US-Denmark Cooperative Research and Education Program in Intermittency-Friendly Community-Scale Renewable Energy Microgrids
Work in Progress

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Funded by National Science Foundation
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TOPICS of STUDY

- Address the technical, social and economic aspects of community scale renewable energy microgrids (electricity generation, heating and cooling).

- Develop a cooperative virtual research, development and education center,

- Focus on system integration based upon site specific solar, wind, biofuels, heat pumps, cogeneration, storage and intelligent agents for load managing.
Research Tasks

**Research task 1:** Identify the energy requirements and the economic, social, regulatory and environmental issues confronting distributed renewable energy systems at each testbed

**Research task 2:** Detailed study of consumer demand, behavior and reflexivity with respect to energy use, distributed generation and associated conservation strategies

**Research Task 3:** Electro-thermal co-optimization of intermittency-friendly micro-grids; investigate novel energy storage devices.
Plan for Educational Activities

1. International Renewable Energy Program & Fellowship

2. Erasmus Mundus Renewable Energy Graduate Course

3. California-Denmark Summer School

4. Global Educational Leadership in Sustainability Program (G-ELSP)

5. Pipeline for Global Sustainability from California Community Colleges

6. Continuing workforce development
PIRE: US-Denmark Cooperative Research and Education Program in Intermittency-Friendly Community-Scale Renewable Energy Microgrids testbeds
Santa Cruz Municipal Wharf

Neither solar, wind or waves are optimal
Santa Cruz Municipal Wharf
Solar window prototype

Configuration

- Double glazing window
- Mobile PV array (i.e. blinds)
- Vents (top and bottom)
- Fan + Heat exchanger (top)

Previous results

- Optimal installation: south, 0° angle of incidence
- Small improvements (1.5%) in power production for automated tracking (vs optimal static orientation)

Future work

- PV Efficiency analysis and measurements
- Influence of PV panels on thermal efficiency

M. Isaacson, A. Chialastri, N. Kapany, 2014
Hartnell College Sustainable Construction and Design Program
Pocket House/ Summer Internship Program/ NSF-ATE

10 ft x 10 ft x 16 ft. living area, kitchen, bathroom. Energy self-contained.

Funded by NSF, Dept. of Education
What are the roadblocks:

.....to getting more energy by renewables

.....Reducing energy consumption

.....Improving energy efficiencies of existent systems

..... Integrating intermittent renewables into the grid system

(in Denmark, government goal is: 35-50% renewables by 2030, 100% by 2050)

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