Northwest Minnesota Clean Energy Resource Team Meeting Summary
April 27th, 2006 – 9 am – 12 pm
Lewis & Clark Conference Room, University of North Dakota, Energy & Environmental Research Center
15 North 23rd Street, Grand Forks, ND 58203

Attendees: Tom Newman, Darryl Bragey, Rodney Ambrosie, Marlon Mackowick, Kurt Soderberg, Oscar Manz, Dalene Monsebroten, Darryl Tveitbakk, Howard Person, Jon Steiner, Denny Hanselman, John Howard, Steve Korstad, Jim Steenerson, Lynn Wolff, Don Matz, Richard Newman, Arlo Rude, Kyle Braaten, Carly Thomsen, Tom Melin, Linda Kingery, Dan Boyce, Robert Shimek, Mike Moore, Richard Shockey, Kirk Williams, Todd Feland, Ann Leeson, Ross Weiler, Paul Sproule, David Bahr, Colleen Oestreich, David Dangerfield, John Shimek, Joel Haskard Lissa Pawlisch, Darren Schmidt, Dan Stepan (note: some names taken from sign-in sheet; pardon the spelling errors).

Presentations from the meeting will soon be posted at: **www.cleanenergyresourceteams.org**

Setting the Stage
Darryl Tveitbakk, Northern Municipal Power Agency General Manager (& Pennington County Commissioner) began the meeting by welcoming the speakers and guests and hoping we would have a good exchange of ideas when considering the potential opportunities for municipal solid waste (MSW) utilization. Darryl posed the question, "Is it possible to create a new 100 MW waste-to-energy (WTE) facility in Northwest Minnesota?"

Darryl then introduced Howard Person, Pennington County Solid Waste Officer who spoke about Pennington County's 18-year attempt to create market MSW pellets (1985-2003). In 1985 Pennington County came up with this great idea to pelletize some of their waste. However they soon found at that utilization of these pellets in burners actually requires that every burner be tested by the MPCA – not a very cost effective proposition. As an alternative they sent the pellets to be burned as energy sources at the Big Stone Power Plant and Walhalla Ethanol Plant (ND), but Big Stone wouldn't pay much for the pellets and it turned out that ethanol wasn't profitable in North Dakota so the ethanol plant closed. With no outlet for the pellets, they began composting, but nobody would buy the compost, and it could have been sent to the landfill for less. The composting facility couldn't keep up with all the material, and eventually a hot spot developed in the storage facility and the building burned down. The project was abandoned in 2003 and now they are a transfer station for MSW. They would need about $40/ton to break even on the pelletization and currently they pay $33.50 a ton plus transportation to send MSW to Grand Forks. It seems they had an idea that was ahead of its time.

Waste to Energy Alternatives – Technology Overviews
Combustion/Incineration
Rod Ambrosie, Wenck & Associates, gave an overview of the Minnesota waste-to-energy landscape and a case study of the Polk County Solid Waste Resource Recovery Plant. There are nine WTE facilities in Minnesota handling 1.4 million tons of MSW for 111,000 homes. The Polk County facility handles 30,000 tons of waste/year from a territory covering 6,000 square miles. The original intent of the facility was to extend the life of the Crookston Landfill, but it is also a steam supplier for Sun Opta (formerly Land-O-Lakes) and the Minnesota Dehydrated Vegetable, both located in Fosston.

The Polk County facility has signed contracts for MSW with four counties and ensures that it gets the maximum amount of MSW by not charging a tip fee for the haulers, but instead charging a monthly service fee. Of course, the problem with such a large scale system is that you get TVs, batteries, wash tubs and all sorts of other stuff that is bad for the incinerator and can lead to breakdowns. So, Polk

County built a Materials Recovery Facility (MRF) that removes objectionable objects and recycles materials that are cost effective, including aluminum, card board and steel. Much of the remaining MRF fine matter is used as cover for landfills. Also ash from the incinerator is currently being used and tested for mixing in with asphalt for road construction. In total 98% of the extracted material is sold and the plant has increased operating capacity. They estimate a 7 year payback for the facility.

Gasification

Darren Schmidt, UND EERC, gave a presentation about gasification but also provided a quick overview of all the various technologies available for converting waste to energy:

- Incineration – most common; 98 plants in the US using incineration, with no new plants since 1993. 13% of all MSW in US is incinerated.
- Gasification – higher cost; used in Japan but not proven in US. Lower temperature than plasma torch.
- Pyrolysis – similar to thermal depolymerization but smaller scale. Ensen Corp uses for wood to make BBQ sauce.
- Plasma conversion – very high temperature; also used in Japan. A lot of municipalities have approached EERC about plasma torch technology. Westinghouse is the only reputable technology for this in the US and communities need to be cautious about "snake oil salesmen".
- Anaerobic digestion – most commonly used for manure, sewage and landfills.
- Thermal depolymerization – one commercial plan in US (Missouri) that steam reforms turkey offal.

Gasification creates fuel through a thermal conversion. Biomass gasification for power started in WWII when gasoline supplies weren't available. Kits to burn wood to power cars were commercially available in the 1940s. After the 1950s gasifiers were scaled up for energy facilities, with coal gasification taking off in the 1970s and then internal gasification combined cycle (IGCC) facilities in the 1990s.

EERC is focusing on small-scale units that would use municipal wood debris to produce 200kW of energy. They hope to produce an automated unit that can be attached to a small manufacturing site and will have a payback rate at around 2-8 years.

Plasma Torch

John Howard, Distributed Generation Solutions and Steve Korstad, Korridor Capital Advisors talked about plasma torch technologies. John spoke about the two largest issues facing a WTE facility of any kind: economics and feedstock. Many of the Resource Conservation and Development Councils were asking about what could be done with biomass and agroforestry beyond pellets. This question combined with the fact that we continue to produce more and more waste every year led the plasma torch idea to come to the fore.

John and Steve, among others, are now working on a $30 million, multi-county plasma torch project based in Koochiching County that would need 100 tons of MSW a day, and 36,000 tons a year. They will bring in waste from a large territory, but they don't want to disrupt existing facilities. They are using Westinghouse and Seimens as partners, and expect the project to be financed roughly 1/3 by county funds (bonds, CREBs), 1/3 by state funds (bonding bill) and 1/3 by federal funds (USDA/DOE). They are also pursuing partnerships with Boise Cascade to buy their steam and Minnesota Power to buy their electricity. Plasma gasification has 90% fewer air emissions than incineration (due to much higher temperature) and the slag can be turned into tile. Other environmental benefits include carcass destruction (think: bird flu?), electronic waste destruction and mercury emission reductions.

Landfill Gas Recovery

Tom Newman, head of the Minnesota Pollution Control Agency's Closed Landfill Program, gave the audience a quick overview about landfill gas, the Closed Landfill Program and using landfill gas for energy. Landfill gas is comprised of 54% methane, 40% CO_2, 4% nitrogen, and 1% volatile organic

compounds (VOCs) which are the real "nasties". Minnesota is home to 109 landfills, 15 of which are municipally owned while the rest are privately owned. The State of Minnesota owns the rights to gas from 107 of these landfills. (note: all Closed Landfill Program (CLP) landfills are unlined because they were constructed before regulations requiring a clay or plastic lining along the base.) Twenty-two landfill sites have active gas recovery systems and 12 of these are slated to use this gas for energy. Over time landfill gas generation is stable, but declining – in their work they've found that active systems typically work best on closed landfills of 1 million cubic feet or greater. To utilize the gas for energy the MPCA is looking at microturbine systems (30 kW systems for $1,000-$2,000/kW) and diesel generators ($250-$600/kW), but both of these technologies require contaminant-free gas and clean up systems generally cost around $250,000. They are also looking at 55kW STM Power stirling engines (external combustion engines) that cost around $800-$1500/kW but do not need pressurized gas and require minimal gas cleanup.

Kirk Williams, UND EERC, also presented on landfill gas utilization and focused in on the fact that small landfill gas utilization was often overlooked. People have to evaluate the economics of the project and also figure out what to do with the gas once they have it. A 1 – 3 MW landfill gas utilization project costs roughly $1,500,000, but new technologies may be getting cheaper. The EERC is looking at the Grand Forks Landfill to see if there is potential to help power a bailing facility or waste water treatment facility. They are performing a basic gas assessment and looking at treatment systems (need to address the siloxanes which will destroy equipment). The landfill is producing gas at 52% methane and 47% CO_2 and generating 520 BTU/standard cubic foot (SCF). They estimate 500-600 SCFM/day gas production potential. There are new processes since 2004 that can be scaled down and would be applicable to about 2000 sites across the county.

Question and Answer Session

After a quick break all of our speakers returned to answer audience questions including the following:

- Where does the mercury go with the plasma torch technology?
    - He reported that it gets "bound up" in other stuff and loses its toxic characteristics. Also it doesn't leach out into the ground.

- How do the economics for the plasma torch technology shake out? What happens if you don't get the grants?
    - The economics are based on the tipping fees, steam sales and rock wool (tiles).
    - If they don't get the grants that they hope for they believe the project will move forward with public-private partnerships.

- What constitutes municipal solid waste?
    - Between 1960-1994 it could be practically anything, but now the industry tries to separate out the recyclables and hazardous products.
    - Will separate out plastics to get more BTUs during incineration.
    - Source separation always works best.
    - In Arizona and California they are currently mining old landfills for aluminum and other metals. (This works best in dry climates) and there have been 8 landfills in Minnesota that have been relocated to other landfills.

- How long you can recover gas from landfills?
    - Around 50 years, drawing 50 cubic feet/min (which is enough to power 100 homes).

- Is there an ideal location (height or depth) for gas recovery?
    - Yes. Thicker landfills are better because you get more concentrated gas. Landfill depth is also determined by groundwater and topographical features. There are different

technologies with some (passive) that only collect gas near the top and active systems that incorporate wells that bore into the landfill to extract gas.

- Can gas systems be incorporated when new landfills are being built?
    - Yes. Fargo's landfill is built cell by cell and each new cell is added to the gas recovery system.

- What about ethanol from waste?
    - Once you convert waste to a syngas you can catalytically convert it to an array of alcohols, including ethanol.
    - Right now the economics to actually do this are tough, but a few panelists suggested that this technology will commercialize within the next 5-10 years.

- What's the difference between incineration and gasification?
    - Incineration needs air and gasification is without air.

- How much of the material into an incineration or gasification system actually comes back out as emissions, ash and other forms of waste?
    - When trying to reduce dioxins & other emissions, a multi-stage process is always the way to go, which is to say that converting a waste to a gas and then burning the gas is always more efficient and cleaner than burning the waste directly.
    - Incineration generally sees a 3 to 1 or 4 to 1 material reduction. Plasma torch would have a 10 to 1 material reduction.

- With these new technologies, what happens when something breaks down? What to you do with the waste in the meantime? Where do you put it?
    - At least for the plasma torch project, their facility will be at an existing waste transfer site/former landfill site so they will be able to store the waste if they need to. They are also planning to build two reaction vessels (so they'll have a back up).
    - For the Polk County example they have the ability to store waste for a week, otherwise it gets diverted to the Crookston landfill.

Wrap Up

After thanking EERC for hosting the event and the speakers and audience for attending, many of the folks took a tour of the EERC facility. CERT members spent time planning future meetings focusing around value-added agriculture, efficiency/GSHP, and wind. More information about those planning sessions, updated agendas and spreadsheets will be sent out to the list serve shortly.