

Montana Energy + Design
Smart Houses - Beautiful Homes

July 14, 2016

Keith Regier, Chairman
Energy & Telecommunications Interim Committee
Legislative Services Division
P.O. Box 201706
Helena, MT 59620-1706

Dear Mr. Regier:

I recently learned that MREA and NorthWestern Energy have submitted a letter to your committee recommending that homeowners no longer be allowed to wire PV systems on their residences. I disagree with that recommendation.

I am a long time professional working in the residential energy field. I've designed and built efficient houses since the mid 1970s. I fully support allowing homeowners to install PV systems on their property, but have never installed a PV system until now. I don't do electrical work.

Last winter I installed a PV system. After friends helped me load the PV panels onto the roof, I installed the entire system myself. That work included all the wiring from the panels to the inverter to the breaker in the service entrance. After completion, I called for an electrical inspection, received approval for the work and then called the utility to install the new meter. The system has worked flawlessly.

Based on that experience, I would like to make the following comments;

- Manufacturers have worked hard to lower the cost of PV systems so that they are cost effective. Panels, rails and inverters have dropped a lot in price in the last few years but the BOS (Balance of System) costs remain high. BOS includes wiring, installation labor and fees and permits. **Having to hire a licensed Electrician to run conduit and install wiring will raise the cost of DIY systems**, especially in rural areas where travel is a factor. We need to keep prices low.
- Residential PV systems are well engineered so that **any handy person can do a professional job**. Rails and panels are installed with a few bolts and the wiring is just as simple.
- **Residential PV systems are safe when installed by homeowners**. All the wiring on the roof is done with manufacture supplied exterior wires that have snap fit male and female ends. All the connections just snap together, which is as simple as plugging a light into a wall socket. The ground work at the inverter was also straightforward. The instructions were clear with plenty of diagrams and photos. I installed conduit and then purchased 10 feet of wire to run between the inverter and the service main. All I had to do was make a few connections, securing the wires in the equipment lugs with a screwdriver. These connections were visible to the inspector.
- **Modern PV systems have built-in redundant safety controls**, so that the system will not energize unless the wiring is done correctly.
- Prior to the PV install, I hired a licensed Electrician to help replace my 200 amp breaker box in the house. He did the box work, and I helped run wires. I can tell you that **the PV connection was simpler by a factor of 10**. Additionally, the amount of time involved was much shorter, so

223 S. 5th St. Livingston, MT 59047 406.220.1498 www.mte-d.com

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the exposure was less. If a homeowner can legally wire a breaker box, what is the logic of not allowing him to wire a simple PV system?

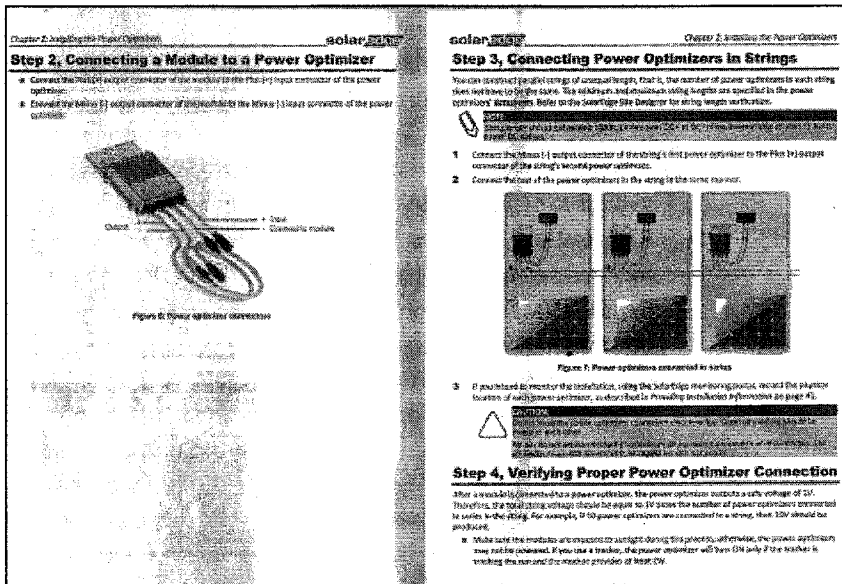
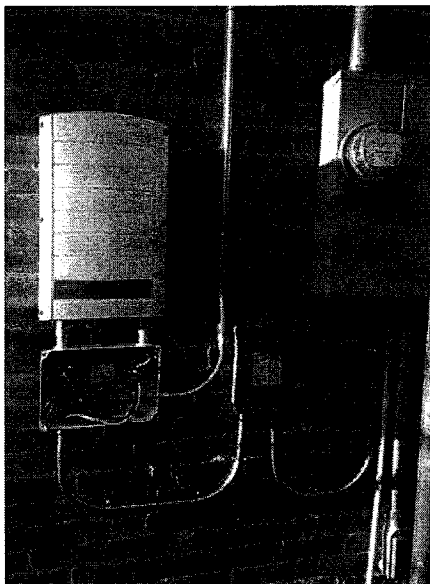
- We have a **strong tradition of allowing homeowners to do their own construction work in Montana**, including electrical, plumbing and mechanical work. As long as they are inspected, these systems have worked well, resulting in safe installations and significant savings for homeowners. Inspections and education are the key.
- As a matter of policy, **we shouldn't carve out an unnecessary exemption within an established law**. Good law making is always a balance between providing detailed solutions to complex problems and the simplicity needed for effective enforcement. We shouldn't make (37-68-103(3)MCA) more complex because there is **no compelling need** to change the law.

Thanks very much for your work this summer. If you have any questions, I am happy to respond.

Sincerely,



Jim Baerg
406-220-1498
jlbaerg@gmail.com
Livingston



Chapter 2: Installing Power Optimizers

Step 2: Connecting a Module to a Power Optimizer

- Connect the positive (+) output connector of the module to the positive (+) input connector of the power optimizer.
- Connect the negative (-) output connector of the module to the negative (-) input connector of the power optimizer.

Figure 8: Power optimizer connection

Chapter 2: Installing the Power Optimizers

Step 3: Connecting Power Optimizers in Strings

You can install multiple strings of optimizers. That is, the number of power optimizers in each string does not have to be the same. The minimum and maximum string lengths are specified in the power optimizer's literature. Refer to the manufacturer's literature for string length restrictions.

NOTE: The maximum string length is 1000 feet (305 m) for the 120V AC output and 1000 feet (305 m) for the 240V AC output.

1. Connect the positive (+) output connector of the string's first power optimizer to the first (+) output connector of the string's second power optimizer.
2. Connect the rest of the power optimizers in the string in the same manner.

Figure 9: Power optimizers connected in series

3. If you intend to monitor the installation, using the SolarEdge monitoring system, record the physical location of each power optimizer, including the prevailing installation requirements in your area.

WARNING: Do not connect power optimizers in series to a string if the string is not designed for series connection. This is a safety hazard.

Step 4: Verifying Proper Power Optimizer Connection

After a module is connected to a power optimizer, the power optimizer outputs a safe voltage of 24V. Therefore, the total string voltage should be equal to 24 times the number of power optimizers connected in series in the string. For example, if 10 power optimizers are connected in a string, their 240V should be produced.

- Make sure the module is connected to a string during bright light. Otherwise, the power optimizers may not be powered. If you use a tracker, the power optimizer will turn ON only if the tracker is tracking the sun and the weather provider is clear ON.