Northeast CERT Meeting Summary

March 23, 2007, 1:30 – 4:00 pm
University of Minnesota Duluth

Introductions and Announcements

Meeting attendees included Mike Mageau, Janelle Stauff, Virg Boehland, Lauri Isaacson, Barbara Reed, Chris Reed, Peter Harris, Jamie Juenemann,Tim Ollhoff, Okey Ukaga, Steve Robinson, Dean Talbott, Nicole Hynum, David Williams, Weilu Lin, Huajiang Huang, Dave Stark, Bill Pederson, Daniel Pope, Lissa Pawlisch

Small Group Summaries

Fundraising/Staffing Group

City of Duluth – City is looking to fill 3 permanent full time positions (Sandy's would be one). In conjunction with these positions, the Mayor asked Dan Green to write a proposal for an Office of Sustainability. There is a small group currently working on the position descriptions as part of this new office. The City would like to have letters of support from the community for this office and these positions; all agreed they work on letters.

Other news:

- St. Louis County is now filling a new position for an energy coordinator.
- EcoHome will be ready for Parade of Homes on May 12th, and will then stay open for a year or two as a resource center.
- Lake Superior Energy Fair (LSEF) is scheduled for Sept 8th. The LSEF group formed a non-profit, 501c3 and is seeking board members. They are hoping to model themselves after MREA.

Community Projects

- Lauri discussed sponsoring a community series with "An Inconvenient Truth" followed by discussion about what could be done about it. The discussions spawned action at local churches to complete energy audits.
- Dave Abasz announced that the Finland Community Center project was receiving an $800,000 federal grant thanks to Representative Oberstar, so now they have enough $ for the building but not for alternative energy pieces. Nonetheless, they are still looking at GSHP + Solar thermal.
- Group talked about wind projects. Chris said that wind industry is a tough place right now with the boom and bust cycle and high demand when times are good. He indicated that it's actually hard to get turbines.

School Projects

- Proctor is having its turbine dedication on Friday, April 20th in advance of Earth Day along with a science fair of sorts. Proctor is also part of a technical education consortium and as part of its role in that teaches kids how to build houses; they're now looking to have the kids build energy efficient homes. They're planning to have UMD students out to talk with Proctor students about careers
- Wolf Ridge ELC has their online monitoring of wind turbine, solar panels, CO_2 emissions, and energy consumption up and running with people-friendly, engaging interfaces.

- Bill indicated that he's been enthusiastic about wind and even proposed an undergraduate research opportunity project to look at putting a small wind turbine on campus (won't likely happen). UMD is working a project that would put PV panels on the new stadium.
- Two Harbors HS, with the help of Silver Creek, is pursuing a 2.6 kW solar array and is seeking people and resources to help move the project forward.

An Energy Journey – Dave Abasz

Dave kicked off our day of emerging energy technology discussion by showing the highlights from his family's 2006 tour of the US and various energy technologies old and new. To start, Dave recounted the family's use of waste-vegetable oil in their VW. They liked the idea of trying to use "waste resources" in an efficient vehicle for their entire 4000 mile trip (turns out they got about 160 miles out of every gallon of diesel they used, because the rest was vegetable oil). To make this possible they actually towed a trailer of vegetable oil behind them. As with all of the technologies they visited, the family evaluated the impact of using this fuel according to a few primary factors and various cause and effect factors. Primary factors included:

- Renewable Source? ☺
- CO2 Release? ☺
- Other Pollutants? ☺

Cause and Effect factors… overall they rated biomass "Using a Waste" with a ☺, and rated "Filling up + packing/unpacking" with a ☹ as they had to unpack all of the camping equipment and other stuff on the trailer and get everyone out of car to refill the tank.

They then went through all of the other resources they visited rating projects on the same three primary factors.

- Wind – they rated the primary factors ☺, but a few issues like transmission, birds and costs to install had ☹ or mixed results.
- Coal – the family visited a coal mining facility in Wyoming. They reported that the mines are pursuing major reclamation efforts and that they actually made surfaces look much like they were before. They fill 320 railcars / day of coal. Overall, on the Abasz family rating system, coal looked ☹ for the big three, but we do have a lot of it.
- Hydro – to check out a hydro project the family headed to the Grand Canyon area and Lake Mead. Hydro received a series of ☺ for the primary factors, but the Abasz' noted concerns with species changes (due to flooding and changes in river structure), the tons of cement used to build and access hydro stations. They also noted that droughts and falling water impact hydro production, although pump and storage systems can be turned on and off to match grid load.
- Nuclear – Then it was off to Los Alamos and Yucca Mountain to learn more about nuclear. While it's not renewable, there is not CO_2 released during power generation (it is released during mining and extraction).
- Thermal – After testing out the hot springs the evaluation of thermal came in pretty positive for thermal energy. No, they weren't just biased by the hot pools; they genuinely felt good about the fact that with thermal you're extracting energy that's already in earth.
- Oil – Some people say oil and think of Texas, others Kansas. Kansas was the home of oil boom after Pennsylvania. Oil did not receive a lot of smiley faces.

Back @ home the Abasz family demonstrates emerging technologies and tried and true practices to effective conservation. While the average home uses 860 kWh, Abasz home uses 80 kWh and hope to reduce that down to 50 kwh. A few features of their home include:

- Super efficient refrigeration (because insulation (thick walls), compressors on top (heat rises), put on porch where generally cooler + work with phantom loads…). Their systems is 3x better than Energy Star.
- Put everything on power strips to avoid phantom loads. Average home wastes 3,000 watts/day on phantom load. That's equivalent to the per capita energy use of S. Korea, Turkey + Argentina.
- Powered with wind (70%) and solar (30%). They chart how much energy is produced and that dictates how much energy the family can use. The two systems are on separate units (so can disconnect wind during lightning storms) and they also have a battery backup.

Big Questions we'll all have to consider…

- How will we power our communities in future?
- Which emerging energy tech will you take?
- What is our moral, spiritual, humanitarian responsibility?
- Is this personal or nation?

Integrated Wind Energy Buildings—*Bill Pedersen – Department of Mechanical & Industrial Engineering, UMD*

Bill has been researching the possibility of buildings that funnel wind to an integrated building turbine. He's be looking at ducted turbines, as they can achieve higher efficiencies than unducted systems, and hoping to address the pitfalls of wind power in urban settings (turbulent air flow, noise issues, lower velocities, safety concerns) by containing the turbines.

To study the possibilities Bill utilized 2D analysis (vertical + horizontal) and 3D analysis (computer to analyze). One needs differential pressure to get wind to flow but stagnation pressure limits up stream pressure. Under the 2D analysis Bill found that since the pressure is dominated by maximum velocity, one must design a building to have lower downstream pressure – thus a horizontal turbine works best. The 3D analysis however, showed that the 2D analysis is overly optimistic on energy production, and in a 3D analysis a vertical turbine system looks good. As Bill described it, you need to the wing walls to direct air flow – you're essentially trying to design BAD airfoil – if you optimize in one direction, you end up minimizing it in another. One of Bill's ideas includes a 3D symmetric building that rotates so that there are always 2 turbines producing energy.

Results to date:

- In Class 2 wind area produced 400 kW of air power in turbine section. At 60% efficiency that's 240 kW in the building. This could offset 4.5 million pounds of CO_2. In Class 4 winds you might be able to produce 600 kW.
- It's not really scalable… turbine section limits differential.
- 200,000 square foot building consumes 3 watts/ ft^2 (including electricity, oil, natural gas). Nationally electricity costs about 10.1 ¢ or \$2.78 / ft^2 / yr. This design could save over \$200,000 / yr in energy plus save 4.5 million lbs of CO_2 (which could also be sold as green tags).

Use of Biodiesel Blends in Marine Vessels—*Dan Pope – Department of Mechanical & Industrial Engineering, UMD*

Dan began by highlighting the various motivations that are driving marine vessels to utilize biodiesel blends – like reduced dependence on foreign oil, reduced emissions, proactively identifying problems and solutions of changing fuel blends, and of course, in response to current mandates. Dan indicated that many in the marine shipping business were surprised by the Minnesota (2% biodiesel) and Federal (EPAct 2.78% of all fuel from renewables, 3.8% by 2007) mandates.

We quickly reviewed what biodiesel is… a fuel made from vegetable oils or animal fats. It has a specific technical specification – ASTM D6751, and worthy of note, it meets the new specifications for diesel as it contains essentially no sulfur. To make biodiesel one reacts the oil/fat with alcohol to yield biodiesel and glycerin. We use it because it's a renewable fuel that has better lubricity than diesel, reduces (most) emissions and biodegrades faster than diesel.

The two major problems with using biodiesel include:

- B100 Softens and degrades certain parts of the fuel system (fuel hoses, pump seals, etc.). This can generally be addressed through replacement parts and is a lesser issue with engines manufactured to run on low-sulfur diesel. B20 blends typically have fewer problems.
- B100 Gels at higher temperatures than #2 diesel (i.e., it has poorer cold flow properties). There are three primary measures of this – cold filter plugging point (temperature at which fuel filter will clog), cloud point (temperature at which solid crystals first appear), and pour point (lowest temperature at which fuel will pour). These issues can be addressed by blending biodiesel with #1 diesel, adding fuel line heaters, storing equipment indoors, and using fuel additives. A few of these solutions, like storing equipment indoors, can be quite problematic for marine operations…, thus Dan's research to help the industry adjust.

Great Lakes Carriers (ex: 1000 foot ore boat)) operate on a 10 month season that runs from mid-March through mid-January. The concern: fuel problems on a big ship can be the difference between life and death. Simply imagine a 1000-foot ore boat unable to stop as it enters the port because its fuel filters have plugged… not good. Some ships have external diesel systems while some are inside and winter lay-ups require long-term storage of fuel (would fuel separate?). Thus, when Minnesota's mandate took effect, lots of ships didn't want to fuel up @ the Duluth Port because they were nervous about the biodiesel blend's impact on their fuel systems. Dan's work has been focused on testing biodiesel and fuel additives in marine applications and making suitable recommendations. In part, this is about ensuring safety, but in part, it's also about changing in-grained habits – operators MUST be comfortable with this "new" fuel.

Integrated Forest Biorefineries— *Peter Huang and Weilu Lin – Bioproducts/ Biosystems Engineering, UM-Twin Cities*

Peter started off big, presenting where the bio-based fuel industry is headed. While today's bio-based fuels rely heavily on corn-based ethanol and soy-based biodiesel, tomorrow's bio-based fuels will incorporate a variety of lignocellulosic fuels (includes everything from mixed grass perennials to trees). The Net Fossil Ratio (how much fossil fuel energy one uses to get a gallon of bio-based fuel) is good for cellulosic materials (around 10:1) and the greenhouse gas reduction

is predicted to approach 80%. In addition, the expected cost of cellulosic fuels is declining over time and expected to be more competitive with gasoline than corn-based ethanol after 2010.

How the forest products industry fit in? There are 120 pulping mills in US right now that could more convert to fuel and product production! In addition, today's pulp + paper mills use both black liquor and purchased power to fuel their operations. In the future, integrated forest biorefineries could allow them to provide all of their own energy.

Lignocellulose contains three components:
1. Cellulose (like for pulp)
2. Hemicellulose
3. Lignin (what it needs for structure; harder to break down)

One can convert lignocelluosic materials to bio-based fuels via *2 platforms*:
- Sugar – one can make various C-3, C-4, C-5, C-6 chemicals; works like a petroleum refinery where one can make fuel, energy, fiber, chemicals + plastics
- Syngas – consists of CO and H_2 – from the syngas one can make methanol, di-methylether (DME), gasoline, diesel, etc.

Integrated Forest Biorefinery will:
- Extract hemicellulose to provide: new products, ethanol, acetic acid
- Use a gasifier instead of boiler to provide power

As part of their research, Peter and Weilu have been working with Professor Shri Ramaswamy to test production levels of several different tree species including Apsen & Hybrid Poplar. They are working to assess which trees provide the best balance amongst: energy production potential (maximized), effort required break down components (minimized), and cost (minimized).

Meeting Wrap-Up
Future Meeting ideas:
- Tour – group discussed going to see Jamie Juenemann's, Dave Stark's, Mike LeBeau's and the new Eco Home. ***We have scheduled this tour for FRIDAY, JUNE 29th, 2007***
- NE CERT Strategic Planning – With the hope that CERTs will soon be funded for an additional 2 years, it's time to start thinking about the future. We'll need to talk about how to formalize the Steering Committee and initiatives where we might want to focus our financial resources.
- Global Warming Perspectives – how are different individuals and sectors planning to address and adapt to global warming – followed by a screening of an Inconvenient Truth (movie night)