Electrical car charging stations and solar energy opportunities

Introduction

During the last annual meeting of the "WATERSIDE VILLAGE OF PALM BEACH CONDOMINIUM ASSOCIATION, INC" held January 25, 2025, a new business item has been made to evaluate different possibilities to address the need of recharging electrical vehicles (EV). This document explores the different aspects related to EV charging, solar energy and potential solutions.

1. Charging electrical vehicles

This section explains the charging times of the current generation of electrical vehicles (EV). Two categories of vehicles are concerned:

Pure electrical vehicles (EV): 100% electric with an internal battery.

Plug-in hybrid EV vehicles (PHEV): Internal combustion engine (ICE) combined with electrical motors(s) and a battery that can plug-in.

1.1. Charger types and speed [1]

Level 1

Level 1 equipment provides charging through a common residential 120-volt (120V) AC outlet. Level 1 chargers can take 40-50+ hours to charge an EV to 80 percent from empty.

Level 2

Level 2 equipment offers higher-rate AC 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 an EV to 80 percent from empty in 4-10 hours.

[1] Charger Types and Speeds, US Department of Transportation
https://www.transportation.gov/rural/ev/toolkit/ev-basics/charging-speeds

Level 3: Direct Current Fast Charging (DCFC)

Direct current fast charging (DCFC) equipment offers rapid charging along heavy-traffic corridors at installed stations. DCFC equipment can charge an EV to 80 percent in just 20 minutes to 1 hour. Most PHEVs currently on the market do not work with fast chargers.

Level 2 and DCFC equipment has been deployed at various public locations including, for example, at grocery stores, theaters, or coffee shops.

1.2. Typical charging price (February 2025):

Tesla supercharger station (12 stations and up to 250 kW)
1201 W Lantana Rd,
Lantana, FL 33462

Charging Fees for All EVs [2]

12:00 AM - 4:00 AM	$0.35/kWh
4:00 AM - 9:00 AM	$0.36/kWh
9:00 AM - 11:00 PM	$0.51/kWh
11:00 PM - 12:00 AM	$0.35/kWh
Idle fees (up to)	$1.00/min

1.3. Cost and time estimations [3]:

Tesla Model Y Long Range AWD 2024, supercharger, charging from 20% to 80%.

Estimated time:	level 3 at 150 kW	18 minutes
	level 2 at 7.2 kW	6 h 15 min.
Miles added:		173 mi.
Estimated cost at 0.35$/kWh:		15.75 $
Estimated cost at 0.51$/kWh:		22.95 $

[2] Tesla web site (https://www.tesla.com/en_eu/findus/location/supercharger/27075)
[3] Tesla Charging Cost Calculator (https://evadept.com/calc/tesla-charging-cost-calculator)

Mitsubishi Outlander PHEV 2025

Estimated charging time [4] and cost (home charging at typical FPL residential rate of 0.16$/kWh including fees and taxes).

Level 1 charging (120 V, 12 A)	
Estimated charging time	Approx. 16 hours
Estimated cost	3.69 $
Level 2 charging (240 V, 15 A)	
Estimated charging time	Approx. 6.5 hours
Estimated cost	3.74 $

2. Legislative context: "Right to charge law" in Florida

"*Newly enacted Section 718.113(8) now provides that regardless of any restriction, an owner can install an EV charging station, at their expense and subject to specified restrictions, within the boundaries of their limited common element parking area (a parking area subject to the owner's exclusive use as a part of their ownership interest). The owner cannot irreparably damage the common elements, must separately meter and pay for electricity, and is responsible for maintaining, repairing, operating, installing and insuring the station. Additionally, an EV station installer's mechanic's lien can only be filed against the owner's unit. The association can (and should) require protections such as installer licensure, insurance, architectural compliance, reimbursement for insurance premium increases, etc., and may utilize statutory collection remedies, ostensibly including lien rights, if the association has to cover the owner's costs.*

The benefits of this legislation are obvious and profound: by pre-empting and minimizing the likelihood of potential disputes over an area that will increasingly gain importance as EVs become more prominent, the law benefits owners and residents alike while enabling reasonable protections for associations." [5]

This law is effective since July 1, 2018.

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[4] Mitsubishi cars web site (https://www.mitsubishicars.com/cars-and-suvs/outlander-phev/specs)
[5] WWW.LAW.COM
(https://www.law.com/dailybusinessreview/2018/04/24/2018-condo-legislation-a-green-light-for-electric-vehicle-owners/?slreturn=2025020533452)

3. Incentives related to EV charging stations

Federal incentives:

"Residential 30C Alternative Fuel Infrastructure Tax Credit"

The Alternative Fuel Vehicle Refueling Property Tax Credit, commonly referred to as the "30C tax credit," gives **qualifying individuals** that install electric vehicle (EV) recharging property located within an eligible census tract a tax credit equal to 30% of the cost with a maximum amount of $1,000 per EV charging port.

* This is subject to change; may be the applicant beneficiary need to be a permanent resident.

Florida incentives for installation of an EV charger.

Florida state incentives: None

FPL incentives: None

4. Charging an EV or PHEV vehicle in a condominium association context

The following section will explore the different possibilities for charging an EV or PHEV vehicle. Two different avenues are possible.

- A charging station dedicated to a condominium owner
- A common charging station provided by the condominium association

4.1. Charging station dedicated to a condominium owner

As required by the Right to charge law, a condominium owner as the right to charge is electrical vehicle (EV or PHEV). However, as specified by the law, all the expenses related to the installation and operation cost are the responsibility of the homeowner. Also, as cited above, "*The association can (and should) require protections such as installer licensure, insurance, architectural compliance, reimbursement for insurance premium increases, etc., and may utilize statutory collection remedies, ostensibly including lien rights, if the association has to cover the owner's costs.*"

Level 1 charging

Considering the charging times of an EV, this solution is more appropriate for PHEV vehicles. It requires a 120V 15 A circuit and will be able to provide 1.4 kW of power to the vehicle charging system. It is also possible to install a 120 V 20 A circuit. This alternative will be able to provide 1.9 kW of power.

This type of installation will typically consist of:

- ✓ An electrical post near the parking space of the condominium homeowner
- ✓ A waterproof electrical cover
- ✓ A GFCI electrical outlet
- ✓ A dedicated breaker in the homeowner's electrical panel

The installation will also require:

- ✓ All the required authorizations
- ✓ Parts and labor for the installation
- ✓ Compliance with the National Electrical Code, building code etc…
- ✓ Insurances if applicable
- ✓ Installation performed by a certified US electrician

Level 2 charging

Considering the charging times for an EV, a level 2 charging station is probably the most efficient solution for a homeowner dedicated charging station. Level 2 charger needs a 240 V circuit. When a 240 V electrical circuit is available, the charging power will be limited by the circuit breaker:

- 240 V, 20 A: 3.8 kW
- 240 V, 30 A: 5.3 kW
- 240 V, 40 A: 7.7 kW
- 240 V, 50 A: 9.6 kW
- …
- 240 V, 100 A: 19.2 kW

We should also note that the maximum level 2 charging power is also dependant of each specific EV.

This type of installation will typically consist of:

- ✓ An electrical post near the parking space of the condominium homeowner or a homeowner condominium exterior wall near the dedicated parking space
- ✓ A level 2 charger
- ✓ A dedicated breaker in the homeowner's electrical panel or access to an existing 240 V outlet (i.e. A/C outlet). In the later case, an automatic switching device is required, and the maximum charging power will be limited by the A/C breaker capacity (typically 20 A, 3.8 kW).

The installation will also require:

- ✓ All the required authorizations
- ✓ Parts and labor for the installation
- ✓ Compliance with the National Electrical Code, building code etc…
- ✓ Insurances if applicable
- ✓ Installation by a US certified electrician

4.2. Charging station(s) provided by the condominium association

This avenue requires the installation of commercial type charging stations to be able to provide a complete solution for owners including metering and payment options.

Level 1 charging station

As explained before, the power available with this kind of solution is very limited (1.4 kW for a 15 A circuit). The charging times of a level 1 station are very long (see section 1.1). This solution was not considered since it is too slow to be shared by more than one user.

Level 2 charging station

This solution is the most common solution found in an apartment/condo complex. This consists of one or more level 2 charging stations. However, compared to a residential installation, this solution is more complex:

- Infrastructure costs associated with the dedicated parking spaces
- Commercial type level 2 charger
- Infrastructure costs of the charger (electrical, trenching …)
- Availability of a power source
- Localisation of the charging station
- Software and network fees (metering and payment solution)
- Maintenance and repair costs
- …

A level 2 charging station is appropriated for both pure EV and PHEV cars. As seen in section 1.1, an EV car can necessitate between 4 and 10 hours to charge. This poses the question of the ratio of the number of stations required versus the number of EV users. We found no rule of thumb that may apply in our context of snowbirds.

Currently the only source of power is located by the west pool, no other electrical panel on the association ground has sufficient power for a level 2 charger.

Level 3 charging station

A level 3 charging station (fast Direct current) is typical of the public stations found nationwide. They provide 50 kW and more (at some places up to 350 kW). However, this solution was not considered since it is way too expensive.

5. Financial aspects of a charging station

This section summarizes the costs aspects and potential revenues of different options.

5.1. Costs of installing a charging station by the owner

Level 1 charging stations.

This solution typically consists of an electrical post for the 120 V outlet and the installation costs required to meet all the requirements such as the electrical code and others.

Estimated cost: **± $ 1 000**

Level 2 charging stations.

This solution typically consists of wall charging station. This requires an access to a 240 V circuit and the installation needs to meet all the requirements such as the electrical code and others.

Estimated cost: **± $ 2 000**

5.2. Costs of a charging station provided by the condominium association

As discussed before, a commercial solution is required to allow metering, payment and sharing by numerous users.

Typical costs of one level 2 charging station [6]:

- Hardware costs: $ 6,000 - $ 10,000
- Installation costs: $ 4,000 - $ 5,000
- Software and Network fees: $ 400 - $ 500 per year
- Maintenance and repair: $ 800 - $ 1,000 per year
- Total upfront costs: **$11,200 - $ 16,500**
- Total annual ongoing costs: **$1,200 - $ 1,500 per year**

[6] Costs actualized for a ChargePoint 7.2 kW commercial level 2 station
https://www.beny.com/how-much-does-a-commercial-ev-charging-station-cost/

5.3. Potential revenues of a commercial level 2 station provided by the condominium association

Ten owners/renters have declared using pure EV cars (all Tesla and all snowbirds). The administration does not have specific information about the PHEV type, but we are confident that we have less than 10 PHEV owners.

Hypotheses:

- One level 2 station installed and able to provide 7.7 kW of charging power.
- 10 EV owners will charge on-site twice a month. This will provide them ±340 miles of added range per month. Total of 20 charging sessions of ± 6 h 15 min. per charging session = 125 hours/month.
- 10 PHEV owners will charge their car four times a month. The range added by charging is specific to each PHEV make/model. Total of 40 charging sessions of ± 6.5 hours per charging session = 260 hours/month.
- The charged cost of energy at 0.35$/kWh. The cost of the energy paid by the association to FPL is ± 0.16$/kWh including taxes hence 46 % of the expected revenues.
- All the EV and PHEV owners are snowbirds. We must then expect revenues from the charging station no more than 4 months/year.
- These hypotheses will occupy the charging station ± 13 hours every single day of the month and will necessitate a reservation schedule to materialize this high level of occupation. This probably correspond to the maximum utilisation rate possible for a single station.

Maximum expected revenues:

EV: 20 charging sessions/month at $15.75	$ 315.00
PHEV: 40 charging sessions/month at $ 3.74	$ 149.60
Total:	$ 464.60
Minus cost of energy paid by the association (46 %)	$ 213.72
Net monthly revenues	$ 251.48
Net annual revenues (4 months x $ 251.48)	**$ 1 005.92**

Realistically, we should consider one charging session of ± 6.5 hours every single day of a month or even less. This reduces the hypothetical annual revenue by half.

Realistic revenue for one charging station: **$503 / year**

Total annual ongoing costs (see 5.2): **$1,200 - $ 1,500 per year**

In this scenario, the expected annual revenue covers less than half the ongoing cost for the operation of one charging station, and no recuperation of the upfront cost of between $11,200.00 to $16,000.00.

6. Solar energy

As seen before, part of the expected revenues of a charging station must pay for the energy consumed from the electric utility (FPL). Since energy from the sun is free, a solar system may be an alternative to provide electrical power.

A basic solar system consists of solar panels and inverters to provide electricity to an existing electrical installation. The inverters convert the direct current (DC) provided by the solar panels to alternating current (AC).

Before installing a solar system, we must consider some hard facts regarding solar energy:

- The “free energy” is available only after the payback period of a solar system installation.
- The typical payback time of such a system is 12-13 years [7] .
- Most of the time, solar energy consultants do not consider repair and maintenance in the payback equation.
- The typical lifetime expectancy is around 25 years for solar panels but frequently less for inverters (5 years warranty). However solar panels lose their efficiency with age: typically, 2% the first year and 0,5 % thereafter.
- The typical cost of a basic 8 kW solar system is more than $ 24 000 installed [8].
- The federal tax incentives do not apply to our condominium association since it does not pay federal taxes.
- A charging station is an “on/off” device: consuming almost nothing when idle or providing a full steady rate of energy while charging.

[7] https://www.solar.com/learn/what-is-the-average-payback-period-for-solar-panels/
[8] https://www.consumeraffairs.com/solar-energy/how-much-do-solar-panels-cost.html

- On a cloudy day, solar panel production can be greatly reduced to 10-25% of the nominal power capacity of the system.
- Since the energy production of solar panel is variable (multiple factors like sun angle, clouds, peak sun hours, month of the year …) this solution is not appropriate as the only energy source for a charging station.
- Such a basic system must be "grid-tied" to send the unused energy to the electrical utility (FPL) and thus reduce the electrical bill. This also requires a specific agreement with the electrical utility and the installation of a special meter for "net metering" billing purpose (energy consumed minus energy sent to FPL). However, the monthly electrical bill cannot be less than 25 $.
- An 8-kWh solar system installed in Hypoluxo has the potential of generating ±12 500 kWh per year [9]. At $ 0.14 kWh, this system may reduce the energy bill by $ 1 750 /year. This confirms a payback period of more than 13 years. However, this does not include the repair and maintenance costs.
- The installation costs are higher in our area since we must comply with local codes in the context of extreme wind conditions.
- Frequent comments from homeowners who installed a solar system:
    - High upfront costs
    - Lack of long-term support
    - Frequent maintenance expenses
    - Multi-decade long-term commitment
    - Increased difficulties selling their homes

Typical ongoing cost for a typical solar system (20-25 solar panels) [10]

Average maintenance costs per year:	630 $
Average repair costs per year:	730 $
Average total cost per year:	**1 330 $ / year**

Considering the complexity of a solar system, a reputable consulting firm must be involved in the conception and the installation of a complete solar system. They must provide detailed upfront costs, annual ongoing costs (repair, maintenance …) and a projected payback schedule. However, without incentives and with the present estimates, a solar system should not pay by itself within 25 years.

[9] The National Renewable Energy Laboratory (https://pvwatts.nrel.gov/pvwatts.php)
[10] Home advisor web site (https://www.homeadvisor.com/cost/cleaning-services/solar-panel-maintenance/)

Appendix 1: Level 1 charging station provided by the condominium owner

Typical components required for this kind of installation.

Power outlet post: ± 120 $

Outdoor electrical box with GFCI 120V outlet: ± 25$

Electrical breaker for the owner's electrical panel: ± 55$

Appendix 2: Level 2 charging station provided by the condominium owner

Typical components required for this kind of installation.

Level 2 charger: ± 600 $

Automatic switching electrical box for connecting to an existing A/C unit: ± 750 $

Or electrical breaker in the owner's electrical panel: ± 55$ (but requires the installation of a conductor between the owner's electrical panel an the outdoor charger $$).

Appendix 3: Level 2 charging station provided by the condominium association

Typical commercial level 2 charging station

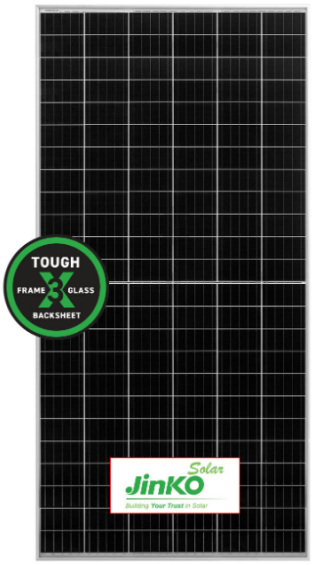
Appendix 4: Typical commercial level 3 charging station

62.5 kW, $ 39,999.00 from Smart charge America (station only)

Appendix 5: Typical 8 kW solar kit (on-grid system)

This example provides only the solar panels, inverters, cables and connectors. No mounting hardware or installation.

8.2 kW Solar Kit - Micro Inverters IQ8 with 20 . Solar Panels



Solar Kit Features - Benefits

8,200 Watts Hourly Energy During Sun Hour
8.2 kW Houry Energy During Sun Hours
41,000 Daily Watts for 5 Sun Hours
240 AC Volt Output
Each Panel takes about 22 SF on the mounting
Enphase 8 Tech Specs

410 watt PV Panels
20 Each USA Made
1,230 kW Monthly E
Enphase Micrinverte
Jinko Solar Panels h
Jinko Solar Pane

Add to Cart

$12,384.27

8.2 kW Microinverter with 20 Jinko 410 watt panel - Solar System DIY Kit:

Optional:
Roof Mounting $2,500.00
Ground Mounting $2,500.00
Solar Permit Service $1,200.00

Appendix 6: Typical 1 kW hybrid solar kit (on and off-grid system)

This example provides only the solar panels, chargers/inverters, batteries cables and connectors. No mounting hardware or installation. This system can be uses as a backup power source or as a complete autonomous system. However, the installation costs are much higher.

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