Running Critical Circuits with your Electric car

Introduction

I always liked the idea of V2G (vehicle to grid) but that is not really what we are talking about here. That would be a direct connection of the traction battery through the charging port to produce alternating current which would require a larger inverter in the charging station or built in inverter in the car. This is not as sexy but because it is basic, it is relatively low cost and can be a nice backup generator for emergencies.

Motivation

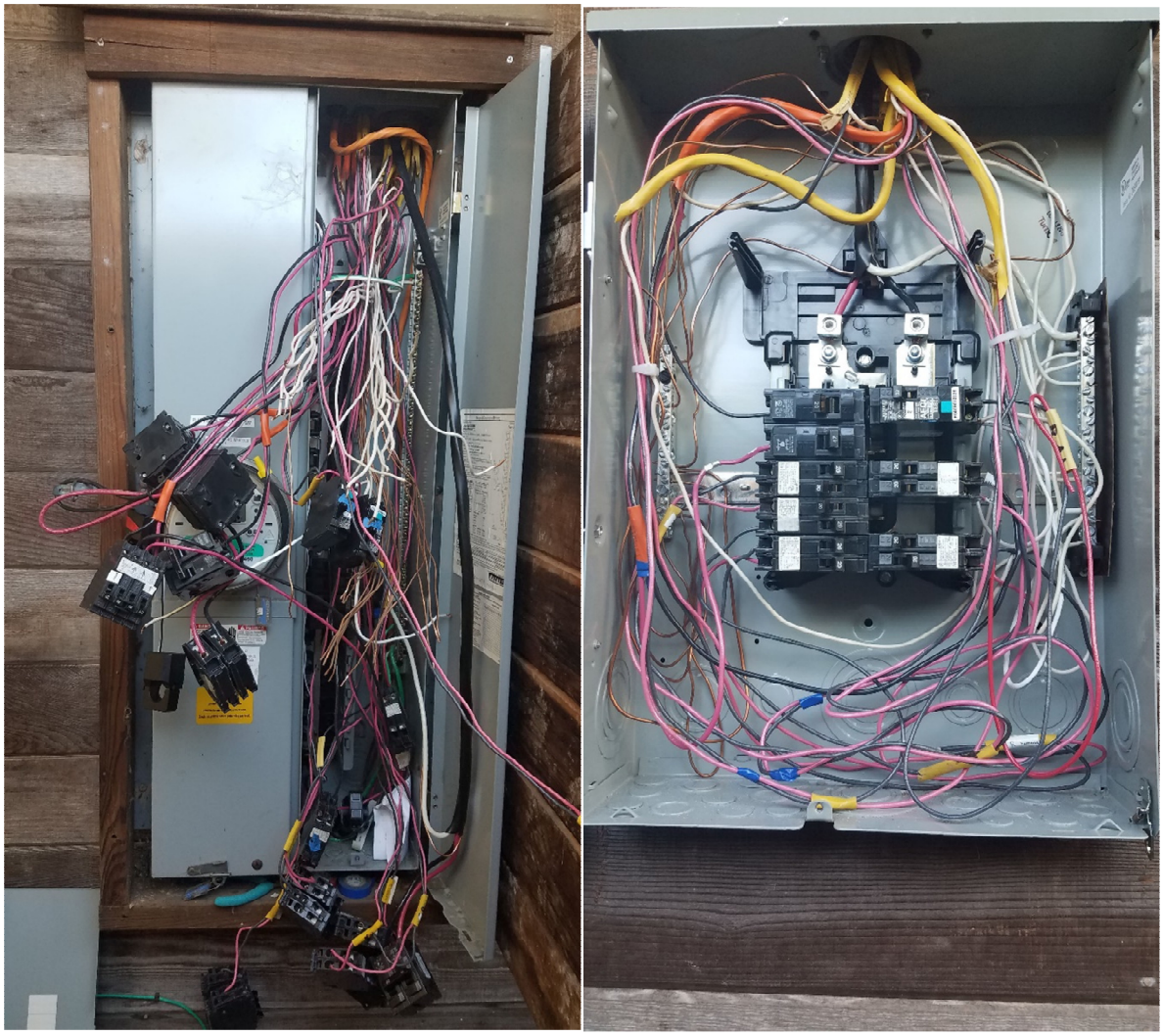
It seemed logical to me that with a 60KW battery in the house, I should not need to worry about power outages. Thought about setting something up for years but two things got me moving on it. First, PG&E power shutdowns for dry weather events and a Nextdoor posting (someone else in the neighborhood with the Bolt EV using a 1200 watt inverter to run his frig and microwave, separately), reminding me of the option to use my 12vdc battery in the electric car with an inverter and the car on, to power my critical circuits. Critical being the refrigerator, which costs me $140 in dry ice for a two-day outage, the house heater, which is a natural gas heater but requires AC for the blower motor and thermostat. I also added my computers and some lights because they don't really take much energy and are nice to have. My Comcast internet service is only good for four hours because the battery at the street hub will only last that long. AT&T will sometimes not be affected by outages, but it is much slower and not acceptable to me.

Planning

To do the basics, you can purchase an inverter and connect it to the battery terminals on your car, turn the car on and plug in extension cords. Again, for two reasons, I wanted to make this a bit more elegant than that. At some point I might have enough money to replace my current inverter with one that offers battery backup, so I wanted a solution that would allow an easy transition to this and eliminate the extension cords running through the house.

Preparation and installation

I installed a subpanel next to my main breaker box and moved my critical circuits over to the subpanel. I put the subpanel on a 50amp breaker (could have used a smaller breaker but that is what I had). I ran #6 wire from the main box to the subpanel.



Breaker boxes are set for 240vac, two hots, a common and ground bar. One hot serves half the breaker spaces and the other hot serves the other half. I wanted all the critical breakers on one

hot because the inverter output is 120vac. As it turns out, some of the circuits in my house are served by 240vac that is split into two 120vac circuits (one romex with two circuits). Some of the circuits I move contained non-critical circuits. I put the non-critical circuits on the other hot.

I put one 10amp breaker on the critical circuit side of the box and ran #12 romex into the garage for an inlet for my inverter from the car. It took me a few hours to prepare the space for the new box. I cut away some plywood on the interior of the garage to access some wires and the space between the studs where the wires would go for the new box. Then I mounted the new box and put in conduit to help guide and manage the bundle of wires going to the new box. I picked a bright warm day to move the wires, which took about three hours total to move and power up. The next day I built a wood frame and roof over the new box.

To prepare the inverter connection I looked at the setup in my Chevy Bolt EV and found there is a longer than needed threaded bolt on the negative side of the battery and just added a nut to this to connect the negative side of the inverter. On the positive side I found a longer than needed bolt inside the fuse box and again, just added a nut. I left these nuts in place to make it easier to connect my terminals when needed. Later, I added an Anderson connector to the car and inverter for faster connection.

I checked the power requirements of the refrigerator and blower on the heater. I checked both the surge and the continuous power requirements. Surge power on the frig was about 1200watts but continuous was only about 120watts. The heater blower was a bit higher at 1400watts and 170watts.

I have had solar for many years and have a monitoring coil on the main lines and the solar panel output. I was aware already that my typical power use over 24 hours was about 600 watts peak, excluding charging stations (two), oven, electric dryer, microwave and toaster.

First Use

The first week after the subpanel was completed, we received a warning message from PG&E that indicated they might turn off the power in our area (including my address) within 48 hours. Oh good, I get to test my new system for real, I thought. Not to be. Within 24 hours we received another notice that they would not be turning off the power in our area after all. A few days later and storm came through and the power went out right in a middle of a TV show we were watching. Here goes, a real test.

Into garage, popped the hood, connected the inverter,

connected the extension cord to the breaker box inlet.

Turned on the car. This is tricky because for the Chevy Bolt EV to stay on, you need to have the car in Neutral. If you are not careful and if you don't follow a sequence, the car will switch from Neutral to Park. Open the driver side door, turn on the car, put it in Neutral, set the brake, get out of the car and shut the door. Verify the car is still in Neutral.

If you are in a garage you can leave the window down to put it in Neutral if that doesn't work for you. Opened both breaker boxes, turned off the breaker that powers the subpanel, turn on the breaker that connects the inverter to one hot in the subpanel. Power is on. Everything I need working is working, including the TV, so we continued watching the show. I checked the wires after about an hour of use and found them to be hardly even warm and the inverter fans were not on.

At night we left it running. If the power were to come on it would be noticeable by the things that would come of that are only connected to the main breaker box. I was up at 5am the next morning and could see the power had come on. The power came on at 2:30am and had gone off about 8:30pm, so it was out for 6 hours. I turned off the inverter switch, and turn on the subpanel switch. Then I turned off the inverter and disconnected the cables. I didn't take careful measurement of the KW used by the car but the max would have been about 4KW or about 14 miles of range. I plan on doing a careful check of the power used next time. I did

measure the output from the batter using my clip over AC/DC amp meter and measured 50 amps when it first came on. This would have been the peak since the frig, heater, TV and light all came on at the same time (600 watts).