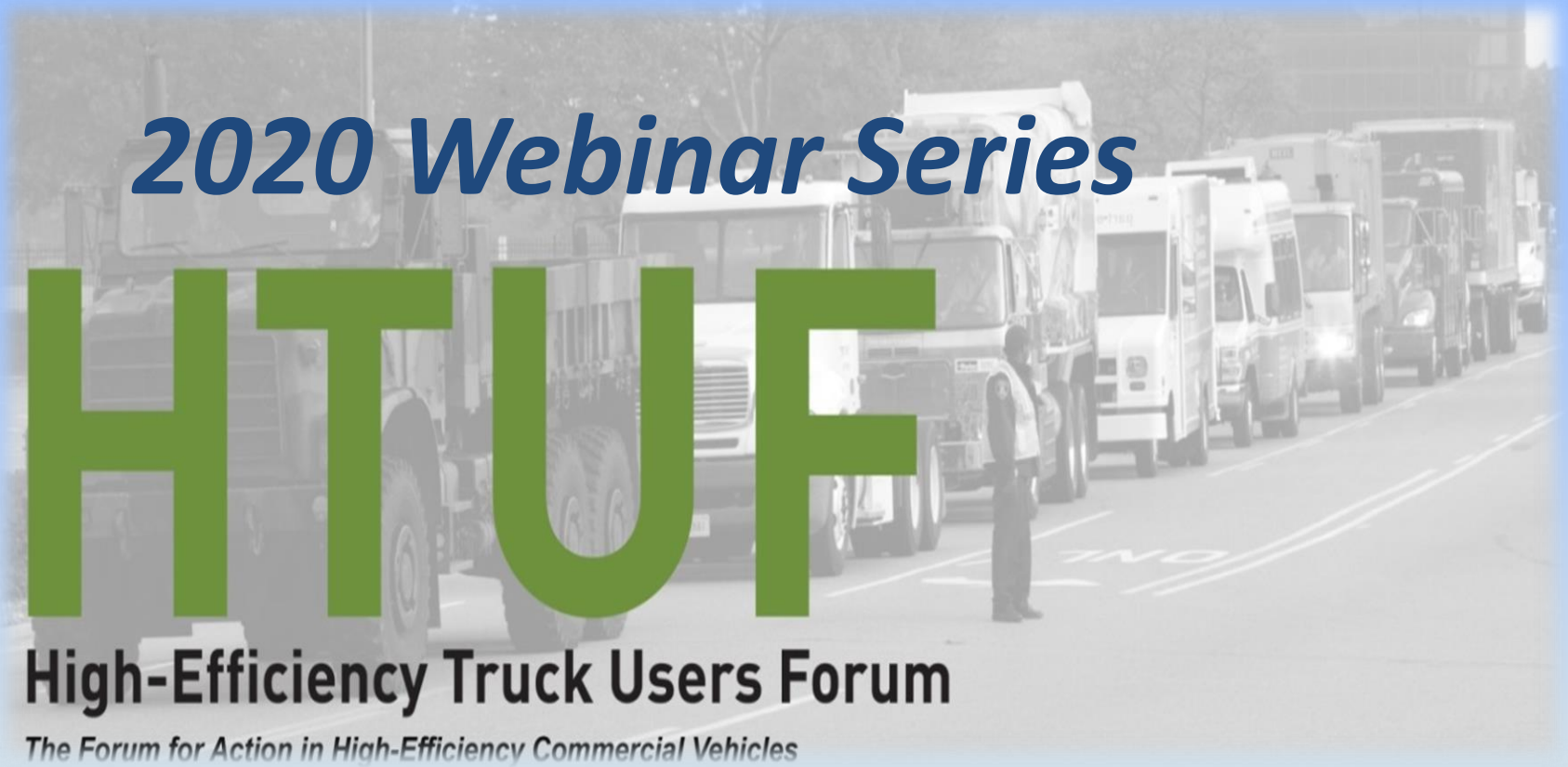

2020 Webinar Series

HTUF

High-Efficiency Truck Users Forum

The Forum for Action in High-Efficiency Commercial Vehicles

CALSTART

U.S.ARMY

DEVCOM GROUND VEHICLE SYSTEMS CENTER

Steven Sokolsky
Program Manager

HTUF
High-Efficiency Truck Users Forum

Agenda

- Program update
  - Army Futures & Concepts Center – Requirements for Tactical & Combat Vehicle Electrification
  - Cybersecurity supply chain working group
- Microgrid/Export Power Update
  - Panel discussion on integrating vehicles into microgrids
- Upcoming HTUF events

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Current HTUF Focus Areas

- ❑ **Informing U.S. Army Futures Command's *Tactical & Combat Vehicle Electrification Requirements***
  - ✓ **Commercial industry engagement & education**
- ❑ ***Vehicle cybersecurity***
  - ✓ **Identify barriers and key issues related to cyber vulnerabilities in the vehicle supply chain**
- ❑ ***Microgrid/Export Power Working Group***
  - ✓ **Increase technology development and industry engagement in export power and its relationship to the development of microgrids**

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Army Tactical & Combat Vehicle Electrification (TaCV-E)

- Futures & Concepts Center (part of Futures Command) drafting requirements for light- and medium-duty vehicles
- HTUF/CALSTART supporting industry engagement activities, connecting with ongoing GVSC work
- First activity is “Industry Day” on **October 20** – opportunity for commercial industry to learn about process and basic requirements
- Will lead to follow-up “One-on-One” meetings with industry stakeholders
- Knowledge gained will inform full requirements to be published in 2021

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Army Tactical & Combat Vehicle Electrification (TaCV-E)

- **TaCV-E Interests:** Increased Onboard Power Generation; Enhanced Powertrain, Hybrid & All Electric Drive Technologies; Battery &Thermal Management Technologies; Formation Power Generation/Sustainment for Mounted Platforms
- **Key Features**
  - 600 Volt DC Power Architecture
  - Hybrid Electric Drive
  - All Electric Drive (Future Increment)

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Army Tactical & Combat Vehicle Electrification (TaCV-E)

Capabilities/Benefits Sought by Electrification

- **Extend Endurance and Operational Reach**
  - ✓ Reduce Liquid Fuel Reliance
  - ✓ Greater Reliability
  - ✓ Simplified Maintenance
  - ✓ Less Spare & Repair Parts
  - ✓ Smaller Support Areas
- **Enhance Platform/Unit Survivability**
  - ✓ Silent Drive/Mobility
  - ✓ Reduce Audible & Thermal Signature
  - ✓ Extended Silent Watch
- **Offers Required Power For Future Lethality & Protection Systems**

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Vehicle Cybersecurity

Safe & Secure Transportation Systems Operation

- **System S/W Reliability**
  - Protection against S/W errors, glitches,..
- **System Cyber IT Security**
  - Protection against malware, cyber attack,….
- **Counterfeit Components**
  - Detection of corrupt parts, loss of design integrity …..

Cyber Attacks Being Demonstrated

Reliability, Cyber Security, & Trusted Components

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Cybersecurity Supply Chain Working Group

Prime Focus Areas:

- Methodologies for identifying counterfeit parts in the commercial vehicle supply chain
- Industry vulnerabilities
- Appropriate roles for government and industry
- Long-term plans for identifying and remediating vulnerabilities
- Methods for sharing information about incidences among industry stakeholders

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Operational Resiliency

HTUF's **Microgrid/Export Power Working Group is** bringing industry and the military together to advance technologies

- The **US Department of Defense** is the **single largest consumer of petroleum** in the world
  - Microgrids provide an opportunity for $8 - $20B savings by 2040
- The military **requires power daily to meet its mission**; at home base and in forward operating bases
  - Microgrids provide ultimate National security at home and during missions

Mobility – Interoperability – Modular – Scalable – Resilient

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Export Power and Microgrids

Host: Jared Schnader
National Program Manager

Agenda

- Introduction – Jared Schnader, CALSTART
- Microgrid Level Set – Jagmeet Khangura, B&V
  - Q&A from Audience (use chat feature)
- Planning Consideration – Bryan Lee, CALSTART
  - Q&A from Audience (use chat feature)
- Wrap Up and Announcements – Steve Sokolsky, CALSTART

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HTUF Export Power and Microgrid Working Group

- Sub-group within HTUF
- Focus on developing key pathways and planning items for power export and microgrids on military bases
- Working Group members consist of Military Representatives, Utilities, OEMs, Suppliers, and Engineering Firms

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Working Group Participants

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HTUF Export Power and Microgrid Working Group

- Current discussions have been surrounding
  - Protocols and safeguards for Cyber Security when plugging into a grid
  - Level-setting between Military and Commercial technologies and goals
  - Important applications for export power and microgrids in military settings

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Jagmeet Khangura

Electric Utility DER

Planning Services Lead

Black & Veatch

Transformative Technologies

How vehicle electrification contributes to the development of microgrids

Jagmeet Khangura

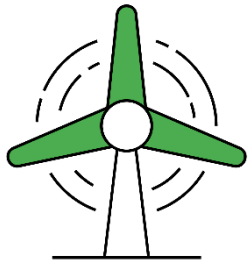
Microgrid Solutions

Agenda

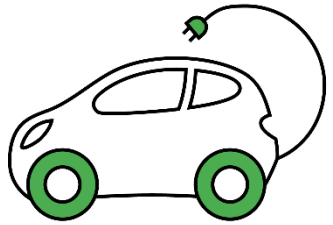
- B&V Intro
- Microgrid Overview
- Transportation Need for Resiliency

B&V Corporate Overview

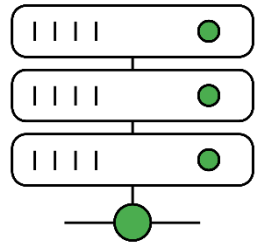
About Black & Veatch



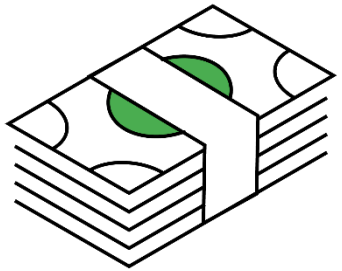
Power Infrastructure/ Reliability & sustainability



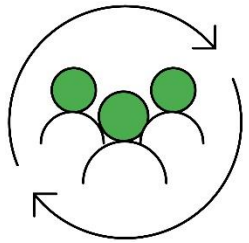
Transportation/ Transformative Technology



Distributed Infrastructure / Mission Critical Facilities

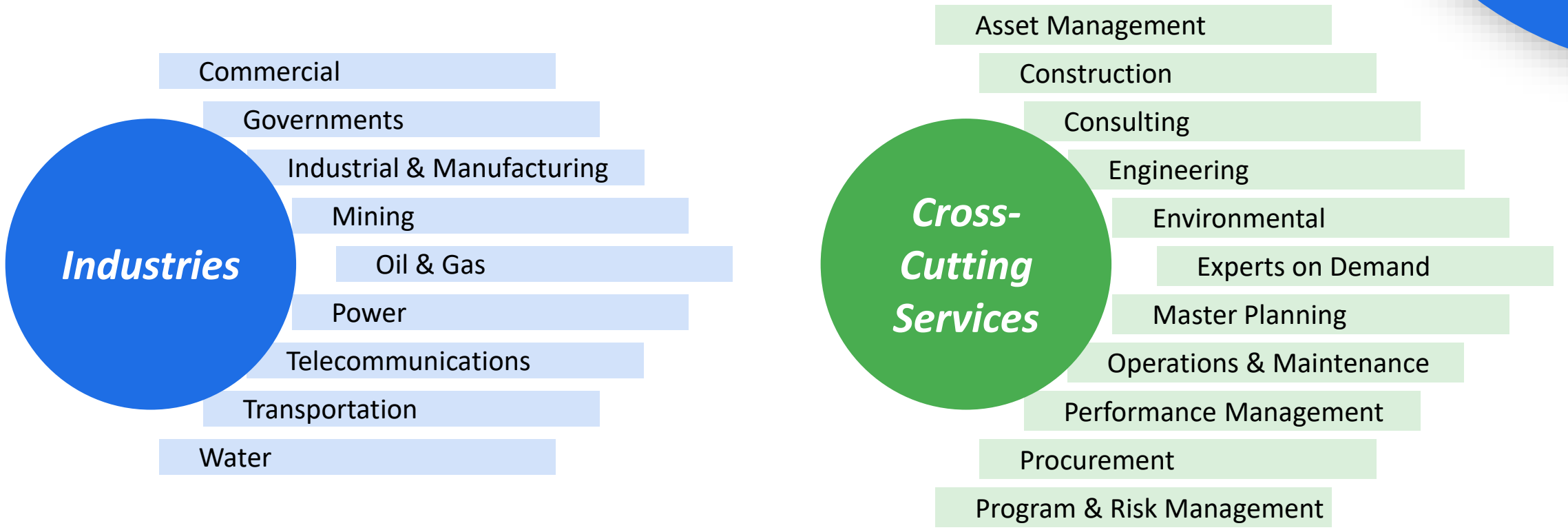


$3.7B
Revenue 2019



10,000+
Professionals

Expertise in Multiple Industries and Disciplines



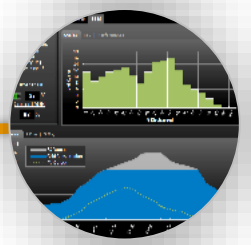
We are structured to deliver a full suite of infrastructure services across diverse markets.

Our WHQ Installation Demonstrates Technology and Delivers a Platform for Solution Development

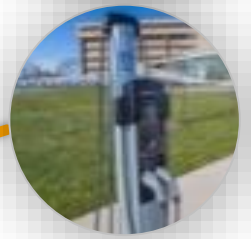
Battery Energy Storage System

Rooftop Solar Photovoltaic (PV)

Microturbines

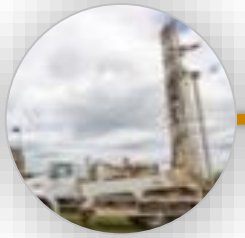


Microgrid Energy Management Application



Electric Vehicle Charging Stations

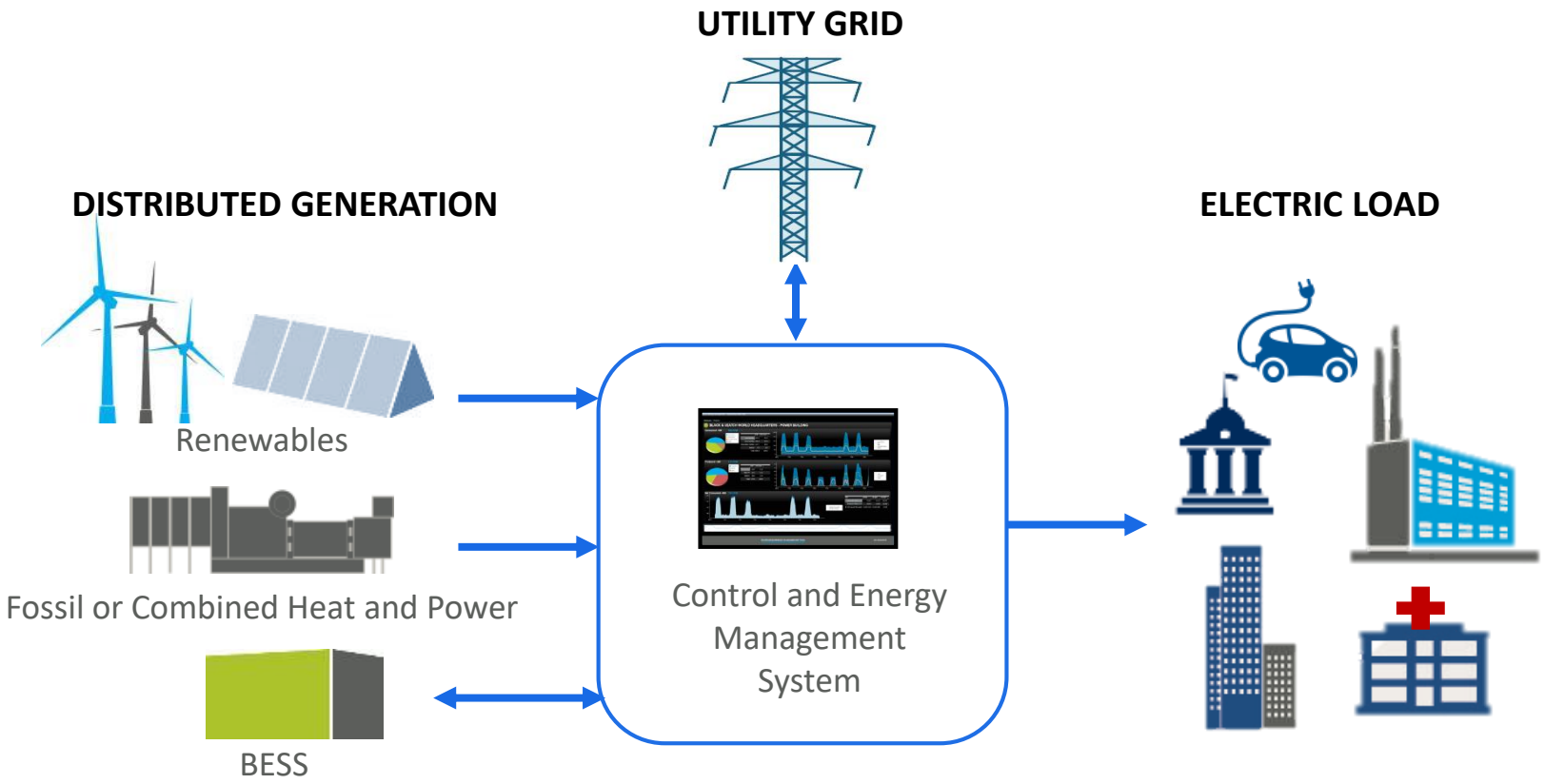
Geothermal



Microgrid

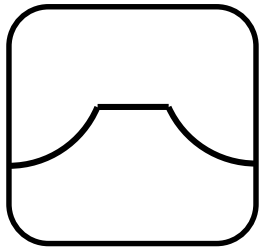
Microgrid Solutions

Integrated system of multiple generations and load, operated as a system, with the ability to operate as an island from the power grid

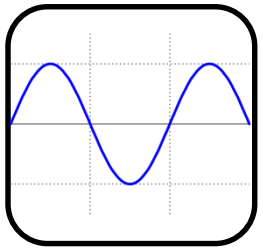


Advanced Functionality

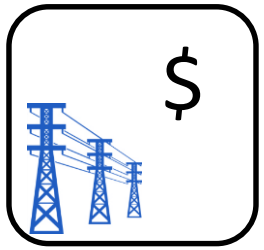
Enables advanced site energy management and potential for services to the utility



Peak shaving

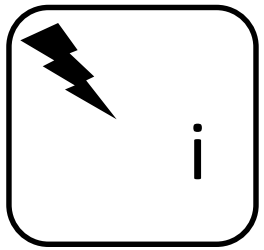


Power quality

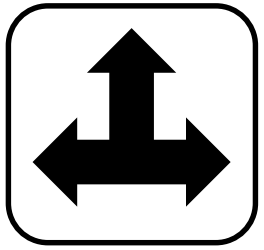


Grid services

Energy management



Island operation



CHP or tri-generation

Multiple Technologies to Meet Local Needs

Fossil / Biogas

- Reciprocating engines
- Gas turbines
- Combined heat and power
- Fossil fueled boilers
- Fuel Cells (NG)

Renewable

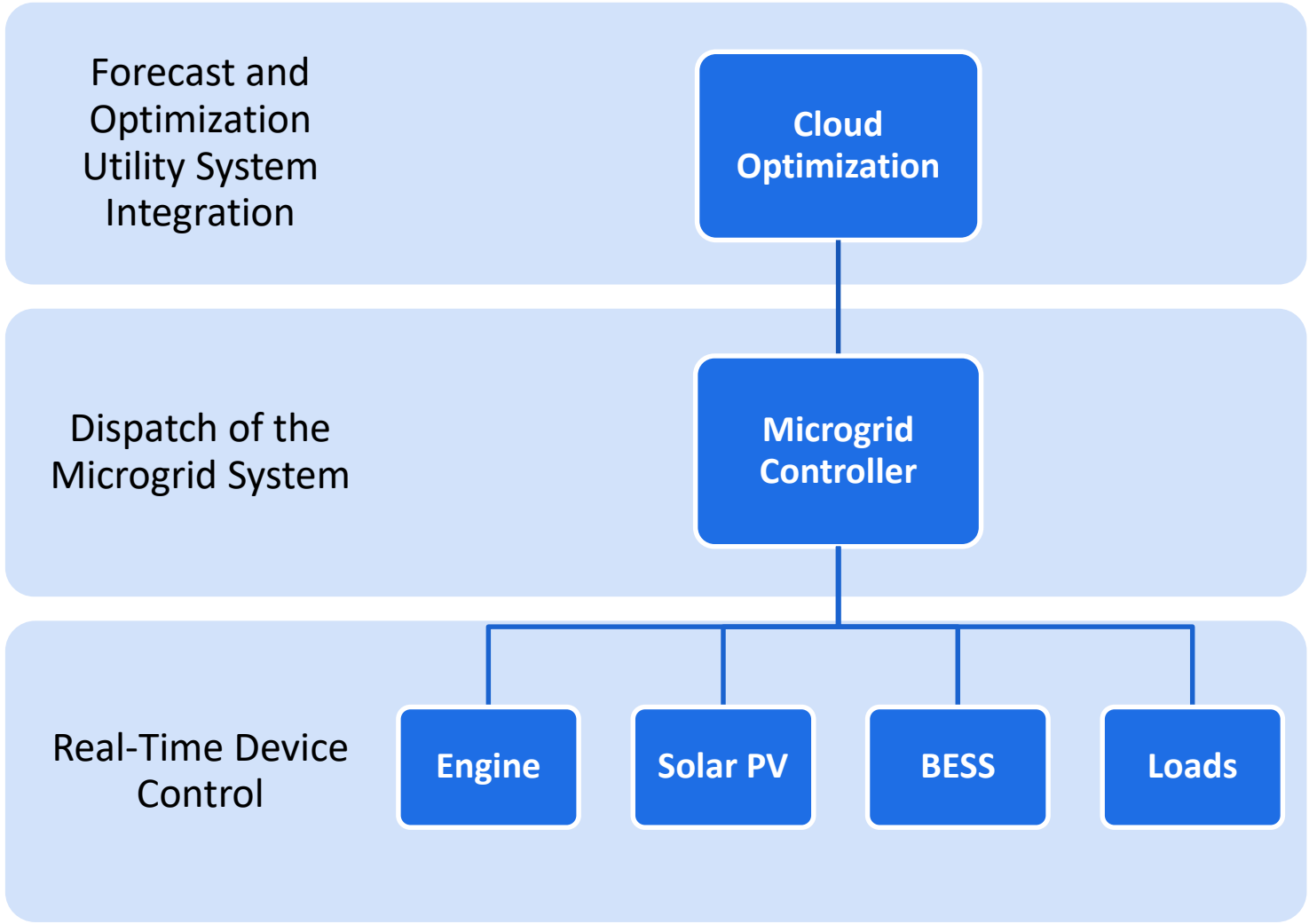
- Solar PV
- Wind
- Biomass/Biogas (digesters)
- Waste to energy
- Fuel Cell (Hydrogen)

Storage

- Batteries
- Compressed air energy storage
- Storage electronics (fly wheels, capacitors, etc.)
- Fuel Storage (Hydrogen, LNG, Diesel, etc.)

Typical Microgrid Control Architecture

Smarter controls enabled by computing power and communications to gain more value from microgrids and distributed resources.



Key Drivers for Microgrids

- Resilience
  - Resilient to catastrophic events that can lead to extended loss of grid power
  - Local risk hazards can inform the microgrid design
- Enhanced reliability of supply
  - Enhanced reliability of supply for the consumer (Power quality/Loss of power)
  - Enhance reliability of the local utility distribution system
- Utility Cost Savings
  - Energy Cost and Demand Charge reduction
- Sustainability Goals
- Rate stability – control over energy spend
- Air Quality

Island and Remote Microgrids

- Pacific Missile Range Facility, Kauai, Hawaii -B&V designed facilities along with backup diesel generators to support a test facilities for a new mission at the Pacific Missile Range Facility Barking Sands.
- Eareckson Air Station, Shemya Island, Alaska (2004) - B&V upgraded an existing diesel power plant located on Shemya Island in Alaska. Because the plant was the primary source of power to the island, it could not be shut down for performance of this work. Required implementation of a sophisticated construction phasing program that accomplished all of the upgrades with only a minimal impact on facility operations.
- Ft. Greely, Alaska (2013) –B&V designed a highly reliable backup diesel power plant to support mission facilities along with a control system. The site is remote being 100 miles south of Fairbanks with only a single 138kV commercial transmission line feeding the site.

Marine Corps Air Station Miramar Mission Assurance Microgrid

- Black & Veatch and Schneider Electric
- Compliant with the DoD Platform Information Technology (PIT) requirements for Information Assurance (IA) system accreditation, Risk Management Frameworks (RMF), and cyber security for Industrial Control Systems (ICS).
- The completed microgrid solution will:
  - Generate redundant electrical power
  - Provide support services to the central grid
  - Help the installation reduce its utility demand charges
  - Manage overall energy load
  - Facilitate and Enhance renewable energy deployment
  - Bolster cybersecurity practices base-wide

COMPONENTS

1.6 MW Solar PV
3.2 MW Landfill gas
3 MW BESS
6.45 MW diesel & NG power plant
SCADA system upgrades
Advanced Microgrid Control System
Operations Center

Transportation Resiliency

Transportation Transition to Electric

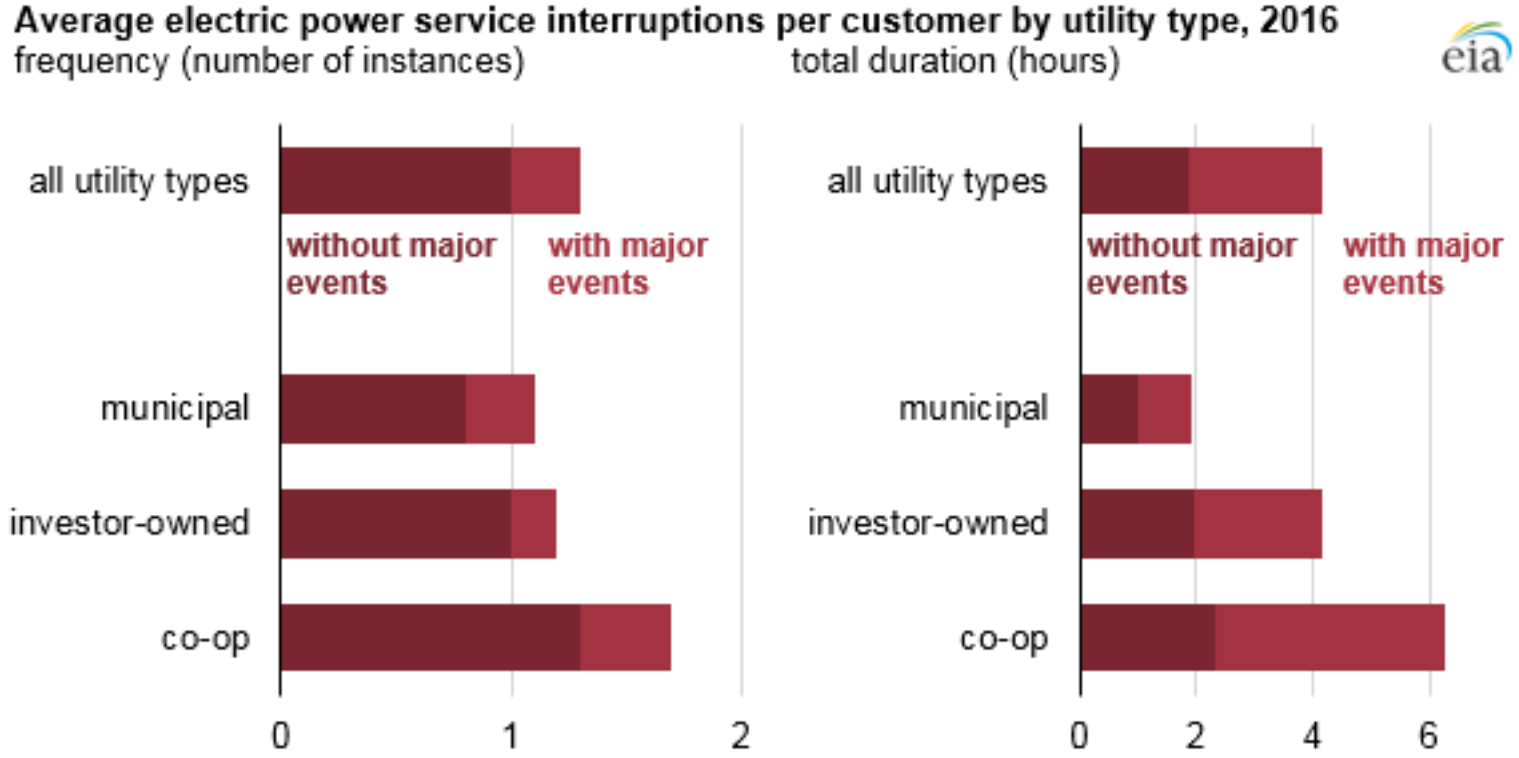
- Transit and commercial fleets are converting to electric
- Most fleets are mixed (electric & diesel) with goal of converting to 100% electric overtime
- Behind the meter solar & battery storage addressing near term goals
  - Utility Cost Savings
  - Sustainability/Renewable Goals
  - Air Quality
- 100% Electric will bring additional challenges requiring microgrids

GRID RELIABILITY METRICS

- IEEE 1366
- SAIDI (System Average Interruption Duration Index)
  - Calculated as the total number of customer outage minutes per year divided by total number of customers served. The units of measurement are in minutes/year.
- SAIFI (System Average Interruption Frequency Index)
  - Calculated as the total number of customer interruptions divided by total number of customers served. The units of measurement are in occurrences/year.
- An interruption is an unplanned loss of utility service to one or more customers as a result of one or more outages on the distribution system for more than 5 minutes.

Metrics describing distribution system reliability

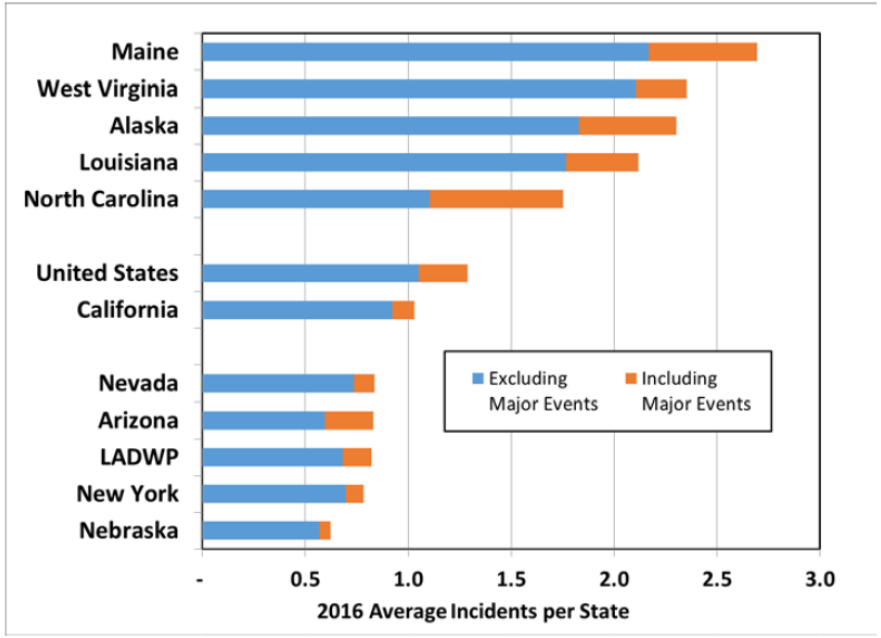
SUMMARY OF US POWER SERVICE INTERRUPTIONS



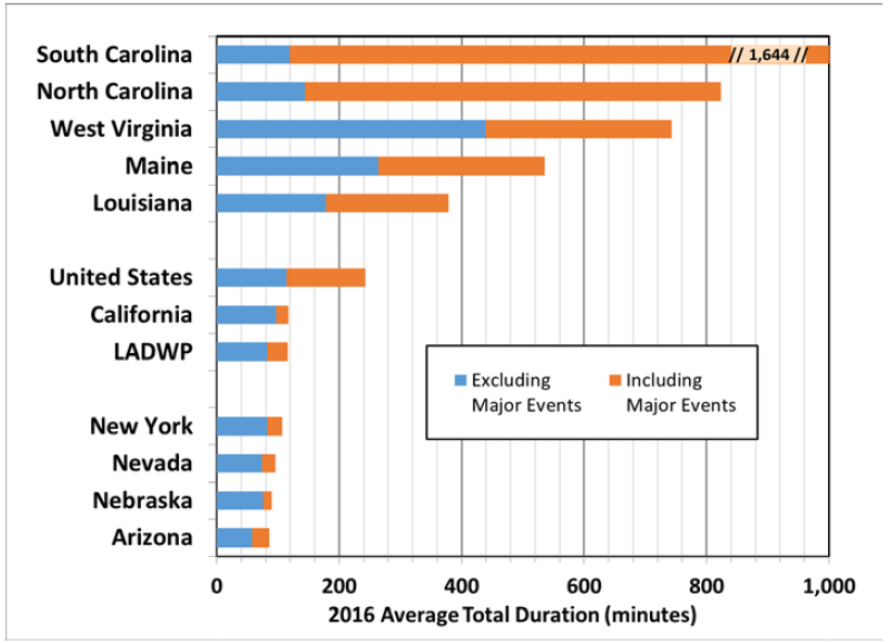
Source: U.S. Energy Information Administration, Annual Electric Power Industry Report (EIA-861 data file) Note durations (SAIDI) are shown in hours, not the IEEE standard of minutes

SUMMARY OF 2016 BEST AND WORST STATES FOR POWER SERVICE INTERRUPTIONS

SAIFI: Frequency of Interruptions

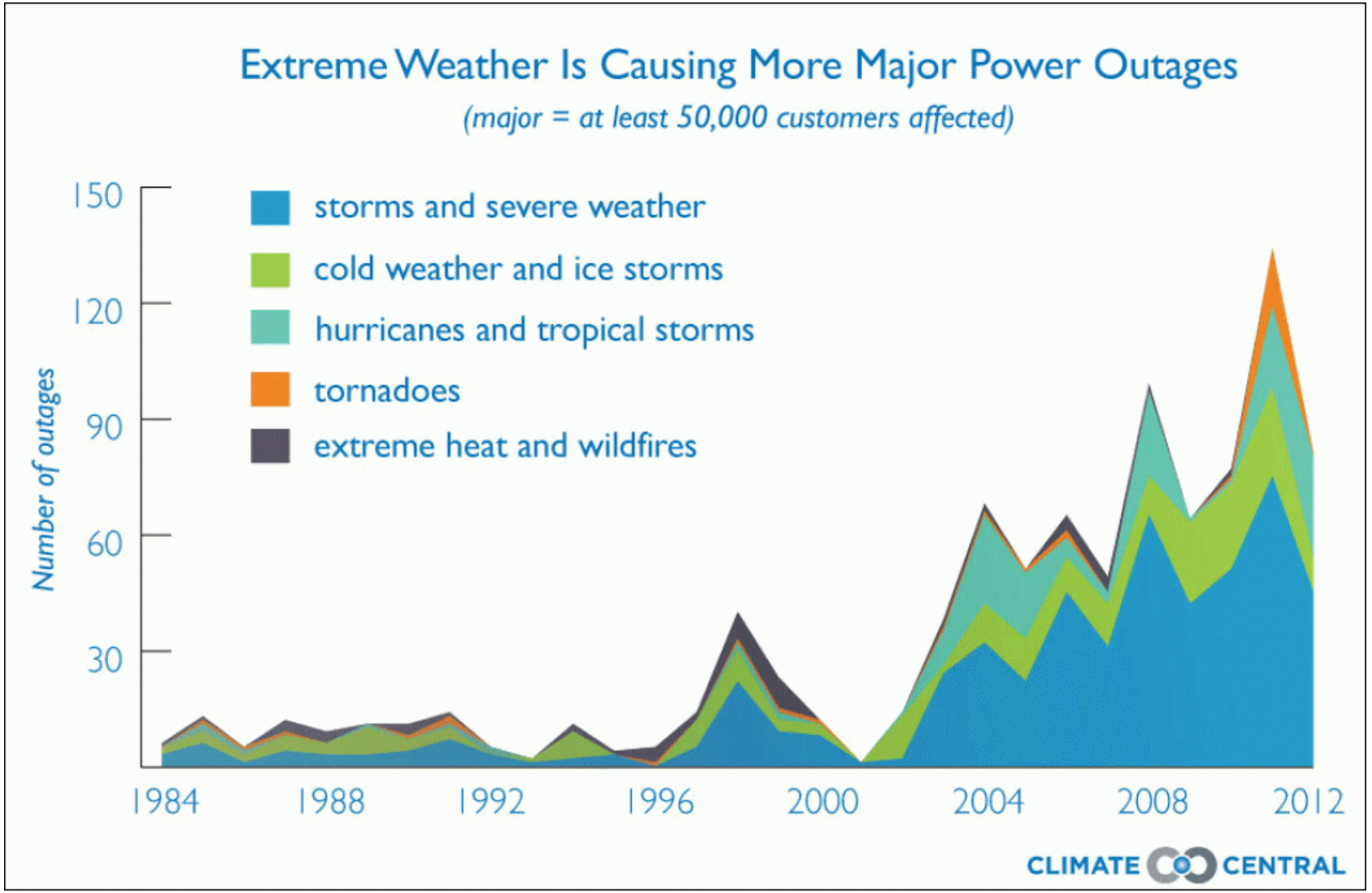


SAIDI: Duration of Interruptions



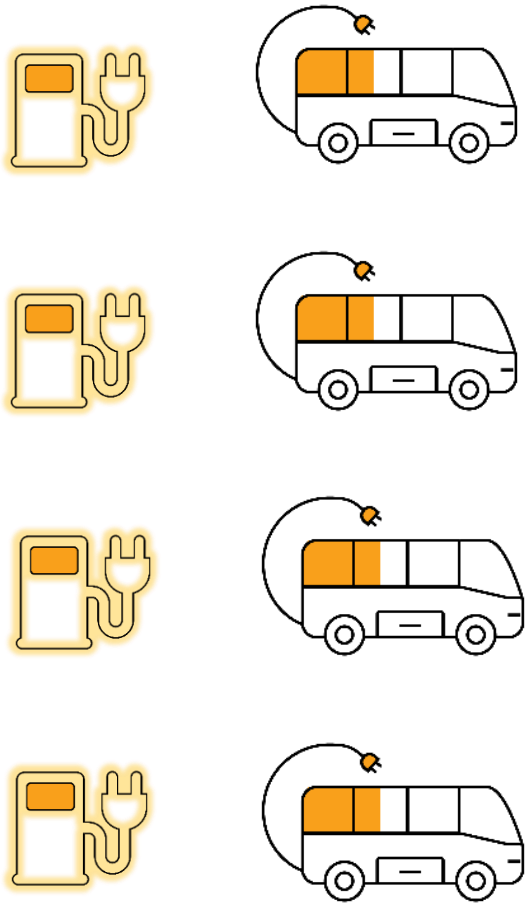
Source: Data Source: U.S. Energy Information Administration, Annual Electric Power Industry Report (EIA-861 data file)

Need for Resilience



Leading Drivers For Fleet Transportation Microgrids

- Resilience
  - Continued service during extended outages
  - Public Transit agencies active in providing regional emergency response
- Utility Cost Savings
  - Need to charging during peaks
  - No availability of reduced rates
- Sustainability Goals
  - City, County or Agency goals to integrate renewable energy
- Air Quality
  - State, City, County or Agency carbon reduction goals



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Thank You

Contact Us

Building a World of Difference
+1 913 458 9859
Khangurjk@bv.com

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Questions?

Please use the Questions function to submit a question to Jagmeet.

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Bryan Lee

Project Manager

CALSTART

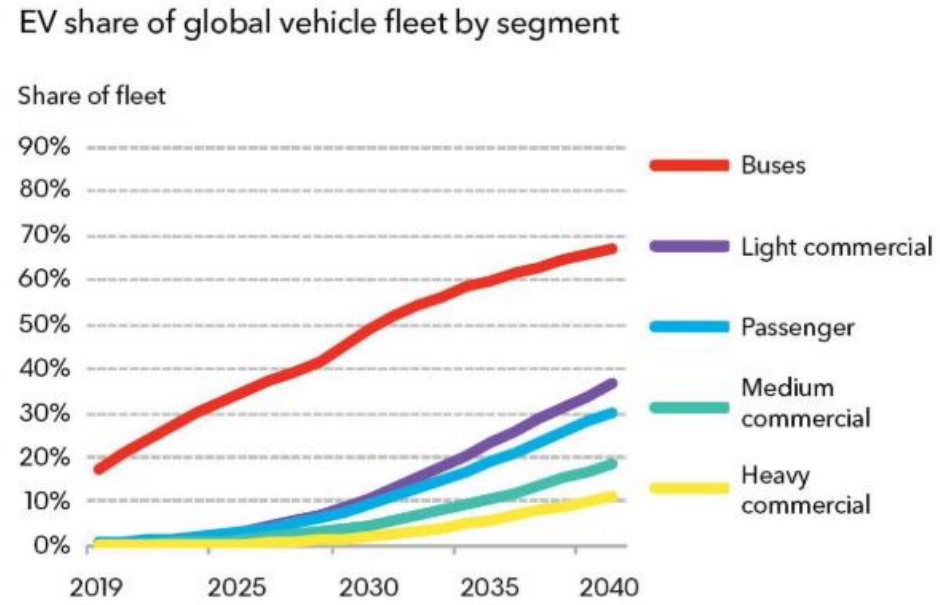
Microgrid and Resiliency Planning

Bryan Lee

8/20/20

Vehicle Electrification

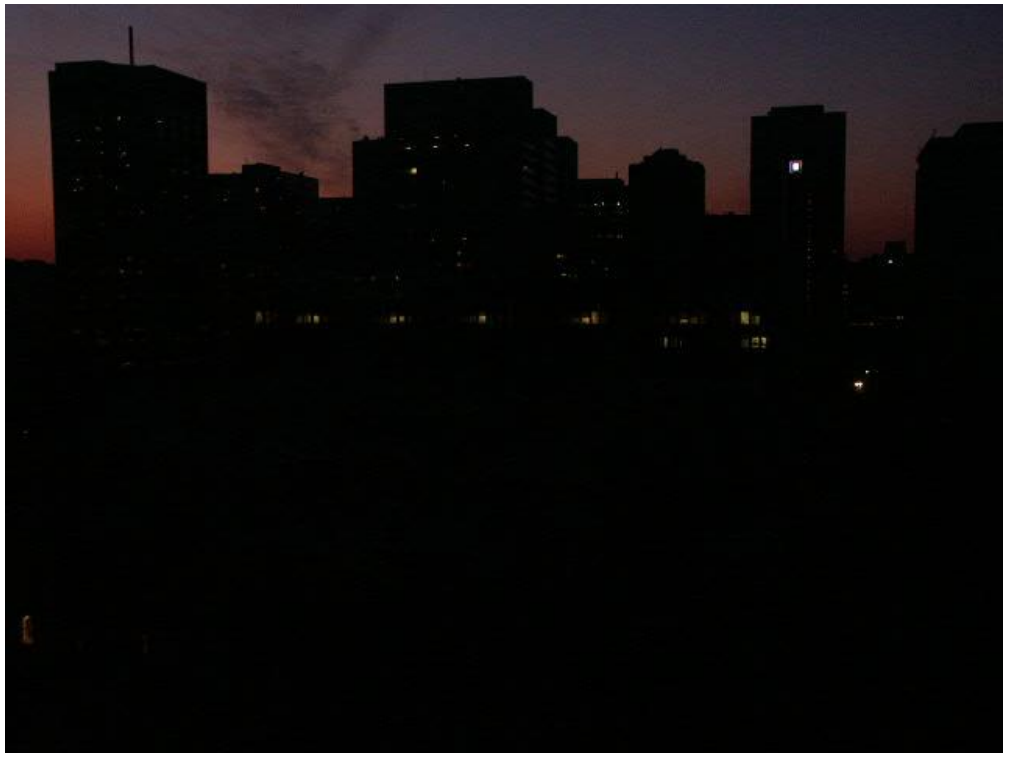
- Transition to zero emission vehicles is occurring rapidly
- Buses and transit are a leader for electrification
- High power demand will strain the grid
- Utilities will need to upgrade infrastructure and increase generation capacity



Source: BloombergNEF. Note: Commercial vehicle adoption figures include the main markets of China, Europe, and the U.S.

Grid Vulnerability to Natural Disaster

- The US electrical grid is relatively stable
  - Average customer experiences about 1 grid outage per year for a total of 2 hours
- Natural disasters like hurricanes or wildfires can lead to prolonged outages
- If the grid fails, vehicles cannot be charged
- If first responders transition to a zero emission fleet, it can impede emergency services

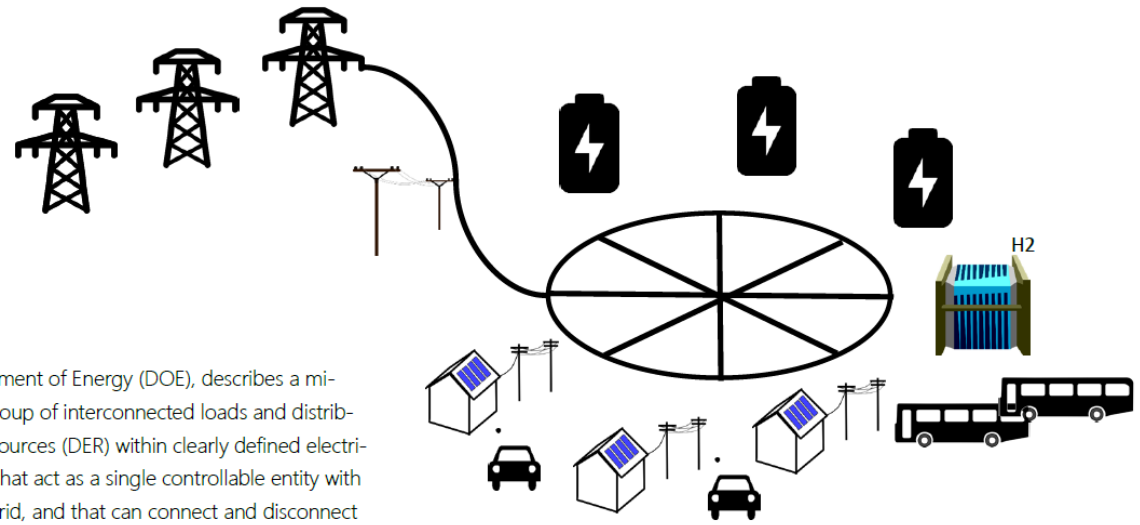


Grid Vulnerability to Attack

- Cyberattacks, kinetic military action, or terrorist attacks against the grid can leave customers without power
- Cyberattacks against Ukrainian utilities have caused blackouts
- The FBI is investigating cyberattacks against multiple small utility companies in America

Microgrids

- Local grid that uses onsite DERs to provide power to a specific campus
- Can disconnect from the grid and provide self-generated power during an outage
- Transit agencies are early adopters of this technology
- CALSTART is working on several microgrids with transit agencies
- We expect other types of fleets to adopt microgrids in the future

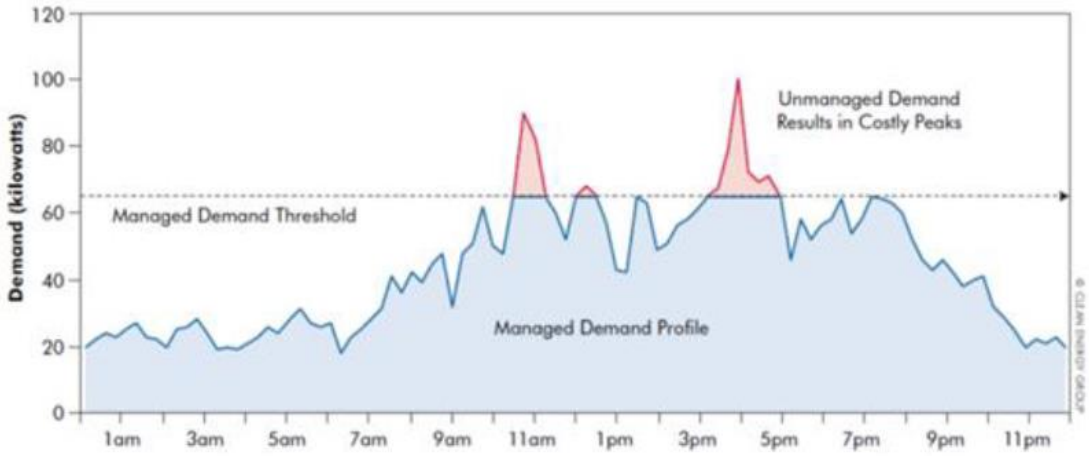


Microgrid

The U.S. Department of Energy (DOE), describes a microgrid as: "a group of interconnected loads and distributed energy resources (DER) within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid, and that can connect and disconnect from the grid to enable it to operate in both grid-connected and 'island' mode." [https://www.energy.gov]

Microgrid Benefits

- Resiliency
- Reduce demand charges
- Generate revenue
- Control over your energy portfolio
  - Solar PV
  - Wind
  - Fuel Cells
  - Generators
  - Hydrogen
- Reduces strain on the grid
- Allows utilities to defer or avoid infrastructure upgrades

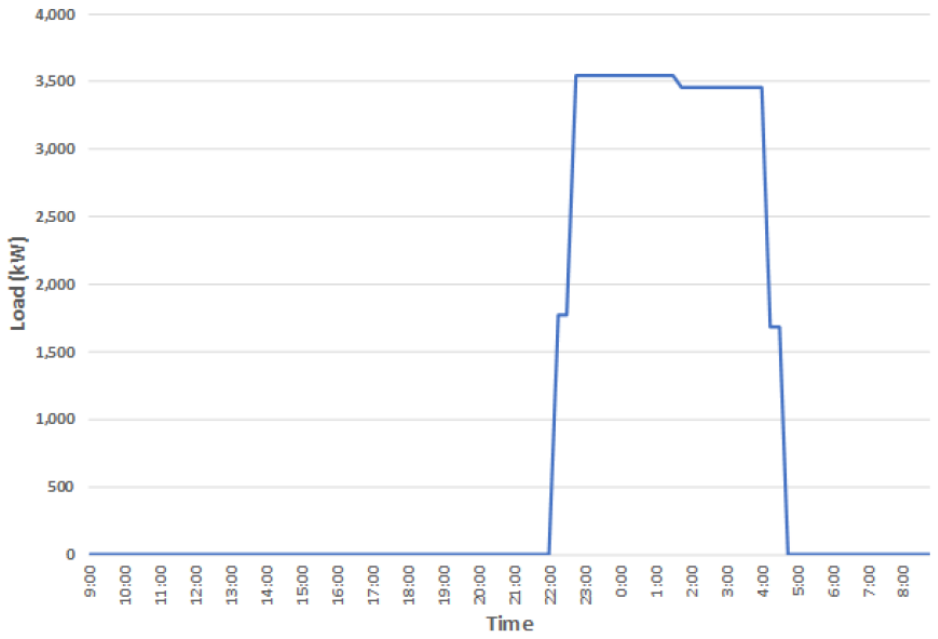


Designing Microgrids

- Understand the microgrid objectives and purpose
- Determine acceptable DERs
- Understand the site's energy/charging needs
  - Building/facility energy consumption
  - Estimate vehicle energy usage
- Develop a load profile (preferably data in 15 minute or hourly intervals)
- Use modelling software to match the most economical generation assets with the load profile

Microgrid Considerations for Battery Electric

- EV charging consumes a large amount of energy
  - 350 – 660 kWh per bus
- High power demand
  - Can be mitigated with smart charging software
- EV charging has a “spikey” load profile
- Charging is usually done at night, when solar PV is not producing energy



Microgrid Considerations for Hydrogen

- Producing H2 via electrolysis is very energy intensive
- H2 production via steam methane reforming is less energy intensive
- Can use hydrogen that is delivered via truck
- Must also power hydrogen compression and dispensing equipment

Lessons Learned

- DERs in a transportation-oriented microgrid must be able to “load follow”
- Generators subject to environmental permits in some jurisdictions
- Hydrogen as a medium of energy storage
- Difficult to provide resiliency to a large fleet with a microgrid
  - Partial resiliency might be more realistic
- Easier to provide resiliency for a hydrogen fleet
- Utility-side/front-of-the-meter microgrids
- These lessons are applicable to any type of fleet

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Questions?

Please use the Questions function to submit a question to Bryan.

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Upcoming HTUF Events

- **August 28** – CCTU Interview with Major Ryan Ressler of Army Futures & Concepts Center on TaCV-E
- **September 17** – HTUF Monthly Webinar – Vehicle Cybersecurity
- **October 20** – HTUF 20th Anniversary – Program origins, rationale & successes; *Army Futures & Concepts Center Electrification Industry Day*

https://calstart.org/projects-htuf-aspx/

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Thank you for participating!

Please send your questions, comments & suggestions to:

Steven Sokolsky
ssokolsky@calstart.org
(626) 744-5604