GRIDWISE ALLIANCE in partnership with NASEO, NARUC, & AASHTO

Grid Integration of EV Charging Infrastructure

March 14, 2022
2-4 PM EST

2:00-2:05	Welcome
2:05-2:10	NEVI Formula Program: Comments from the Joint Office
2:10-2:20	Near-term grid investments for EV charging infrastructure
2:20-2:40	Behind the meter: Technology solutions
2:40-3:10	On the grid: Utility experiences
3:10-3:30	Policy perspective: State views and challenges
3:30-4:00	Discussion

Near-Term Grid Investments for Integrating Electric Vehicle Charging Infrastructure

A GridWise Alliance Issue Paper

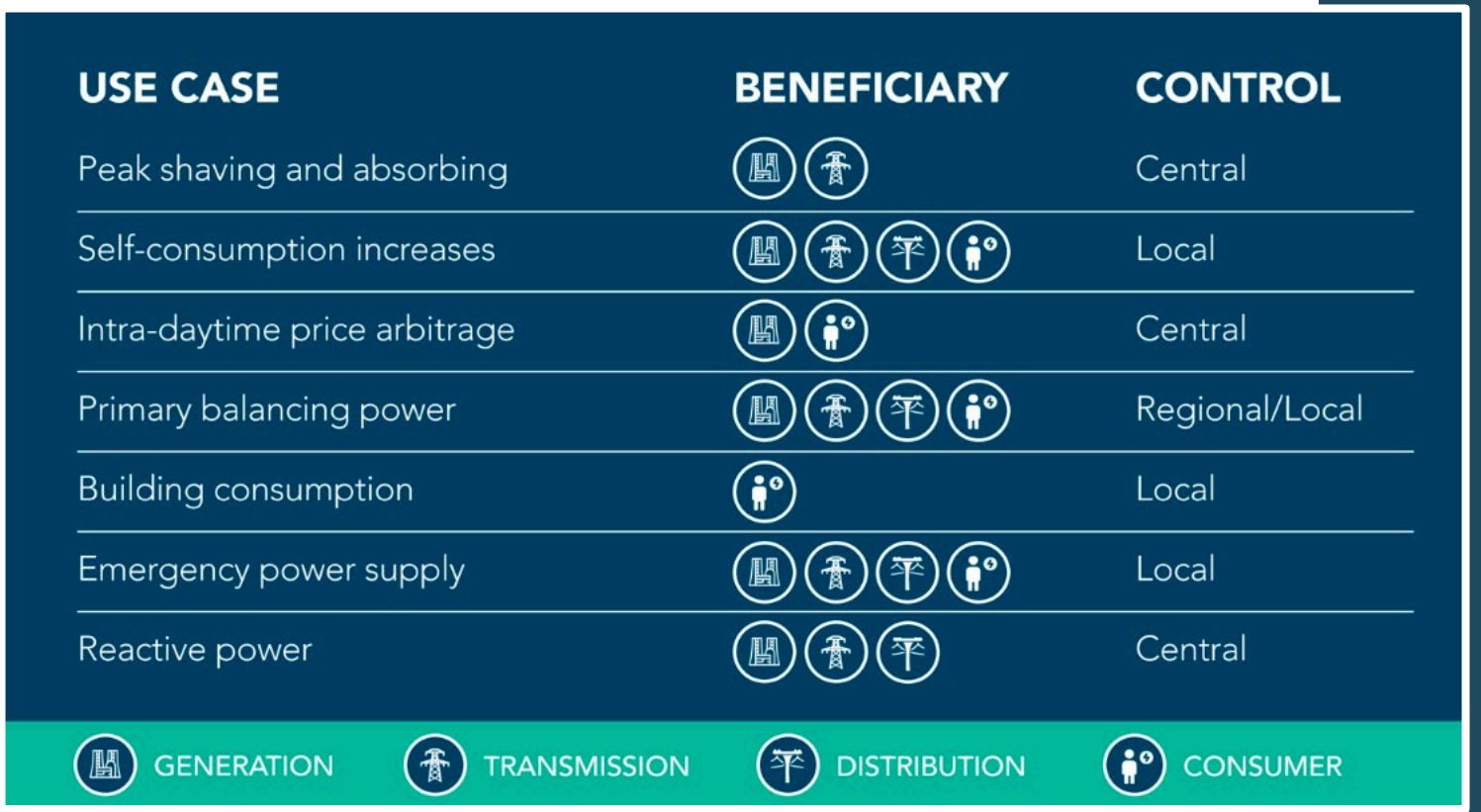
Aurora Edington, Policy Director
GridWise Alliance

GridWise Alliance Workshop:
Grid Integration of EV Charging Infrastructure
March 14, 2022

Download the paper: **www.gridwise.org/resources**

Where we are today

- EV infrastructure dependent upon a safe, secure, reliable, and affordable grid
- GWA highlights “no-regrets” near-term investments to support increasing EV charging demand
- Organized by five grid functional areas



Grid use cases supported by transportation electrification
Source: Dell Technologies

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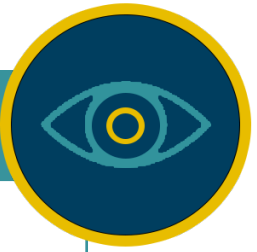
Near-term Grid Investment Needs

Integrated Planning

- Early and frequent coordination*
- Hosting capacity studies: top-down and bottom-up
- Load forecasting assumption and methodology support*

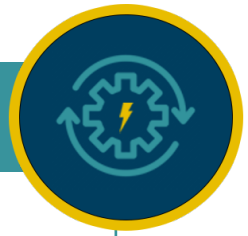
System Visibility



- Broadband infrastructure
- Advanced metering infrastructure*
- Dynamic line rating

Near-term Grid Investment Needs

Real-time Operation



- Voltage regulation technologies
- Energy storage systems*
- Distributed energy resource management systems (DERMS)*

Consumer & Energy Services Engagement

- Consumer engagement and coordination*
- Low-cost grid disconnects

Emerging Grid Architecture

- Interoperability standards*
- Make-ready sites

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Download the issue paper: **www.gridwise.org/resources**

Coming Next

Time	Topic	Speakers
2:20-2:40	**Behind the meter: Technology solutions**	Asaf Nagler, Vice President, External Affairs, **ABB** Ricardo Taveres, International Strategy Director, **Dell Technologies** Joshua Wong, CEO, OpusOne Solutions, **GE Digital**
2:40-3:10	**On the grid: Utility experiences**	Jason Haines, Manager of Fleet Electrification, **Duke Energy** Gideon Katsh, Principal Analyst, Clean Energy Development, **National Grid** Joel Danforth, Energy Programs & New Business Director, **United Power**
3:10-3:30	**Policy perspective: State views and challenges**	Tim Sexton, Assistant Commissioner, **Minnesota DOT** Commissioner Maria Bocanegra, **Illinois Commerce Commission** Will Toor, Executive Director, **Colorado Energy Office**
3:30-4:00	**Discussion**	Moderated discussion based on chat questions

MARCH 2022

EV Charging Infrastructure

Asaf Nagler, VP External Affairs

ABB E-mobility

By the numbers

Chargers sold globally

680K▲

Countries deployed

88 ▲

Employees

1000 ▲

R&D OEM Partners

50+ ▲

Years in e-mobility

12+ ▲

Data as of February 2022

EV Chargers Live in Varying Environments

Global installed base:
All units: 680,000+
DCFC: 30,000+

EV Charging Infrastructure—From Grid to Wheel

Grid → Gear & Components → Charger → Vehicle

MV Switchgear

MV to LV transformer

ReliaGear Switchboard

Surge Protective Device

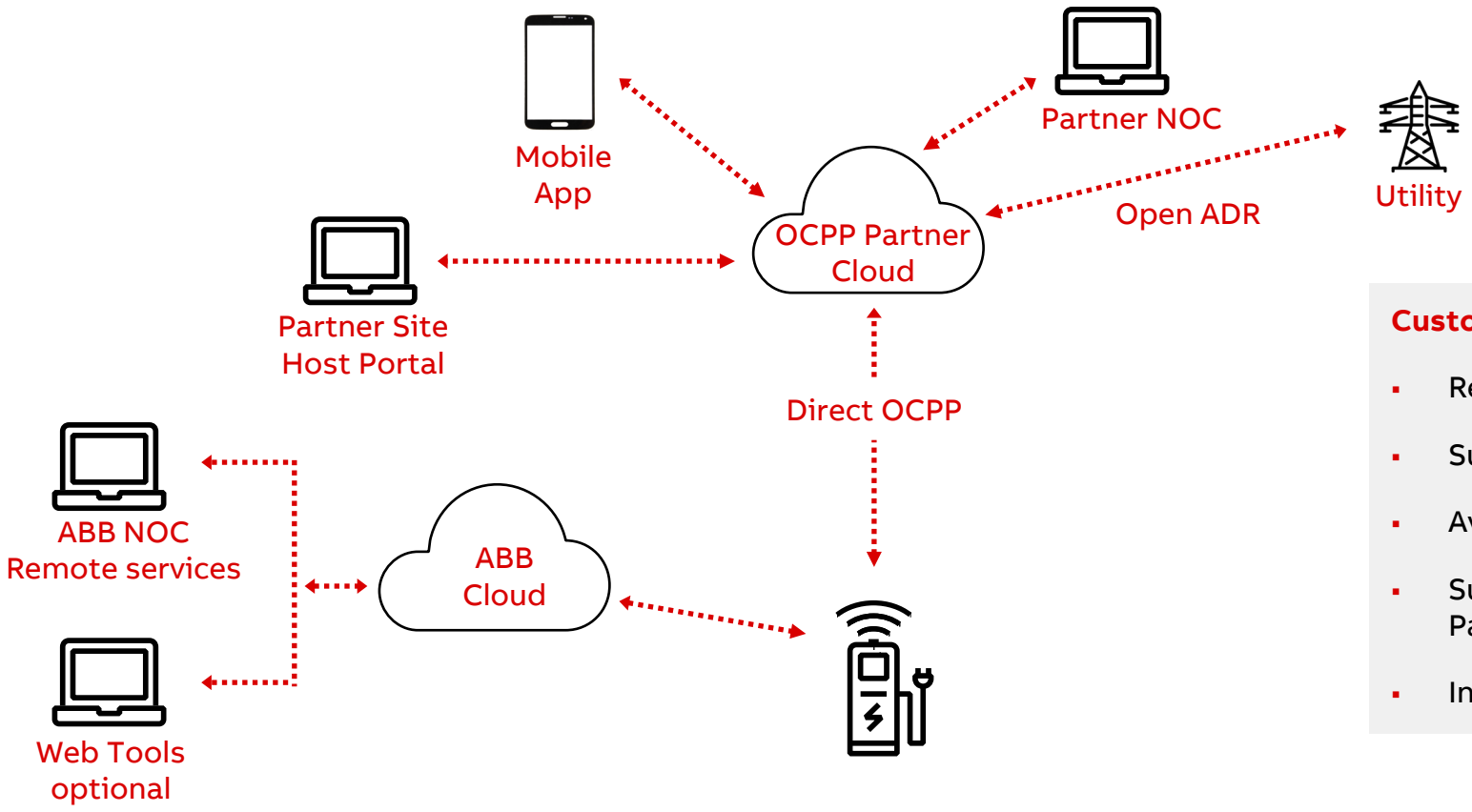
Optional LV step-down transformer

Safety switches

Range of EV chargers

Charging Infrastructure is Hardware and Software Working Together

Interoperability is Paramount



Customer Benefits

- Remote diagnostics and push firmware remotely as needed
- Support multiple networks
- Avoid stranded assets
- Supporting multiple authentication modes: Network apps, Payment Modules, RFiD, PIN, Autocharge, ISO 15118 (PnC)
- Integrate stations with any OCPP Network Provider

Service & Maintenance is Key to Customer Experience

Chargers are Critical Infrastructure

EV Chargers are not “set it and forget it”

24/7/365 remote connectivity and service:

- Large in-house network ops team
- Remote monitoring and diagnosis
- Robust, scaled firmware updates
- Remote commissioning for fast start up

On-site parts and warranty services

- Service level agreements and preventive maintenance
- Warranty execution and extended warranty packages
- Locally stocked parts

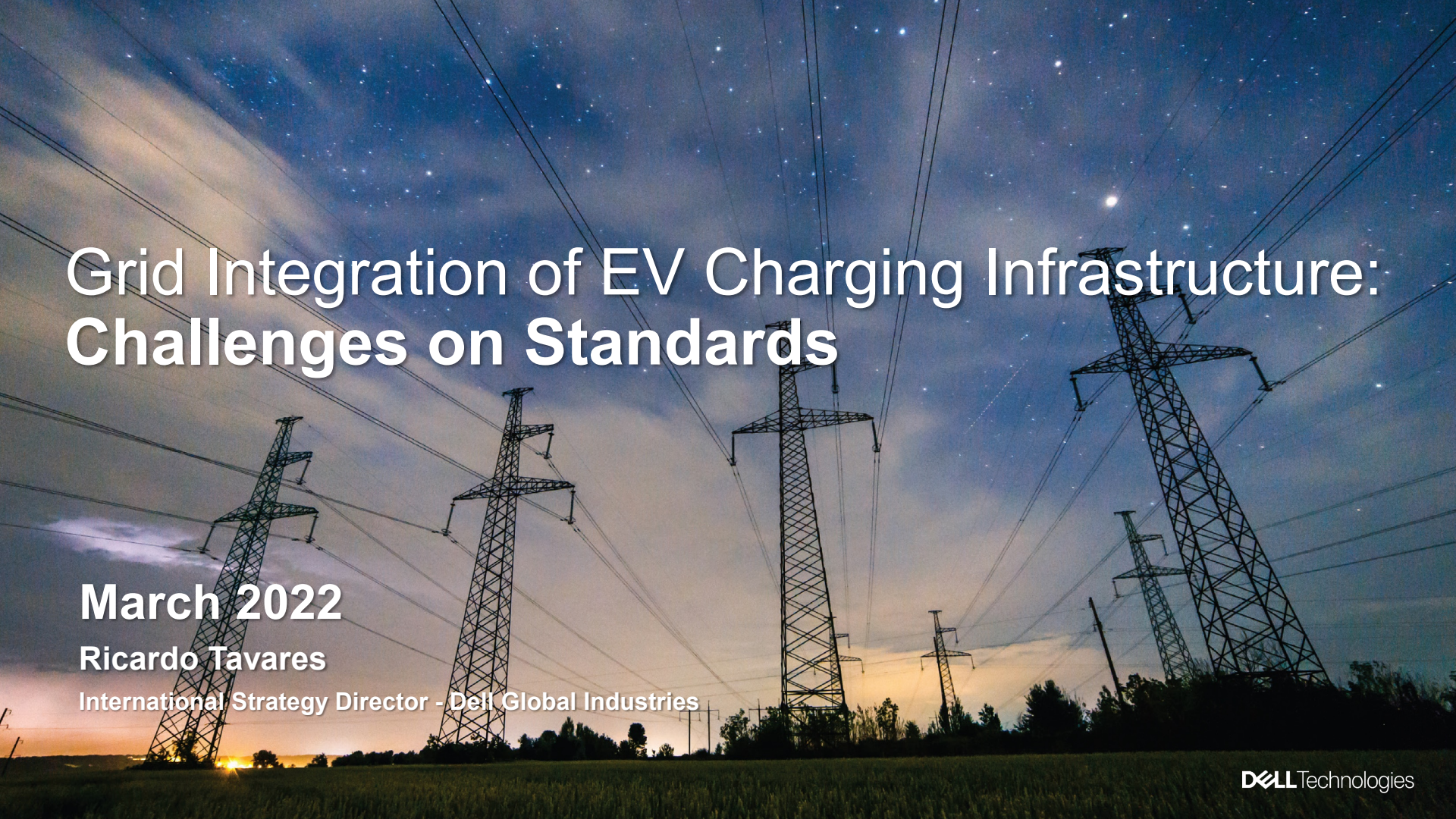
Training & Certified Technicians

- Certified technicians trained on each OEM
- Experienced tech support and service network
- Customized commissioning and service training programs

Customized software services

- OCPP integration
- Autocharge & ISO 15118 implementation
- Vehicle-side interop testing and validation

ABB diagnoses 90%+ service cases remotely; solves 75%+ of these cases without on-site intervention.



Grid Integration of EV Charging Infrastructure: **Challenges on Standards**

March 2022

Ricardo Tavares

International Strategy Director - Dell Global Industries

DELL Technologies

The need for STANDARDS

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NEWS

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Tech

EU rules to force USB-C chargers for all phones

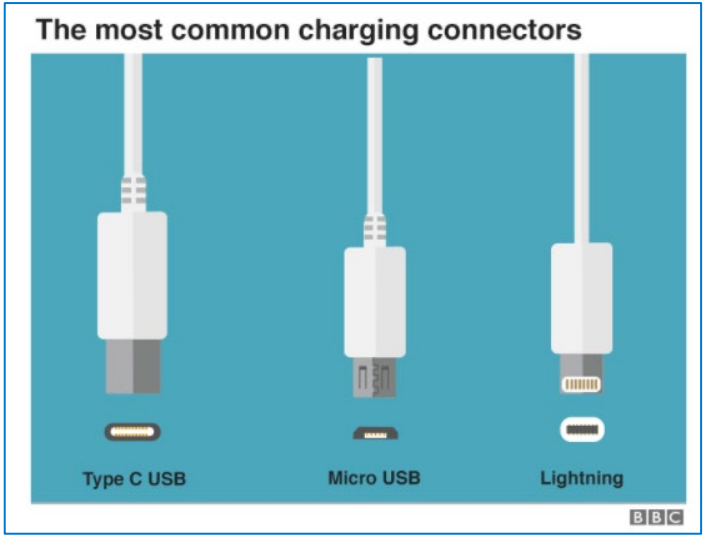
By Cristina Criddle
Technology reporter

23 September 2021 | Comments

Some Apple devices - such as the iPad Pro and Mac laptops - use USB-C (left) while the iPhone uses Lightning (right)

Manufacturers will be forced to create a universal charging solution for phones and small electronic devices, under a new rule proposed by the

The increasing need to standardize, both because of environmental concerns as well as user convenience, is paramount.

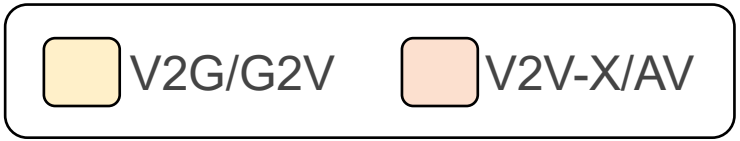


EV Charging Standards

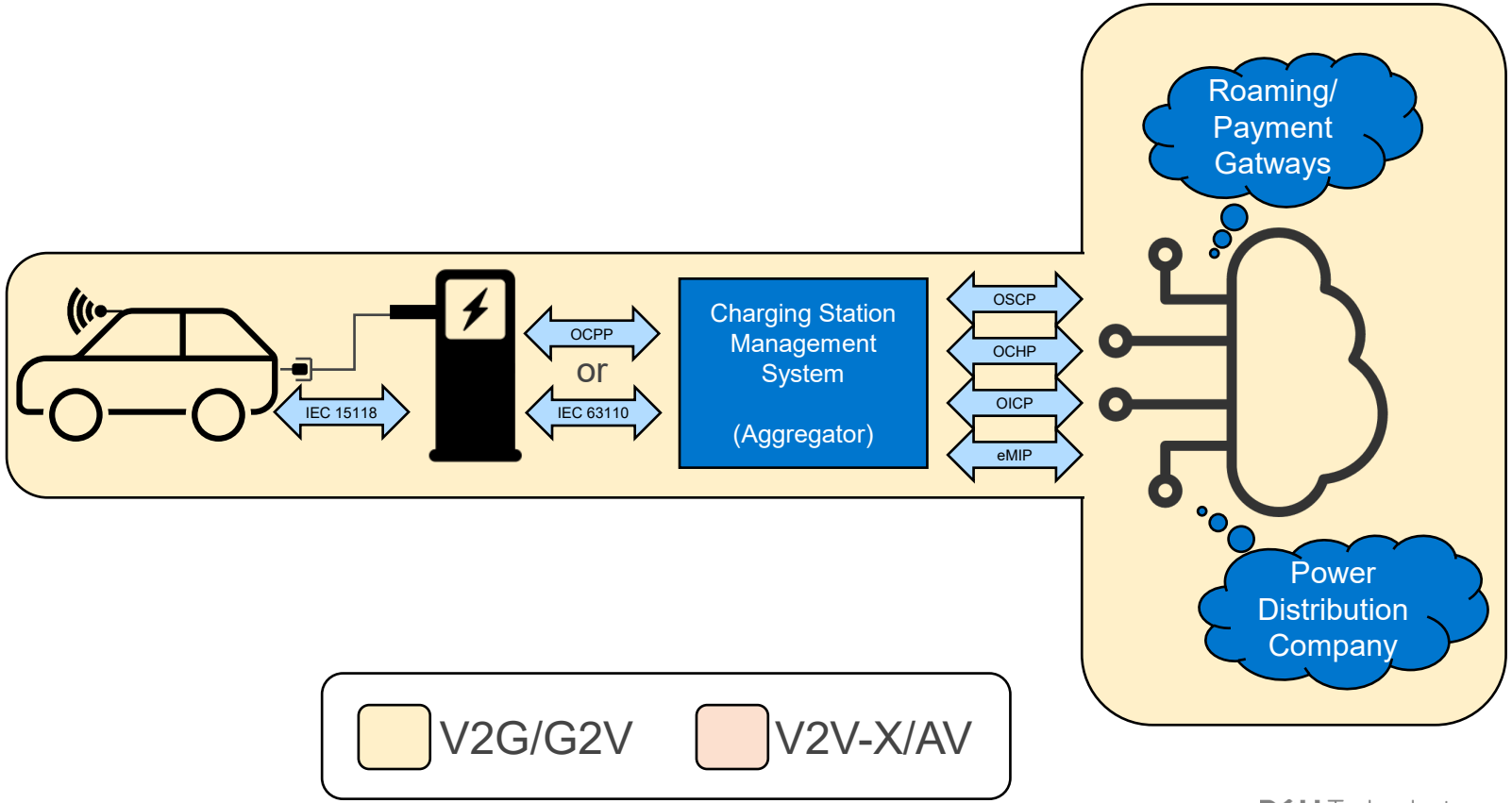
AREA	U.S.A.	EUROPE	CHINA	JAPAN	
Standard	SAE	IEC	GB/T	CHAdeMO	Tesla
AC	 J1772	 62196-2	 20234.2	 J1772	 Tesla
DC	 J1772	 62196-3	 20234.3	 CHAdeMO	

Standard	IEC	SAE	GB/T	Others
Connector	62196-1 62196-2 62196-3	J1772	20234-1 20234-2 20234-3	
Commu-nication	61850 61980-2 61980-3	J2293-2 J2836 J2847	27930	ISO 15118
Topology	61439-5 61851-1 61851-21 61851-22	J2953	18487-1 29781 33594	
Safety	60364-7 60529 61140 62040	J1766 J2894-2	18384-1 18384-3 37295	ISO 6469-3 ISO 17409 NBT 33008

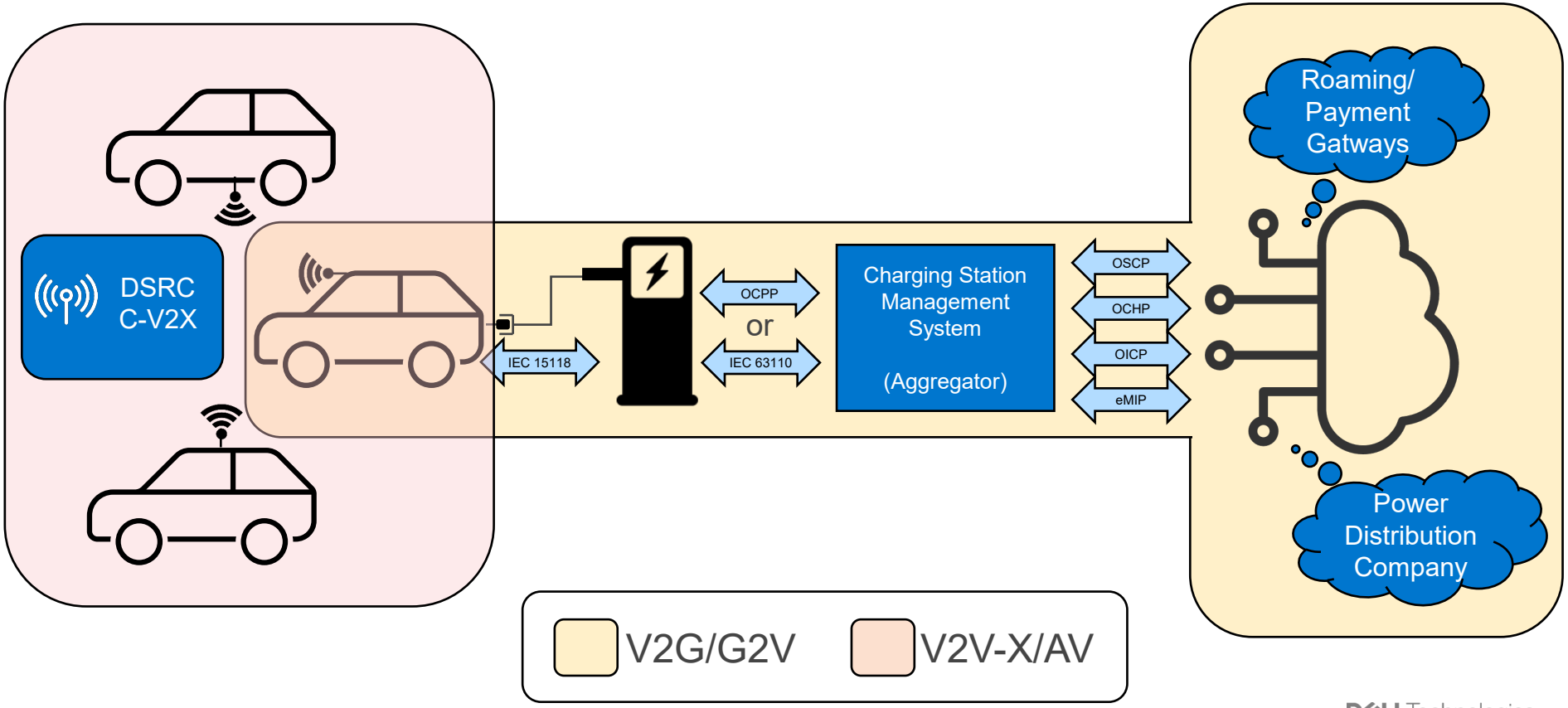
Comms & Protocols



Comms & Protocols



Comms & Protocols



Charging Grid Design / Urban Challenges

Type	Level	Type of EV	Power Delivery	Tension (Volts)	Current (Amps)	Typical Usage	Urban Application
AC Only	L1	Small Evs; Two-wheelers	1.4kW-11kW	120V/240V	15A-20A	Residential	City Perimeter
DC Only	L2	Average EVs	2.5kW-19.2kW	240V	Up to 80A	Public Charging	Large Urban Centres
AC+DC (Combined Coupler)	L3	Large EVs; Trucks / Buses	Up to 350kW (typ. 50kW)	208-600V 3ph.	300A	Fast Charging	Highways

Conclusions / Challenges for the Industry

- Standards definition:
  - Vehicle-to-Grid communication
  - Vehicle-to-Vehicle communication
  - Vehicle-to-Building / Home / (Local Production – Local Consumption)
  - Charging Managemen Systems real-time communication to backbone/scada
- Vehicles:
  - Standardization of plugs/connectors
  - Standardization of BMSs (Battery Management Systems) to allow DC-direct

Additional Data / Sources

- Dell Energy, Climate & Sustainability
- International Energy Agency
- Power Networks Demonstration Centre (PNDC)
- World-Energy
- MagnumCap V2G Solutions
- Engie V2G Pilot

opusone solutions
From GE Digital

Grid-as-a-Platform for EV Integration

MARCH 14, 2022

JOSH WONG, CEO

Who Are We?

opus one solutions
From GE Digital

Opus One Solutions from GE Digital is enabling the digital utility with the most advanced distribution energy management platform, GridOS®.

We offer a suite of interoperable software solutions purpose built for Transmission, Distribution, and Market Operators to plan, manage, optimize and trade renewables and DERs across the energy network.

Global Customers Base

FORTIS, hydro one, ieso, Emera, Scottish & Southern Electricity Networks, SP ENERGY NETWORKS, ENGIE, edp, PG&E, nationalgrid, e·on, EDISON, ComEd, TATA POWER-DDL, Ameren, CMS ENERGY, SPgroup, SMUD, Hawaiian Electric, AusNet services

Recognized by:

50 Technology Fast 50 2021 CANADA CLEAN TECHNOLOGY WINNER Deloitte.

GLOBAL CLEANTECH 100 2022

FAST COMPANY ENERGY

RED HERRING 100 N. AMERICA WINNER

Guidehouse

Gartner

The Energy Transition is Driving Utility Disruption

Industry Drivers

Rise in Renewables

Electrification of Transportation

Prosumer Engagement

Corporate Goals

Legislative, Regulatory & Energy Markets

Global Infrastructure Spending

Distributed Energy Resources (DERs)

PVs, storage, EVs, DR, etc.

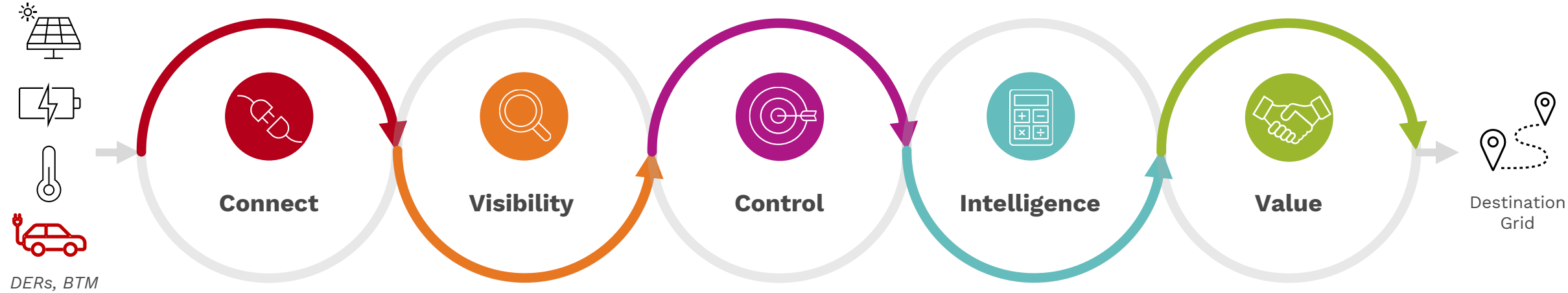
Load Growth Via Electrification

Where do we start?
How do we get there?

How can I keep my grid safe, reliable and secure, including and with DERs?

How do I satisfying my customers and keep energy affordable?

The DER/EV Management Roadmap



DERs, BTM providers, Aggregators

Utility Pain Points

- Clearing connection queue in time
- Customers dissatisfied with connection denial, time and costs
- Data sharing and privacy

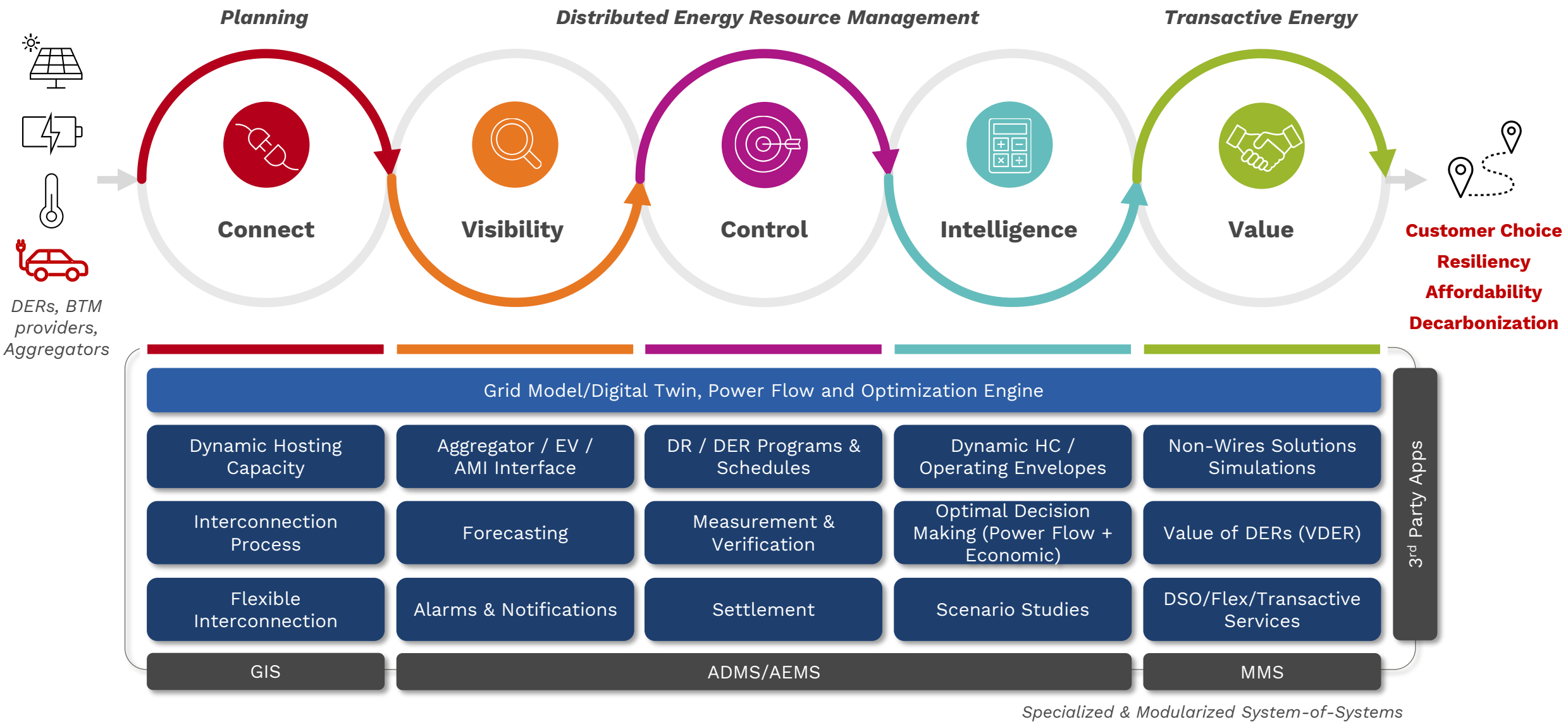
- What DERs? Where are they? What are they doing?
- Does control room or planning know?
- There’re a lot of them! Systems and processes scalable?

- Can I control them? Schedule them?
- Go through aggregators? AMI? DR programs and contracts?
- How do I know they actually operated?

- At risk of causing grid violations? Where/when, & how much headroom?
- How do I secure my grid? Can I optimize with DERs?
- What if?

- Non-wires alternative (NWA) requirements
- Stacked value of DER (VDER)
- Flexibility trading marketplace, DSOs

Solutions to Power the Journey Forward



Specialized & Modularized System-of-Systems

JOSHUA WONG
Founder and CEO
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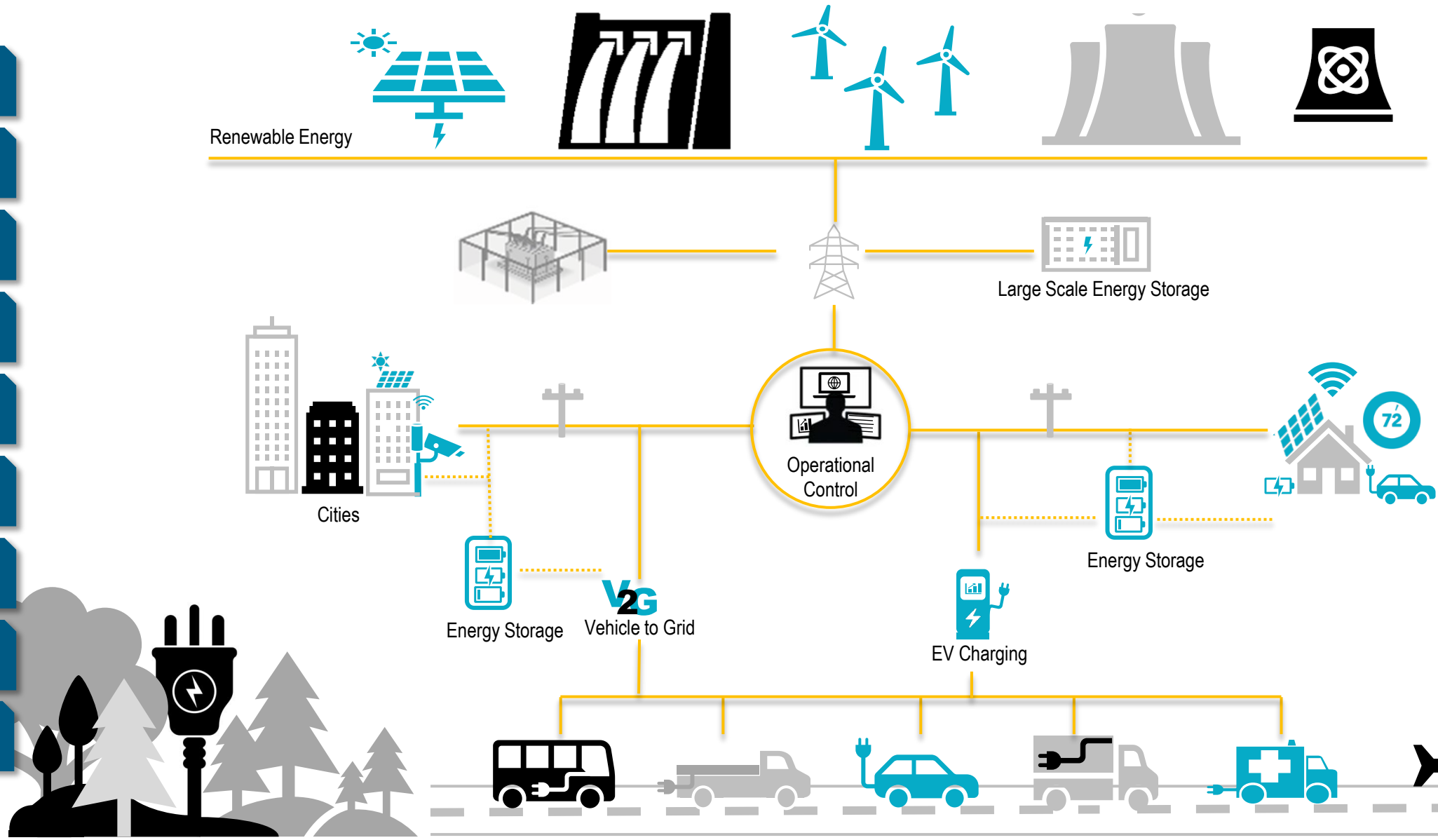
+1 (416) 818-1518

Integration of Electric Vehicles to Modern Utility Grid

- Clean Energy Production
- Accurate Load Forecasting
- Grid Modularity and Adaptability
- National Account Partnerships
- Right Size Grid Improvement Plans
- Proactive Grid Upgrades
- Customer Offerings
- Rate Design & Infrastructure Tariffs
- Storage Capacity Bridges and Buffers



Major Cities | Municipalities | Neighborhoods | Airports | Trucking Fleets | Rental Fleets | Shipping Fleets | Vehicle Dealership

EV Highway Charging

Gideon Katsh
Principal Analyst, Clean Energy Development

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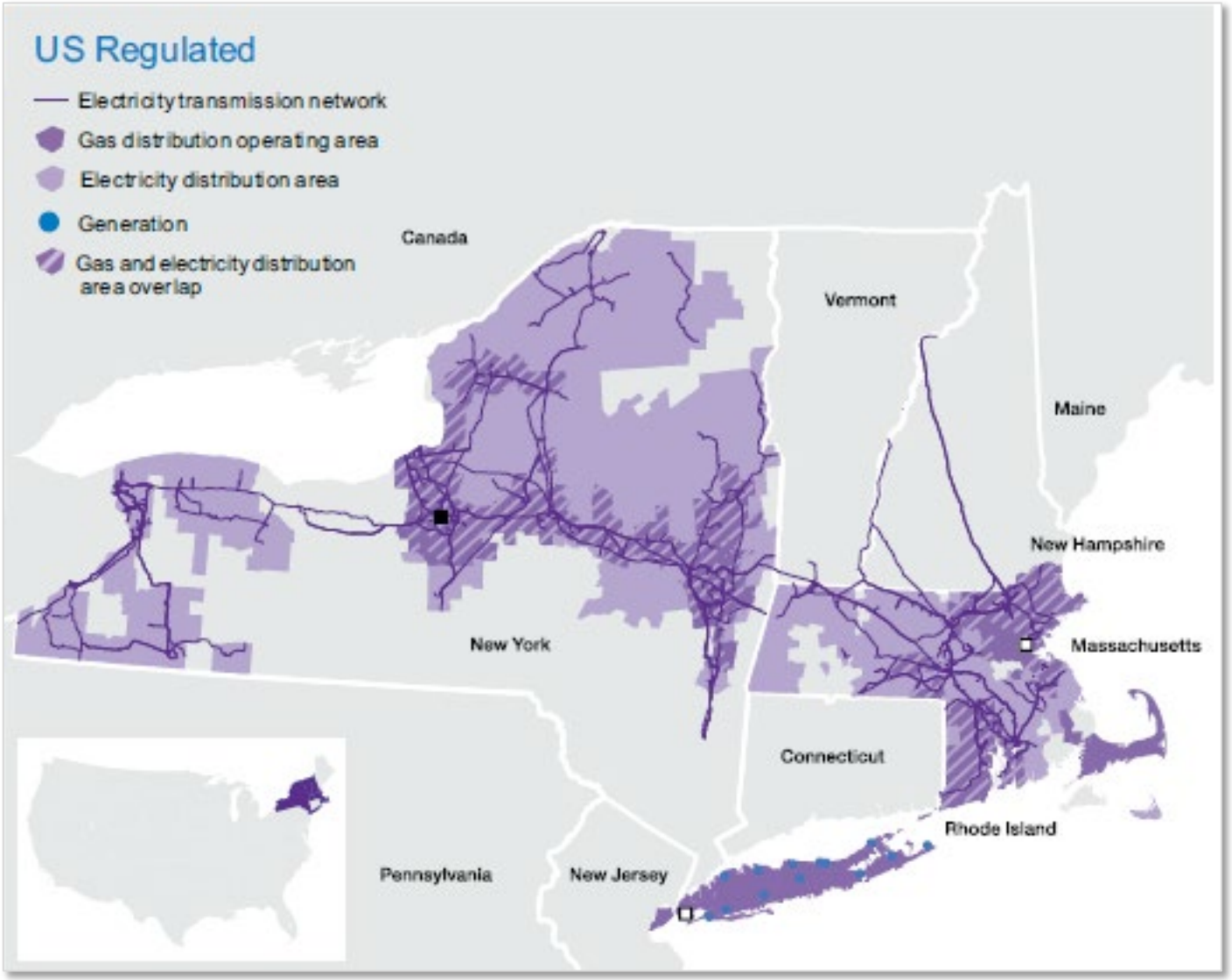
March 14, 2022

nationalgrid

National Grid USA: Who we are



- **Electric and gas utility delivering energy to 20+ million** people in New York, Massachusetts, and Rhode Island
- Large Make-Ready EV programs in New York and Massachusetts
- Over 4,100 charging ports installed, 47% in environmental justice and disadvantaged communities
- Fleet advisory services and alternative charging rates

Fast charging will be important for highway drivers

Minutes to Charge 100 Miles of Range

	Tesla Model 3	Nissan Leaf	Ford Mustang Mach-E	Volvo XC40 Recharge	Rivian R1T
Level 1 (1.5 kW)	1,080	1,400	1,560	1,720	2,040
Level 2 (12 kW)	135	175	195	215	255
DCFC (50 kW)	32	42	47	52	61
DCFC (150 kW)	11	14	16	17	20
DCFC (350 kW)	5	6	7	7	9

Fast charging will be important for highway drivers

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DCFC (350 kW)	5	6	7	7	9

Allowing customers to charge in a reasonable amount of time will require ultra-fast DCFC at service plazas – and even higher-powered charging for MHDVs (1 MW +) is under development

Illustrative highway service plaza charging needs

Example: 20 gasoline and 4 diesel pumps

Allowing the same throughput of electric (light-duty) vehicles could require 2-3x the number of charging ports

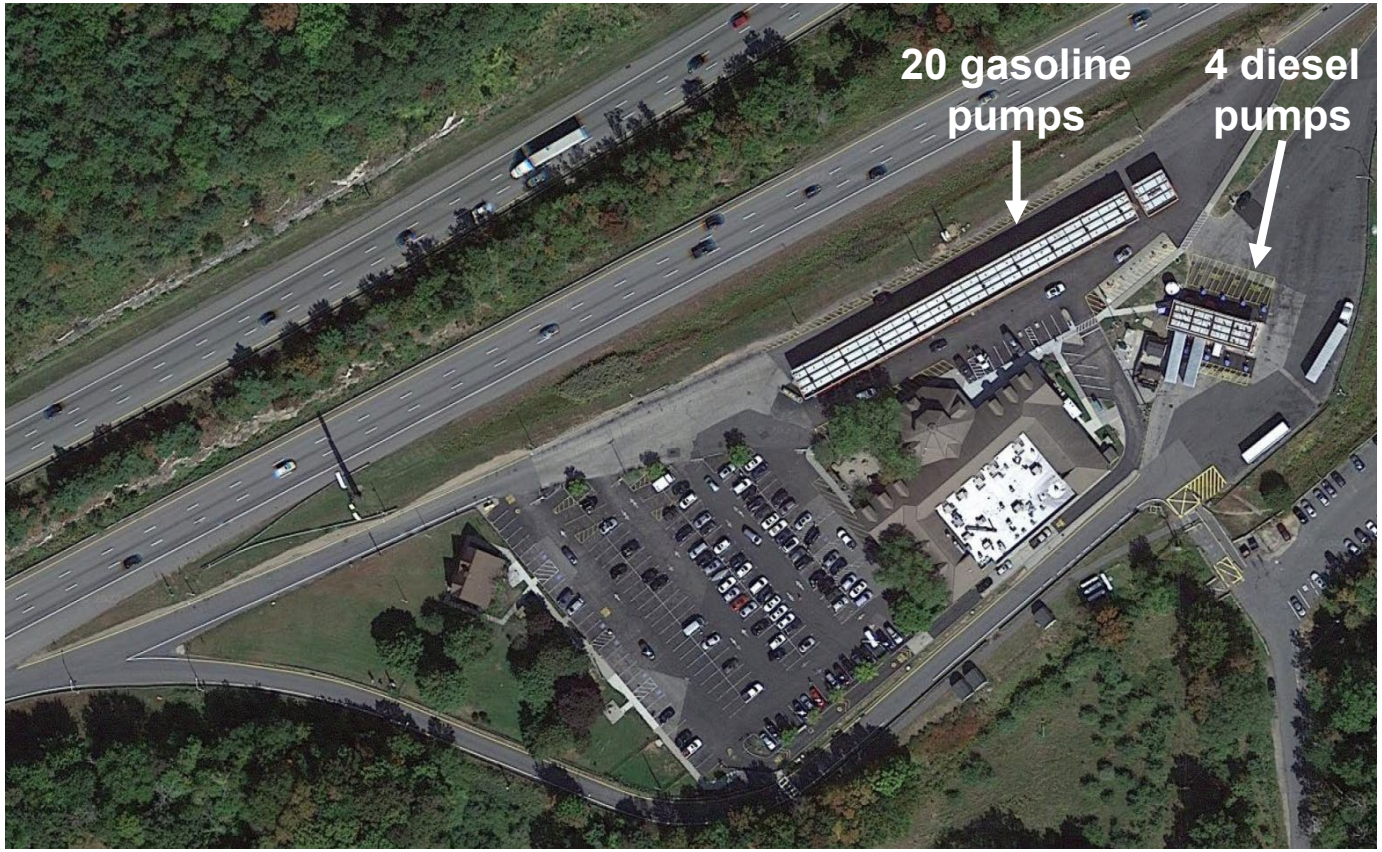
20 chargers x 150 kW = 3 MW demand (peak)

20 x 350 kW = 7 MW

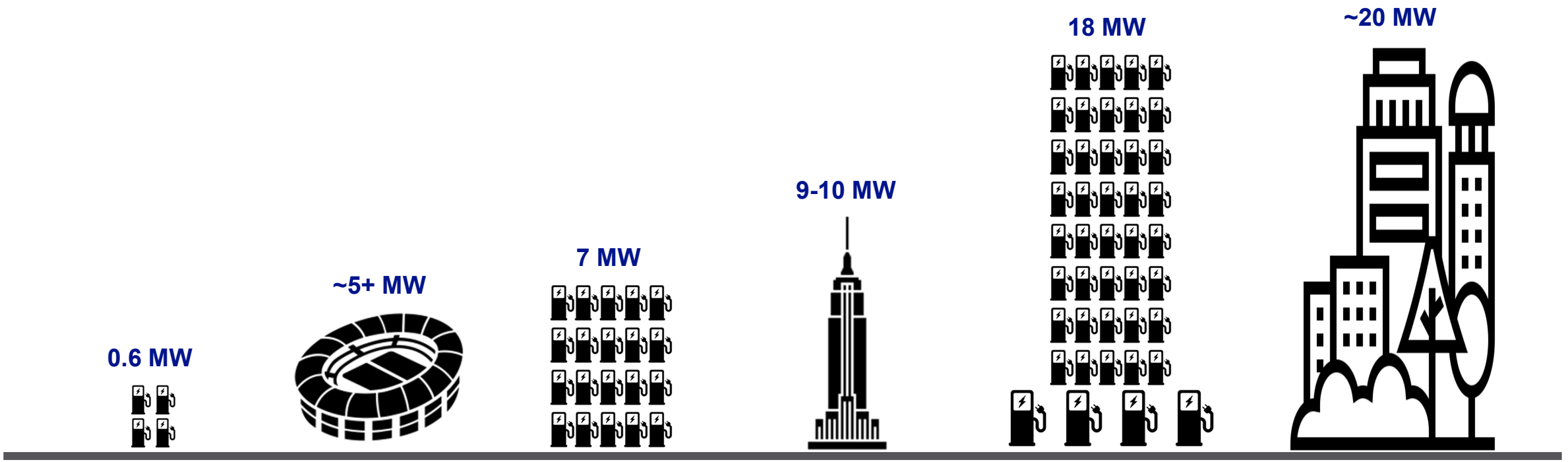
40 x 350 kW = 14 MW

Charging for MHDVs would add additional demand, potentially 350 kW – 1 MW per port

These are loads typically seen for large commercial or industrial customers



Highway charging plazas will have electric demand comparable to much larger users



Design idea borrowed from this report, p. 34: www.aceee.org/research-report/t2102

A case study from the UK provides insight to highway charging needs

Rugby Moto Services
April 2021

Usage materialized much faster than anticipated

Rugby Moto Services
November 2021

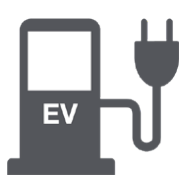
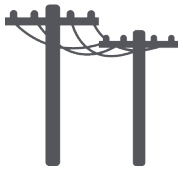
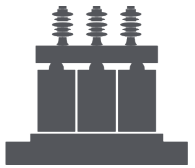
19:23

Rugby Moto M6 Junction 1 Services today! When we arrived there was also a couple more waiting to charge and also all the Tesla points were in use too. More #BEV were arriving to charge as we were leaving.
This just shows how rapidly things have changed in the last twelve months. Those planning future charging sites need to think BIG! What was adequate twelve months ago is no longer practical. Two charge points at service stations is now counted as ridiculous! This is a brilliant new site, but I hope they have their charge point expansion plans already drawn up? Just imagine the queue in another twelve months time, and this was a bad weather day when many stayed at home.

5 5 comments

News Feed Watch Marketplace Groups Notifications Menu

There is a critical need to align infrastructure timelines with electrification roadmaps

~2 Months to Construct	~6-12 Months to Construct	~2-10 Years to Construct
		
Onsite Upgrades	**Local Upgrades**	**Broader System Upgrades**

- **Pilot Vehicles**
- **First Stage Electrification**
- **Large-Scale Electrification**

Utilities could incorporate EVs into planning by working with developers and state agencies on locations, site sizes, and timelines

Contact

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gideon.katsh@nationalgrid.com

For additional information, National Grid released a study with Hitachi Energy on electric fleets in September 2021, available here:
https://www.nationalgridus.com/media/pdfs/microsites/ev-fleet-program/understandinggridimpactsofelectricfleets.pdf

nationalgrid

Case Study of Fast-Charger Demand: Keenesburg, Colo

Joel Danforth

Energy Programs & New Business Director

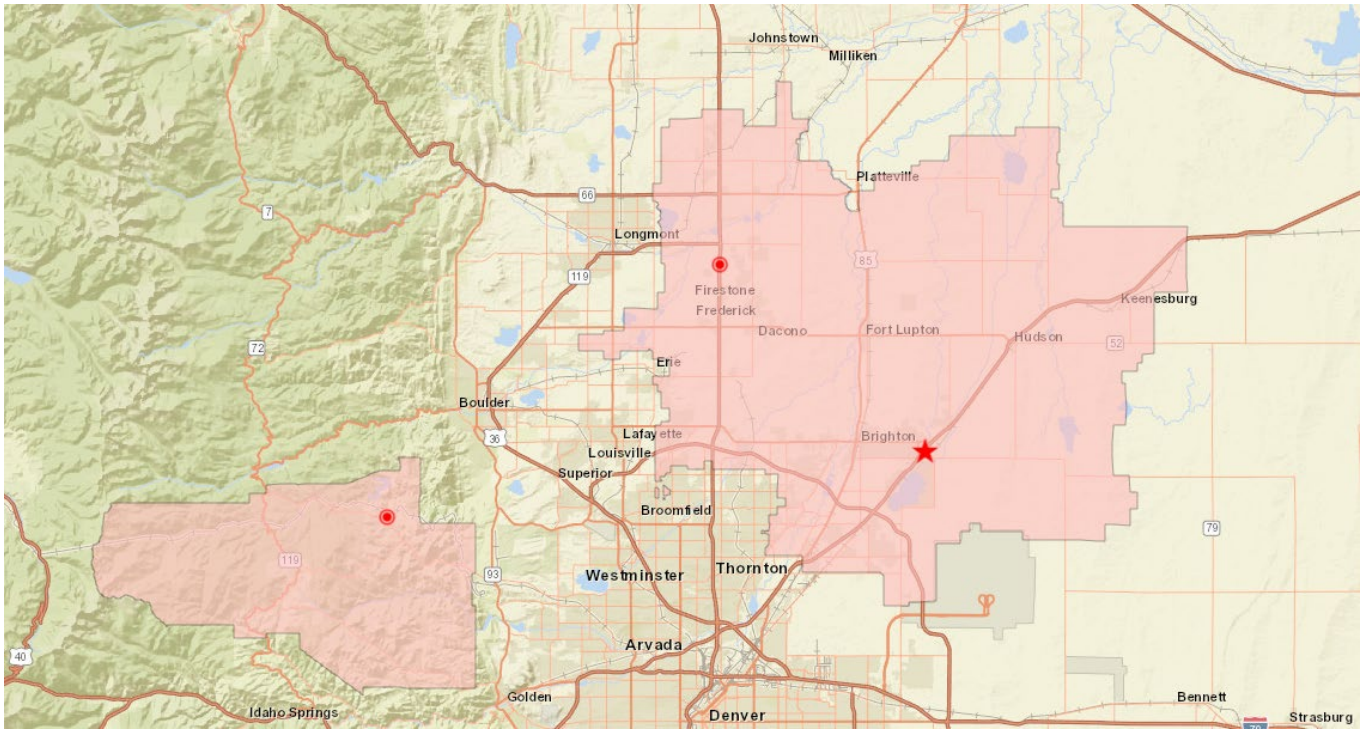
jdanforth@unitedpower.com

UNITED POWER

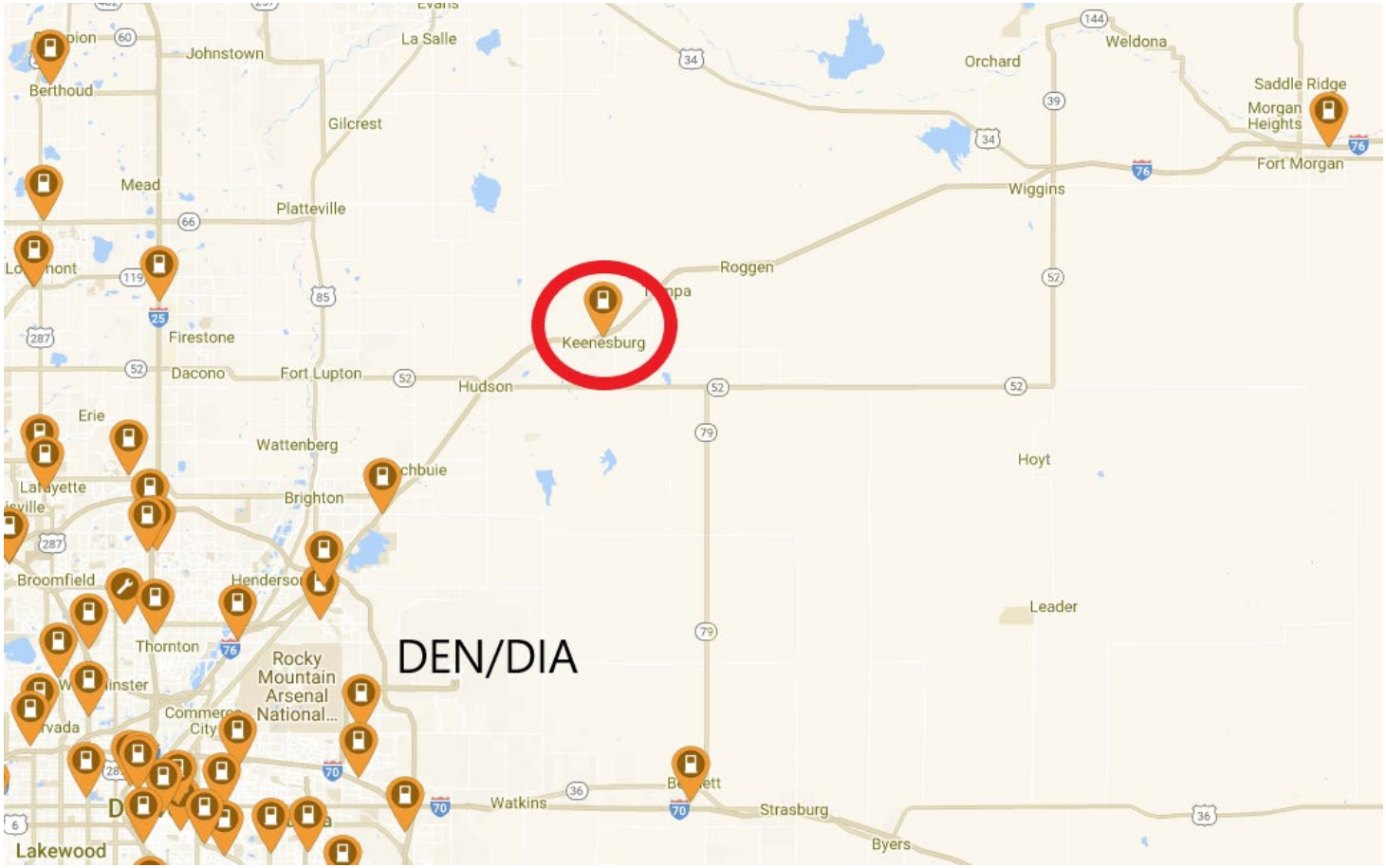
Your Touchstone Energy® Cooperative

About United Power

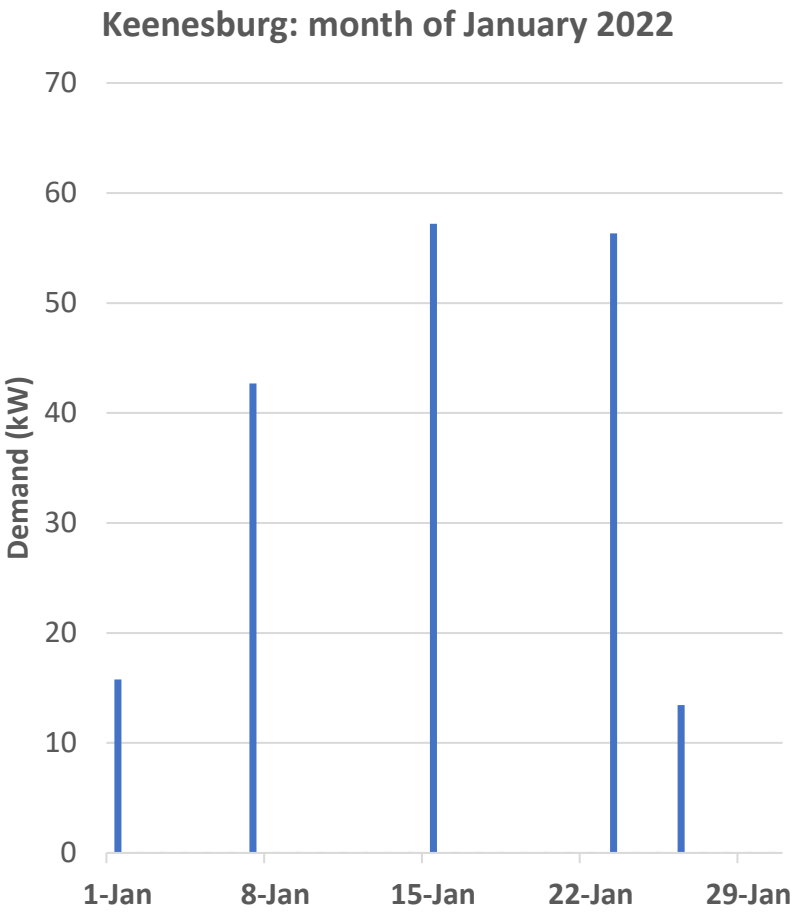
- United Power is a cooperative electric utility serving the regions to the north and west of the Denver metro area. We serve a population of ~4,500 EVs (4% of our meters.)



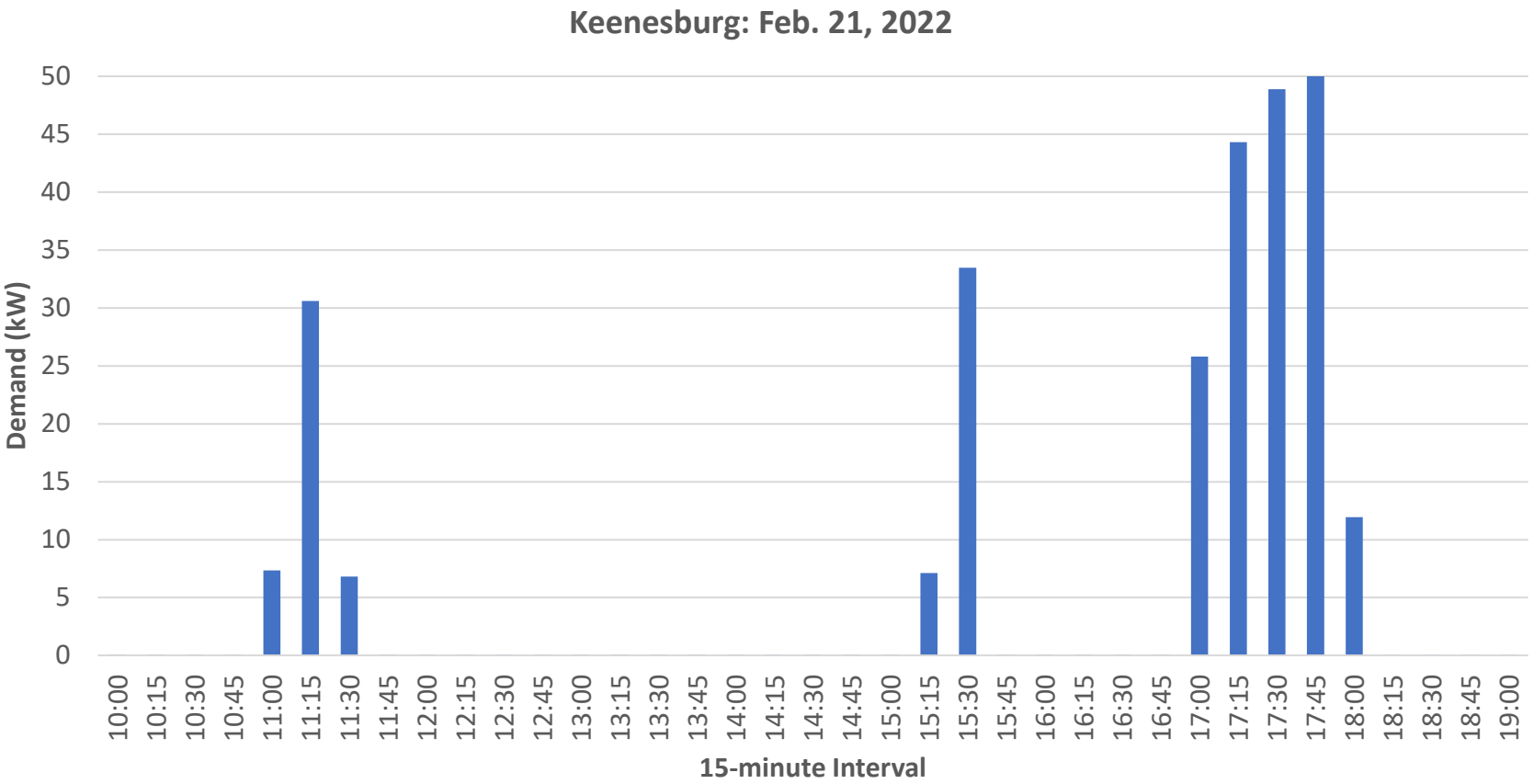
Map of Fast-Chargers in our Region



Keenesburg Fast-Charger



Detailed Snapshot of Keenesburg Fast-Charger Load



Utility Demand Charges

- Cost recovery for transformers, conductors, and ramping up generators to meet incremental demand.
  - United Power demand charge: $1.50 / kW-month
    - 50 kW monthly max[1] * $1.50 = $75 per month
  - Tri-State wholesale coincident peak charge: $19.34/kW
    - 50 kW on-peak[2] * $19.34 = $967
  - Total demand/peak charges for month of Feb. - **$1,042**
    - *What is the probability that someone charges during the coincident peak (which may occur M-F 2pm-10pm)?*

[1] monthly max demand (kW) as measured at the meter.
[2] coincident peak (highest hourly demand [kW] of the month) as measured for the entire grid.

Possible Solutions

- **Storage-Assisted Recharging**
  - Stationary battery trickle-charged during non-operating hours and discharged to meet the 50-kW demand of the fast-charger.
    - This makes economic sense if the monthly cost of the battery integration is less than the monthly demand charges.
- **Fast-Charger Subscriptions**
  - Non-local EV drivers pay a higher up-front connection fee ($9) to activate the fast-charger.
  - Local EV drivers pay a monthly subscription fee ($9) to access fast-chargers. Up-front connection fee is waived for subscribers.

Questions?

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