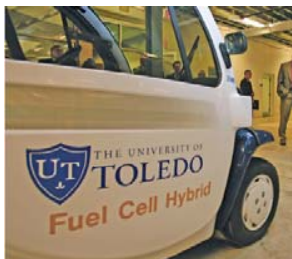


University System of Ohio Research Center of Excellence

Advanced Renewable Energy and the Environment at The University of Toledo

FLC Midwest Regional Meeting
Madison WI
August 18, 2010

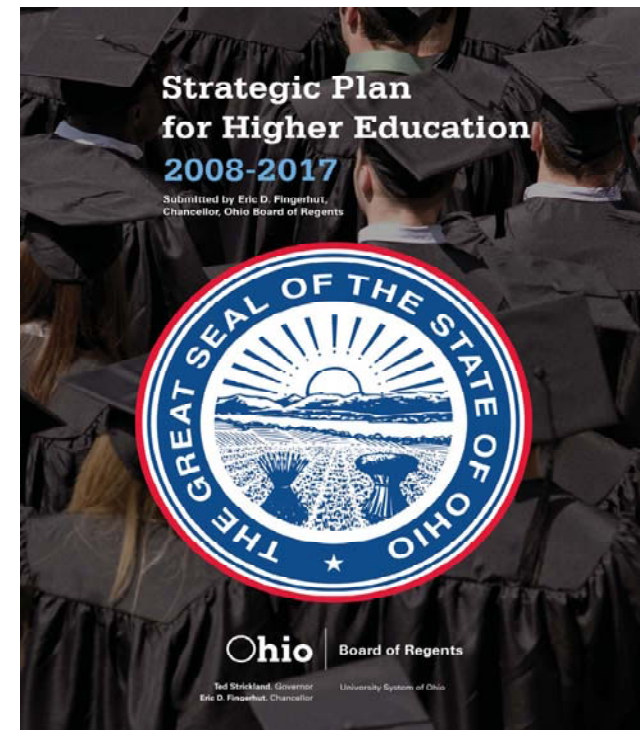


Frank J. Calzonetti
Vice President for Research and
Economic Development



University System of Ohio Centers of Excellence

- Defined in the University System of Ohio's Strategic Plan for Higher Education, March 2008
- High quality academic centers that anchor dynamic industry clusters
- Elements:
 - Outstanding faculty and students
 - Connections to the local economy
 - Economic impact (jobs, start-ups, license income)
 - Data verified by credible and widely **recognized metrics**



University of Toledo's Center of Excellence Advanced Renewable Energy and the Environment

- Designated by Governor Ted Strickland and Ohio Board of Regents Chancellor Eric D. Fingerhut on October 28, 2009
- UT submitted three Center of Excellence Proposals
 - Advanced Renewable Energy and the Environment
 - Transportation Logistics
 - Biomarker Discovery and Translational Bioscience (also designated by the Chancellor)
- Future designations to be made (transportation June 2010)
- Governor Strickland visited UT to confirm designation on October 29

Why Renewable Energy and The Environment?



- Addresses Major Global Growth and Investment Trends
 - Need for clean energy
 - Need for sustainable development
- Internationally recognized program in solar energy and growing recognition in other areas
- Strong research faculty and excellent research facilities
- Strong interdisciplinary efforts in environmental research
- Internationally known clean energy incubator
- Important contributions to growth of local industry and leadership in industrial recruitment
- Leadership in developing a renewable energy cluster
- Strong research relationships in place with other universities and federal agencies

Major Elements of Research Center of Excellence

Advanced Renewable Energy

- Solar Energy
- Biomass
- Wind
- Energy Storage and Energy Management



Environmental and Ecosystem Sciences, Monitoring and Remediation



Solar Energy

UT a Global Leader in Thin-Film PV

- Critical mass of research faculty
- Competitive awards and strong Third Frontier support
- Unique research facilities
- PVIC (Wright Center for PV Innovation and Commercialization)
- Unique technology incubator
- Strong IP position
- Strong history in commercial development
- Recognition of technology cluster
- Global positioning
- Strong political support



UT's Lead Technology—Thin Film Photovoltaics

Thin-film PV –UT's Niche

- light-absorbing layers about one micron thick
- Lower efficiencies than c-Si (7-13%)
- But, less expensive to produce
- More flexibility with applications (lighter, flexible)
- Concern about lifetime performance

Thin Film Photovoltaics Research at UT

- **amorphous silicon (a-Si)**
 - e.g. Xunlight Corporation
- **cadmium telluride (CdTe)**
 - e.g. First Solar—global leader
- **copper-indium-gallium-diselenide (CIGS)**
 - e.g. Nanosolar (California)
 - expected to provide higher efficiencies at low production costs

Solar Energy

Connection to the industry's local economy

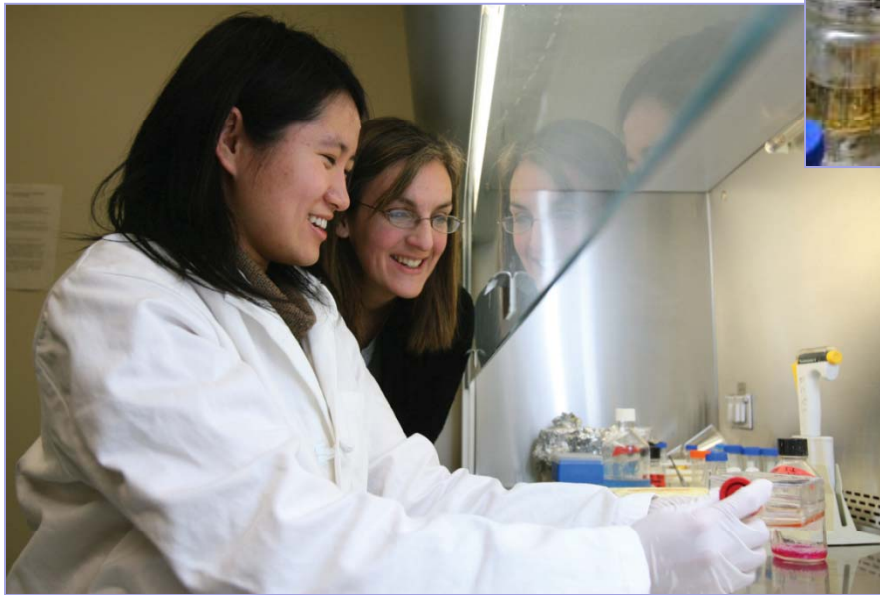


- 27 technologies licensed and/or optioned
- \$2.8 Million in industry sponsored research
 - Includes \$2.4M of federal pass through money
- 38 invention disclosures
- 25 companies have a relationship with the Center of Excellence
 - Companies such as Pilkington, Unisolar, First Solar, Solar Fields, MWOE, Xunlight, ITF, Calyxo, Xunlight 26, and Willard & Kelsey are located in NW Ohio & SE Michigan
- More than 6,000 people are working in the solar industry in the state or region related to the Centers of Excellence

Biomass Energy

Expanding area of Technology

Biomass energy from *non-food* sources such as cellulose and algae



UT's Research Focus

Biomass from cellulose

- Novel pretreatment of cellulose using room-temperature ionic liquids
- Biomass processing technology

Algae Biofuels Research Facility

- Ohio Wright Project Award with Ohio University
- Pilot-scale facility on the Scott Park Campus



Biomass Energy Local Economic Contributions

- Three technologies licensed and/or optioned
- \$1 million Industrially financed research expenditures (5 years)
- Three invention disclosures
- Two companies have relationship with the Center of Excellence
- Companies such as Sugnait Systems, The Andersons and Red Lion are located in NW Ohio & SE Michigan



Wind Energy

UT's Core Strength

- Expertise in College of Engineering working for many years with NASA on wind turbine designs
- U.S. DOE Collaborative project underway with BGSU in Advanced Offshore Wind Energy (BGSU prime)
- Separate U.S. DOE Award to evaluate two-bladed wind turbine design for offshore installations (UT prime)
- Opportunity to establish unique position in offshore wind—likely to be major area of development



Energy Storage

- Batteries
 - Long history of work with the automotive industry
- Power Management/Smart Grid
 - Hand held to grid scale systems
- Fuel Cells
 - Many years of collaboration with NASA Glenn

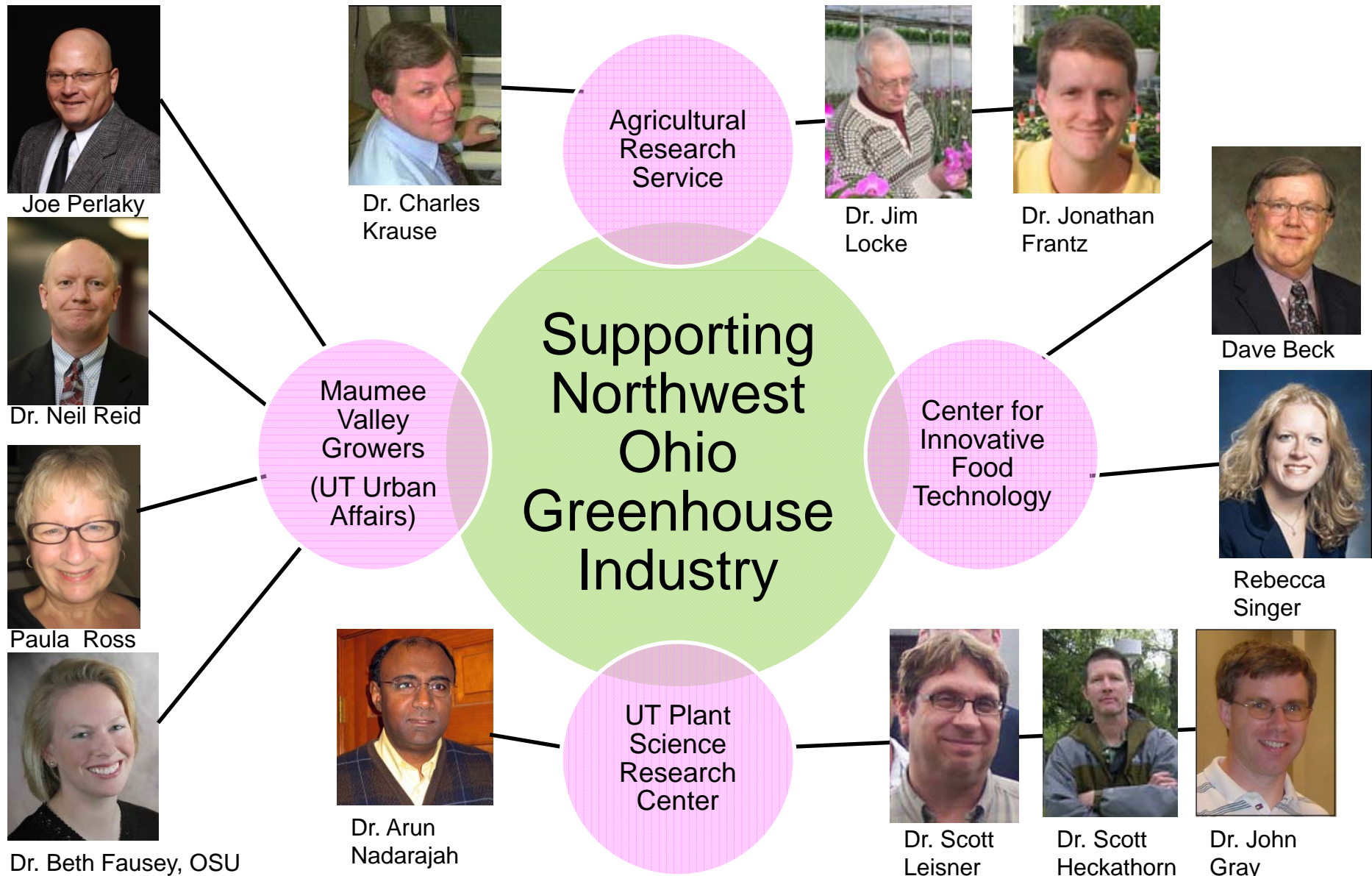
Environmental and Ecosystems Sciences, Monitoring and Remediation

- Critical mass of faculty across several academic departments
- Unique assets
 - Lake Erie Research Center
 - Plant Science Research Center
 - Agricultural Research Service collaboration
 - Stranahan Arboretum experimental site
 - GIS/remote sensing laboratory
 - Oak Openings AmeriFlux monitoring station
- Strong linkages to local companies
- Strong collaborations with other research centers and government agencies in the U.S. and abroad
- Addressing local problems and those of the Great Lakes—leading toward solutions and understanding of global problems



Lake Erie Research Center

Greenhouse Industry and Urban Agriculture



Environmental & Ecosystem Sciences, Monitoring, and Remediation

Local Economic Contributions

- 6 invention disclosures
- Addressing challenging local environmental problems
 - King Road Landfill
 - E coli at Maumee Bay State Park
 - VHS outbreak in Great Lakes
 - Sewage sludge monitoring
- Greenhouse industry
- Urban Agriculture



Scott Park Campus of Energy and Innovation

- UT has committed an entire campus to advancing and demonstrating renewable, alternative and sustainable energies.
- The campus will serve as a hands-on alternative energy laboratory for teaching, research and demonstration.
- The campus will generate energy and reduce the University's carbon footprint.
- Proposed projects will include work with wind, solar, biomass, geothermal, energy storage, electric transportation, and transformational grid analytics and modeling.

We are creating high wage jobs

- Jobs directly from university research
- Jobs created by research in collaboration with local industry
- Jobs created as new enterprises are formed
- Advancing technology clusters-
-Jobs attracted as new companies move into region to be near industry cluster



Clean and Alternative Energy Incubator – Wright Center for Photovoltaic Innovation and Commercialization



UT-PVIC Currently Occupies space in the Clean and Alternative Energy Incubator

- 1,100 m² state-of-the-art laboratory space

UT and Dow Corning partnering to form the “Solar Valley Research Enterprise” with submission to DOE PV Manufacturing Initiative



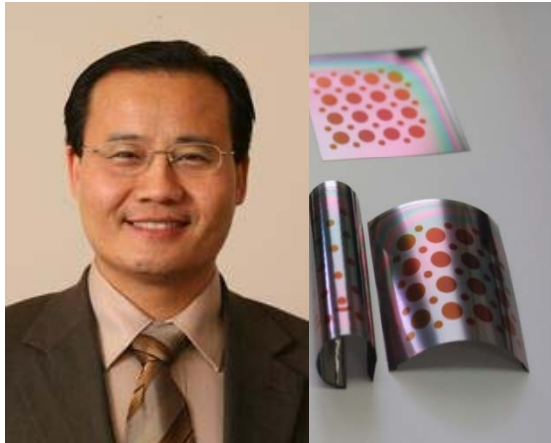
Clean and Alternative Energy Incubator



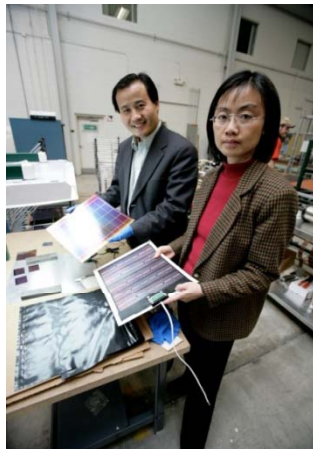
Current Metrics:

- **12 Companies**
- **5 Graduates**
- **4 Joint Ventures Formed**
- **8 Centers**
- **216 Business Jobs Created, with 21.5 postings**
- **17.5 Center Jobs with 6 postings**
- **Total Wage impact is greater than \$15,660,000**
- **Over \$660,000,000 in investment, loans, and grants in local companies**

Creating Jobs from University Spinoff Company



Dr. Deng advanced research in his UT Lab on a-Si solar cells



Scaled up and tested cell in UT's Incubator



Xunlight located its manufacturing facility approximately 1 mile from the University's Main Campus



Xunlight delivered its first shipment of commercially manufactured solar modules to The University of Toledo



Renewable Energy and the Environment Global Positioning

- Positioning Northwest Ohio as a leading global cluster for renewable energy
- Understand growing industry
- Foster collaborations
- Attract investment to Ohio
- World Future Energy Summit (Abu Dhabi) and MASDAR
- Evaluating China opportunities



Thank You!

Frank Calzonetti
Vice President for Research and Economic Development
The University of Toledo
frank.calzonetti@utoledo.edu

