NETCO
NATIONAL ELECTRICAL TRADE COUNCIL

Summary Report
National Occupational Analysis:
Construction Electrician-Solar Photovoltaic (PV) Systems Certified

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National Occupational Analysis: Construction Electrician – Solar Photovoltaic (PV) Systems Certified

About the National Electrical Trade Council (NETCO)

The National Electrical Trade Council (NETCO) is a joint Labour-Management partnership of the International Brotherhood of Electrical Workers (IBEW), First District, Canada and the Canadian Electrical Contractors Association (CECA). Its mandate is to promote national standards, apprenticeship and ongoing journeyperson skills training in Canada with a particular focus on the three Red Seal electrical trades. NETCO's *National Solar Photovoltaic (PV) Strategy* responds to the electrical industry's desire for a Made-in-Canada, nationally-coordinated approach to workforce skills development associated with a projected increase in demand for renewable energy sources.

Through the IBEW and CECA communities, NETCO is the voice of the electrical industry in Canada and speaks on behalf of over 8,000 electrical contractors and IBEW Local Unions representing 63,000 members in every province and territory. A significant number of IBEW members work as electrical journeypersons and apprentices.

Occupational Context & Scope

This research applies exclusively to the occupation of Construction Electrician[1]—the official Red Seal occupational title approved by the Canadian Council of Directors of Apprenticeship (CCDA). It articulates tasks that **all** qualified journeyperson Construction Electricians carry out in applying their trade skills to the installation of solar photovoltaic (PV) systems. As such, this task analysis is a companion piece to the *National Occupational Analysis (NOA) for Construction Electrician (2008)*. It breaks out a complementary bundle of tasks related to solar PV systems embedded in the Red Seal Program's standards of excellence and promotes the electrical industry's enduring commitment to safety.

The occupational title associated with this National Occupational Analysis is *Construction Electrician—Solar Photovoltaic (PV) Systems Certified*. It reinforces that the current workforce of qualified journeyperson Construction Electricians already has the core electrical skills—acquired over 4-5 years of apprenticeship that includes up to 9000 hours of in-class and on-the-job training—to meet the demands of the solar PV industry. A comparatively modest investment in ongoing journeyperson skills training (i.e., typically 16-24 hours) is all that qualified journeyperson Construction Electricians require to become familiar with PV technology and its application to industrial, commercial and residential settings.

NETCO acknowledges that this task analysis does not include a broader range of tasks performed by others working in the solar PV industry related to, for example, systems design. The National Occupational Analysis for *Construction Electrician—Solar Photovoltaic (PV) Systems Certified* is a significant foundation stone in what perhaps may evolve to a suite of national standards for various occupations that engage with the solar PV industry.

[1] Some provinces and territories use variations of this occupational title: Electrician Construction and Maintenance in Ontario; Electrician (Construction) in Quebec; and Electrician in Saskatchewan, Alberta, British Columbia, Northwest Territories and Nunavut. Regardless of nomenclature, the occupation links to National Occupational Classification (NOC) Code 7241 across all jurisdictions.

PV A **Solar Photovoltaic (PV) Systems Safety** **23% of Exam**	**PV A 1** Complies with legal requirements (e.g., code), standards and project-specific policies and procedures applicable to Solar PV Systems Safety	**PV A 1.01** Complies with legal requirements related to code, legislation and regulations	**PV A 1.02** Complies with industry standards and trade practices	**PV A 1.03** Complies with project-specific policies and procedures		
	PV A 2 Performs hazard analysis and risk assessment	**PV A 2.01** Identifies hazards	**PV A 2.02** Identifies risks	**PV A 2.03** Assesses levels of risk	**PV A 2.04** Implements risk control measures	**PV A 2.05** Determines residual risks	**PV A 2.06** Sets adequate risk reduction
	PV A 3 Controls risks related to multiple energy sources	**PV A 3.01** Identifies and eliminates hazards	**PV A 3.02** Assesses and controls risks	**PV A 3.03** Applies lockout, arc flash and live work procedures		
	PV A 4 Uses safety equipment	**PV A 4.01** Identifies safe practices when working at heights	**PV A 4.02** Uses personal protective equipment	**PV A 4.03** Inspects personal protective equipment for adequacy	**PV A 4.04** Verifies that safety equipment is safe to use	**PV A 4.05** Maintains safety equipment documentation	

PV B **Solar Photovoltaic (PV) Systems Pre-Installation On-Site Review** **15% of Exam**	**PV B 1** **Interprets design documents**	**PV B 1.01** **Reviews project objectives, resources and requirements outlined in preliminary assessment**	**PV B 1.02** **Reviews site-specific installation issues outlined in survey of site conditions**	**PV B 1.03** **Reviews utility requirements for interconnection and metering**	**PV B 1.04** **Reviews other design documents (e.g., issued by manufacturers)**	**PV B 1.05** Identify considerations for locating and installing PV arrays
	PV B 2 **Reviews site-specific installation documents**	**PV B 2.01** **Identifies whether all information related to installations is in layout drawing**	**PV B 2.02** **Identifies potential interferences/conflicts**			
	PV B 3 **Develops implementation strategy**	**PV B 3.01** **Plans project tasks and procedures**	**PV B 3.02** **Identifies timelines**	**PV B 3.03** **Identifies required tools, equipment and materials**	**PV B 3.04** **Coordinates with other stakeholders**	**PV B 3.05** **Identifies hazards and risks**

PV C **Solar Photovoltaic (PV) Systems Installation** **49% of Exam**	**PV C 1** Verifies site conditions with reference to design documents	**PV C 1.01** Verifies bill of materials	**PV C 1.02** Verifies certification of equipment	**PV C 1.03** Verifies electrical distribution	**PV C 1.04** Verifies ground/soil conditions	**PV C 1.05** Verifies roof conditions	**PV C 6.06** Verifies site access
		PV C 1.07 Verifies site security	**PV C 1.08** Verifies site logistics				
	PV C 2 Installs modules and arrays/BIPV	**PV C 2.01** Locates structural support elements (e.g., joists, roof trusses)	**PV C 2.02** Marks position of arrays and supports	**PV C 2.03** Installs array support systems to structural elements	**PV C 2.04** Weatherproofs mechanical and electrical penetrations	**PV C 2.05** Installs bonding to support structures	**PV C 2.06** Installs modules complete with bonding to array support systems
		PV C 2.07 Interconnects electrical connection of modules					
	PV C 3 Installs inverters	**PV C 3.01** Verifies enclosure ratings	**PV C 3.02** Marks position of inverters	**PV C 3.03** Installs mounting supports	**PV C 3.04** Mounts inverters	**PV C 3.05** Bonds inverters to grounding system	**PV C 3.06** Interconnects electrical connection of inverter
	PV C 4 Installs bonding, grounding, surge and lightning protection	**PV C 4.01** Identifies location of grounding electrodes	**PV C 4.02** Interconnects all grounding electrode systems	**PV C 4.03** Interconnects bonding systems to grounding electrode systems	**PV C 4.04** Installs lightning protection system	**PV C 4.05** Installs surge protection equipment	**PV C 4.06** Verifies continuity

PV C Continued **Solar Photovoltaic (PV) Systems Installation**	**PV C 5** Installs electrical protection and controls (e.g., disconnects overcurrent protection, combiner boxes)	**PV C 5.01** Verifies electrical enclosure ratings	**PV C 5.02** Verifies overcurrent ratings	**PV C 5.03** Marks position of components	**PV C 5.04** Installs mountings and supports	**PV C 5.05** Mounts components	**PV C 5.06** Labels components
		PV C 5.07 Bonds to grounding system	**PV C 5.08** Installs interconnecting raceways, conductors and/or cables				
	PV C 6 Installs utility metering equipment	**PV C 6.01** Verifies electrical enclosure ratings	**PV C 6.02** Marks position of utility equipment	**PV C 6.03** Mounts utility and metering equipment	**PV C 6.04** Installs wiring for utility and metering equipment	**PV C 6.05** Bonds to grounding system	
	PV C 7 Connects to distribution systems	**PV C 7.01** Connects to utility	**PV C 7.02** Connects to panel board	**PV C 7.03** Connects to direct coupled loads			
	PV C 8 Installs batteries and charge controllers (DC Voltage)	**PV C 8.01** Verifies electrical enclosure ratings for charge controllers and battery disconnects	**PV C 8.02** Mounts charge controllers and battery disconnects	**PV C 8.03** Assembles battery racking	**PV C 8.04** Places batteries in position	**PV C 8.05** Interconnects batteries	**PV C 8.06** Bond racking and enclosures to grounding system
		PV C 8.07 Interconnects electrical components					

PV C Continued Solar Photovoltaic (PV) Systems Installation	PV C 9 Installs energy monitoring and control systems	PV C 9.01 Verifies electrical enclosure ratings	PV C 9.02 Mounts electrical components	PV C 9.03 Installs interconnecting raceways, conductors and/or cables	
	PV C 10 Coordinates inspection with authority having jurisdiction (AHJ)	PV C 10.01 Identifies authority having jurisdiction (AHJ)	PV C 10.02 Arranges inspections	PV C 10.03 Addresses deficiencies	
	PV C 11 Commissions PV Systems	PV C 11.01 Inspects electrical and mechanical system components	PV C 11.02 Confirms PV system performance	PV C 11.03 Documents PV System performance	PV C 11.04 Verifies equipment labelling

PV D

Solar Photovoltaic (PV) Systems Troubleshooting & Maintenance

13% of Exam

PV D 1	PV D 1.01	PV D 1.02
Monitors system performance	Interprets performance data in relation to specifications	Identifies performance issues

PV D 2	PV D 2.01	PV D 2.02	PV D 2.03	PV D 2.04	PV D 2.05
Troubleshoot PV system problems	Identifies symptoms of the problem	Interprets relevant system documentation	Determines root cause of problem	Remediates problem	Documents the results

PV D 3
Decommission PV System for Repair

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