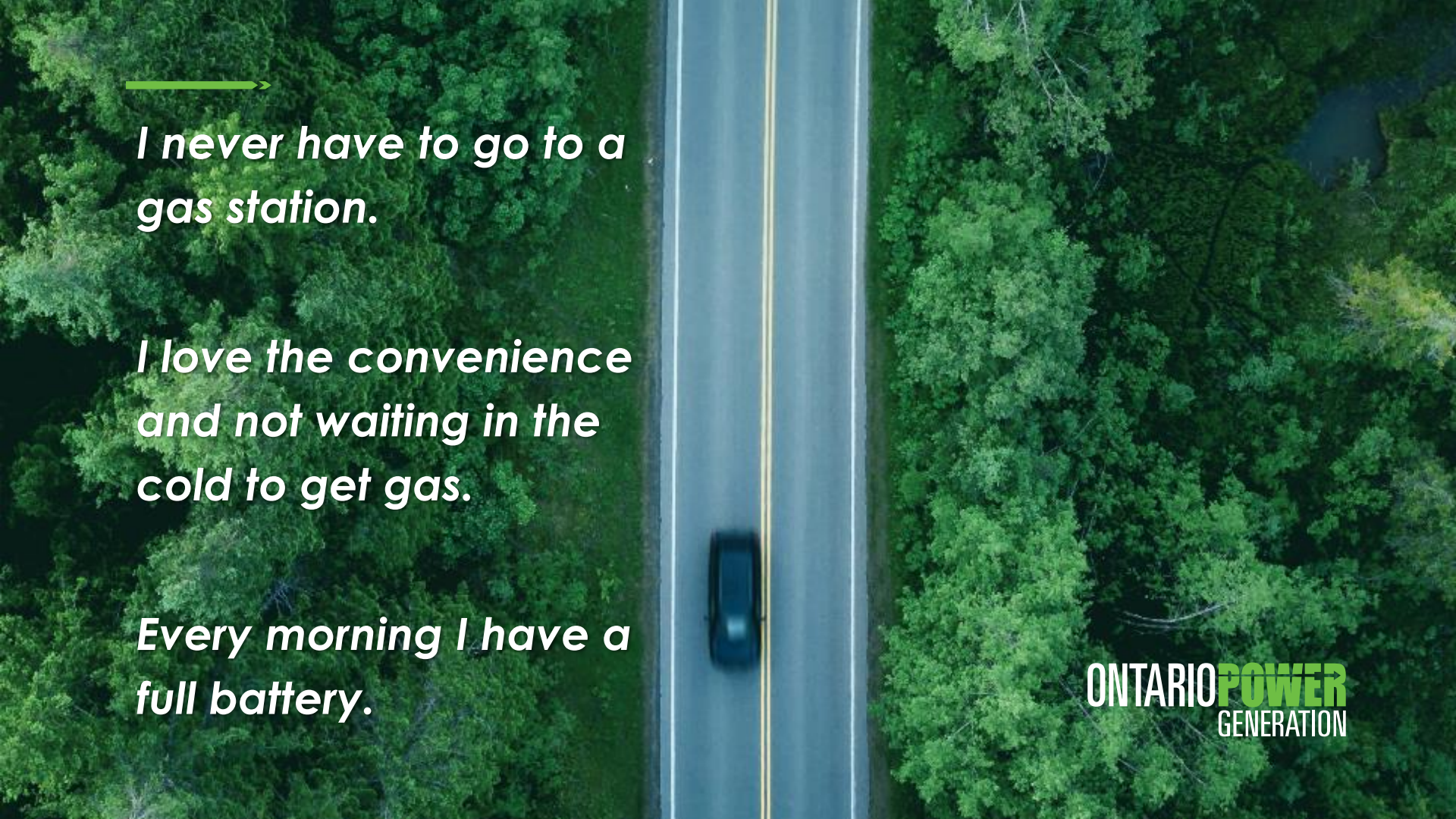
EV Charging:
Back to Basics Overview

Tyler Seed | June 14, 2019

ONTARIO POWER GENERATION


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.
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Agenda

1 | OPG and the EV game

2 | Where and how do EVs charge?

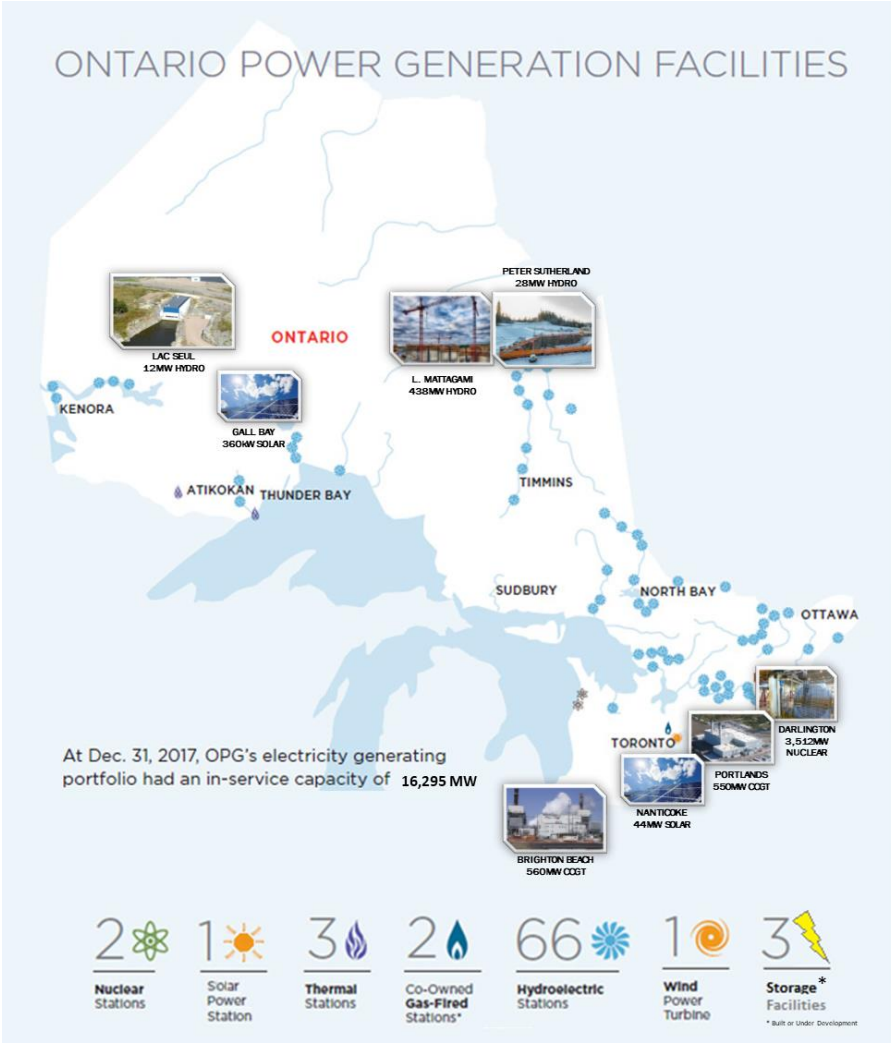
3 | Home and Workplace

4 | Public Charging

- A few FAQs
- Market
- Locations
- Numbers

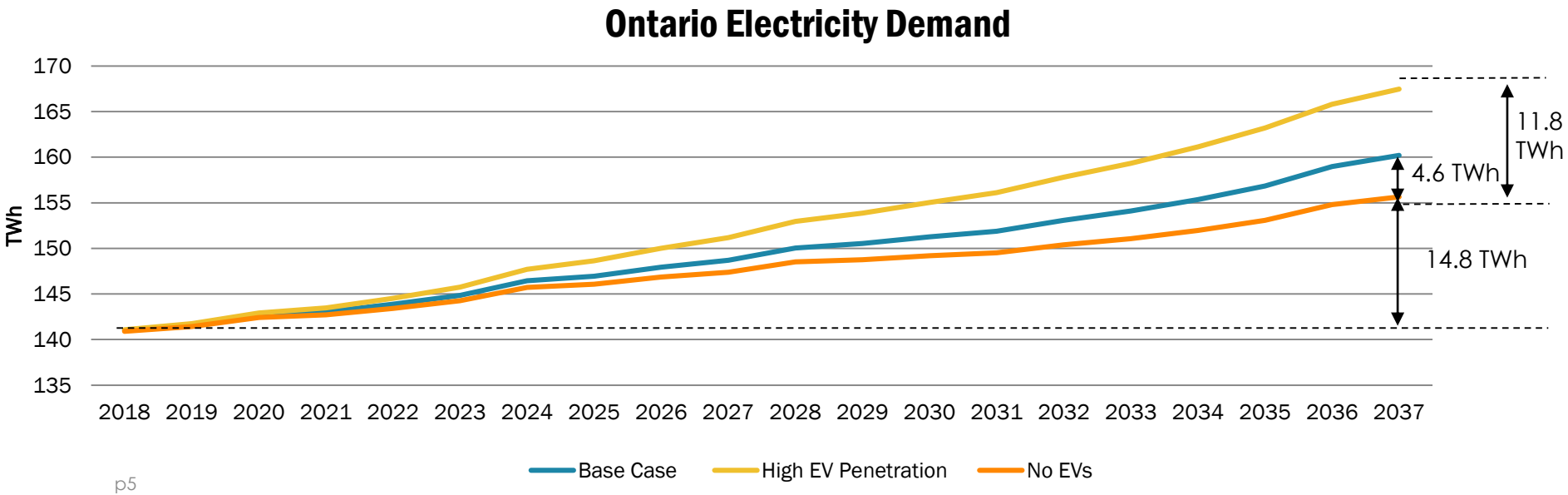
OPG Overview

- 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

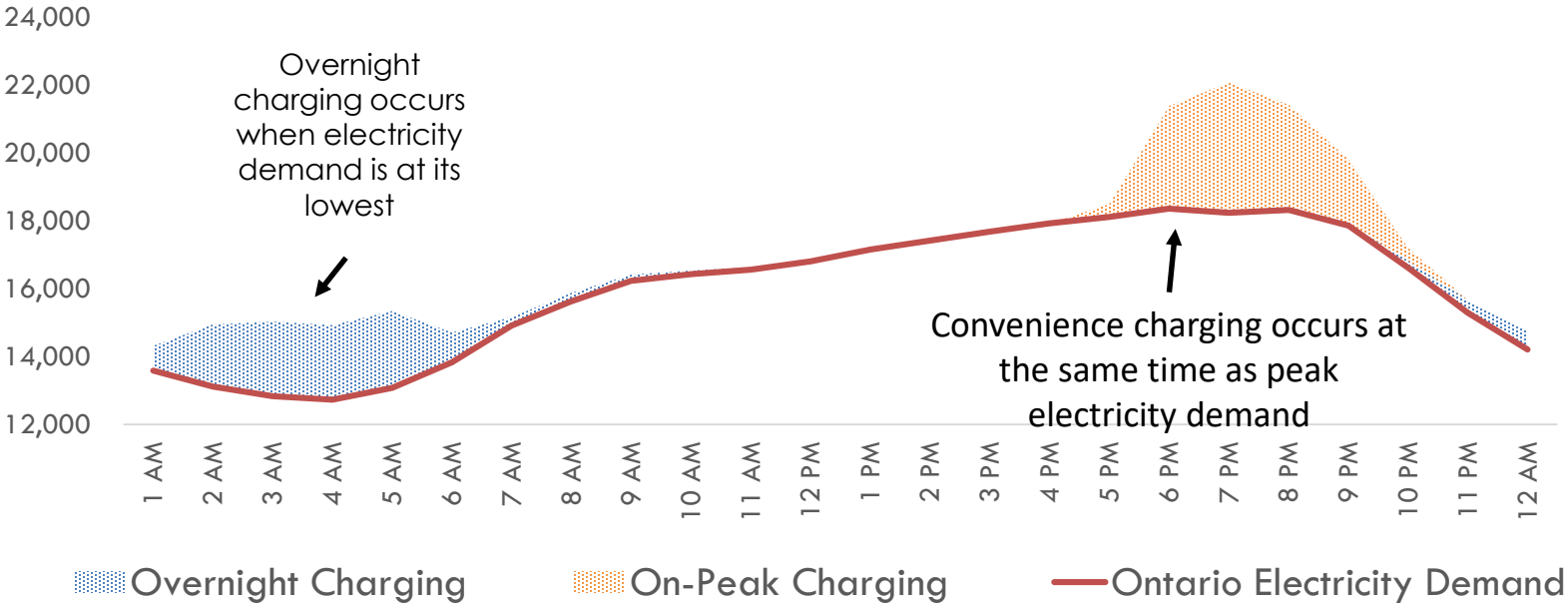


Load Growth

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



Managing demand will be essential



Charging by the Level

Level 1

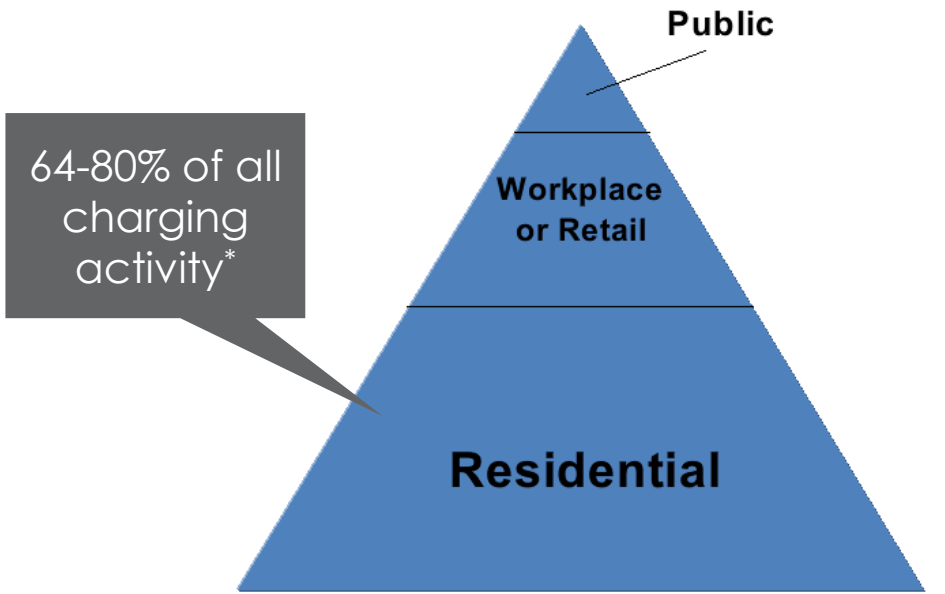
Level 2

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?



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Charging at Home

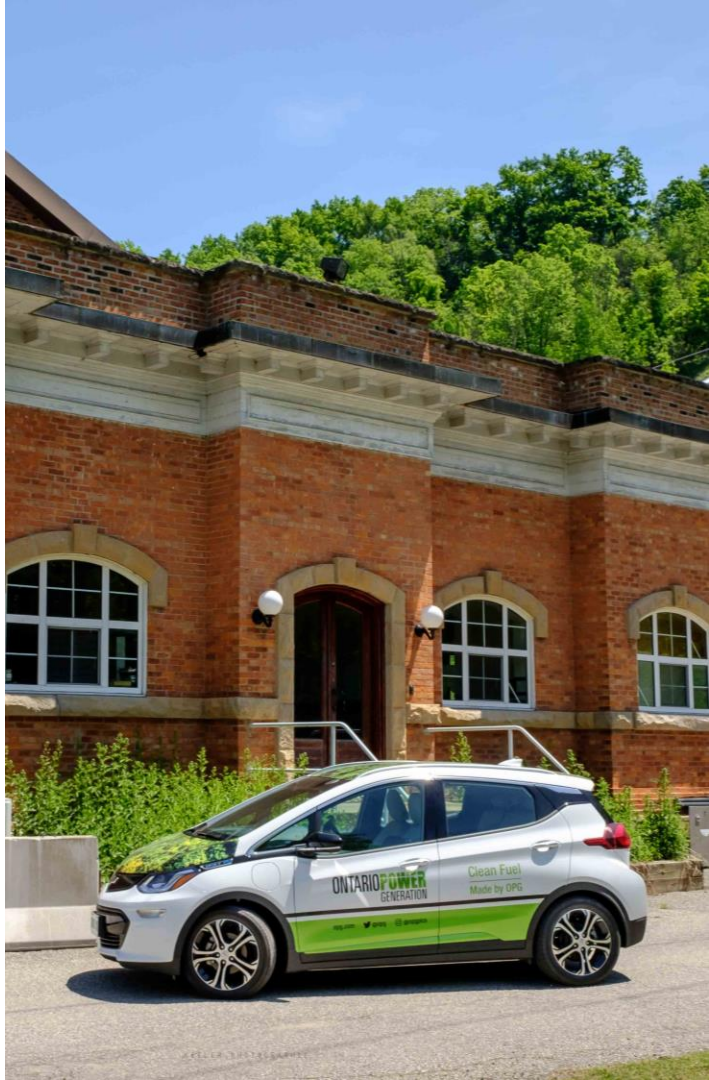
Where the heavy lifting happens.

- 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.

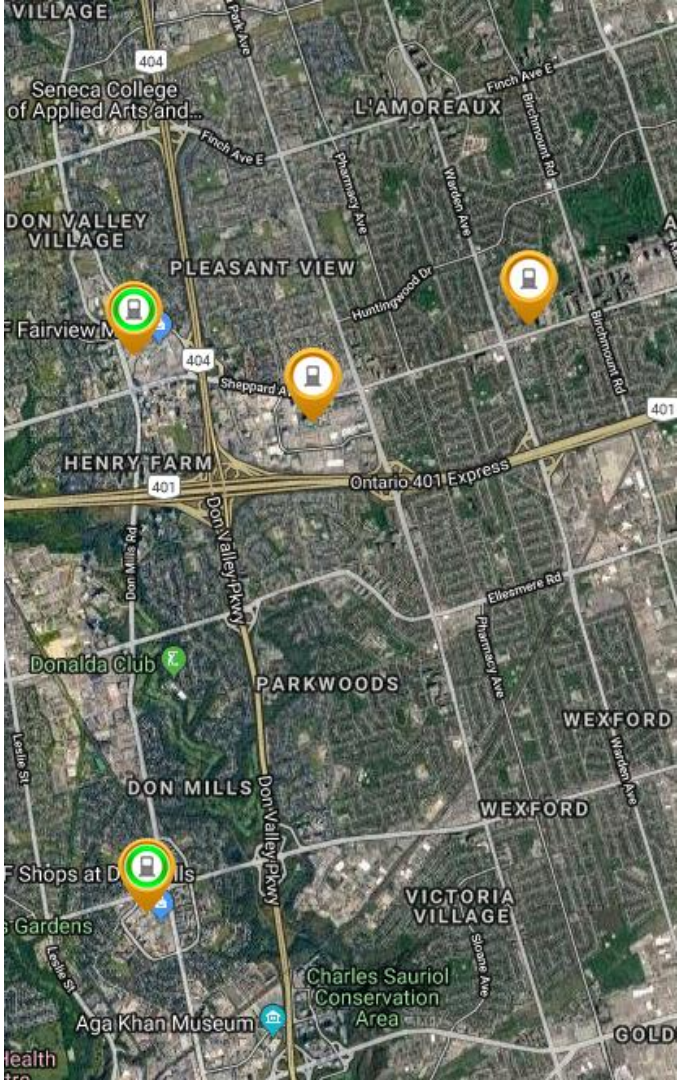
Who needs public charging?

	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 sssion	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

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Charger Options

ABB 50 kW

Tritium 50 kW

BTC 150 kW+

Efacec 150 kW+