

Interconnection of Distributed Generation

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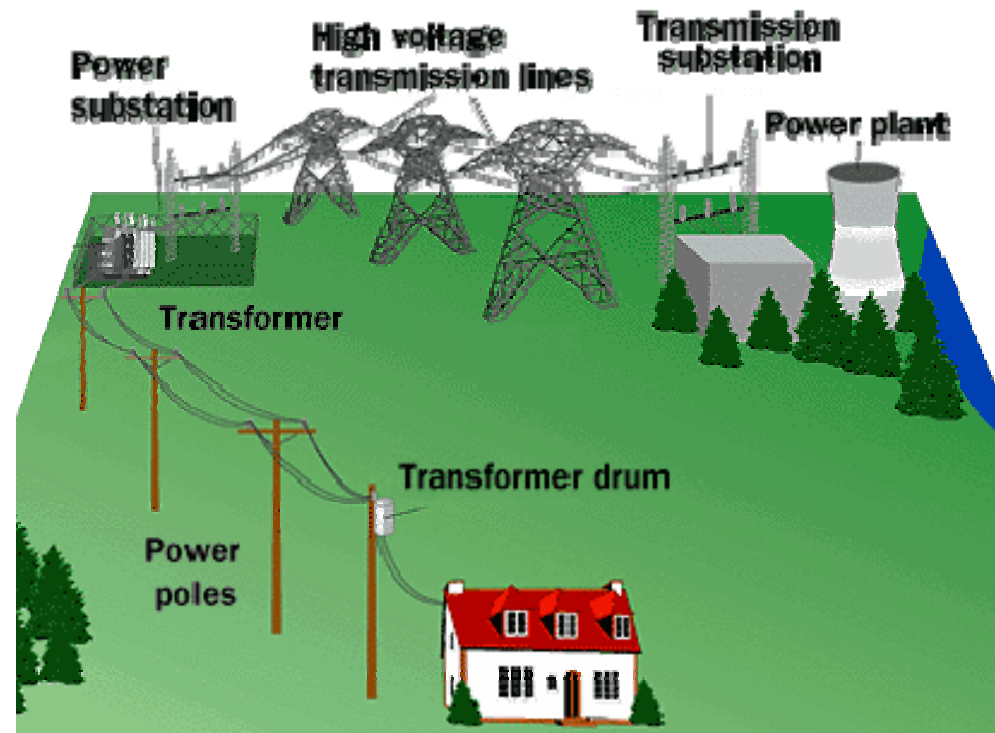
Electric Transmission and Distribution System

The Electric Power System (EPS) is designed to safely and reliably move high quality power from source to load.

Distributed Generation (DG) can be interconnected to the transmission and distribution system

DG must be designed & interconnected so there is no adverse affect on:

- ◆ Safety
- ◆ Reliability
- ◆ Power quality



Where & How to connect to the EPS

Generators may connect at various voltage levels based on:

- ◆ Aggregate rating of generation system
- ◆ Type of distribution system located nearby and characteristics of the system

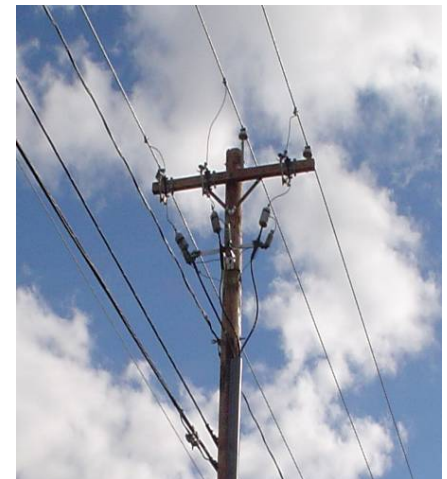
Interconnecting customer is responsible for costs of all studies and upgrades to Electric Power System

Interconnection voltage levels:

- ◆ Transmission – usually \Rightarrow 69 KV (bulk power)
- ◆ Distribution - usually \leq 69 KV (DG)
- ◆ Secondary voltage – under 1000 volts

Early research can help determine the makeup of local transmission or distribution:

- ◆ Three-phase power nearby?
- ◆ Voltage level of local distribution? (e.g. 4 kV feeder can limit connection)
- ◆ Any red flags from the local utility? (e.g. other DG already on line or tail end of feeder, etc.)



Governing Regulations and Bodies

State jurisdiction vs. FERC jurisdiction

- Will your system impact the bulk power system (transmission)?
- Will you sell to the market or will you sell to the host utility as a QF or under net metering?
- Are you the “first on” the distribution feeder?
- ◆ ISO-NE Schedule 22 and Schedule 23: If you will be connecting to the transmission system, or if you will sell to the market on an existing “FERC jurisdictional” feeder.
 - Independent System Operator New England administers
 - Significant application fee and queue-ing
- ◆ Distribution Level interconnection tariffs: Connection to a distribution feeder under “State Jurisdiction”
 - Local Distribution Company administers
 - MA for investor owned utilities have a standardized process
 - See the following links for assistance
 - <http://sites.google.com/site/massdgc/>
 - <http://masstech.org/cleanenergy/howto/interconnection/tariffs.htm>

Things to keep in mind

- ◆ Budget time and money for various interconnection studies
 - Applying through ISO-NE Schedule 22 / 23 – you will be placed in a queue
 - Applying to local utility
- ◆ Budget time and money for potential modifications needed for the utility's Electric Power System
- ◆ Require your equipment suppliers to provide accurate information about the generators to be installed
- ◆ You may need a specialized engineer for relay and protection
- ◆ Larger systems have more impact on the EPS
- ◆ Utilities want to help you interconnect (but)
- ◆ Utilities need all the proper information and time to evaluate and ensure no adverse impact on:

Safety

Reliability

Power quality

Interconnection can be easy and inexpensive

Scenario – installation of a 5.4 MW power plant using landfill methane gas and sunlight (solar PV).

Location: Closed landfill at the edge of a town.

Local distribution system: Three-phase 23 KV distribution which runs down street near landfill.

Modifications needed: New junction pole, primary metering pole and anchors. Some protection modifications required.

Interconnection can be difficult and expensive

Scenario – installation of a 5.4 MW power plant using landfill methane gas and sunlight (solar PV).

Location: Closed landfill at the edge of a town.

Local distribution system: Single phase 2.4 kV distribution line which runs down street near landfill. Nearest three-phase is half mile away and nearest system over 4 KV is at substation 2 miles away.

Modifications needed: Install new substation transformer and controls, either double circuit 15 kV class dedicated feeder or re-conductor and convert area from 4 kV to 15 kV class.

600 KW Landfill Gas Plant connecting to radial 13.8 KV circuit

Application March 5, 2008

Studies cost ~ \$6,000

**Impact Study started May 20,
completed August 25 (delays waiting
for customer info)**



**New primary metering pole and other
minor modifications total ~\$30K**

Go live date – March 24, 2009

600 KW Wind Turbine System connecting to radial 22.8 KV circuit

Applied for interconnection July 2005

Studies cost approximately \$7.25K

All studies completed November 13, 2005 (delays waiting for customer info)

Agreement sent to customer February 9, 2006 (delays waiting for customer info)

EPS modifications total ~\$55K

Went live on June 14, 2006



?? 6 MW Photovoltaic System Connecting to 13.2 KV ??

The largest PV array in our New England territory to date is Brockton Brightfields - ~450 KW on a 13.8 KV feeder in Brockton

National Grid received an application in May 2009 for 6 MW of solar at a single location (13 times larger than Brockton Brightfields) – still in initial review – this system scale is new to distribution companies



Google maps

Final Thoughts

Do some early research on the electric power systems in your area and budget plenty of time and financing for interconnection.

If you want more specifics on connecting to the Distribution System, please attend one of the quarterly seminars hosted by utilities. See DOER's DG Interconnection site at <http://sites.google.com/site/massdgic/> for the next session.

You may be approached by developers to lease your municipal space for installation of utility scale PV

National Grid may be one of them.....

Questions

Thank you for your attention!

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