



## Hayden Island Solar Charge Station *draft proposal*

*by Sam Churchill* (1503 Hayden Is. Drive, #868)

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### **SYSTEM DESCRIPTION**

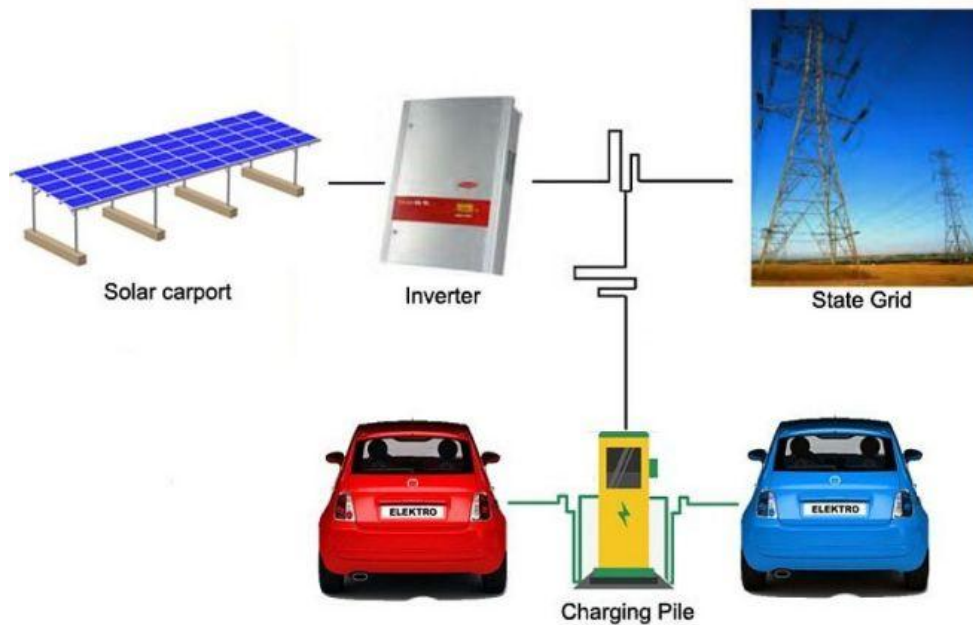
This proposal describes a solar-powered EV charge station paired with a shared Nissan Leaf to provide low income residents on Hayden Island with low cost car rental (\$3/hr to rent). Electric bike would also be rented for \$1/hr (for residents). This concept would also act as a proof of concept for an island-wide electric shuttle.

In addition, it utilizes a bi-directional charge station, enabling the park to save money by powering the adjoining laundry and shower facility FROM the vehicle's battery. Savings on electricity (~\$150/month) combined with income from EV/bike rentals (\$500/mo) enables self-sustaining operation.

## SYSTEM COMPONENTS

Components of this proposal include

- One, 2018 Nissan Leaf (\$20K)
- One, 6kW solar array canopy (\$20K)
- One, Solar Edge single phase inverter (\$2K)
- One, [bi-directional Wallbox](#) with an input/output of 7.7 kW (\$4K)
- Misc equipment and construction costs (\$8K)
- TOTAL: ~\$55k (less ~\$10K rebates for car and solar panels)



The 60 kW/hr EV battery is charged by the 7kW solar array. A [SolarEdge Inverter](#) (\$2K) produces pure sine wave 220 AC. The [bi-directional Wallbox](#) car charger (\$4K) with an output of 7.7 kW is connected to the 220 solar inverter. An automatic 220 Volt power switch will direct power to the most needy load (clothes dryer or car) .

### Bike and Car sharing in Manufactured Home Community



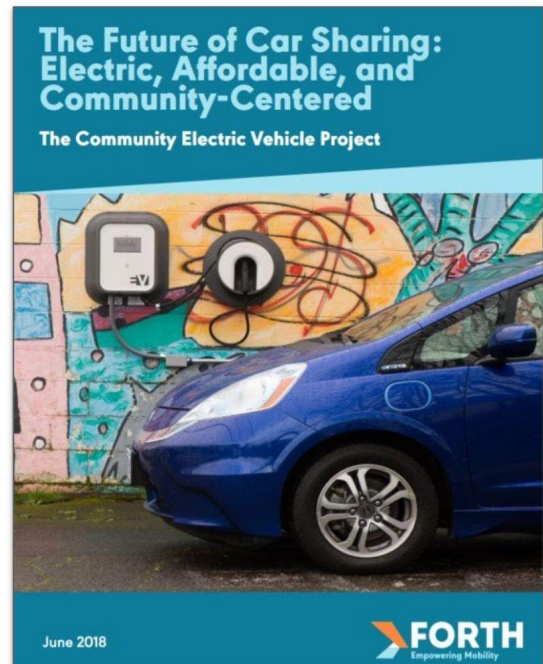


## BENEFITS

A solar powered charge station has several benefits:

### Electric Car Rental

- \$3/hr rental, \$5/hr visitors
- Free solar car charging
- Self sustaining at \$300/mo
- Provides battery backup
- Lowers pool & laundry costs
- Free WiFi



A bike rental facility could offer electric bikes as well as user supplied bikes for public rental. Bike rental might be facilitated by Biketown or by a non-profit using 3rd party software such as Turo.



### Electric Bike Rental

- \$1/hr rental
- Self-sustaining at ~\$100/mo
- Can supply own bike to rent
- 3rd party service provider

## MANUFACTURED HOME COMMUNITY; AN IDEAL TARGET POPULATION

Residents of the 450+ manufactured homes on Hayden Island are generally of lower means with a high percentage of LatinX and other minorities as well as seniors on fixed incomes. Many do not have cars and have difficulty grocery shopping since the island's only grocery store, Safeway, closed some two years ago. Another 150+ residents live in the adjoining RV park. About half are permanent residents and many also lack automobiles.

### 2020 Engagement & Awards Timeline\*



#### Learn more:

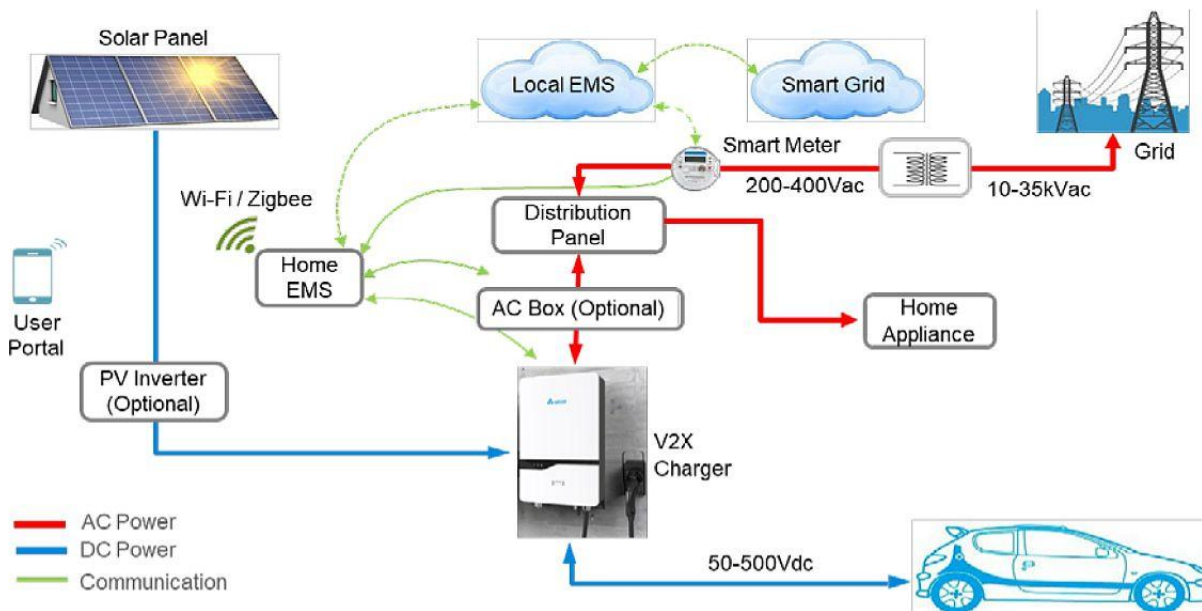
[www.portland.gov/BPS/cleanenergy](http://www.portland.gov/BPS/cleanenergy)

#### For any questions, please contact:

CleanEnergyFund@portlandoregon.gov | 503-823-7713

## NEED FOR A SOLAR CHARGE STATION

All electricity comes to Hayden Island from a single sub-station on the west end of the island. Because the island is dependent on the mainland power and the Manufactured Home Community has an integrated RV Park, it enables post-earthquake and emergency scenarios where electricity is down for weeks or longer.



## Powering the community center from the sun

For example, a solar canopy charging a 60 kW/hr Nissan Leaf could continuously power a small group of emergency vehicles or RVs. I live in the RV Park and use less than 600 kW/hrs of electricity a month (about 20kW/hrs a day). With an average of 4 hours of sun landing on a 7kW solar array, each day would generate broadly speaking ~28kW/hrs of electricity that could be stored in Nissan Leaf's battery. The bi-directional capability of a 7kW Wallbox charger means the car's 40-60 kW/hr battery could be used to power the Park's community center, powering lights, kitchen, heat and air conditioning.

## Heat the pool, showers and power dryers

The Leaf's battery could also power the swimming pool heater or the public laundry room and shower -- completely from the sun. That would save about \$100/month. A 60 kw/hr battery might get topped off - and used - daily for heating the pool for running the dryers. It still leaves 40kW/hrs left in the car for about 150 miles of driving. At night, if the car needs charging, it would simply plug in to the AC power. During the day, when the car is gone, sunshine powers the pool heater. The 7 kWatt solar array goes through the DC to AC inverter, which then powers the pool heater.

## SYSTEM REQUIREMENTS

The solar panels need to generate 7 kilowatts between 4-6 hours daily (28kW/hrs - 42kW/hrs) if we are to charge the car PURELY on sunshine. The most popular solar panels typically generate 350 watts in direct sun, so we need at least twenty, 350 watt panels to generate 7 kW. The panels cost about \$350 each or 20 panels for \$7K total.

The 350 watt panel dimensions are about 72" x 40", and require 330 sq ft. A 5kW installation (14 panels), needs about 230 sq ft. A 7kW installation would need two, 6ft high panels (12ft) by ten, 40" wide panels (28ft).

That means we need a 12ft x 28ft section of south facing roof for our panels. Each panel also needs a \$100 SolarEdge power optimizer, mounted underneath each of the 20 panels (\$2000).

## Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US



INVERTERS

### Optimized installation with HD-Wave technology

- Specifically designed to work with power optimizers
- Record-breaking efficiency
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Fixed voltage inverter for longer strings
- Integrated arc fault protection and rapid shutdown for NEC 2014 and 2017, per article 690.11 and 690.12
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Extremely small
- Built-in module-level monitoring
- Outdoor and indoor installation
- Optional: Revenue grade data, ANSI C12.20 Class 0.5 (0.5% accuracy)



The wires run into a Solar Edge, 10Kw HD Wave SE 1000H-US string inverter (\$2500), or equivalent. It outputs pure 240 volt, AC sine wave power at up to 42 amps (10 kilowatts). We plug our 240 volt, 7.4 kWatt Quasar car charger into the inverter to charge the car. It's bi-directional so it can power home appliances from the battery. Additional electrical pnels, safety shutoff switches, and monitoring gear will be detailed later.

## Quasar



The charging revolution that allows bidirectional charging. Quasar features facial recognition and gesture control technology. It comes with an integrated cable and allows for a charging output of up to 7.4 kW.



### Experience Intelligent Auto-Switching



The Secondary Output is drawing power.



When the Primary Output begins to draw power, the Secondary Output is paused.

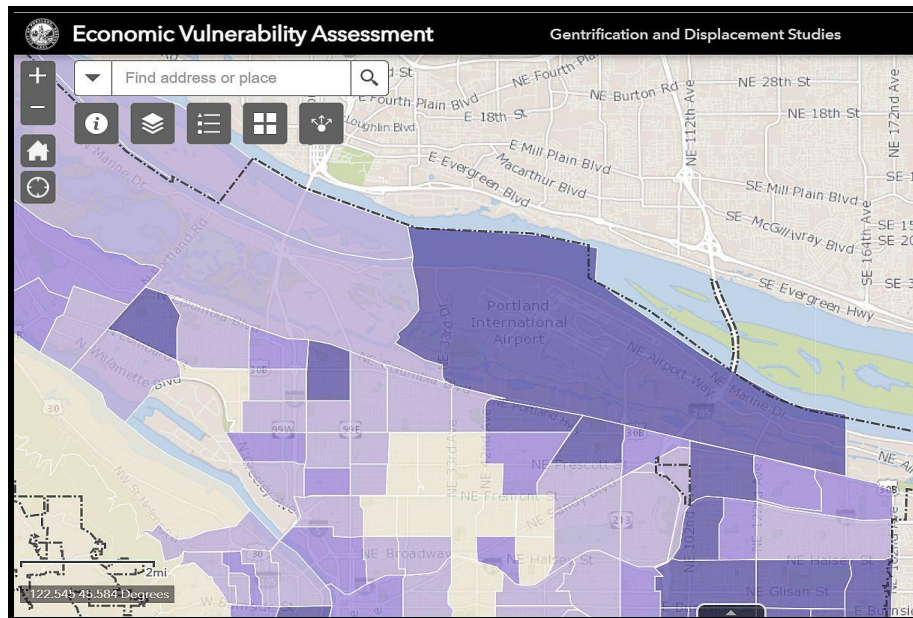


Once the Primary Output completes its session, the Secondary Output picks up where it left off.

## NEEDS ADDRESSED

The Manufactured Home Community on Hayden Island and a solar charge station for EVs uses green energy efficiently and addresses the needs of the target audience.

- High percentage of low income and minority clientele
- Many residents have no car
- Island dependent on shore power
- Lowers cost of car and bike rental
- Lower cost of electricity for Park management
- Bi-directional emergency power after blackout
- Low cost - no Tesla Powerwall required
- Low risk - Car/bike requested by residents and RVers
- Model for island-wide electric shuttle



## SUMMARY

This draft proposal looks at the Manufactured Home Park on Hayden Island as a possible location for a solar powered electric vehicle charge station. The benefits to the community would be access to inexpensive transportation, resiliency, lower operational cost of facilities and amenities for residents. A bidirectional charge station is specified for a 2018 Nissan Leaf. That lowers cost by eliminating the need for a home storage battery and allows the sun to power the swimming pool heater as well as showers and laundry room. The solar charge station and car could be located at several different locations, near the entrance to the RV Park, or near the swimming pools at the property.

## Possible locations

at Manufactured Home Park:  
(needs south facing exposure)

1. South Shore Pool
2. Main Office by Pool
3. RV Park Laundry
4. 1501 Laundry room
5. 1501 Parking area



The proposal is expecting total costs to be in the neighborhood of \$50K, which includes the cost of purchasing and installing the solar canopy (~\$20K), a used 2018 Nissan Leaf with a 60 kW/hr battery (\$20K), a bi-directional charger and power splitter (\$5K), labor (\$6K), and misc equipment (\$4K). Total of ~\$55K does NOT include solar & EV rebates (~\$10K).

Revenue is expected to be in the neighborhood of \$500/month or \$6K/year. Monthly revenue comes from car rental (~\$350/mo) and bike rental (~\$150/mo). Park management gets to keep the approximate \$100/month savings in utility bills from running a portion of the pool heaters and laundry facilities off the car battery. With \$500/month revenue, the non-profit entity would be basically self-sustaining while offering below market rates are bike and car rentals.

## Solar EV Charge Station Cost Model

- Free Level 2 (7kw) charging (4-8 hrs)
- DC fast chargers >50kW (1hr), too expensive
- 7.5 kW bi-directional charger can heat pool (\$4K)
- Provides both CSS and CHADEMO plugs
- 4kW EV solar station has internal 24kW battery (\$50K)
- One used 2018 Leaf (\$15K), plus two bikes (\$3K)
- Car is \$3/hr. Bikes are \$1/hr. Non-residents \$2 more.
- Residents may provide own vehicle (managed by Turo)
- Self-funding. Average revenue ~\$450/mo (\$15/day)
- Total cost ~\$75K. Annual revenue ~\$5K



## How low income users benefit:

### Electric bike rentals

- Self sustaining at \$100/mo
- Managed by 3rd party software

### Electric car rentals

- Grocery shopping
- School & errands

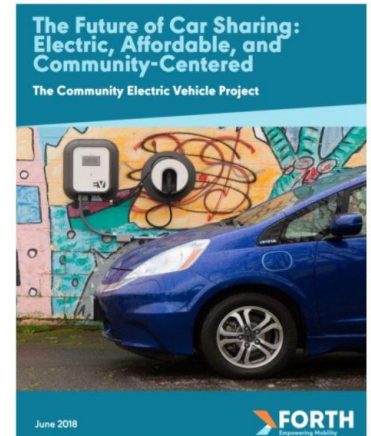
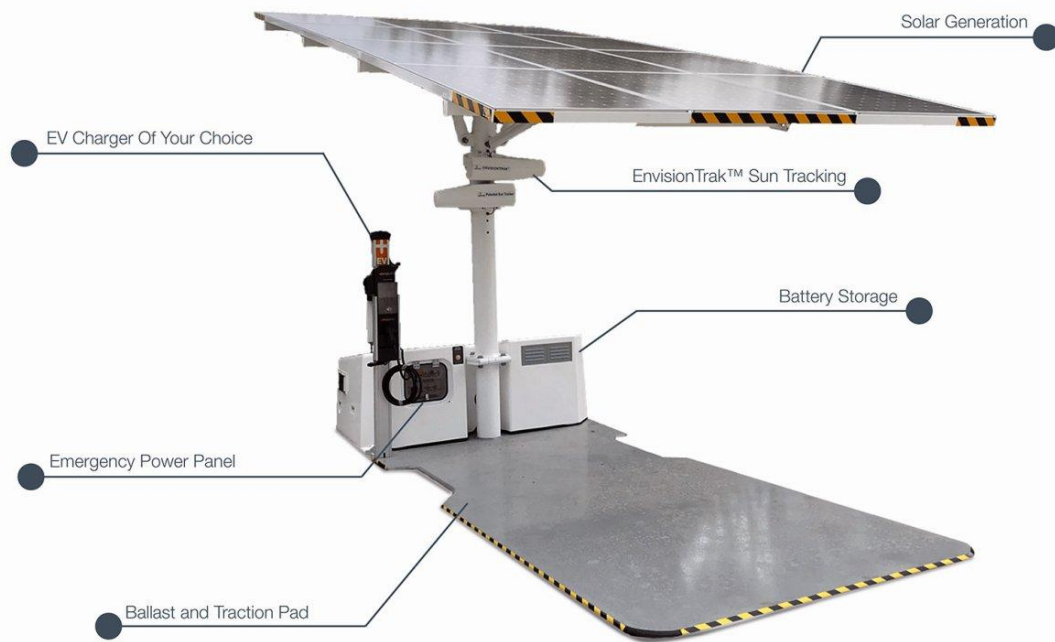


Table 24: Comparison of selected electric cars by battery type and capacity, range and charge time

Car supplier	BMW	Chevrolet	Mitsubishi	Nissan	Tesla
Model	i3	Chevy Volt	i-Miev	LEAF	Model S
Battery chemistry	LMO/NMC (22 kWh, 204 kg)	LMO/NMC (16 kWh, 181 kg)	NMC (16 kWh; 147 kg)	LMO (30 kWh, 272 kg)	NCA (90 kWh, 540 kg)
Range (km)	130-160	64	128	250	424
Charge time	~4 hours at 230 V AC, 30 A; 50 kW Supercharger; 80% in 30 minutes	10 hours at 115 V AC, 15 A; 4 hours at 230 V AC, 15 A	13 hours at 115 V AC 15 A; 7 hours at 230 V AC 15 A	8 hours at 230 V AC, 15 A; 4 hours at 230 V AC, 30 A	9 hours with 10 kW charger; 120 kW Supercharger, 80% charge in 30 minutes



For further information:

**1. Portland Green Energy Fund**

<https://portlandcleanenergyfund.org>

**2. PowerPoint of this paper**

[https://docs.google.com/presentation/d/e/2PACX-1vTvlzYEVewA0G0kxlp5Y-pYeQ4lf6zViEV5nlUT08WsrWL17AQHACsJCXdpH\\_4FtzpVOvjUAb0-ou2z/pub](https://docs.google.com/presentation/d/e/2PACX-1vTvlzYEVewA0G0kxlp5Y-pYeQ4lf6zViEV5nlUT08WsrWL17AQHACsJCXdpH_4FtzpVOvjUAb0-ou2z/pub)

**3. Oregon Solar EV Charger**

<https://ev4.website/business-model/>

**4. Wall Box Bidirectional Charger:**

[https://wallbox.com/en\\_us/bidirectional-ev-charger](https://wallbox.com/en_us/bidirectional-ev-charger)

**5. Off Grid Solar EV Charging**

<https://offgridinstaller.com/off-grid-ev-charging/>

**6. Electrify America's Solar Chargers**

<https://electrek.co/2020/02/27/electrify-america-to-deploy-30-off-grid-solar-ev-chargers-in-rural-california-communities/>

**7. Neo Charge 220 Volt Power Splitter**

<https://www.getneocharge.com/shop-pages/appliance-smart-splitter-3>

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