

Energy Cogeneration from Agricultural and Municipal Wastes (ECoAMu) National Program

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ABSTRACT & OBJECTIVES

The National Program on Energy Cogeneration from Agricultural and Municipal Wastes (ECoAMu) is designed to mitigate net greenhouse gas (GHG) emissions from agriculture through energy co-generation while improving production efficiency and resource conservation. The main objective of the Program is to support establishment and technical/economic assessment of model demonstration plants, over a four-year (2002-2006) period, for energy co-generation from the use of agricultural and/or municipal wastes, including animal manures. The program is led by Agriculture and Agri-Food Canada and is funded by the Climate Change Action Plan 2000 through Natural Resources Canada). The Program is being delivered in collaboration between governments and industry organizations. The poster provides information on five projects that are currently supported across Canada under this program, four on anaerobic digestion and one on gasification of wastes.

WHAT WE HOPE TO LEARN



- GHG emissions reduction (CH₄ destroyed)
- Energy production (fossil fuel displaced)
- Effluent nutrient value (odour control, pathogen destruction, compost ability of solids, irrigation value of liquids)
- Economic & environmental assessment

PROJECT DESCRIPTIONS

Integrated Manure Utilization System

The integrated manure utilization system (IMUS), led by the Alberta Research Council and Highmark Renewables, will provide the livestock industry with an economically and environmentally viable technology for managing animal manure as a valuable resource. It will derive economic benefit from organic carbon and nutrients contained in the manure while eliminating adverse environmental impacts. The IMUS uses manure as raw material to generate biogas, biofertilizer and reusable water. The IMUS technology integrates the following main components: solid manure handling system, anaerobic digestion, biogas utilization, solid/liquid separation, nutrient recovery system, bio-based fertilizer production.

The IMUS will be demonstrated at Highland Feeders in Vegreville, Alberta, one of the province's largest feedlots. The demonstration plant will use manure from 7 500 head of cattle.

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Low Temperature AD and Co-Generation for Hog Manure Management

The low temperature anaerobic digestion technology developed by Bio-Terre Systems Inc. in close collaboration with AAFC is a complete process chain designed to produce energy from hog manure and to manage nutrients from intensive pig farming in a sustainable, economically viable fashion.

One of the unique processes that Bio-Terre Systems inc. has developed and is refining is the use of excess biogas to maintain the temperature of the bioreactors, to heat water and farm buildings. The anaerobic digestion process is able to remove up to 50% of phosphorus and heavy metals present in the manure, which is critically important in some areas where years of manure fertilization for crop nitrogen needs has resulted in large reserves of phosphorus accumulated in the soil. The technology is especially attractive in regions with large concentrations of pig farms, creating a shortage of available farmlands for spreading manure. The technology allows farmers to use the liquid part of the treated manure as an odorless nitrogen fertilizer with a very low content of phosphorus and heavy metals such as copper and low pathogenic elements. The impact of removing phosphorus and heavy metals from the crop nutrient chain is very significant and can reduce the total land base needed for sustainable land application of manure by 50 percent or more.

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Gasification of Agricultural Residues & Sorted MSW

ENERKEM will demonstrate their BIOSYN technology to gasify densified straws and sorted and densified MSW. The goal is the production of a synthetic gas, i.e. 'biosyn gas' that, after conditioning, is 'as clean as' natural gas. The biosyn gas can be conveniently used for the production of electricity via gas turbines, boilers/steam turbines combinations or internal combustion engines (ICE). Co-generation can be achieved by using the hot gases exiting the gas turbine or the ICE to generate low-pressure steam or hot water. The demonstration will take place in an existing 3.6 tonnes/day unit located at Sherbrooke, Quebec. It will provide the technological, environmental and economic data that will facilitate and guide the decision making process regarding its commercialization in the Canadian context.

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Production of Energy Using AD and Post Treatment Technology Beside a Commercial Hog Operation

Clear-Green Environmental Inc. ("Clear-Green") has partnered with Cudworth Pork Investors Group Ltd. ("CPIG"), SaskPower Corporation, Ag-West Biotech Inc., The Canadian Cement Association ("CAC") and Canadian Adaptation and Rural Development Saskatchewan ("CARDS") to install a commercial manure processing facility. The project involves the design, construction, commissioning, optimization, operation and improvement of the technology as applied to this site.

The project is a commercial demonstration project where advanced anaerobic digestion technology is being coupled with newly developed nutrient separation technology to produce a variety of valuable end products. SaskPower is installing the generation equipment, plus an additional operating commitment to purchase biogas from the plant. CPIG is providing the manure and paying a manure management fee, while also buying heat at an offset to natural gas cost price.

The fertilizer production process uses a new technology developed by Clear-Green and several suppliers. The technology enhances energy production in the anaerobic reactors and provides significant new revenue streams. Through management of the nitrogen, the project also creates a larger volume of greenhouse gas credits through a reduction of nitrous oxide emissions.

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unrealized sources. All manure will be processed into biologically stable, odourless and pathogen free fertilizer/soil amendment, electricity and water, which is recycled on farm. GHG emissions will be directly reduced as a result of fully enclosed vessel processing of manure. Surplus renewable energy supplied to the grid will provide additional GHG offsets.

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TABLE OF POTENTIAL GHG REDUCTIONS & ENERGY PRODUCTION

PROJECT	PROPONENT	WASTE	ENERGY PRODUCTION	GHG REDUCTION kt CO ₂ e/yr
Integrated Manure Utilization System Alberta	Highmark Renewables	7,500 head beef feedlot	800 kWe 1050 kWt	9.25
Low Temperature AD and Co-Generation for Hog Manure Quebec	Bio-Terre Systems Inc.	20,000 hogs	-	1.80
Gasification of Agri. Residues & MSW Quebec	Enerkem Technologies Inc.	Manure & MSW	-	0.26
Production of Energy Using AD and Post Treatment Technology Saskatchewan	Clear Green Environmental Inc.	1200 sow farrow finish	120 kWe	2.50 (25 if N to fertilizer is considered)
Lynn Cattle Turnkey Integrated Manure Processing Plant - Ontario	Lynn Cattle Co.	5,500-head beef feedlot	7,000 kwh/yr	26.5

The Establishment and Demonstration of the Lynn Cattle Turnkey Integrated Manure Processing Plant

The proposed Lynn Cattle Turnkey Integrated Manure Processing Plant (T.I.M.) is designed to demonstrate the full potential of Anaerobic Digestion (AD) Technology, its importance and implications for agriculture in Canada. A fully integrated research component in association with Ridgetown College and the University of Guelph is expected to generate independently verified research and performance data for the plant, specifically regarding performance of the digester, the cogeneration modules and water recovery including GHG baseline and mitigation data. Once operational, the Lynn Cattle T.I.M. project will provide a proven "boiler plate" and become the catalyst for implementation across several agricultural sectors: livestock operations of similar size, formation of co-operatives for smaller farms and application development for small to medium scale implementation on individual smaller farms.

The integrated systems approach will realize the full resource potential of the family farm's manure, eliminating environmental concerns while creating new revenue streams from previously

WHERE TO GET MORE INFORMATION

http://res2.agr.ca/initiatives/manurenet/en/hems/ecoamu_main.html



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Environmental Technology Assessment for Agriculture (ETAA) Program

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INTRODUCTION

The Environmental Technology Assessment for Agriculture (ETAA) five-year National Program (2003 -2008) is funded under the Agricultural Policy Framework (APF) agreement of 2002 between the federal and provincial/territorial governments.

The ETAA program has been established to assess innovative technologies that conserve, maintain and enhance the health of natural resources associated with agricultural production; and to provide information on these technologies for the benefit and use of stakeholders. The program will help identify innovative and sustainable technologies for adoption by farmers to reduce the risk of soil, water and air contamination, and to reduce adverse impacts on biodiversity. Total funding for the program is \$10 M; funding will be utilized to



establish on-farm collaborative projects in which farmers, industry and scientists would participate to assess the economic benefits and impacts of innovative technologies on the soil, water and air quality and /or biodiversity.

Multidisciplinary teams of farmers, industry, AAFC scientists in collaboration with non-government scientists and professionals are eligible for funding under the program. Assessment projects will be established on farms representing dairy, swine, poultry, feedlots, cow/calf operations, mixed crop and irrigation systems. These farms will be chosen for representative climates and soil zones of Canada.

PRINCIPLES AND IMPLEMENTATION OF THE ETAA PROGRAM

The ETAA program deals with the quantitative assessment of innovative and integrated ETs that have the potential of inducing positive impacts on soils, water, air, biodiversity and renewable energy use. Preferred technological packages for ETAA are those that offer new environmental, economic and operational flexibility to producers. ETAA favours ETs that enhance the utilization of existing resources and production outputs. This program does not support assessments of single technologies alone that have been or are being widely used by farmers or ranchers (i.e., zero-tillage).

The ETAA Program considers funding for on-farm assessment of integrated environmental technologies (i.e., two or more technology

areas and/or types from the ensuing table) that focus on the following:

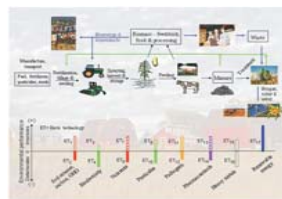
1. Animal wastes and manures	a) Waste and manure treatment b) Land application of a) c) Bioproducts
2. Animal production	a) Precision feeding b) Phytase c) Rumen function modifiers
3. Crop nutrients	a) Alternative nutrient sources (i.e., slow release fertilizers); microbial and other organic products b) Land application of nutrients c) No till with alternative nutrients and alternative management strategies
4. Pest management	a) Biological control b) Reduced-risk/Bio-rational products c) Plant resistance to pests d) Pest prevention/Cultural control e) Improved pesticide application
5. Renewable energy	a) Co-generation: anaerobic digestion, thermo- chemical, gasification of agricultural biomass and alternative feedstocks b) Biodiesel use - on farm c) Wind (small scale, up to 12 MW) and solar (thermal and photovoltaic)

PROGRAM GOVERNANCE

The ETAA Program is managed, operated, and delivered by AAFC under the guidance and advice of five Technical Review Committees and one Industry Advisory Board, consisting of individuals with related scientific, technical and industrial expertise.

USING LIFE CYCLE ANALYSIS TO ASSESS ENVIRONMENTAL IMPACT

The identification, selection and assessment of state-of-the-art ETs to reduce the environmental footprint will be based primarily on the Life Cycle Analysis (LCA) of biological, chemical and physical inputs, processes and outputs associated with agricultural production. LCA is an internationally recognized assessment model of a product's impact on energy, economic and environmental values. The LCA is particularly useful in ensuring that benefits derived in one area do not shift the impact burden to other places within a product's life cycle.



Using the Life Cycle Analyses to assess ETs in relation to environmental impact

Comprehensive analysis supplying estimates of economic and environmental outputs and information for selected ET's will be performed. The data will be available for use by individual producers, other stakeholders and by government for policy development processes.

The ETAA program is unique in its use of a comprehensive set of eleven indicators that consider a broad set of environmental issues that correspond to APF priority areas. However, not all indicators may be relevant to all environmental technology projects as shown.

Correlation of ET's to relevant environmental performance indicators

Environmental Issue:		Energy	Air	Water	Soil							
Indicators:		Net energy use % renewable energy use	Net greenhouse gas emissions Ammonia	Residual N Total P load to water Pathogen hazard	Pesticide hazard Soil organic carbon	Total soil erosion Biodiversity						
ET Area	ET Type	1	2	3	4	5	6	7	8	9	10	11
1. Animal Wastes & Manures												
a	Waste and manure treatment		X	X				X				
b	Land application of manure fertilizer		X	X		X	X			X		
c	Bioproducts		X	X				X				
2. Animal Production												
a	Precision feeding		X	X								
b	Phytase		X	X								
c	Rumen function modifier		X	X								
3. Soils and Crops												
a	Alternative nutrient sources, microbial and biochemical agents		X	X	X					X	X	
b	Land application of mineral fertilizers		X	X	X	X				X		
c	Tillage		X	X	X					X	X	
4. Pest Controls												
a	Biological agents									X		
b	Biorationals									X		
c	Low toxicity pesticides + IPM									X		
5. Renewable Energy												
a	Co-generation: anaerobic digestion, thermochemical, gasification	X	X	X	X	X						
b	Biodiesel use	X	X	X								
c	Wind (small scale, up to 12 MW) and Solar (thermal and photovoltaics)	X	X	X								

PROJECT DESCRIPTIONS Round 1

A first round of project selection started in January 2004 and completed in May 2004. To date, six projects

Project	Proponent	Project Location(s)
1 Environmental Technologies for Wild Blueberries	Bragg Lumber Company	NB, NS, PEI
2 Best management practices to improve sustainability and productivity of forage-based beef cattle production systems	Manitoba Forage Council;	MB
3 Controlled Release and Alternate Fertilizer Materials Use in Conservation Cropping Systems	Agrium	BC, AB, SK, MB, ON, Eastern Canada
4 Evaluation of the GreenSeeker technology to better manage the spatial variability of nitrogen and the efficiency of nitrogen fertilizers in wheat and canola at a field scale level	Indian Head Agricultural Research Foundation	ON, MB, SK
5 Integrated anaerobic digestion and fertilizer production for the disposal of swine manure, mortalities (deadstock) and potential slaughter waste; environmental and economic review	Clear Green Environmental Inc	SK
6 Technical, economical and environmental assessment of a solid-liquid isolation system for pig manure	Coopérative fédérée de Québec	QC

A second call for proposals was sent out Aug 13, 2004 and the deadline for application was September 30, 2004. For further information, please visit:

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