



04th Feb 2016 Waterloo Institute for Sustainable Energy WISE

Electric Vehicle (EV) Charging



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Renewable Energy Technology

Agenda:

1. Who we are
2. What is driving EVs
3. EVs presently available in Canada
4. Level 1, level 2 and level 3 charging stations
5. Charging experience within the Windsor Essex EV Association WEEVA membership
6. Solar carports for EV charging
7. Outlook
8. Q & A





Renewable Energy Technology

1. Who we are Green Sun Rising:

Windsor's longest operating solar company.

Founded in January 2008, before the Green Energy Act.

Professional engineering company, for solar PV and solar thermal.

Over 1,600 kW of implemented grid-connected PV systems, over 2.5 MW of solar mounting systems, and ST.

Supported by leading solar manufacturing companies.





Renewable Energy Technology

Green Sun Rising:

Benefiting from the decades of solar engineering know-how of our German and Austrian partner companies, we started off where they left.

We use professional engineering tools and proven methodologies in our designs.

Over 220 successfully completed solar system projects in Canada to date.



The RET-Center in Windsor:

We created the Renewable Energy Technology Center in Windsor, by converting a closed automotive tooling factory, renovating it and “recycling” it into new life. We operate the large showroom, with inside and outside operating solar systems and solar demonstrations, our office, the warehouse, and the manufacturing shop, where we also manufacture solar mounting systems.

We provide training, seminars, support the visits of groups, hold events, and receive school classes etc.

We have provided formal solar training programs for the University of Windsor, and the St Clair College.



2. What is driving EVs?

Clean Air Legislation:

California’s air resource board (Carb) has mandated that by the model year 2025 at least 15.4% of new vehicles sold in California must be Zero Emission Vehicles (ZEV).

Model Years	Total ZEV Percent Requirement	Minimum ZEV floor
2018	4.5%	2.0%
2019	7.0%	4.0%
2020	9.5%	6.0%
2021	12.0%	8.0%
2022	14.5%	10.0%
2023	17.0%	12.0%
2024	19.5%	14.0%
2025	22.0%	16.0%

To date 9 additional states have adopted this mandate (Connecticut, D.C., Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, Vermont)



2. What is driving EVs?

Fuel Efficiency Standards:

New Corporate Average Fuel Efficiency (CAFE) standards have been significantly increased:

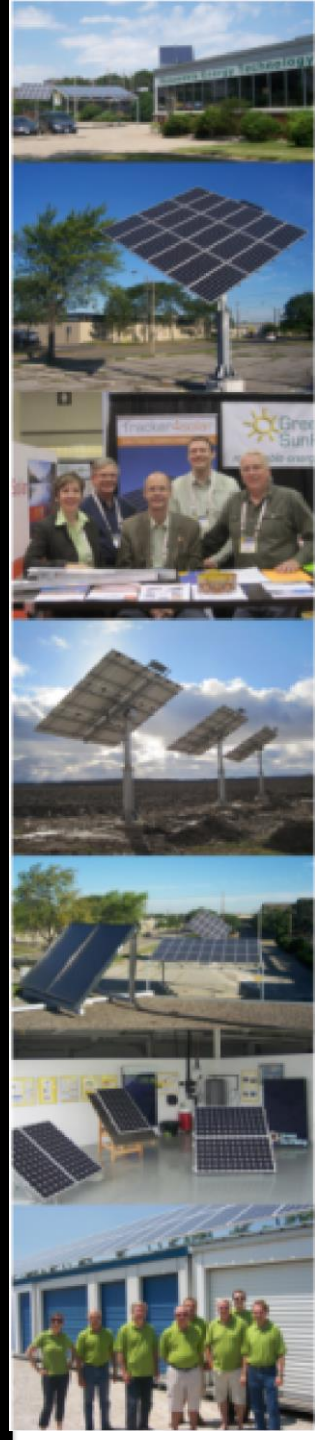
example compact passenger car:

2015	39 miles/gallon (m/g)
2020	49 m/g
2025	60 m/g

Quote from Bob Lutz:

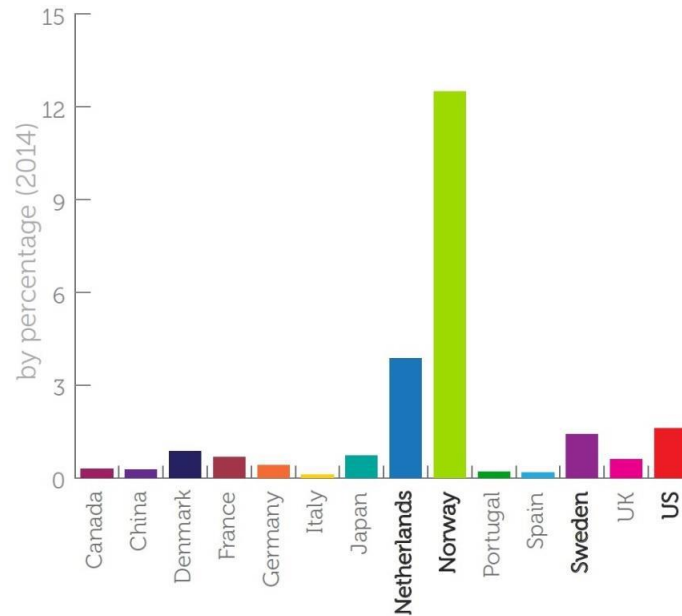
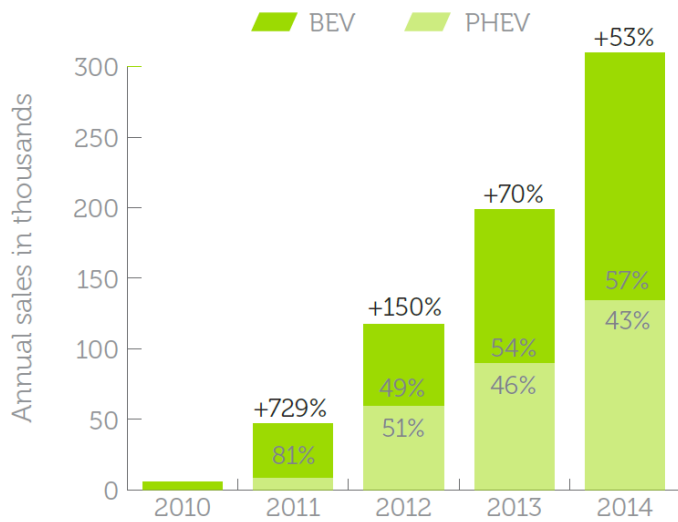
The electrification of the automobile is inevitable.

Future carbon emission reduction targets (eg 80% off carbon by 2050)



2. What is driving EVs?

Country Specific Incentives:



Global EV Outlook 2015 by the International Energy Agency



3. EVs presently available in Canada:

BMW i3	21.4 kWh	160 km
Cadillac PHEV	16.5 kWh	55 km
Chevrolet Spark	21 kWh	132 km
Chevrolet Volt	16.5 kWh	61 km
Ford C-Max Energi PHEV	7.6 kWh	34 km
Ford Focus Electric	23 kWh	122 km
Ford Fusion Energi PHEV	7.2 kWh	34 km
Mitsubishi MiEV	16 kWh	100 km
Nissan Leaf	24 kWh	121 km
Panamera S E PHEV	9.4 kWh	36 km
Smart ForTwo Electric	17.6 kWh	109 km
Tesla S	60 kWh	224 km
Tesla S	85 kWh	426 km
Toyota Prius PHEV	7.6 kWh	18 km
and more are coming.....		



3. example MiEV:

Electric Cars | Electric Cars Available in Canada | Benefits of Driving Electric | Incentives

Electric Cars Available in Canada

Mitsubishi i-MiEV

The i-MiEV has a very efficient electric motor and battery management system; in combination with its light weight overall, these allow the i-MiEV to be the most efficient EV on the market thus far.

As the Mitsubishi is intended to be an urban commuter car, it is the model of basic transportation with few luxury features available. However, this also means that the i-MiEV is one of the lowest priced EVs available, making it a very popular option for fleet duty.

STARTING PRICE
\$27,998 MSRP

[Manufacturer Website](#)



SPECIFICATIONS

EMISSIONS/COST TO DRIVE

The Car

CATEGORY
BEV

DRIVE TRAIN
RWD

TORQUE
145 lb-ft

PASSENGERS
4

SAFETY FEATURES

- RISE (Reinforced Impact Safety Evolution) body construction and front-end crumple zones.

CARGO SPACE
13.2 cu ft.

WEIGHT
2,545 kg

DOORS
5

Unique Features

CHAdemo DC Quick Charging Port Comes Standard

Performance

HORSEPOWER
66 hp

TOP SPEED
130 km/h

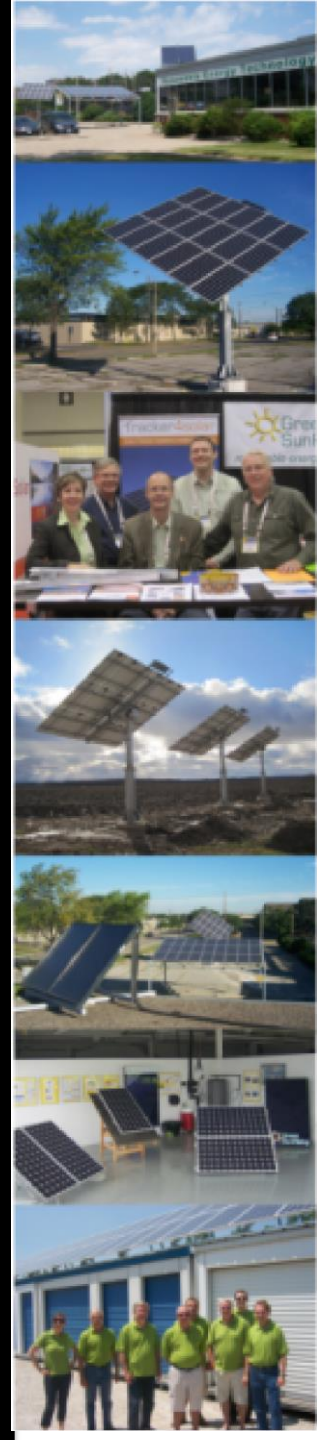
RANGE ON ELECTRIC
100 km

ACCELERATION (0-100KM/H)
11.5 s

TOTAL RANGE
100 km



3. example MiEV:



3. example Volt

Electric Cars Available in Canada

Chevrolet

VOLT

The Chevrolet VOLT was the first PHEV to be sold in North America and is currently the best-selling electric car. This PHEV has a battery that provides about 80 km of all-electric range when fully charged before a small gas engine generator kicks-in to provide electricity for longer trips.

This 4-passenger, midsize sedan comes with all of the latest amenities, including GM OnStar system telematics to control the heat, air conditioning, charging times and other applications through a smartphone.

To locate a Chevrolet VOLT dealership near you, please contact **General Motors' Customer Care Centre at 1-888-446-2000**.

STARTING PRICE

\$39,590 MSRP

[Manufacturer Website](#)



SPECIFICATIONS

EMISSIONS/COST TO DRIVE

The Car

CATEGORY
PHEV

DRIVE TRAIN
FWD

TORQUE
294 lb-ft

PASSENGERS
4

SAFETY FEATURES

- OnStar Automatic Crash Response
- Lane Keep Assist
- Rear Cross Traffic Alert
- Forward Collision Alert

ELECTRIC MOTOR
111 kW

CARGO SPACE
10.6 cu ft.

WEIGHT
3,543 kg

DOORS
5

Unique Features

- Chevrolet MyLink including 178 mm touch-screen
- Gracenote music database and Stitcher SmartRadio compatibility
- Built-in Wi-Fi Connection
- OnStar Remote Link

Performance

HORSEPOWER
149 hp

TOP SPEED
160 km/h

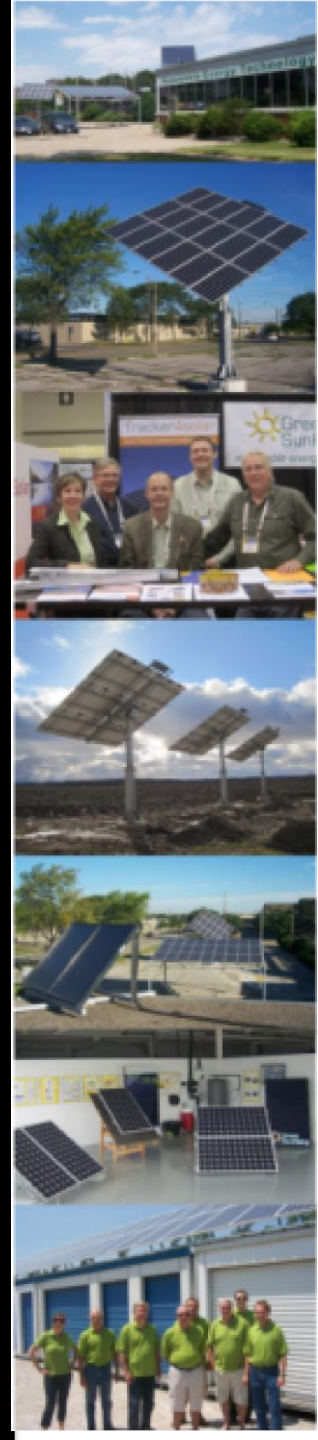
RANGE ON ELECTRIC
85 km

ACCELERATION (0-100KM/H)
8.4 s

TOTAL RANGE
675 km



4. Solar PV for off-grid Systems – example solar bikeport and solar bench for laptop and E-bike charging



4. Solar PV for off-grid Systems – example solar bench at the Windsor University :



4. Solar PV for off-grid Systems – example solar bar



www.GreenSunRising.com



4. EV charging stations



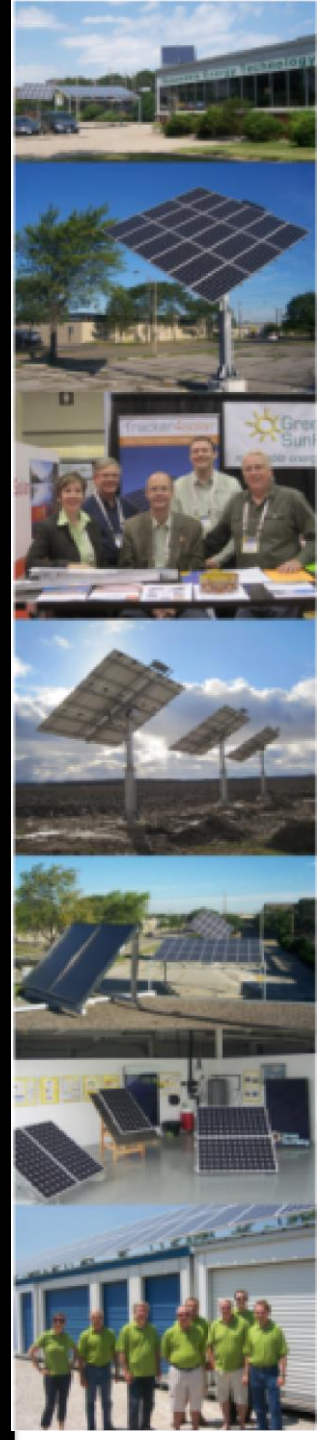
www.EV4solar.com
www.RET-Center.com
www.WEEVA.ca



4. EV charging stations

- Level 1: 120VAC 1-phase
- Level 2: 240VAC 1-phase
- Level 3: 3-phase 208VAC into quick charger DC

EV battery capacity:		Range:
GM Volt	16 kWh	60 – 80 km
Mitsubishi MiEV	16 kWh	80 – 130 km
Nissan Leaf	24 kWhs	100 – 140 km
Tesla S	85 kWhs	300 – 420 km



4. Example level-1 charging stations

level-1 charger 120 V AC supplied by OEM with the EV purchase

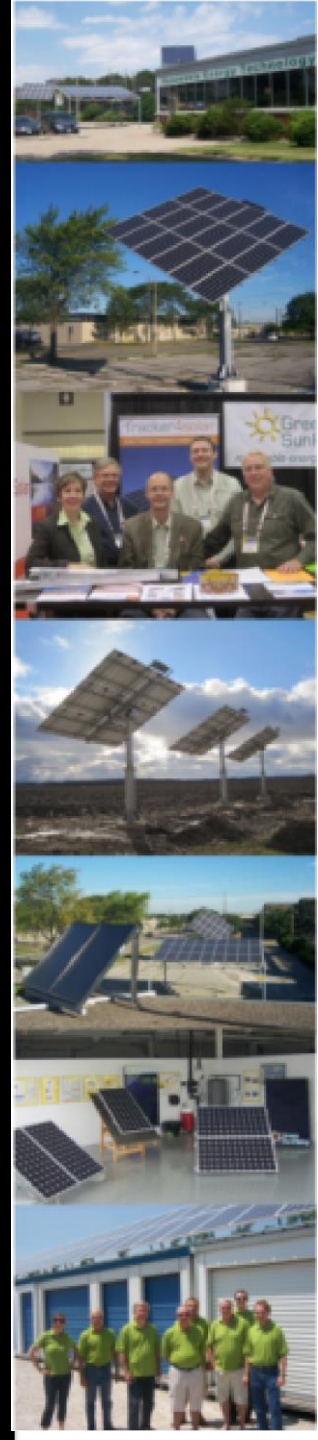


Example Mitsubishi MiEV
supplied level-1 charger 8 Amp

Standard SAE
connector for
level-1 and level-2



Example GM Volt supplied level-1
charger 12 Amp



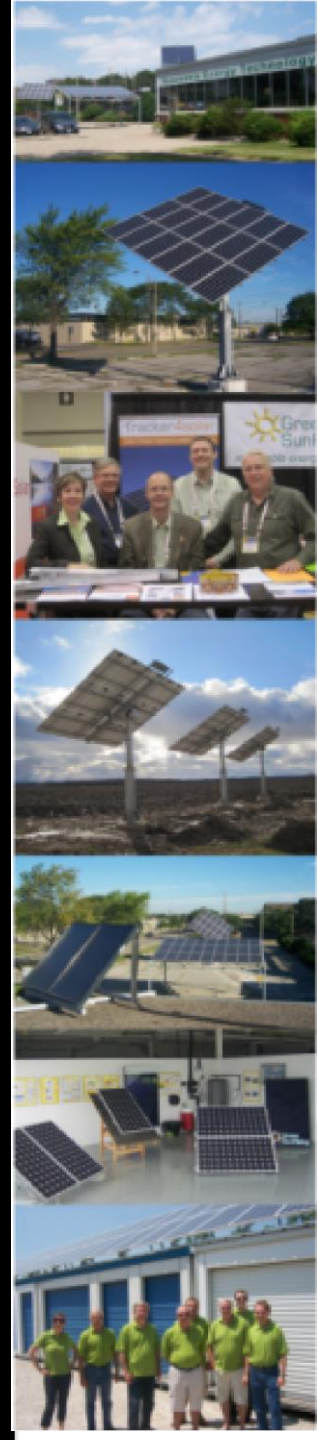
4. Example level-2 charging station

level-2 charger 240 V AC and 30 Amp charge current
Eaton commercial grade with pedestal



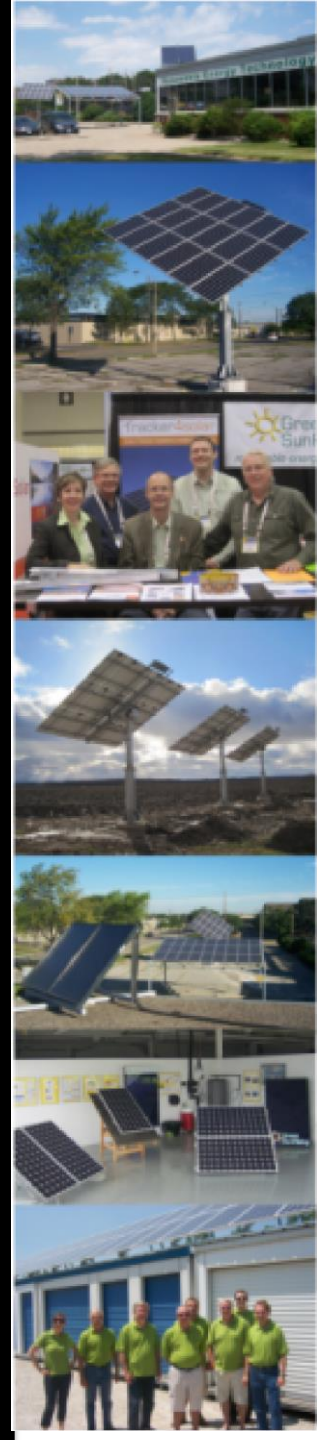
4. Example level-2 charging station

level-2 charger 240 V AC and 30 Amp charge current
Eaton commercial grade pole side mounted – winter conditions



4. Example level-2 charging station

level-2 charger 240 V AC and 30 Amp charge current
Easton commercial grade pole mounted



4. Example level-2 charging station

level-2 charger 240 V AC and 30 Amp charge current
Easton commercial grade (1st generation) pole mounted



4. Example level-2 charging station

level-2 charger
240 V AC and 30 Amp
charge current
Eaton residential grade
pedestal mounted
inside garage

below Bosch unit



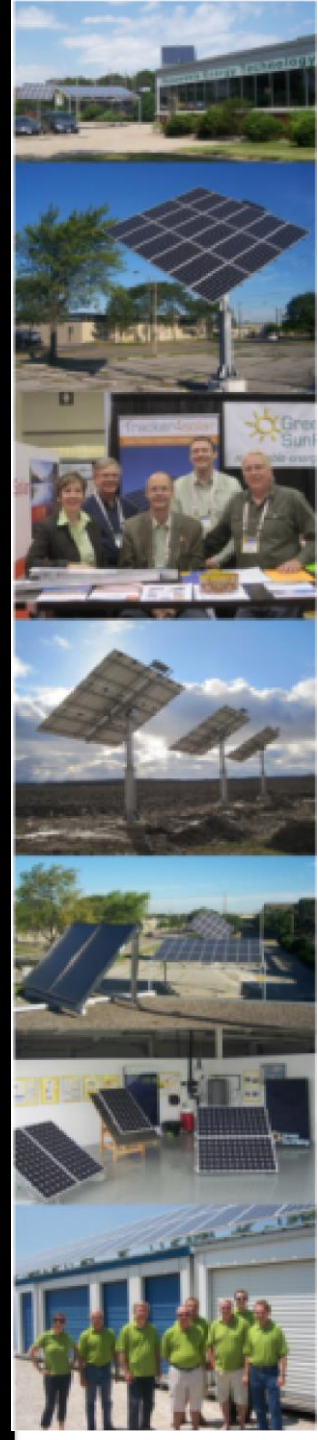
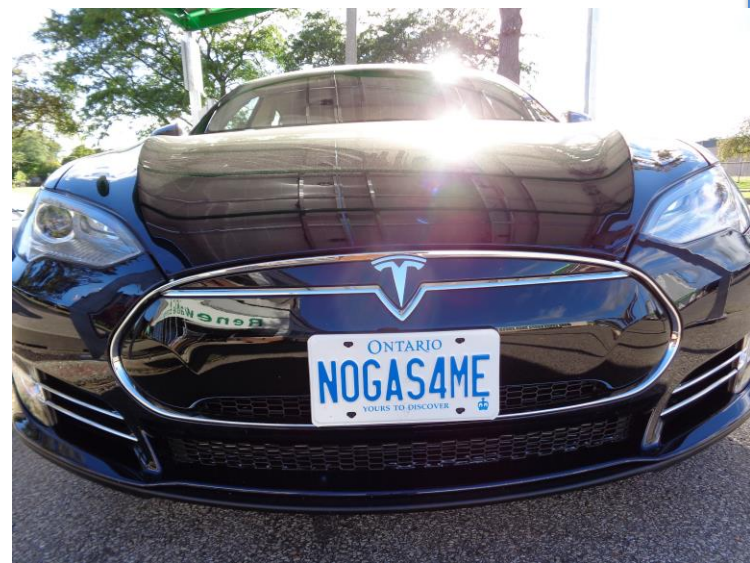
4. Example level-2 charging station

3 kW solar PV system = 15,000 km annual driving with the MiEV
left meter: consumption right meter: solar generation



4. Example level-2 charging station

level-2 charger 240 V AC and 30 Amp charge current
Eaton residential grade pole mounted



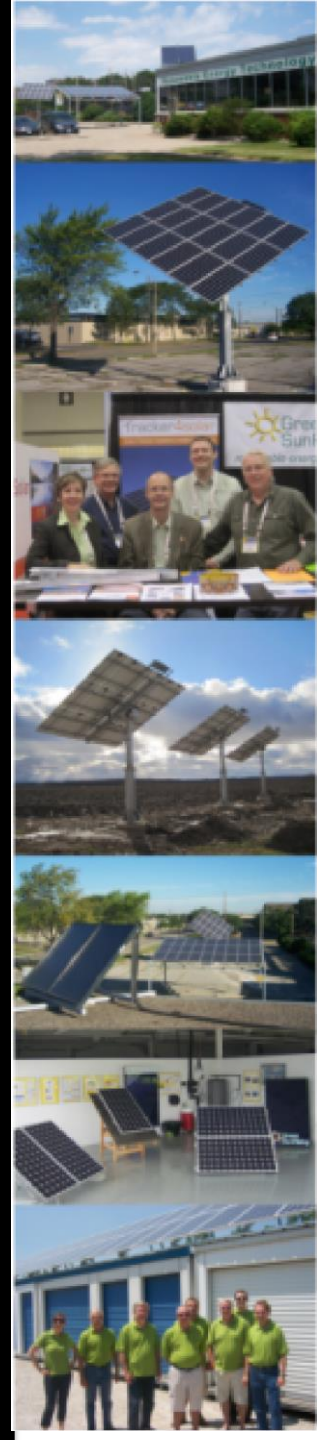
4. Example level-2 charging station

level-2 charger 240 V AC and 30 Amp charge current
at a super market pedestal mounted



4. Example level-2 charging station

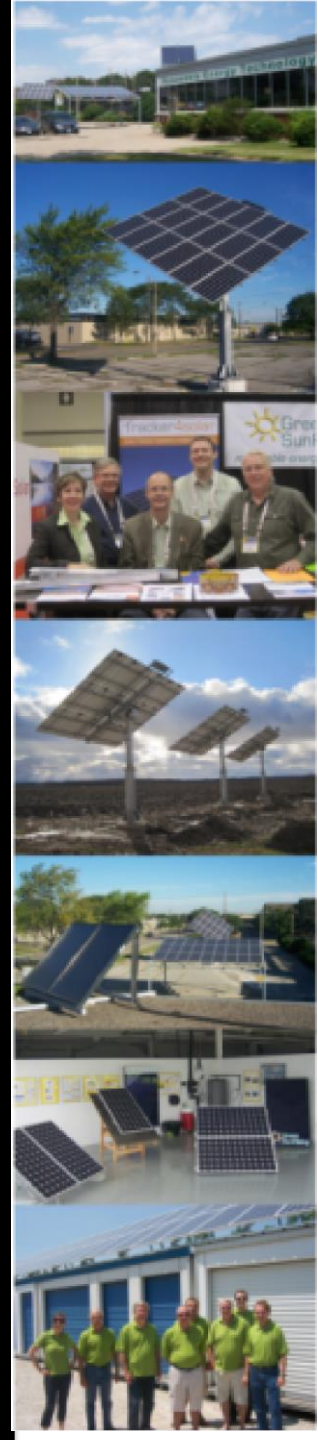
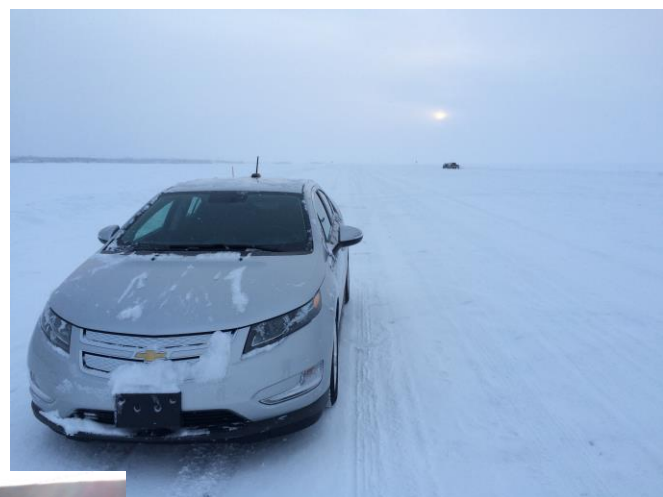
level-2 charger 240 V AC and 30 Amp charge current
examples dual head charging station



4. Example level-2 charging station

level-2 charger 240 V AC and 30 Amp charge current
example at Arctic Energy Alliance in Yellowknife NWT

from Dec 2014 to Nov 2015:
9929 km driven
533 kWh and 546 l gasoline used
(5.5 l / 100 km average) for driving;
516 kWh used for battery
conditioning while plugged in



4. Example level-3 charging station

Quick-charger over 300 V DC and over 100 Amp charge current
Nissan NA Headquarters Farmington Hills MI



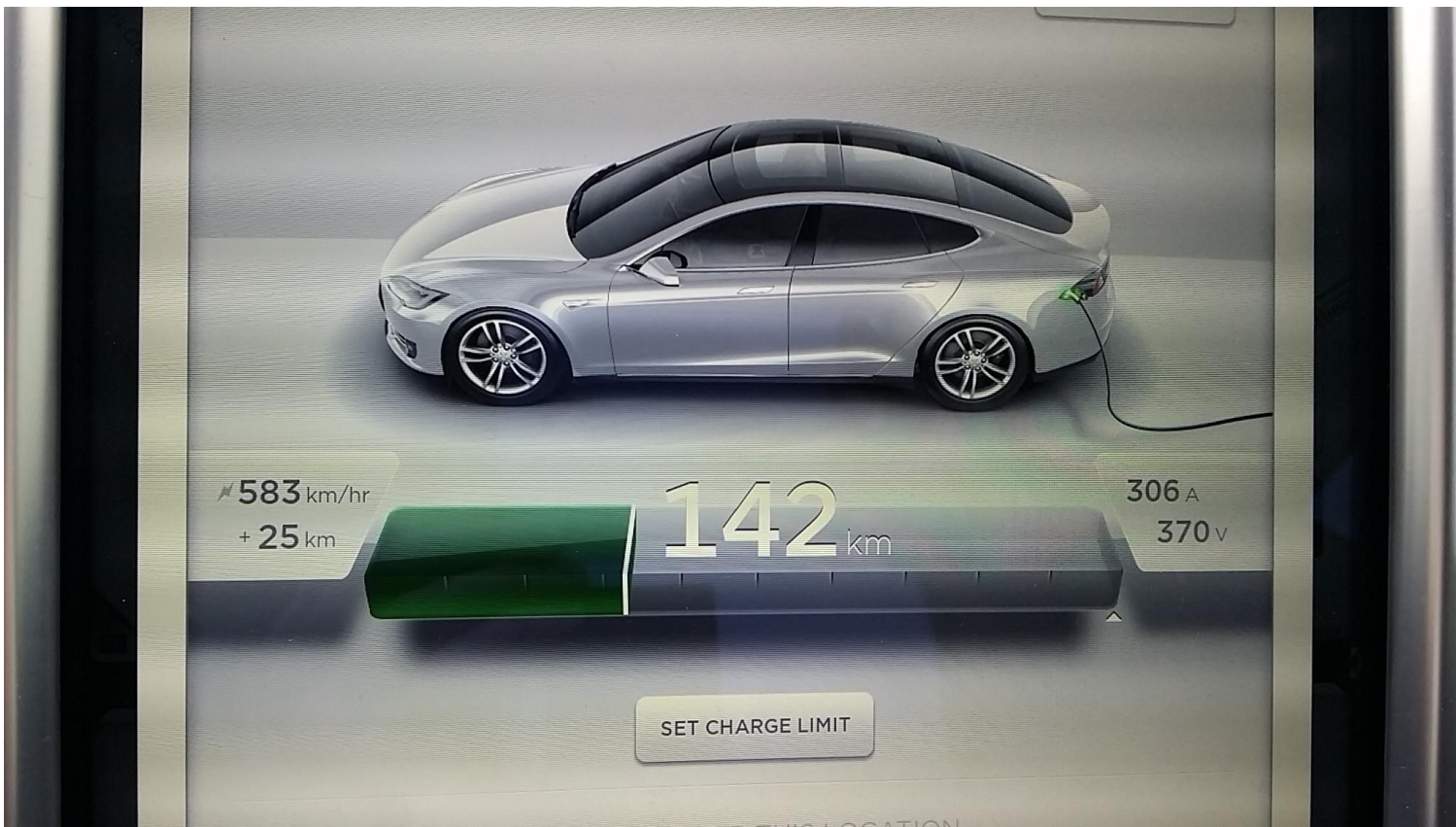
4. Example level-3 charging station

Quick-charger Tesla in Comber ON



4. Example level-3 charging station

Tesla screen shot during quick charging



4. Example level-3 charging station

Nissan Quick-charger in Toronto ON



4. Example level-3 charger plug

Level-3 charger plug next to level-2 charger plug at the Nissan Leaf
CHAdEMO connector



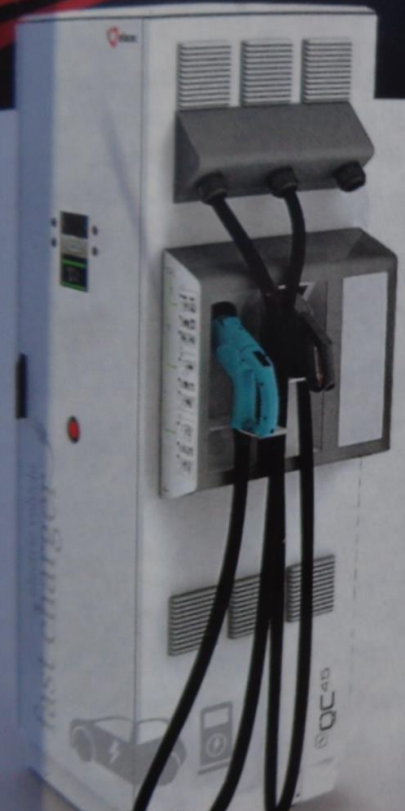
4. Example level-3 charger plug

CCS Combined Charging System



4. Example level-3 charger with dual plug


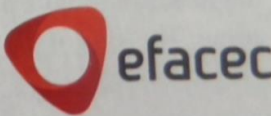
example CCS and CHAdeMO plug on one charging station

A white, vertical DC quick charger with two charging ports. The top port is for CCS and the bottom port is for CHAdeMO. A blue CHAdeMO cable is plugged into the bottom port. The unit has a small display screen and several indicator lights on the left side.

Efacec QC45 DC Quick Chargers

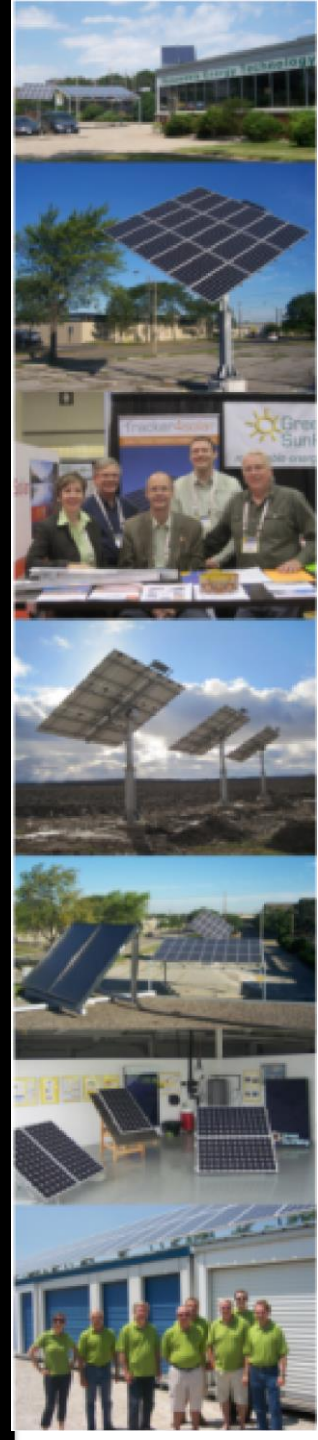
- **Over 600** DC Quick Chargers installed worldwide
- **In extreme environments** from Minnesota to the Middle East
- **0 to 80%** in less than 30 minutes
- **DC** up to 50 kW
- **Multi-standard** (CHAdeMO & CCS Combo)
- **Color screen** (for user interface)
- **High efficiency:** > 93%
- **Built-in** communications (3G; LAN)
- **Local and remote** monitoring and control

Efacec USA
2725 Northwoods Pkwy, Suite B
Norcross, Georgia 30071
(470) 395-3648
sales.eem.usa@efacec.com

The logo for QC45, consisting of a blue square with a white 'Q' and the text 'QC45' in blue.The logo for Efacec, featuring a red stylized 'e' shape followed by the word 'efacec' in a lowercase, sans-serif font.

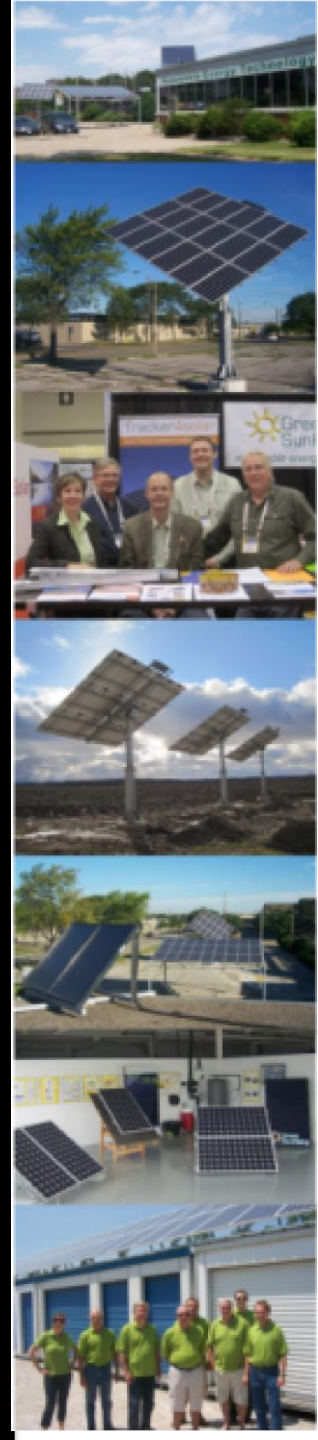
5. Charging Experience within WEEVA

charging from a solar off-grid system



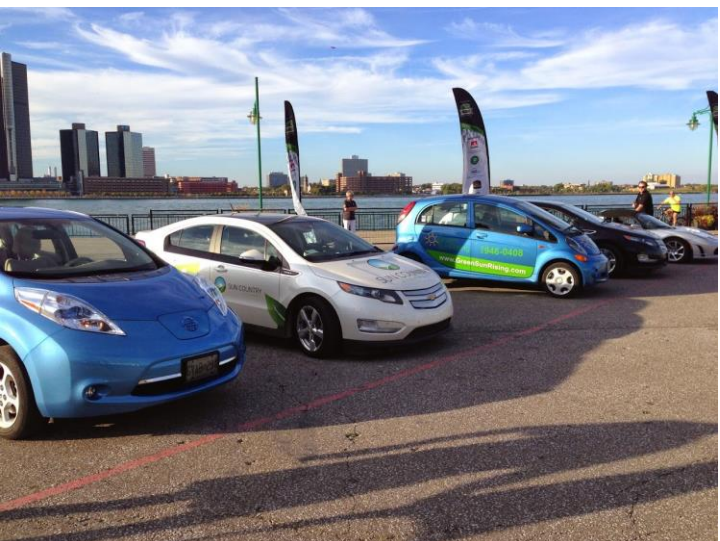
5. Charging Experience within WEEVA

driving the EV for 4 weeks with solar off-grid charging only



5. Charging Experience within WEEVA

various EV events and gatherings



5. Charging Experience within WEEVA

driving the Nissan Leaf from Windsor to Toronto, and back, by Sean Hart.

total of 675 km

used 14 charging stations on the way

charge received: 80 kWh

charge used: 96 kWh

time spent charging en route: 12 hrs 23 minutes

mainly used country roads to avoid high speed



6. Solar Carports for EV Charging

a purely electric EV requires about 3,500 to 4,500 kWh of electricity to drive about 15,000 km annually.

depending on angle and orientation a 3 kW solar PV system can generate up to 3,500 kWh annually. 3 to 4 kW of installed solar PV power (20 m² to 27 m² solar array) is enough for one EV.

solar carports make better use of existing parking areas, provide shelter and shading, and generate clean electricity.



7. Outlook

Clear trends will continue:

- zero emission transportation
- zero emission energy generation (renewable energies)
- net-zero homes and buildings
- carbon emission reduction/elimination
- climate change mitigation
- intelligent grid going multiple ways (versus central one-way); time of use charges;
- use EVs for grid storage and grid stabilization



7.0 Examples of Energy Autonomous Homes

Einfamilienhaus- SonnenEnergieHaus®



Abb. 74: Ansicht Musterhaus – Variante



Abb. 75: Außenansicht Variante

Bauherr	Weberhaus
Planer	Gerd Schallenmüller Resys AG
Fertigstellung	2010
Baukosten	k.A.
technische Daten	
Wohn-/Nutzfläche	153,04 m ²
Jahresheizwärmebedarf	10.645 kWh/a (berechnet)
Pufferspeicher	1100 Liter Paradigma Expresso
Solkollektoren	16,33 m ² (CPC-Vakuum-Röhren) Paradigma
Solare Deckung	60%, Soll: 6.315 kWh/a, Ist: 6.421 kWh/a
Nachheizung	wasserführender Kaminofen; Elektroheizstab, wasserführender Kaminofen als Option
Besonderheiten	große Photovoltaikanlage (11 kWp), Stromüberschuss im Sommer, öffentliches Netz als Speicher

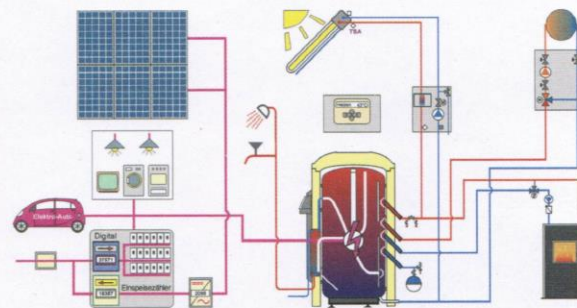


Abb. 76: Prinzipschaltbild





Renewable Energy Systems

7.0 Examples of Energy Autonomous Homes



www.GreenSunRising.com



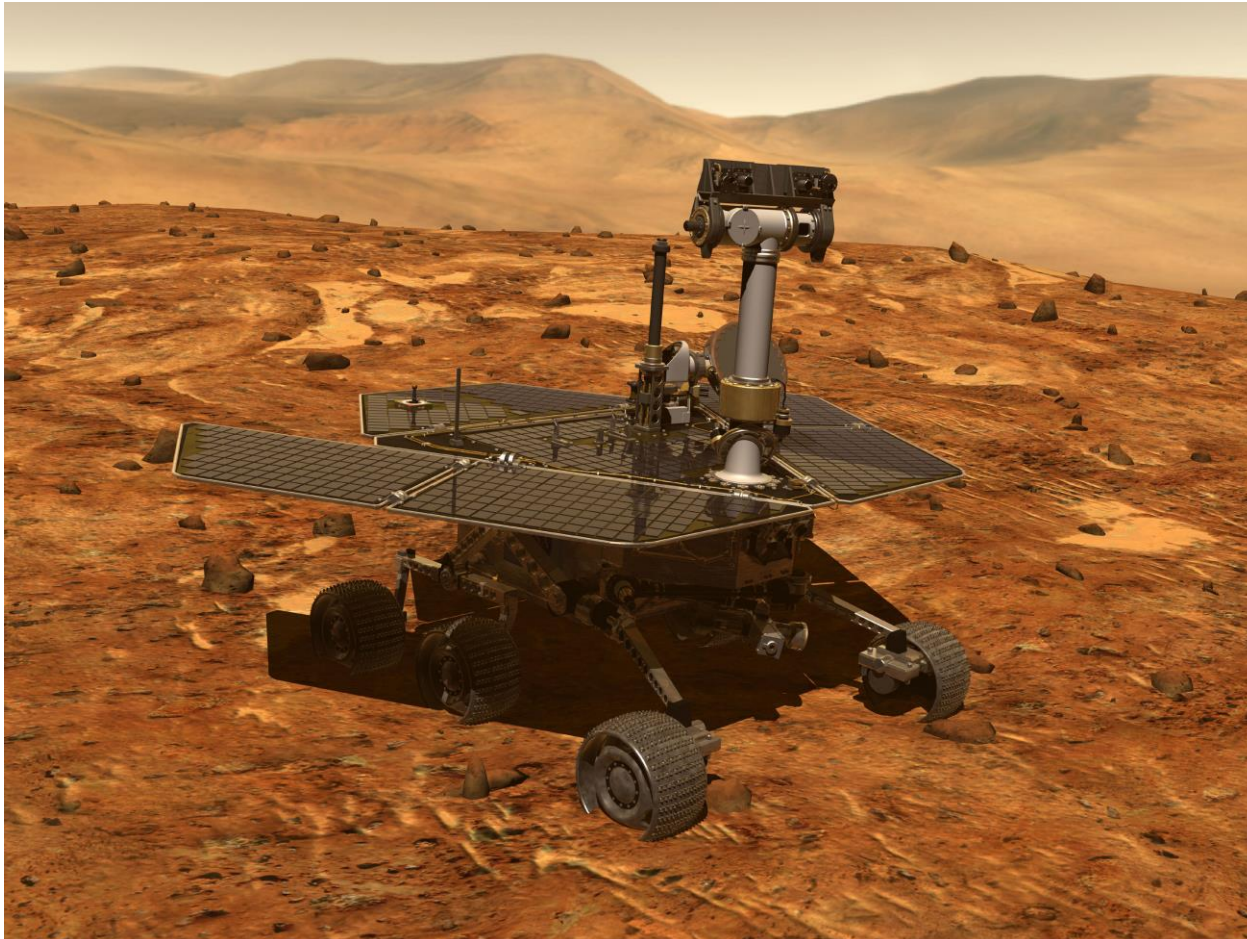
Princess Elisabeth Antarctica Station – zero emission



In Antarctica on Sunday the world's first "zero emission research station" was officially opened: The [Princess Elisabeth Antarctica](http://www.GreenSunRising.com). Commissioned in 2004 by the Belgian government, the Princess Elisabeth Antarctica (sounds like a hotel, doesn't it?) will allow 20 scientists to carry out research on climate change, and, apart from getting down there, not contribute to it while doing that research: The whole base is powered through renewable energy sources: Eight small-scale wind turbines, as well as solar panels provide all the electricity; solar thermal technology melts snow to provide water. Currently, this is the only polar research station entirely powered through renewable energy, most bases being powered by diesel generators.



Mars Rover – next gas station 78,340,000 km away



www.GreenSunRising.com

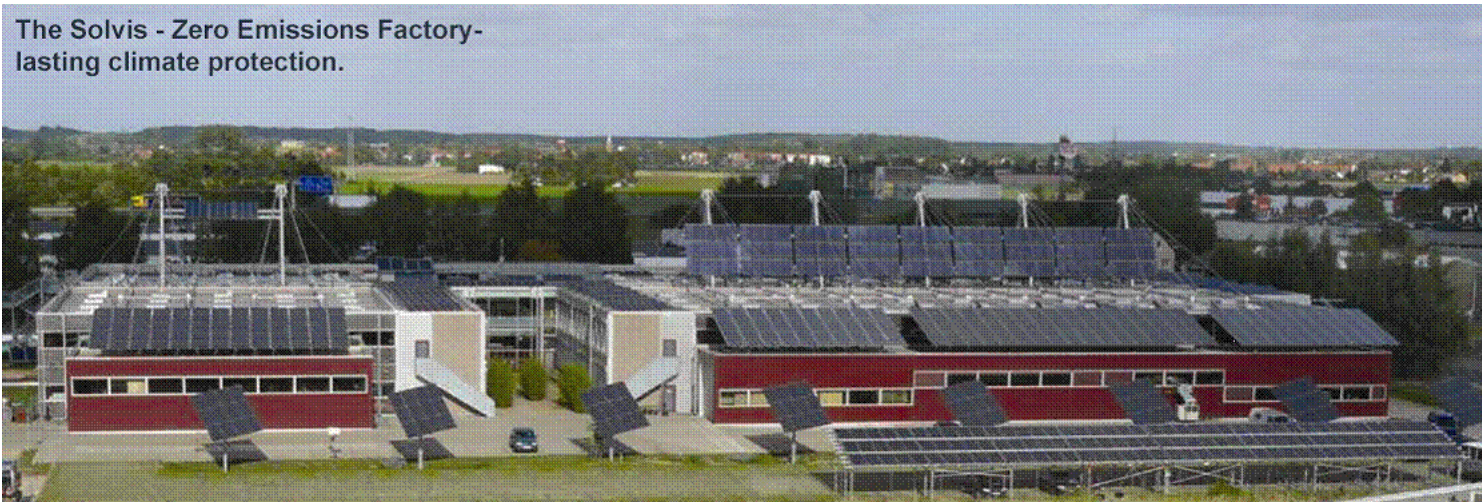




Renewable Energy Technology

8. Questions & Answers

The Solvis - Zero Emissions Factory - lasting climate protection.



RET-Center Windsor
(previous Windsor Tool
& Die Factory)
1680 Kildare Road
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www.RET-Center.com
519-946-0408

