WASHINGTON STATE UNIVERSITY
Energy Program

Resource Conservation Management Summit

WSU Energy Program
Resource Conservation Management
May 7, 2024

Zoom Housekeeping

- Please rename yourself with your affiliation or workplace.
- This webinar is being recorded (break-out rooms are not).
- **Please keep yourself muted unless you are talking.**
- To ask questions, use the chat or "raise your hand" to speak.
- If you are experiencing any technical issues, please call 360-956-2224 for help. Please note our limited capacity to address issues while the webinar is running.

WSU Energy Program

- Self-supporting department within Washington State University based in Olympia
- This presentation part of the Resource Conservation Management (RCM) Program
- Other programs: community solar, Washington state energy codes (residential) support, green transportation education and outreach, community energy efficiency, workforce development, and more

https://www.energy.wsu.edu

Resource Conservation Management Program

- RCM support and workforce development
- Public agencies in Washington State
- Provides
  - Monthly newsletter
  - Webinars
  - Publications
  - Technical assistance
  - RCM position announcements & promotion


RCM News

WASHINGTON STATE UNIVERSITY
Energy Program

RCM News for February 2024

A Newsletter for Resource Conservation Managers in the Northwest

In this issue:

Announcements
Articles
- Indoor Environmental Quality
- LED Advantages
- MERV 13 Filters
- Sustainable Steps for Buildings

Upcoming Events & Training Opportunities
Resources

To receive the newsletter, send email to rcm@energy.wsu.edu

** Must perform RCM work at public agencies in Washington State **

Project Support

This project was supported in part by Grant No. DE-EE0009488 awarded by the U.S. Department of Energy. Points of view in this presentation are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Energy.

Grant funds are administered by the Energy Program, Washington State Department of Commerce

Presenters and Hosts

- Karen Janowitz
  Project Manager, WSU Energy Program

- Jim Jensen
  Green Transportation Program Director, WSU Energy Program
- Katherine Morgan
  Principal, ArchEcology

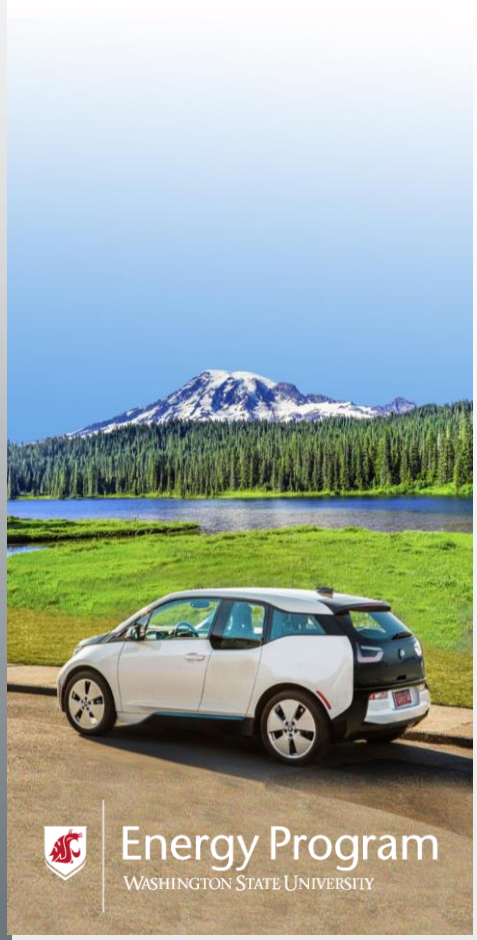
- Rebecca Sheppard
  Senior Project Manager, Building Potential/Smart Buildings Center
- Britton Rife
  Senior Project Manager, Building Potential/Smart Buildings Center

Agenda

- 12:00 Welcome
- 12:10 Presentation: Electric Vehicles & Resource Conservation
- 12:45 Follow-up to March 20 EMP/O&M webinar
- and Asset data collection discussion
- 1:30 Break
- 1:40 Break-out rooms
  - University/College
  - K-12
  - Offices & Government (City/County/State/Federal)
  - Other
- 2:40 Report back from break-out rooms
- 2:55 Closing

Break-out rooms

- Break-out rooms
  - University/College
  - K-12
  - Offices & Government (City/County/State/Federal)
  - Other
    - People who support the work of others: utilities, consultants, etc
- You will choose the room you want to attend.
- Non-profits and federal sectors may consider Offices & Government
- Those not working at, or supporting, a WA public facility, please limit participation.



Washington
Green Transportation Program
Moving forward with Washington's public fleets

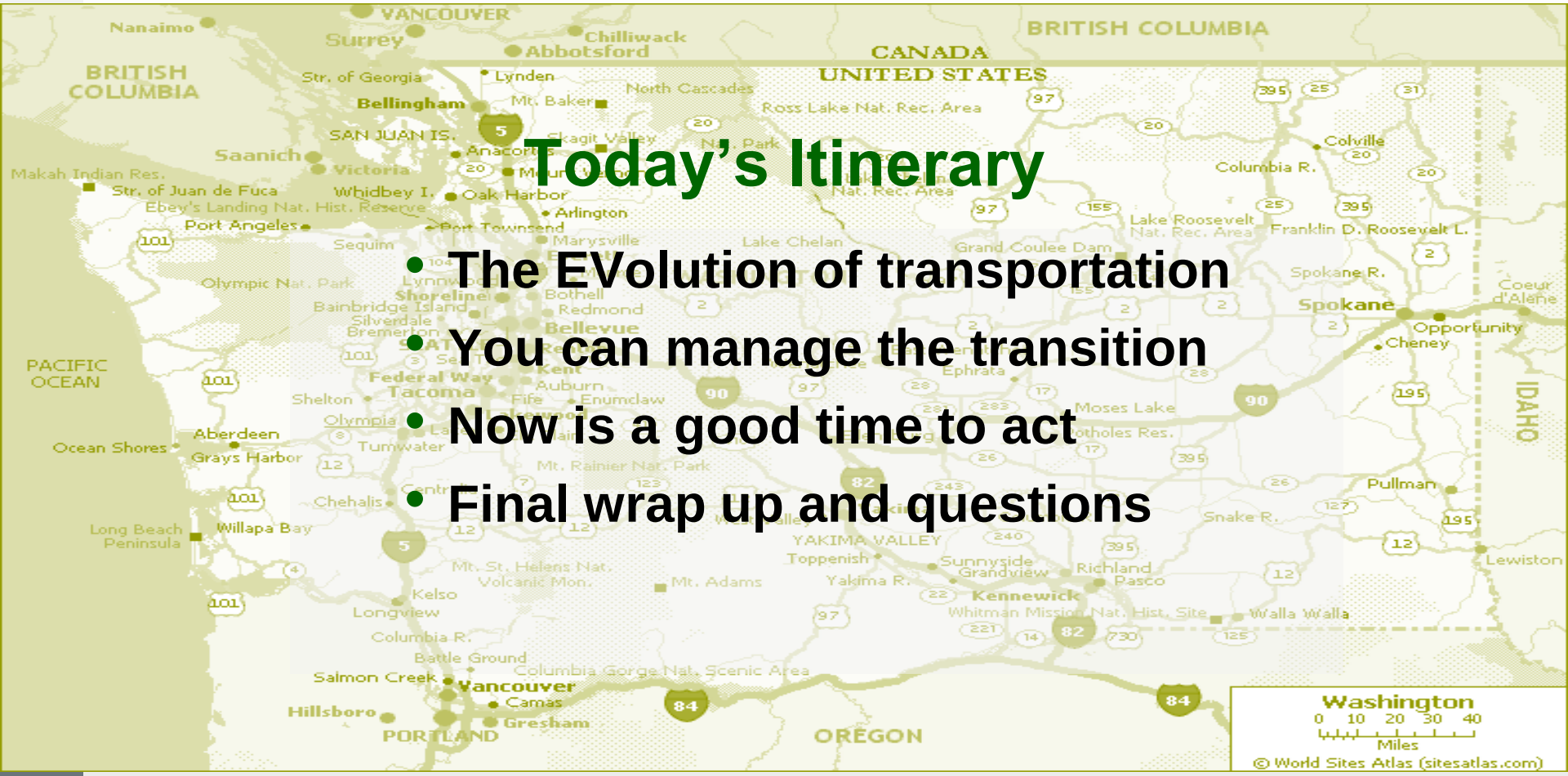
Electric Vehicles & Resource Conservation

Jim Jensen, Director

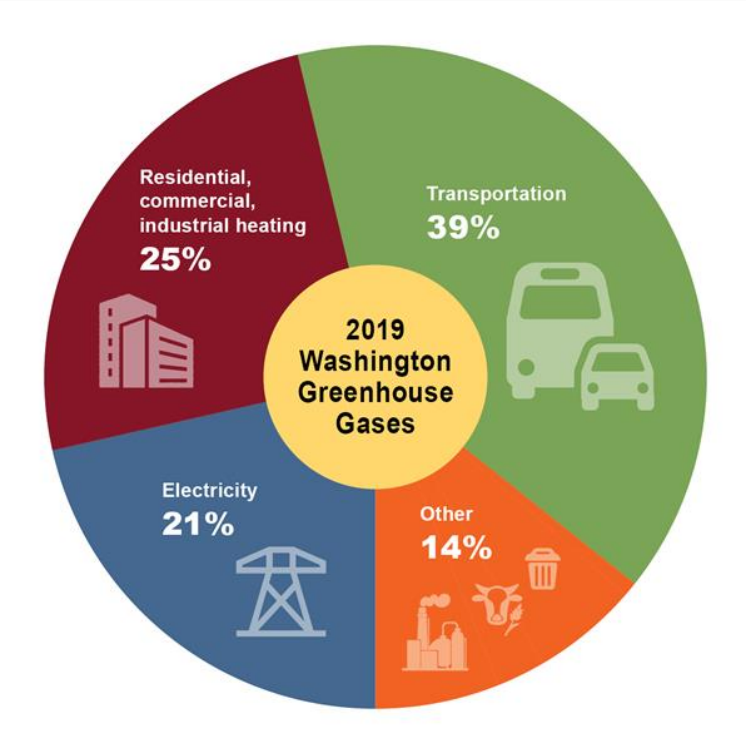
May 2024

Today's Itinerary

- The EVolution of transportation
- You can manage the transition
- Now is a good time to act
- Final wrap up and questions



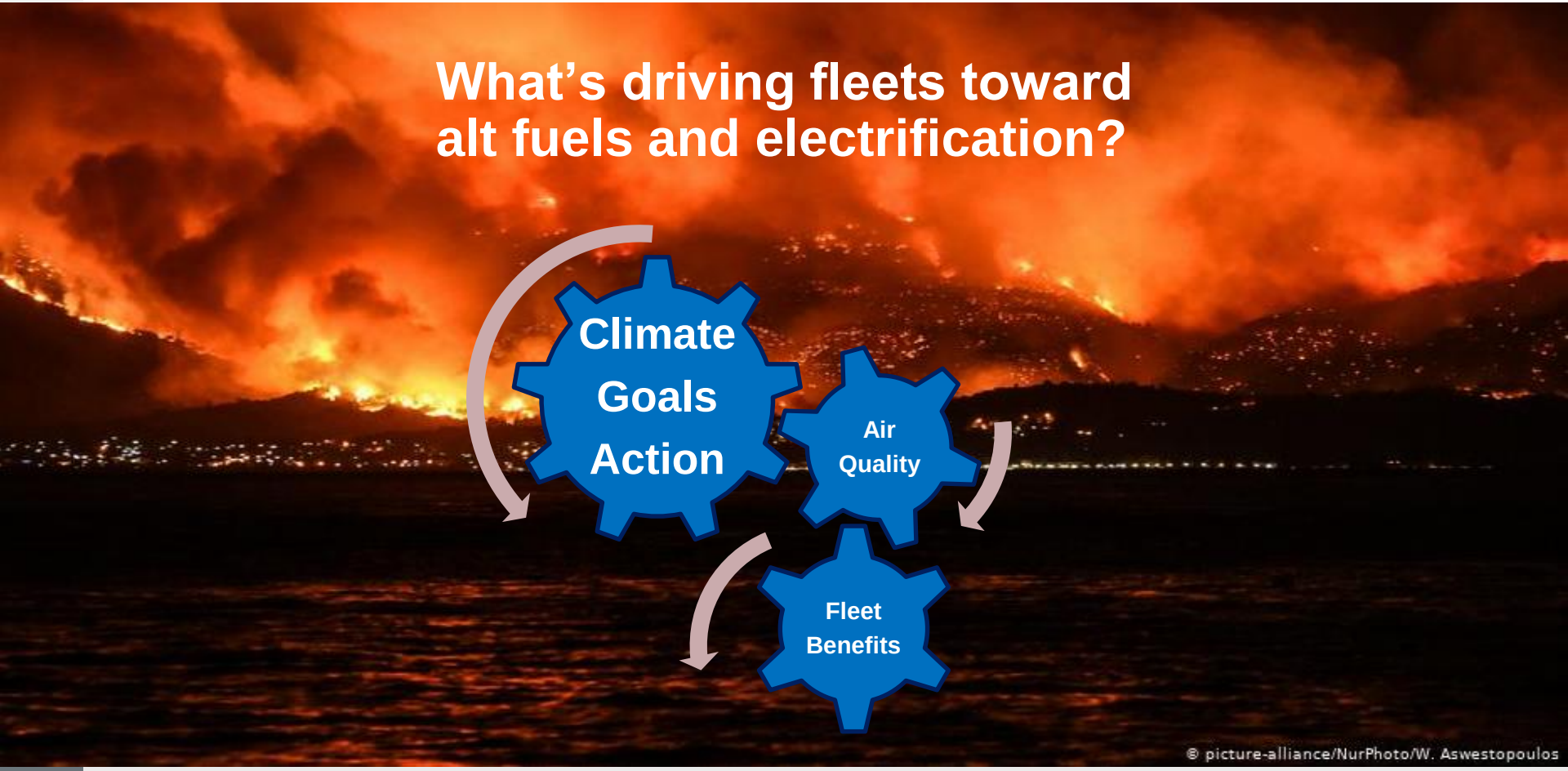
Role of Transportation in Climate Change



Dept of Ecology, GHGs in Washington, 2019

Photo: ucsusa.org

What's driving fleets toward alt fuels and electrification?



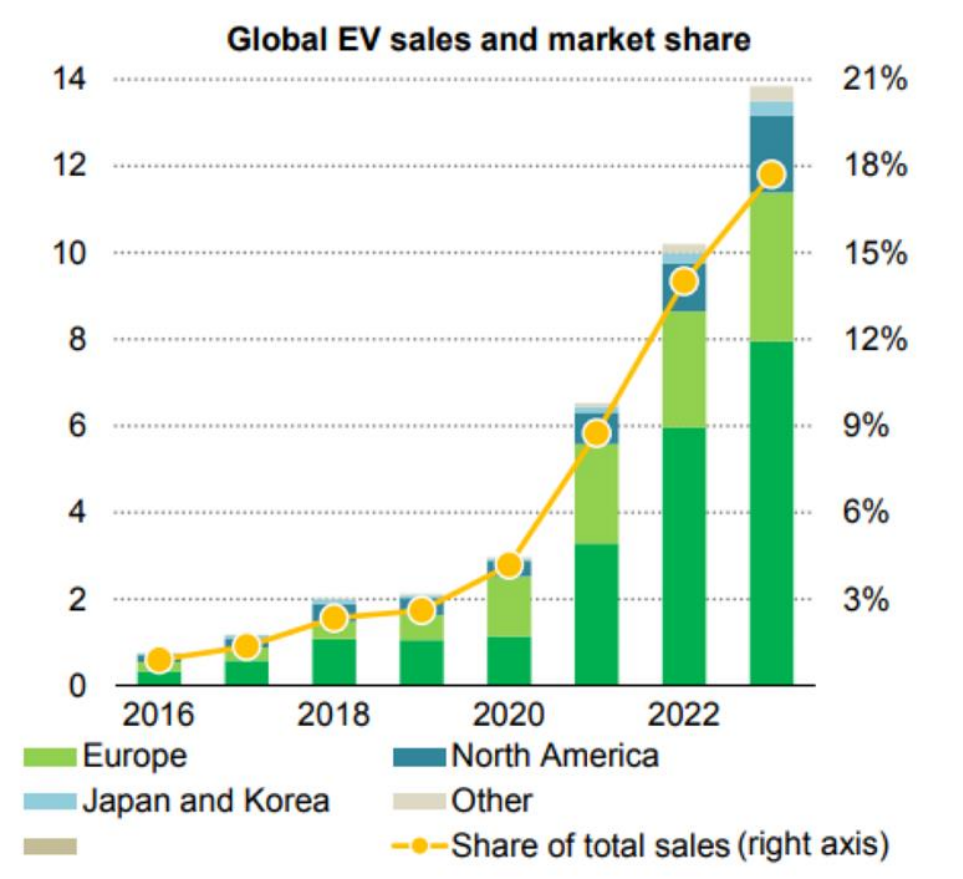
US Automakers Pledge 40-50% EV sales by 2030

American Honda Motor Co. • BMW North America • Ford Motor Company • General Motors • Hyundai Motor Company • Jaguar Land Rover Limited • Kia Motors America • Mazda Motor Company • Mercedes-Benz USA • Mitsubishi Motors North America • Nissan North America • Stellantis North America • Subaru of America • Tesla Motors • Toyota Motor Sales • Volkswagen Group of America • Volvo Group North America

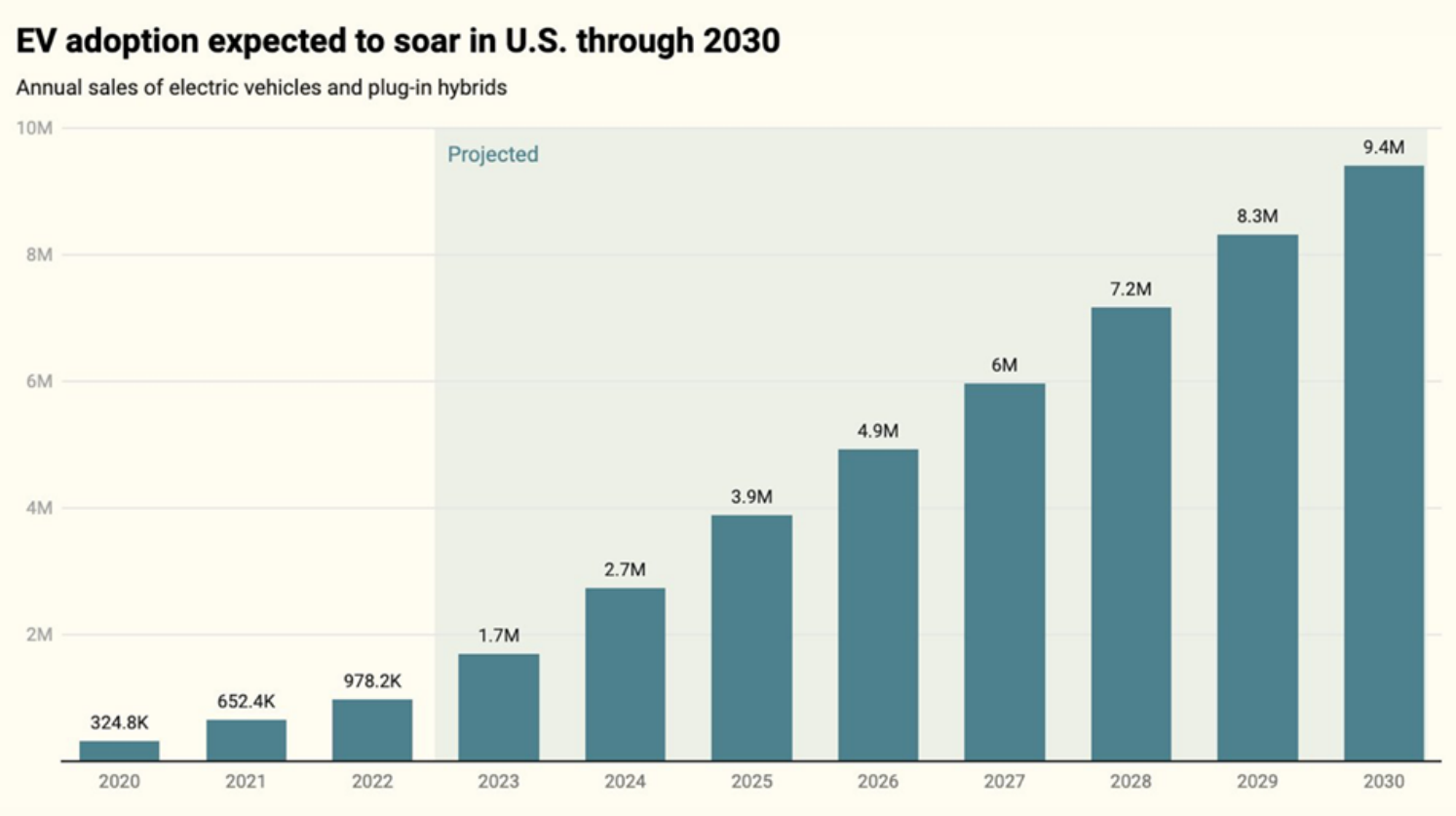
US Automakers Pledge 40-50% EV sales by 2030

New Emissions Standards Expect EVs to be 67% of New Car Sales by 2032

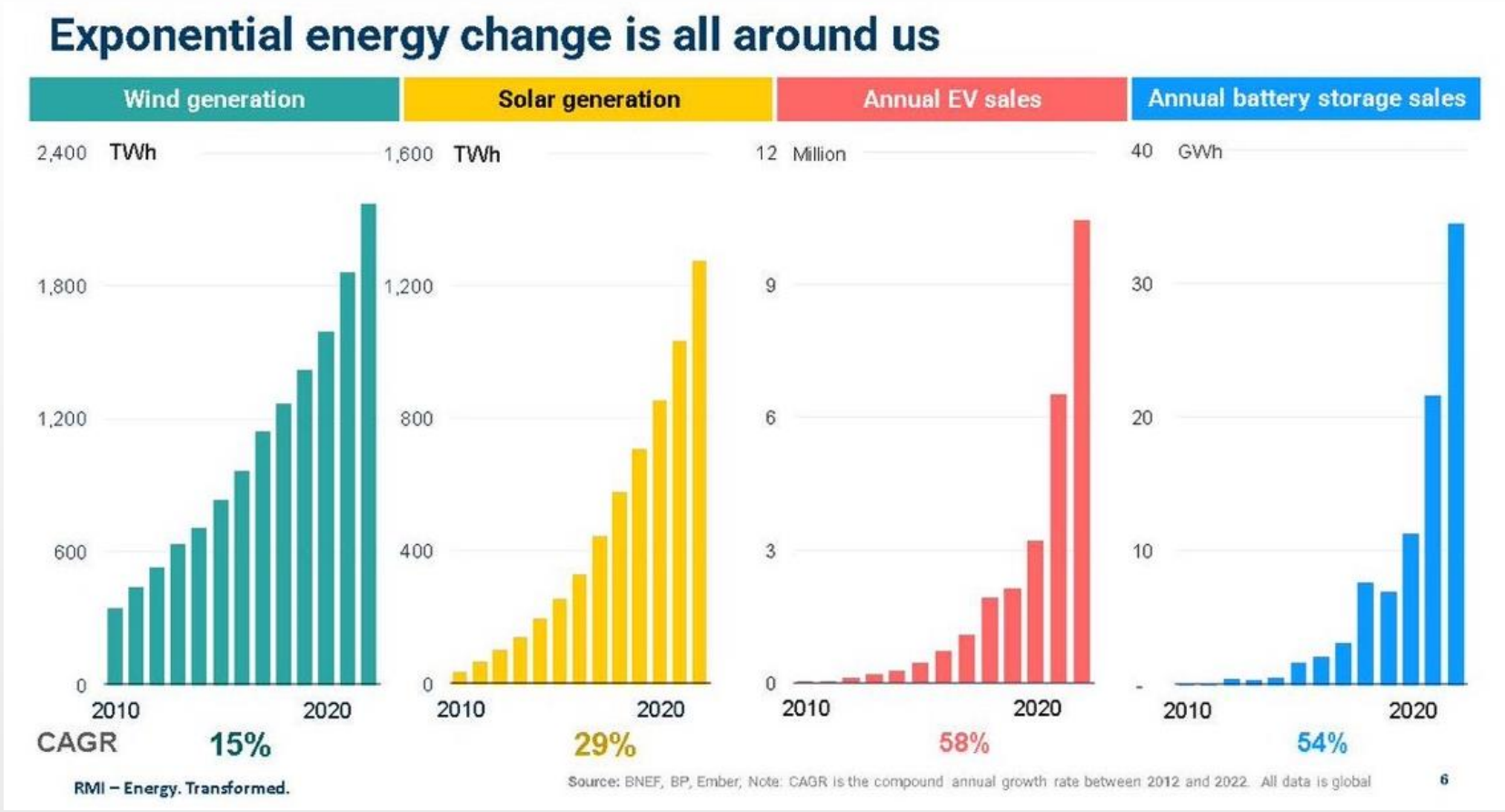
Motor Company • Mercedes-Benz USA • Mitsubishi Motors North America • Nissan North America • Stellantis North America • Subaru of America • Tesla Motors • Toyota Motor Sales • Volkswagen Group of America • Volvo Group North America


Global EV sales and market share
14
12
10
8
6
4
2
0
21%
18%
15%
12%
9%
6%
3%
2016
2018
2020
2022
Europe
North America
Japan and Korea
Other
Share of total sales (right axis)

IEA, 2023

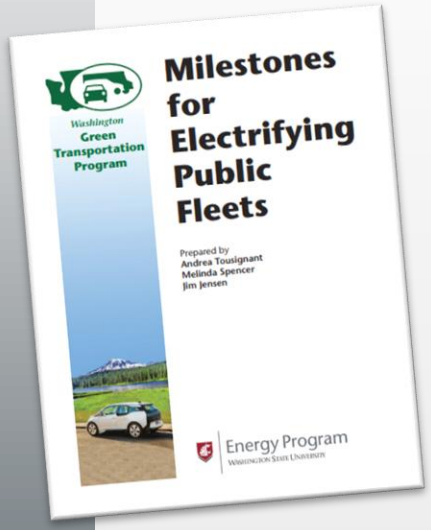


Canary Media



RMI-Energy. Transformed.

A Typical Fleet ZEV Transition



Internal Planning & Assessment

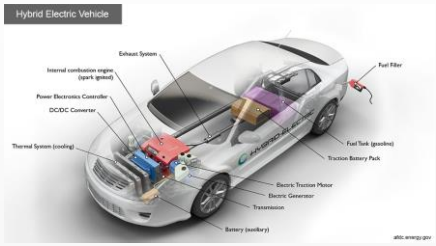
Coordinate with External Partners

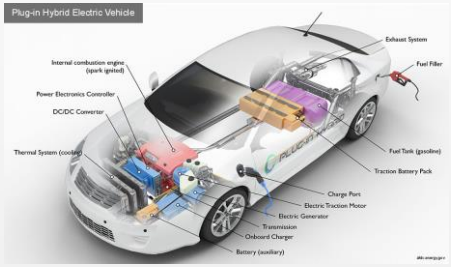
Action & Funding Phase

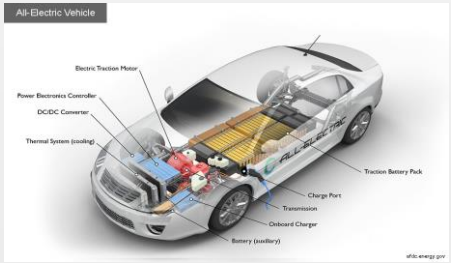
1. Assemble your team and set goals
2. Identify EV candidates
3. Calculate electric loads
4. Facility planning and capacity assessment
5. Engage utility
6. Engage vendors and contractors
7. Finalize plans
8. Procurement
9. Installation
10. Implementation

Electric Vehicle Types

- Hybrid Electric Vehicle (HEV)
  - Uses both gas and electric motors
  - Charged through regenerative braking
  - Original Toyota Prius and lots of others
- Plug-in Hybrid Electric Vehicle (PHEV)
  - Uses both gas and electric motors
  - Can be charged externally
  - Chevy Volt, Toyota Prime series, Jeep Xe models, etc
- Battery Electric Vehicle (BEV)
  - Fully electric
  - Must be charged externally
  - Ford, GM, VW, Nissan, Kia, Hyundai, Tesla, and Rivian, etc







Light-Duty Electric Vehicles (Sedans)

Chevy Bolt

Nissan Leaf

Hyundai Ioniq

Kia Soul

Tesla Model 3

Mini Cooper

Many more…

BUY IT TODAY

PlugStar by Plug In America

Light-Duty Electric Vehicles (Pick-ups and SUVs)

Chevy Pickup (model unspecified)

Ford Mach-e

Kia Niro

Hyunda Kona

Ford F150

Tesla Cyber Truck

XL Plug-in Hybrid F150

Rivian Pickup, SUV

Toyota Rav4 (PHEV)

Ford Escape (PHEV)

PRODUCTION IN 2021-2022 → PRODUCTION IN 2021 → BUY IT TODAY

Light- & Medium-Duty Electric Vans

Arrival

Mercedes Sprinter (Europe Only Currently)

Rivian

Freightliner MT50e Chassis (Q1 2021)

Chanje Panel Van

Ford Transit

Adomani Electric Cutaway Van Chassis

TIMELINE UNKNOWN | PRODUCTION IN 2021 | BUY IT TODAY

Medium-Duty Electric Trucks

Daimler eCanter

Daimler eM2

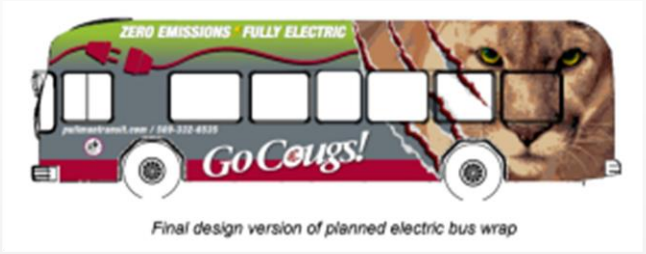
BYD Front-cab

Adomani Front-cab

PRODUCTION IN 2021

BUY IT TODAY

Electric Buses



Final design version of planned electric bus wrap

Electric Refuse Trucks and Sweepers

MACK Refuse Truck (Production 2021)

LION Electric Refuse Truck

Global Environmental Sweeper

BYD Refuse Truck

BUY IT TODAY

Heavy-Duty Class 8 Electric Tractors & Trucks

Nikola (unknown)

PACCAR Lineup

Daimler Lineup (eCascadia, eM2, eCanter)

Tesla Semi

BYD Tractor

PRODUCTION IN 2021-2022 → BUY IT TODAY

Heavy-Duty Non-Road Electric Vehicles

Volvo Compact Wheel Loader

Volvo Compact Excavator

Wiggins 70,000lb Forklift

Linde 15,000lb Forklift

DANNAR MPS

Mecalac Mobile Excavator (timeline unknown)

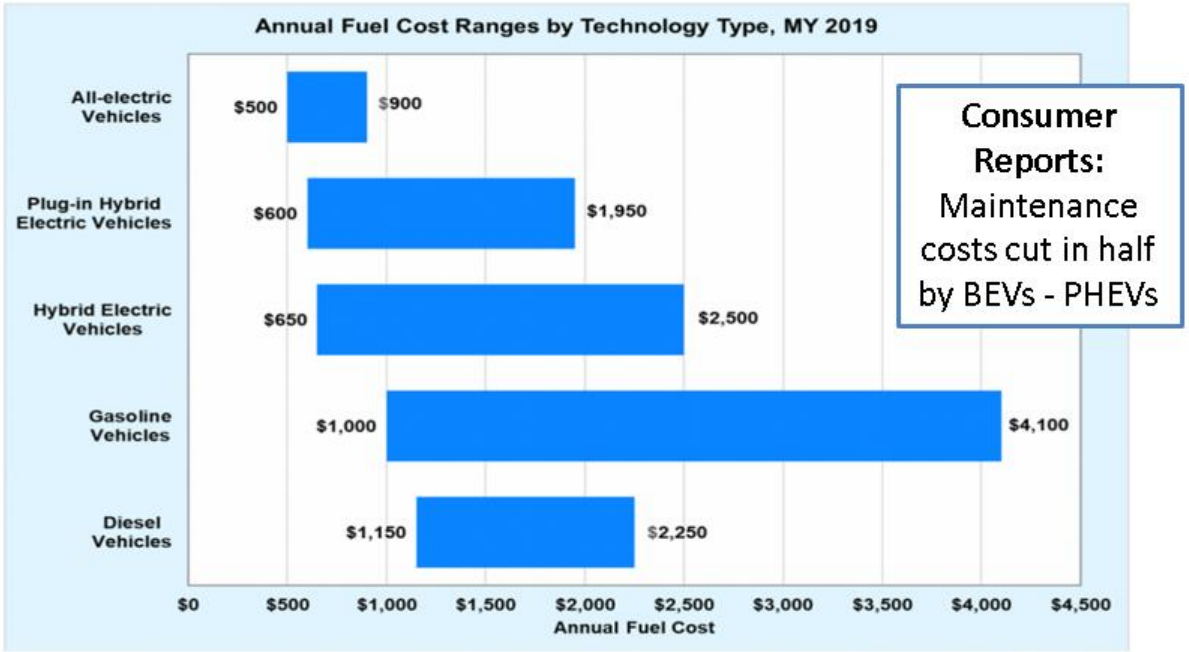
Mobi Freewire Battery + Charger

Lektro (ground support equipment) eGSE

Kalmar eGoat

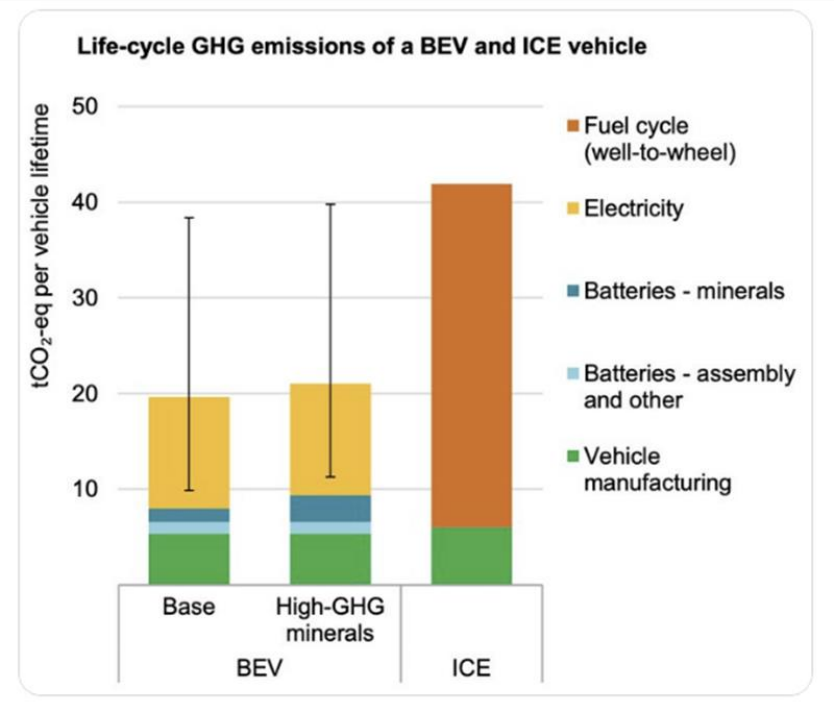
PRODUCTION IN 2021-2022 → BUY IT TODAY

EVs are cheaper to operate



U.S. Department of Energy: https://www.energy.gov/eere/vehicles/articles/fotw-1109-november-25-2019-all-electric-vehicles-have-lowest-estimated-annual

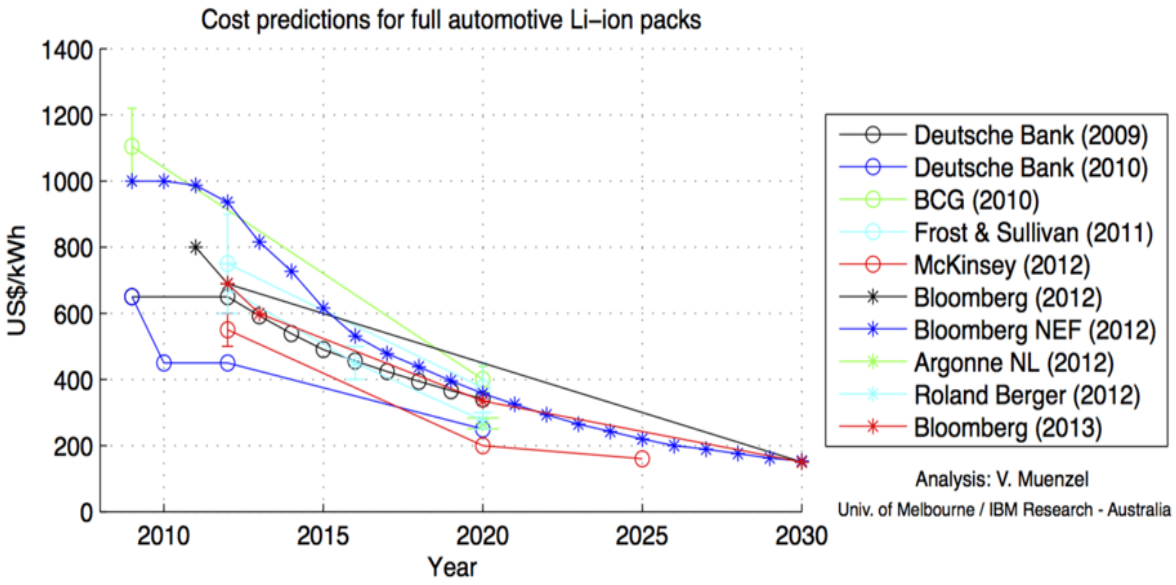
Battery Improvements



Source: "The Role of Critical Minerals in Clean Energy Transitions,"
International Energy Agency (IEA), May 2021

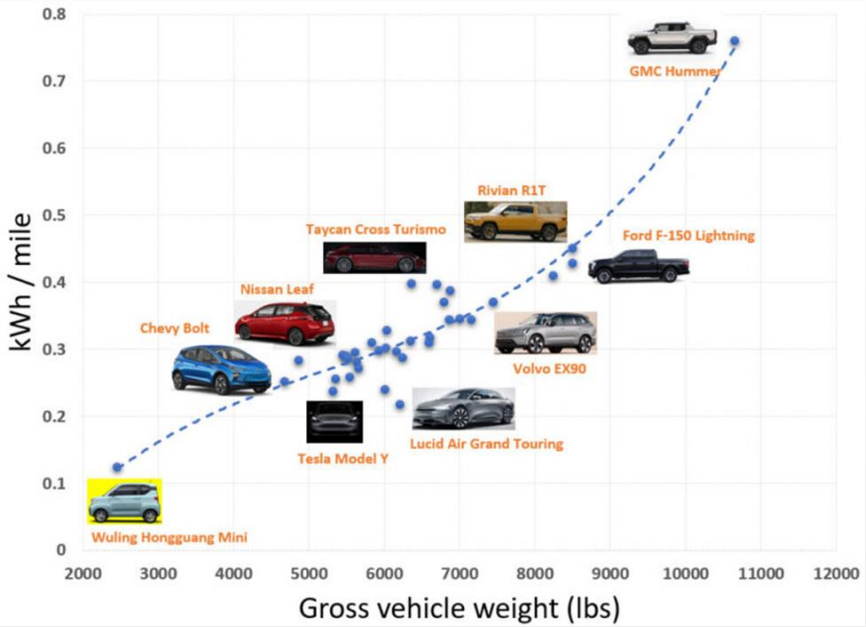
Source: Bloomberg

Battery Cost Reductions



Electrical Efficiency of EVs

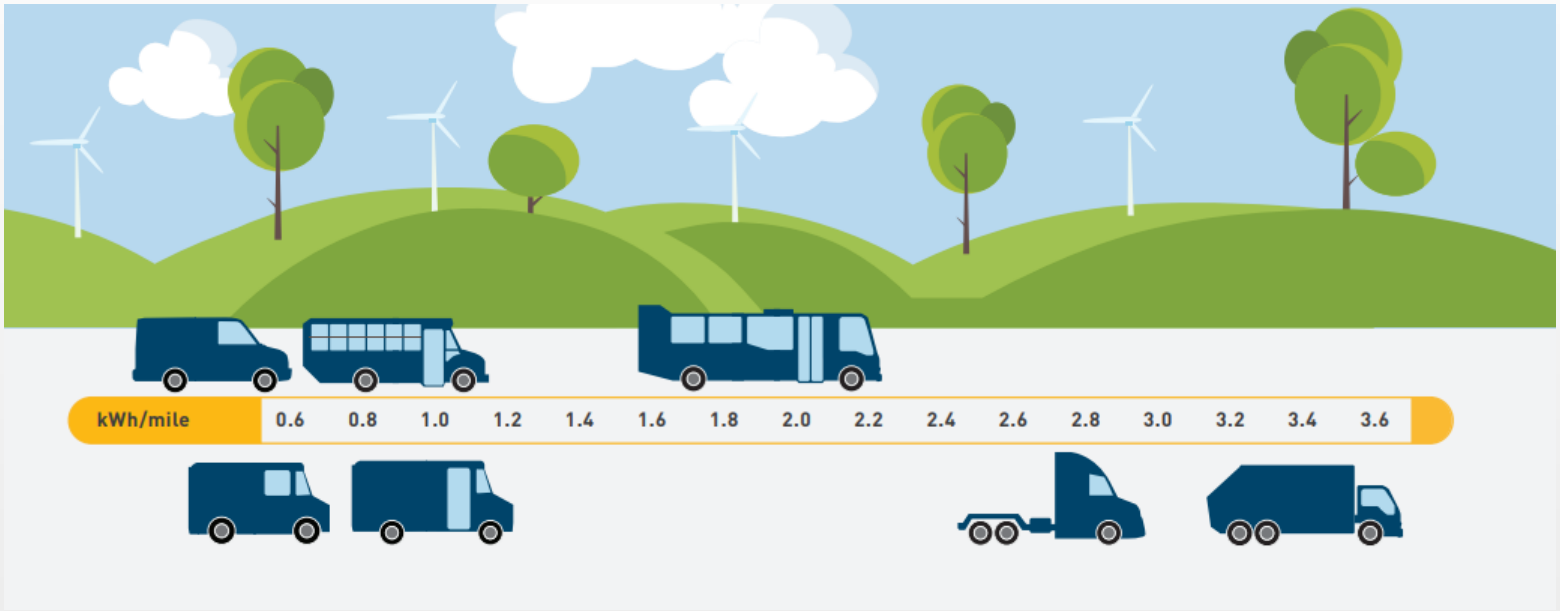
Miles/kWh versus MPG



kWh/mile versus MPG

Example: Going 100 miles = 4 gals gas or **80 lbs** of CO2 = 25 kWh of electricity or **0.11 lbs** of CO2

EV Efficiency: Medium- and Heavy-Duty



Source: Take Charge: A Guidebook to Fleet Electrification and Infrastructure, PGE

EV Charging Planning

Graphic: nap.edu

Charging Level	Power Output Charging Session	Small EV (40 kWh battery)	Medium EV (65 kWh battery)	Large EV (90 kWh battery)
Level 1	2.3 kW	11h 36m	18h 50m	26h 05m
Level 2	7.4 kW	3h 36m	5h 51m	8h 06m
Level 2	11 kW	2h 25m	3h 56m	5h 27m
Level 2	22 kW	1h 08m	1h 45m	2h 27m
DCFC	50 kW	32 min	52 min	1h 12m
DCFC	100 kW	16 min	26 min	36 min
DCFC	150 kW	-	17 min	24 min
DCFC	240 kW	-	11 min	15 min
DCFC	300 kW	-	8 min	11 min

Source: EVBox

EV Charging & Utilities

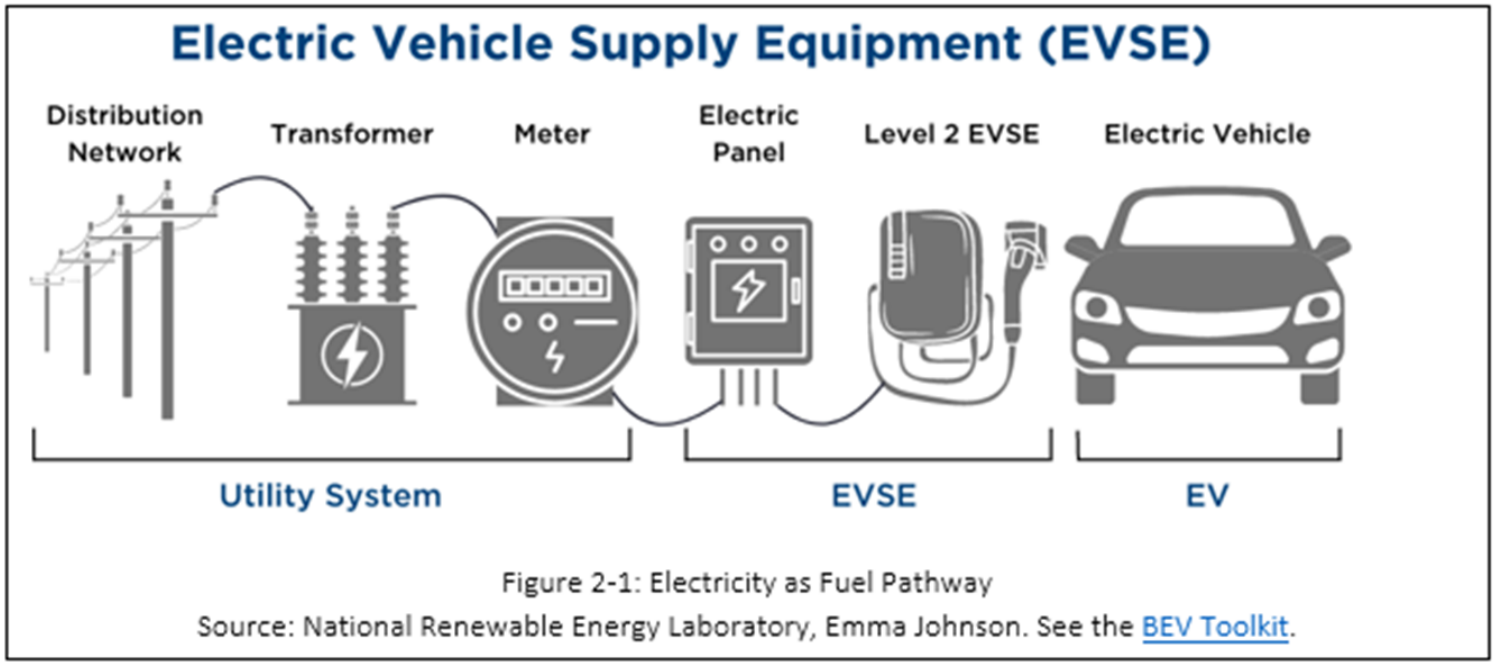


Figure 2-1: Electricity as Fuel Pathway

Source: National Renewable Energy Laboratory, Emma Johnson. See the BEV Toolkit.

EV Charging Connectors

Level 1	Level 2	DC Fast Charging
 J1772	 J1772  Tesla	 CHAdeMO  CCS Combo  Tesla Supercharger
SAE J1772	SAE J1772 Tesla or North American Charging Standard (NACS)	CHAdeMO – CCS Combo Tesla or North American Charging Standard (NACS)
120 V	240 V	480 V
1.9 kW max	Up to 19.2 kW power	CHAdeMO – typically 50 kW power
		CCS Combo – up to 350 kW power
		Tesla – up to 400 kW power

Figure 2-4. Common Charging Levels and Connector Standards

Planning for EV Changing Infrastructure

Hardware and Network Options

- Power levels
- Vehicle to charger ratios
- Network versus non-network
- Load management software

Installation

- Internal electrician staff
- Local contracting services
- Meet any specific grant requirements

Workplace Management

- Administration, parking updates
- Employee training about vehicles and charging

Dual-port wall-mount unit attached to a building column. Shows L2 J1772 plug. Dept. of Commerce, Olympia (Photo: WSU)

Single dual-port charging unit positioned to serve multiple vehicle parking spots. (Photo: Dept. of Ecology)

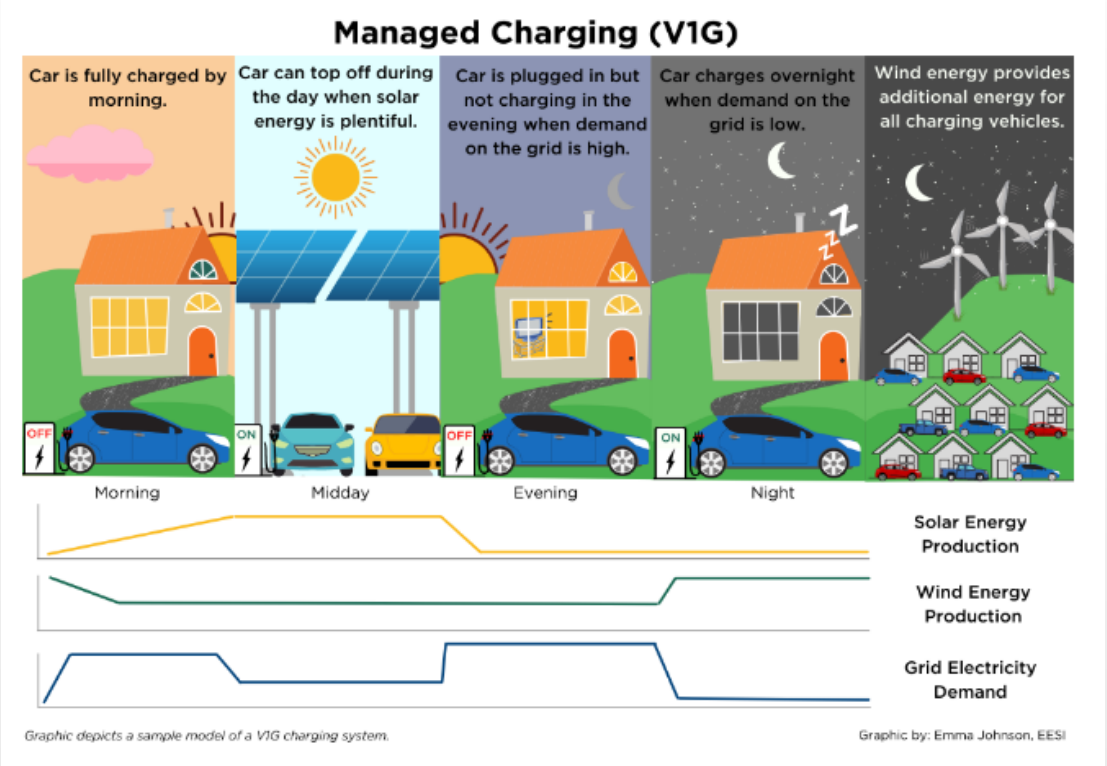
Single pedestal EVSE serving three spaces including an ADA-compliant space. WSDOT, Shoreline (Photo: WSU)

L2 EVSE located side by side to cut costs and power EVs on both sides.

Dual-port L2 EVSE set apart to charge EVs side by side. In-ground conduit to individual concrete pads.

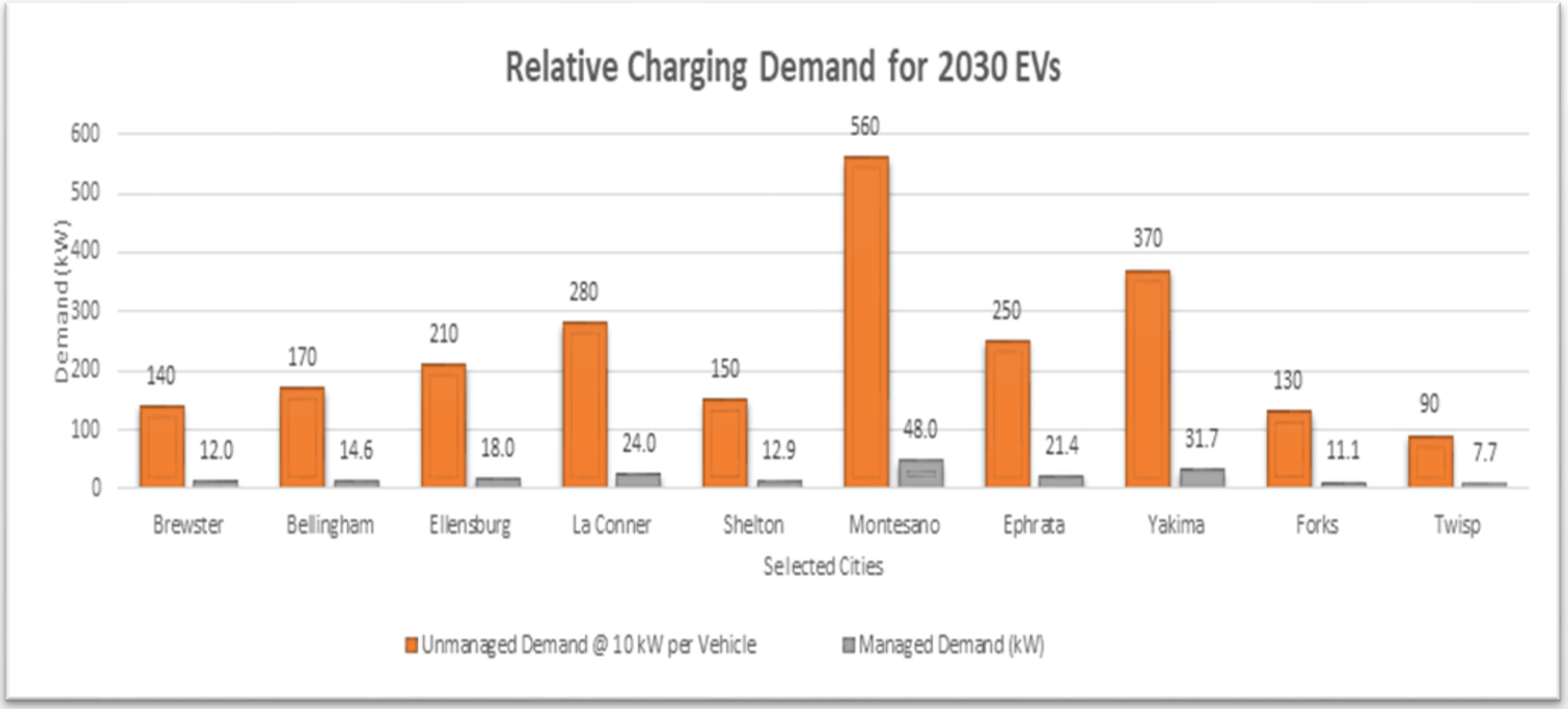
Utility box in foreground serves L2 EVSE in a row for EVs on both sides.

Ways to Manage EV Charging Demand



Source: Beneficial Electrification League – Electrification Toolkit

Ways to Manage EV Charging Demand



Assumptions: 1:1 V:P ratio, 10kW/EVSE, 14-hour charge window

$23.5 B in Federal Infrastructure Investments

- $5 B for school buses (ZEV & alt fuel)
- $5 B for transit buses (ZEVs)
- $7.5 B for EV infrastructure
- $6 B for battery research/recycling
- $39 B for transit system improvements, including accessibility (much for light rail systems)
- $17 B for ports
- $25 B for airports
- $8 B for R&D for Hydrogen Hubs

$400+ M in State Investments

- $40 M for electric school buses (Ecology)
- $30+ M remaining VW settlement funds (Ecology)
- $50+ M for electric transit buses (BEBs and FCBs) (WSDOT) ($3 billion total, Move Ahead Washington transportation package)
- Funding for ports and state and local ferries
- $3.4 M - Zero Emission Access Program (ZAP) (WSDOT)
- $5 M for innovative electrification (ETS) (Commerce)
- $5 M for Tribal fishing boats
- $7 M for clean hydrogen fueling stations
- New Interagency EV Coordinating Council and Office of Renewable Fuels
- ZEV Mapping & Forecasting Tool for infrastructure development
- $71 M to WSDOT (from federal IIJA) for EV infrastructure on major highway corridors
- $15 M for ZEVIP infrastructure on secondary corridors (WSDOT)
- $100+ M for non-highway charging infrastructure (Commerce)
- $25 M for ZEV promotion, support to underserved communities (Commerce)
- $110 M for medium- & heavy-duty vehicles (WSDOT)

Getting EV Ready

Project Scope – Budget – Timeline

www.transportation.gov/equity-Justice40

GTP Delivers “Next Step” Assistance

- ✓ Education: website, studies, resources, publications, and more
- ✓ **Alt Fuel-Vehicle Technical Assistance Group (AFV-TAG)**
- ✓ Webinars: BEVs and infrastructure, renewable hydrogen series
- ✓ In-person events: e.g., field trips and ride-and-drives
- ✓ Coordination with utilities, agencies, and community partners
- ✓ Technical assistance: all types of public fleets (150 consults) 40 examples of next step assistance:
  - Presentations
  - Research – answering questions
  - Vehicle TCO comparisons
  - Introductions & connections (utilities, vendors, consultants, etc)
  - **Assistance planning electric school bus transitions!**


Energy Program
WASHINGTON STATE UNIVERSITY

Report to the Legislature
October 2021 Update

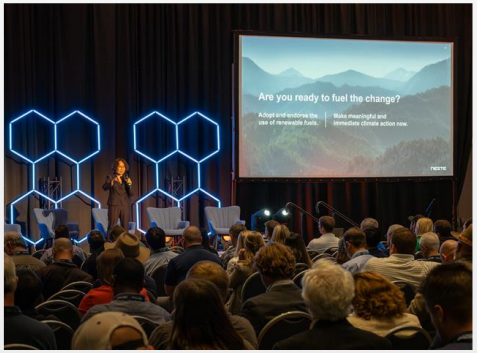
Washington Green Transportation Program
Moving forward with Washington's public fleets

The Washington State Legislature delivers green transportation through several strategies

www.energy.wsu.edu/GreenTransportationProgram

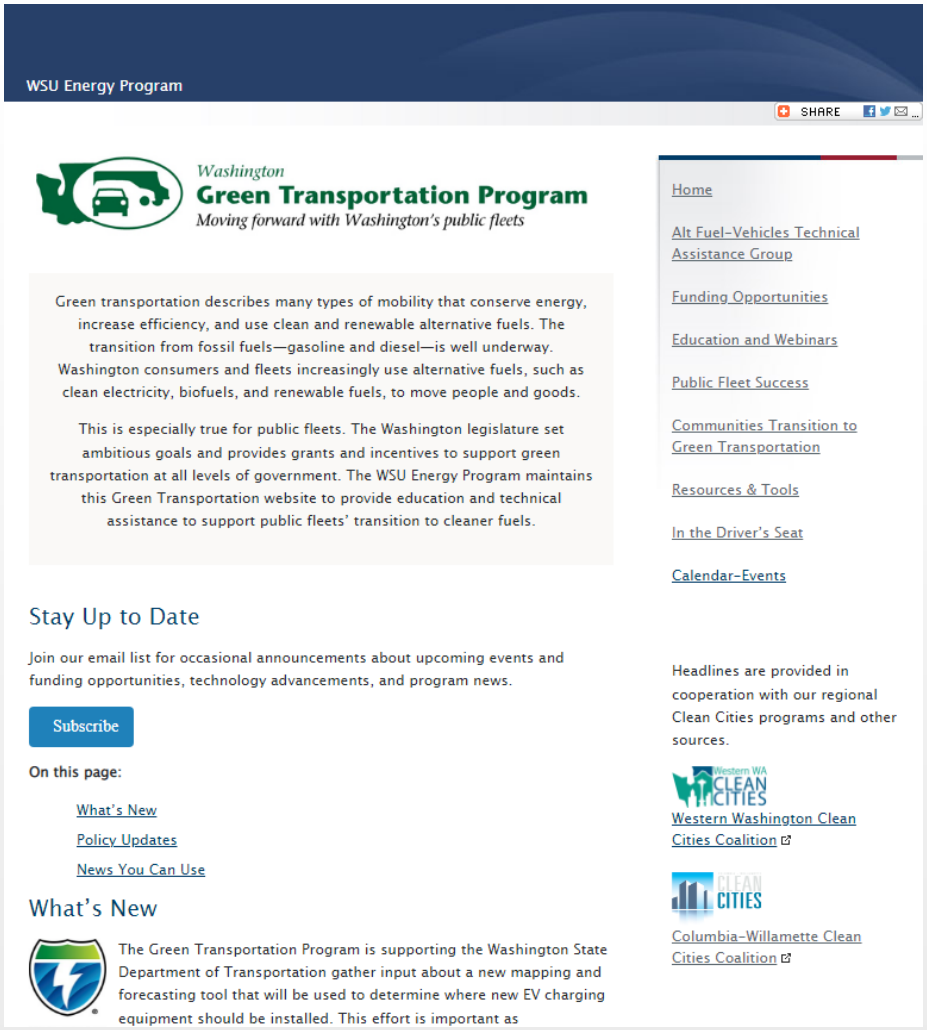
This Year With RE+

Green Transportation Summit & Expo 2024



August 20-22, Tacoma Convention Center

Use our discount code: 24CP-WSU, 30-50% off



Search

WSU Green Transportation Program

Email Requests

greentransportation@energy.wsu.edu

ArchEcology

Clean Buildings Discussion

Follow up to March 20 Webinar on Energy Management Plans and O&M Programs

Large group discussion

- Progress on EMPs?
- Improvement project planning, share strategies for prioritizing
- O&M program development and implementation

EMP development follow up

- Has anyone tried using the ArchEcology template? Is it helpful?
- What other resources are you accessing for guidance?
- What is missing or needed? Information? Staffing?

Free template kit:

http://archecology.com/emp

Energy Improvement Implementation

- What are lessons learned you can share around developing and implementing:
  - New policies
  - New tools
  - New practices

O&M Program Implementation

Recent poll of a BOC class* found

- 23% think their O&M program is ready for CBPS
- 45% think theirs is ‘getting there’
- 27% thought theirs is not ready
- 5% not sure

* (not a scientific sample)

How are they approaching O&M?

- 11% have a mostly reactive program
- 26% said they have a mix of reactive and preventative
- 48% have a more structured/scheduled program
- 58% said they use a CMMS (computer-based maintenance management system) about a quarter of those also use BAS

O&M Management tools

- Overview article (albeit from a provider)
  - https://safetyculture.com/app/tracking-tools/
- Software vendor comparison site
  - https://www.capterra.com/building-maintenance-software/

- Some program folks mentioned using are: Maximo (IBM) most frequently mentioned, Archibus, Service Central, Compass, Fixit Maintenance Connection, Megamations

- In chat: What do you use? How do you like it?

Demo of SafetyCulture.com

- *Not an endorsement*
- Some benefits are:
  - Flexible pricing
  - Good support
  - Nice user-interface

ANYONE WILLING TO GIVE A DEMO OF YOURS?

Related Discussion Questions

- Asset data collection, reporting, and standards development
- Creating and implementing the O&M platform
- Preventative maintenance prioritization and tasking
- Methods/database systems

Can start now and carry into breakout rooms…

Break

Please come back online at 1:40

Break-out room - Universities/Colleges (Karen)

What your peers would like to discuss

- Energy efficiency related behaviors, tenant engagement strategies
- WA State Energy Code (WSEC) changes
- Methods/database systems
- Clean Buildings Energy Management and O&M Plans submissions

- What have you been working on or busy with that would be of interest to others?
- What's been working well?
- What hasn't been working well?

Break-out room – K-12 (Rebecca)

What your peers would like to discuss

- HVAC costs
- Clean Buildings requirement
- Creating and implementing the O&M platform
- Preventative maintenance prioritization and tasking
- BOC
- HB 1799, Managing Organics

- What have you been working on or busy with that would be of interest to others?
- What's been working well?
- What hasn't been working well?

Break-out room – Offices & Government
(Katherine)

What your peers would like to discuss

- EV charging
- Energy management planning
- Green products
- CBPS, benchmarking, lifecycle cost analysis, energy audits
- Asset data collection, reporting, and standards development
- How to prioritize multiple energy projects with limited time and budget

- What have you been working on or busy with that would be of interest to others?
- What's been working well?
- What hasn't been working well?

Break-out room – Other (Britton)

- What your peers would like to discuss
  (Utilities, Consultants, ESCOs)
  - Outreach & awareness of incentive programs
  - Multifamily

- What resources do you have to help people?
- How can you help their workload?

- What have you been working on or busy with that would be of interest to others?
- What's been working well?
- What hasn't been working well?

Break-out room report back

- Office/government
- K-12
- University
- Other

Mark Your Calendars

Next RCM WSU Energy Program Webinar

Occupant Engagement Program Case Study: WSU's Energy + Comfort Campaign

June 5, 2024, 12:00 to 1:00 PM Pacific Time

via Zoom

Registration information to come

WASHINGTON STATE UNIVERSITY
Energy Program

Karen Janowitz

WSU Energy Program
JanowitzK@energy.wsu.edu

www.energy.wsu.edu