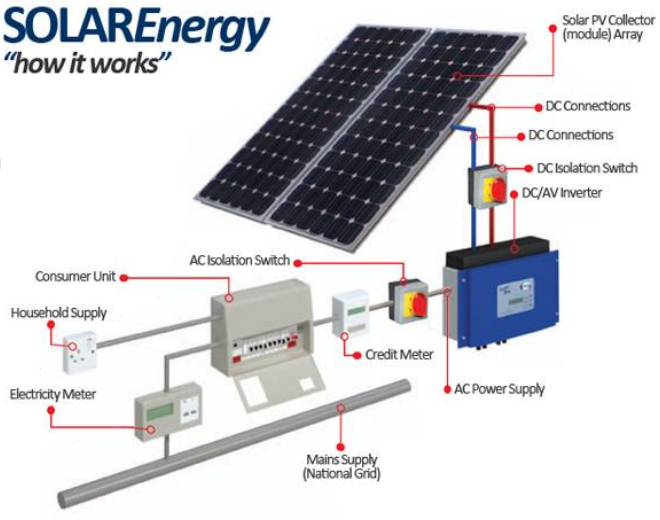
Noca Clean Energy is a Canadian-based clean technology company that is manufacturing an electronic device called the EFE Power Booster. The EFE Power Booster is designed to increase the output of a Photovoltaic (PV) panel by an average of 45%. The EFE Power Booster is compatible with all commercially available PV panels used in both small (household), medium (commercial), and large (solar farm) PV systems.

How Photovoltaic Cells Produce Electricity

Solar panels are made up of Photovoltaic cells that have the ability to absorb solar energy (photons) and convert them into useable energy. As trillions of photons (particles of light) hit the surface of a solar panel, a small portion of electrons are knocked free from their atoms and can subsequently be used to generate a flow of electricity. Unfortunately, the majority of electrons collide with each other and this creates excess heat. These heat emissions result in a significant loss of efficiency.



How does the EFE Power Booster Work?

Noca Clean Energy and their partners has designed an Electronic Circuit Unit (ECU) which acts as the main operating system within the EFE Power Booster. The ECU creates a horizontal magnetic flux that promotes and facilitates the linear flow of electrons. This prevents electrons from interfering, obstructing, or colliding with other electrons. As a result, electrons move efficiently without creating excess heat
and flow freely to the inverter where they are converted to useable output.

Connecting the EFE Power Booster to a PV Power System

The EFE Power Booster is connected directly to each PV panel in the array. Therefore, a PV array consisting of 100 panels would require 100 EFE Power Boosters to achieve an overall average system output increase of 45%. The EFE Power Booster is compatible with all PV panels on the market and is ideal for both roof-top and ground PV systems for residential, commercial, or large-scale solar farm applications. The EFE Power Booster can be integrated into new PV systems or easily retrofitted into existing installations

Case Studies: Return On Investment (ROI) for the EFE Power Booster

What Follows are two case studies that illustrate the ROI of adding EFE Power Boosters to a solar project. Courtesy of NREL, a national laboratory of the U.S. Department of Energy, the PVWatts Calculator was used to demonstrate the annual electricity generation of two different solar energy generation scenarios described in detail below. It is worthwhile to mention that the PVWatts Calculator takes into consideration system losses (soiling, shading, snow, wiring, light degradation, availability etc.), an overall PV module efficiency of 16%, DC to AC conversion, light hours, weather patterns, and more. A full description of all parameters, metrics, as well as their meanings can be found here: http://pvwatts.nrel.gov/

Case Study 1: ROI for Residential Solar Applications

As of January 1, 2016 the new Feed-In-Tariff published by the Ontario Power Authority (OPA) stipulates that homeowners in Ontario who install solar panels on their roof are guaranteed $0.242/ kWh[1] for as much energy as they can produce. The example below illustrates how this program can result in significant income earnings by installing a 10kW system in Toronto, Ontario, Canada.

- Nameplate Capacity: 10kW
- Number of solar panels: 40, 250 watt panels
- Annual Electricity Generation: 11,939kWh
- Annual Income: $2,889
- Cost of System: $35,000[2]
- Length of Contract with OPA: 20 years

Total Profit after 20 years: (20 x $2,889) - $35,000 = $22,780

Although income can be earned with PV installation in the above example, the income earned can be substantially increased by retrofitting this PV solar system with the EFE Power Booster which will increase the output of each panel by 45%. The following calculations illustrate the income increase for a conservative estimate.

Conservative estimate (45% output increase) with EFE Power Boosters
Cost of Power Booster for entire system: $200 x 40 panels = $8,000
Annual Electricity Generation: 11,939kWh + 45% = 17,312kWh
Annual Income: 17,312kWh x **$0.242/kWh** = $4189
Change in Annual Income: $4,189- $2,889 = $1,300
Payback on Power Boosters: $8,000 (total cost) / $1,300 (annual profit) = **6.15 years**
Total profit after 20 years: (20 x $4,189) - $43,000 = $40,780

[1] This rate is for all roof-top PV systems in Ontario with a capacity of 10kw - 100kw. See: http://fit.powerauthority.on.ca/sites/default/files/version4/FIT-Price-Schedule-2016-01-01.pdf
[2] Estimated system cost taken from: http://solardirectcanada.com/solarpowersystems.php
Note: these values are approximate; every installation is unique.

Case Study 2: ROI for a 50MW Solar Project

- Nameplate Capacity: 50MW
- Annual Electricity Generation: 59,697,176kWh
- Annual Income: 59,697,176kWh x **$0.347/kWh**[3] **=** $20,714,920
- Length of Contract with OPA: 20 years

Total income after 20 years: (20 x $20,714,920)= $414,298,400

Conservative estimate (45% output increase) with EFE Power Boosters
Cost of Power Booster for entire system: $200 x 200,000 panels = $40,000,000
Annual Electricity Generation: 59,697,176kWh + 45% = 86,560,905kWh
Annual Income: 86,560,905kWh x **$0.347kWh** = $30,036,634
Change in Annual Income: $30,036,634- $20,714,920= $9,321,714
Payback on Power Boosters: $40,000,000 (total cost) / $9,321,714 (annual profit)
= 4.29 years
Total Additional Income after 20 years: (20 x $9,321,714) = $186,434,280

Environmental Considerations

Affordability is no longer a point of contention when considering solar power as a means for power generation. Competitive pricing has bumped up the ROI of a PV installation. It is evident that energy derived from the sun is not only environmentally advantageous but now economically viable as well. At this point, the cost of a PV installation is so competitive that the environmental benefits of solar power are quickly becoming a bonus of the technology instead of being the only advantage. Considering the data generated in the aforementioned case study, it is worthwhile to mention the environmental benefits linked this kind of PV arrangement.

The bulk of the environmental footprint of a PV technology originates during material sourcing, manufacture, and delivery. Once installed, PV systems have a minimal contribution to global CO2 emissions. The EFE Power Booster is a retrofit that enables the production of more energy without increasing the environmental footprint; in this case, effectively offsetting the carbon footprint of 45% additional panels.

A large-scale, 50MW solar farm in Toronto, Ontario, Canada would generate approximately 59,697,176kWh of electricity per year. As examined, if one increases this output by 45% using EFE Power Boosters, the same solar farm would produce 86,560,905kWh of electricity, only with considerably less carbon emissions per kWh. If one applies this metric to the annual 10 932 kWh[4] required by the average North American home, then the difference of 45%, or 26,863,729kWh, amounts to the annual electricity required to power over 2,457 North American homes.

[3] The Ontario Green Energy Act offers $0.347/kWh for solar installations over 5MW. Source: http://www.energy.gov.on.ca/en/fit-and-microfit-program/2-year-fit-review/appendix-4/
[4] Source: https://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3