

REPORT on POSSIBILITIES for CHARGING of ELECTRIC VEHICLES in the EDINBURG BUILDING GARAGE

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REPORT CHARTER:

On Tuesday 18 October 2022, a general meeting was held in the first floor general purpose room (by the front door). Toni Vezeau brought up the eventual need for EV (all Electric Vehicle) charging in the building garage. As we start to purchase all electric vehicles, and as prospective unit buyers require charging for their EVs – we will need some provision for that.

Ken Chuchro (847 826 3666) and Robert Kubala (425 606 9397) volunteered to do some kind of investigation of what might be done, and what the costs might be. This is the compendium of that inquiry.

THE EMERGING AUTOMOBILE SITUATION

Electric vehicles may become the majority transportation means in the US by the end of the decade or so. Such vehicles have fewer components, should be easier to maintain, easier to produce (with all manufacturing and use factors included), produce less environmental damage, and should be longer lasting and more reliable. (See Appendix B at the end of this report.)

Through Elon Musk's pursuit of Tesla electric vehicle manufacture and sale, but also due to the Chinese (albeit authoritarian) government copy-cat encouragement of Tesla's EV manufacturing, we already have a small but rapidly growing percentage of EVs on the American roads. Nissan with the Leaf, GM with the Chevy Bolt, and with other manufacturers selling their initial EVs in some volume – the outlook is clear. It's only a matter of perhaps 5 to 10 years or so before EVs become a large portion of the US fleet.

Providence Point units with individual garages will have no problem with the incursion of EVs. Household garages have the usual 115 volts AC, 15 or 20 ampere electrical outlets to power the *Level One* charger units that EV customers can purchase from the dealer selling the vehicle.

Buildings, like the Edinburg, are another matter! Our garage has a few 115 VAC outlets in the Visitor parking slots – but that's it!

The time will come, where we will have one or more EVs assuming residence in the Edinburg building garage. And we can anticipate an EV owner becoming a potential Edinburg unit owner – but only if there is at least some minimal way of charging that EV in the garage.

Seemingly, we have no way to fairly do that. An EV owner could connect a minimal, say a Type 1 or J1772, charger to a guest outlet in the basement – but all the building residents would be paying the electricity bill. (I calculate that as: 30 days x 10 hours per day x 1.5kW x \$0.15/kWh or \$67.50 per month.) That is, 23 Edinburg units could each be paying up to \$2.80 per month to subsidize one unit's EV's energy requirement.

So what might we do?

CHARGING POSSIBILITIES (for EDINBURG and PROVIDENCE POINT)

The following table indicates our possibilities as best Ken and Bob have come up with:

#	Name	Time Frame	What Do	How Use
1	Do Nothing	Our current state	Provide no new facilities. Let EV users plug into one of the visitor AC sockets. Edinburg residents share the small costs of letting a few residents use Edinburg electricity for free.	Let EV owning resident plug her/his level 1 EV charger into any of the visitor's parking slot 120 VAC outlets. All residents pay a little extra for the 1.5kWh per hour of electricity used. So even a 'heavy user' – say 10 hrs charging per day – would cost less than \$100 per month. (See p2 and note at end of Appendix A.)
2	Honor system	Anytime deemed appropriate.	Work out an agreement with each Edinburg EV owner to pay the building for the extra electricity they use. A wall socket meter of electricity use can be used. (see Appendix – F)	Let each EV owning resident connect and use her/his charger to any available outlet – and then submit an estimate of that use (the number of hours connected that month) and a check each month (for the number of kilowatt hours x \$0.15) to the building captain to pay for the additional electricity used.
3	Expand the number of garage AC sockets.	When the number of EVs in the garage becomes numerous.	Increase garage circuit breaker panel capacity, and run conduit along the wall providing outlets for every stall. Put metering at every stall.	Have 'special assessment' to pay for electrical work and special outlet metering. Every resident can connect her/his level 1 charger to her/his outlet.
4	Provide commercial grade charging stations at Prov. Point	When the fraction of vehicles at Providence Point becomes large. Ten years or so from now.	Provide level 2 or 3 chargers at one end of the library building.	Similar to the commercial charging stations we currently see at Fred Meyer, etc. Users insert credit cards for payment. Facilities installed and operated by Prov.Pt. – or commercial entity – whichever makes better sense.

OUR RECOMMENDATION

NEAR TERM (next several years):

Just use the ‘honor system.’

Note that EV batteries lose only about 1% of their charge per day if the automobile is left unused – so there is generally no need for overnight charging if the EV is used and charged on a regular basis.

If, for some reason, some resident with an EV needs an emergency or overnight charge, let ‘em use one of the guest 120 VAC wall sockets in the basement using a wall socket power meter. The electric cost (\$0.225 per hour for a charge at 1.5kW per hour) – to be able to drive the vehicle to a repair facility or full-fledged charging station – is no big deal.

Let them use their *type/level 1* charger, and then write a check to give to the building captain to pay for this unusual electricity use.

DOWN the ROAD:

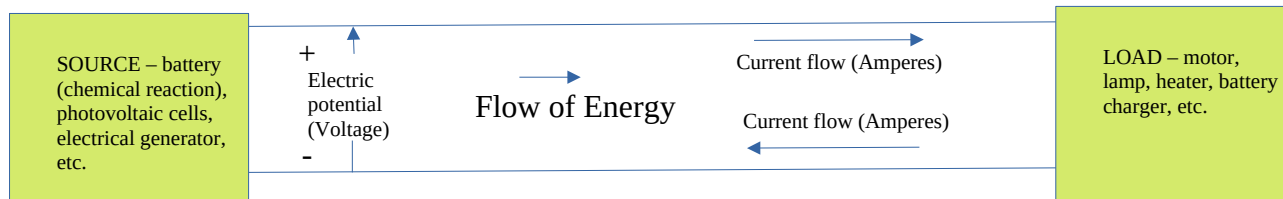
As the next several years (3 – 7) go by, let’s see how rapidly our Providence Point population switches to EVs. If the adoption of EVs gets significant in the buildings with underground garages, and the outside world fails to provide adequate *level 2 or 3* chargers (to fully charge while shopping or eating out), then the Providence Point Maintenance Department might want to install high rate chargers (such as in the following pictures) at the Town Hall, Library, Club House, and/or South Community Center.



Appendix A – BASIC ELECTRICITY CONCEPTS

Energy is the ability to make something happen, to do work. There is mechanical and electrical energy.

The usual use of electricity is to transport energy from an electrical source (such as a battery or electrical generator), to a place (called a ‘load’), through electrical conductors (usually wires), where it is used to provide mechanical motion, create heat, create light, or cause chemical reactions. A schematic diagram, such as the following, shows this transfer of energy:



This sending of electrical energy is accomplished by the source imposing a potential, a **voltage**, a push if you will, across a pair of electrical conductors (usually metal wires), in order to force an electrical current (usually composed of electrons) to flow to the load, which then flows back from the load to the source (on the bottom conductor above). That flow, going through the load (such a lamp, heaters, motors, computer chips, and the like) under pressure from the source – delivers the energy.

Electricity delivered to an electrical motor produces rotation of a metal shaft. In an EV that shaft is connected to a wheel surrounded by an air filled rubber tire. When it is desired to brake an EV, the mechanical energy of motion of the automobile and wheel is turned into electricity by the motor. That motor thus becomes a generator, a source, whereupon the flow of electrical energy then flows from the motor back to the controller of vehicular electricity – which flows it back to the EV battery. That is, during ‘regenerative braking,’ the motor becomes a generator.

Generally, ‘**current**’ consists of the flow of electrons. One **ampere** of current is thus flow of: 6,350,000,000,000,000,000 (6.25x10¹⁸) electrons per second past any point in a conductor.

To make a current, that is to make a stream of electrons flow – a ‘push’ – a force, as said above, has to be applied. That force is called a ‘potential’ or **voltage**, which is measured in volts.

The rate at which energy is transferred is proportional to both the pressure applied (the voltage) and the amount of the flow (the quantity of electrons per seconds) that occurs. This rate of electrical energy flow is the **power** delivered and is measured in **watts**.

To summarize into a few simple equations:

$$\begin{aligned} \text{power} &= \text{voltage} * \text{current} \\ \text{or} \\ \text{watts} &= \text{voltage} * \text{amperes} \end{aligned}$$

One watt (say produced by a 1 volt battery delivering 1 ampere to a small lamp) gives off enough heat that you wouldn’t want to hold that lamp between your fingers. (I learned this, the hard way, when I was a youngster.) But the levels of energy and power required to operate an EV (about 300 watts per mph, 12 kW at 40mph), is hugely greater. We use a scaled-up unit of the watt and the second to discuss the power and energy needs of EVs:

Power: 1 kW (one kilowatt) is: 1,000 watts

Energy: 1 *joule* of energy = 1 watt * 1 second

1 kWh (one kilowatt hour) is: 1,000 watts for a full hour

or

1,000 watts * 3600 seconds (or 3,600,000 watt-seconds)

or

3.6 million joules.

Note that a simple level 1 EV charger charges at a rate of about 1.5kW. This is charging at 120 volts times 12.5 amperes, and is well within the 15 ampere limit of an ordinary 120 volt wall electrical outlet. So such an outlet can charge at level 1 delivering 1.5kWh each hour at a cost of about: 1.5kWh x \$0.15 per kWh or \$0.225 per hour of charging.

Appendix B – EVs ARE SIMPLER, BETTER VEHICLES

To begin with, the electric motors providing the propulsion for EV are much simpler than the internal combustion engines (ICEs) required of the current fleet of automobiles and trucks. Propulsion and considerable braking are provided by the direct-current electric motors (which are also inherently electrical generators). These are far simpler than the ICEs which have many times and varieties of mechanical parts, parts which also have far more stringent dimensional and manufacturing requirements. And ICEs require highly complex transmission mechanisms in order to operate the vehicles at the very different speeds and torque requirements of practical vehicles – and they cannot return vehicle energy of motion back into fuel. Furthermore, the controls for the EV motors and batteries are physically quite simple (even though the micro-computer functioning and corresponding computer programming is quite complex).

These practical, economics related factors imply EVs will dominate in the future. That EVs (presuming their required electricity energy is produced by solar and wind generation devices) are ecologically desirable – gives great importance to a rapid adoption of their use.

----- The Electricity (Fuel) Needs of EVs -----

Of course, electric vehicles require no gasoline or fuel oil. Here, we will consider the Tesla Model 3 as a reasonably typical EV automobile.

Its electricity storage requirement is 50kWh (or 85kWh for an enhanced version of the vehicle). This is the energy contained in its battery when it is fully charged. Since this auto gets about 4.4 miles per 1 kWh of energy, this gives the Model 3 a theoretical range of 220 miles (374 miles for the 85kWh battery). Realistically, you'd better stop for a full recharge after you get down to say 20% charge left (after about 175 miles for the 50kWh battery or 300 miles for the 85kWh battery).

For everyday city driving, most EV owners might likely be well served by (my guess) 60 miles of range. For that you would need 14 kWh of overnight charging. If you can connect your EV to an in *level 1* residence charger for 10 hours (say 9pm to 7am), then a charging rate of 1.4 kW is satisfactory. That would require a 120 volt AC power outlet to allow a current flow of 12.3 amperes – which is well within range of an ordinary house hold outlet. (This presumes about 90% efficiency in charger efficiency.)

So a category 1 charger (*Type 1* or *J1772*) is sufficient to serve a typical EV owner at the Edinburg charging from an ordinary 120 volt electrical outlet!

----- Volts and Amperes inside an EV -----

Cruising around in an EV at 30 miles/hour – one that gets 4.4 miles per kWh of energy – informs us that in one hour such an EV will use: 30 miles / (4.4 miles/ kWh) or 6.82 kWh of energy in that hour or requires a power delivery rate of power from the batteries to the wheels of: 6.8 kW.

Given that the typical voltages on EV power trains is about 400 volts, a power consumption of 6.8 kW implies that:

$$6,800 \text{ watts} / 400 = \text{about } 17 \text{ amperes}$$

is the value of the current flow. At 60 miles per hour speed (because of more than proportional increased air friction) , the voltage is about the same for the power train, but the current draw will be more than twice, or more than 34 amperes.

----- Don't mess around with the power train Electrical Wiring !! -----

With about 400 volts there (and 800 volts in future vehicles) **DON'T MESS AROUND** with the wiring, battery compartment, or anything else near the power train!!!

Appendix – C – CHARGING SPECIFICS

Electric Vehicle Charging Speeds

Currently (30 Dec.2022) Electric vehicles can be charged using three different maximum charging speeds.

Level 1

The slowest, Level 1 equipment, provides charging through a common residential 120-volt (120V) AC outlet. Level 1 chargers can take 40-50 hours to charge a battery only electric vehicle (BEV) from empty and 5-6 hours to charge a plug-in hybrid electric vehicle (PHEV) from empty.

Level 2

Level 2 equipment offers charging through 240V (in residential applications) or 208V (in commercial applications) electrical service, and is common for home, workplace, and public charging. Level 2 chargers can charge a BEV from near empty in 4-10 hours and a PHEV from near empty in 1-2 hours.

Direct Current Fast Charging (DCFC)

The fastest speed, direct current fast charging (DCFC) equipment, enables rapid charging along heavy-traffic corridors at installed stations. DCFC equipment can charge a BEV to 80 percent in just 20 minutes to 1 hour. Most PHEVs currently on the market do not work with fast chargers.

Shown below are typical Level 2 and DCFC charging stations.



Level 2 chargers (left) are common in home, workplace, and public settings and can charge a BEV from empty in 4-10 hours. Direct current fast chargers (right) are common as public chargers and along highway corridors and can charge a BEV to 80 percent in under an hour. (123RF and [Washington State Department of Transportation](#) photos)

Summary of EV Chargers, Their Connectors, and Charging Times:

The below table summarizes the typical power output, charging time, and locations for PHEVs and BEVs for the different charger types. (Note: Because the last 10 percent of charging an EV battery can take as long as the first 90 percent, for longer trips, it can save time to charge part-way [e.g., 20 to 60 percent] and drive fewer miles between charges rather than recharge fully and drive more miles between charges.) For more information on the power requirements of different chargers, see the [Utility Planning](#) section of the toolkit [I haven't included this 'tool kit' in this report. RK].

Overview of EV chargers: power output, plug type, and charge time for light-duty vehicles.
(Adapted from the [Alternative Fuels Data Center](#))

	Level 1	Level 2	DC Fast Charging
Connector Type¹	J1772 connector 	J1772 connector 	CCS connector  CHAdeMO connector  Tesla connector 
Typical Power Output	1 kW	7 kW - 19 kW	50 - 350 kW
Estimated PHEV Charge Time from Empty²	5 - 6 hours	1 - 2 hours	N/A
Estimated BEV Charge Time from Empty³	40 - 50 hours	4 - 10 hours	20 minutes - 1 hour ⁴
Estimated Electric Range per Hour of Charging	2 - 5 miles	10 - 20 miles	180 - 240 miles
Typical Locations	Home	Home, Workplace, and Public	Public

¹ Different vehicles have different charge ports. For DCFC, the Combined Charging System (CCS) connector is based on an open international standard and is common on vehicles manufactured in North America and Europe; the CHAdeMO connector is most common for Japanese manufactured vehicles. Tesla vehicles have a unique connector that works for all charging speeds, including at Tesla's "Supercharger" DCFC stations, while non-Tesla vehicles require adapters at these stations.

² Assuming an 8-kWh battery; most plug-in hybrids do not work with fast chargers.

³ Assuming a 60-kWh battery.

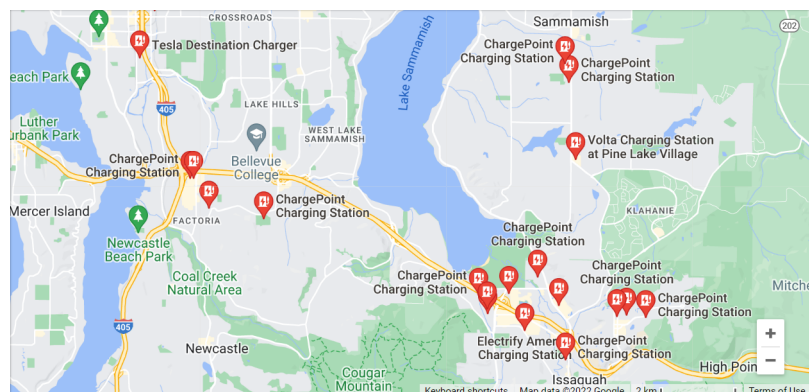
⁴ To 80 percent charge. [Charging speed slows](#) as the battery gets closer to full to prevent damage to the battery. Therefore, it is more cost- and time-efficient for EV drivers to use direct current (DC) fast charging until the battery reaches 80 percent, and then continue on their trip. It can take about as long to charge the last 10 percent of an EV battery as the first 90 percent.

Current SAMMAMISH and ISSAQUAH Area Charging Stations

Electrify America Charging Station
 Electric vehicle charging station
 755 NW Gilman Blvd · (833) 632-2778
 Open 24 hours CCS · 150.0 kW Total 5
 CHAdeMO · 50.0 kW Total 1
 J1772

ChargePoint Charging Station
 Electric vehicle charging station
 5150 220th Ave SE · (888) 758-4389
 Open 24 hours J1772 · 6.5 kW

Volta Charging Station at Pine Lake Village
 Electric vehicle charging station
 Sammamish, WA
 Open · Closes 12AM J1772 · 8.3 kW



Appendix – D – SOME INTERESTING EV Aspects

[The following is from: How Long Do Electric Car Batteries Last? Dustin Hawley | Sep 21, 2022]

Many drivers are transitioning towards electric vehicles, and by 2040, EVs are expected to represent more than two-thirds of passenger vehicle sales

BATTERY BASICS

Gasoline-powered cars have lead-acid batteries, while EVs use lithium-ion battery packs. These latter are the same batteries you can find in your cell phone or laptop. Lithium-ion batteries have greater energy density and hold their charge longer than standard car batteries. In the future, other elements than lithium might be used.

The term kWh or kilowatt-hour refers to an electric car's battery capacity. The more kWh your vehicle has, the longer you can drive around before recharging. So, think of kWh-rating as picking a gas tank size when choosing an EV.

While the kWh rating helps understand how far your vehicle can go, it does not give an idea about how long your battery will last.

EV BATTERY LIFE

Every EV battery in the USA comes with a warranty, lasting for eight years minimum or up to 100,000 miles. However, you should always familiarize yourself with the warranty terms as there may be other catches. For instance, KIA offers a ten-year battery pack warranty, while Hyundai provides lifetime coverage.

Generally, electric vehicle batteries last 10-20 years, but some factors may reduce their lifespan. For instance, batteries may degrade faster in hotter climates as heat does not go well with EVs. Additionally, charging the battery at a Level 3 station can cause the battery to overheat, as the charging process is too quick. This process can negatively affect performance and longevity.

However, many manufacturers have learned these lessons beforehand and include protective measures in their cars.

How many years does a Tesla battery last?

According to Elon Musk on Twitter, Tesla car batteries are supposed to technically last for **300,000 to 500,000 miles**, which is 1,500 battery cycles.

That's between 22 and 37 years for the average car driver, who, according to the Department of Transportation, drives about 13,500 miles per year.^{Sep 5, 2022}

15 to 20 years

“Today, most EV batteries have a life expectancy of **15 to 20 years** within the car – and a second life beyond.” It's also worth noting that EV battery technology is still evolving, so as tech develops we expect batteries' lifespan to increase – as well as becoming cheaper, smaller and even lighter.^{Jul 15, 2022}

BUYING A REPLACEMENT

If your warranty runs out and the battery just happens to be beyond repair, you have to look for a replacement. Unfortunately, a new pack can cost \$5,000 on average and as much as \$15,000 in some cases.

Fortunately, prices are expected to drop in the next two to three years as EV adoption continues to grow among consumers. Additionally, manufacturers are trying to do everything possible to improve the lifespan of their EV batteries. Today, you can expect your battery to degrade at 2.3 percent per year. So, if your EV's range is 150 miles, you will lose about 17 miles of accessible range to about 130 in five years.

IMPORTANT NOTE: Bob Hanson (a resident here at Providence Point - robert-j-hanson@outlook.com) has the following to tell us about EV battery replacement!

'One last item. A lady I know had a Tesla (one of the least expensive models) and the battery went out. She went to the repair center and was told the following: The battery replacement was about \$3K but the labor charge to replace it was between \$17K and \$19K, so they both agreed that the car was totaled. Also, the Cadillac battery has a cost of about \$50K. So if it has to be replaced, the \$50K is not the actual battery cost but in lieu of it's the labor. GM does not want to have someone total a \$100K car due to a \$6K battery, I.e. it's the labor charge in disguise.'

Bob Hanson has been studying EVs for some time. He is willing to offer a class (which I and many people I know would like to attend) at Providence Point Communiversity. All of us need to let Tony Curry, director of Communiversity, know that we are interested!

BATTERY PROTECTION

As mentioned, heat directly correlates with your battery's lifespan. Something similar goes for cold, but it does not reduce life expectancy, only range and performance. All EVs work optimally at 70 degrees Fahrenheit, and because of that, manufacturers started equipping the vehicles with thermal management systems. Their complexity depends on the model and brand, but liquid cooling is usually involved, as it helps keep the temperature at an acceptable level.

You can do nothing about charging, though. Whenever you replenish the charge, your battery slowly degrades with each cycle. While it is normal for an iPhone to undergo this process often, car owners expect to get more out of their rides than four or five years. That is precisely why you will never be able to fully deplete or charge the battery in an EV. Even with zero percent battery life, while you cannot drive, some energy will still be preserved. It helps to improve battery longevity drastically.

Should I charge my Tesla to 80% or 90?

What percentage should I charge the battery to? For regular use, we recommend keeping your car set within the 'Daily' range bracket, **up to approximately 90%**. Charging up to 100% is best saved for when you are preparing for a longer trip.

APPENDIX - E - PUBLIC EV CHARGERS



Sale

TESLA GEN 3 WALL CONNECTOR
HOME ELECTRICAL VEHICLE
CHARGING STATION FOR TESLA
MODEL S 3 X Y

★★★★★ (1)



Solar panels (A) help charge charging station electricity storage (B) to allow charging EVs at higher rates than the electrical mains can provide.

Appendix – F – COMMERCIAL CHARGING STATION COSTS

If you're thinking of installing a commercial EV charging station, it's important to know that the cost can vary depending on a number of factors. Generally speaking, you should budget between \$2,000 and \$10,000 per Level 2 charging station. This includes the electrical and construction work as well as the charger itself. Of course, the exact cost will depend on things like the type of charger you choose and the extent of the electrical work required. But with a proper planning, you can be sure to get the best possible value for your money.

How Much Does a Commercial EV Charging Station Cost?

Ultimately, the final figure will be much lower due to the rebates and incentives available for commercial EV charging installations. If you have existing electrical infrastructure (220 VAC) that can be adapted for EV charging stations, you can save even more.

What are the costs associated with a commercial EV charging station installation?

In order to figure out how much installing an EV charging station at your property will cost, you'll have to consider infrastructure and installation costs. Infrastructure expenses will be the most expensive and will depend on:

- Cost to deliver power to the commercial EV charging stations
- Labor and material costs for electrical conduit and wire, which will require digging
- Labor and material costs for pouring new concrete
- Labor and material for electrical panels (if needed)
- Networked or non-networked (connected to internet/online management system or not)

How much does a commercial EV charging station cost? Installation expenses depend on factors such as:

- Number of chargers
- Charger manufacturer
- Charger level
- Labor
- Permits
- Taxes
- Location
- Landscaping/lighting features

EV charging solution financing options

As mentioned above, rebates, incentives, and tax credits will cause the eventual price you pay to electrify your facility much lower than initial estimates. Yet, there are even more options available to you that can help cut initial EV charging projects costs down even more. Here are three financing options offered by WattLogic:

Turnkey installation – Everything is covered for you. An EV charging company that offers this option should provide design, product selection, permitting, rebate and incentive management, and installation. With this option, you don't have to worry about anything but figuring out how to alert everyone about the new EV charging stations!

Fleet charging as a service or workplace charging as a service – You pay a monthly subscription fee and avoid paying all upfront costs. With this subscription fee, you receive everything as you would have had you purchased it outright. If you choose WattLogic as your EV charging company, with our fleet charging as a service package you will also receive revenue from people charging, which could cover the cost of your subscription fee. Depending on how robust your EV charging station system is you could even see positive cash flow!

Shared Revenue – The EV charging contractor will install your stations for you and take on the cost, then collect the revenue your stations receive from drivers charging their EVs. A variation of this option would be the EV charging installer splitting both the cost and revenue with you.

Appendix – G – Wall Socket – Power Meter

11/26/22, 7:19 AM

Poniie PN2000 Plug-in Kilowatt Electricity Usage Monitor Electrical Power Consumption Watt Meter Tester w/Extension Cord - - ...

Deliver to robert
Issaquah 98029

Tools & Home Improvement ▾

EN ▾

Hello, Robert
Account & Lists ▾

Returns
& Orders

0

All Cyber Monday Deals Holiday Gift Guide Clinic Customer Service Best Sellers Music Automotive Shop Cyber Monday deals

Tools & Home Improvement Best Sellers Deals & Savings Gift Ideas Power & Hand Tools Lighting & Ceiling Fans Kitchen & Bath Fixtures Smart Home

Seesii Portable 4 Gas Detector



\$75⁹⁹

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Tools & Home Improvement ▸ Electrical ▸ Breakers, Load Centers & Fuses ▸ Accessories ▸ Meter Sockets

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Share

Poniie PN2000 Plug-in Kilowatt Electricity Usage Monitor Electrical Power Consumption Watt Meter Tester w/Extension Cord

Brand: Poniie

2,550 ratings

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Brand Poniie
Power Source Ac
Style Voltage
Color White
Item Weight 0.5 Pounds

About this item

- **HIGH POWER WATT METER:** Counts consumption by Kilowatt-hours, with high-power tolerance rated at Max.16A, compatible with 220v ac
- **REFINED ACCURACY:** Built-in high precision current sensor. Ensures you the best accuracy-Class 1.0 with 0.01W, 0.01V and 0.001A resolution
- **BACK-LIGHT & MEMORY:** With wide view angle, clear backlight large LCD Display and hold over circuit memory for cumulative kilowatt-hours
- **PROFESSIONAL KILOWATT METER:** Start detection 0.20W, you can virtually monitor standby or working power dissipation of all your electronics
- **BUY WITH CONFIDENCE:** 1-YEAR Warranty by Poniie; full ABS fire retardant material housing and comes with 14AWG heavy duty extension cord

[See more product details](#)

Customer ratings by feature

Energy efficiency	5.0
Accuracy	4.5
Easy to use	4.5

Prime Exclusive Deal
\$22.39

Prime Exclusive Deal
This deal is exclusively
for [Amazon Prime](#)
members.

[Join Prime](#)

[Cancel anytime](#)

Buy new:
\$27.99
FREE delivery: Thursday, Dec 1
Ships from: Amazon
Sold by: PoniieDirect

[Add to List](#)

Have one to sell?

[Sell on Amazon](#)

Cyber Monday Deal



ANENG Digital Clamp Meter...

\$15⁹⁹

Sponsored

https://www.amazon.com/dp/B0777H8MS8/ref=sspa_dk_detail_1?psc=1&pd_rd_j=B0777H8MS8&pd_rd_w=QkM6r&content-id=amzn1.sym.dd2c6db... 1/12