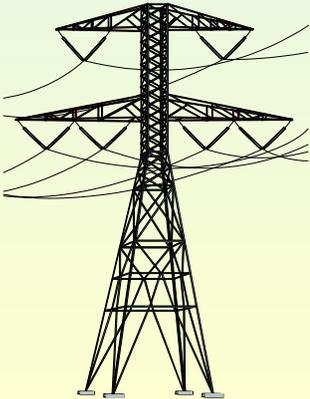




**conectiv**  
*Power Delivery*

# Interconnection Technical Considerations

(Generator Units Up to 25 kW)

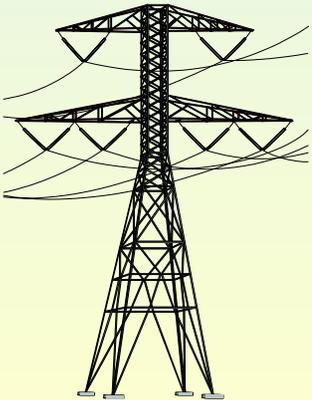


# Interconnection Technical Considerations

## Not a New Idea

---

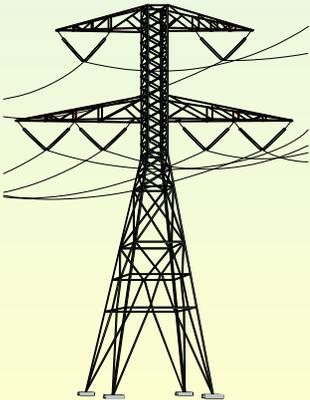
- Conectiv Technical Considerations go back to mid 1980's
- Focus on large units interconnected at transmission level
- Size & impact required extensive protection arrangements
- Interconnected small units not a factor



# New Technology Becomes Available

---

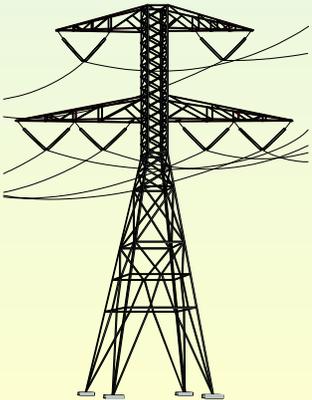
- Advances make small generation systems such as solar practical and cost effective for homeowners & businesses.
- Interconnected systems can be used to offset electric energy needs.
- Small (up to 25kW) generating systems have lower impact and require less elaborate protection arrangements.



# New Conectiv Technical Documents

---

- New Technical Requirements document needed to address small generators.
- Goal to lessen burden/cost to generator owners & streamline application process.
- Document to parallel national standards.
- Net Energy Metering (NEM) Tariff Rider developed as financial incentive to these smaller generator installations.

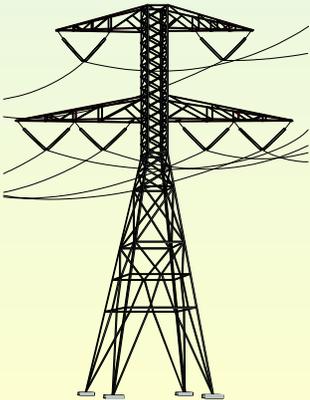


# PV Systems Tied to Conectiv

## Why the Concern?

---

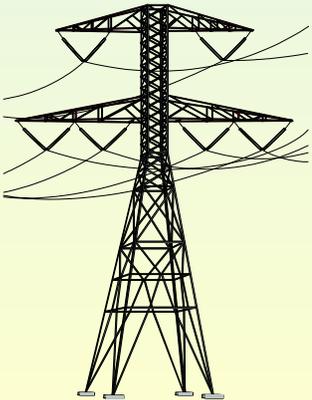
- Safety to Conectiv Personnel
- Safety to the General Public
- Impact/Damage to other Conectiv Customers
- Impact on Operation/Performance of Conectiv utility equipment.



# Need for Protection

---

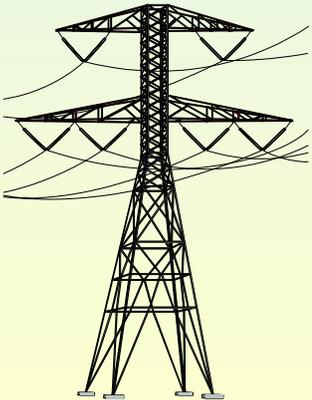
- Utility system subject to many natural & man-made hazards.
- Hazards cause problems such as short circuits, grounded conductors, open conductors.
- Problems require circuit or equipment to be de-energized as quickly as possible to minimize damage and to remove any safety risk.



# Sharing Protection Responsibility

---

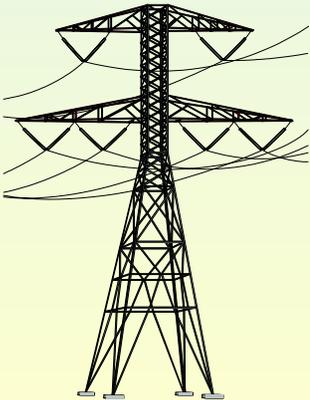
- Before de-regulation, Conectiv owned and controlled all generation connected to the grid & had full responsibility for protection.
- Interconnection of customer owned generation in parallel with Conectiv now expands this protection responsibility to include the Generation Owner.
- Generator Owner has the responsibility to protect their facility and the impact of their facility on the Conectiv grid.



# Basic Interconnection Protection Goals

---

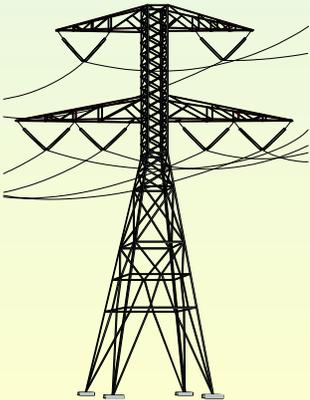
- Protect Conectiv grid from adverse impacts of customer owned generation.
- Protect customer owned generation equipment from faults or other disturbances on the Conectiv grid.
- Cease parallel operation for abnormal operating conditions.
- Permit the desired range of power transfer without false operation.



# Interconnection Protection Design Considerations

---

- Design & installation must meet all applicable national, state & local safety, construction & performance codes.
- IEEE C27.95 *IEEE Guide for Protective Relaying of Utility-Consumer Interconnections.*
- IEEE Std. 929 *IEEE Recommended Practices for Utility Interface of Photovoltaic (PV) systems.*
- IEEE Std. 519 *IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems.*
- UL 1741 Underwriters Labs. Inc. *Static-Inverters and Charge Controllers for Use in Photovoltaic Power Systems.*



# Interconnection Protection Design Considerations (Cont.)

---

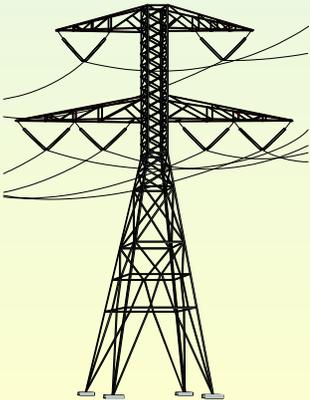
- Design & installation must meet Conectiv's document *Technical Considerations Covering Parallel Operation of Customer Owned Generation of Less than 1 MW*, dated 1/19/00.
- Delivery voltage must be 60 Hz. and at same voltage as delivery point.
- Up to 10 kW can be single phase. Over 25 kW must be three phase.
- Units between 10 kW and 25 kW must be specifically evaluated.



# Interconnection Protection Design Considerations (Cont.)

---

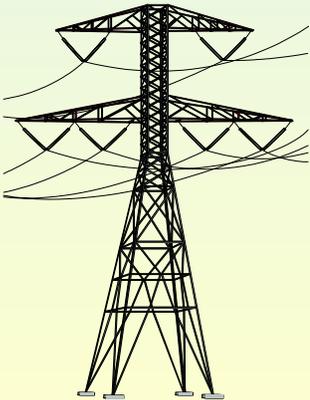
- DC to AC Inverters must be of the non-islanding type as defined in IEEE 929 and UL 1741.
- Design to include a disconnect switch with visible break that is accessible to Conectiv and can be locked open by a Conectiv padlock.
- *(For generation 25 kW or less, customer has the option to allow Conectiv to pull meter and agrees to accept the consequences.)*
- Dedicated interface transformer not required if installation meets IEEE 929 and 519.



# Interface Performance Requirements

---

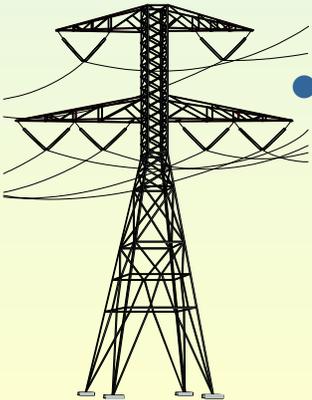
- Generation must automatically disconnect if Conectiv circuit is lost.
- Generation must not energize a previously de-energized Conectiv circuit.
- Generation must automatically disconnect if voltage and/or frequency go outside defined limits.
- Interface protection must be monitored and any failure must cause the interface to open.



# Interface Performance Requirements (Cont.)

---

- Generator shall immediately disconnect for a fault on the Conectiv source circuit.
- Generator may reconnect when utility voltage and frequency has returned to normal and remains there 5 minutes.
- Generator must not inject harmonics into the Conectiv grid or cause excessive voltage flicker.
- Limitations are defined in IEEE 519, Tables 10.3 & 11.1 for harmonics and Fig. 10.3 for flicker.



# Interface Trip Points

(For Generation Up to 25 kW)

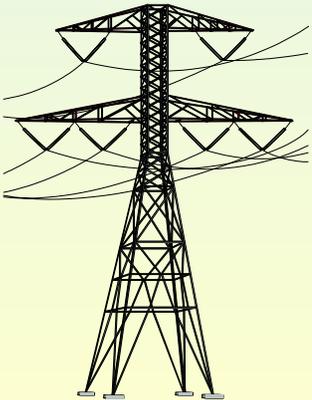
## Voltage

- Trip in 0.1 Second for  $V < 50\%$
- Trip in 2 Seconds for  $50\% \leq V < 88\%$
- Trip in 2 Seconds for  $106\% < V < 137\%$
- Trip in 0.03 Second for  $137\% \leq V$

## Frequency

- Trip in 0.1 Second for  $F < 59.3$  Hz.
- Trip in 0.1 Second for  $F > 60.5$  Hz.

(Same As IEEE 929)



# Customer Responsibilities

---

- Submits completed Conectiv Generator Interconnection Application
- Certifies that design & equipment meets necessary requirements and standards.
- Obtains all the necessary inspections.
- Agrees to cease parallel operation upon request of Conectiv if operation is unsafe, impacts service to other customers, or interferes with Conectiv's system maintenance.
- Applies a Warning Label at the service entrance.

