

# **IESO Smart Grids Forum**

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# **Farm Biogas Cogeneration in Ontario**

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# ANF Energy Solutions

- DG grid connection specialists
- No project ownership
- Current projects (Form B submitted)

Biogas	23
Landfill Gas	2
Wind	24
PV	4

In association with Nielsen Systems Inc.  
and Keller Engineering Associates

# Anaerobic Digestion and Biogas

- Anaerobic digestion is the breakdown, in the absence of oxygen, of manure and other complex organic materials into biogas and stable residue.
- Biogas, which is predominately methane, can then be used to produce energy in the form of electricity and heat.

# Terryland Farms – 180kW



# Fepro Farms



- Pioneer of biogas generation in Canada
- Installed a 50kW unit in 2003
- Received the 2007 Ontario Premier's Award for Agri-food Innovation Excellence
- New 499kW unit in construction

# Fepro Farms – New Digester



# Fepro Farms – 499kW Generator



# Benefits of Anaerobic Digestion

- **Energy**
  - Efficiently recovers useful energy from organic wastes: fats & oils, food processing, fruit & vegetable, animal feed, crops.
  - Farms cover their own electrical & heating requirements.
- **Environmental**
  - Reduces greenhouse gases, pathogens, weed seeds & water pollution.
- **Operational**
  - Manure management, odour control, fertilizer quality
- **Financial**
  - New revenue streams, relatively fast start-up, rural economic development

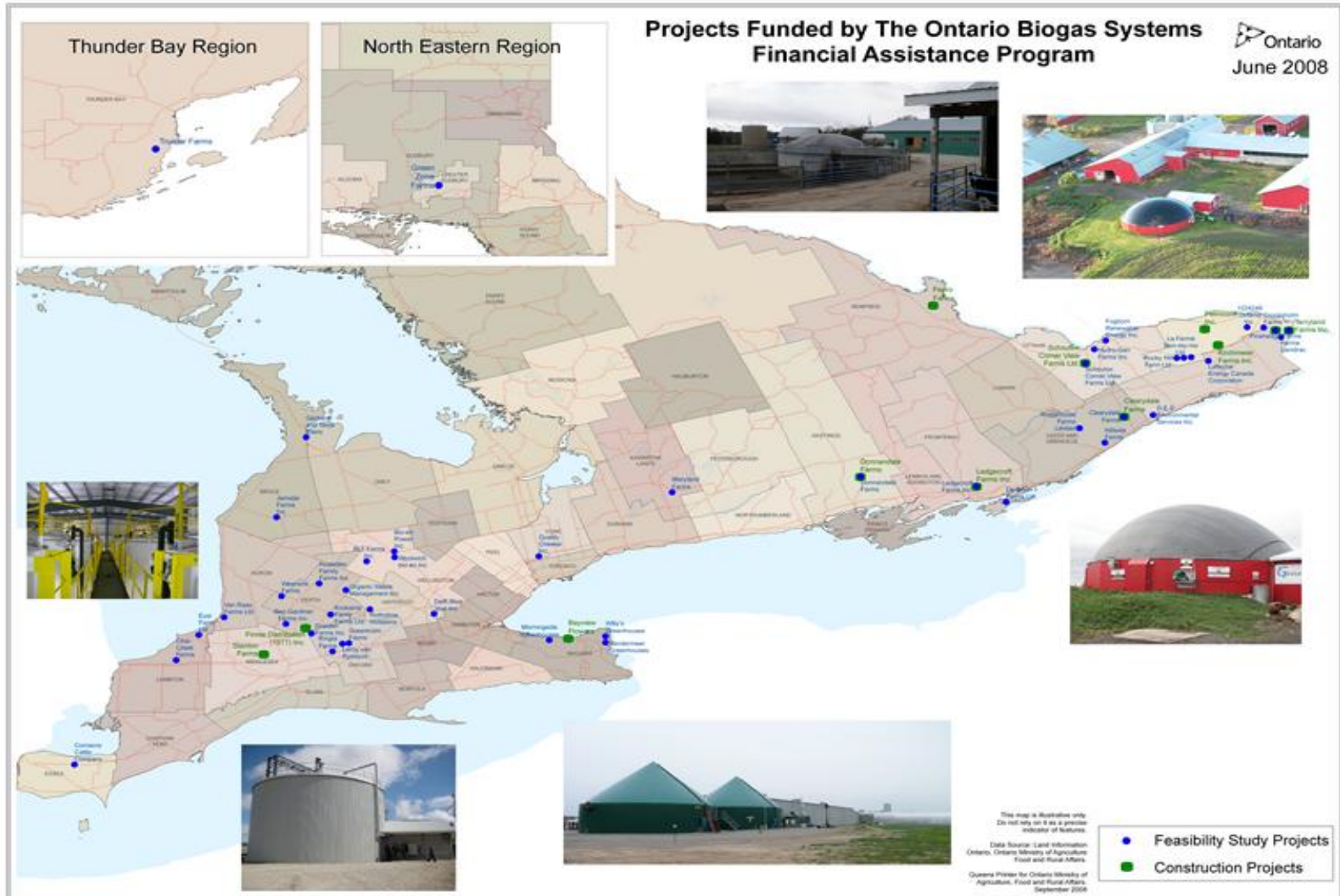
# Financial Assistance

- Well established in Europe – Developing industry in Ontario and Canada.
- OMAFRA's (Ontario Ministry of Agriculture, Food and Rural Affairs) Ontario Biogas Systems Financial Assistance Program - \$11.2 million.
- **Phase 1 (Feasibility):** Up to 70% of eligible costs up to \$35,000 per project.
- **Phase 2 (Implementation):** Up to 40% of eligible costs up to \$400,000 per project.

# Objectives of the Biogas Program

- To develop an agri-food based biogas sector in Ontario.
- To promote renewable energy.
- To reduce Greenhouse Gas (GHG) emissions.
- To improve the use of agricultural and food products and byproducts.
- Enough agricultural and food byproducts for 100s of systems

# OMAFRA Funded Biogas Projects



# The Current Situation in Ontario

- OMAFRA funded 46 feasibility studies (phase 1 funds fully allocated)
- 12 projects at phase 2, with 2 more pending.
- 4 systems up and running with RESOP.
- Several systems waiting for RESOP review or below the red line, **but some are building anyway.**

# Funded Phase 2 Projects

Phase 2 Projects - Biogas System Construction and Implementation		
Business Name	County/District	Project Information
Pinehedge Farms Inc.	Prescott & Russell	Organic dairy farm and yoghurt production, electricity production, and thermal energy
Terryland Farms Inc.	Prescott & Russell	Dairy farm, electricity production
Fritz and Paul Klaesi	Renfrew	Dairy farm, electricity production, expanding existing biogas system
Ledgecroft Farms Inc.	Leeds & Grenville	Dairy farm, electricity production
Kirchmeier Farms Inc	Prescott & Russell	Dairy farm, electricity production
Petrocorn Inc	Prescott & Russell	Dairy farm, electricity production
Clearydale Farms	Grenville	Dairy farm, electricity production
Donnandale Farms Inc.	Hastings	Dairy farm, electricity production
Schouton Corner View Farms	Ottawa/Carlton	Dairy farm, electricity production
Stanton Bros. Ltd	Middlesex	Dairy farm, electricity production
Finnie Distributing (1977) Inc.	Perth	Byproduct processor and natural gas replacement

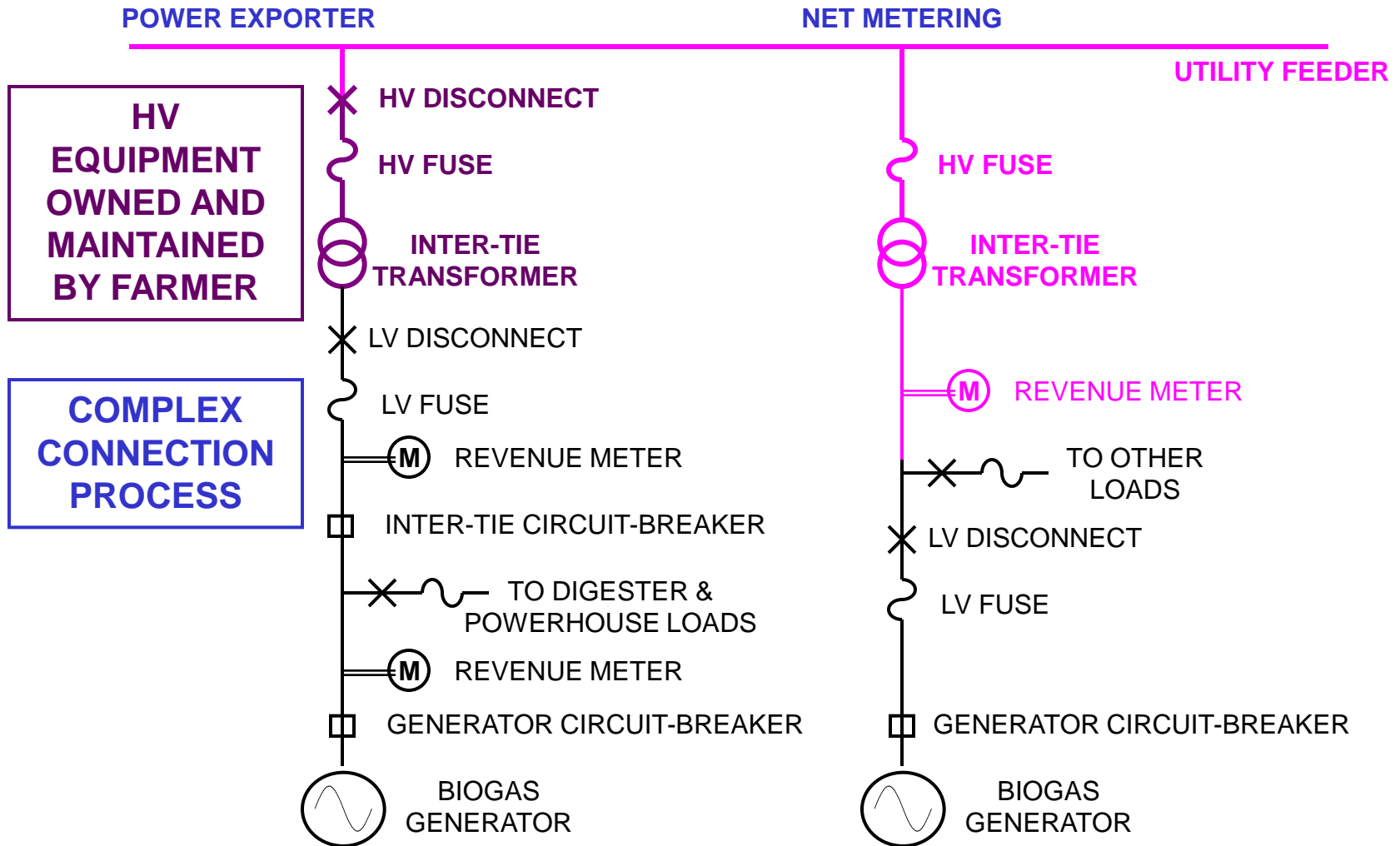
# Key Project Features

- Rural – Hydro One service territory
- Weak feeders:
  - Low fault current
  - Low feeder load downstream of the last recloser
- <500kW
- Fuel stored in digester, thus dispatchable, and available 24/7, including in emergency.

# Key Issues

- Complexity and Ownership of High-voltage Assets
- Cost Recovery Strategy & Deep Entry
- Uncertain Financial Background
- Grid Access
- Anti-Islanding Protection

# Ownership of High-Voltage Assets



# Cost Recovery Strategy & Deep Entry

- Demand customers pay over life of connection
  - Utility own connection assets
- Generators pay up front for their connection costs, the utility connection costs and utility deep reinforcements
  - Generator owns connection assets

# Uncertain Financial Background

- RESOP suspended in May 2008
- New yellow and orange zones
- Affects many <500kW biogas projects
- Many farmers already incurred costs
- Risk to previously agreed financing
- Cannot commit to CCRA - risk to queue position

# Grid Access

- Big interest in RESOP following its launch in 2006, **but** many projects unable to access the grid
- No grid access ↻ No RESOP, No project
- There is no right to grid access
- Distribution Code is 'First-come First-served' for all generation in 10kW-10MW range
- Forces projects to secure grid access first, before feasibility and detailed engineering design
- Rules allow generation companies to '**purchase**' the available grid capacity (\$5K/10MW) – tradable/negotiable asset?

# The Hydro One Queue

<b>Project Size</b>	<b>Applications</b>
<500 kW	39
501 kW - 8.99 MW	184
9 – 10 MW	971
<b>Full Substations</b>	<b>117 of 151</b>

- From Hydro One queue 31-Oct-08
- Over 80% of projects in 9-10 MW range
- Many substations full
- Blockages started in windy areas (near Great Lakes)
- Blanket applications in Eastern Ontario Aug/Sept 07
- Small biogas being shut out from many agricultural areas

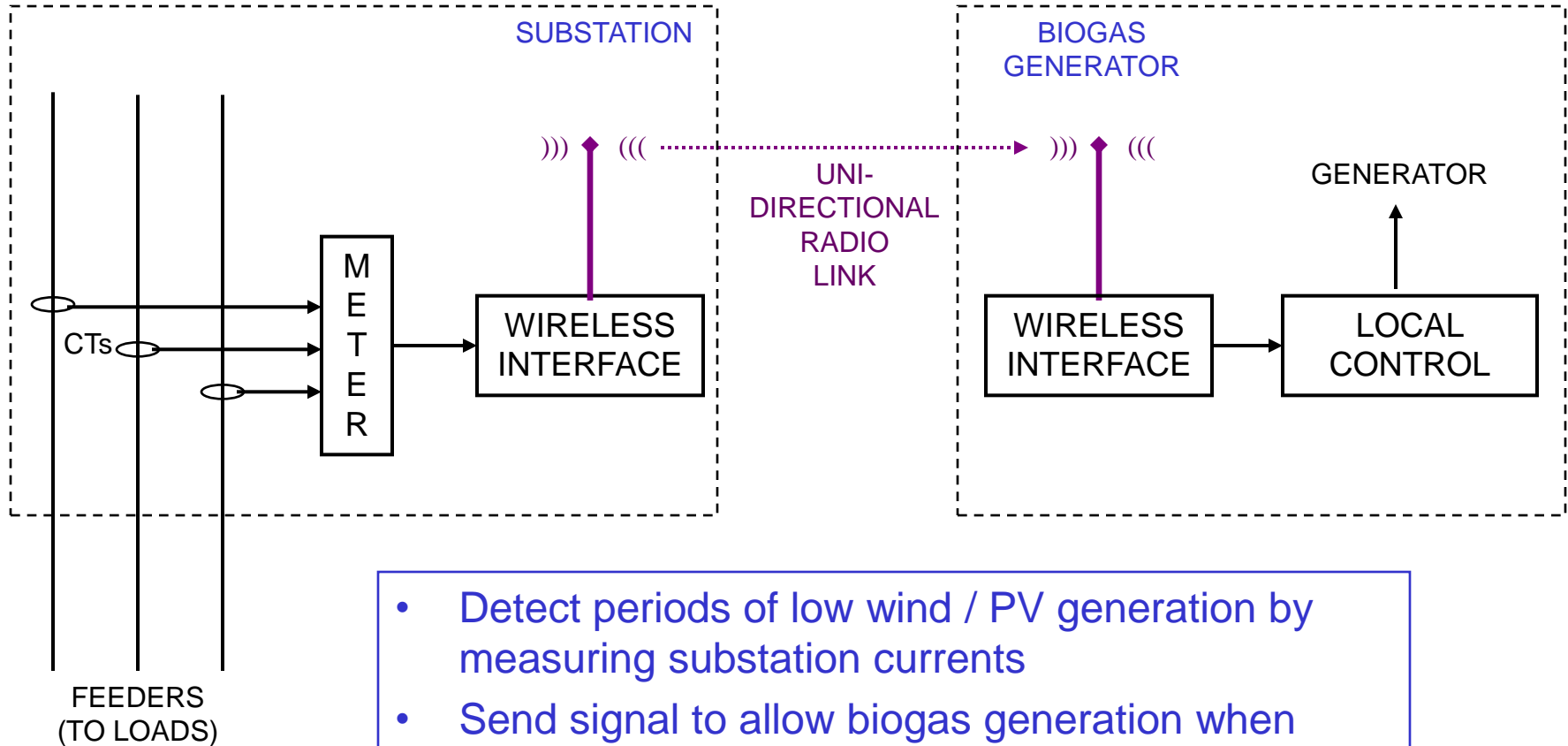
# Wind & Farm Biogas

Wind	Farm Biogas
Typically 9-10MW	Generally <500kW
Multiple applications financed by large corporations	Individual applications financed by farmers
Flexible on location	Tied to farms
30-35% capacity factor	70-100% capacity factor
Grid access is first step - companies forced to speculate	No speculation, but forced to rapidly submit Form Bs
Removes opportunity for small biogas	No significant impact on wind farm development

# Case Example

- Form A was submitted in April. At the time the substation was clear with 40MW capacity.
- IFA was received in July. Detailed electrical design was undertaken, including obtaining technical and cost data from manufacturers.
- Form B went in October.
- In the previous month all remaining grid capacity had been taken by one foreign company that applied to connect four 10MW PV farms to the substation.

# Twinning with Wind & PV



# Anti-Islanding Protection

Anti-islanding protection has been found to be a major barrier to the connection of small (<500kW) generation to rural feeders in Ontario.

- Above 50% of the minimum load downstream of the last recloser, the general utility requirement is for **Fast Transfer Trip**.
- Cost of **Fast Transfer Trip** (\$125K-\$250K) can be a show stopper.

# Fast Transfer Trip

- Main reason cited for **Fast Transfer Trip** is potential damage to generators from torque shock.
- Cost of **Fast Transfer Trip** is independent of the project size, and is not proportionate with the scale of the potential damage.
- The potential for damage is based on hydro generators, which have high inertia and long shafts. Biogas engines are low inertia with short shafts.

# The Single-phase Hydraulic Recloser



- Extensively deployed across Ontario
- On poles and in Distribution Stations
- Recloses in 1-2 seconds
- No status indication
- Unsuitable for **Fast Transfer Trip**

# Protection Standards

	Current North American Standards	Local Utility Requirement
<50% Minimum Feeder Load	Local U/O frequency Local U/O voltage	
>50% Minimum Feeder Load	<b>Fast Transfer Trip : \$125k - \$250k</b> <b>Show stopper for small DG!</b>	
Disconnect time	< 2 sec. (IEEE 1547, CSA C22.3 No. 9)	Varies, but can be < 1 sec.

- Alternatives being explored with Hydro One.

# Terryland Farm Biogas



- Novel anti-islanding strategy utilising Reactive Power export protection
- On-site tests March 2007
- Met the trip time requirement.
- Accepted by the utility
- Only applicable to feeders with inductive load characteristics, and with some risk of nuisance trips from motor starting
- **Avoided the cost of Fast Transfer Trip**