Power and Energy Calculator tool for Workplace Charging

This tool is designed to help Plug-in Vehicle (PEV) owners and employers or property management calculate, decide and plan for workplace charging (WPC). The numbers in these calculations should not be considered definitive, but rather as planning estimates.

How are PEVs used and how much power and energy do they need?
For accurate calculations and fair energy cost compensation PEV owners are required to charge their vehicles at home and use the WPC only to top of the battery after the morning commute and trips that occur during the workday. WPC system can be also used to provide energy for preheating/cooling when needed. Most PEVs also have a preheating/cooling function that allows the user to preheat or cool the car to a chosen temperature using grid power before they leave. If the parking is located in a heated/cooled garage, the user naturally does not need to use this function, but if the parking is outdoors and the weather is cold or hot, this is a good feature to have. The Energy needed for this function should be taken into account when calculating energy needs. As a rough calculation number we use 2kWh/heating or cooling event. Some Plug-in Hybrids (PHEVs) have relatively small batteries that might limit how much energy they can draw in a day.

Energy and Power needs:

		Numbers	Example
1	Vehicle make and model		Nissan Leaf SL 2012
2	Charger size (in car, contact dealer for this info if needed)	kW	3.3 kW
3	Electricity consumption (www.fueleconomy.gov)	kWh/mile	0.34 kWh/mile
4	Driving range on electricity (EPA)	miles	73 miles
5	Commuting distance one way	miles	10 miles
6	Average other daily driving	miles	5 miles
7	Total daily mileage (= Row 5 + Row 6)	miles	15 miles
8	Average daily energy need from driving: Compare rows 4 and 7 and choose the smaller number then multiply it by row 3. (=Row 4 or 7 * row 3).	kWh	5.1 kWh (15 * 0.34)
9	If there is a need for preheating/cooling, write 2 to this row	kWh	2 kWh
10	Total energy need (=Row 8 + Row 9)	kWh	7.1 kWh
11	Charging time using 110 V Level 1 charging cord (=Row 10 / 1.4)	Hours	5.1 Hours
12	Charging time using 240 V Level 2 EVSE (=Row 10 / Row 2)	Hours	2.2 Hours
13	How long is the car parked during the day	Hours	8 Hours

The most important numbers from this sheet are the charging times in rows 11 and 12 compared to the parked time in row 13. These will give an idea of how long the vehicle would need to be charged to replenish the energy used by a day's driving. If the Level 1 charging time (Row 11) is shorter than the time that the owner expects the car to be parked at work, then Level 1 charging can be considered, but if it is longer, then Level 2 EVSE is needed.

This worksheet was developed as part of the Workplace Charging Outreach and Education project funded by Minnesota Pollution Control Agency. Author Jukka Kukkonen, PlugInConnect. For more info visit www.WorkplaceCharging.com

Next we will calculate the average energy consumption figures and average energy costs.

Average Energy Consumption and Energy Costs

		Numbers	Example
1	Vehicle make and model		Nissan Leaf SL 2013
2	Charger size (in car, contact dealer for this info)		3.3 kW
3	Electricity consumption (EPA)	kWh/mile	0.34 kWh/mile
4	Driving range on electricity (EPA)	miles	73 miles
5	Commuting distance one way	miles	10 miles
6	Average other daily driving	miles	5 miles
7	Total daily mileage (= Row 5 + Row 6)	miles	15 miles
8	Average daily energy need from driving Compare rows 4 and 7 and choose the smaller number then multiply it with row 3. (=Row 4 or 7 * row 3).	kWh	5.1 kWh (15 * 0.34)
9	How many days/year user expects to need the preheating/cooling	days	50 days
10	Average preheating/cooling energy need (=Row 9 / 250 * 2)	kWh	0.4 kWh
11	Total energy need (=Row 8 + Row 10)	kWh	5.5 kWh
12	Cost of energy	$/kWh	0.11$/kWh
13	Average daily energy cost (=Row 11* Row12)	dollars	0.61 dollars
14	Average monthly energy cost (=Row13*22)	dollars	13.30 dollars

Rows 13 and 14 show the estimated average energy costs. These give a pretty good idea of how much charging energy the PEV will consume and can be used as a base assumption when discussing the metering and payment options.

Exceptions and modifications to these calculations
- If the user expects a lot of variation in daily driving mileage, it might be good to do a “worst case scenario” calculation, too.

Remember that there is some seasonal variation to these numbers in cold climates. In the summer the power consumption will be somewhat lower and in the winter it will be a bit higher. Variation can be expected to be +/- 20%.

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