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MEMORANDUM

TO:	Laurie Fischer - DBA	REF. NO.:	053042
FROM:	Brandon Moffatt, P. Eng, MBA	DATE:	May 9, 2008
C.C.:	Paul Scanlan, Jennifer Keuning		
RE:	**Recommendations For Renewable Energy (Biogas) Policy Implementation in Wisconsin**		

DRAFT

1.0 INTRODUCTION

For renewable energy, specifically on-farm anaerobic digestion (AD) or biogas, to make a significant contribution to economic development in the Wisconsin agricultural and rural development sectors, it will be essential to improve technologies and develop a mature industry of installed and maintained renewable energy projects. The goal should not only be to install capacity for energy generation, but to create a sustained and profitable industry. It will also establish a renewable source of natural gas in the State of Wisconsin which does not have any natural gas production potential.

This memorandum was prepared by Conestoga-Rovers & Associates (CRA) on behalf of the Wisconsin Dairy Business Association (DBA) to review successful programs that have facilitated the growth of a biogas sector, the impact that it could have on a region, and the steps forward that need to occur in the State of Wisconsin.

2.0 GLOBAL EXPERIENCE

The development and implementation of biogas-specific renewable energy has been addressed by other jurisdictions, with varying degrees of success. Global experience regarding the implementation of renewable energy policies shows that the most successful method is electricity feed-in tariffs/premiums on renewable sources of natural gas, such as those utilized in Europe. The tariffs have been developed to be tiered and allow all renewable energy providers and technologies to have a more level payment system based on economies of scale. Feed-in tariffs create a known source of revenue for a guaranteed period of time and allow for more support from the investment market *(IEA, 2004).*

Under feed-in laws, electric utilities are obligated to enable renewable energy plants to connect to the grid and must pay fixed rates for the purchase of energy generated from these renewable sources. The earliest feed-in laws were enacted in California in the 1980s, allowing for California to become the world's leader in renewable energy use. Early European systems were also developed in Germany and Denmark. The most successful systems provide a fixed payment for renewable energy that varies by technology type, plant size and occasionally by location and has some relationship to generation rates. In fact, while more than

46 countries have installed wind capacity, just three – Germany, Spain, and Denmark, all of which utilize feed-in laws, account for almost 60 percent of total installed electrical capacity by the end of 2004 *(Aβmann, 2006).*

The sustainable growth of the AD industry in Germany was ensured through two key policy elements. The first was a guaranteed feed-in tariff system for electricity. These feed-in tariffs were fixed rates for 20 years, with built-in annual decreases in the rates. However, the increased generation prices that were caused by these feed-in tariffs were shared by electricity consumers, and not exclusively through government subsidy. The following table provides a breakdown of the feed-in tariffs for AD in Germany from 2006 *(Preusser, 2006).*

AD SYSTEM FEED-IN TARIFFS FOR ELECTRICITY GENERATION IN GERMANY

	€/kWh	*$US/kWh*
Base Prices for AD systems		
Up to 150 kW	0.115	0.183
Up to 500 kW	0.099	0.157
Up to 5 MW	0.089	0.141
5 MW to 20 MW	0.084	0.133
Bonus for energy crops		
Up to 500 kW	0.06	0.095
500 kW to 5 MW	0.04	0.064
Additional incentives		
Co-generation bonus	0.02	0.031
Technology bonus	0.02	0.031

It should be noted that the bonus tariffs are cumulative. A typical small 100 kW AD system that was eligible for the bonuses would have received as much as €0.215/kWh ($0.341/kWh). The second key policy was an assurance that an AD system would have access to the grid. The policy, although not a complete guarantee, required that electrical companies provide the infrastructure for connection of the AD system to the grid *(Preusser, 2006).*

Closer to Wisconsin, there have been other initiatives aimed at promoting on-farm AD for renewable energy generation. Vermont and New York have established programs which are similar in nature to Germany, for the promotion of on-farm biogas systems.

Vermont

The Central Vermont Public Service (CVPS) Cow Power™ Program allows customers to choose to pay an extra $0.04 per kilowatt-hour (kWh) for electricity generated by dairy farms. CVPS will also allow customers to choose to buy 25 percent, 50 percent, or all of their electricity through the Cow Power™ rider. For every kWh requested by customers and provided by a Vermont farm, CVPS will pay the farmer 95 percent of the market price for energy plus the Cow Power™ charge of $0.04 for the environmental benefits of the generation. If not enough kWh are available from participating CVPS farms, CVPS will attempt to acquire and retire Renewable Energy Certificates from another regional renewable energy source. If no Certificates are available in the regional market for $0.04/kWh or less, the company will deposit the

payments into the CVPS Renewable Development Fund. This fund, overseen by an independent board, provides incentives to farmers to stimulate further renewable on-farm electricity generation in Vermont.

New York

The Anaerobic Digestion Gas (ADG) -to-Electricity Program is issued under the Customer-Sited Tier (CST) portion of the New York State Renewable Portfolio Standard (RPS) program and seeks to support the purchase, installation, and operation of ADG-fueled electric power generation equipment in New York State. Up to $11 million is available under this first-come, first-served program, with a maximum of $1 million in financial incentives available per ADG System. Both capacity and performance-based electricity production incentives are available. These incentives are:

- A $500 per kilowatt (kW) Capacity Incentive is offered to cover a portion of the total purchase and installation costs of new equipment. The maximum Capacity Incentive does not exceed the lesser of $350,000 or 50% of the total purchase, engineering services, and installation costs of the new equipment; and
- A performance incentive for electricity generated by new equipment ($0.10/kWh) as well as a performance incentive for electricity generated by eligible existing equipment ($0.02/kWh). However, the systems must operate at an annual capacity factor of 80% to be eligible for the program.

This program was set up to encourage the use of AD treatment of farm wastes and the resulting public benefits. The incentives are provided on (a) the eligibility capacity limit in the Net Metering Law which currently caps farm waste electric generating equipment at 400 kW or (b) the customer's approximate Peak Connected Load, whichever is greater. However, it should be noted that the current funding was expected to last for the 2 year duration of the program, but NYSERDA is already looking for additional funds.

3.0 ECONOMIC IMPACT

Through various channels, stakeholders can play a key role in laying the groundwork for a strong and viable AD sector. Initiating electrical, gas pipeline, and environmental standards and policies, as well as creating demonstration projects and knowledge sharing programs will create a growth-promoting environment for AD technology. Direct benefits from a fully-realized AD industry in Wisconsin are numerous. In addition to increased renewable and decentralized energy generation capacity, a successful farm-based AD industry can provide substantial carbon emission reductions and rural economic development.

In the development of AD systems, economies of scale play an important factor in the costs associated with construction of these facilities. Based on literature available from Europe, as well as discussions with industry partners that are currently constructing AD facilities in North America, the following is the range of relative capital costs for particular size facilities:

- <50 kW systems - $6,000 - $10,000/kW
- <100 kW systems - $6,000 - $8,000/kW
- <250 kW systems - $5,000 - $7,500/kW
- <1 MW systems - $3,000 - $6,000/kW

Therefore, as shown in Germany, a feed-in tariff program needs to be defined on a tiered basis to allow for all sizes of farm operations to contribute.

Based on a program which allowed for growth of all sizes of biogas systems, it would have a significant impact on rural development. Input/output analyses completed for renewable energy projects demonstrate that for each $1.00 spent to acquire energy resources from outside a community, only about $0.33 of economic activity is generated within the community. On the other hand, each $1.00 spent within the community produces, through the economic 'multiplier effect', approximately $1.67 of local economic activity. The multiplier effect of investment in renewable energy technologies increases local economic activity in three ways. First, local businesses that sell goods and services benefit directly. Second, a regenerative cycle is created when funds realized through energy are reinvested in energy businesses. Third, lower utility bills for commercial and residential energy consumer's result in increased profits and disposable income.

Therefore, farm-based AD systems will create a positive impact on rural development by providing jobs in high-skill manufacturing, and on-site operations, as well as increasing the tax revenue potential for the municipality. This job creation projection is based on the conclusion of 13 independent reports and studies that analyze the economic and employment impacts of the clean energy industry in the US and Europe. These studies employed a wide range of methods, which adds credence to the findings, but at the same time makes a direct comparison of the numbers difficult. The following chart is taken from a study of all 13 reports which then went on to determine job impacts for each technology. In the table, "MWa" refers to average installed megawatts de-rated by the capacity factor of the technology *(Berkeley, 2004).*

AVERAGE EMPLOYMENT FOR DIFFERENT ENERGY TECHNOLOGIES

	Average Employment Over Life of Facility (jobs/MWa)		
Energy Technology	*Construction, Manufacturing, Installation*	*O&M and Processing*	*Total Employment*
Biomass - high estimate	0.4	2.44	2.84
Biomass - low estimate	0.4	0.38	0.78

AD systems would also have an impact on rural economic development, as jobs in such areas as highly skilled manufacturing would be created to construct and operate these facilities, as well as an increase in the tax revenue for the community. The proportion of skilled jobs to net employment is 27 to 29 percent, accounting for approximately a third of net employment growth *(European Commission, 2006).* In more sparsely populated rural areas, where diversification of industry is critical in job creation, smaller numbers of new jobs can have a far more significant rural economic development benefit, than the comparable number of jobs in centralized urban areas or off-shore production *(ADAS, 2003).*

4.0 SWOT ANALYSIS

In an effort to engage renewable energy policy implementation for farm-based AD, several strengths, weaknesses, opportunities and threats must be considered and addressed. These are as follows:

1. AD technology presents significant environmental and rural economic development opportunities and benefits (Strength).
2. AD technology faces significant barriers that require changes to government policy and regulations (Weakness).
3. AD technology faces real and in some cases perceived financial payback challenges that must be addressed before mass adoption will be viable (Threat).
4. Economies of scale clearly demonstrate that smaller-scale; decentralized generation and efficiency investments require a higher level of financial incentive and/or tiered pricing structure (Opportunity).
5. A more decentralized energy supply system resulting in a dramatically larger number of installations spread throughout rural areas will provide greater job growth and economic benefits as ownership, profits, and purchasing decisions are made locally and the likelihood of adverse public reaction to siting (NIMBY) should be reduced (Strength).

Compared to other renewable energy technologies, few technical barriers exist for AD. The main barriers visualized in Wisconsin will be the return on investment for farm-based systems, and the interconnection and electrical grid or gas pipeline access issues. More indirect barriers, which will significantly affect project viability, are the feedstock quality, quantity, and price (both regional and state-wide).

If subsidies were available for equipment purchase and installation, or if long-term generation rates scaled for the size of the facility and type of feedstock, then AD could be adapted to the Wisconsin energy market and contribute to farm and rural development.

5.0 POLICY IMPLEMENTATION

To properly assess economic impact and competitiveness, policies must address:

- The issues of scale of the AD systems;
- The cost savings and increased revenue for farms and rural communities;
- The overall contribution to the economy including rural economic development and cross-sectoral economic integration;
- The retention opportunities; and
- The timeframe for implementation.

There are several recommended policy instruments as options for Wisconsin to utilize to develop a viable on-farm AD industry:

- Research, Networks and Education Development;
- Financial Incentive Development;
- Transmission Grid, Pipeline Access and Permitting Policy Development; and
- Environmental Attributes Policy Development.

Under each of these policy instruments there are specific targets that can be achieved with the cooperation of all stakeholder including DBA, investor-owned utilities (IOUs), electrical cooperatives, and government.

Research, Networks, and Education

- Dedicated, significant, long-term research funding;
- Global leaders in AD technology enticed to come to Wisconsin;
- Development of networks and associations to enable research, networking, industry development, and advocacy;
- Development of a center focused on the use of biogas as a transportation fuel;
- Appropriate government staffing in the relevant departments;
- Support for regional and state farm associations, rural communities, and food production/processing industries to educate and encourage adoption;
- Establishment and promotion of renewable energy education and training programs at colleges within the state; and
- Ensure stakeholder and public education/awareness on technologies.

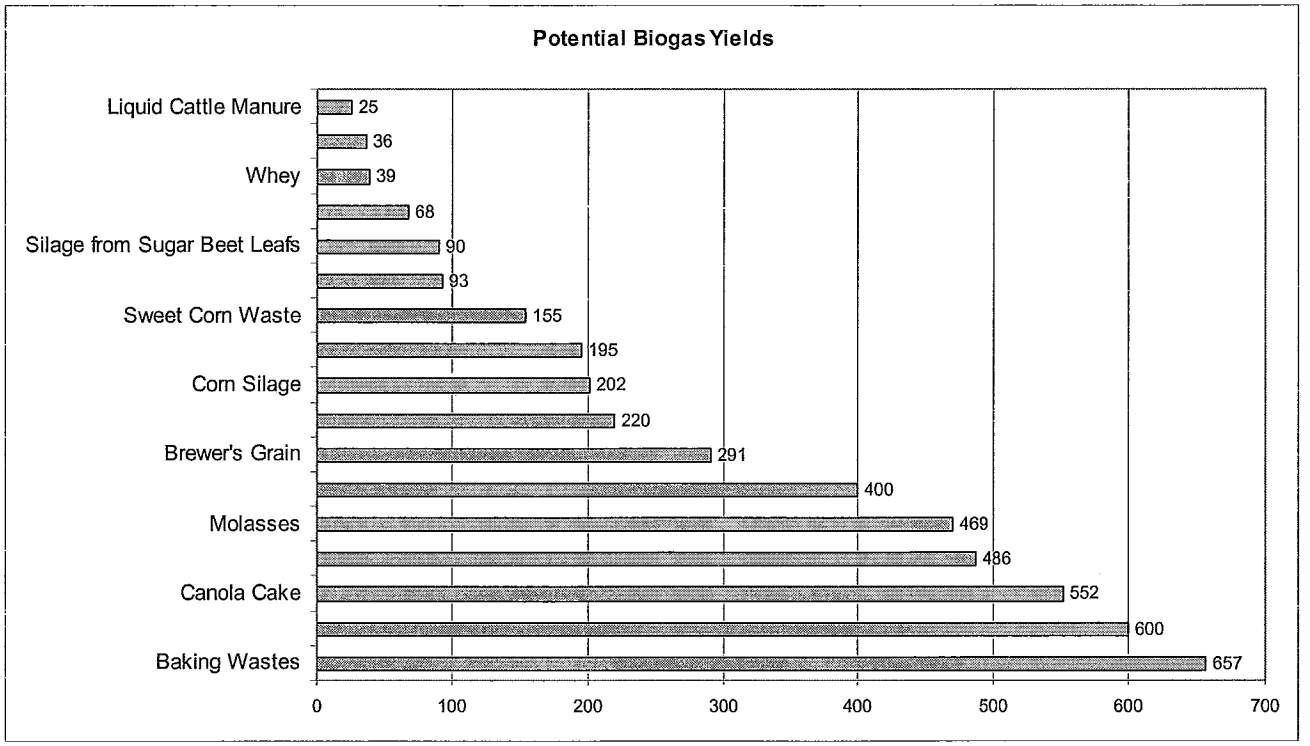
Financial Incentives

- Dedicated fund with simplified but accountable process to support feasibility studies and pilot installations for AD in order to speed up implementation similar to Focus on Energy but available to all farms in Wisconsin;

- Implementation of capacity-tiered feed-in pricing and renewable natural gas premium structures to assist in meeting waste diversion and renewable energy targets as well as consideration for smaller installations. The various stakeholders should provide incentives for further AD developments - for example:

    - Systems that have a lower generation capacity receive a higher electricity price to compensate for economies of scale;
    - Systems using energy crops as an AD feedstock receive a higher electricity price because the inputs have a higher cost than managing manure;
    - Systems using food-based inputs collect a tipping fee and produce larger quantities of biogas thus are provided with a lower electricity price (see table below);
    - Systems that use all of the heat produced from the cogeneration units for value-added purposes should receive a bonus to promote its use instead of wasting it;
    - Systems that use new and innovative technology for biogas utilization such as micro turbines or Sterling engines as well as digestate processing such as advanced nutrient separation systems should receive a bonus to allow for industry development; and
    - Systems that produce renewable forms of natural gas have a floor price but can go higher as the local hub price changes.

BIOGAS YIELDS FROM VARIOUS ORGANIC FEEDSTOCKS



Based on these recommendations, an example could be:

PROPOSED AD SYSTEM FEED-IN TARIFFS FOR ELECTRICITY GENERATION AND FLOOR PRICES FOR RENEWABLE NATURAL GAS IN WISCONSIN

	$US/kWh	*Floor Price $/mmBtu*
Base Prices for Co-Digestion AD systems		
Up to 150 kW	0.15	8.00
Up to 500 kW	0.135	7.50
Up to 5 MW	0.12	7.00
5 MW to 20 MW	0.10	6.50
Additional incentives		
Heat Usage Bonus	0.025	--
Manure Only Usage Bonus	0.085	$9.00
Energy Crop Bonus	0.075	$9.50
Technology Bonus	0.031	--

This financial incentive program would be reviewed every 2 years to allow for modifications to accelerate or decelerate the appropriate incentive for technology development. It would also include a 100% inflation factor for projects but the program, and a degression factor for new systems that are added after a specified period of time;

- The program would also allow for net metering (up to 250 kW) instead of the program that was previously outlined which would facilitate sell all and buy back;
- Examine benefits of an investment attraction fund that would be designed to stimulate the green energy technology manufacturing sector; and
- Conduct trade missions and investment tours to connect foreign investors to Wisconsin opportunities and Wisconsin companies with possible foreign technology suppliers for licensing or joint ventures.

Transmission Grid, Pipeline Access, and Permitting Policy

- Review of time and cost to investors of transmission grid capacity and pipeline connection processes to facilitate deployment of AD technologies. This should include:
    - Guaranteed access to 10% of electrical substation and feeder capacity for biogas projects;
    - Guaranteed access to the natural gas pipeline with the utility providing the monitoring equipment to each AD system;
    - All new generation facilities are required to install a load controller that allows the utility to temporarily reduce the power output of a generator if the grid cannot accept full energy generation;
    - All new electricity generators must pay an entry grid access fee into a transmission grid update fund based on nameplate generation capacity. The proceeds of this fund will be used to upgrade existing substations and transmission lines to accommodate the creation of new generation capacity and to act as a disincentive for acquiring an interconnection position on a speculative basis;
    - All new renewable natural gas generators must pay an entry access fee into a pipeline update fund based on their generation capacity. The proceeds of this fund will be used to by the utility to install monitoring equipment and upgrade existing pipelines to accommodate the creation of new generation capacity.
- Reassessment of time and cost associated with permitting of green energy projects as the number of installations increases.

Environmental Benefits Policy

- Biogas systems offer many environmental attributes beyond the generation of carbon-neutral energy, a trait unique in the renewable energy sector. These additional environmental attributes should remain the property of the producer to allow for further industry and project development.

- The utilities should retain environmental benefits accrued from the generator to the consumer, while any environmental benefits produced before the generation of electricity should remain the property of the producer.