

# Anaerobic Digestion: Ontario Provincial Initiatives

Green Innovations and  
Renewable Energy Opportunities for the Caledon  
May 26, 2015

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# Why farm-based biogas in Ontario?

- New revenue on the farm
- Renewable energy production [heat, electricity, gas]
- Support food processing
- Increased nutrient utilization
- Societal benefits :
  - Pathogen Reductions/ Clean Water
  - Reduced GHG emissions / Clean Air
  - Reduced Odour / Less Nuisance
- Supports farmers' environmental goals and reducing product C-footprint through the value-chain



# 16,414 MW

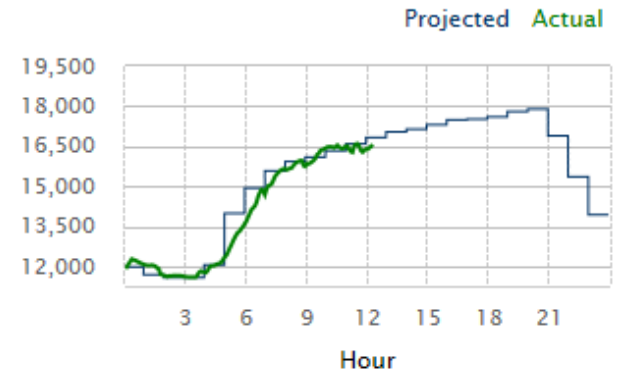
Current Hour's Demand at 12:00 p.m. EDT

Projected Demand at 2:00 p.m. EDT **16,834 MW**

Today's Projected Peak at 9:00 p.m. EDT **17,900 MW**

Summer Record Peak **27,005 MW**  
Aug 1, 2006

## Ontario Demand (MW)



## SUPPLY

Hourly Output by Fuel Type at 11:00 a.m. EDT

Nuclear	9,969 MW
Hydro	4,405 MW
Gas	388 MW
Wind	930 MW
Solar	74 MW
Biofuel	33 MW



Hourly Imports **175 MW**

Hourly Exports **2,037 MW**

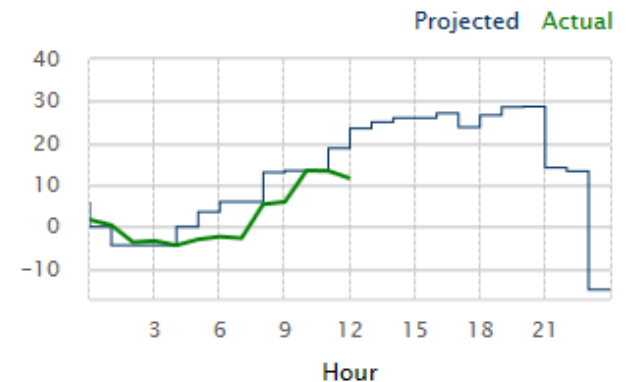
Generator Availability at Peak at 10:00 p.m. EDT **28,550 MW**

## PRICE

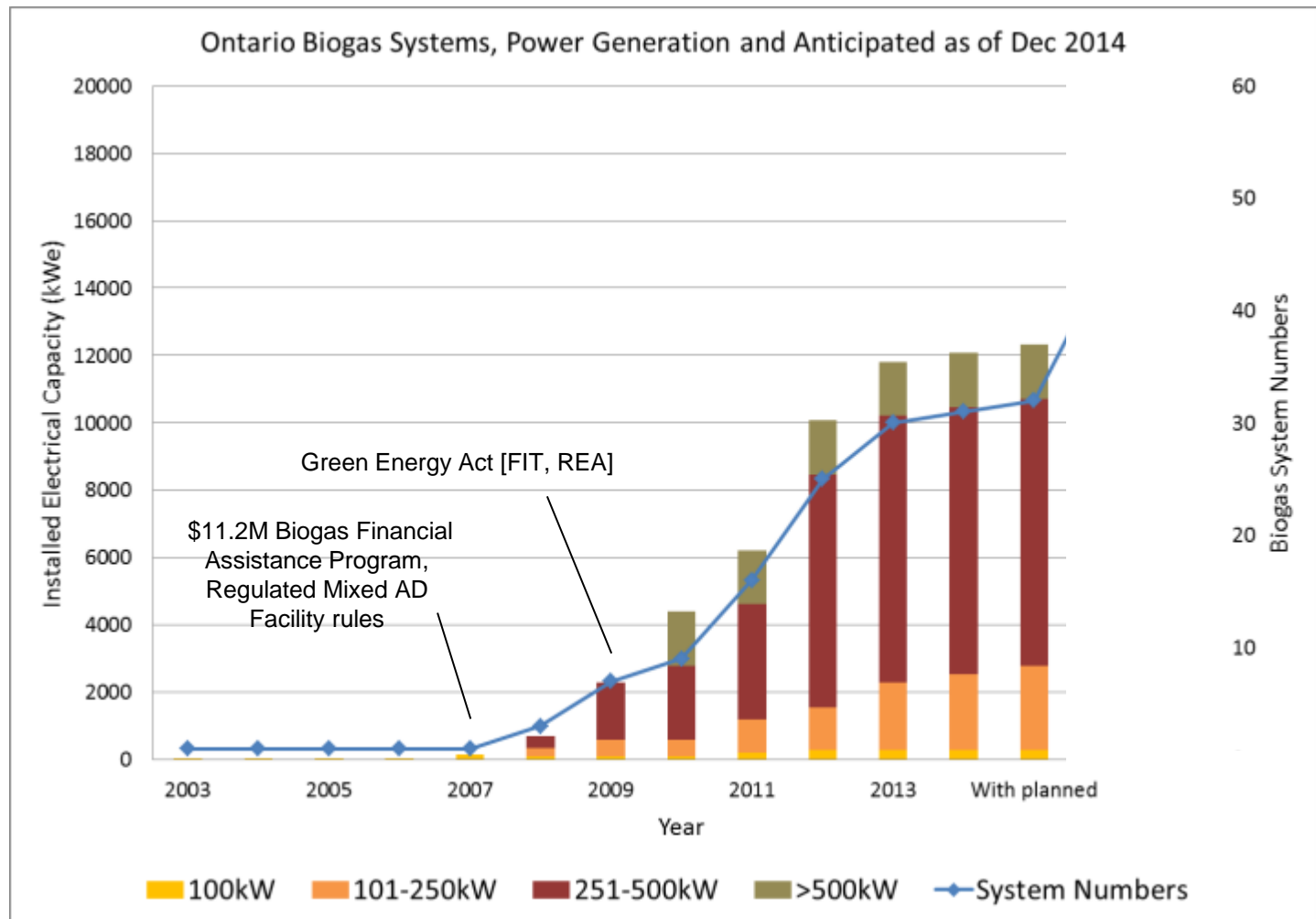
# 1.16 ¢/kWh

Current Hourly Price at 12:00 p.m. EDT

Hourly Ontario Energy Price (\$/MWh)



# Agricultural biogas system growth



# Feed-In Tariff (FIT) 4 Draft Rules

- Independent Electricity System Operator (IESO) delivers FIT4
- FIT: offers a standard price for different renewable energy technologies based on the cost of developing and delivering a project
  - Various priorities and constraints
  - Only for projects < 500 kW
- Final FIT4 rules anticipated early June, application period end of July
- Procurement Target: 241 MW
  - 2/3 to Contract Capacity Set-Asides (municipal, community, aboriginal) - 161 MW
  - 80 MW available to general pool of applicants
  - FIT3 ~500 MW of applicants!

# September 30, 2014 Feed-In Tariff Prices

Renewable Fuel	Project Size Tranche*	Price (¢/kWh)	Escalation Percentage**
Solar (PV) (Rooftop)	≤ 10 kW	38.4	0%
	> 10 kW ≤ 100 kW	34.3	0%
	> 100 kW ≤ 500 kW	31.6	0%
Solar (PV) (Non-Rooftop)	≤ 10 kW	28.9	0%
	> 10 kW ≤ 500 kW	27.5	0%
On-Shore Wind	≤ 500 kW	12.8	20%
Waterpower	≤ 500 kW	24.6	20%
Renewable Biomass	≤ 500 kW	17.5	50%
On-Farm Biogas	≤ 100 kW	26.3	50%
	> 100 kW ≤ 250 kW	20.4	50%
Biogas	≤ 500 kW	16.8	50%
Landfill Gas	≤ 500 kW	17.1	50%

## FIT PRICE ADDERS

	Aboriginal Participation Project		Community Participation Project		Municipal or Public Sector Entity Participation Project	
Participation Level (Equity)	> 50%	≥ 15% ≤ 50%	> 50%	≥ 15% ≤ 50%	> 50%	≥ 15% ≤ 50%
Price Adder (¢/kWh)	1.5	0.75	1.0	0.5	1.0	0.5

# Feed-In Tariff (FIT) 4 Draft Rules

- Priority Points:
- Municipal Council Support, Aboriginal Support, Public Sector Host Site
- Price Reduction Tier Three:
  - 26.3 c/kWh becomes 23.1 c/kWh
  - 20.4 c/kWh becomes 18.0 c/kWh

Price Reduction Tiers	Price Reduction	Priority Points
Base Price	0	0
Tier One	4%	1
Tier Two	8%	2
Tier Three	12%	3

## Additional Biogas Considerations in FIT4

- CCSA are a difficult fit for farm-based projects:
  - FIT3 had applications for 35 on-farm AD systems.
  - 6 co-op projects secured FIT3 contracts
- Prices of 26.3 ¢/kWh and 20.4 ¢/kWh for 100 kW and 250 kW systems: energy crop use may be viable. Less so with bid-down.
- Rural grid connections eliminate many projects





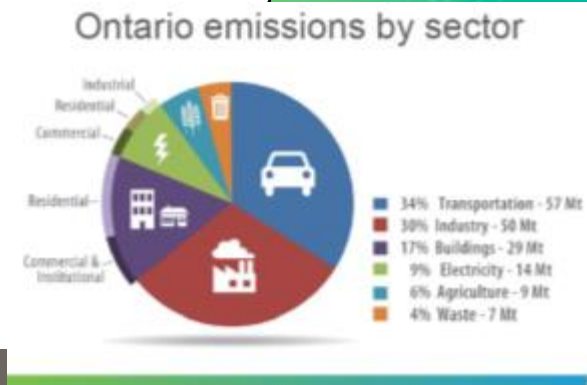


## Amber Energy Co-op – Elgin County

- Six FIT3 co-operative anaerobic digestion contracts, 6 X 250 kW
  - Achieved FIT3 maximum co-op level: >50 landowners in the county, 100% co-op ownership
- Co-op will own and operate the anaerobic digesters, contract with the host land-owner:
  - 3 dairy sites, 2 vegetable sites, 1 hog site
  - Manure/digestate exchange, annual rental fee
- Co-op coordinates centralized feedstock reception/distribution
- Central feedstock receiving hub:
  - Home to biodiesel production: glycerine feedstock produced
  - <10 km to each site: sharing equipment is possible
- Regulated Mixed AD Facility 50% food waste model is intended
- Some energy crops as feedstock
- Ground-breaking on 3 projects in August 2015

# Ministry of Environment and Climate Change (MOECC) Climate Change Discussion Paper

- Public comments on Discussion Paper closed March 29, 2015
- Cap and trade system to limit GHG emissions – Western Climate Initiative with Quebec and California
- “Will reward innovative companies and create more opportunities for investment in Ontario”
- Potential opportunity for biogas:
  - Reduced emissions
  - Replace fossil fuel use



## Mixing food waste: what has changed?

- On October 25, 2013, the Government filed amendments to O. Reg. 267/03 to enhance the anaerobic digestion approval program under the Nutrient Management Act (NMA)
  - Key Change: Facilities can now treat up to 50% off-farm materials under the **Regulated Mixed Anaerobic Digestion Facility** program



# 25% Versus 50% Off-farm Feedstock

- University of Guelph Biogas Calculator:
- <http://bioeconproject.com>
- Average Ontario Dairy Farm: 85 milking cows
  - 25% off-farm material (1300 m<sup>3</sup>/ yr), mid strength vegetative waste, \$10/tonne tipping fee  
**= 57 kW capacity, negative NPV**
  - 50% off-farm material (same material)  
**= 100 kW, positive NPV**

Microsoft Excel - Ad July 21st 2011 450 cows --- \$2750000 5.20.xls

File Edit View Insert Format Tools Data Window Help

Share As Application View Settings

Interest Rate: 5%

### Loan Amortization Schedule

Enter values		
% of Base Capital Cost Financed	90.00%	
Loan amount	1,791,007.28	Press to Reset Loan
Annual interest rate	5.50%	Amount to % Based Setting
Loan period in years	20	
Number of payments per year	1	
Start date of loan	10/11/2011	
Optional extra payments	0	
Lender name:		

Pay. No.	Payment Date	Beginning Balance	Scheduled Payment	Extra Payment	Total Payment
1	10/11/2012	\$ 1,792,097.28	\$ 182,519.90	\$ -	\$ 182,519.90
2	10/11/2013	\$ 1,732,847.98	\$ 182,519.90	\$ -	\$ 182,519.90
3	10/11/2014	\$ 1,700,000.41	\$ 182,519.90	\$ -	\$ 182,519.90
4	10/11/2015	\$ 1,664,880.48	\$ 182,519.90	\$ -	\$ 182,519.90
5	10/11/2016	\$ 1,625,591.02	\$ 182,519.90	\$ -	\$ 182,519.90
6	10/11/2017	\$ 1,582,279.22	\$ 182,519.90	\$ -	\$ 182,519.90
7	10/11/2018	\$ 1,534,727.22	\$ 182,519.90	\$ -	\$ 182,519.90
8	10/11/2019	\$ 1,482,596.42	\$ 182,519.90	\$ -	\$ 182,519.90
9	10/11/2020	\$ 1,379,484.21	\$ 182,519.90	\$ -	\$ 182,519.90

# How Much Food Waste is out There?

## Estimated Flow of Organic Waste



# Collaborative Feedstock Sourcing

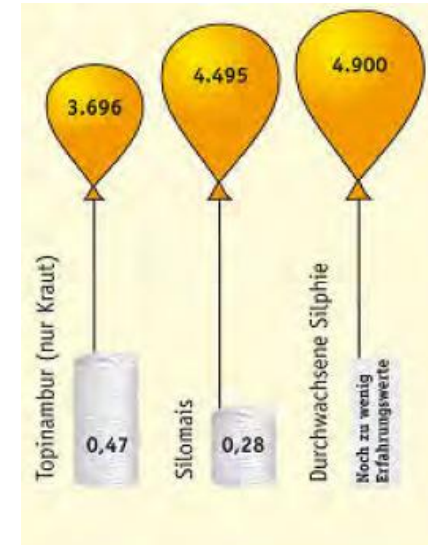


- Collaboration of biogas system operators
- Offer consistent relationship for feedstock generators:
  - Higher quality service
  - Dependability of destination: redistribution if for instance one site has down time – up-time advantage
  - Consistent message on pricing, value, quality
  - Flexibility in approvals and equipment amongst many AD systems
- Primarily operating in SW Ontario



# Cup Plant as Biogas Energy Crop

- Perennial, native, pollinator friendly
- High biogas per unit area ( $\text{m}^3/\text{ha}$ ) yield:
  - 4900  $\text{m}^3/\text{ha}$  (cup plant) vs 4500  $\text{m}^3/\text{ha}$  (corn silage)
- German trials since 2008
- Initial biogas yield tests at UG Ridgetown
- Establishment trials at OMAFRA Simcoe this season





2015  
International  
Year of Soils

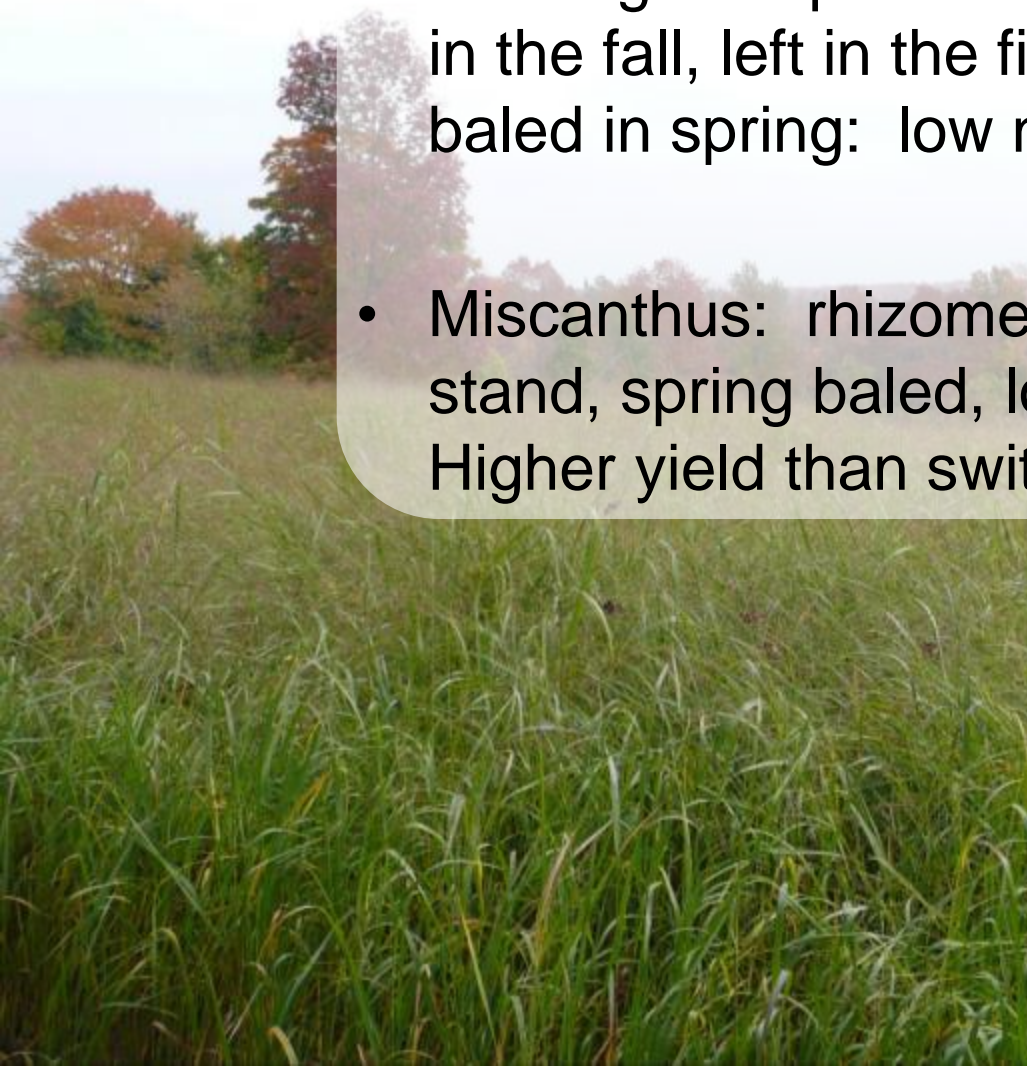
## Agricultural Biomass Switchgrass and Miscanthus

- Soil health: perennial crops for erosion prevention
- Wheat straw: normally 4-5 ¢/lb
  - Currently 10-12 ¢/lb
  - Low winter wheat acres (low grain price, late fall soybean harvest) and cold winter mean on-going price pressure.
- Result: interest in dedicated biomass crops
  - Predictable availability
  - Interesting performance characteristics



# Switchgrass and miscanthus

- Switchgrass: planted from seed (perennial), cut in the fall, left in the field to leach nutrients, baled in spring: low nutrient high C straw
- Miscanthus: rhizome establishment, winter stand, spring baled, low nutrient high C straw. Higher yield than switchgrass.



# Ontario Biomass Producer's Co-op (OBPC)

- Sustainable production and marketing of biomass.
- Principles:
  - Economical return to the farmer (7 ¢/lb, \$300/ac)
  - Buyer deals with the co-op, co-op looks after supply.
- Membership open to all Ontario farm operations, from small to large scale
- Associate members who are engaged in the biomass industry



# Questions?

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