

# Board of Electricity

## Meeting Minutes

Tuesday, January 13, 2015 @ 9:00 a.m.

Minnesota Room, Department of Labor & Industry

443 Lafayette Road, St. Paul, MN 55155

### **Members Present:**

Andy Toft (Chair)  
Kim Huxford  
John McConnell  
Jim Freichels  
Willy Hoskins  
Scott Novotny  
Laura Karow  
Dan Westberg  
Sam Sampson  
Dan Klein

### **Members Absent:**

Doug Fingerson  
Joe Vespa

### **DLI Staff & Visitors:**

Wendy Legge (DLI)  
Suzanne Todnem (DLI)  
Scott McLellan (DLI)  
John Williamson (DLI)  
Lyndy Lutz (DLI)  
Todd Green (DLI)  
Dean Hunter (DLI)  
Stacy Miller (Commerce)  
Jack Kluemphe (Commerce)  
Gary Thaden (NECA)  
Brian Winkelaar (IBEW 110)  
Peter Lindahl (IBEW)  
Chris Kohn (IBEW)  
John M. Lutz (IBEW)  
Ray Zeran (IBEW)  
Al Stork (IBEW)  
Andy Snope (IBEW)  
Bill Heaney (IBEW)  
John Kripotos (IBEW/MnSEIA)  
David Shaffer (MnSEIA)  
Duane Hendricks (Egan Companies)  
David Fisch (MNESTA)  
Scott Nutting (CEIA)  
Jim Nimlos (Mpls. Electrical JATC)  
Judi Rubin (MEA)  
Clara DeRosier (MEA)  
Anthony Acosta (TruNorth Solar)  
James Drummond (TruNorth Solar)  
Cole Blucker (TruNorth Solar)  
Jim Donovan (TruNorth Solar)  
Charlie Pickard (Alladin Solar)  
Donna Pickard (Alladin Solar)

## **I. Call to Order**

The meeting was called to order at 9:00 a.m. by Chair Toft. Roll call was taken by Laura Karow and a quorum was declared.

**II. Approval of Meeting Agenda**

A motion was made by Sampson, seconded by Westberg, to approve the agenda as presented. The vote was unanimous and the motion carried.

**III. Approval of Previous Meeting Minutes**

A motion was made by Freichels, seconded by Klein, to approve the October 9, 2014 meeting minutes. The vote was unanimous and the motion carried.

**IV. Regular Business**

a. **Expense Approval** – Toft reviewed and approved the per diem and expenses. A motion was made by Karow, seconded by McConnell, to approve per diem and expenses. The vote was unanimous and the motion carried.

b. **Enforcement** – Final statistics of CCLD Enforcement Stats for 2009 through 2014 were reviewed (see attachment A).

c. **E-Licensing and e-TRAKiT** – John Williamson provided an update. e-TRAKiT #3 is tentatively scheduled for roll-out January 26, 2015 and is more user friendly and intuitive. Robin Geiger is training contractor inspectors and will send them a full set of instructions.

**IV. Special Business**

- Sam Sampson briefly discussed electrical licensing reciprocity and referred to the handout titled “Reciprocity by State – Calendar Year” (see attachment B).
- Sampson noted that he has not heard back from the State of Wisconsin regarding the possibility of establishing reciprocity.

**VI. Committee Reports**

Nothing to report

**VII. Complaints**

No complaints brought forth

**VIII. Open Forum – Solar Photovoltaic (PV) Systems Questions and Answers (FAQ - see Attachment C)**

**1. Peter Lindahl from IBEW Local 292**

Expressed appreciation for the FAQ that positioned enforcement of solar photovoltaic (PV) installations in a positive way and he thanked the Board for their great work. He added that there are hundreds of megawatts planned for Minnesota.

**2. Lynn Hinkle, MNSEIA regarding solar PV FAQs**

The installation of solar in Minnesota is due to expand exponentially. In 2013, 14-17 megawatts of solar PV were installed. In the past, solar wasn't competitive and didn't attract capital or businesses. In 2014, laws were passed that enabled significant growth in Minnesota. Made in Minnesota (MiM) will add 40 megawatts (to the grid). Hinkle added that community solar gardens could generate up to 100

megawatts of new solar capacity. Xcel Energy Inc. placed no limit on the number of solar gardens that could potentially be built across the state. There are exciting things about to happen to the solar industry – let's figure out a way to keep this moving forward. Minnesota has attracted two large manufacturers to the state – the solar industry is attracting capital, attention, and creating jobs. He believes the industry is going forward in a reliable and safe way for individuals installing solar and he noted that fall protection is critical and important. He stated that the Department of Commerce has been instrumental in helping to implement legislation and aide in growing the industry. In addition, DEED, AG, and MPCA have partnered with them and because of these positive partnerships they felt blindsided by the FAQs. He is thankful that Commissioner Ken Peterson reached out to them – a meeting is scheduled for Friday, January 16, 2015. Hinkle hoped the Board would agree that all of the stakeholders from DLI, Deed, and Commerce need to work together to enable the solar industry to grow at a stable pace and asked for consistency on the FAQs. Hinkle noted that the fee schedule and EL#6 of the FAQ, in particular, would be discussed at the meeting with the Commissioner. (The industry) is moving forward and they don't want work in the pipeline to be disrupted. He wants to move towards new regulations to sustain jobs and keep their businesses alive.

Chair Toft referred to the Board of Electricity's Final Interpretation issued July 8, 2009, regarding Solar PV Systems (see attachment D). Electrical installations must follow provisions in the current National Electrical Code (NEC). Toft noted that in 2009, installations and the racking system were different. The Electrical Act states that licensed electricians are the only persons that can do electrical installations in Minnesota and he added that having qualified persons perform safe electrical installations is the most important issue.

Hinkle asked what constitutes electrical work and Article 690 and if this (solar installations) is really work that electricians want and need to do. He asked the Board if there was a way to move forward. He is aware of the strong language in Article 690 and he reiterated that they don't want to see any safety related issues, life safety, or worker injuries and are only interested in the industry growing steadily and reasonably.

Westberg added that Minnesota prides itself on the fact that electricians follow code and apprenticeship programs train workers correctly and safely.

Hinkle said they would address safety. They won't be in a position to re-write Article 690 but they will need to figure out how to produce crews that are safe.

Toft noted that crew sizes consist of one licensed electrician and two unlicensed.

Hinkle asked if it was possible to do direct hiring and added that this would be a fruitful path to explore.

Toft stated that the Board makes final interpretations of the NEC.

### **3. Jim Donovan, TruNorth Solar regarding solar regulation**

Safety is their number one concern. Market pressures will affect safety and projects going forward. Cost will be pushed down in order to get projects pushed through. A lot of them are financed and subsidized and it is delicate to keep the industry going from an economic standpoint. If there aren't enough electricians to do installations this could affect safety. Looking from an operations standpoint, he feels they will have a difficult time finding 200 full-time, trained electricians to install roof modules.

Karow asked where his staff is currently being trained and said there is a lot of training facilities that will train electricians to do this (solar installation) work.

Donovan said they only put the module on the roof. If the racking is considered grounding then their installers won't be able to do this. He asked if they will be able to find apprentices and electricians to install modules able to do 420 megawatts and he expressed concern with labor supply and demand.

Toft replied that (Donovan's) installers need to be registered as unlicensed and supervised by licensed people.

Donovan noted that currently modules are being put up with an electrician doing the wiring portion.

### **4. Ralph Jacobson, Innovative Power Systems regarding solar composite crew**

Jacobson has been a solar installer since 1991. At that time it wasn't on anyone's radar but in 2009 he saw there was an issue because of the Board of Electricity's decision to consider solar photovoltaic as electrical work. He asked if his master electrician could take responsibility for all of the work and asked why the rule is written the way it is with two unlicensed with one licensed electrician. Why do they have to be from the same company? Is it possible for the composite crew to maintain the ratio? Is there a reason why this won't work or can there be conditions placed to keep the pathway clear? Tariffs have caused the price of PV modules to rebound and there is a struggle to keep costs down in order to continue forward.

Toft asked if Jacobson's master electrician supervised the subcontractors and what their trade was.

Jacobson replied that he has electrical union subs that do the wiring and non-electrical subcontractors that set up the work and mount the PV modules.

Novotny asked why the ratio doesn't work and said safety is of the highest concern.

Jacobson said he had to hire his crew as direct employees. He gets a price per watt from subcontractors but when using employees it's dollars-per-hour with more risk.

Westberg asked what the difference is with a licensed contractor doing the work and ratios.

Jacobson said he has buyers, 3<sup>rd</sup> party finance, and then teams are put in place. More than 5 years ago he would have done all in-house but now it has become a sharing of the risk. It costs half again as much then the risk is all on him if he has employees. For subcontractors, the risk goes on them and then they need to maintain their workers' compensation. Do we have a business model that will still work with a composite crew? He wants to know why the rules are written the way they are. As the solar industry grows how can they build their crews and put their installers under a licensed electrician.

Freichels said he believes there is a misunderstanding of what electrical work is. He believed companies were using non-electrical workers to do work that should be performed by licensed electricians. All work considered electrical needs to be supervised by a master electrician.

Toft noted that the understanding of the rules and statutes are being misunderstood as is the definition of electrical work.

**5. Duane Hendricks, Egan Company, regarding photovoltaic solar panel installation**

Hendricks said there seems to be a concern there won't be enough labor. He is a contractor with a growing business and they've always been able to acquire needed labor. He discussed the importance of the 2/1 ratio and said it works very well. He said that he doesn't agree with having non-licensed workers doing any portion of the installations. There are currently several hundred electricians available and many others that want to become electricians. One of the benefits of ratios is that everyone remains safe. Training skilled electricians means safety on the jobsite and safe installations and there are a lot of good contractors that can do these installations. He said he doesn't believe there is a labor shortage – people will migrate to where the work is and the electrical industry is a great industry. Contractors not wanting to follow the codes and standards should change their business model.

**IX. Board Discussion**

Sampson said another misunderstanding is the scope of the Board's powers. The Board has the authority to create rules that regulate electricians, to adopt and make final interpretations of the National Electrical Code. The commissioner of Labor & Industry is charged with administering and enforcing licensing rules. What is electrical work as defined in statute and what isn't? Need to be sure everyone understands exactly what they are talking about. He looks forward to continuing discussion on these issues.

Klein said he would welcome doing any of the solar work as an electrical contractor.

Westberg said he hopes the Department respects the Board's rules and statutes. He said ratios shouldn't be an issue and added that any company can find electricians to perform this work. Keep the Board in mind when making decisions (to the Commissioner).

Toft added that in 1899 the Board of Electricity was established and adopted a National Electrical Code (NEC). Toft recommended the Commissioner maintain the status of what the NEC is and what it means. It could lead to a lot of other questions on what electrical work is.

**X. Announcements**

Next Regularly Scheduled Meetings (subject to change) – Minnesota Room, DLI

- **Tuesday, April 14, 2015 @ 9:00 a.m.**
- **Tuesday, July 14, 2015 @ 9:00 a.m.**
- **Tuesday, October 13, 2015 @ 9:00 a.m.**

**XI. Adjournment**

**A motion was made by Westberg, seconded by Novotny, to adjourn at 10:12 a.m. The vote was unanimous and the motion carried.**

Respectfully Submitted,

*Kim Huxford*

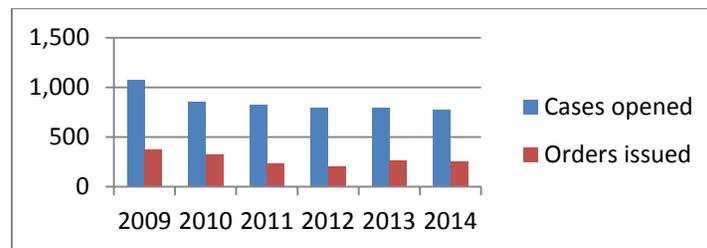
Kim Huxford  
Secretary



## CCLD ENFORCEMENT STATS 2009-2014

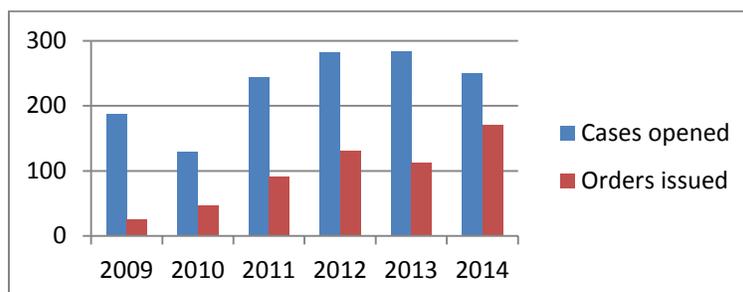
### RESIDENTIAL BUILDING CONTRACTOR

	CASES OPENED	CASES CLOSED	ACTIVE CASES	ORDERS
2014	774	714	657	252
2013	793	868	629	267
2012	790	735	702	203
2011	828	1,013	713	231
2010	851	770	869	326
2009	1,078	1,152	722	375



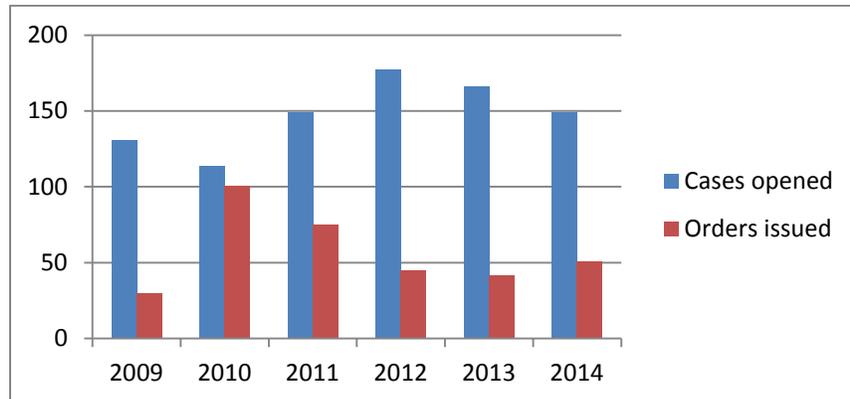
### ELECTRICAL

	CASES OPENED	CASES CLOSED	ACTIVE CASES	ORDERS
2014	250	238	220	171
2013	284	286	177	112
2012	282	380	194	131
2011	243	321	333	91
2010	129	N/A	427	47
2009	188	N/A	388	26



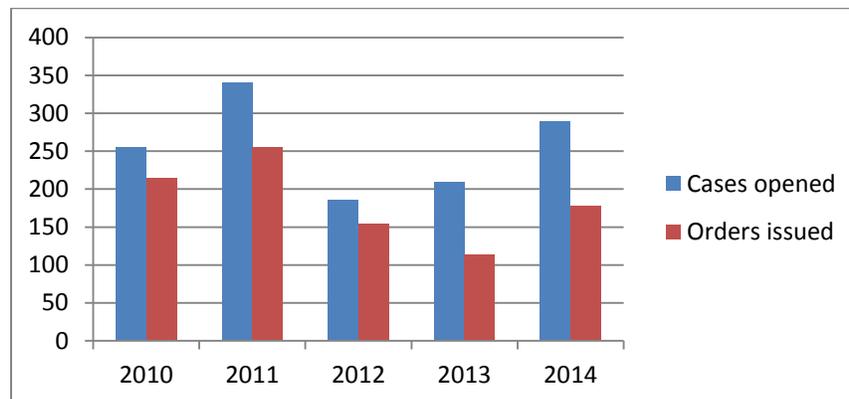
## PLUMBING

	CASES OPENED	CASES CLOSED	ACTIVE CASES	ORDERS
<b>2014</b>	<b>149</b>	<b>157</b>	<b>102</b>	<b>51</b>
<b>2013</b>	<b>166</b>	<b>178</b>	<b>108</b>	<b>42</b>
<b>2012</b>	<b>177</b>	<b>173</b>	<b>115</b>	<b>45</b>
<b>2011</b>	<b>149</b>	<b>160</b>	<b>113</b>	<b>75</b>
<b>2010</b>	<b>114</b>	<b>N/A</b>	<b>112</b>	<b>101</b>
<b>2009</b>	<b>131</b>	<b>N/A</b>	<b>146</b>	<b>30</b>



## WORKER MISCLASSIFICATION

	CASES OPENED	CASES CLOSED	ACTIVE CASES	ORDERS
<b>2014</b>	<b>289</b>	<b>260</b>	<b>148</b>	<b>178</b>
<b>2013</b>	<b>210</b>	<b>171</b>	<b>162</b>	<b>113</b>
<b>2012</b>	<b>186</b>	<b>274</b>	<b>128</b>	<b>154</b>
<b>2011</b>	<b>340</b>	<b>370</b>	<b>214</b>	<b>255</b>
<b>2010</b>	<b>255</b>	<b>N/A</b>	<b>196</b>	<b>214</b>



**ELECTRICAL**

<b>JOURNEYMAN A ELECTRICIAN</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Alaska	0	2	2	4	4
Arkansas	2	1	7	5	7
Colorado	6	7	15	7	6
Iowa	0	3	10	5	9
Montana	0	2	2	1	2
Nebraska	19	6	9	9	9
North Dakota	53	39	54	56	41
Oklahoma	1	2	0	0	0
South Dakota	18	30	28	16	22
Utah	0	2	0	0	0
Wyoming	2	3	12	3	7
<b>JOURNEYMAN A ELECTRICIAN Totals:</b>	<b>101</b>	<b>97</b>	<b>139</b>	<b>106</b>	<b>107</b>
<b>MASTER A ELECTRICIAN</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Iowa	0	6	7	6	6
Nebraska	9	4	9	9	12
North Dakota	19	13	22	21	22
South Dakota	10	5	9	5	17
<b>MASTER A ELECTRICIAN Totals:</b>	<b>38</b>	<b>28</b>	<b>47</b>	<b>41</b>	<b>57</b>
<b>Total Electrical Reciprocity:</b>	<b>139</b>	<b>125</b>	<b>186</b>	<b>147</b>	<b>164</b>

**PLUMBING**

<b>JOURNEYMAN PLUMBER</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
North Dakota	10	6	16	25	10
South Dakota	32	4	7	9	2
<b>JOURNEYMAN PLUMBER Totals:</b>	<b>42</b>	<b>10</b>	<b>23</b>	<b>34</b>	<b>12</b>
<b>MASTER PLUMBER</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
North Dakota	3	5	12	7	10
South Dakota	2	2	6	3	4
<b>MASTER PLUMBER Totals:</b>	<b>5</b>	<b>7</b>	<b>18</b>	<b>10</b>	<b>14</b>
<b>Total Plumbing Reciprocity:</b>	<b>47</b>	<b>17</b>	<b>41</b>	<b>44</b>	<b>26</b>
<b>Total Licenses Issued Via Reciprocity:</b>	<b>186</b>	<b>142</b>	<b>227</b>	<b>191</b>	<b>190</b>

## Solar Photovoltaic (PV) Systems Questions and Answers

The following frequently asked questions and answers are a compendium of existing statutes, rules and National Electrical Code (NEC) provisions that are applicable to all electrical installations, with a special emphasis related to the installation of solar photovoltaic systems

### Electrical Licensing

**EL-1)** Are solar PV systems, including photovoltaic modules, panels and arrays, and their associated components, considered to be electrical equipment under the State Electrical Code?

**Answer:** Yes. The State Electrical Code adopts by reference the 2014 edition of the National Electrical Code (NEC). Solar photovoltaic systems fall within the definition of “equipment” as it is defined in the NEC. See NEC Article 100 and Article 690 for all pertinent definitions. Accordingly, solar PV systems, including photovoltaic modules, panels and arrays, and their associated components, are electrical equipment under the State Electrical Code.

(Reference the Board of Electricity Final Interpretation dated July 8, 2009 available at <http://www.dli.mn.gov/PDF/boe/Interp/SPS.pdf> )

**EL-2)** How is the term “electrical work” defined in state law?

**Answer:** [Minnesota Statute 326B.31, Subdivision 17](#), defines “electrical work” as follows:

*Electrical work. "Electrical work" means the installing, altering, repairing, planning, or laying out of electrical wiring, apparatus, or equipment for electrical light, heat, power, technology circuits or systems, or other purposes. The installing, altering, repairing, planning, or laying out of electrical wiring, apparatus, or equipment for electrical light, heat, power, technology circuits or systems, or other purposes includes, but is not limited to, the performance of any work regulated by the standards referred to in section [326B.35](#).*

**EL-3)** Are the solar PV systems that are regulated by the National Electrical Code considered “electrical work”, as the term is defined in [Minnesota Statute 326B.31, Subdivision 17](#)?

**Answer:** Yes. Unless specifically exempt in [Minnesota Statute Chapter 326B](#), all electrical work installed in Minnesota is required to be installed in accordance with all applicable electrical licensing and inspection requirements.

**EL-4)** Solar PV systems are generally installed on some form of structural support system (racking) on building roofs, on poles, on the ground and on a wide variety of structures. Are the non-electrical structural support systems considered to be “electrical work”, as the term is defined in [Minnesota Statute 326B.31, Subdivision 17](#)?

**Answer:** No. Non-electrical equipment and non-electrical structural support elements that consist of brackets, racking, purlins, blocking, frames, poles, concrete, roofing ballast, skids, anchors and similar are not considered electrical work. Such structural support systems usually require [professional design](#) by a registered structural engineer; this type of professional design work is not within the scope or authority of any classification of Minnesota electrical license.

**EL-5)** Some solar PV systems use a support system that incorporates enclosed electrical wireways (channels) and interconnecting electrical conduits that are used to provide structural support for the individual solar PV modules and they also serve as raceways for electrical circuit conductors. Is this type of support system, or portions thereof, considered to be “electrical work”, as the term is defined in [Minnesota Statute 326B.31, Subdivision 17](#)?

**Answer:** Yes. This type of support system, or the applicable portions thereof, is considered to be “electrical work”, as the term is defined in [Minnesota Statute 326B.31, Subdivision 17](#). Portions of the support system that includes wireways, conduits, raceways or other enclosed channels expressly intended for electrical circuit conductors or the extension of electrical circuitry is considered electrical work.

**EL-6)** Some solar PV support systems provide structural support for the solar PV modules and the metallic support system (structure) is identified or listed as an equipment grounding conductor. Is this type of support system or structure, or portions thereof, considered to be “electrical work”, as the term is defined in [Minnesota Statute 326B.31, Subdivision 17](#)?

**Answer:** Yes. NEC Article 690 has specific requirements for such support systems or structures.

**EL-7)** Some solar PV support systems provide structural support for the solar PV modules and the metallic support system may also be bonded to a grounding electrode and a grounding electrode conductor, where the metallic support system may serve as a path for electrical ground-faults (See the definition of “ground-fault current path” in the NEC). Is this type of support system, or portions thereof, considered to be “electrical work”, as the term is defined in [Minnesota Statute 326B.31, Subdivision 17](#)?

**Answer:** Generally no. Metallic structural support systems (not otherwise used as electrical wireways, raceways or electrical conductors, such as equipment grounding conductors) that may serve as a path for ground-fault current does not automatically mean that the installation of such structural support system is considered electrical work. There are numerous metallic systems and elements in the built environment that serve as paths for ground-fault current or that may also serve as a means for other forms of electrical grounding and bonding, yet they are not considered to be electrical work. They could include, but not be limited to, structural

steel, reinforcing steel, metal building components, water piping, gas piping, ductwork, electrical shielding and the earth itself.

**EL-8)** Is the installation of any of the following items considered to be “electrical work”, as the term is defined in [Minnesota Statute 326B.31, Subdivision 17](#)?; Grounding and bonding adapters, bushings, clamps, clips, conductors, couplings, devices, electrodes, fittings, grids, hubs, jumpers, locknuts, lugs, mesh, plates, rods, shunts, straps, wedges, wires and similar.

**Answer:** Yes. The installation of electrical grounding and bonding conductors, apparatus, components and similar is considered to be “electrical work”, as the term is defined in [Minnesota Statute 326B.31, Subdivision 17](#). All such electrical grounding and bonding conductors, apparatus, components and similar are required to be identified and listed for the purpose and installed in accordance with the manufacturer’s installation instructions.

**EL-9)** With respect to electrical or structural systems, are there other statutes and rules that may be applicable to solar PV installations?

**Answer:** Yes. [Minnesota Statutes 326.02, Subdivision 1](#) contains provisions that require licensure of persons who practice or offer to practice professional engineering. The practice of professional engineering is further defined in [Minnesota Statute 326.02, Subdivision 2](#).

**EL-10)** Are licensed electrical contractors allowed to plan and layout their own electrical work?

**Answer:** Yes. [Minnesota Statutes 326.02, Subdivision 5](#) states in pertinent part:

*“Subd. 5. Limitation. The provisions of sections 326.02 to 326.15 shall not apply to...the planning for and supervision of the construction and installation of work by an electrical...contractor...as defined in and licensed pursuant to chapter 326B, where such work is within the scope of such licensed activity and not within the practice of professional engineering...”*

**EL-11)** If someone has additional questions related to professional design and licensure, to whom should they address their questions?

**Answer:** Please contact the [Minnesota Board of Architecture and Engineering](#) at <http://mn.gov/aelslag/> or 651-296-2388.

<this space is reserved for additional questions and answers>

## Electrical Code and Technical

**EC-1)** National Electrical Code (NEC) Section 690.9(D) requires overcurrent devices for PV source and PV output conductors to be accessible, but does not require them to be readily accessible. What does the NEC require or allow when the PV system is on a rooftop or an elevated structure?

**Answer:** NEC Article 100 definitions:

**Accessible (as applied to equipment)** *Admitting close approach; not guarded by locked doors, elevation, or other effective means.*

**Accessible (as applied to wiring methods)** *Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building.*

**Accessible, Readily (Readily Accessible)** *Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom access is requisite to actions such as to use tools, to climb over or remove obstacles, or to resort to portable ladders, and so forth.*

The definitions are not intended to mean that equipment may not be elevated where it can be reached with a portable ladder or located behind locked doors, when qualified persons who need access have the necessary means to do so. The requirement states only that locked doors, elevation or other effective means must not “guard” against access.

The overcurrent devices mounted on or behind modules or structural members of a PV system shall be accessible without damaging the PV modules or the structure in order to permit safe access for installers, maintenance personnel and the electrical inspector.

**EC-2)** The new requirements in NEC Section 690.12 address the requirement for a rapid shutdown function for all PV system circuits mounted in or on buildings. What type of equipment will be acceptable in order to comply with the Rapid Shutdown requirements?

**Answer:** Police, firefighters and other emergency persons must contend with elements of PV systems that remain energized after the utility service disconnect is opened. The rapid shutdown function provides the necessary means to mitigate the shock potential that poses a danger to first responders. NEC Section 690.12 outlines the shutdown time constraints, placement or location in the PV circuit and the level of energy that the rapid shutdown function will need to operate in order to achieve the protection. Designs and methods for achieving rapid system shutdown are not addressed in the NEC, other than 690.12(D) which requires the equipment (single function or multiple devices) performing the rapid shutdown to be listed and identified.

**EC-3)** NEC Section 690.31(A) requires readily accessible PV source and PV output conductors over 30 volts to be guarded or installed in a raceway. What methods will be acceptable in order to comply with the requirements for guarding or protecting PV conductors that are installed in readily accessible locations?

**Answer:** NEC Article 100 defines guarded as covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger. Most PV systems do not have means for attaching raceways. The conductors would be considered “not readily accessible” by using any of the items mentioned in the NEC definition or by elevation or location, provided the conductors are high enough or located in such a manner to remove the likelihood that individuals could approach or come into contact with conductors. Installations will be considered guarded when access is limited to qualified persons.

**EC-4)** If listed alternating-current (ac) AFCI protection is not available to meet the rule of NEC 705.12(D)(6), how can installers provide the required protection for a utility-interactive inverter’s wiring harness or cable output circuit?

**Answer:** The NEC rule states that a utility-interactive inverter with a wire harness or cable output circuit rated 240-volts, 30-amps or less that is not installed in a raceway shall be provided with listed ac AFCI protection.

At this time, products that meet the NEC requirement apparently are not available. NEC Section 90.4 specifically permits the authority having jurisdiction (AHJ) to accept installations and equipment that involves new technologies, products or materials that are not yet available at the time the Code is adopted to comply with the most recent previous edition of this Code adopted by the jurisdiction.

Unlike NEC Section (D)(6) in the 2014 NEC, the 2011 NEC has no requirement for AFCI protection of the wiring harness or cable output. Until at least one 240-volt 30-amp ac arc-fault circuit-interrupter device is made commercially available, the language in the 2011 NEC will be permitted.

**EC-5)** Does the 2014 NEC have specific color code requirements for the identification of PV conductors?

**Answer:** Yes. NEC Section 210.5(C)(2) and 215.12(C)(2) state that each ungrounded conductor of direct-current (dc) branch circuits and feeders operating over 50 volts shall be identified by polarity at all terminations, connections and splice points, and the identification method(s) must be posted at the branch circuit or feeder panelboard where the conductors originate.

Conductor identification is required by NEC Section 200.6 wherever positively or negatively grounded systems are encountered. NEC Sections 408.3(E)(2) and (F)(4 and 5) contain the provisions for labeling dc buses and properly identifying ungrounded dc systems and resistively grounded dc systems.

**EC-6)** When a PV source connection is made on the supply side of a service disconnect, is the PV disconnect treated as service equipment and required to meet all of the NEC requirements for a service disconnect?

**Answer:** Yes. Every disconnecting means that has a direct connection to the electrical grid shall be listed and identified as being suitable for use as service equipment and shall meet all of the required ratings.

The interconnected electric power production source (solar PV system) is permitted to be connected to the electrical grid as follows:

- NEC 230.2(A)(5); As a separate service (for interconnected parallel power production)
- NEC 230.40 Exception No. 5; As a separate set of service-entrance conductors
- NEC 705.12(A); As a separate connection to the supply side of an existing service disconnecting means (in effect, a separate set of service-entrance conductors)

NEC 230.70 has a basic rule that states that the disconnecting means for each service, or set of service-entrance conductors, shall not consist of not more than six switches or circuit breakers. Where there are two to six disconnecting means for a service, the disconnects shall be grouped. Where there are two separate services (Service A; normal power) (Service B; solar PV power production source), the disconnects for Service A shall be grouped, and the disconnects for Service B shall be grouped. However, the NEC does not require that the disconnects for both Service A and Service B be grouped together (Service A and Service B could be located on opposite ends of a building). Where a building or structure is supplied by more than one service, permanent plaques and directories are required.

Regardless of whether the solar PV system is connected to the utility electrical grid via a separate service, a separate set of service-entrance conductors or a supply side connection, there are numerous rules that need to be taken into consideration, including but not limited to rating, location, grouping, marking, etc. for disconnects, overcurrent protection, grounding, bonding, labeling and so on.

Contrary to conventional electrical distribution in which the premises electrical system is typically a consumer of electrical power, utility-interactive interconnected solar PV systems distribute excess electrical power onto the electrical grid. The bi-directional service disconnecting means serves a dual role as both the ac disconnecting means for the solar PV system and as the disconnecting means for the service or service-entrance conductors.

**EC-7)** Do the rules in NEC Article 225 for outside branch circuits and feeders apply to solar PV systems?

**Answer:** Yes. The scoping provisions in NEC 225.1 state that the article covers requirements for outside branch circuits and feeders run on or between buildings, structures or poles on the premises. It also covers electrical equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures or poles. NEC 225.3 and the accompanying table also act as a reminder that Article 225 is specifically applicable to solar photovoltaic systems in Article 690.

See Article 100 for the definitions of *Building* and *Structure*. The definition of *Structure* has broad applicability as determined by the Authority Having Jurisdiction (AHJ). It might not be obvious to some solar PV installers, but a ground-mounted solar PV array, located away from the building, is considered a structure for the purpose of Article 225. In addition to all of the rules in Article 690 for the solar PV system, all of the general rules in NEC Chapters 1 through 4 are applicable, including Article 225.

<this space is reserved for additional questions and answers>

## Inspection Fees and Procedures

**EF-1)** The inspection fee schedule in [Minnesota Statutes 326B.37](#) does not contain any specific inspection fees that correlate with the typical solar PV system. Has the department established electrical inspection fees that directly correlate with solar PV systems?

**Answer:** Yes. When the inspection fee schedule is applied to a project and the calculated fee results in a total fee that is not reasonable (i.e. excessive), or the inspection fee schedule does not correlate with the electrical work associated with the project, [Minnesota Statute 326B.37, Subdivision 12](#) authorizes the department to negotiate inspection fees that result in a total fee that is reasonable and more appropriately offsets the cost of providing the inspection service.

**EF-2)** What does the department's interim solar PV system inspection fee schedule look like?

**Answer:** The following electrical inspection fees will be applicable to solar PV systems and installations:

(a) The inspection fee for the installation of solar PV systems, is

- (1) 0 watts to and including 5,000 watts, \$60; or
- (2) 5,001 watts to and including 10,000 watts, \$100 or
- (3) 10,001 watts to and including 20,000 watts, \$150 or
- (4) 20,001 watts to and including 30,000 watts, \$200 or
- (5) 30,001 watts to and including 40,000 watts, \$250 or
- (6) 40,001 watts and larger, \$250, and \$25 for each additional 10,000 watts.

(b) For the purpose of paragraph (a), the watt rating is the total estimated alternating current (ac) energy output of the solar system. The total dc energy output is not used.

(c) The solar PV inspection fees shall include inverters, modules, panels, combiners, converters, charge controllers, disconnecting means and electrical conductors between the inverter and the ac panelboard for stand-alone solar PV systems, or the conductors between the inverter and the service equipment or other power production, distribution and utilization system, such as a utility system and its connected loads, that is external to and not controlled by the solar PV power system.

(d) In addition to the inspection fees in (a), additional inspection fees may be applicable on large-scale projects for the inspection of additional electrical infrastructure between the inverter output circuit and the electrical production and distribution network. The inspection fees shall be calculated according to [Minnesota Statutes 326B.37, subdivisions 2, 3, 4, and 6, paragraphs \(d\), \(f\), \(j\), and \(k\).](#)

(e) When a plan review is required or performed the plan review fee is \$80 per hour.

**Minnesota Solar PV System  
Electrical Inspection Fee Chart**

<b>Solar PV System Rating*</b>	<b>Inspection Fees</b>
0 – 5,000 watts	\$60
5,000 – 10,000 watts	\$100
10,001 – 20,000 watts	\$150
20,001 – 30,000 watts	\$200
30,001 – 40,000 watts	\$250
40,001 and larger	\$250, and \$25 for each additional 10,000 watts
*The watt rating is the total estimated alternating current (ac) energy output of the solar system. The total dc energy output is not used.	
The solar PV inspection fees shall include inverters, modules, panels, combiners, converters, charge controllers, disconnecting means and electrical conductors between the inverter and the ac panelboard for stand-alone solar PV systems, or the conductors between the inverter and the service equipment or other power production, distribution and utilization system, such as a utility system and its connected loads, that is external to and not controlled by the solar PV power system.	
In addition to the basic solar PV inspection fees, additional inspection fees may be applicable on large-scale projects for the inspection of additional electrical infrastructure between the inverter output circuit and the electrical production and distribution network. The inspection fees shall be calculated according to Minnesota Statute 326B.37, subdivisions 2, 3, 4, and 6, paragraphs (d), (f), (j), and (k).	
When a plan review is required or performed the plan review fee is \$80 per hour.	

**EF-3)** Is a plan review required prior to the installation of a solar PV system?

**Answer:** Not at this time. However, installers of solar PV systems are expected to be able to answer any questions about the solar PV system posed by the Authority Having Jurisdiction (AHJ). The Solar America Board for Codes and Standards (Solar ABCs) has developed a set of standardized plan submittal and permit application documents that can be used to outline all of the plans, specifications and details for various types of solar PV systems. Solar PV installers are strongly encouraged to utilize these documents and make them available to the AHJ well in advance of the start of construction.

For large-scale solar PV projects, the department strongly encourages solar PV installers to contact the department well in advance of the start of construction in order to schedule one or more project review meetings. There is no plan review fee for these meetings. The purpose of the meetings is for the exchange of information and to help ensure the successful completion of the solar PV project. The department welcomes the opportunity to host these meetings.

**EF-4)** Upon request will the department perform a plan review prior to the installation of a solar PV system?

**Answer:** Yes. Please contact the department at [dli.electricity@state.mn.us](mailto:dli.electricity@state.mn.us) for more information. The department reserves the right to charge a plan review fee of \$80 per hour when performing plan reviews.

Solar America Board for Codes and Standards Expedited Permitting

<http://www.solarabcs.org/about/publications/reports/expedited-permit/forms/index.html>

- Standard String System
- <http://www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Example1-StandardStringSystem.pdf>
- Micro-Inverter System
- <http://www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Example2-Micro-Inverter.pdf>
- AC-Module System
- <http://www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Example3-ACModule.pdf>
- Supply-Side Connection System
- <http://www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Example4-Supply-SideConnection.pdf>

## Equipment Approval

**EA-1)** For electrical installations covered by the National Electrical Code (NEC), what is the difference between “*approved*” and “*listed*” when it comes to the acceptability of electrical equipment?

**Answer:** In accordance with NEC 110.2, conductors and equipment required or permitted in the NEC shall be acceptable only if they are approved. The term *Approved* is defined in Article 100 simply as “Acceptable to the authority having jurisdiction” (AHJ). However, suitability of electrical equipment is commonly required to be evidenced by *Listing* and *Labeling*. See the definitions of *Listing* and *Labeling* in NEC Article 100. Listed and labeled equipment is required to be installed in accordance with any instructions that are included in the listing and labeling. In North America there are several testing laboratories that evaluate electrical equipment, list the equipment in published product directories and label the equipment as evidence that the equipment meets all applicable safety standards. In the U.S., the Department of Labor Occupational Safety & Health Administration (OSHA) administers the program that is responsible for accrediting the [Nationally Recognized Testing Laboratories \(NRTLs\)](#) (Examples of NRTLs include UL, ETL-ITSNA, MET, CSA, etc.)

**EA-2)** Does the NEC require solar PV equipment to be listed?

**Answer:** Yes. Simple approval of solar PV equipment by an AHJ is not permitted in the NEC. There are numerous examples in the NEC where electrical equipment is specifically required to be listed (e.g. luminaries, wiring methods, automatic transfer switches, service equipment, hazardous locations, etc.). NEC 690.4(B) specifically requires inverters, motor generators, PV modules, PV panels, ac PV modules, dc combiners, dc-to-dc converters and charge controllers to be listed for PV applications.

**EA-3)** Does the U.S. Department of Labor Occupational Safety & Health Administration (OSHA) require electrical equipment in the workplace to be listed and labeled?

**Answer:** Yes. More information is available in [Standards – 29 CFR, part 1910.303](#), Occupational Safety and Health Standards.

**EA-4)** Does Minnesota have similar OSHA regulations requiring electrical equipment in the workplace to be listed and labeled?

**Answer:** Yes. The Minnesota Department of Labor and Industry also enforces the Minnesota Occupational Safety and Health Act ([MNOSHA](#)) and federal standards.

**EA-5)** In addition to the equipment approval requirements in the NEC, does Minnesota have overriding statutes or rules related to the approval of electrical equipment?

**Answer:** Yes. Minnesota Rules Chapter (MRC) [3801.3619](#) and [3800.3620](#) contain provisions for the approval of electrical equipment. [MRC 3801.3619](#) contains definitions. [MRC 3801.3620](#) contains the provisions for the approval of electrical equipment. [MRC 3801.3620, Subpart 1](#) essentially requires all equipment used as part of or in connection with an electrical installation to be listed and labeled by a nationally recognized testing laboratory.

**EA-6)** Does [MRC 3801.3620](#) contain any alternatives to listing and labeling?

**Answer:** Yes. [MRC 3801.3620, Subpart 2](#) outlines the provisions that can be utilized to obtain the department's approval of certain types of electrical equipment. The two most common methods for third-party certification of non-listed equipment includes; 1) field evaluation by a nationally recognized testing laboratory, or 2) field evaluation by a registered electrical engineer.

**EA-7)** Does the department have more information online related to equipment approval?

**Answer:** Yes. Approval requirements for electrical equipment are online at <http://www.dli.mn.gov/CCLD/ElectricalEquipment.asp>

## **Building Code**

**BC-1)** Does the Minnesota State Building Code contain provisions related to the installation of solar PV systems?

**Answer:** Yes. The 2015 Minnesota Building Code is currently working its way through the rulemaking and adoption process. The new building code will contain provisions for the installation of solar PV systems. The code provisions will be found in Minnesota Rules Section 1305.3113, which will be in the 2012 International Building Code (IBC), as amended and adopted. The code provisions will include rules related to roof access, pathways and spacing requirements in an effort to mitigate hazards and to aid in firefighting operations.

<this space is reserved for additional questions and answers>

**Board of Electricity**  
**c/o Department of Labor and Industry**  
**443 Lafayette Road North**  
**Saint Paul, MN 55155-4344**  
dli.cclboards@state.mn.us

**FINAL INTERPRETATION**

Subject: Solar Photovoltaic Systems  
Code Reference: Minnesota State Electrical Code, Chapter 1315  
Submitted by: Mr. Gary Thaden, National Electrical Contractors Association,  
830 Transfer Road, St. Paul, MN 55114; and  
Mr. John Ploetz, The Minnesota Electrical Association, Inc.,  
3100 Humboldt Ave. S., Minneapolis, MN 55408-2588; and  
Mr. Dan McConnell, IBEW Local 292, 312 Central Avenue,  
Suite 292, Minneapolis, MN 55414  
Approved by: Board of Electricity  
by Joseph Vespa, Chair  
Date Received: Mr. Thaden's submission: June 10, 2009  
Mr. Ploetz's submission: June 12, 2009  
Mr. McConnell's submission: June 12, 2009  
Issue Date: July 8, 2009

**Questions:** Are Solar Photovoltaic Systems, including photovoltaic panels and their associated components, electrical equipment under the State Electrical Code?

**Answer:** Yes. The State Electrical Code adopts by reference the 2008 edition of the National Electrical Code (NEC). *See* Minn. R. 1315.0200. Solar Photovoltaic Systems fall within the definition of "equipment" in the 2008 NEC. *See* NEC 690.4(D) (2008). Accordingly, Solar Photovoltaic Systems, including photovoltaic panels and their associated components, are electrical equipment under the State Electrical Code.

**Commentary:** The Board considered these requests for interpretation and made a determination regarding the final interpretation at the July 7, 2009, Board meeting. All persons present who wished to speak were given a full and fair opportunity to speak. The Board also considered written comments that were received before the meeting. As required by Minnesota Statutes, section 326B.127, subd. 5, the Board will consider this Final Interpretation for adoption as part of the Minnesota Electrical Code.

Date: July 8, 2009

  
\_\_\_\_\_  
Joseph Vespa, Chair  
Board of Electricity