

Research and Commercialization of Renewable Energy Technologies

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IUPUI

Indiana University-Purdue University Indianapolis



- 31,000 Students
- \$300,000,000 R&D each year

Lugar Center for Renewable Energy



MISSION

To promote research excellence in renewable energy through collaborative efforts among faculty in the disciplines of engineering, chemistry, physics, biology, and environmental affairs and public policy.

GOALS

- Develop an international reputation for excellence in renewable energy research, with an emphasis on renewable hydrogen generation and its applications.
- Develop and sustain a core expertise in fuel cell technology and in bio-fuel production and applications.
- Develop and sustain research activities through collaborations and partnerships with federal agencies, state government, and industry.
- Pursue commercialization of new technologies through industry collaborations.
- Expand participation to all Indiana University campuses.

Focus Areas



Renewable Energy



SCHOOL OF ENGINEERING AND TECHNOLOGY

INDIANA UNIVERSITY-PURDUE UNIVERSITY
Indianapolis



- Batteries & Grid Storage
 - Li-metal
 - Anode/cathode/electrolyte chemistry
 - Seawater flow battery
- Fuel Cells & Hydrogen
 - Non-Pt catalyst for PEM
 - Hydrogen generation and storage
 - Anion-Exchange Membranes
 - SOFC for APU and home energy
- Combustion Engines
 - Advanced gas turbines
 - Internal combustion engines
 - Power and propulsion systems
- Waste-to-Energy
 - Heat, oils for refining, electricity
 - Advanced gasification for MSW and biomass
 - Gas-to-liquids biofuels
- Policy & Economics
 - Urban, State, Federal
 - Energy forecasting and land use changes
 - Environment & Human health
- Commercial/Institutional & Buildings
 - Sustainable buildings
 - Energy and resource recovery
- Traditional Renewables
 - Wind power, including hydraulic wind
 - Solar power, including Space Solar Power

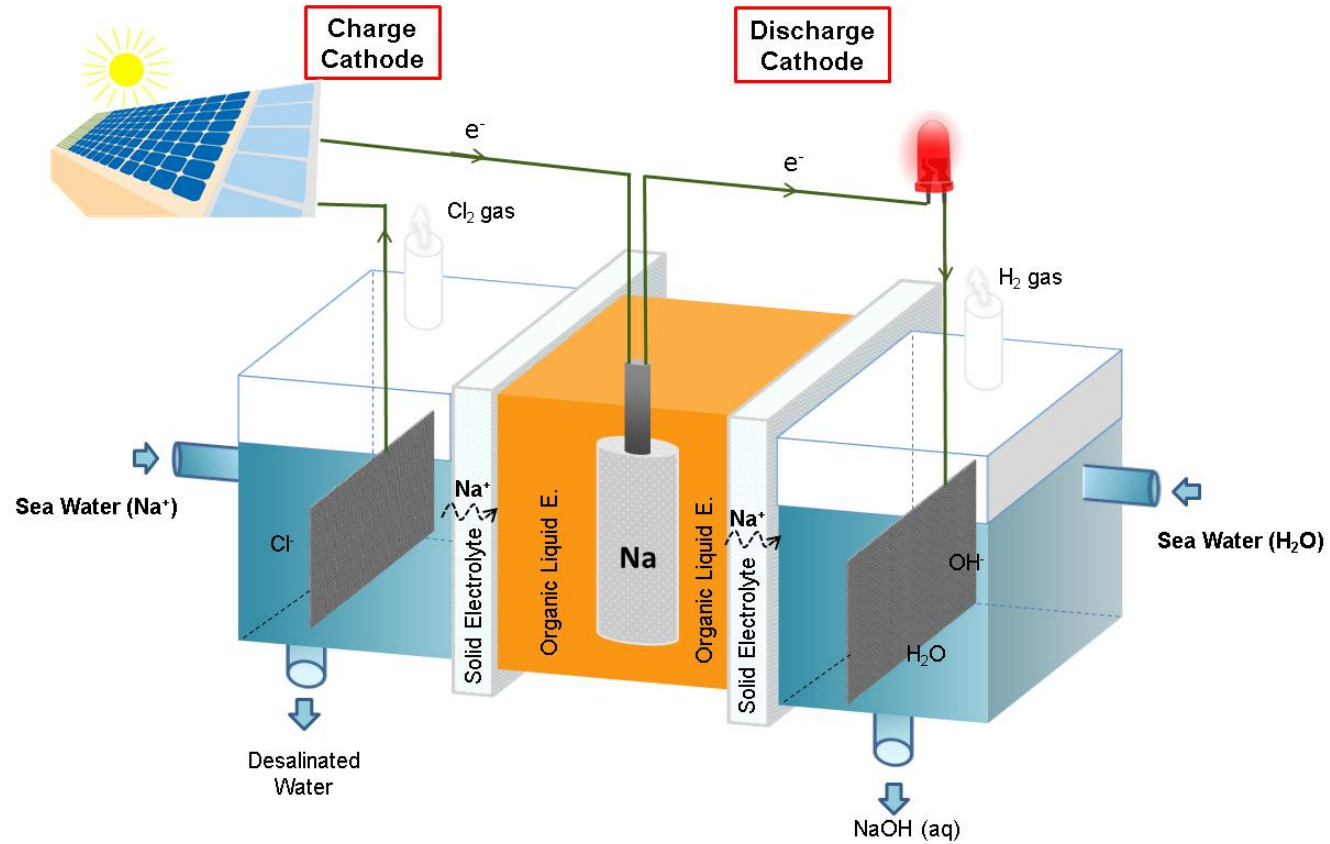
- Installation & Maintenance
 - Training
 - Automation
 - Diagnostics
- Manufacturing Science
 - Photovoltaic semiconductors
 - Nanotechnology
 - Fuel Cells
 - High-temperature ceramics
- Efficiency
 - Industrial assessment
 - Curriculum development
 - Sustainable Technologies Certificate
- Entrepreneurism
 - Economic pro forma & business plans
 - Incubators and mentoring
 - Raising capital
- Sustainability & Lifecycle Analysis
 - Electric vehicles
 - Energy storage
 - Urban environment
- Switchgear, Diagnostics & Cybersecurity
 - Single transistor inverter
 - Synchronous distributed generation
 - Microgrids

Grid Storage using Seawater

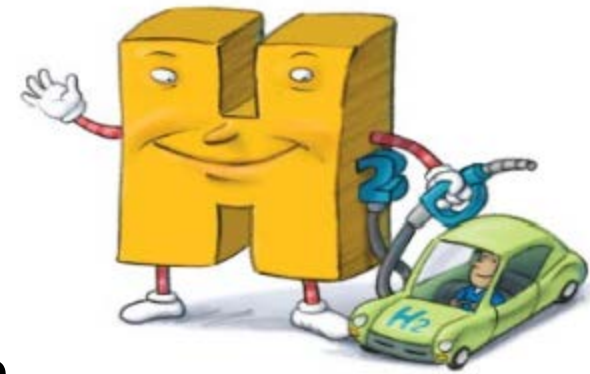


FLOATING TURBINE

Mounting wind turbines on a floating platform will allow wind farms to be built in deep water

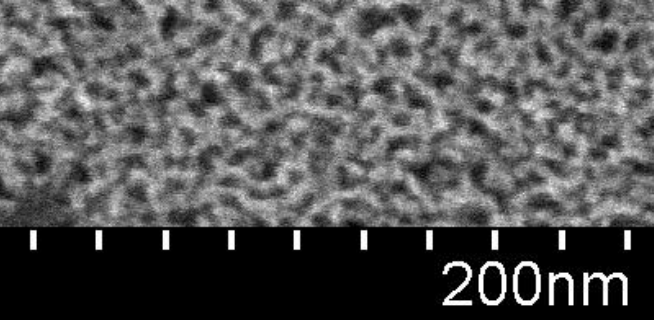


Hydrogen Generation

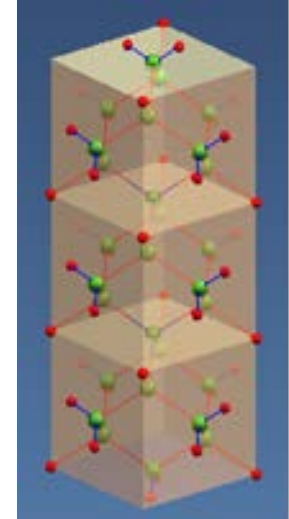


- Small-scale hydrogen generation
 - USDA BRDI \$1.0MM + \$2.0MM DOE + more
 - Tube furnace, externally heated
 - Clean syngas ($H_2 + CO$)
 - Energy self-sufficient (once started)
 - Hydrogen slipstream available
- Scales up!
 - Bundled tubes, fed in parallel
 - Modular for right-sizing

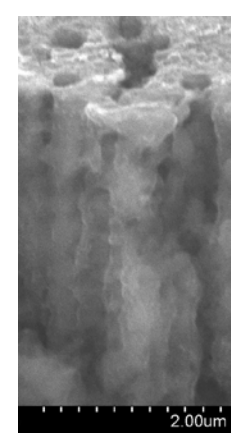
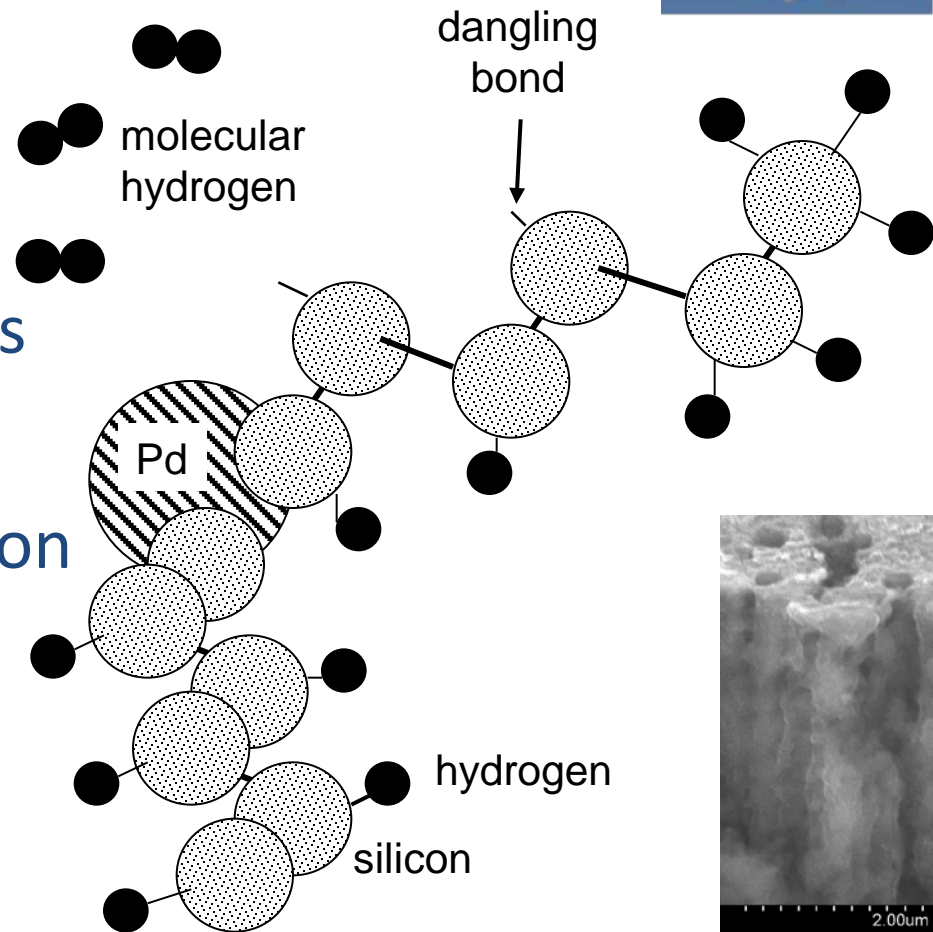




H₂ Storage Method

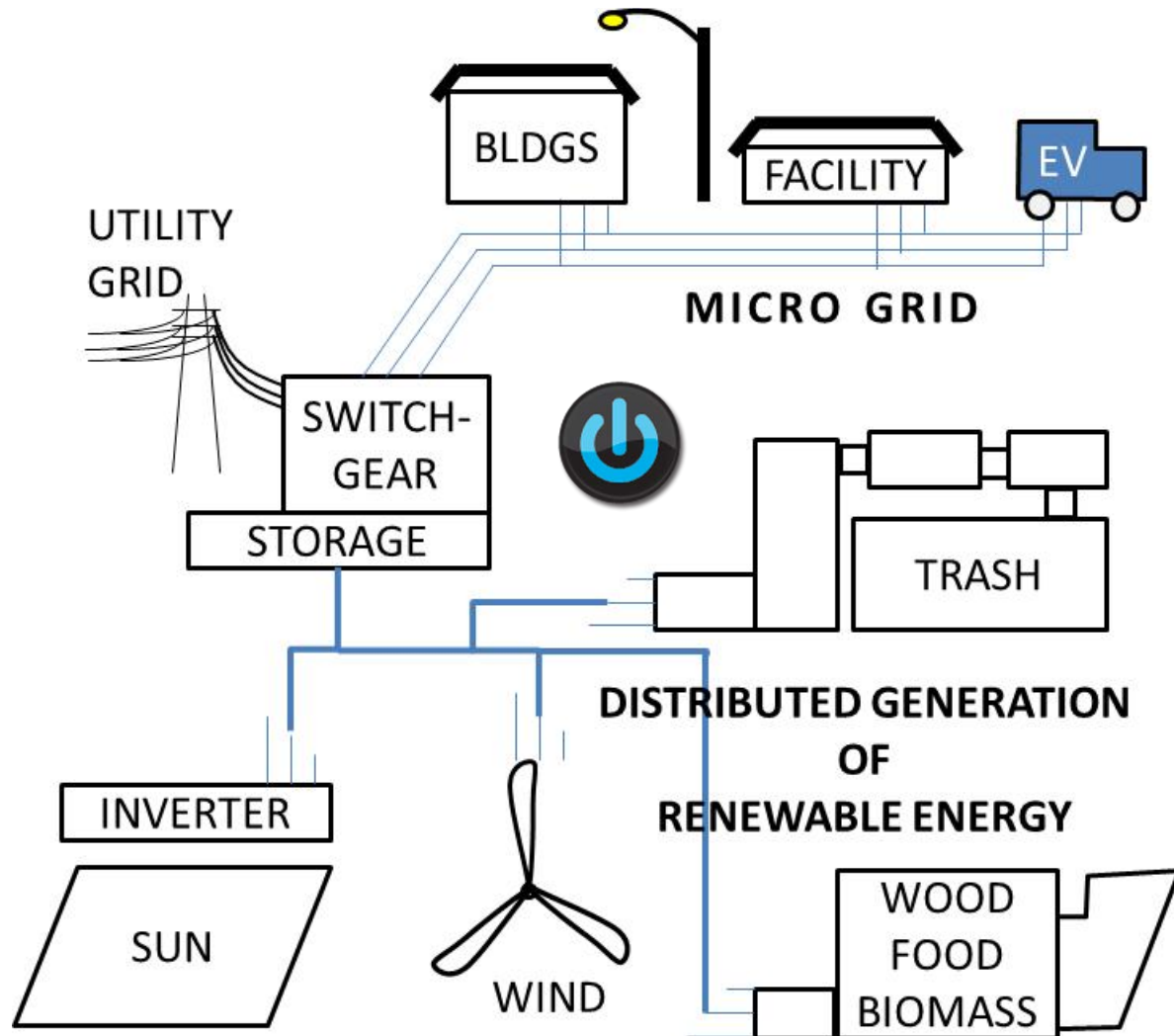


- Microporous silicon
 - High surface area for hydrogen bonding
- Strategic Catalyst
 - Reduces H-H bond energy
 - Allows “spillover”
- Can be made from biomass
- Abundant
 - Earth’s crust is 21% silicon
- Safe for humans
- 4 Patents granted



Robust Load-Leveling Microgrid

- Collaboration
 - IUPUI, Lugar Center
 - Mechanical Electrical Systems, Inc.
 - Indy Power Systems, Inc.
- 5 Patents granted
- Useful for: campuses, bases, institutions, cities, industrial parks.





Commercialization



- Entrepreneurs-in-Residence - retired engineers
 - 3 SBIR proposals pending, subcontracting IUPUI
- IU Research and Technology Corporation (IURTC)
 - Tech transfer arm of the university system
- Kelley School of Business – Entrepreneurship
- SPEA – Policy and research direction studies
- Four Spin-Ups based on Lugar Center technologies
 - Actively seeking investors now
- Engaged with Chambers of Commerce

To learn more...

- www.lugarenergycenter.org
- E-mail: lcre@iupui.edu
- Phone: +1 317-278-0812
- IUPUI: Science & Engr. Lab Bldg.



New home for the Lugar Center

