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# **Distributed Electricity from Agricultural and Food Resources in Ontario**

**Conference on Biomass and Energy for the Great Lakes Economy  
June 9, 2008**

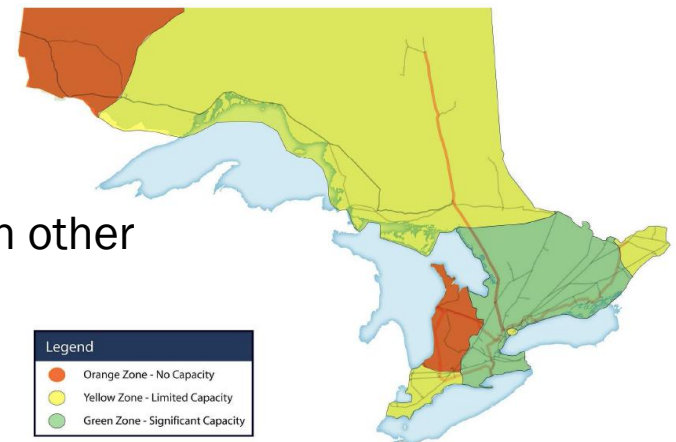
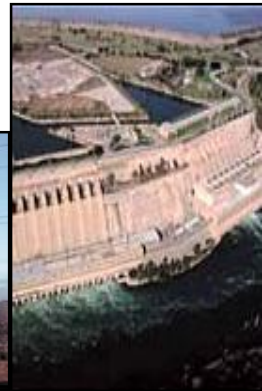
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# Overview

- Distributed electrical power
- Status of agri-food distributed electricity
- Agricultural and food resources

# Centralized Electrical Power

- Ontario's electrical grid was historically designed based on LARGE centralized facilities:
  - Niagara Falls, coal, nuclear
  - Centralized provincial ownership
- Advantages:
  - Large facilities can be more efficient
  - Nuclear, Niagara only work at large scale
- Challenges:
  - Transmission constraints
  - Source and load often distant from each other
  - Efficiency losses
    - Sagging wires – blackout 2003



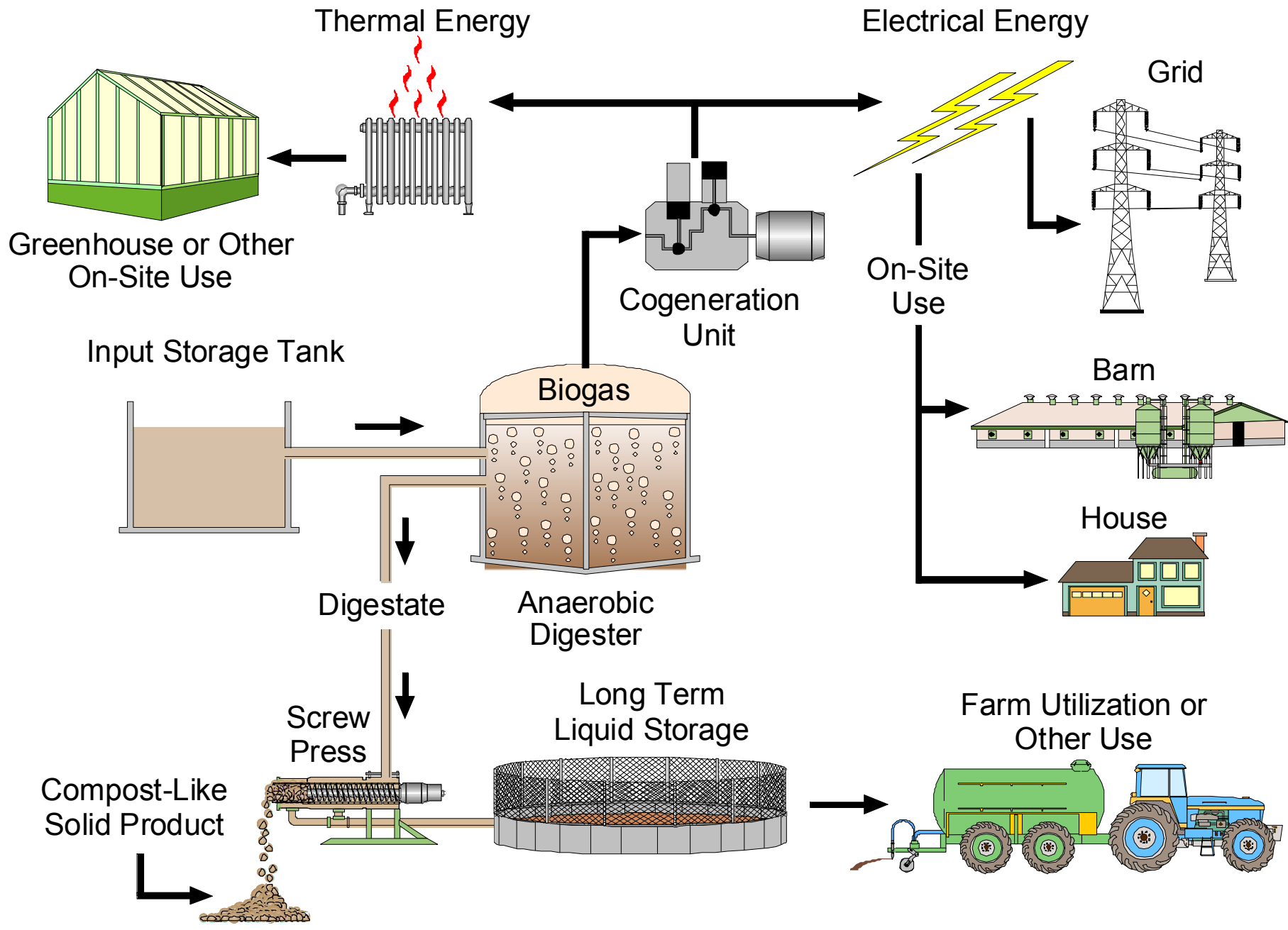
# Distributed Electrical Power

- Distributed electricity production:
  - Multiple, decentralized sources of production
  - Locate source and load in closer proximity
- Advantages:
  - Improved grid stability and response
  - Reduced losses
  - Smaller scale
    - Other ownership options
    - Renewable energy sources
    - Increased efficiency for use of co-generation
- Challenges:
  - Existing grid designed for one-directional flow
    - “Grid” vs. tree with roots
  - Increased management of system
    - Intermittency of sources

# Using Agricultural and Food Resources for Electricity

- Produce biogas (methane)
  - Burn biogas in an engine on-site, turn a generator
  - Alternative: biogas into natural gas pipeline – use at natural gas electrical facilities like new Portlands Energy Centre in Toronto
    - Storable
    - Alternative uses such as natural gas cars
  - Other options:
    - Burn dry biomass, generate steam, turn a turbine
      - Biomass at Nanticoke
    - Pyrolysis for bio-oil, or further gasification for syngas
      - Burn the bio-oil or syngas to turn a generator
- Keep an eye on sustainability, nutrient cycles, transportation
- Competition for dry biomass resources





# Electricity from Agri-food Biogas

- Multiple benefits:
  - Distributed electricity
  - “Small” scale
  - Local ownership
  - Use of local inputs = revenue within Ontario
  - Green, renewable, bio-based
  - Low carbon footprint (reduced GHG emissions)
  
  - Nutrients remain for re-use
  - Reduced odour, pathogens from hard-to-handle materials
- Limited resources – premium product, not bulk commodity
- May cost more

# Klaesi Farm





# Bayview Flowers

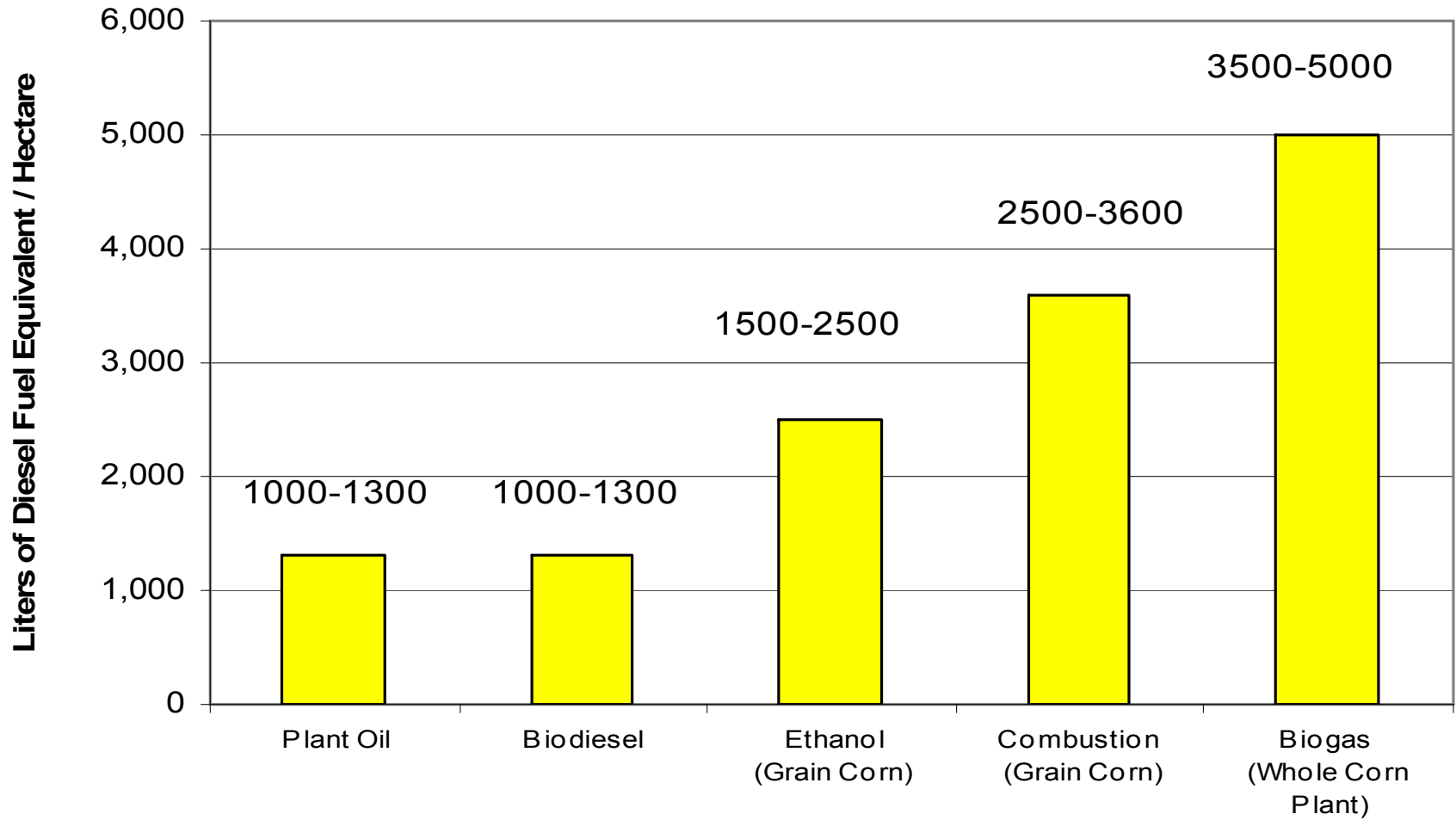


# Proposed Port Colborne Project

- StormFisher biogas
  - Industrial zoning
  - Based on European Design
- Inputs:
  - Grape pomace
  - 130,000 tonnes available locally: local grain mills, food ingredient manufacturer and chicken processor
- 2.6 MW co-generation system (sale through RESOP)
  - Potential local industrial use of heat
  - Alternative is upgrading to natural gas quality



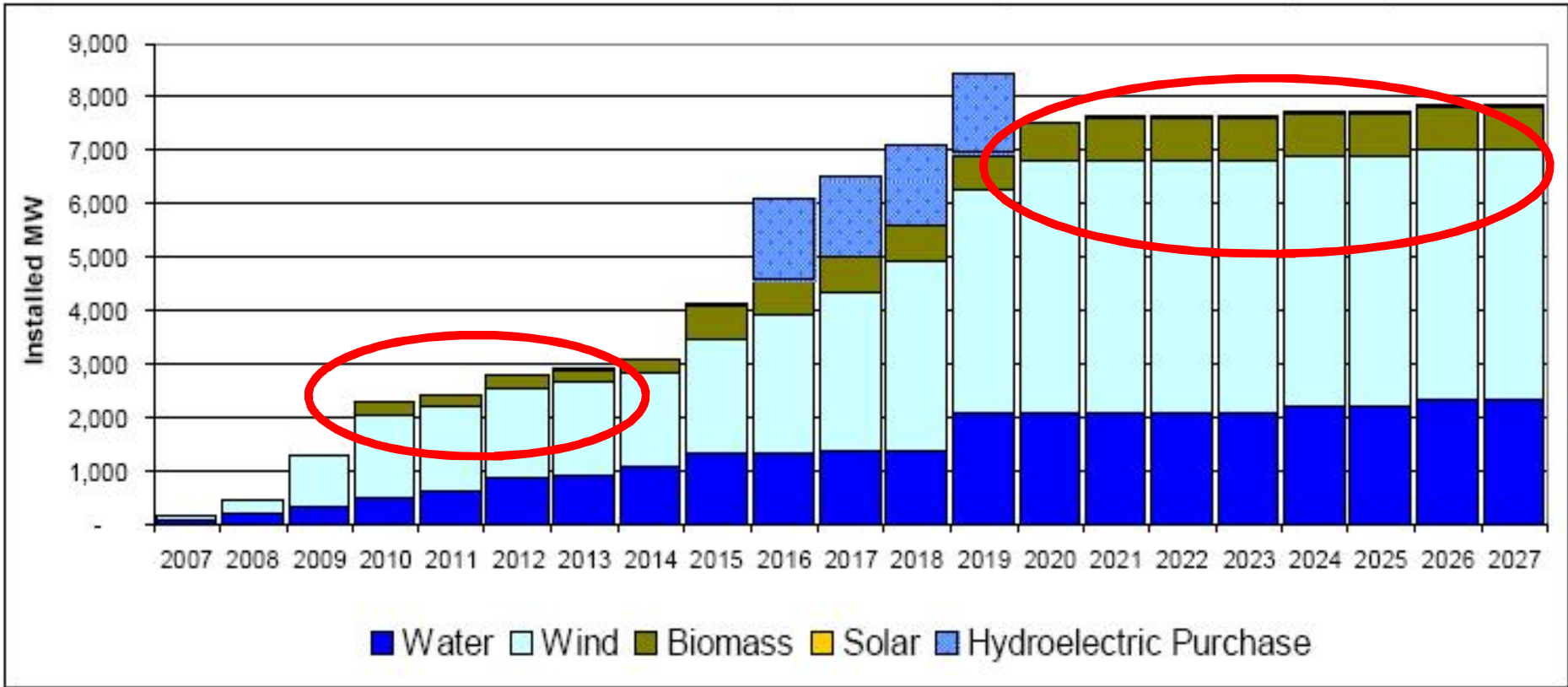
# Fuel Equivalency





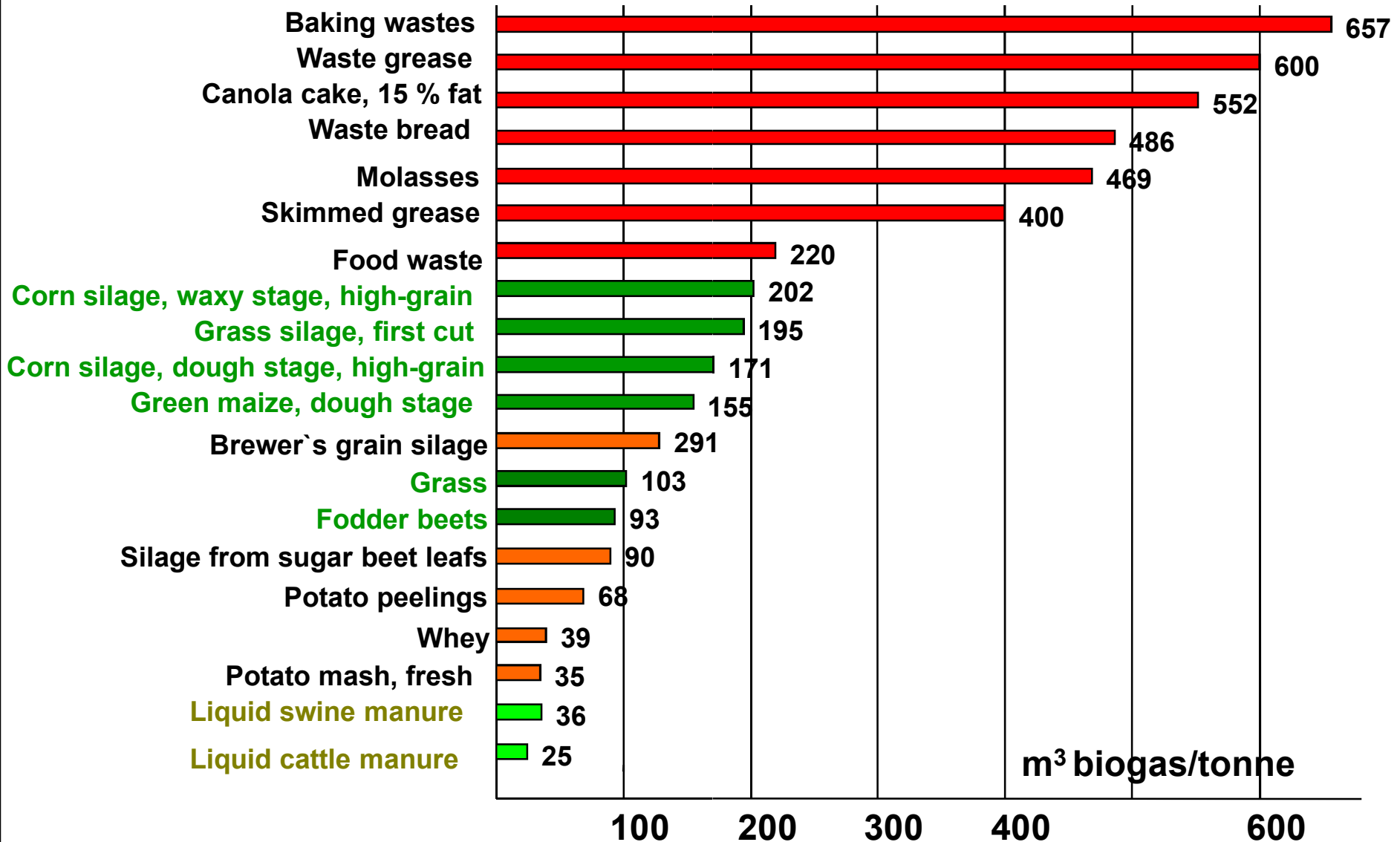
# How Much?

## Integrated Power System Plan: New Renewables



Includes committed resources.  
Source: OPA

# Potential Biogas Yields



# Food-Based Inputs for Biogas

- Conservative estimate based only on published materials:
  - Between 1.2 and 9.8 million tonnes reasonably available
  - 53 to 697 GWh/year electricity ( <100 MW continuous)
  - 0.64 to 8.4 million GJ/year natural gas
- Primary sources:
  - meat processing, rendering, grains and oilseeds, plate food waste
- Wet sloppy stuff
  - Best for biogas, and tough to handle elsewhere
  - Hauling cost limits size and location = distributed power!
  - Seasonality – hard to design for
- New streamlined regulations:
  - Nutrient Management Act, Environmental Protection Act



## Energy Crops

- High energy-density compared to manure
- Increased energy production potential
  - Corn silage
    - Yield: 6500 kWh per acre per year (electrical + equal heat)
      - 1800 kWh per cow per year from manure
    - At 17¢/kWh = \$1100 gross income per acre
- 10% of energy produced is required to grow, harvest, transport and digest crop
- Best applied if opportunity to use heat from co-gen unit
- Recent work by NRC to look at enzymes to breakdown switchgrass or miscanthus as an input for biogas
  - Access marginal lands instead of prime ag lands



# Ontario's Standard Offer Program

Higher price for electricity from renewable or clean sources offered by the Ontario Power Authority

- Final contract details November, 2006
- 11 ¢/kWh, basic
- 14.52 ¢/kWh for peak power
  - Blended price at 8000 hours operation = ~11.9 ¢/kWh
- OMAFRA Factsheet Available

# Connecting to the Electrical Grid

- Connection Impact Assessment
  - Key first step of any electrical project
  - Requirement by local electrical utility to determine line capacity, impact on neighbouring facilities etc.
- Queue: nearly 2000 applications
  - “Expedited Process” for small systems <500 kW
- Projects can be moved up in the queue if the projects ahead in the queue not willing to downsize



# Recent proposed changes by OPA and OEB

## Proposed RESOP changes:

- Freeze for new RESOP contracts until Aug 4, except micro (<10 kW) and farm-based biomass <250 kW
  - contract project milestones to avoid monopolization
  - 10 MW of projects per proponent per Transformer Station
  - 50 MW of projects per resource type per proponent at any one time before commercial operation of any one project
  - expansion of transmission constraint zones

## Proposed Distribution System Code changes:

- Eliminate queuing for small non-intermittent sources
  - new small (<250 kW) farm based biogas projects, and ones currently in the queue, will be able to "jump" the queue to connect to the grid if there is capacity.
  - "micro-embedded generation facility" definition is expanded to include "non-intermittent generation technology" which is solar, water, biomass/biofuel, or fuel cell projects =< 250kW.

# Biogas Funding Program

## Goals:

- Kick start biogas sector
- Reduce climate change emissions
- Build 20-30 biogas systems



## **BIOGAS SYSTEMS FINANCIAL ASSISTANCE PROGRAM**

*Guidebook*

# Applying for Funding

- First come, first served basis for projects that meet eligibility criteria
- **Phase 1**
  - feasibility, design, and planning studies
  - 70% cost-share, \$35,000 max
- **Phase 2**
  - construction, implementation, and commissioning
  - 40% cost-share up to \$400,000 max (less any Phase 1 funding)
  - Phase 2 needs building permit with application if required
- Can apply to Phase 1, 2, or both

# General Eligibility Criteria

- Eligibility criteria of an anaerobic digester project :
  - the project uses at least 75% agricultural or food-based products or by-products,
  - the project produces biogas for use in the production of electricity or heat or for fossil fuel replacement, *and*
  - the project manages digestate in a manner that avoids landfill or sewage disposal

## Some Concluding Observations

- Distributed Power: Biogas is Ontario's clearest opportunity for low-cost, non-intermittent, renewable, geographically diverse, distributed electrical power
- Agrifood biogas systems well-positioned over next 3-5 years:
  - RESOP \$, and energy policy/program streamlining
  - Ability to mix food materials and potentially receive tipping fees
  - Ontario Biogas Systems Financial Assistance Program
- Primarily local materials for construction, local ownership, local inputs, local revenue, local cost savings

# Some Concluding Observations

- Next steps:
  - The proof is in the pudding – get more systems built
  - Finding integrated co-gen opportunities such as community heating
  - Demonstrate financial model
- Near future:
  - natural gas
  - automotive fuel
  - growing biogas inputs on lower quality agricultural lands



## More Information

- Ontario Biogas Systems Financial Assistance Program
  - [www.ontario.ca/biogas](http://www.ontario.ca/biogas)
- OMAFRA's Energy Website:
  - [www.omafra.gov.on.ca/english/engineer/energy.html](http://www.omafra.gov.on.ca/english/engineer/energy.html)

