Incorporating Manure Digester Projects With Utility Systems
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Presentation Overview
- WPS philosophy on renewable energy
- Electric distribution interconnection
- Local gas distribution system injection
- Interstate gas pipeline injection
- Development of Wisconsin Bio-Gas Injection Standards

Wisconsin Public Service’s Commitment to Renewable Energy

WPS Bio-gas Fueled Electric Purchases
- Currently purchasing over 100,000 MWH/year for RPS compliance and Nature Wise sales
- Sources include dairy digesters/boilers, and landfill recovery
- In negotiations for an additional 3+Mw of capacity from numerous small generators

Electric Interconnection Standards
- 1999-Institute of Electrical and Electronics Engineers (IEEE) interconnection standard:
  Universally adoptable
  Technology-neutral
  Cover distributed resources as large 10 MVA.
- Energy Policy Act of 2005 established IEEE 1547 as the national standard for the interconnection of distributed generation resources

Electric Interconnection Standards
Public Service Commission to promulgate interconnection rules for distributed generators of <15 megawatts. Also directs PSCW to create advisory committee with representation from State agencies, and other stakeholders.

2004- Chapter PSC 119 “Rules for Interconnecting Distributed Generation Facilities”

PSCW 119

IOUs and municipal utilities covered (Coops encouraged to adopt)
Categorize by capacity and provide for several levels of interconnection review
Standardized process for application and prescriptive timelines for utility response
Standard application forms and contracts

http://psc.wi.gov/utilityinfo/electric/distributedGeneration/interconnectionProcedure.htm

PSC 119 Minimum Protection Requirements

“Protection & anti-islanding equipment to prevent the facility from adversely affecting the reliability or capability of the distribution system
Over/under frequency & voltage function
Overcurrent function
Ground fault protection
Synchronism check function
Other equipment utility requires

Anti-Islanding Requirement

Prevent power quality problems
Prevent out-of Phase Reclosing
Mitigate safety hazards
Solutions vary depending on size and type of DG and load profile of feeder

Electric Interconnection Summary

Design requirements are always specific to location and related operating limitations!
Bio-Gas Injection into Local Utility Distribution Systems

Equivalent to local road system
Operating pressures typically 15-200 psi
Regulated by the state Public Utility Commissions

Distribution system issues
Location of facility in relation to gas system
Lower operating pressure reduces cost of compression however, also limits off-take capacity
Daily and seasonal variation of customer demand on system could limit ability to place gas on the system
Supplier responsible for interconnection costs
Design requirements are always specific to location and related operating limitations
Sale of gas to utility for system or third party?
Need process for Daily scheduling and system balancing?

Distribution system Example
Scenic View Dairy, Saugatuck/Fennville Michigan

2600 head of dairy cattle

Distribution system Example
Production facility/utility interconnection point

Gas Quality Standards
Michigan Public Service Commission Technical Standards - Mandated Gas Quality

• Allowable BTU Range – 950 -1100/scf
• Total Sulfur – less than 20 grains/100 scf
• H2S – less than .3 grains/100 scf

Additional Michigan Gas Utilities Quality Standards

H2S – Less than .25 grains/100 scf
Total Sulfur – Less than 5 grains/100 scf
O2 – 1% or less by volume
CO2 – 2% or less by volume
N2 – 8% or less by volume
Gas temperature shall not exceed 110 degrees
Gas shall be commercially free from objectionable odors, dust, hydrocarbon liquids, water and any other solid or liquid matter which might interfere with its merchantability or cause injury to or interference with proper operation of the equipment through which it flows and any substance that might become separated from the Gas in MGU's facilities.
Gas Quality Standards

Physical Control – Specific Gravity
Cycle Time for sampling from monitoring equipment is too long (10 – 20 minutes)
Specific Gravity changes immediately with gas composition changes
Specific Gravity Testers have very short Cycle time (10 seconds)

Station design includes quality monitoring, automatic shut down, and odorization
Current flows are approx. 4.1 mcf/hour

Gas Quality Standards

Physical Control Schematic

Lessons Learned
Partnership and information exchange between Utility and Project Development Engineers is essential
Flexibility of Utility for gas purchases is important
System demand
All or none flexibility
Plan for time in schedule to tune Gas Processing operation
Determine and plan for Utility system pressure variability

Interstate Pipelines

• Equivalent to the Interstate highway system
• Operating pressures of 500+ psi
• Regulated by the Federal Energy Regulatory Commission & US Department of Transportation

Interstate Pipelines
### Interstate Pipeline issues

- Location of facility in relation to pipeline
- High operating pressure increases cost of compression however, typically less issues with off-take (if contracted for firm capacity)
- Supplier responsible for interconnection costs?
- Design requirements are always specific to location and operating limitations
- Interconnection agreement with interstate pipeline?
- Gas sales, through marketer or bi-lateral contract with end user?
- Need process for Daily scheduling and system balancing?

### Interstate Pipeline Quality Standards

Quality & operating standards are usually a function of a pipeline system’s design and the markets it serves.

### Interstate Pipeline Quality Standards

In general, standards specify that the natural gas:

- Be within a specific range of heating value (caloric value). For example, in the United States, it should be about 1,035 ± 5% Btu per cubic foot of gas at 1 atmosphere and 60 °F
- Be delivered at or above a specified hydrocarbon dew point temperature (below which some of the hydrocarbons in the gas might condense at pipeline pressure forming liquid slugs which could damage the pipeline)
- Be free of particulate solids and liquid water to prevent erosion, corrosion or other damage to the pipeline.
- Be dehydrated of water vapor sufficiently to prevent the formation of methane hydrates within the gas processing plant or subsequently within the sales gas transmission pipeline
- Contain no more than trace amounts of components such as hydrogen sulfide, carbon dioxide, mercaptans, nitrogen, and water vapor.
- Maintain mercury at less than detectable limits (approximately 0.001 ppb by volume) primarily to avoid damaging equipment in the gas processing plant or the pipeline transmission system from mercury amalgamation and embrittlement of aluminum and other metals.

### Wisconsin Distributed Resources Collaborative (WIDRC)

- Created to address distribution level electric interconnection standards
- Starting to discuss standards for biomethane injection into distribution system and interstate pipeline
- One possible outcome could be gas equivalent to PSC 119 in electric
- Involvement by PSCW staff, Consultants, Utilities & Citizen Groups