

# Solar Powered Golf Cart for Mall Marketing

A resiliency/marketing proposal by Sam Churchill

## INTRODUCTION

A solar charged golf cart is proposed for Hayden Island. It provides mobile 5G broadband with free WiFi and two 42" digital advertising screens for Mall promotions. It provides 4 kilowatt/hours of AC power in the event of an emergency as well an interactive social media wall and charge station for phones or other small devices. The budget is projected at \$5,000-\$10,000. This paper is a vision statement, providing only rough estimates for function and cost.



## GOAL

The goal is to provide community resiliency after an earthquake. The self-funded vehicle provides a useful commercial service in its routine daily application.

## OVERVIEW

Solar panels, batteries and electronics have recently become cheaper, more useful and reliable, enabling new and innovative applications. We believe a 48 volt electric golf cart with four, 100 watt solar panels on the roof (400 watts total), could provide an innovative Mall promotional vehicle as well as a resilient, post-earthquake recovery/communications vehicle.

In routine daily use the golf cart would be used for Hayden Island promotions, mostly from the Mall. The cart would be parked on the mall, ideally near outdoor dining locations. It provides free WiFi for nearby patrons and the 42" OLED displays, behind rainproof plexiglass covers, show looping PowerPoint slide shows, providing information about



nearby events and non-profit organizations as well as business promotions. Business promotions typically cost \$5 a day. With 40 paid PowerPoint slots, revenue might be ~\$200/day. In a 30 day month, that might bring in some \$6,000. We'll project a more conservative \$3,000/month revenue stream for advertising revenue.

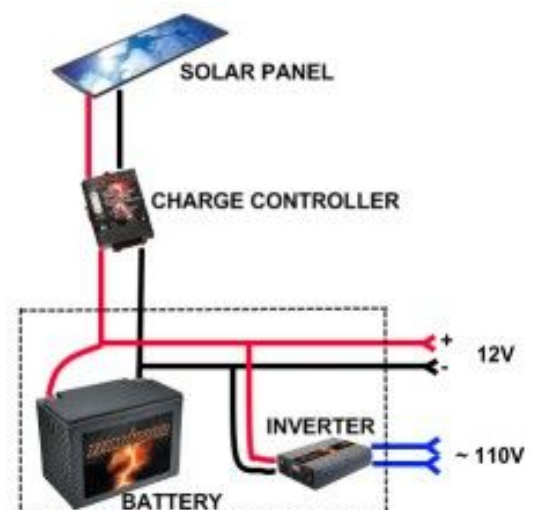


For public events, such as a concert, the electric golf cart could also provide live streaming services for \$100/day. The LTE/5G mobile hotspot enables live streaming via YouTube Live or Facebook Live. Equipped with 3 HDMI cameras and a small audio mixer, live streamcasts of music concerts, boating events and promotions are possible. The two, 42" monitors provide an enlarged view of the artists while the 2nd monitor provides a live social media wall, with scrolling posts from Twitter, Facebook and YouTube.

In a post-earthquake mode, the 400 watt solar panel could provide gas-free power, and up to 2,000 watts of pure sinewave AC power as well as charging of cellphones and other devices. It could also power a consumer satellite internet terminal such as ViaSat or HughesNet for communications even if the island loses all AC power and cell phone connectivity.

## TECHNICAL OVERVIEW

**Batteries:** The total battery capacity of the golf cart is 4800 watt/hrs. We propose using four 12 volt batteries





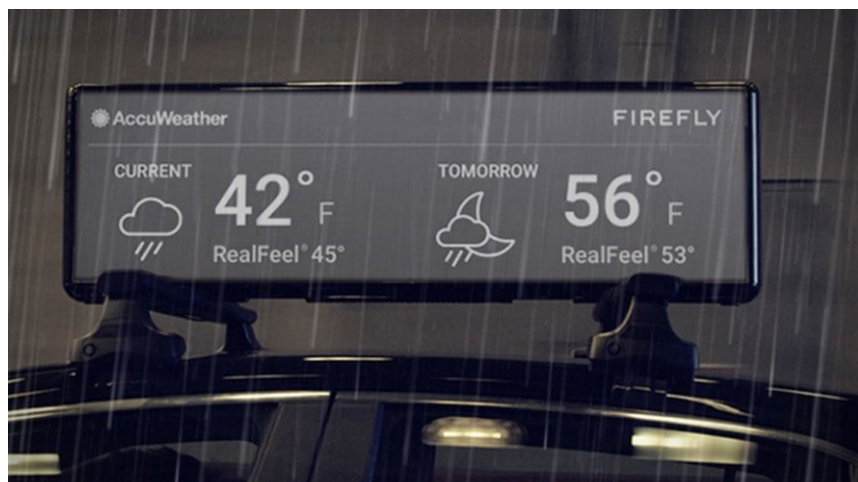
connected in series. They have a capacity of 12v/100amp/hrs each. A power drain of 240 watts per hour is estimated. That means the batteries could provide up to 10 hours of runtime (2400 watt hours). The total capacity of the four 1200 watt/hr batteries is 4800 watt/hrs, but they should never be drained 100%. With a 240 watt power drain, the batteries drain about 50% of the 4800 watt/hr capacity after 10 hours. Used Lithium batteries are recommended for this application since they can be drained nearly 100% and last longer for about the same price per battery (about \$500 for a 12 volt/1200 amp/hr capacity).

**Solar Panels:** We use four 100 watt mono crystalline panels (\$70 each) wired in series for 48 volts times 7 amps or about 350 watts total for about \$280. More solar power would take up too much space to fit on a golf cart roof. Up to 2400 watts daily can be generated from the sunshine alone. That equates to 400 watts over 6 hours or 300 watts over 8 hours. Optionally, [a single 400 watt, 48 volt panel](#) (\$400) may be used. The solar panels connect to an MPPT charge controller.



**Charge Controller:** A \$650, MPP Solar PIP5048MG 5000W Inverter Charger enables a 48 Volt solar panel to charge the 48 volt battery bank. The charge controller can charge AGM, Gell Cell, and Lithium batteries efficiently using Maximum Power Point Transfer (MPPT) and can output as much as 5000 watts AC from its pure sine wave inverter.

**Large Video Monitors:** Two, 42" monitors covered with clear plexiglass or a rooftop taxicab digital advertising platform could be used. Digital advertising is a popular option for Uber and Lyft, both inside and outside the car. Digital ads like Firefly, which travels on taxi roofs, can be triggered by location or time. Octopus is an entertainment/tip/advertising platform available for passengers inside the vehicle.



## ADVERTISING REVENUE

If you had 20 different ads, at \$5/day each, that's \$100/day (\$3,000/month). Pays for itself in year one. Three different Powerpoint slideshows could be rotated for morning, noon and night. If the Golf Cart provided a free Mall shuttle, advertising could be triggered by location and time using software like Firefly. Otherwise, the daily ad carousel could be downloaded from Google Docs, using a phone like the Samsung Galaxy S10, which can output directly into the monitor's HDMI input.

## LIVE WEBCASTING

The solar powered golf cart is independent of grid power. As a tool for musical performances, it provides 4.8 kWatt hours of AC power, free mobile hotspot service, and even live streamcasting services via Facebook Live or Youtube Live. Using free software like Open Broadcast System (OBS) which runs on Mac, Linux or Windows, a laptop can switch multiple cameras and streamcast it to the internet. A \$300 camera switcher from Black Magic makes switching between four HDMI sources, like cameras, laptops or phones.



The Solar Cart could be leased out for community events at a rate of \$100-\$200 a day. It could also webcast community events, such as HiNoon meetings or boating events. A simple audio mixer can supplement the two channel audio input from the camera switcher.

## RESILIENCY

After a subduction zone earthquake, island power, supplied by the overhead transmission lines west of the Railroad bridge may be out, with little chance of immediate recovery. The same could be said of cellular service as well as water, sewer, and gas. In that event, the Solar Cart could become a life saver, providing a mobile platform with 4800 watt hours of electricity - no gas required. The cart can also be used as an emergency information center, powering satellite internet provided by ViaSat, HughesNet or Starlink. The local WiFi hotspot could keep island residents connected to the internet (via satellite), while the large video screens could scroll live Twitter and Facebook feeds, Powerpoint information, and live webcasts.



## PARTS LIST

### Solar Golf Cart

1. Used Golf Cart (less batteries) -----	\$1000
2. Four, 100 watt Renogy panels @\$75 -----	300
3. Four, 1200 watt/hr, 12 Volt (used) Valence Lithium batteries --	2000
4. One, MPP Solar charge controller with inverter/shore power --	500
5. Two, 42" monitors with waterproof plexiglass enclosure @\$250 -	500
6. Misc connectors, mounts and wiring -----	200
TOTAL -----	\$ 4,500



### Live Webcasting Option

1. Windows Laptop -----	\$ 500
2. Three, HDMI cameras @ \$200 each -----	600
3. One, HDMI camera switcher -----	300
4. One, OBS software package -----	N/C
5. One, Mobile Hotspot -----	150
6. Audio mikes, cables, misc. -----	150
7. Satellite Internet (ViaSat, HughesNet or Starlink) -----	300
TOTAL -----	\$2,000

### DEMOGRAPHICS

Digital advertising on a Golf Cart or even a shuttle around the Jantzen Beach Mall might be worth a shot. The demographics near Hayden Island seem promising. The Mall attracts some 10,000 people a day while the island's permanent resident population is around 3,000.

#### 1767-Jantzen Beach Center

#### Portland, OR

	1.00 Mile Radius	3.00 Mile Radius
Count of Pop 0 to 4 years	143	5,315
Count of Pop 5 to 14 years	187	8,687
Count of Pop 14 to 22 years	116	6,330
Count of Pop 22 to 30 years	150	6,598
Count of Pop 30 to 45 years	474	17,578
Count of Pop 45 to 60 years	689	13,987
Count of Pop 60 to 75 years	1,023	10,514
Count of Pop 75+ years	357	3,478
Population 0 to 4 Years	4.54%	7.33%
Population 5 to 13 Years	5.97%	11.98%
Population 14 to 21 Years	3.69%	8.73%
Population 22 to 29 Years	4.79%	9.10%
Population 30 to 44 Years	15.10%	24.25%
Population 45 to 59 Years	21.94%	19.30%
Population 60 to 74 Years	32.59%	14.50%
Population 74 Years Plus	11.37%	4.80%
Median Age	56.7	38.2

### ON-LINE RESOURCES

- [Oregon Climate Plan](#)
- [Oregon Clean Vehicle Rebate Program](#)
- [Oregon Solar Incentive Programs](#)
- [Portland Clean Energy](#)
- [Energy Trust](#)
- [Community Solar Program](#)
- [Forth Mobility: Cost Savings](#)
- [Metro Grants](#)

## **MANAGEMENT STRUCTURE**

A major goal of this concept is to create a self-sustaining community asset that provides post-earthquake communications and power to island residents. As a non-profit entity, this concept might qualify for more grants and programs. It might be managed under a 501(c)3 entity such as the High Noon neighborhood association, an HOA, or a standalone entity managed by the Jantzen Beach Mall, Columbia Crossing, or other island-based enterprise.

The main goal of the digital advertising functionality is to provide self-sustaining revenue support for its occasional community use as a tool to provide live webcasting, free internet access and emergency power. We believe it's daily commercial use as a free public internet hotspot and community message center will make it a valued community asset.

## **SUMMARY**

This paper describes a 48 volt electric golf cart, with a capacity to store 4,800 watt hours of electricity. The solar-powered electric golf cart can power a 480 watt load for up to 10 hours. It's charged with 400 watts of solar on the golf cart roof, but may also be charged overnight using an ordinary 110 Volt outlet.

The solar-powered golf cart generates revenue through advertising, but it provides the capability to live webcast even when power or cellular communications is down. We estimate a startup cost of approximately \$10,000, with an estimated revenue of \$2000-\$3000 per month. With a running cost of approximately \$1000/month, we believe the Cart could be paid off in year one, with subsequent years generating revenue for the non-profit entity managing its operation.

