

Interconnection Standards Overview

**Rooftop Solar Challenge
SunShot Initiative
U.S. DOE**

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Background

- **Network for New Energy Choices develops “Freeing the Grid” report.**
- **The report identified the best and worst practices in net metering and interconnection policies in the U.S.**
- **The report contributing authors, Jason Keyes and Kevin Fox (Keyes, Fox & Wiedman LLP) recommended simple solutions to streamline the policies using model rules.**
- **Keyes and Fox made primary and secondary best practice recommendations for Wisconsin.**
- **This presentation will give an overview of their recommendations and provide insight into achieving them.**
- **Some other interconnection issues, outside of the report, will also be discussed.**

Primary Recommendations

-> Require consistency in interconnection standards throughout the state.

- PSC 119 applies to all electric providers regulated by the PSCW.
- To reach consistency throughout the state, the electric cooperatives will have to follow the interconnection standards.
- There are 24 electric cooperatives in Wisconsin.
- Electric cooperatives are not regulated by the PSCW
- Each electric coop is governed by an independent board.

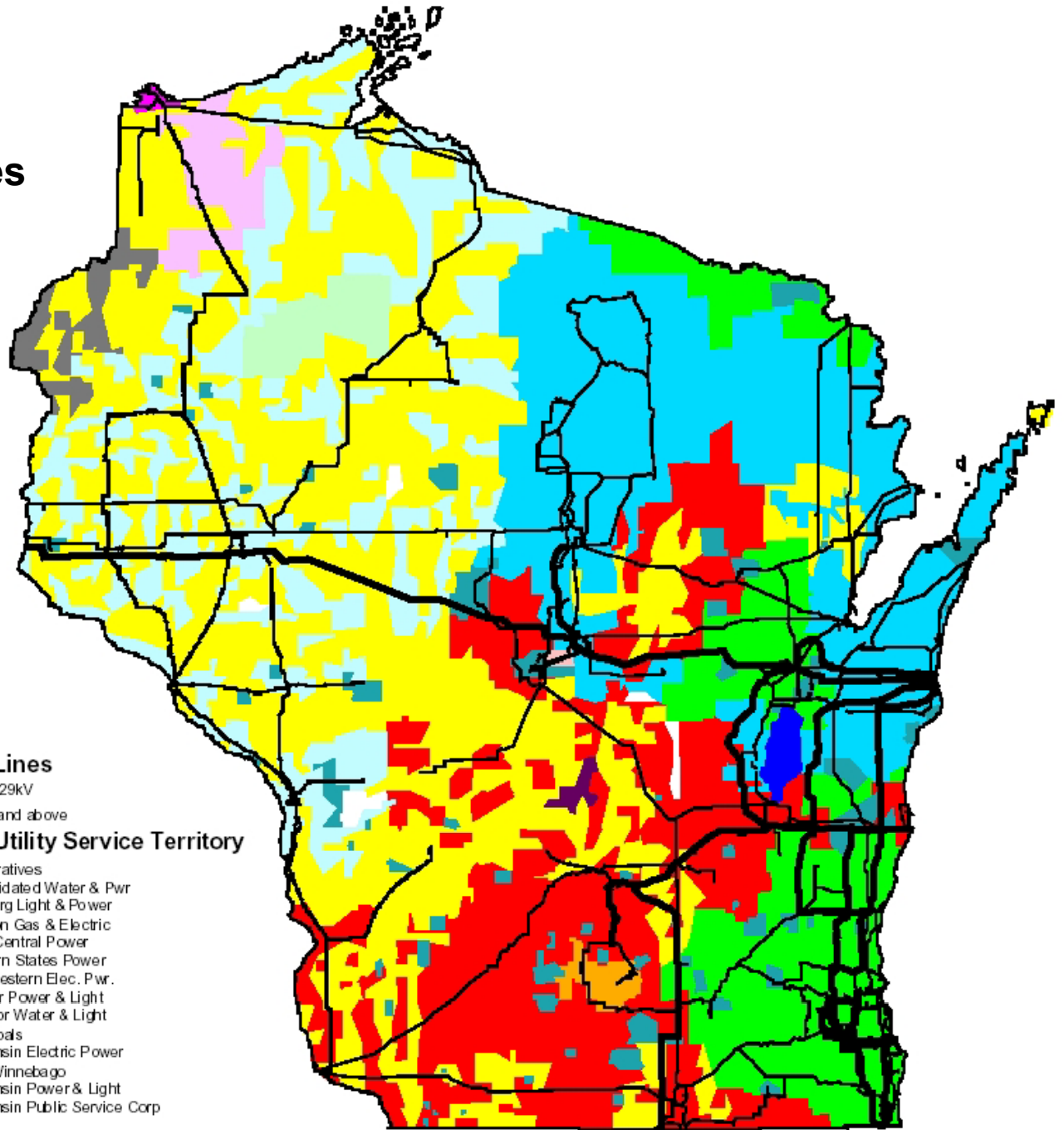
Enabling this will require either legislation or a binding memorandum of understanding (MOU) with all the electric cooperatives or the Wisconsin Electric Cooperative Association (WECA)

The electric cooperatives are located primarily in the western half of the state.

Electric Lines
~ 115V-229kV
~ 230kV and above

Electric Utility Service Territory

- Cooperatives
- Consolidated Water & Pwr
- Dahlberg Light & Power
- Madison Gas & Electric
- North Central Power
- Northern States Power
- Northwestern Elec. Pwr.
- Pioneer Power & Light
- Superior Water & Light
- Municipals
- Wisconsin Electric Power
- Lake Winnebago
- Wisconsin Power & Light
- Wisconsin Public Service Corp



-> Adopt the FERC's technical screens as part of an expedited interconnection process.

The FERC technical screens are perhaps the most thoroughly used and vetted aspect of the FERC SGIP.

The SGIP standards are already in place for FERC-jurisdictional interconnections within Wisconsin, and used in the existing Open Access Transmission Tariff (OATT) throughout the Midwest ISO.

Enabling this will require either legislation or for the PSCW to open a rulemaking docket.

-> Prohibit external-disconnect-switch requirements for inverter-based generators.

PSC 119.20(3) states that “the public utility may require that the applicant furnish and install an interconnection disconnect switch that opens, with a visual break, all ungrounded poles of the interconnection circuit.”

- An exemption for 10 kW inverter-based systems may be a compromise.

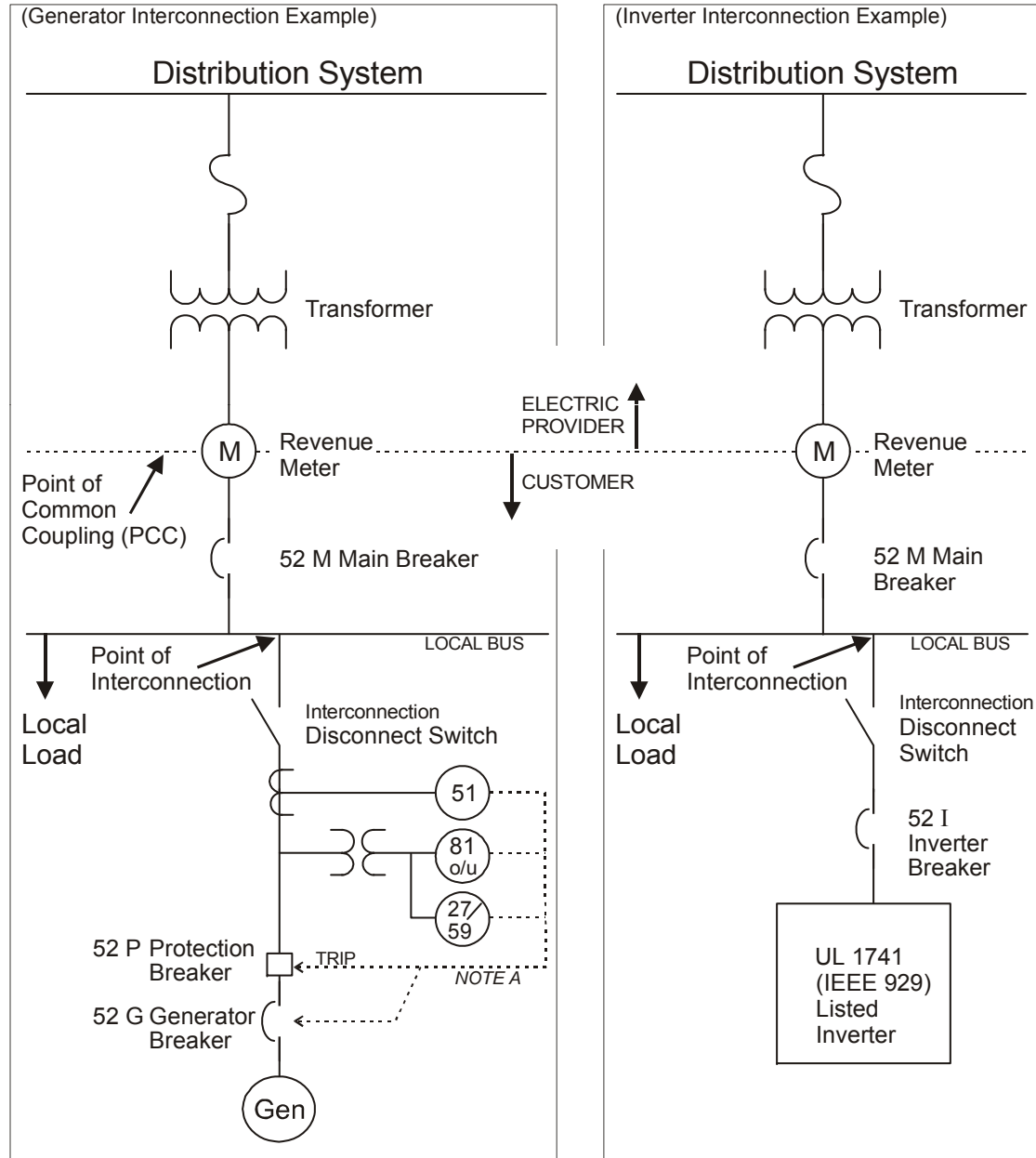
Enabling this will require either legislation, the PSCW to opening a rulemaking docket or a binding MOU with all the electric providers.

Typical Small System Disconnect Switch



Source: NREL

One-Line Diagrams of Systems 20 kW or less

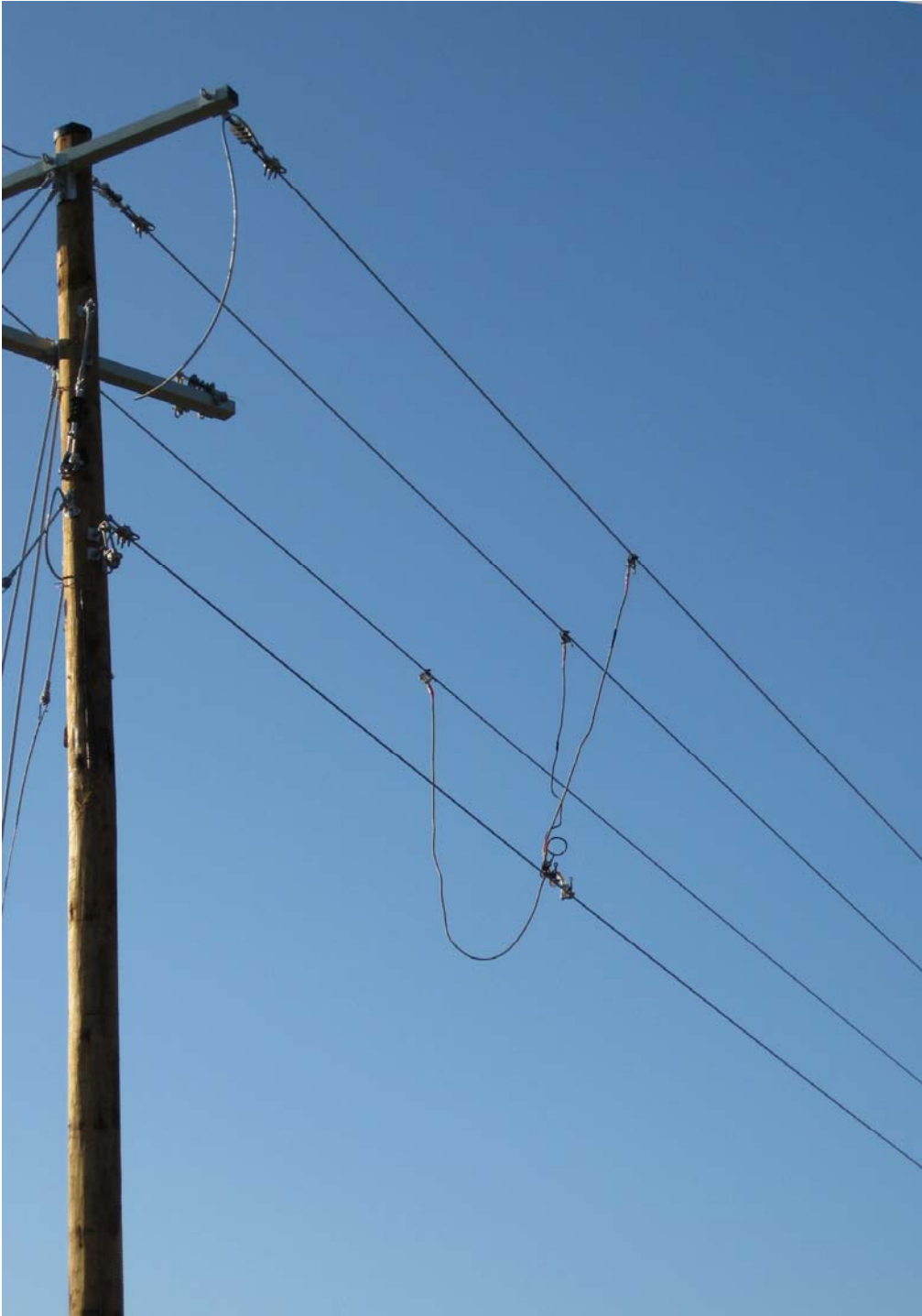


In the event of a feeder outage, a line crew will risk injury from a PV system only if *all of the following events occur*:

- 1. The inverter fails to disconnect automatically and somehow produces power without the necessary external voltage source present*
- 2. The anti-islanding, voltage, and frequency methods fail in the inverter*
- 3. The load at the output of the inverter matches the connected load of the PV owner and adjacent customers (This is statistically improbable.)*
- 4. The line worker chooses to work the line energized but fails to follow procedures*
- 5. The line worker chooses to work the line de-energized but fails to test and ground the line.*

Line workers must consider a line energized unless it is positively known to be de-energized, per Rule 420 of the NESC.

Source: NREL



**Grounding of power lines
while work is being done on
them.**

Photo: L&S

In the event of an electric power outage, a utility will dispatch a line worker to:

- Troubleshoot the outage
- Clear the line or cause of outage
- Repair any damage
- Ensure the area that was damaged is now safe
- Restore power.

Prompt Restoration of Service Imperative:

- restore power to customers as quickly as possible
- line workers must travel to each location with a utility-accessible EDS to lock the switch in the open position before starting repairs
- after the repairs have been completed, the line workers must travel to each location and manually close the switch (to restore PV power to that customer).

Source: NREL

The NEC requires that the system have a means of disconnecting the system on the DC side of the inverter and the AC side of the utility-interactive inverter. In addition, the NEC states that a “disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the system conductors.” Ungrounded conductors may be disconnected by either a switch or circuit breaker, per the NEC .

Of 35 states with interconnection rules for PV-inverter-based systems, 18 require an EDS for all systems, 8 specifically waive the requirement for small systems (that meet specific technical requirements), and 9 leave the decision to utilities.

With the more than 30,000 interconnected PV systems in the United States, there has not been a single line worker injury caused by an inverter-based PV system.

Source: NREL

Secondary Recommendations:

-> Prohibit additional insurance requirements.

PSC 119.05 Insurance and indemnification.

Table PSC119.05-1 shows the following insurance requirements:

Category	Generation Capacity	Minimum Liability Insurance Coverage
Category 1	20 kW or less	\$300,000
Category 2	> 20 kW to 200 kW	\$1,000,000
Category 3	> 200 kW to 1 MW	\$2,000,000
Category 4	> 1 MW to 15 MW	Negotiated

Category 2 - 4 must name the public utility an additional “insured” in the liability policy.

Enabling this will require either legislation or for the PSCW to open a rulemaking docket.

-> Reduce interconnection process timelines to at least the FERC standards.

PSC 119.04 Application process for interconnecting DG facilities.

Most PSC 119 timelines are equal to or more advantageous than the FERC SGIP

Identified Areas of Improvement:

- Feasibility Study Report/(*Engineering Review results*): Cat 4- **40** days should be reduced to 30 days (FERC SGIP)
- System Impact Report/(*Distribution System Study*): Cat 4- **60** days should be reduced to 30 days (FERC SGIP)

Enabling this will require either legislation or for the PSCW to open a rulemaking docket.

-> Remove system size limit.

Wis. Stat. § 196.496 Distributed generation facilities.

(1) Definition. In this section, "distributed generation facility" means a facility for the generation of electricity with a capacity of no more than 15 megawatts that is located near the point where the electricity will be used or is in a location that will support the functioning of the electric power distribution grid.

Enabling this will require legislation.

-> Institute informal process for interconnection disputes.

PSC 119.40 Right to appeal. The owner of a generating facility interconnected or proposed to be interconnected with a utility system may appeal to the commission should any requirement of the utility service rules filed in accordance with the provisions of this chapter be considered excessive or unreasonable, Such appeal will be reviewed and the customer notified of the commission's determination.

Wis. Stat. § 196.26 Complaint by consumers; hearing; notice; order; costs. (1) COMPLAINT. In this section, "complaint"

means any of the following:

(a) A complaint filed with the commission that any rate, toll, charge, or schedule, joint rate, regulation, measurement, act, or practice relating to the provision of heat, light, water, or power is unreasonable, inadequate, unjustly discriminatory, or cannot be obtained.

-> Institute informal process for interconnection disputes- cont.

"Alternative dispute resolution" (ADR)

An informal dispute resolution processes in which the parties meet with a professional third party to arbitrate and mediate. This third party could be a special master appointed by the PSCW.

Enabling this will require either legislation or for the PSCW to open a rulemaking docket.

Communication Links for Distributed Generation

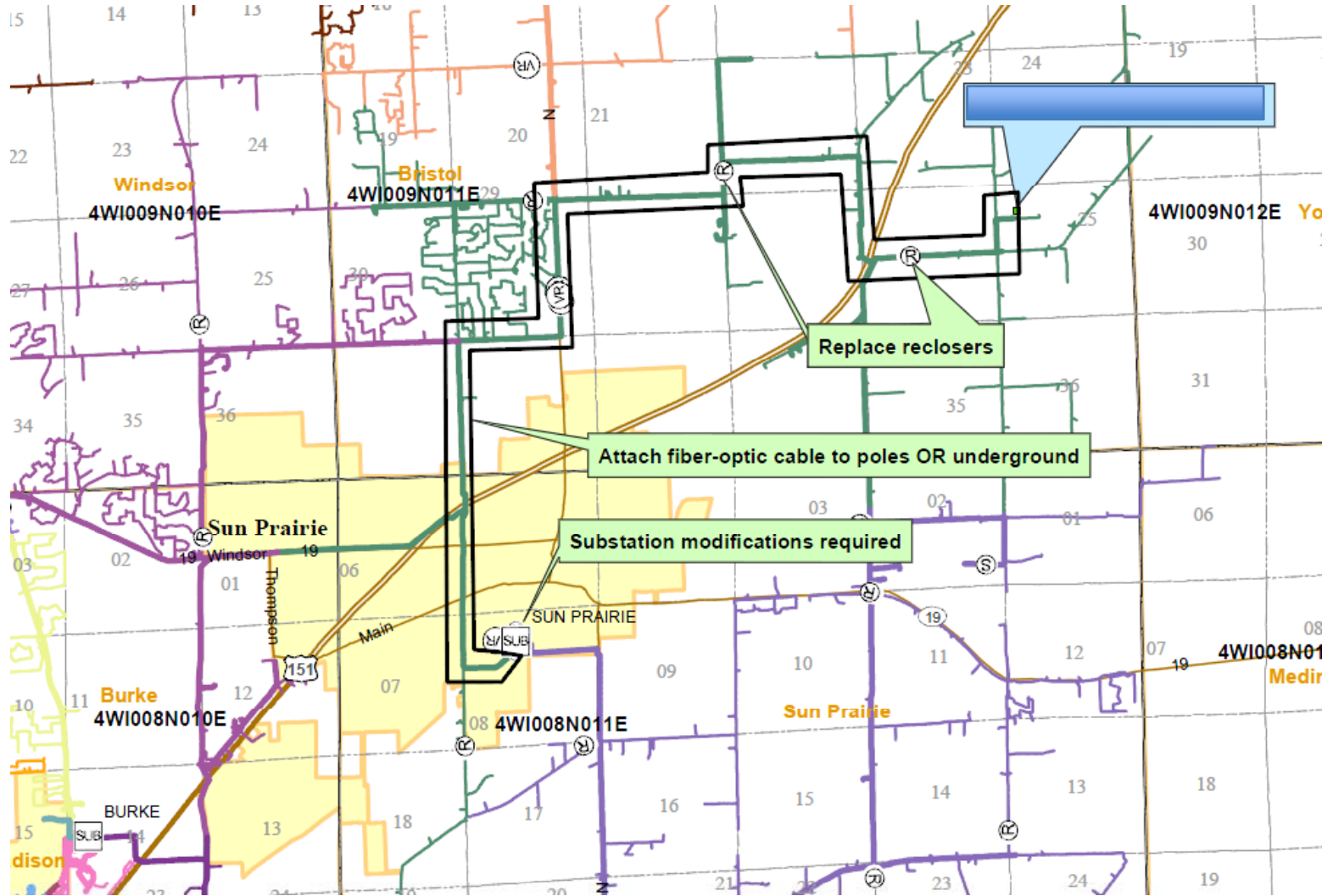
PSC 119.25 states that the public utility may require telemetry equipment (communication links) for monitoring functions that include transfer-trip functionality, voltage, current, real power (watts), reactive power (vars), and breaker status for a Category 3 or Category 4 DG facility.

The communication links may include a dedicated telephone line, Satellite link, T1 line and fiber---optic cable.

These communication link types vary greatly in cost.

Specifying an expensive communications link type can be cost prohibitive for small DG facilities.

Communication Link Route - Case 1



Costs Associated with Communication Link – Case 1

Item	Description	Cost
Upgrade Sun Prairie Substation - cost details provided on separate sheet	Replace one feeder recloser with a 1200 amp circuit breaker – new foundation required.	
	Add relay panel at control house with SEL 351S relay and RTU.	
	Add line potential transformer to distribution feeder SUPN1075.	
	Run conduit with control cable from new ATC control house to breaker.	\$ 169,842
Communication Link	8 miles of UG fiber-optic cable @ \$5.50/ft	\$ 232,320
	Fiber-optic terminal equipment	\$ 13,000
Replace Distribution Line Reclosers	2 Microprocessor-controlled distribution line reclosers, already in stock, plus associated relays	\$ 29,000
TOTAL COST		\$ 444,162

Suggested Best Practice:

Change PSC 119 to require the least-cost communication link type
For DG projects, unless the utility can demonstrate engineering
necessity.

Enabling this will require either legislation or for the PSCW to open a
rulemaking docket.

Keyes and Fox 2011 Score for Wisconsin: Grade of C

2010 Category	2010 FTG Score	2011 Review Score
Eligible Tech	0	0
System Capacity	-0.5	-0.5
Breakpoints	1	1
Timelines	-1	-1
Interconnection Fee	2	2
Engineering Fee	0	0.5
External Disconnect	-1	-1
Certification	0	0
Tech Screens	-2	-2
Secondary Networks	1	1
Standard Form	0.5	0.5
Insurance	-2	0
Disputes	0	0
Rule Coverage	0.5	0.5
Misc.	-1	-1

Questions?