

Permitting

- ◆ CAFO
- ◆ Animal Waste Management Plan
- ◆ Electrical Interconnection



AD – Effect on Utility System?

- ◆ Distributed Generation – Good if placed in the right spot
- ◆ Interconnection costs are different for every situation.
- ◆ System is designed for generation
- ◆ Who assumes risks?



Distributed Generation Interconnection Guidelines

- ◆ Step 1.
 - ◆ Electric provider needs to provide guidelines and appropriate standard application forms.



Distributed Generation Interconnection Guidelines

◆ Step 2

- ◆ Applicant completes forms and returns them to the public utility.
- ◆ With a one-line Schematic Diagram alone with a check for \$250.

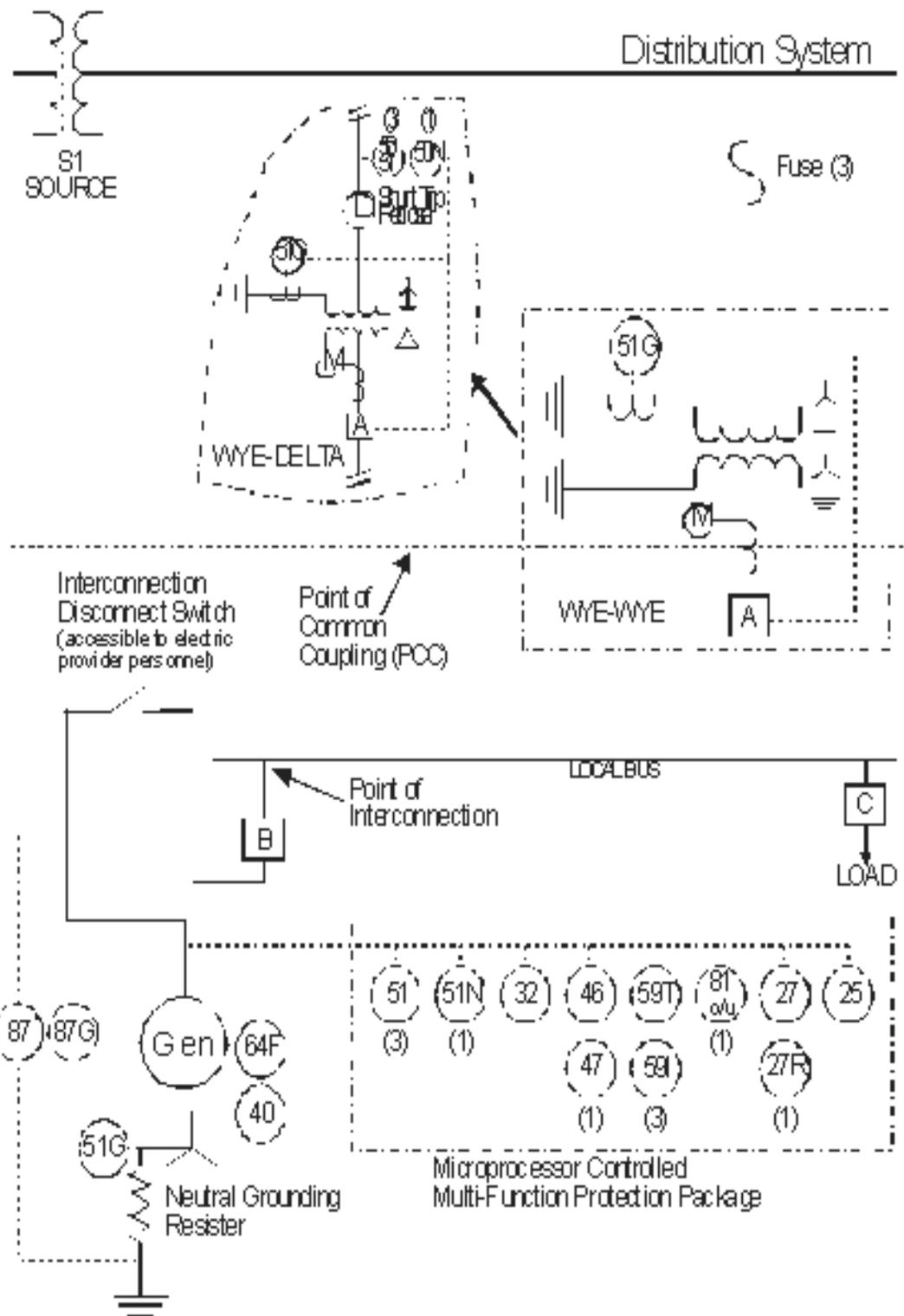


One-line Diagram

- ◆ Generator or inverter
 - ◆ Induction
 - ◆ Synchronous
- ◆ Point connected to customers system
- ◆ Point of common coupling
- ◆ Lockable interconnection disconnect switch
- ◆ Method of grounding, generator and transformer
- ◆ Protection functions and



Distribution System



Generation

- ◆ Inductive
 - ◆ Needs a sign wave from an outside source.
- ◆ Synchronous
 - ◆ Produces its own sign wave (can stand alone)
- ◆ Inverter
 - ◆ Produces DC voltage and needs to be converted to AC (also can stand alone)



Generation

- ◆ The type of generation equipment depends on if the the customer will use the electrical energy produced on farm, or if it is all going to the utility grid.



Control Schematics

- ◆ Showing all protective functions and controls for generator protection and distribution system protection



Site Plan

- ◆ That shows the location of the interconnection disconnect switch, adjoining street name, and the street address.
 - ◆ With major equipment
 - ◆ Service entrance
 - ◆ Electric meter
 - ◆ Interconnection disconnect switch
 - ◆ And interface equipment.



Distributed Generation Interconnection Guidelines

- ◆ Step 3
 - ◆ After receiving \$250 check and paper work.
 - ◆ Within 10 days working days, the public utility shall notify the applicant whether the **application is complete**.



Distributed Generation Interconnection Guidelines

- ◆ Step 4

- ◆ Within 10 days after receiving a completed application.

The utility will **determine if and engineering review is needed**, and state the cost of that review.



Distributed Generation Interconnection Guidelines

◆ Step 5

- ◆ Upon receiving from the applicant written notification to proceed and receipt of applicable payment of \$500,
Then the utility shall complete an engineering review and notify the applicant the results with 20 working days.



Distributed Generation Interconnection Guidelines

◆ Step 6

- ◆ After review of the application
 - ◆ distribution system study is need
 - ◆ customer makes payment (cost based)
 - ◆ 20 working day to respond
 - ◆ Cost estimate good for 1 year



Distributed Generation Interconnection Guidelines

◆ Step 7

- ◆ Customer has one year to except and pay for any modifications on the distribution.
- ◆ Utility will complete system upgrades
- ◆ Customer installs DG unit



Distributed Generation Interconnection Guidelines

- ◆ Step 8
 - ◆ Upon receiving notification of completion of DG installation
 - ◆ Utility has 20 days for commissioning tests at its expense
 - ◆ Perform anti-islanding test
 - ◆ Verify protective equipment settings
 - ◆ Or waive its right, in writing to witness tests
 - ◆ Customer shall provide utility with results.



Distributed Generation Interconnection Guidelines

◆ Step 9

- ◆ Utility has 10 days for approval or disapproval of interconnection.
- ◆ Utility provides in writing acceptance and final cost reconciliation
- ◆ Sign interconnection agreement



Distributed Generation Interconnection Guidelines

◆ Step 10

- ◆ A signed interconnection agreement
 - ◆ Agreements that may need to be completed.
 - ◆ Wheeling agreement
 - ◆ Back up power agreement
 - ◆ May include easements or right of way if an extension is required.



Wheeling Power to a 3rd party

- ◆ Interconnection agreement with electrical provider.
 - ◆ Compliance with FERC, MISO, state laws & Regulations



Wheeling Power to a 3rd party

- ◆ Negotiate sale to **purchaser**
- ◆ Sign purchaser power agreement with **purchaser**
- ◆ Sign wheeling contract with electrical **provider**
- ◆ Sign a back up power agreement with electrical **provider** (if needed)



Insurance requirements

Generation Capacity	Minimum Liability Insurance coverage
20 kW or less	\$300,000
20 kW to 200 kW	\$1,000,000
200kW to 1 MW	\$2,000,000
1MW to 15 MW	Negotiated



Power Generation for AD

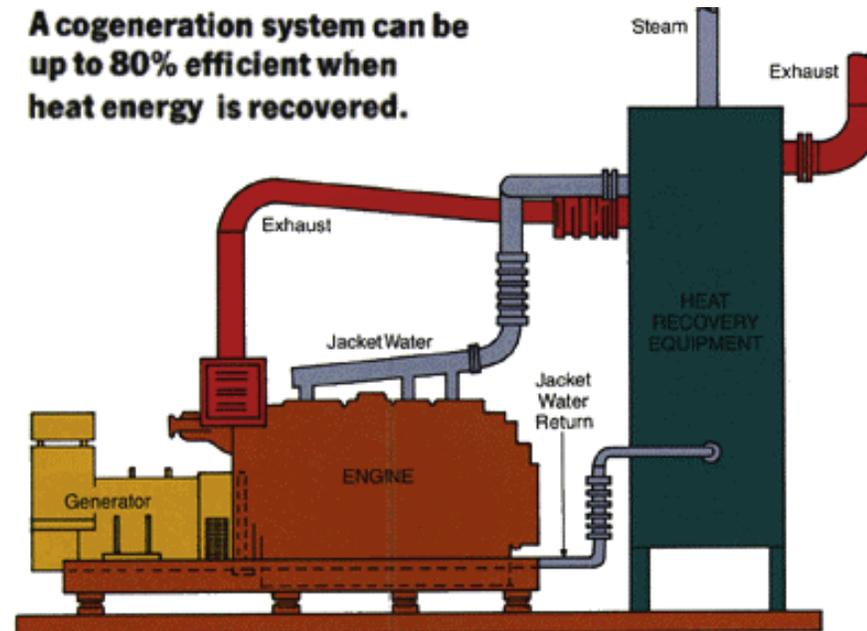
- ◆ Internal Combustion Engines
- ◆ External Combustion Engines
- ◆ Steam turbine
- ◆ Micro turbine



ALLIANT ENERGY™

Internal Combustion Induction or Synchronous

A cogeneration system can be up to 80% efficient when heat energy is recovered.



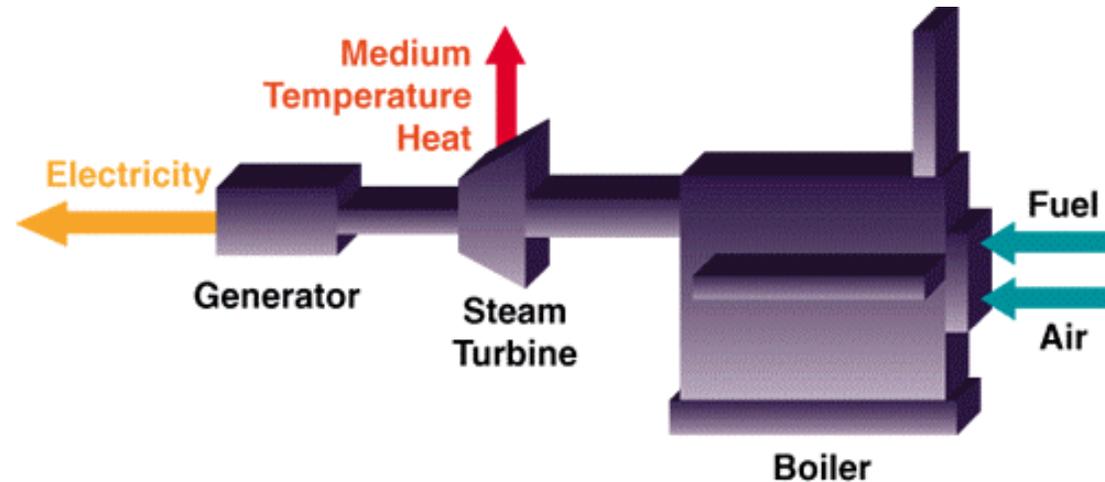
ALLIANT ENERGY™

External Combustion Synchronous



ALLIANT ENERGY™

Steam Generation Induction or Synchronous



Micro-Turbine Inverter



ALLIANT ENERGY™

Generator Maintenance for internal combustion

- ◆ Size of oil reservoir will determine oil change intervals.
(every 2 weeks to once a month)
- ◆ Need a high ash oil
- ◆ With right engines and higher water jacket temperatures (200 degrees +) Sulfur has shown not to be a problem.



Engine Maintenance for External Combustion

- ◆ Oil changes once a year
- ◆ No plugs
- ◆ No ignition system
- ◆ Gas compression skid, low gas pressure



Steam Turbine Maintenance

- ◆ Scale prevention
- ◆ Pipe erosion



Micro-Turbine Maintenance

- ◆ Change air filters
- ◆ Requires special gas skid
- ◆ Requires vary clean gas
- ◆ Requires high gas pressure 60 Psi to run



Gas Quality

- ◆ **Sulfur and moisture** are the 2 biggest problem for some co-gen units.
- ◆ Cat, Waukesha, and STM only minimal problem.
- ◆ Capstone, and Hess need extensive gas clean up.



Heat Recovery

- ◆ **Only 30 %** of all the energy going in to a co-generation unit comes out in the form of **electricity**.
- ◆ **70 %** is in the form of **heat**.



Heat Recovery

- ◆ 1/3 of the heat recovered will be needed for the digester.
- ◆ Other uses
 - ◆ Hot water for farm
 - ◆ Heat parlor
 - ◆ Temper water for fish farming
 - ◆ Heating a green house



Biogas Production/Animal

- ◆ Feedstock dependent
- ◆ Dairy
 - ◆ 5 to 8 cows/kW
- ◆ Hogs
 - ◆ 40 to 64 finisher's per kW
- ◆ Poultry
 - ◆ 1000 Layers per kW



Future Considerations

- ◆ Carbon credit values are marketable in Europe and may soon be in the U.S.
- ◆ Tax credits
- ◆ Operation and maintenance options



Duane Hanusa

Agriculture Customer Services

Alliant Energy

2777 Columbia Dr.

Portage, WI. 53901

608-742-0888

duanehanusa@alliantenergy.com



ALLIANT ENERGY™



ALLIANT ENERGY™