

California- Denmark Workshop: The Road to a 100% Renewable Energy System

August 1,2, 2011

M. S. Isaacson

*Baskin School of Engineering
University of California at Santa Cruz
msi@soe.ucsc.edu*

Financial Support from DASTI, CITRIS, CenSEPS



MONDAY, AUGUST 1, 2011

8:00am - 8:50am	Workshop Registration, Breakfast, Coffee and Tea
8:50am - 9:00am	Welcome and Introduction, Michael Isaacson, Baskin School of Engineering, UCSC
9:00am - 10:30am	Needs/Benefits for 100% Renewable Energy System Moderator: Ali Shakouri, UCSC
	Patricia Hoffman, U.S. Department of Energy <i>"Maximizing Renewable Energy in the U.S. Electric Grid"</i> Brian Mathiesen, Aalborg University <i>"Benefits of 100% Renewable Energy Systems for Denmark"</i> Max Wei, Lawrence Berkeley National Laboratory <i>"California's Energy Future: Scenarios for Achieving 80% emissions reduction in 2050"</i>
10:30am - 10:50am	Coffee Break
10:50am - 12:30pm	Technological Solutions Moderator: Chresten Traeholt, The Technical University of Denmark
	Morten Blarke, Aalborg University <i>"Smart Technology Markets in the Intermittency-friendly Energy System"</i> Lee Ackerson, Soquel Energy <i>"Problems, Solutions, Whose Perspective?"</i> Andrew Burke, UC Davis, <i>"Sustainable Personal Electric Transportation"</i> Francesco Marra, The Technical University of Denmark <i>"A 100% Renewable Energy Road with Electric Vehicles"</i> Randy Katz, UC Berkeley <i>"Supply-Following Loads: A Berkeley View"</i>
12:30pm - 1:30pm	Lunch Buffet

1:30pm - 3:00pm	Social/Economic Interactions Moderator: Bryan Jenkins, UC Davis
	<p>Arne Remmen, Aalborg University <i>"Energy efficiency – A Short-Cut to An Energy System Based on 100% Renewables"</i></p> <p>Dina Biscotti, UC Davis <i>"Political and Market Mobilization for Renewable Energy and Energy Efficiency"</i></p> <p>Shi You, The Technical University of Denmark <i>"Virtual Power Plants: Enabling 100% Renewable Energy System"</i></p>
3:00pm - 3:30pm	Coffee break
3:30pm - 5:00pm	Solutions/Environmental Issues Moderator: Michael Isaacson, UCSC
	<p>Jonathan Trent, NASA Ames Research Center <i>"Tools and Fuels for a Sustainable Future"</i></p> <p>Ali Shakouri, Baskin School of Engineering, UCSC <i>"Large and Small Scale Renewable Energy Solution Trade offs"</i></p> <p>William Ahlgren, Cal Poly, San Luis Obispo <i>"The Dual-Fuel Strategy: An Energy Transition Plan"</i></p>
5:30pm - 6:30pm	Wine Reception/Networking

Tuesday, August 2, 2011

8:30am - 9:00am	Breakfast, Coffee and Tea
9:00am - 10:00am	Summary of Panel Discussions/Further Discussion Needs/Benefits of 100% Renewable Energy System Moderator: Ali Shakouri, Baskin School of Engineering, UCSC Technological Solutions, Moderator: Chresten Traeholt The Technical University of Denmark
10:00am-10:30am	Coffee break
10:30am-11:30am	Summary of Panel Discussions/Further Discussion Social/Economic Considerations Moderator: Bryan Jenkins, UC Davis Solutions/Environmental Issues Moderator: Michael Isaacson, Baskin School of Engineering, UCSC
11:30am - 12:00pm	Funding Opportunities for Research Collaboration Lars Nielsen, Innovation Center Denmark Silicon Valley
12:00pm - 1:00pm	Lunch Buffet
1:00pm - 2:30pm	Next Steps

Jonathan Trent, “Tools and Fuels for a Sustainable Future”

- NASA : Going to Mars, 3 year round trip
- Waste have to be processed into energy, water and food
- Biofuels, feasible, affordable, scalable, sustainable and doesn't compete with agriculture.
-
- Biodiesel Crops and Production, highest is microalgae (organisms that are a few microns in diameter)
- Waste water in California (waste treatment plant, waste water is dumped into ocean), 1.9 Billion Gal/day
- OMEGA project description on Treasure Island
 - Bioreactors using waste water
 - Flexible Material
 - Uses solar energy to grow algae
 - Making different products
 - Benefits of doing this project off shore
 - Use as marine habitat (eatable seaweed)
 - 2 facilities, Santa Cruz and San Francisco

Ali Shakouri, Large Scale and Small Scale Renewable Energy Tradeoffs

- Energy Use, 13TW in 2007
- Felix's forecast, all wrong predictions
- Path and the requirement, are we heading in the right direction
- Issue about the renewables, very dilute
- Land requirement
- Efficiency goes up with the size (especially for wind turbines) (surface to volume issue)
- Trend toward bigger turbine size
- Economy of scale but it did not continue that much
- Installed project costs are on the rise after a long period of decline (could be due to oil prices going up): also materials from politically unstable regions
- Intermittency of Renewables is another problem
- Storage is key
- US Energy Flow 2008, Electrification on a big scale, rejected energy is 58%
- Comparing to US Energy Flow 1950, rejected energy is 49%
- Decentralized production is the key. How?
- Thermoelectric Devices
- Hot Water Cogeneration
- Solutions for developed and developing countries could be different

William Ahlgren, “The Dual-Fuel Strategy: An Energy Transition Plan”

- Fuel is crucial in the global energy system.
- Renewable fuels must compete with fossil fuels.
- Renewable must be liquid.
- Energy sources are converted to energy vectors to enable trade.
- A vector is an energy carrier that can be bought and sold.
- Fuel dominates energy trade.
- Transition to renewable sources requires renewable fuels.
- All energy trade is carried by two renewable fuels plus electric power.
- Economic inertia created by legacy infrastructure. To complete, renewable fuels must be compatible.
- Renewable fuel cycle.
- Renewable Fuel Options: Hydrogen, Ammonia, Methanol
- Dual Fuel Exchange
- Cost Per Volume (CN\$/L) (Ammonia < Methanol)