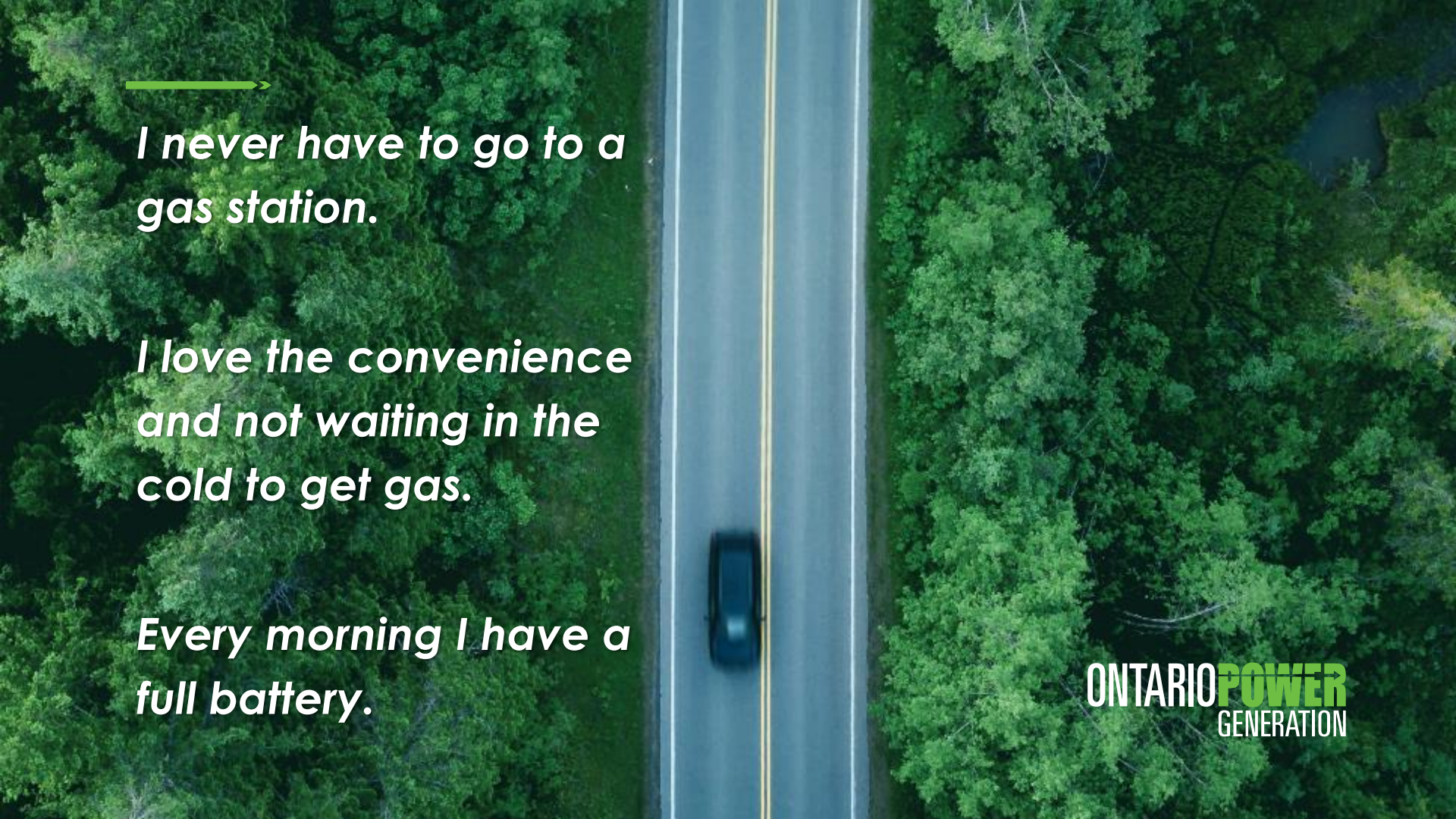




EV Charging: Back to Basics Overview

Tyler Seed | June 14, 2019

ONTARIO **POWER**
GENERATION

An aerial photograph of a two-lane road with a double yellow line, cutting through a dense green forest. A dark-colored car is driving away from the viewer on the right side of the road. In the upper left corner, there is a green arrow pointing to the right.

*I never have to go to a
gas station.*

*I love the convenience
and not waiting in the
cold to get gas.*

*Every morning I have a
full battery.*

ONTARIOPOWER
GENERATION

Agenda

- 1 | OPG and the EV game
- 2 | Where and how do EVs charge?
- 3 | Home and Workplace
- 4 | Public Charging

A few FAQs

Market

Locations

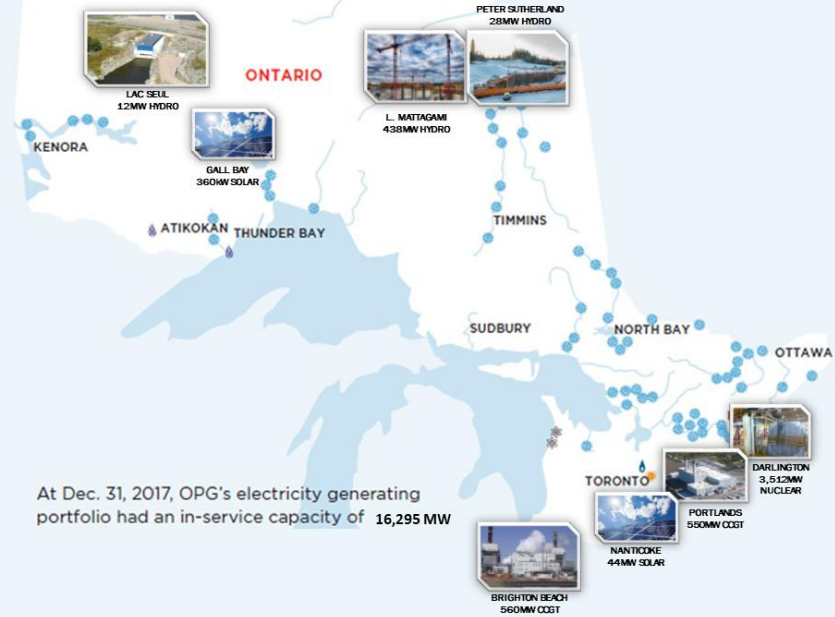
Numbers



OPG Overview

- Ontario's largest and lowest-cost energy provider
- Produces almost 50% of electricity in Ontario
- Over 99% of OPG's power is free of smog / carbon emissions
- Committed to ensuring our energy production is reliable, safe and environmentally sustainable today and for the future

ONTARIO POWER GENERATION FACILITIES



At Dec. 31, 2017, OPG's electricity generating portfolio had an in-service capacity of 16,295 MW

2 
Nuclear
Stations

1 
Solar
Power
Station

3 
Thermal
Stations

2 
Co-Owned
Gas-Fired
Stations*

66 
Hydroelectric
Stations

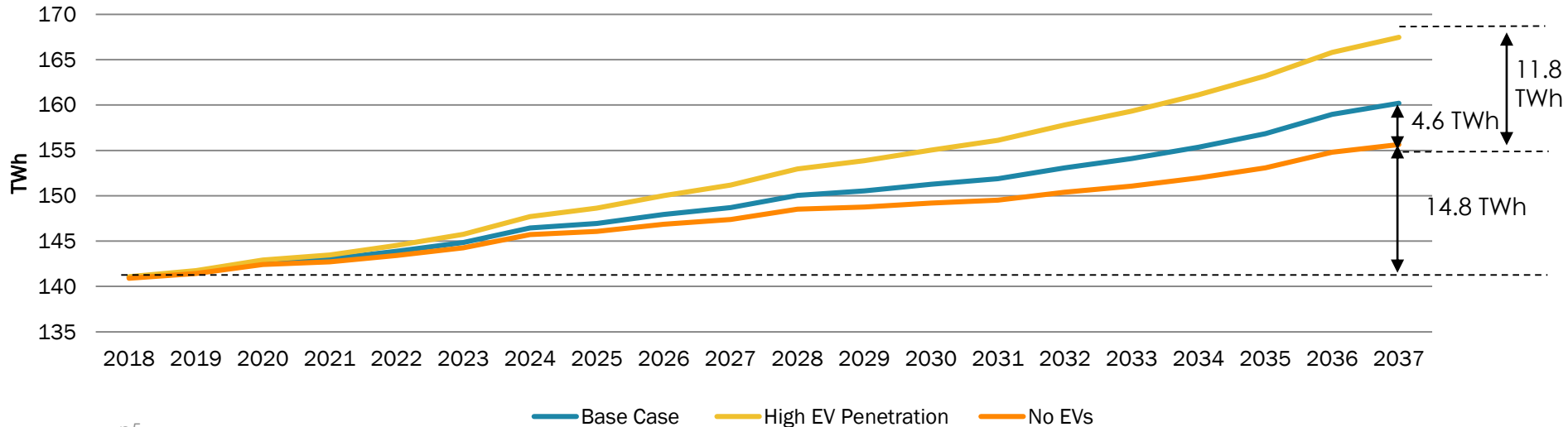
1 
Wind
Power
Turbine

3 
Storage
Facilities
* Built or Under Development

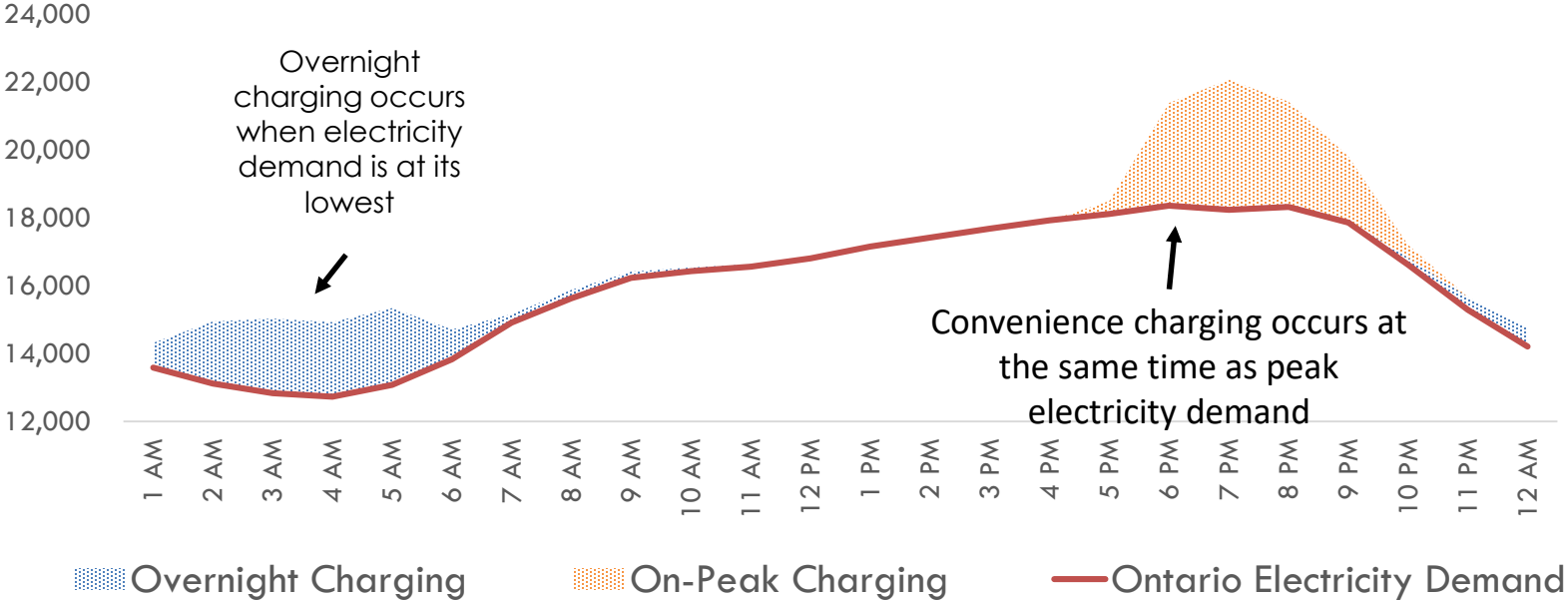
Load Growth

OPG forecasts 25-45% of electricity demand growth over the next 20 years could be EVs.

Ontario Electricity Demand



Managing demand will be essential



Charging by the Level



Level 1



Level 2

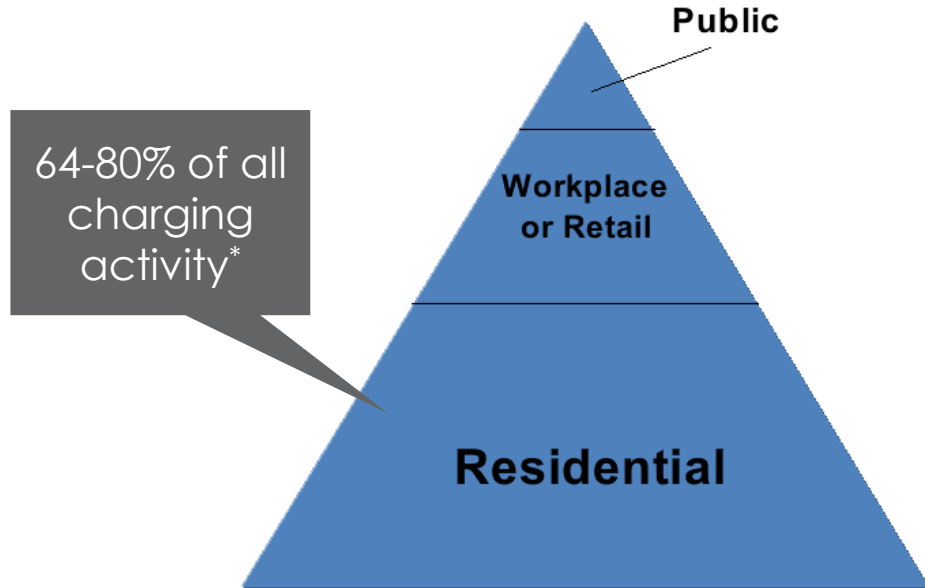


Level 3

Charging by the Level

	Level 1	Level 2	Level 3 / High Power / DC Fast
Power Output (kW)	2 kW	7 kW	50+ kW
Duration of Typical Charging Session	8 - 20 hours	2 - 4 hours	15 - 25 minutes
EV Range per hour of Charge	7.3 km per hour	42 km per hour	385 km per hour
Typical Supply Power Specifications	120 VAC/12-16A	208/240 VAC/16-80A	480 VAC 3-Phase

Where does charging happen?



Charging at Home

Where the heavy lifting happens.

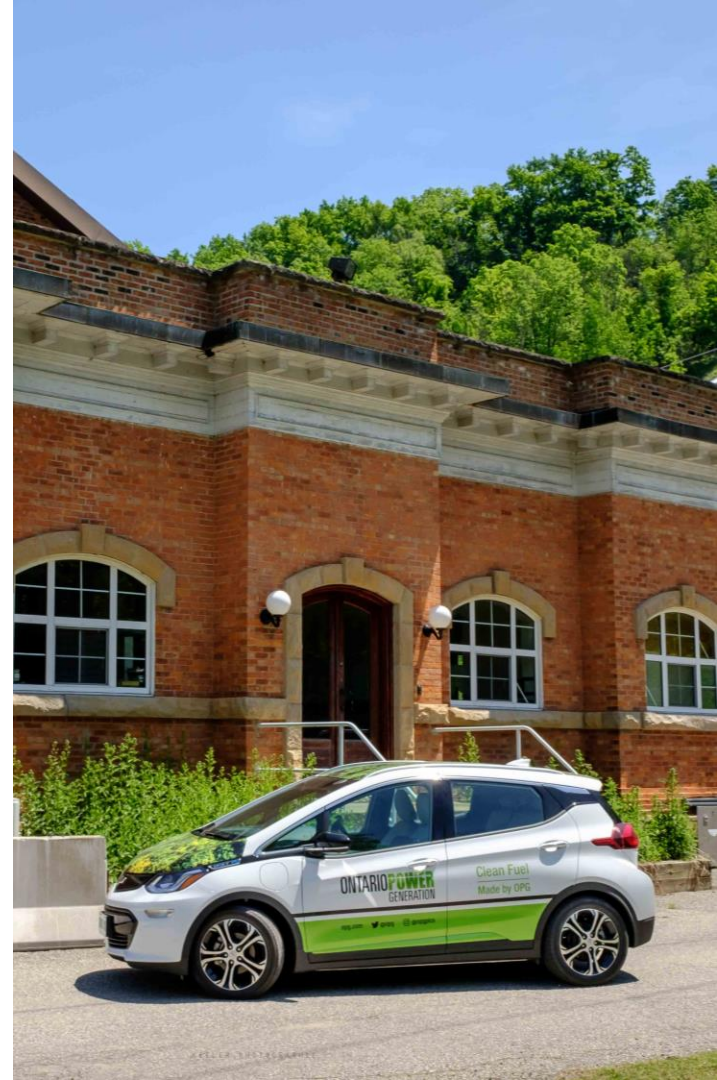
- Most BEV (full battery electric) owners install Level 2
- Level 1 often enough for PHEV (hybrids)
- Smart chargers enable additional load shifting/demand management options
- “Charging as a service” models on the way
- MURBs and garage orphans are a challenge



Charging at Work

The second home base

- Chargers can often serve both employees and fleet
- Track and optimize usage
- Demand management
- Smart placement
- Power share among bank of chargers to reduce upgrade costs



Public Charging

Does public charging represent a promising revenue stream?

Probably not anytime soon.

Are chargers a destination in themselves?

Probably not.

Should public charging be free?

No.



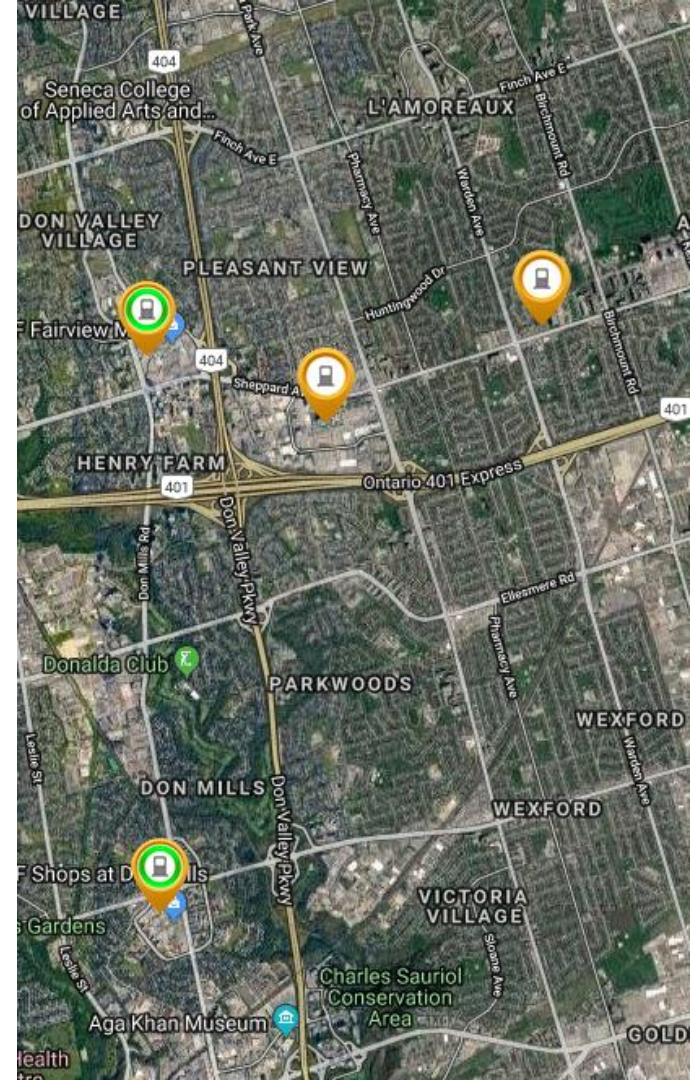
Who needs public charging?

	Level 2	Level 3
Visitors	X	X
MURB residents / garage orphans	X	X (maybe)
Commuters	X	X (maybe)
Passing through		X
Ridesharing/Taxi		X
Local Errands	X (maybe)	

If we build them, will they come?

Considerations for locating chargers:

- Is it convenient? MURBs nearby? Highways?
- What will people do while they're charging? Are there washrooms? Food? Retail?
- Does it feel safe at night? Does it feel comfortable?
- Is it accessible at all times?
- Is the parking paid? Enforced?
- Will other chargers drink your milkshake?
- How much will it cost to install?



Public Charging by Level

	Level 2	Level 3 / High Power / DC Fast
Power output (kW)	7 kW	50+ kw
Duration of typical session	2 - 4 hours	15 - 25 minutes
Range per hour of Charge	42 km per hour	385 km per hour
Typical user rates (per hour)	\$1.50 - \$3.00	\$12.00 - \$20.00
Installation cost	\$5K - \$10K	\$100K - \$200K
Annual operating expenses	\$200 - \$700 + electricity & transaction costs	\$3000 - \$4000 + electricity & transaction costs

Questions?

An aerial photograph of a multi-lane highway stretching through a dense forest. The sky is filled with large, white, fluffy clouds. The overall color palette is dominated by greens and blues.

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Charger Options

ABB 50 kW



Tritium 50 kW



BTC 150 kW+



Efacec 150 kW+

