

Solar PV in Alberta

September 30, 2016

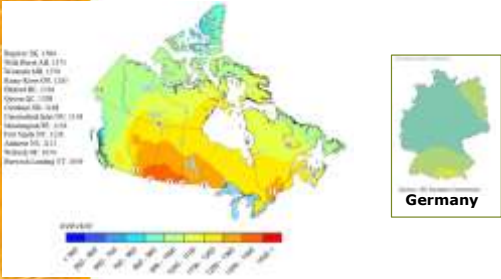
David Kelly, P. Eng

SkyFire Energy Inc.

- Founded in 2001 in Calgary
- Offices and staff in Edmonton and Calgary
- Western Canada's leading solar EPC (Engineering, Procurement and Construction) firm. 7MW+ across 8 provinces and territories including:
 - >35% of all grid tied solar in Alberta
 - >30% of all grid tied solar in BC
- Partners:
 - Dave Kelly, P. Eng. – CEO, Founder
 - CanSIA board of directors, board of SESA
 - Tim Schulhauser, MBA, P. Eng. - President
 - Light Up The World board of directors
 - David Vonesch, P. Eng. - COO
 - Board chair of Alberta Renewable Energy Co-operative (SPARK) and Vice-Chair of Alberta Co-operative Energy
- Certified Master Electrician, Journeyman Electricians, CSA Construction Electricians – Solar PV Systems Certified
- COR Certified, ISNet World Registered, ComplyWorks



Alberta's Solar Resource

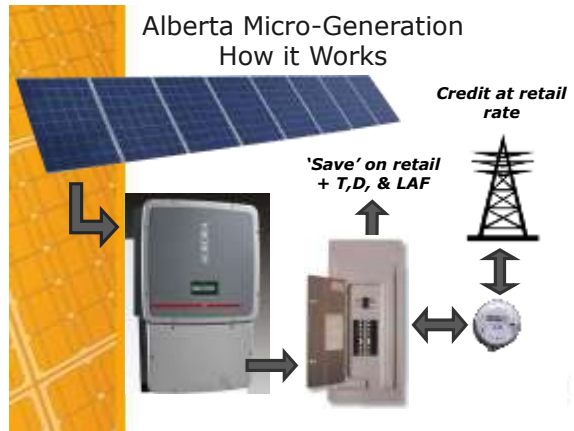
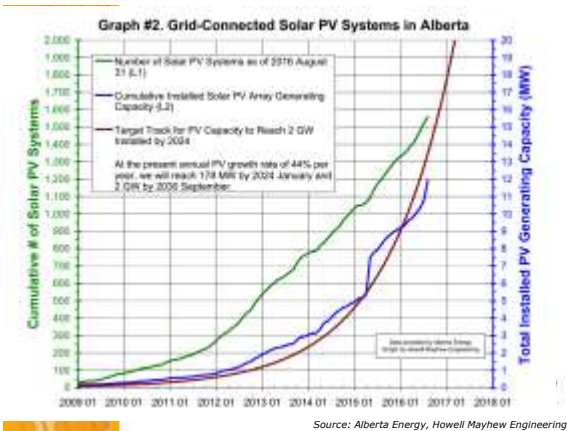


Source: Natural Resources Canada, Canadian Solar Industries Association

Solar PV Worldwide Potential

Ranking of Major Cities Worldwide in Terms of Yearly PV Potential	
City	Yearly PV Potential (kWh/kW)
Cairo, Egypt	1635
Los Angeles, USA	1485
Sydney, Australia	1343
Calgary, Alberta	1292
Rome, Italy (Italy has 3 rd most solar installed worldwide)	1283
Rio de Janeiro, Brazil	1253
Edmonton, Alberta	1245
Beijing, China (China has 2 nd most solar installed worldwide)	1148
Washington, DC., USA	1133
Paris, France	938
Tokyo, Japan (Japan has 4 th most solar installed worldwide)	885
Berlin, Germany (Germany has 1 st most solar installed worldwide)	848
Moscow, Russia	803
London, England	728

Source: Natural Resources Canada for PV potential, SkyFire Energy research for installed capacity ranking

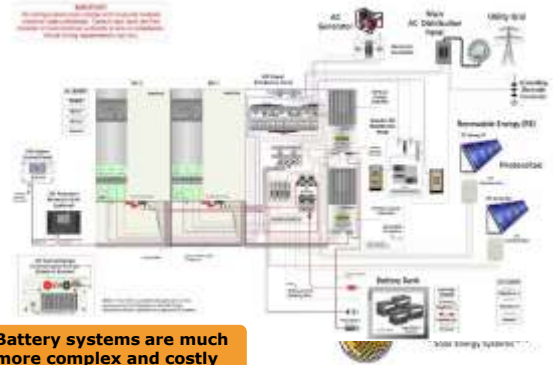




Grid tied with battery backup



Dual-Inverter System Renewable Energy (Solar)



Battery systems are much more complex and costly

Tesla Power Wall

It is a battery and still requires solar modules and an inverter



AB Micro-Generation (MG)

- Simplified application for <1MW load offsetting systems
- No application or metering costs:
 - Free application
 - Free bi-directional meter
 - No on-going metering charges
- Quick approval – Micro-Generation eligibility must be approved within 14 days



AB Micro-Generation (MG)

○ **Possible changes for 2017**

- >1MW perhaps up to 5MW
- >Load offsetting, may be limited by service capacity
- Enhanced net billing for >retail compensation



AB Distributed Generation (DG)

- Larger scale
- Direct utility connection
- No offsetting load
- Full AUC application (6mo-1yr)
- Full metering charges
- Pool Price \$0-\$999/MWhr
- None in Alberta today



2015 Code Changes Expanded Section 64

Significant Changes:

- 64-218 Rapid Shutdown
 - System must be <30V within 3m of array within 10 seconds of shutdown
 - Micro inverters and optimizer based systems meet this requirements w/o rooftop switch
- 64-210 Rodent Protection
 - Without module level AFCI, wiring must be protected from rodents
 - Micro inverters and optimizer based systems meet this requirements

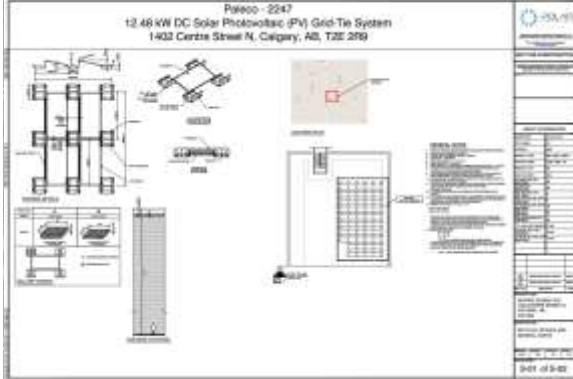


Rapid Shutdown



Typical Rodent Guard





Electrical Install Considerations

- Solar plus main breaker limited to 1.25x bus bar capacity for residential
- 100A service typically 5 kW solar
- 200A service typically 10kW solar
- Solar plus main breaker limited to 1.2x bus bar capacity for commercial
- Solar breaker must be at opposite end of bus from main breaker
- DC runs in conduit or armored cable
 - Micro-inverters have AC output from rooftop



Residential Install Considerations

- Architectural guidelines may restrict solar
- Fire officials vary on requirements
 - Most fire departments will not put anyone on a roof and do not require setbacks
 - Module surface no more slippery than metal
- Loading
 - Typically 2.5 PSF for residential sloped roof installations
- System typically lag bolted to truss
 - New mounting systems screw into sheathing only



Commercial Install Considerations

- Setbacks
 - 1-2m setback typical for flat commercial roofs
- Loading is a concern on older commercial roofs
 - Most flat roof installs are ballasted
 - 4-10 PSF typical depending on slope and wind
 - 10% of commercial roofs in Ontario suitable for solar
 - Load limited
 - Too cluttered with HVAC and other equip



Other Design Considerations

- Backup genset disconnect
- Calgary downtown secondary network: no export
- Design for efficiency or maximum output?
- Small inverters 208VAC, large 480 VAC
- Keep it simple. Standard racks are 5, 10, 12, 15 degrees. On new buildings 20 or 25 degree racks may be considered if roof can accommodate weight.
- Existing buildings – roof condition, roof strength



Grants and Incentives

1) AMSP – through MCCAC and available for municipally owned buildings or land. Based on DC system size.

Total Installed Capacity (DC)	Rebate
<10 kilowatts	\$0.75/Watt
10 kilowatts to <150 kilowatts	\$0.60/Watt
150 kilowatts to 1 Megawatt	\$0.45/Watt

Maximum 20% of system cost. System costs are typically \$2-\$3/watt (dc).

2) Growing Forward II – farmers

Install Type	(Without an Energy Assessment)	(With an Energy Assessment)
Solar PV Contractor-Installed	\$4.45/W to maximum 20% of project costs	\$4.36/W to maximum 25% of project costs
Self-installed	\$4.15/W to maximum 10% of project costs	\$4.36/W to maximum 20% of project costs
Grant Maximum	(60 kW or \$60,000)	(60 kW or \$60,000)

3) Sask. – NM and SPP

4) MB - \$1/watt grant



Cranston– Calgary, AB

Multi Unit Residential

2 modules with each unit with option to add



Cranston– Calgary, AB

Solar optional on every home from builder



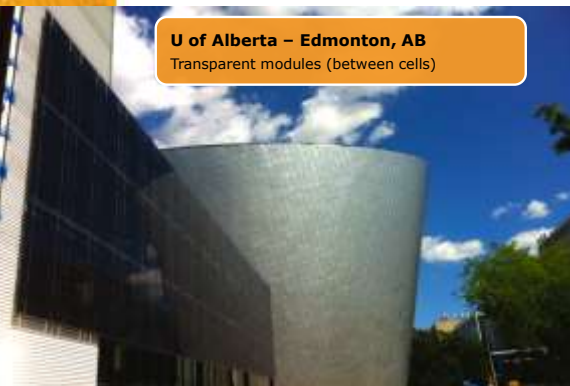
Larch Park – Edmonton, AB

Largest residential system in Western Canada



U of Alberta – Edmonton, AB

Transparent modules (between cells)



U of Alberta – Edmonton, AB

Transparent modules (between cells)





2 MW Solar Farm – Bassano, Alberta
Largest PV system in Western Canada



July Electricity Bill for Green Acres

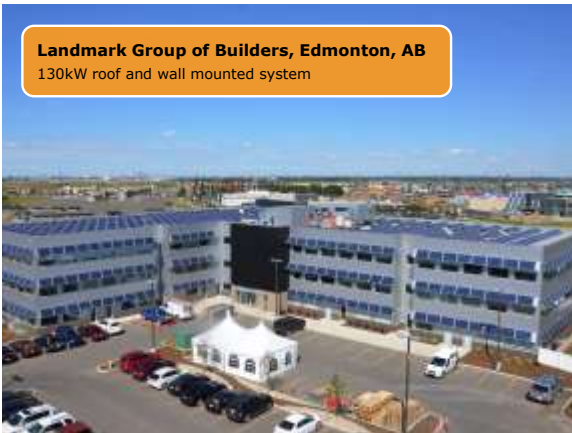
Account #	Account Name	Address	City	Province	Postal Code
[REDACTED]	Green Acres Society Learning Ctr. Ltd.	2425 - 2nd Ave South	Lehrberge, Alberta	T1A 1A1	

Bill #	Start Date	End Date	Usage (kWh)	Rate	Amount
001	07/01/16	07/31/16	11,400	\$0.0000	\$0.00
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Bill Summary:
 Billing Date: 08/01/16
 Billing Period: 07/01/16 - 07/31/16
 Total Amount Due: \$24,280.95

1.05MW SunMine – Kimberley, BC
Largest system in British Columbia
Direct utility tied (DG)





Landmark Group of Builders, Edmonton, AB
130kW roof and wall mounted system



Okanagan College – Penticton, BC
259kW system installed in 2011



Okanagan College – Kelowna, BC
194kW Solar Canopy



Telus Garden Office - Vancouver, BC
70 kW translucent solar canopy; largest PV system in Vancouver



SkyFireEnergy
Solid Energy Solutions



Example of a bad installation



Questions?
www.SkyFireEnergy.com | 403-251-0668
tim@skyfireenergy.com