

# Solar – Energizing the North



March, 2017 – Mikhail Ivanchikov  
mi@dandelionrenewables.com

# Agenda

---

- What is solar energy? What are efficiencies? Solar in the cold North?
- Alberta solar regulations
- Solar potential for the Northern Alberta
- Economic business Case for Solar
- Northern Alberta success stories



# What is solar energy and current efficiencies

---

**Solar** is the cleanest and most abundant renewable energy source. Modern technology can capture this energy for variety of uses: to generate electricity, to provide light, to provide heating.

There are several ways to harness solar energy:

- Photovoltaic
- Solar Heating
- Concentrating Solar
- Geo-exchange
- Passive Solar

Today our focus will be on solar electric or **photovoltaic** (PV) approach.

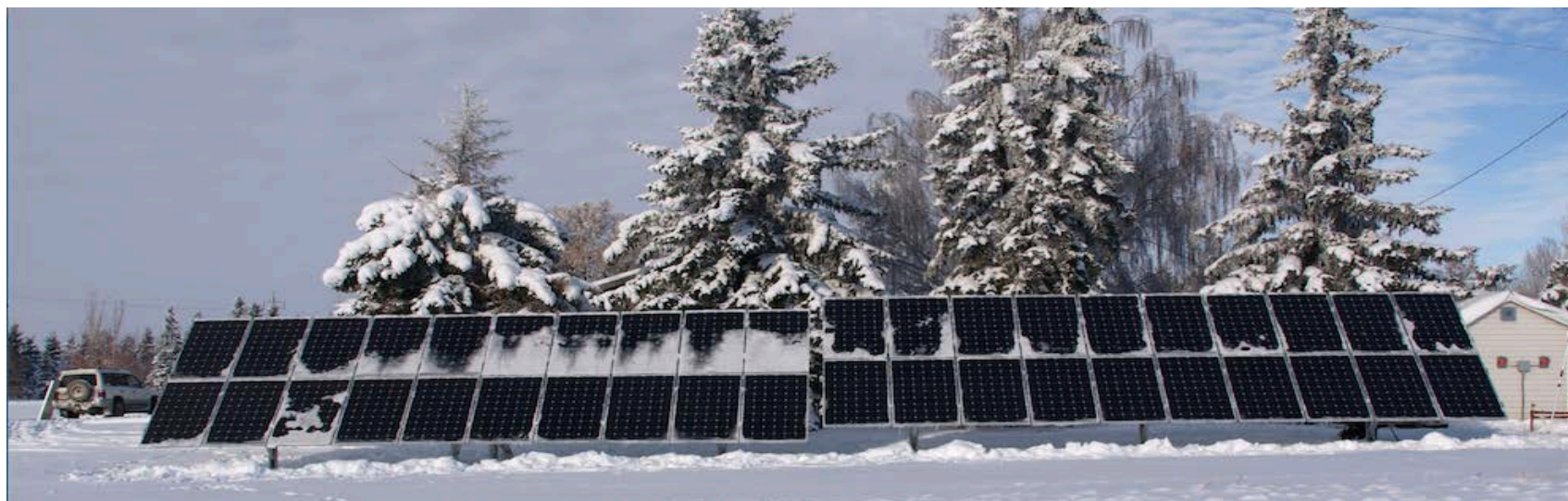
It was discovered in 1839 and explained by Albert Einstein in 1905. When solar energy strikes a semiconductor with one positive and another negative side (such as silicon), electrons are knocked loose from the atoms in the semiconductor material. Electron movement creates a current.

**Solar cell efficiency** is determined by ratio of the electric power output to the incident sunlight power. Current solar PV efficiencies range from 15%-20%. Shall we be concerned about wasting solar energy by using this low-efficient technology?

# PV in Far North, in Cold and under Snow

---

- Solar energy reductions at short winter days are offset by longer summer days;
- PV module will produce 29% more energy at -45C than in +25C (cell temperatures);
- For most PV systems snow results only in around 5% annual energy losses, 15% is the worst case.



# Alberta Solar Regulations - #1 Micro-generation

Since 2009 we have AB Micro-generation Regulation:

- Net-billing (export credit rate = energy charge)
- No cost for solar intermittency
- Simplified interconnection process
- Solar systems sized based on annual consumption, up to 5MW capacity

Question: Does energy storage need to be installed for grid-tie solar systems?

Answer: Under AB micro-generation regulation, electricity grid fulfill the function of the battery.

You may consider a battery in your solar power system for:

- Back-up against power outages and poor grid quality
- Off-grid solar when grid-tie is unavailable or expensive
- Shaving peak demand in commercial



# Alberta Solar Regulations - #2 Municipalities

---

Alberta Municipal Solar Program (AMSP) provides financial rebates to Alberta municipalities and community-related organizations who install solar PV on municipal buildings or land.

The scope is limited to projects that are compliant with AB Micro-generation regulation.

The rebate cannot exceed 25% of the eligible expenses and is based on installed DC capacity according to the table below.

<b>Total Installed Capacity (DC)</b>	<b>Rebate</b>
<10 kilowatts	\$0.90/Watt
10 kilowatts to <150 kilowatts	\$0.75/Watt
150 kilowatts to <2 Megawatts	\$0.60/Watt
2 Megawatts to 5 Megawatts	\$0.55/Watt

# Alberta Solar Regulations - #3 Growing Forward

Growing Forward Solar program provides funding for Alberta producers with a minimum of \$10,000 of farm commodity or livestock production income. Funding is determined by the table.

Required criteria:

- Grid-tied, not off-grid,
- Approved under Alberta's Micro-Generation Legislation,
- Positioned to optimize sunshine and minimize shading,
- Have manufacturer-warranties on: Solar modules, Racking, Inverters and/or Micro-inverters,
- Producing power that is used in the production of a primary commodity, and
- Purchased after April 1, 2013, including already-installed systems.

Install Type	Without an Energy Assessment	With an Energy Assessment
Solar PV Contractor-Installed	<b>\$0.45/W</b> to maximum 20% of project costs	<b>\$0.60/W</b> to maximum 25% of project costs
Self-Installed	<b>\$0.15/W</b> to maximum 10% of project costs	<b>\$0.30/W</b> to maximum 20% of project costs
Grant Maximum	100 kW or \$50,000	100 kW or \$50,000

# Alberta Solar Regulations - #4 Indigenous Communities

Alberta Indigenous Solar Program ( AISP ) is a pilot program that provides grants to Alberta Indigenous communities or organizations to install solar PV systems:

- 2KW to 1MW solar DC capacity, only roof-top installations are currently allowed;
- Installations must be completed within 1 year of signing the grant application;
- Program opened in October 2016 and is first come first serve until funding is exhausted;
- AISP provides funding upto 60% of eligible costs up to a max of \$200,000 per project;





# Alberta Solar Regulations - #5 Solar Rebate (expected)

---

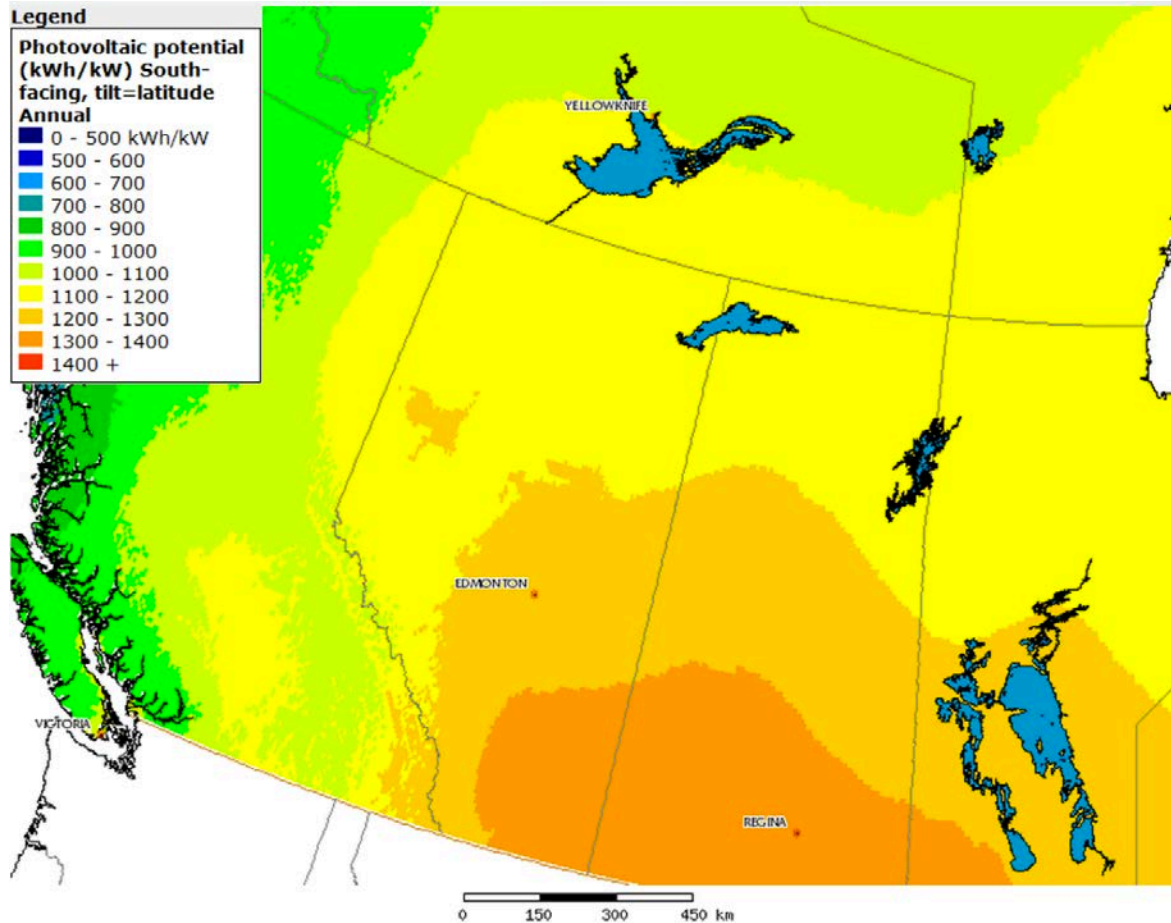


It is expected to be 2-year solar rebate program for residential and commercial solar installation and be limited to \$36 million. The program will be managed by a third-party.

The program is anticipated to cover up to 30% of the solar installation costs or 75 cents per watt of installed capacity for residential solar and 25% for commercial solar systems starting as of summer 2017.

The program details are expected to be announced this spring with the systems installed after announcement to be grandfathered.

# Solar Potential in the Northern Alberta

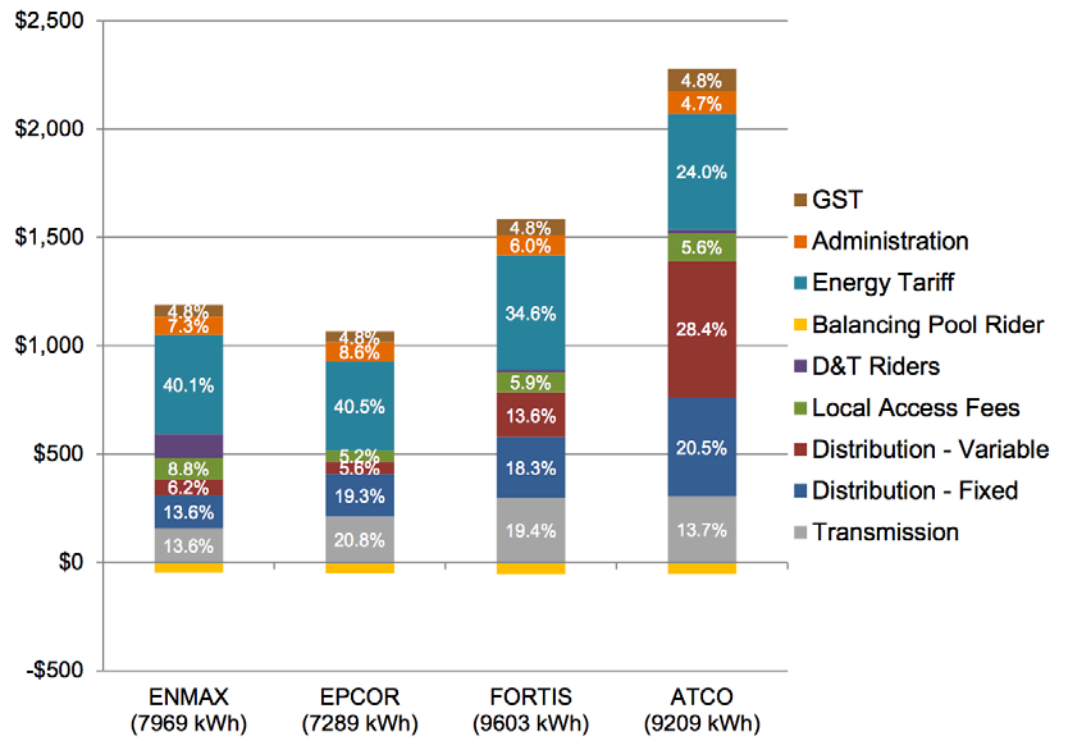


Solar potential for solar South-facing array at latitude tilt:

Regina	1361 KWh/KW
Edmonton	1245 KWh/KW
Peace River	1200 KWh/KW
Athabasca	1200 KWh/KW
Germany	950 KWh/KW

# Other Solar “Benefits” for Solar the Northern Alberta

Figure 2.1 – Typical Detached Home Annual Total Regulated Electricity Bill in 2015 by Service Zone (Annual Consumption in kWh)



# Economic Business Case for the Northern Alberta

2015 ATCO Total Bill Charge:  $\$2,300/9,209\text{KWH} = \$0.25/\text{KWh}$

Alternative

Off-grid solar with levelized cost of  $\$0.25/\text{KWh}$

2015 ATCO Variable Rate Captured by Grid-tie Solar =  $\$0.129/\text{KWh}$  ( assuming 60% delivery offset)

Average residential (rural) grid-tie PV system 7.2KW @  $\$20,000$  (or  $\sim\$2.7/\text{W}$ ) installed.

	No support	Expected rebate (30%)
Levelized cost	$\$0.089/\text{KWh}$	$\$0.063/\text{KWh}$
Payback	17 years	12 years
IRR	5%	9%



# Northern Alberta Success Stories #1

85KW Solar Carport for RMWB South Operations Center with EV charging station



# Northern Alberta Success Stories #1

**SOC** - [View System Summary](#) Inverter-Direct

Day [Week](#) [Month](#) [AC Energy](#) [AC Power](#) [AC Voltage](#) [AC Current](#) [DC Voltage](#) [DC Current](#)

<< < > >> Now: Wed Mar 22, 2017 6:49 pm EDT

May 4 2016  **AC Energy- 322 days ago [Wed May 4, 2016 EDT]**

Inverter	322 days ago	Lifetime	Timestamp
inv#1 11601412044 PVI 28TL	114.6 kWh	39106.6 kWh	[11:15:32 pm]
inv#2 11601414023 PVI 28TL	116.1 kWh	40192.1 kWh	[7:23:53 pm]
inv#3 11601416040 PVI 28TL	117.1 kWh	39753.1 kWh	[11:15:32 pm]

**\*\* Note: Each colored block represents time-span of 1 hour. \*\***

AC Energy  inv#1  inv#2  inv#3

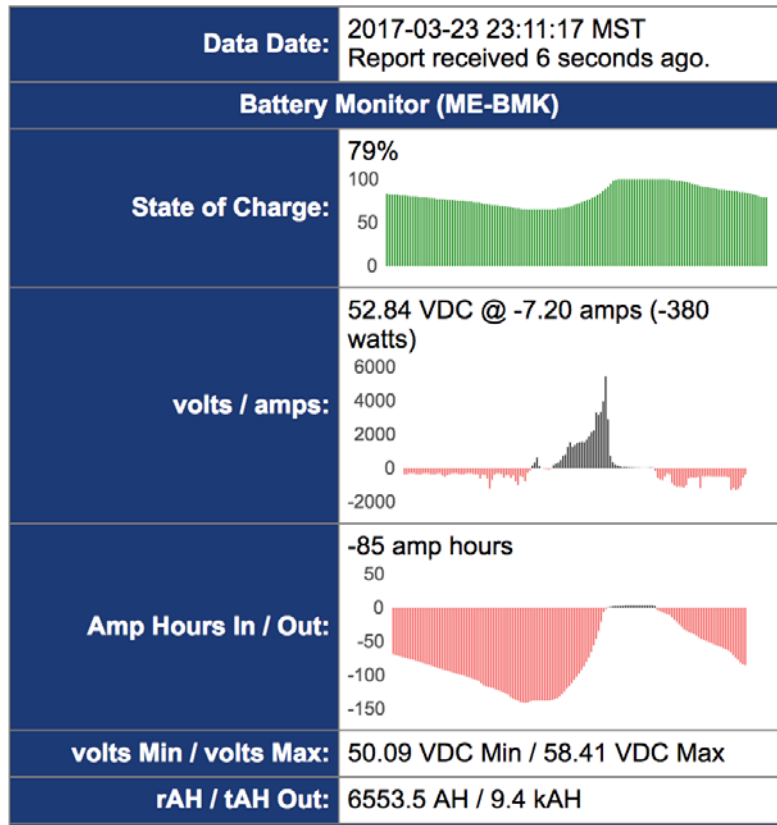
## Northern Alberta Success Stories #2

Bonneville 8KW off-grid with 21KWh li-ion batteries



# Northern Alberta Success Stories #2

Now



Battery-based systems opportunities:

- Residential: competitive to high delivery charges
- C&I: Optimization of peak demand charges
- Remote monitoring of off-grid systems
- Costs of batteries will continue declining



---

## Contact info

10171 Saskatchewan Dr,  
Edmonton, Alberta T6E 4R5

**Phone: (780) 566-6058**

Email: [mi@dandelionrenewables.com](mailto:mi@dandelionrenewables.com)

Website: [www.dandelionrenewables.com](http://www.dandelionrenewables.com)



**Dandelion  Renewables**