

Net Zero Energy Living *With Heat Pumps*



The stories of
15 families'
quests for
energy
independence



using renewable
energy & electric
vehicles



- ***Motivations for Net Zero Living***

- Oil Crisis of 1979
- Awareness of causes of Climate Chaos

- ***Set Goals to be achieved***

- Build passive solar home
- Reduce carbon footprint to zero

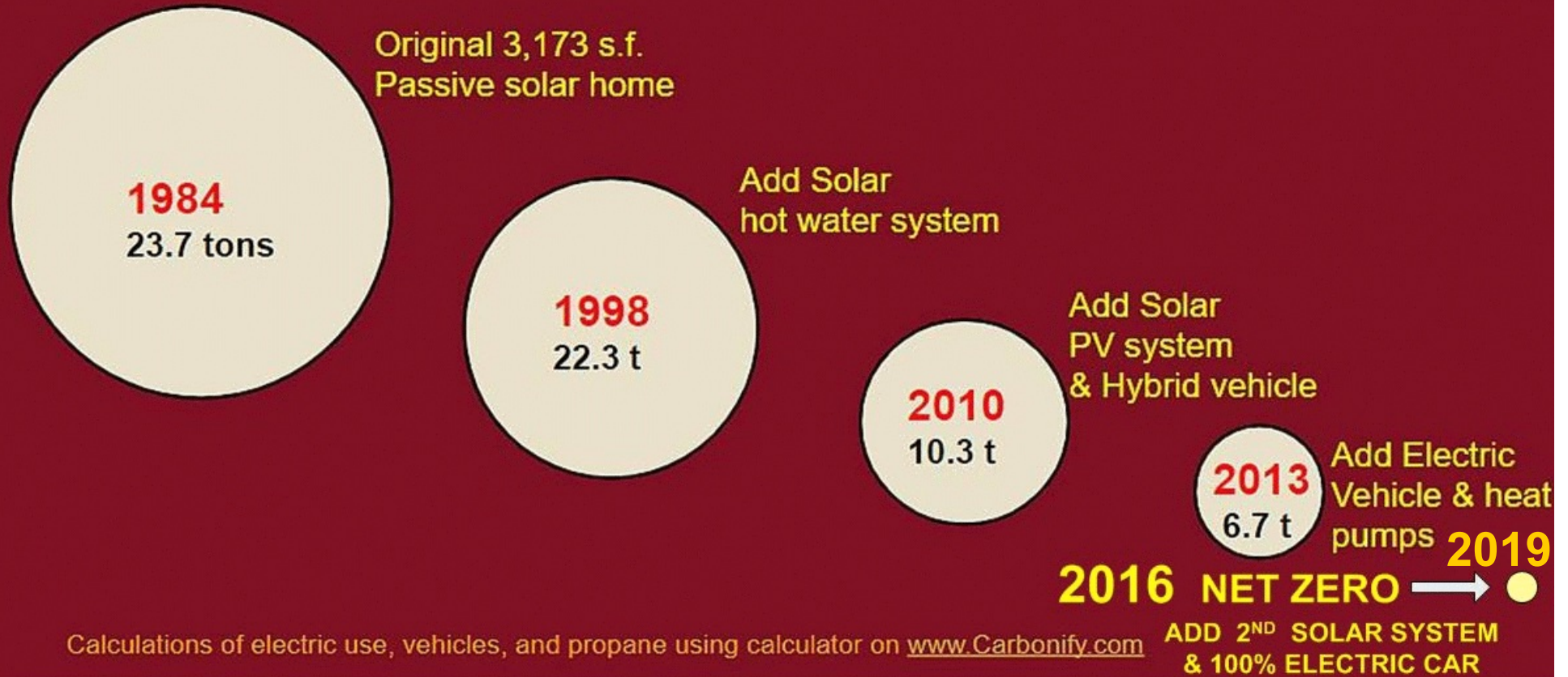
- ***Develop step by step Plan***

- Install solar hot water & photovoltaics
- Replace heating & a.c. systems
- Switch to electric vehicles

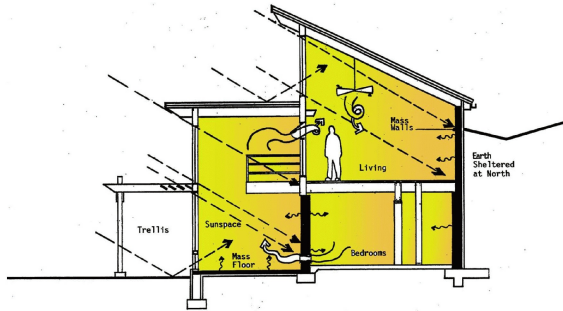
- ***Implement each step of Plan***

- Implement steps when funds and incentives are available

Reducing my Carbon Footprint over time

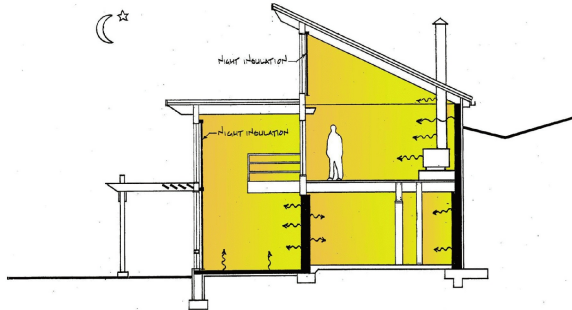


HELIOS PASSIVE SOLAR HOME



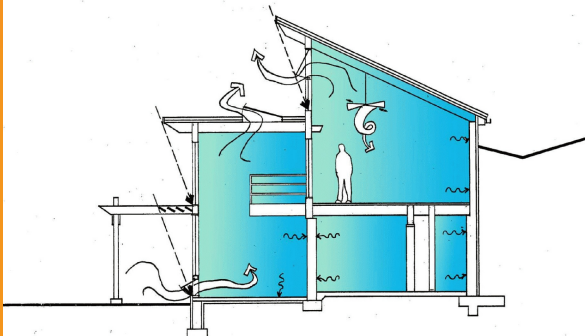
WINTER DAY

Direct solar gain to mass walls and floors.
Overhangs block out high summer sun.



WINTER NIGHT

Solar heat stored in mass walls and floors is re-radiated to the spaces.



SUMMER DAY

Natural convection induces warm air to rise and exit at high awning windows.

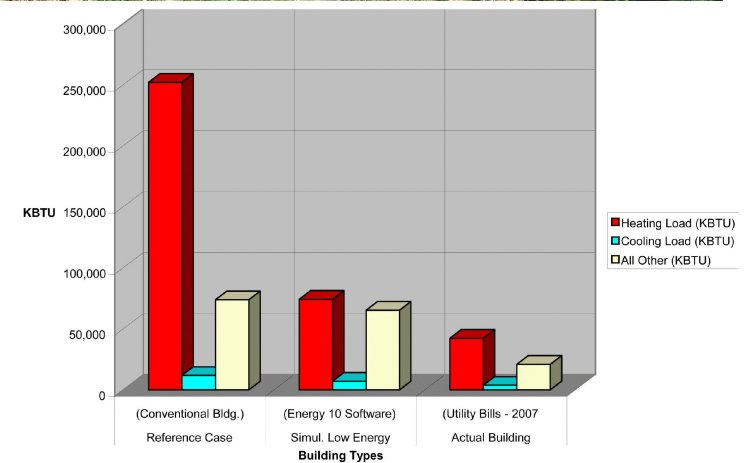
- Passive Solar
- Earth Sheltered
- 2-Story Sunspace
- Mass Walls & Floors
- Highly Insulated
- Thermal Envelope



This 3,173 sq.ft. home in Lafayette, N.J. achieves 80 percent energy savings over a similar sized conventional home due to the south facing insulated glazing, partial earth-sheltering, two-story sunspace, mass walls and floors, highly insulated thermal envelope, and solar hot water system.

SA SPECTOR ASSOCIATES
ARCHITECTS
SUSTAINABLE BUILDING SOLUTIONS

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ANNUAL ENERGY USE COMPARISON

Helios actual energy use compared with computer simulations of conventional and low-energy homes.

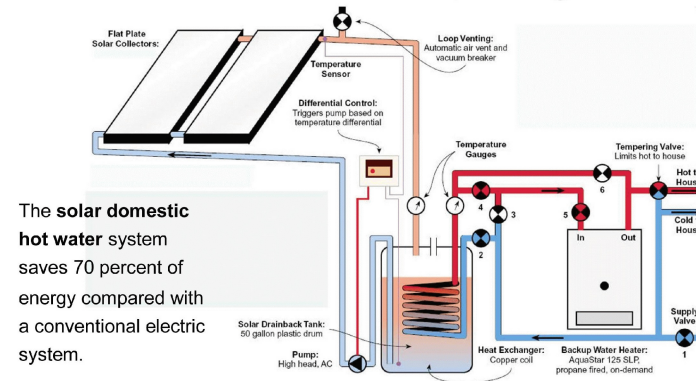
HELIOS ACTIVE SOLAR SYSTEMS



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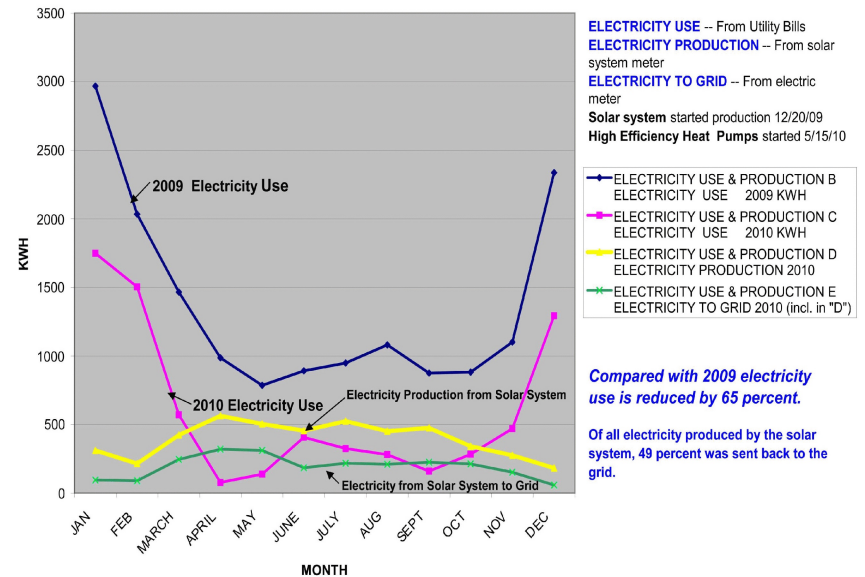


The solar domestic hot water system saves 70 percent of energy compared with a conventional electric system.

SOLAR DOMESTIC HOT WATER SYSTEM

HELIOS - ELECTRICITY USE & PRODUCTION - 2010

and Comparison with 2009 Electricity

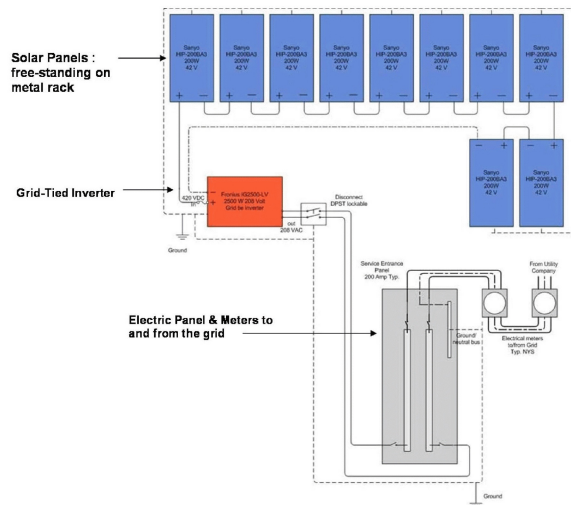


ELECTRICITY USE -- From Utility Bills
ELECTRICITY PRODUCTION -- From solar system meter
ELECTRICITY TO GRID -- From electric meter

Solar system started production 12/20/09
High Efficiency Heat Pumps started 5/15/10

Compared with 2009 electricity use is reduced by 65 percent.

Of all electricity produced by the solar system, 49 percent was sent back to the grid.



A 5 KW solar photovoltaic grid-tied system is mounted on metal frames on the flat roof and upper sloping roof and provides 50 percent of electrical needs. In the future a ground mounted 5 KW solar system will be installed to take care of 100 % of the electrical needs.

SOLAR PHOTOVOLTAIC — GRID TIED SYSTEM

2012 Lease Nissan Leaf EV

PV + EV = 0 0

Photo-Voltaic solar collectors +
Electric Vehicle = Zero energy use & Zero emissions



Electric charge status is reported to your computer, cell phone, and tablet



Solar Collector System
For Home & Vehicle

240 V. charging station
Directly charges at home



ZERO EMISSIONS

Saves 7,500 lbs. of Carbon Dioxide each year
Compared with average car driven 10,000 miles

NISSAN LEAF
ELECTRIC VEHICLE
100 mile range max.

ENERGY COSTS

For 80 mile range -- charging with solar energy = ZERO COST
-- charging at night @ 4 cents / mile = \$ 7.20

Average cost = 2 cents / mile
Annual cost (10,000 miles / year) = \$ 200.



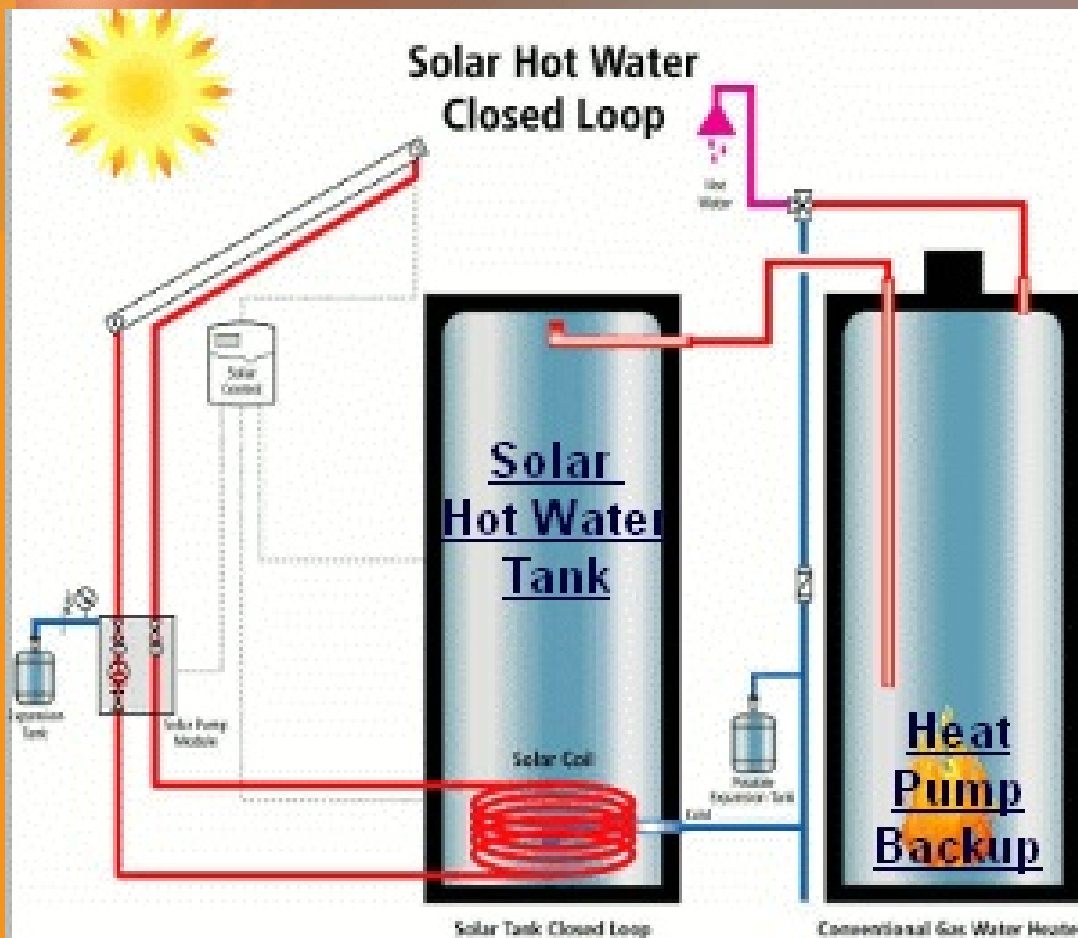
2012 - Add 16 collectors

**Total 8.8 KW solar system
producing 9,200 kwh/yr**



2010 - 2014 Add 3 wall mounted
Air to Air Heat Pumps





2013 - Add Heat Pump Water Heater as backup for solar hot water



**2019 - Add Floor Mounted
Heat Pump**

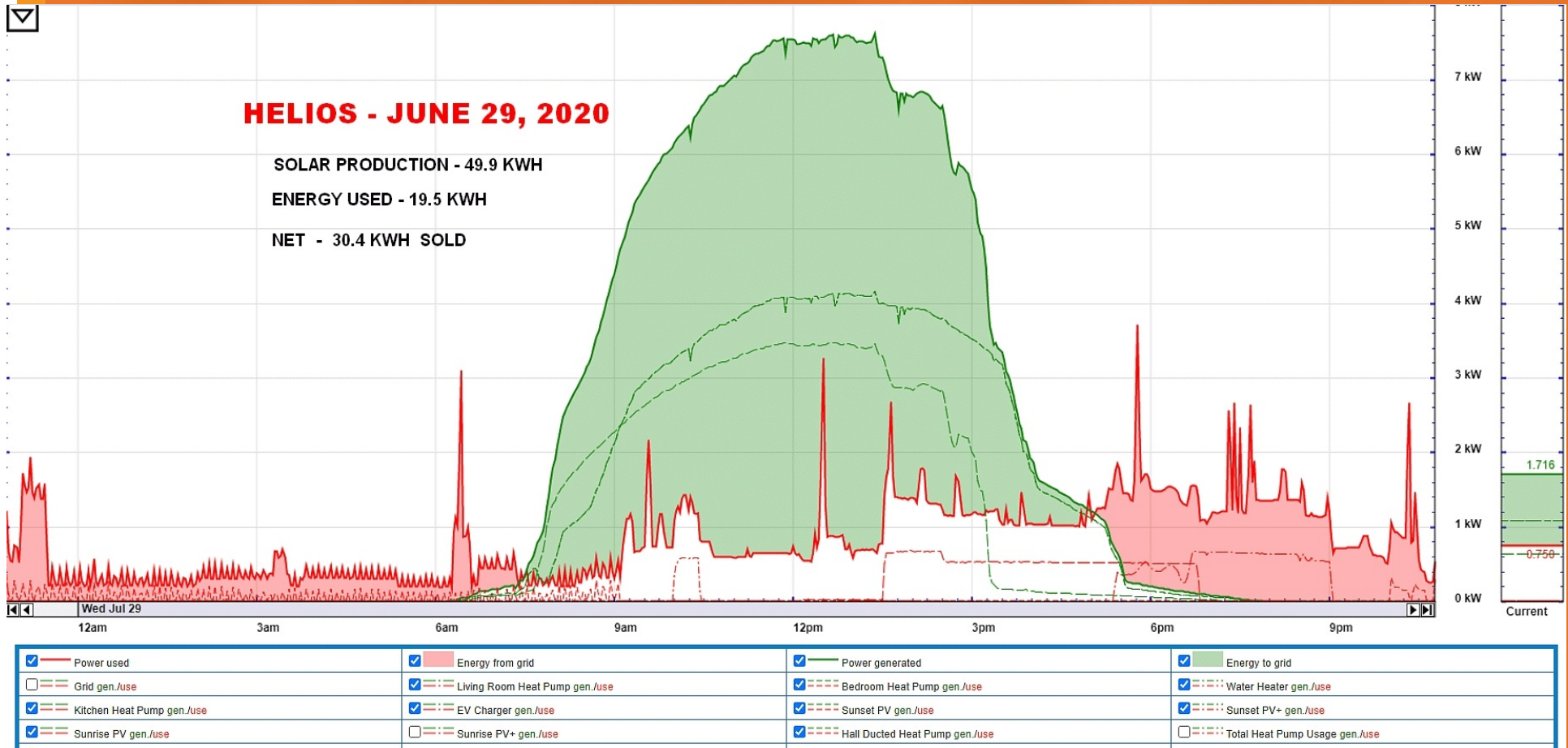
**Outside Condenser Unit
for each Heat Pump**



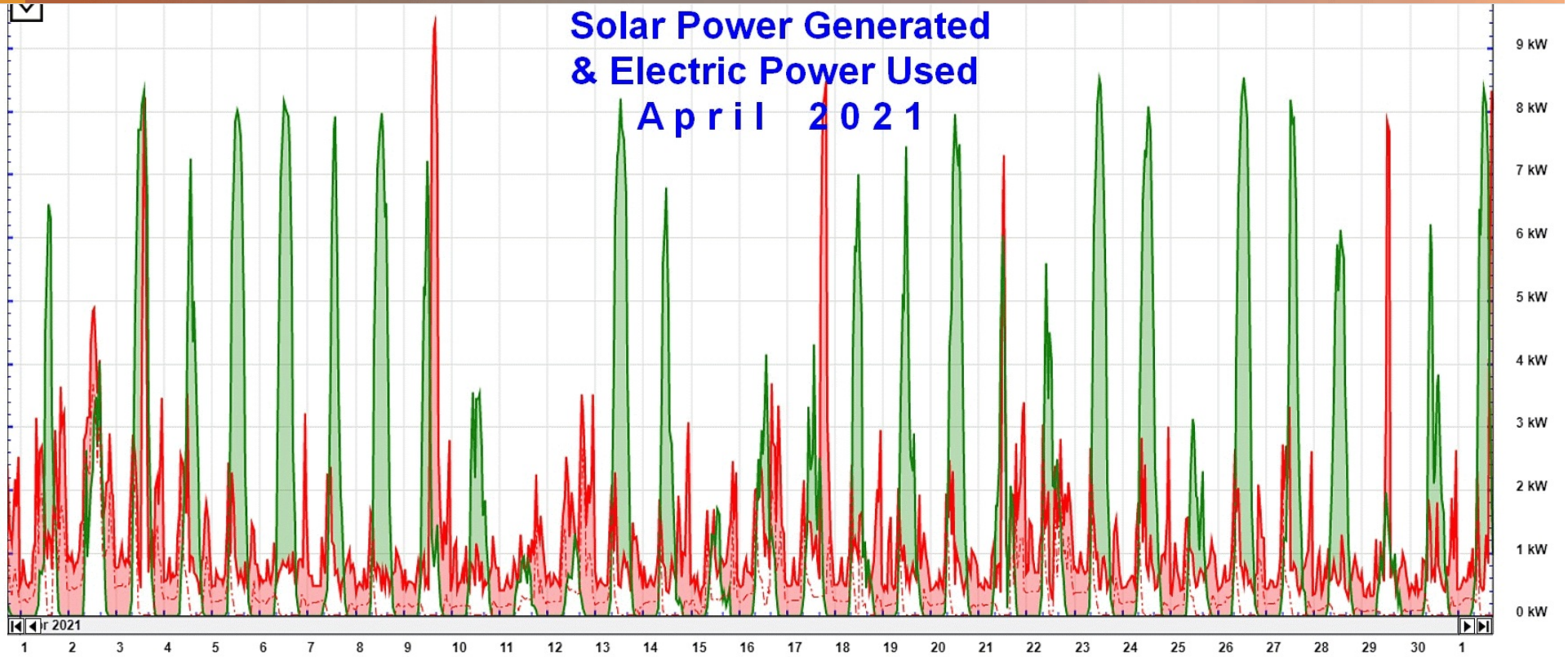
2019 - Ducted Heat Pump supplying 3 rooms



Monitoring Electric Use & Solar Production

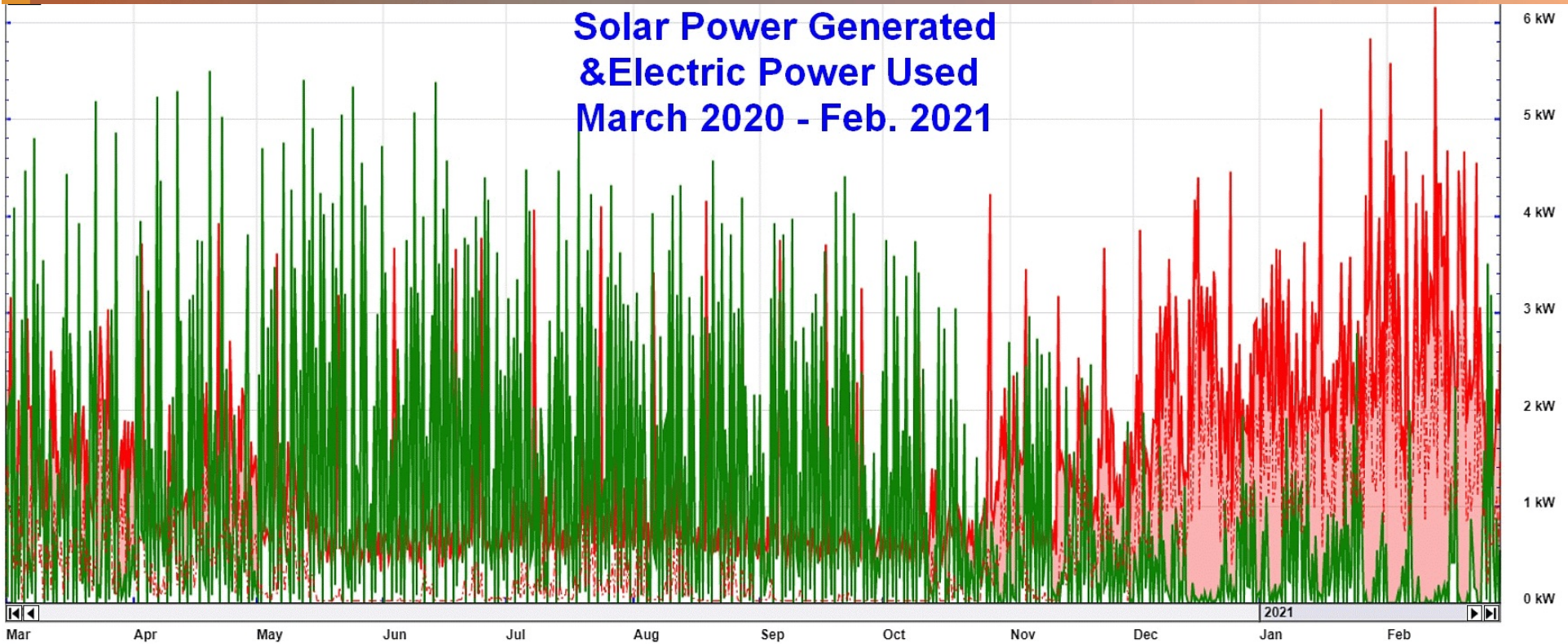


Solar Power Generated & Electric Power Used April 2021



<input checked="" type="checkbox"/> Power used	<input checked="" type="checkbox"/> Energy from grid	<input checked="" type="checkbox"/> Power generated	<input checked="" type="checkbox"/> Energy to grid
<input type="checkbox"/> Grid gen./use	<input type="checkbox"/> Living Room Heat Pump gen./use	<input type="checkbox"/> Bedroom Heat Pump gen./use	<input type="checkbox"/> Water Heater gen./use
<input type="checkbox"/> Kitchen Heat Pump gen./use	<input type="checkbox"/> EV Charger gen./use	<input type="checkbox"/> Sunset PV gen./use	<input type="checkbox"/> Sunset PV+ gen./use
<input type="checkbox"/> Sunrise PV gen./use	<input type="checkbox"/> Sunrise PV+ gen./use	<input type="checkbox"/> Hall Ducted Heat Pump gen./use	<input checked="" type="checkbox"/> Total Heat Pump Usage gen./use

Solar Power Generated & Electric Power Used March 2020 - Feb. 2021



<input checked="" type="checkbox"/> Power used	<input checked="" type="checkbox"/> Energy from grid	<input checked="" type="checkbox"/> Power generated	<input checked="" type="checkbox"/> Energy to grid
<input type="checkbox"/> Grid gen./use	<input type="checkbox"/> Living Room Heat Pump gen./use	<input type="checkbox"/> Bedroom Heat Pump gen./use	<input type="checkbox"/> Water Heater gen./use
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2019- Purchase 10 Solar Panels in local Community Solar System



**Provides 3.4 KW producing
4,000 kwh/yr for my home**

NET ZERO ENERGY USE HOME

On Site
Solar
8.8 KW

9,200
kwh/yr

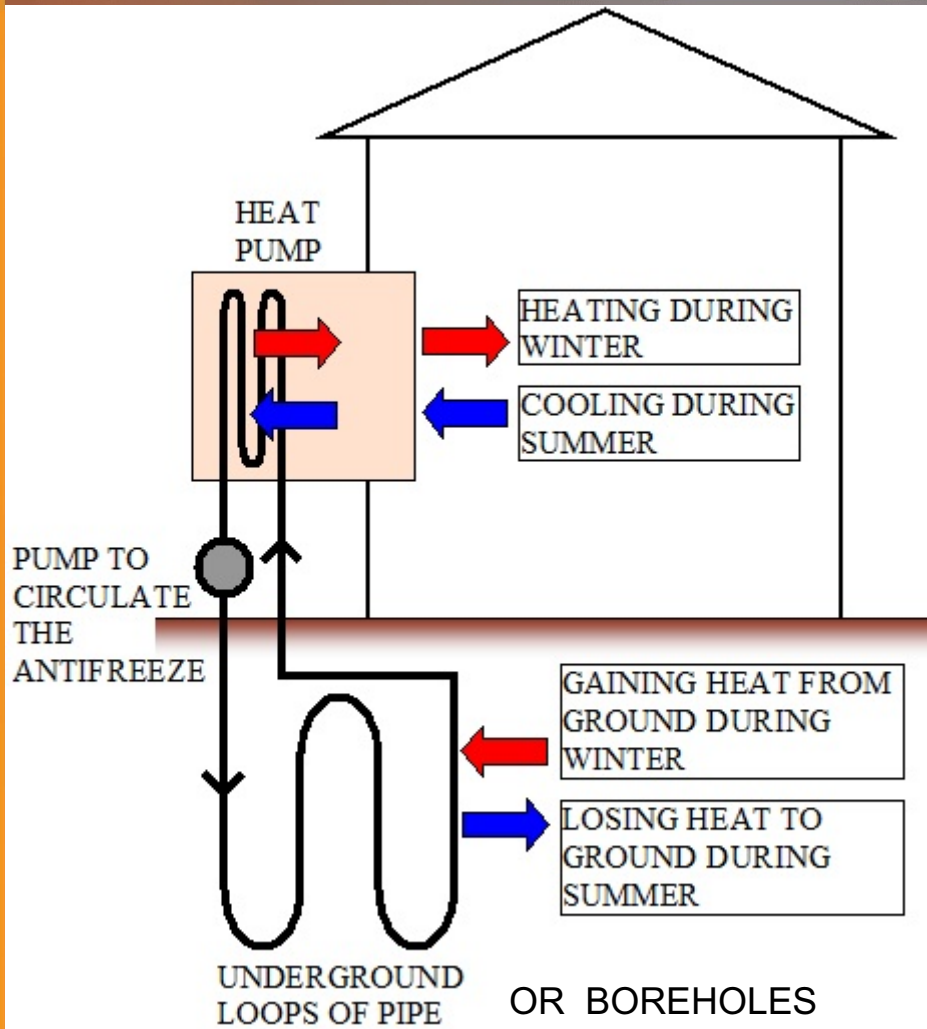


Off Site
Solar
3.4 KW

4,000
kwh/yr

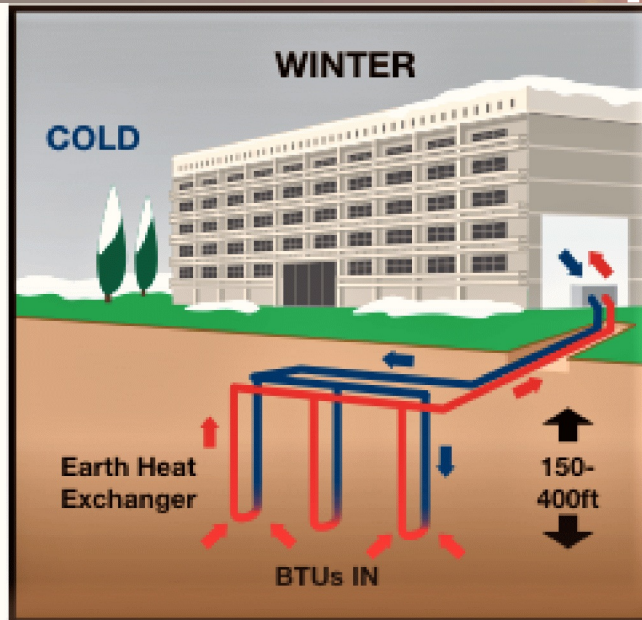
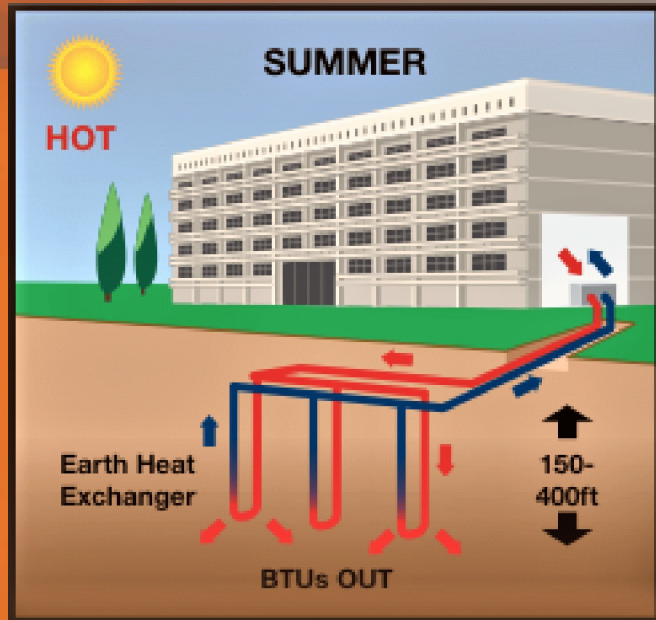
Our home produces as much energy annually as it consumes

Ground Source Water to Air Heat Pumps



RESIDENTIAL DESIGN

Ground Source - Commercial Water to Air Heat Pumps



Child Care Center



2017 & 2020 - Chevy Bolt Electric Vehicles



2023 Electric Vehicle reserved for lease



Net Zero Energy Living with Heat Pumps

Passive Solar
Solar Hot Water
Solar Photovoltaics
Heat Pumps
Electric Vehicles

