

ELECTRIC VEHICLE (EV) TECHNOLOGY: INFRASTRUCTURE DEVELOPMENT AND ITS IMPLICATIONS FOR THE EXISTING ELECTRICITY GRID

- Emerging Regulatory Issues Workshop
 - February 6-7, 2018.
 - Kingston, Jamaica
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- OUR/CBD/USAID-CARCEP/High Commission of Canada



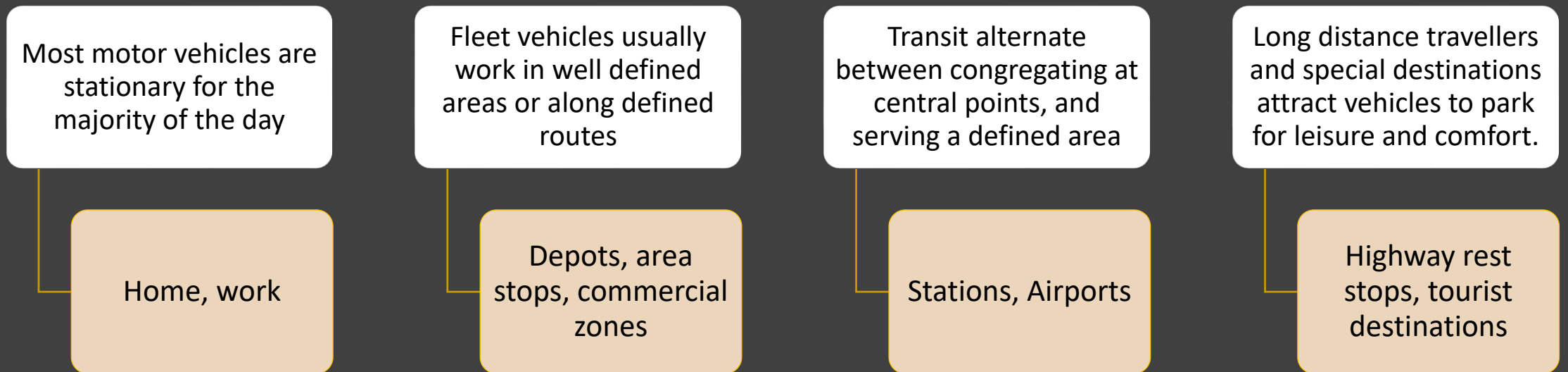
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What is an EV developer?

- A company that develops the electric vehicle service equipment (EVSE) needed to support electric mobility.
- We match application with technology from the perspective of serving the driver best.
- Provide the EV driver with charging service at convenient opportunities (when the car is not moving for a 15min or more period of time)



The opportunity to charge



Development example A

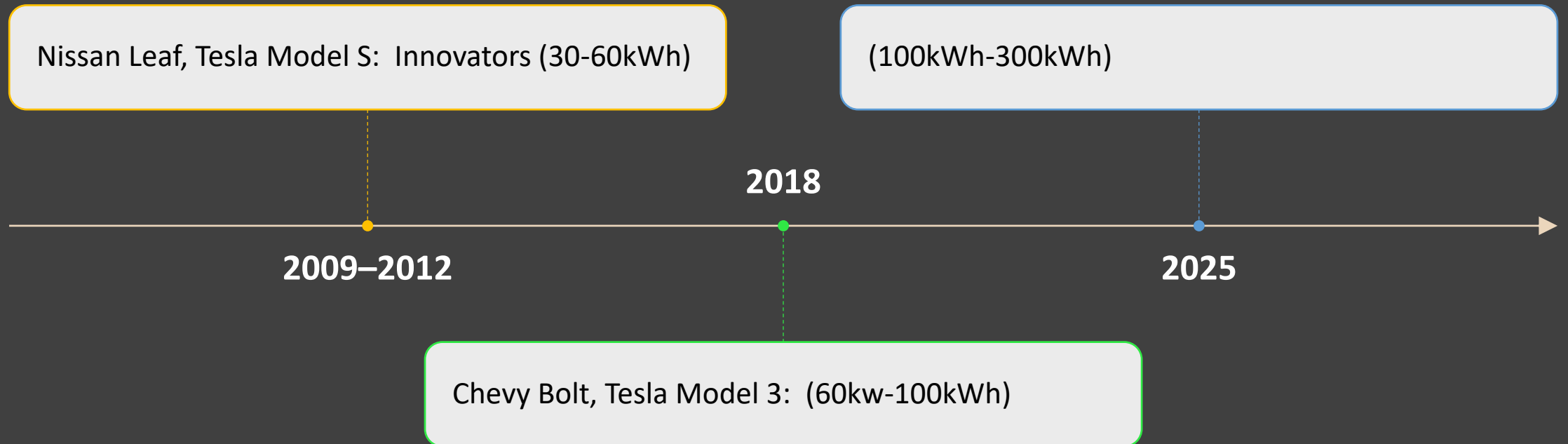
- The Province of Ontario, and the Canadian Federal government have set Zero emission vehicle targets for 2030.
- As a result incentives and rebates have lowered the cost of acquiring EV for consumers and businesses, and charging infrastructure
- One of Xergy's clients: A partnership between the City of Peterborough and Peterborough Utilities, the local power distribution company.
- Resulted in a comprehensive network of 9 public charging stations at 7 different sites making it one of the most dense EV charging plugs per EV areas in Canada.

Development example B

- Jamaica Public Service Company and Xergy Energy work on building the business cases for fleet electrification.
 - Currently studying a public and private fleet.
 - Report published by JPSCO expected in Spring 2018.
 - Measuring current EV technology suitability for local driving conditions
 - Providing spatial data on where EVSE might be needed most
 - Data will be used to present recommendation for public policy on EV growth

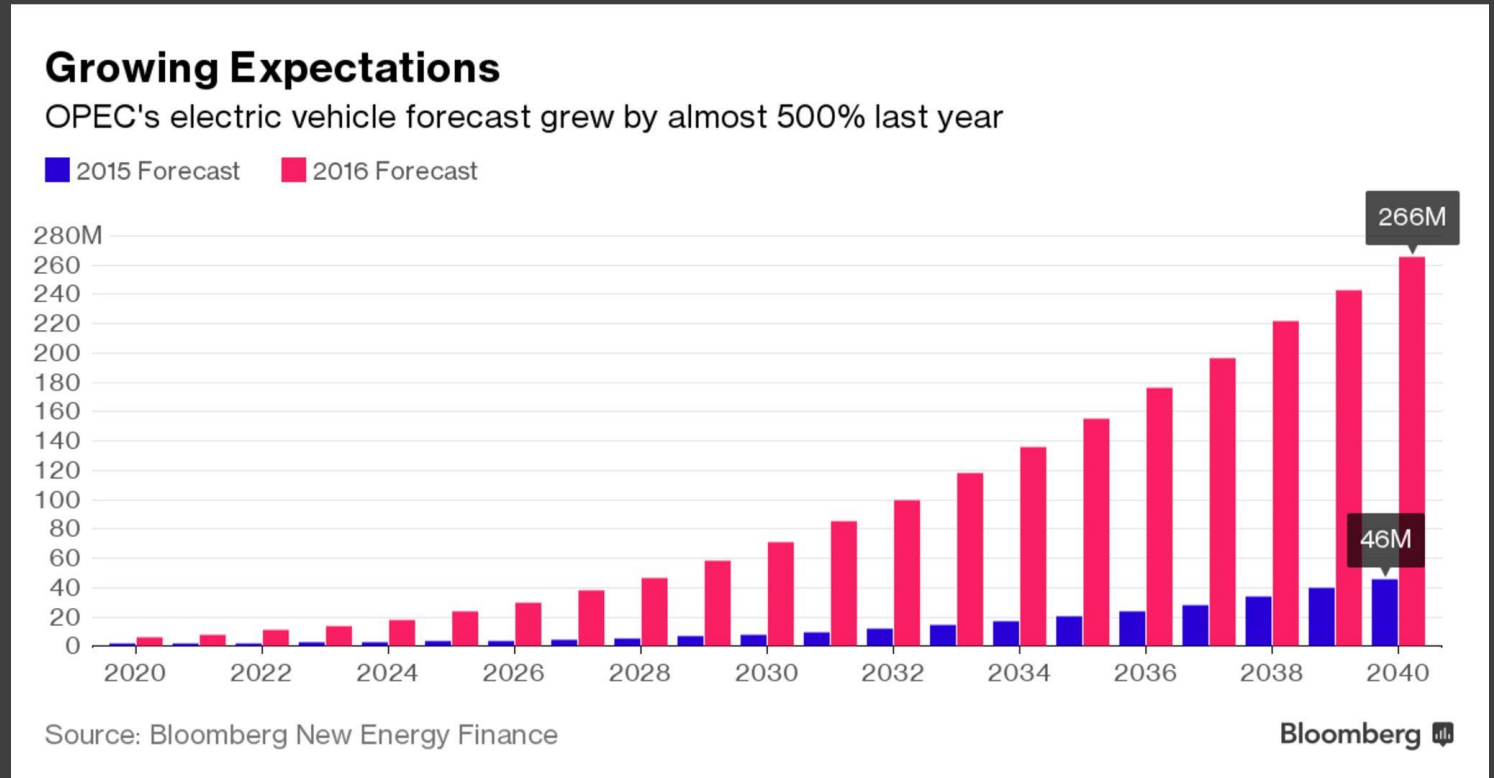


Where are EVs going?



The growth in variety

- Light duty
- Luxury
- Medium duty
- Specialty trucks



Opportunity and Threat

Opportunity

- Reducing tailpipe emissions, important in carbon markets.
- Increasing kWh sold into marketplace
- Grid support (V2G)
- May increase ability to absorb renewables



Threat

- Strain on existing delivery resources
- Mobile loads

The enthusiast marketplace

Consumers won't buy unless they can see a network of stations (Range Anxiety)

Private sector stations won't appear until there is a critical mass of EV customers

The diagram consists of two rounded rectangular boxes connected by a thin white circular line. The left box is orange and contains the text 'Consumers won't buy unless they can see a network of stations (Range Anxiety)'. The right box is a darker brown and contains the text 'Private sector stations won't appear until there is a critical mass of EV customers'. The circular line connects the top of the left box to the top of the right box, and the bottom of the right box to the bottom of the left box, forming a complete circle.

Private sector stations won't appear until there is a critical mass of EV customers

Accelerate Demand and Supply

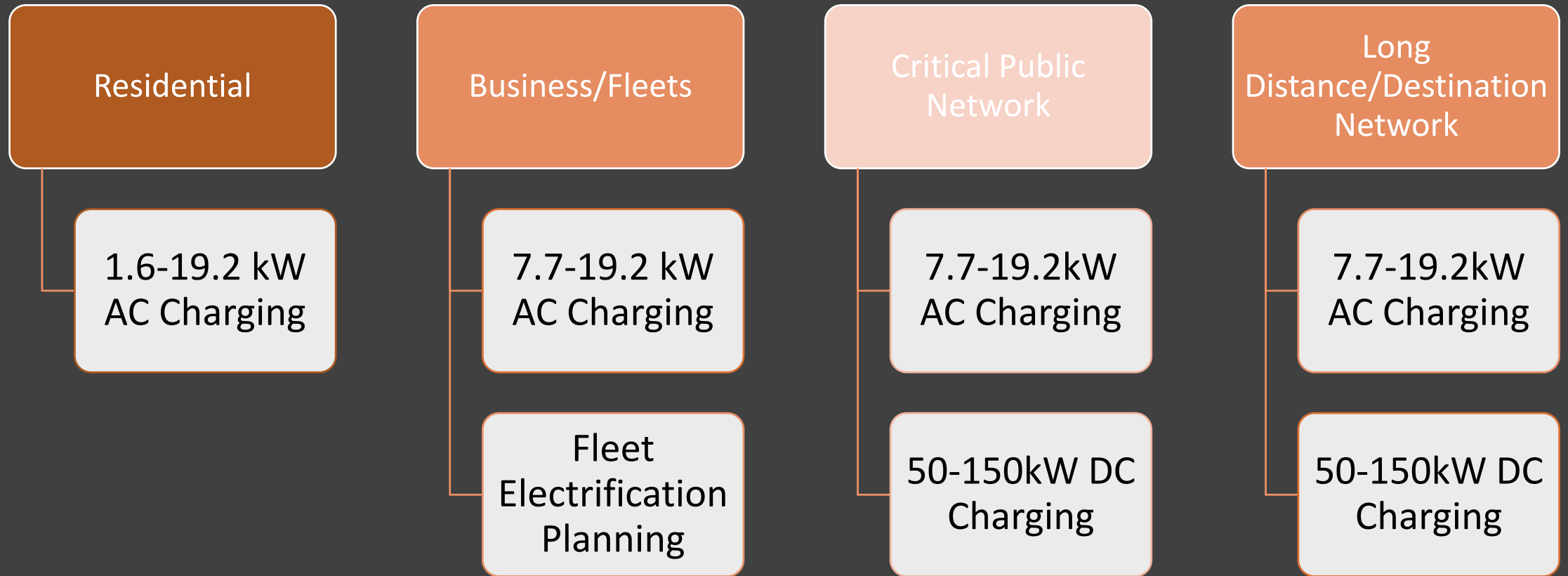
Create demand via special
Projects

- Government adoption in public transit, and fleets
- Procurement incentives for business fleets
- Critical charging network across territory

Support supply economics
using policy

- Purchase incentives
- Duty relief
- Introductory charging rates

EVSE marketplace breakdown





EVSE Residential/Commercial Development

Most EV charging will take place at the home or work of the owner, where they will typically leave with a 100% SOC.

- Adding AC loads can sometimes be a challenge depending on size of service to building.
- Infrastructure in high density locations can be insufficient (Apartments/Condos, rural areas) or cost prohibitive
 - Public charging can alleviate some of that

EVSE Fleet Development

- Business Fleets are accelerators to EV markets
 - Aggregated operational cost savings
 - Ability to purchase in bulk – several large fleets can kick start an entire EV industry.
 - Business fleets drive demand up for public charging
 - EV fleets positively influence consumer EV sales



EVSE Public and Destination Development

- Level 3 DC fast charging units can place a significant demand on existing infrastructure with each plug plugging anywhere from 50-150kW for 15-45mins.
 - Smart units that can throttle based on transformer conditions
 - Integrate renewables and energy storage
- Development best done with a mix of utility support and public/private site hosts
 - Multiuse land to ensure financial vitality of site

Search for a Charging Location

Legend

Filters

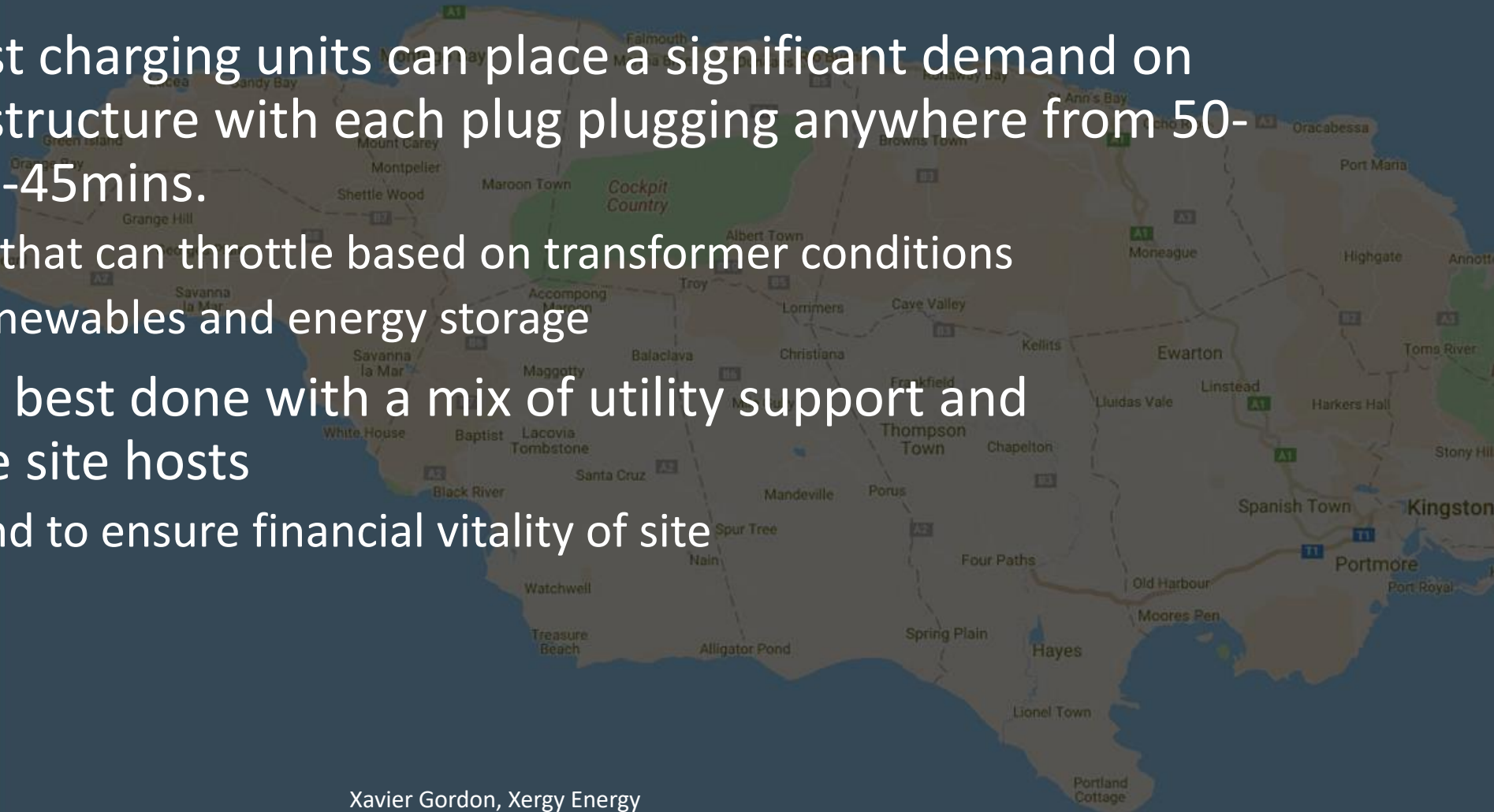
Region

North America

Plugs

- EV Plug
- Supercharger
- NEMA 14-50

Networks



Example

- Xergy Energy developed site in Norland, Ontario.
 - 50kW DC level 3 and 7.7kW AC Level 2
 - Owned by Utility
 - Located on City property
 - Adjacent to TransCanada highway
 - Adjacent to 24hr Grocery
 - Covers range of most EV to next DC quick charger (also owned by Utility)



Future proofing

- Stations pushing 350kW per plug
- 400A+ on a 1000V line
- Finding sites that can be futureproofed
- Designing infrastructure with EV in mind
- Mitigation of inadequate infrastructure with renewable generation and onsite storage

Vehicle to Grid (V2G)

The players

1. **Vehicle Manufacturer:** Vehicles must be equipped with the capability to allow two-way flows of electricity. They must also be able to price V2G capability at a level that customers will be willing to pay
2. **Vehicle Owner:** must be adequately compensated for allowing the grid operator to use the vehicle to provide grid services and must be assured that the vehicle will be available for personal use when needed
3. **Utility:** must derive enough benefit from the availability of vehicles to compensate for the additional cost of monitoring and controlling the vehicle-grid interactions, paying owners, and administering the system





Xavier Gordon, Xergy Energy

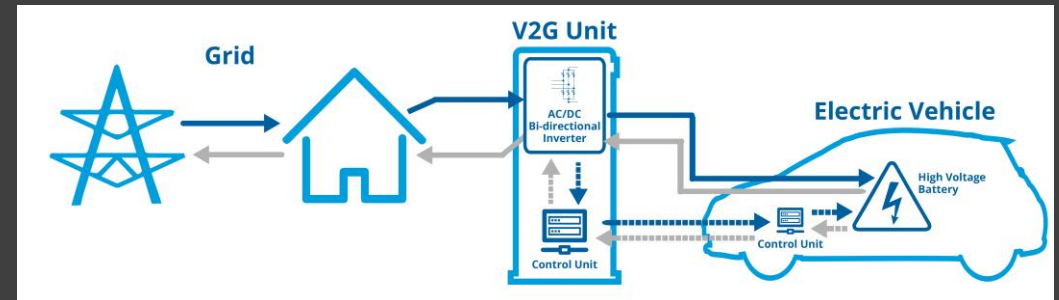
V2G: The benefits for the public good

Consumer

- Emergency backup power (residential)
- Emergency backup power and peak shaving (commercial, industrial)
- Financial incentive to resell to grid (all)

Electricity Market

- Bulk energy storage. Accelerates renewable energy penetration
 - $\text{Generation} > \text{Demand} = \text{Absorb.}$
 - $\text{Generation} < \text{Demand} = \text{Release}$
- Operating reserves (\$)
- Frequency regulation (\$)



In practice...

- Car owner sets three limits for V2G participation, but always has option to opt out of V2G interaction and function as a load only
 1. Departure time setting: Target 100% SOC at set time
 2. Grid Services: Limit to when SOC>60%
 3. Emergency backup: Limit to when SOC>25%
- Needs EV with hardware and software to support two way power
 - Could be an important sales feature in 3rd generation EV (after 2025)
- Needs EVSE with hardware, software, and communication to support two way power and communications between utility and car battery
 - EVSE site hosts could benefit from grid services

V2G market development

Very early stage for development

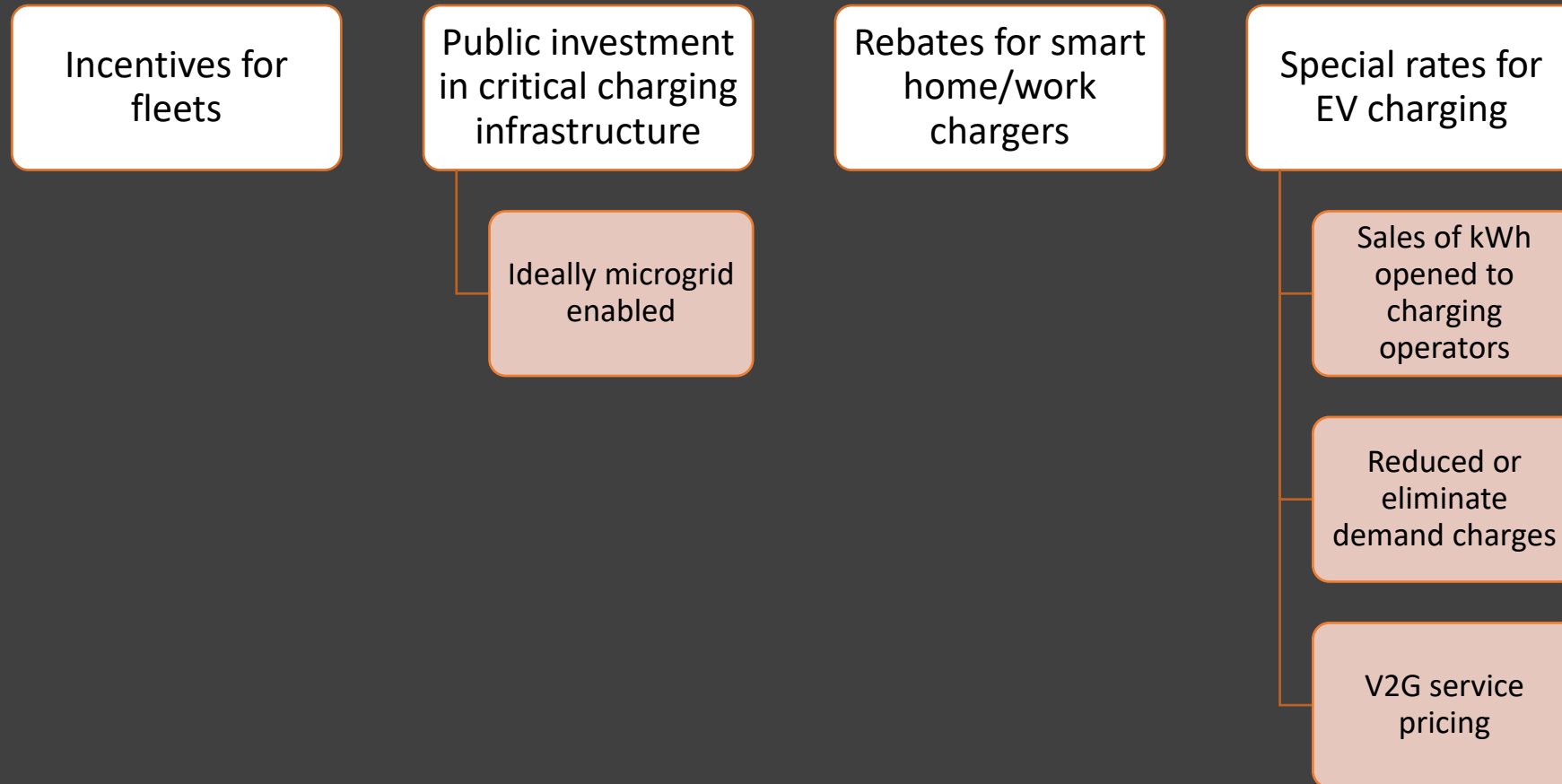
- No clear path on when V2G will be standard (only available on Nissan, Mitsubishi, Hyundai)
- No commercial V2G EVSE on the market
- No comprehensive policies on V2G service pricing



Early Opportunity for regulators

- Price V2G service pricing (also applies to stationary energy storage)
- Engage manufacturers to let them know a market exists
- Engage fleet operators as they can aggregate benefits fastest

Policy to support EVSE



Key takeaways from an EVSE developer

- If you build it, they will come
- Study large fleets in service territory to determine a critical infrastructure network map
- Future proof DC fast charging sites
 - Charging speed increases
 - Energy storage to reduce grid impact
- Policy should consider charging a “public service”.
- Target 2025 as date when EV will hit mass adoption

Open discussion

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