



**Session #16: Green Garage Winners  
& Best Practices 2020**

**December 09, 2020**



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## SFTVCS Finale:

**December 16:** Change Management to Remove Resistance & Roadblocks featuring



# Format

- **Q&A at the end**
- **Submit questions and comments to “Panelists”**
- **Scheduled for 2:00p-3:30p**
- **Handout**
- **Recording**



Rick Sapienza

[resapienza@ncsu.edu](mailto:resapienza@ncsu.edu)

Phone: 919-515-2788

- Clean Transportation Program Director NC Clean Energy Technology Center at NC State University
- 8 years with NC State
- 30+ years experience including General Motors, Draper Lab and Great Lakes Pulp & Fibre in both engineering and business management roles



## Green Garage Winners & Best Practices 2020 December 09, 2020

- 2:00-2:09 **Rick Sapienza, NCCETC/Tom Johnson, The 100 Best Fleets**--Introduction and Welcome
- 2:09-2:11 **Courtney Bozic, Clean Fuels Consulting**--Judge's Comments
- 2:11-2:21 **Dr. Jack Brouwer, UC Irvine**--Hydrogen for Transportation
- 2:21-2:25 **Shawn Dawson, Westerville Schools OH**
- 2:25-2:33 **John Walsh, Endera**—MD Electric Solution, Paratransit and Box Truck Options
- 2:33-2:37 **Peter Bednar, City of Albany GA**
- 2:37-2:41 **Gary Burr, City of Tulsa OK**
- 2:41-2:45 **Dan Zenger, City of Vancouver WA**
- 2:45-2:49 **Keith Bare, Laketran**
- 2:49-2:53 **Michael Crosby, City of Roanoke VA**
- 2:53-3:01 **Monte McLeod, Thompson Gas**—How to Get into the Propane Game
- 3:01-3:05 **Jolie Hughes, West Valley Construction**
- 3:05-3:09 **Charlie Stevenson, Essential Utilities**
- 3:09-3:15 **Tom Johnson, The 100 Best Fleets**--Green Garage Winners Announcement 2020



# Green Garage Contest



Tom C. Johnson,  
author of the *Green Fleet Awards™*  
the *Green Garage Contest™*  
and *The 100 Best Fleets in the Americas™*

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San Francisco, CA 94131  
[www.the100best.com](http://www.the100best.com)  
415-285-8391 | [tom@the100best.net](mailto:tom@the100best.net)





# Our thanks to the Green Garage Contest Sponsors!





- Environmental Scientist w/ more than 30 years experience
- Principal Consultant at Clean Fuels Consulting since 2003
- 20 years experience with clean transportation strategies and technologies
- Chief Judge for the Green Fleet Awards, involved for 13 years
- Chief judge for newly launched Green Garage Contest with *lighter* spin on highlighting sustainable fleet and garage practices

R. Courtney Bozic  
[chinchinb@yahoo.com](mailto:chinchinb@yahoo.com) or  
[Courtney@greeningyourfleet.com](mailto:Courtney@greeningyourfleet.com)  
631-665-6513  
[www.greeningyourfleet.com](http://www.greeningyourfleet.com)



# University of California, Irvine





Jack Brouwer PhD  
[jbrouwer@uci.edu](mailto:jbrouwer@uci.edu)  
(949) 824-1999x221

- Professor of Mechanical and Aerospace Engineering at The Henry Samueli School of Engineering University of California Irvine
- Director of the National Fuel Cell Research Center and the Advanced Power and Energy Program
- Areas of research focus are high-temperature electrochemical dynamics and integrated energy systems research that includes fuel cells, gas turbines, electrolyzers, and solar and wind power
- PhD in Mechanical Engineering from MIT



**National Fuel Cell  
Research Center**

UCIrvine | UNIVERSITY  
OF CALIFORNIA

December 9, 2020

# Do We Really Need Hydrogen?

*Green Garage Awards*  
NC Cleantech

Irvine, CA



**National Fuel Cell  
Research Center**

UCIrvine | UNIVERSITY  
OF CALIFORNIA

Jack Brouwer, Ph.D., Director

December 9, 2020

# Popular Thinking & Arguments

## Main Strategy:

- 100% renewable (solar, wind, geothermal, ...) power generation
- Electrify ~~all~~ end-uses
- Use batteries to handle <sup>some</sup> intermittency on grid & for <sup>some</sup> end-uses

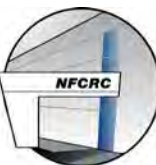
## Arguments against hydrogen & fuel cells:

- Most hydrogen today is made from fossil fuels (natural gas)
- Making hydrogen from water & electricity is less efficient than charging a battery
- Making electricity from hydrogen in a fuel cell is less efficient than a battery (i.e., round-trip efficiency is lower than a battery **except for long duration storage!**)
- Hydrogen is difficult to store and move around in society



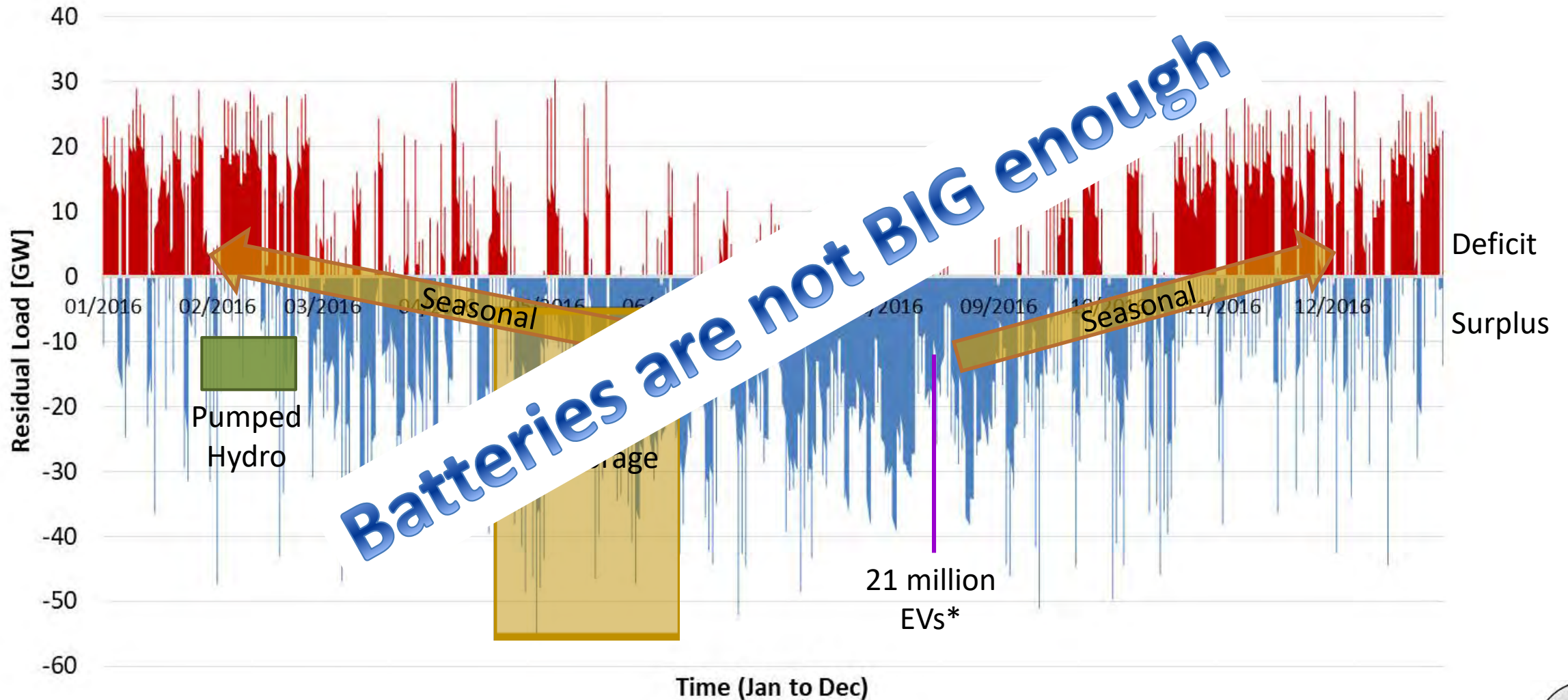
I agree with most of this!

Subtly untruthful - Not the whole story



# Amount of Storage Required for 100% Renewable – CA

- Wind dominant case (37 GW solar capacity, 80 GW wind capacity)



\* Nissan Leaf Equiv. – 62 kWh



# Energy Storage Need - World

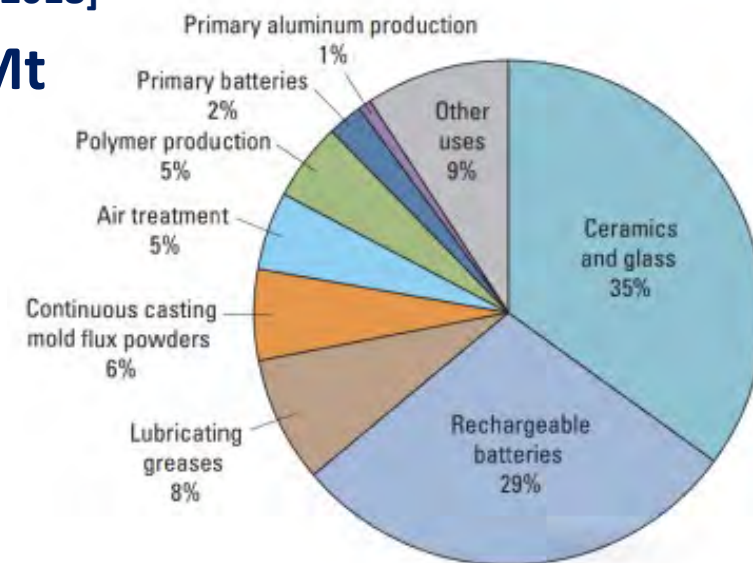
## Simulate meeting of TOTAL world electricity demand w/ Solar & Wind

	Solar contribution	Wind contribution	Consumption and storage ratio	Consumption (TWh)	Storage (TWh)
Africa	0.70	0.30	8.39	9,178	1,088
America	0.45	0.55	7.83	4,919	4,919
Asia	0.50	0.50	7.95	10,178	10,178
Europe	0.30	0.70	7.50	3,592	3,592
Oceania	0.50	0.50		205	205
<b>TOTAL</b>					<b>19,981 TWh</b>

**There is not enough lithium or cobalt in the world**

- To build one Li-ion battery
- World Li resources
- World Co resources
- 40% of Co come

[M.S. Thesis, 2018]  
 Co: 25,815 Mt  
 (total), 120 Mt (ocean floor)  
 Democratic Republic of the Congo



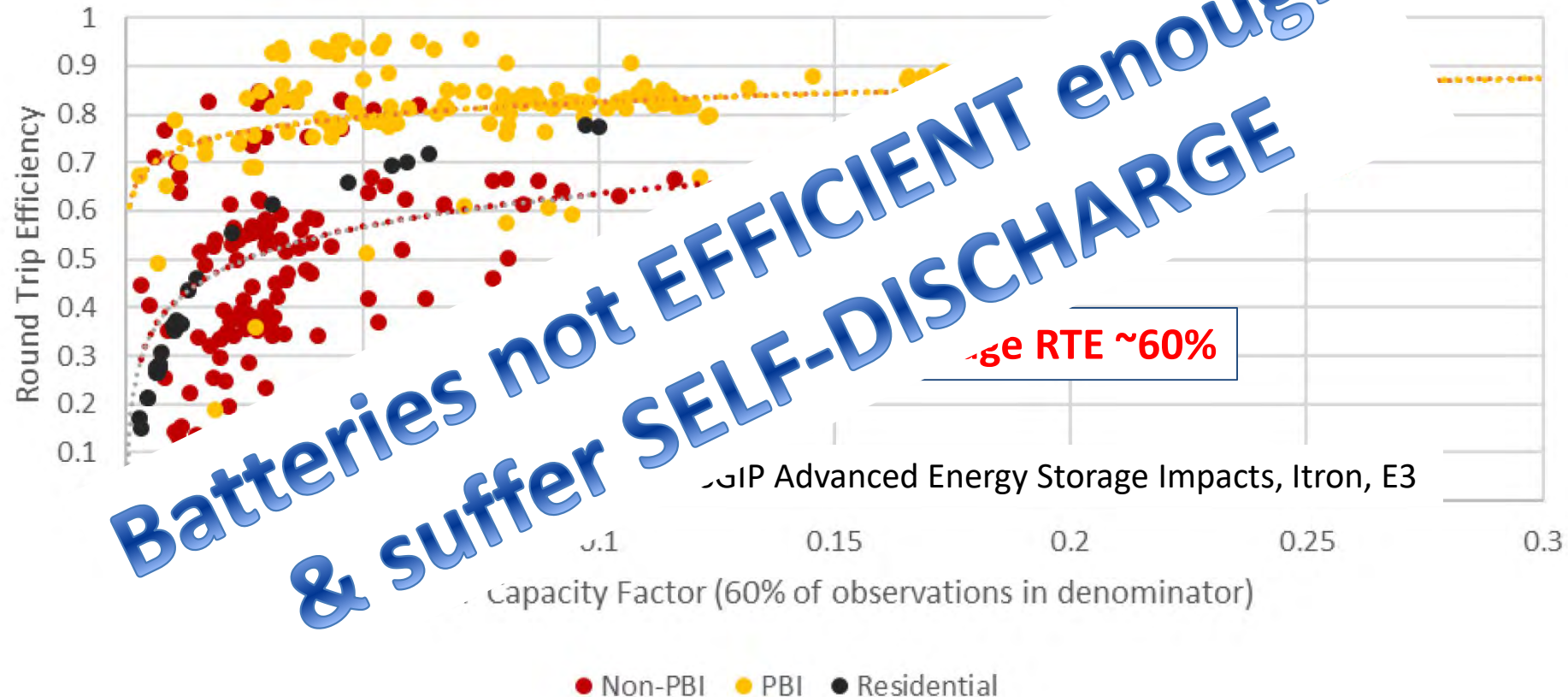
Source: U.S. Geological Survey, 2018



# Lithium-Ion Battery Measured Performance

## Round-Trip Efficiency (>90% in Laboratory Testing)

- Measured battery system performance in Utility Applications

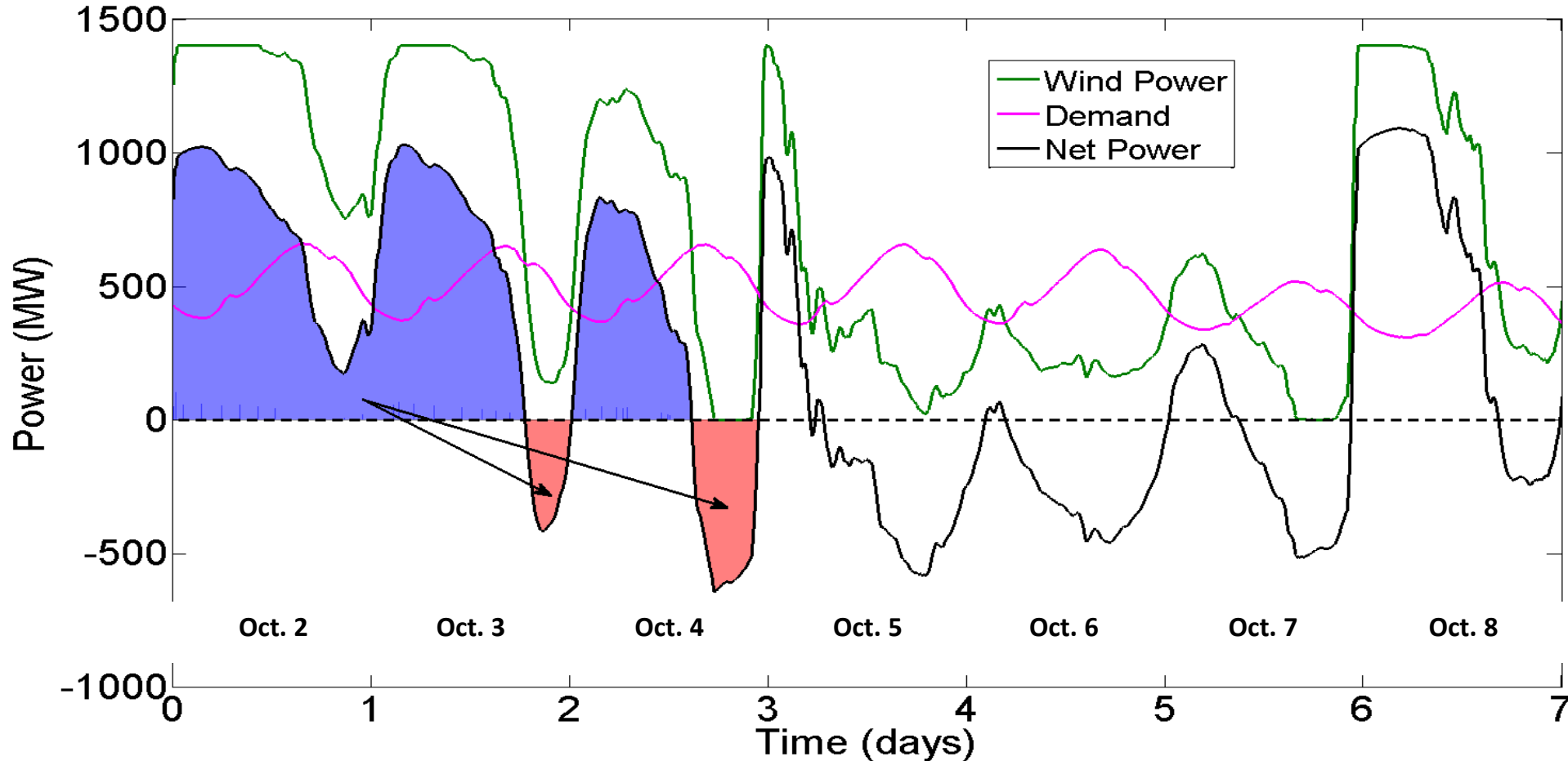


- Self-Discharge (the main culprit), plus cooling, transforming, inverting/converting, and other balance of plant



# Hydrogen Energy Storage Dynamics

- Hydrogen Storage complements Texas Wind & Power Dynamics



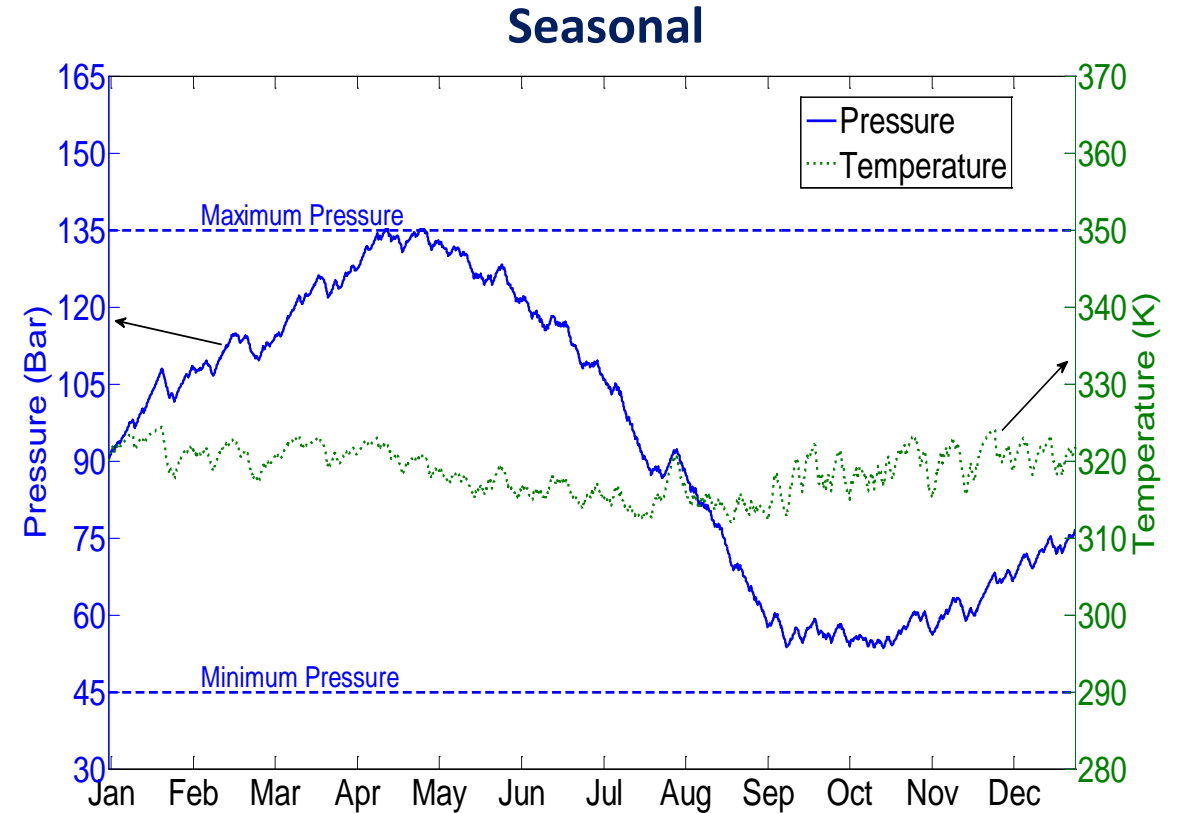
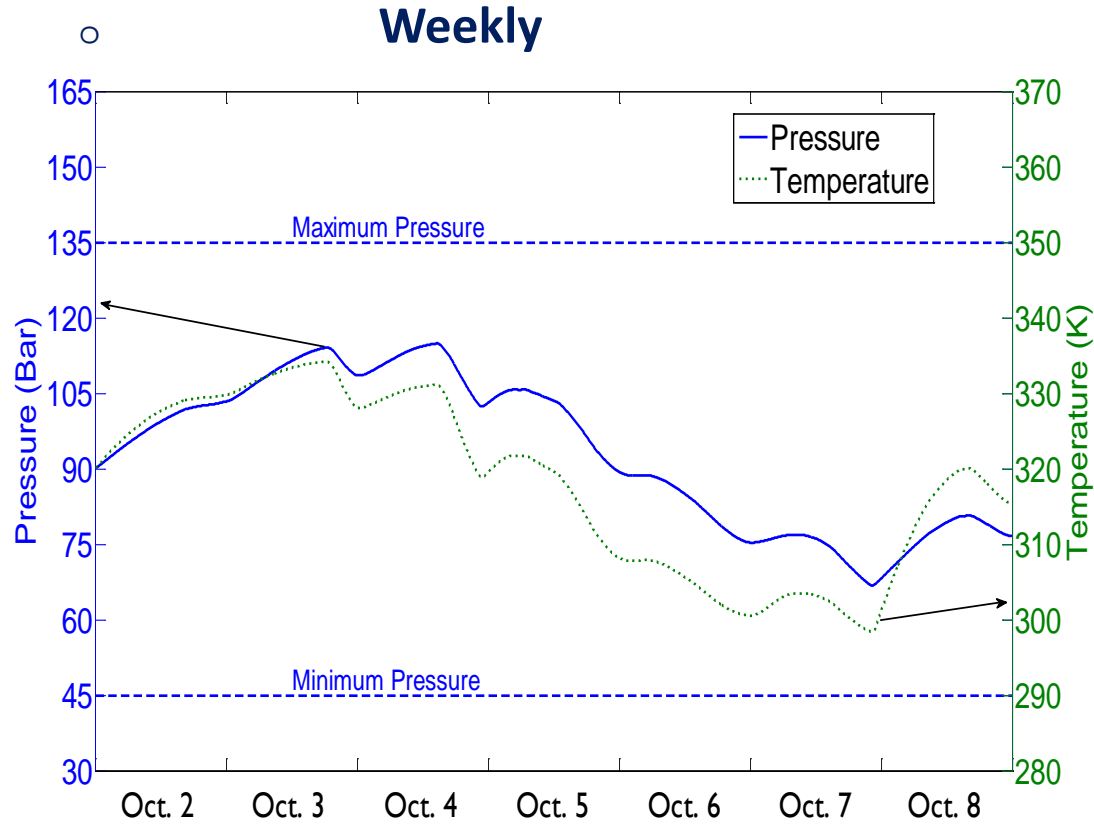
- Load shifting from high wind days to low wind days
- Hydrogen stored in adjacent salt cavern

Maton, J.P., Zhao, L., Brouwer, J., *Int'l Journal of Hydrogen Energy*, Vol. 38, pp. 7867-7880, 2013



# Hydrogen Energy Storage Dynamics

- Weekly and seasonal storage w/ H<sub>2</sub>, fuel cells, electrolyzers



But what can we do if we don't have a salt cavern?

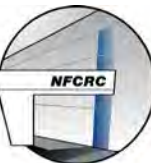
Maton, J.P., Zhao, L., Brouwer, J., *Int'l Journal of Hydrogen Energy*, Vol. 38, pp. 7867-7880, 2013



# Transport (Buses): Two Zero Emissions Options

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- **Battery Electric**
  - **Currently lower bus costs**
  - **Higher conversion efficiency**
  - **Shorter range**
  - **Lesser payload (e.g., # of passengers)**
  - **Emissions reductions depend upon how electricity is produced**
  - **Infrastructure costs are lower for fractions of fleet conversion (small number of buses)**
- **Fuel Cell Electric**
  - **Currently more expensive bus costs**
  - **Lower conversion efficiency**
  - **Longer range**
  - **Larger payload (e.g., # of passengers)**
  - **Emissions reductions depend upon how hydrogen is produced**
  - **Infrastructure costs are lower for complete fleet conversion (large number of buses)**



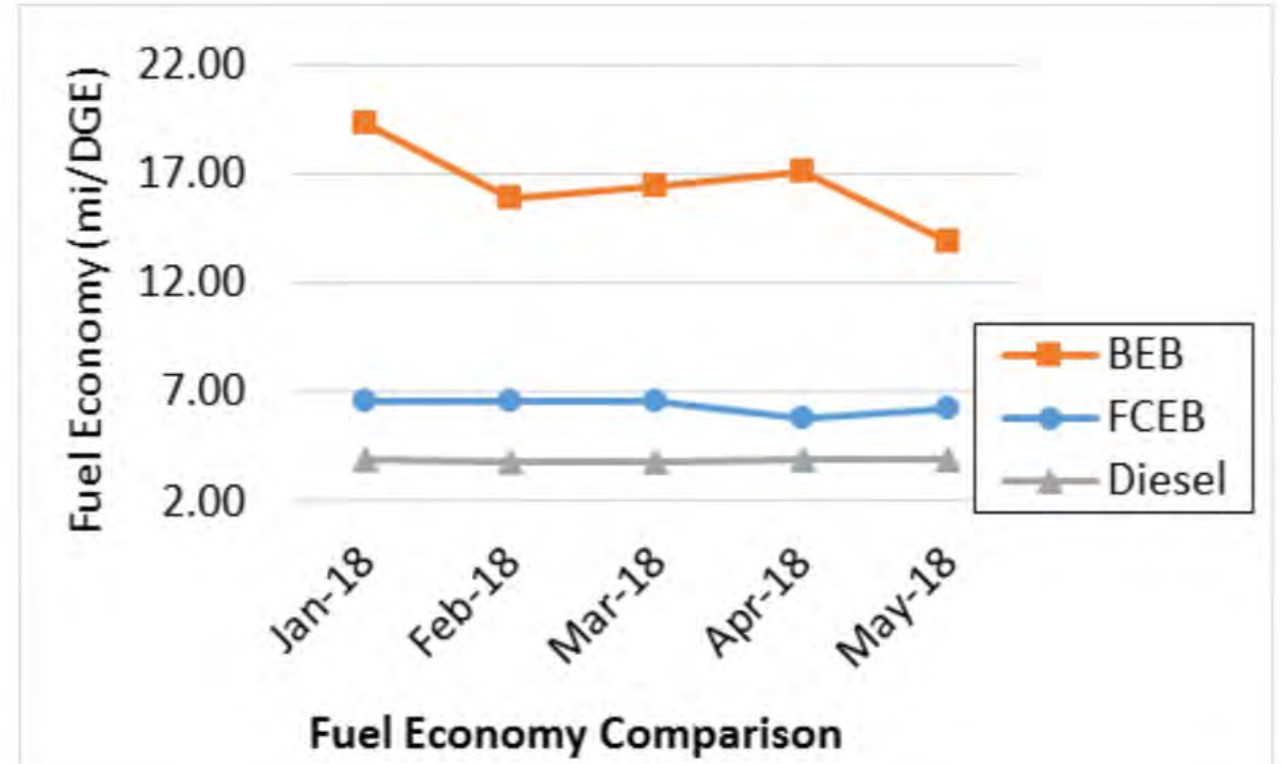
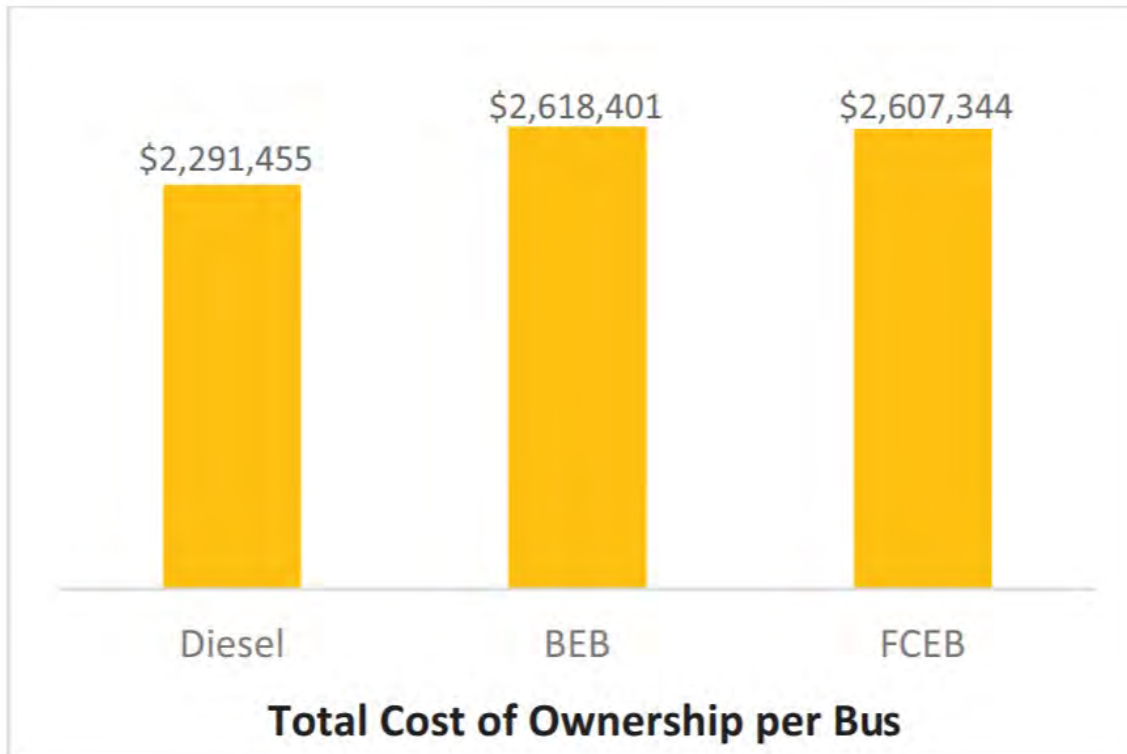
# UC Irvine Bus Fleet – Anteater Express

- **20 Battery Electric Buses (2018 model year)**
  - BYD (Build Your Dreams); > 4 hours charging time; 161 mile range; 41 passengers
- **1 Fuel Cell Electric Bus (2015 model year)**
  - Eldorado National; Ballard FC; BAE Trans.; ~15 minutes fueling time; 260 mile range; 56 passengers



# UC Irvine Bus Fleet – Anteater Express

- Measured performance and costs – total cost of ownership similar



# Orange County Transit Agency (OCTA)

## Hydrogen Fueling Station

- Largest hydrogen fueling station in nation for transportation
- Fuel capacity: 18,000 gallons
- Bus capacity: 40-50 buses, scalable to 100 with additional fuel storage and components

## Fuel Cell Electric Buses

- 10 FCEB in current fleet
- Length: 40 feet
- Capacity: 35 seated, 33 standing
- Range: 300 miles



# SunLine Transit Agency (Palm Springs area)

## 10 Battery Electric Buses

- BYD • Build Your Dreams (2016 model)
- Battery pack ~ BYD Iron Phosphate 295 kWh
- Range ~ 155 miles



## 17 Fuel Cell Electric Buses

- Eldorado National (2014 model 40' Axess)
- Ballard Power System ~ FC velocity HD6, 150kW
- Hybrid-drive ~ BAE Systems Series HybriDrive® propulsion system
- H2 storage ~ Gaseous hydrogen: 50 kg at 5,000 psig
- Battery pack ~ 200 kW, 11.2 kWhr nanophosphate Li-ion, regenerative braking
- Range 300 to 350 miles



Electrolyzer Cell Stacks

## On-site Renewable Hydrogen Generation

- 2.5 MW electrolysis system
- Hydrogenics (a Cummins corporation)





# Hydrogen is Essential for Sustainability

## Hydrogen: 11 features required for 100% zero carbon & pollutant emissions

- Massive energy storage potential
- Rapid vehicle fueling
- Long vehicle range
- Heavy vehicle/ship/train payload
- Seasonal (long duration) storage potential
- Sufficient raw materials on earth
- Water naturally recycled in short time on earth
- Feedstock for industry heat
- Feedstock for industry chemicals (e.g., ammonia)
- Pre-cursor for high energy density renewable fuels
- Re-use of existing infrastructure (lower cost)



Saeedmanesh, A., Mac Kinnon, M., and Brouwer, J. *Hydrogen is Essential for Sustainability*, *Current Opinion in Electrochemistry*, 2019.

# Hydrogen is ESSENTIAL for Zero Emissions

*Green Garage Awards*  
NC Cleantech

Irvine, CA



**National Fuel Cell  
Research Center**

UCIrvine | UNIVERSITY  
OF CALIFORNIA

Jack Brouwer, Ph.D., Director

December 9, 2020



Shawn Dawson

[DawsonS@westerville.k12.oh.us](mailto:DawsonS@westerville.k12.oh.us)

614-797-5957

- Fleet and Logistics Manager for Westerville City School District in OH
- Involved with all materials, operations and services for the school district custodial supplies, testing materials, food, mail, furniture. . .
- Primary goal is to work within the structure and framework of the district as efficiently and seamlessly as possible while meeting everyone's needs and expectations





John Walsh  
john@enderacorp.com  
307.776.9994

- CEO of Endera, a vertically integrated transportation technology company specializing in commercial electric vehicles, charging stations and software solutions
- Has served C-level positions at multiple venture backed technology companies
- Operates an investment company in focused on Transportation, Energy, Technology and Real Estate
- Appeared on ABC's Shark Tank



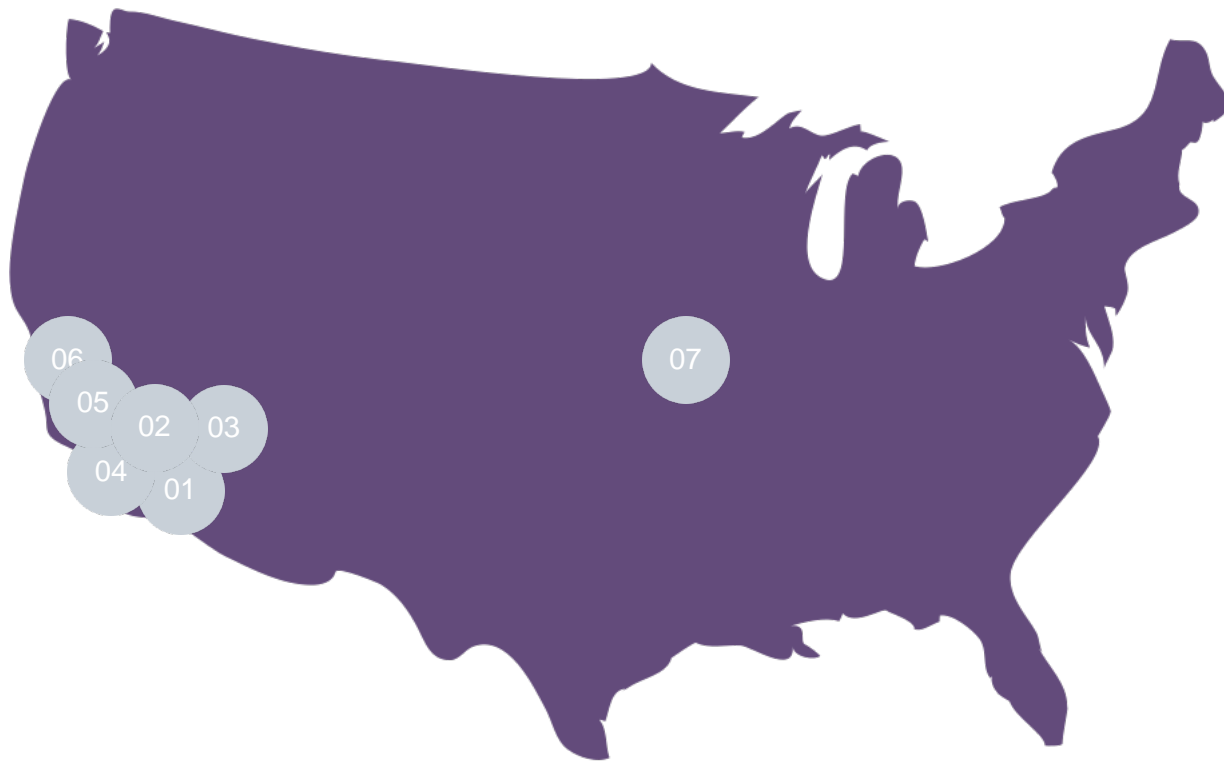
**ENDERA**

# OUR MISSION

We aim to accelerate the adoption of sustainable energy through innovative commercial electric vehicles and clean energy products.

Join us in a new era of clean energy transportation.





# OUR CUSTOMERS

WE PROUDLY SERVE

7

CUSTOMERS  
ACROSS THE U.S.

293

VEHICLES SOLD



# TURNKEY EV SOLUTION

EV VEHICLES

CHARGING  
INFRASTRUCTURE

AI TELEMATICS



PROPRIETARY AND CONFIDENTIAL INFORMATION





# OUR VEHICLES



## B-SERIES

Our B Series provides an ideal lightweight, versatile solution as an assisted living, medical transport, church bus, or hotel.

RANGE: 130-160 mi.

CAPACITY: 14-29 riders



## D-SERIES

Our D Series delivers the maximum amount of power and payload while still achieving record levels of efficiency.

RANGE: 120 mi.

CAPACITY: 32-36 riders



## L-SERIES

Our L Series is a perfect solution for delivery cargo. We've designed the Model L to be extremely light so that you maximize range and payload.

RANGE: 180 mi.

PAYLOAD: 6,900 lbs.

# DC WALLBOX EV CHARGER



PROPRIETARY AND CONFIDENTIAL INFORMATION

# CHARGING STATIONS

SAE J1772 COMPLIANT  
25kW AND 50kW OPTIONS

- 01 HIGHWAY SERVICE
- 02 FLEET
- 03 PARKING
- 04 SERVICE STATION
- 05 WORKPLACE



# ENERGY MANAGEMENT

COST-EFFECTIVE

01

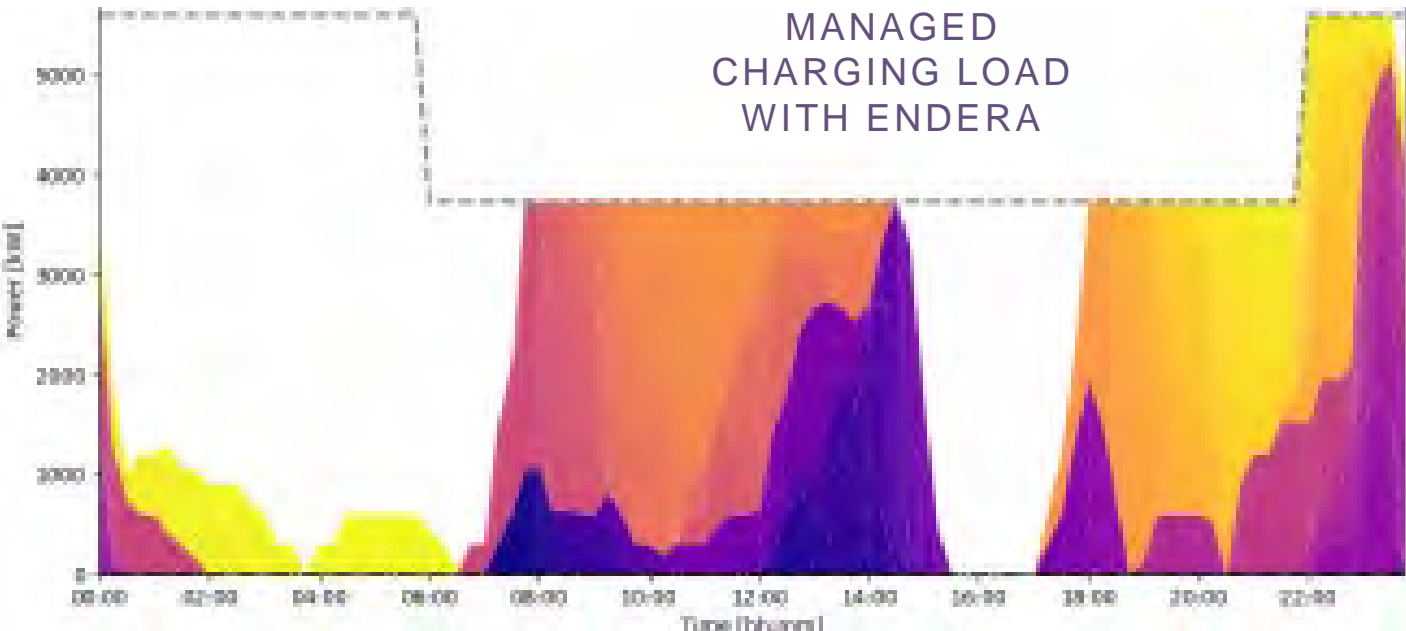
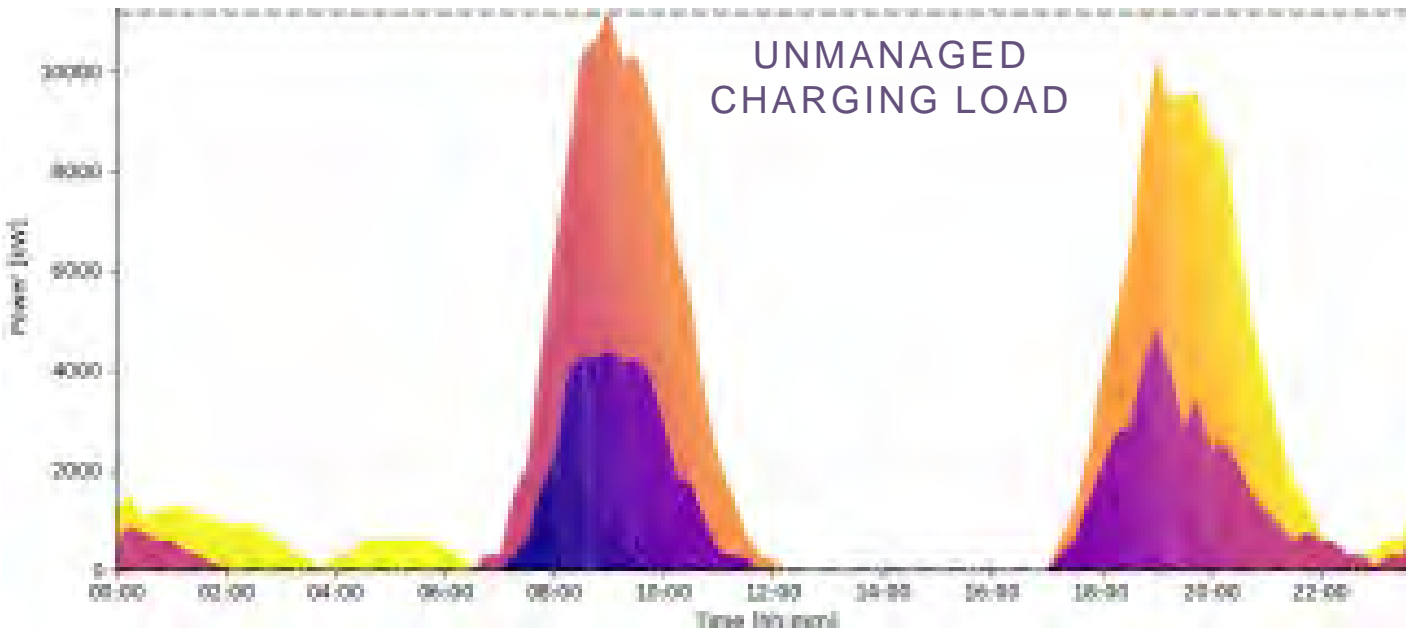
MONITORS AND MANAGES VEHICLES AND CHARGING STATIONS

02

IDENTIFIES UNUSED CONNECTIONS

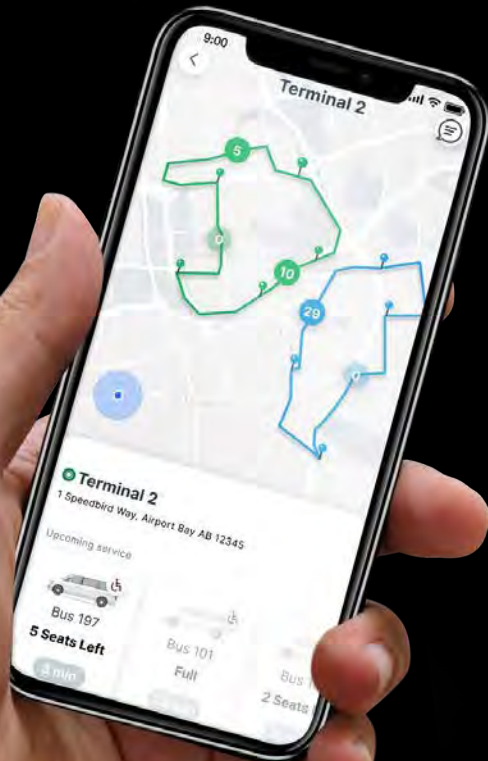
03

OPTIMIZES PRIORITY PROCESSES





RIDING MADE EASIER



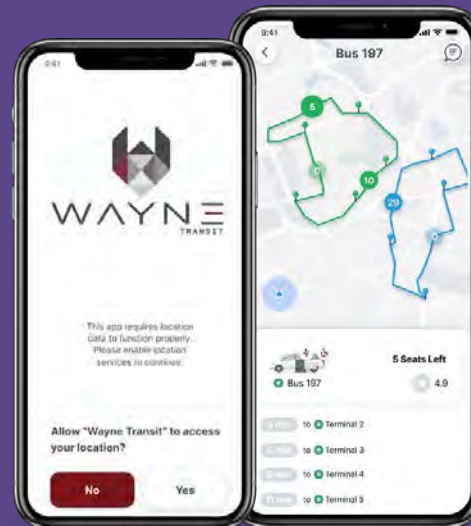
## IR / FACIAL RECOGNITION SYSTEM



Automates rider counts and driver reports

Detects temperatures to slow the spread of COVID-19

## iOS AND ANDROID RIDER APP



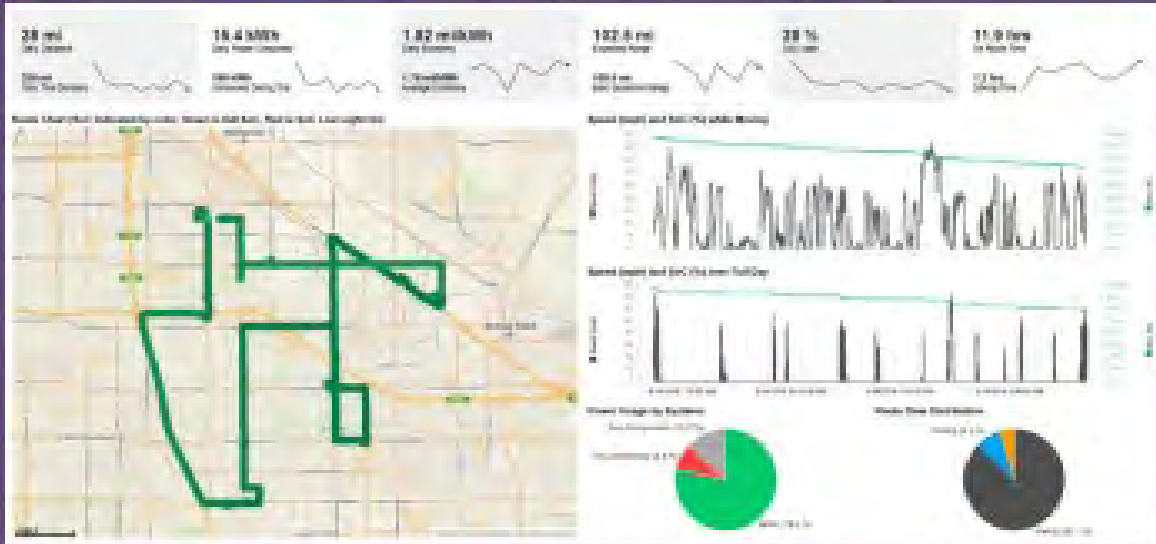
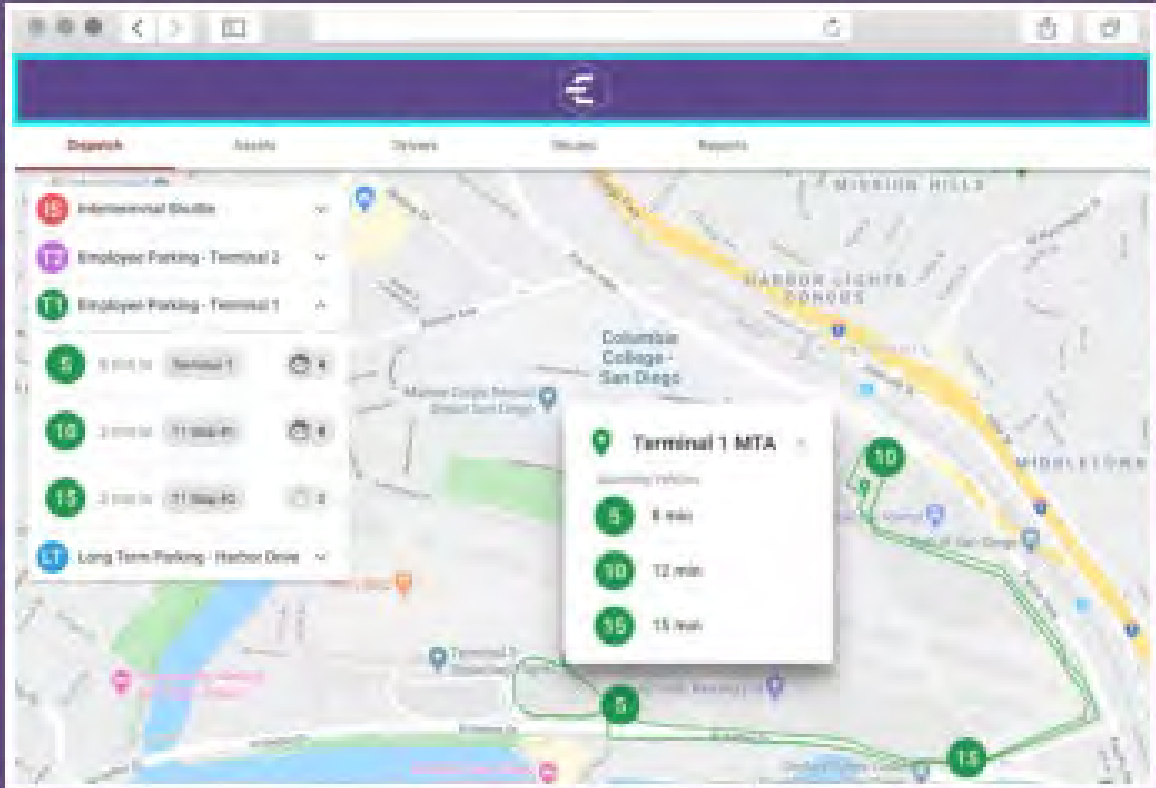
View bus location, ETA, and seat availability

Enhances rider experience and insights

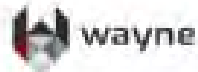
PROPRIETARY AND CONFIDENTIAL INFORMATION

# FLEET MANAGEMENT

## CUTTING-EDGE



- 01 PERFORMANCE DATA
- 02 ENERGY USAGE
- 03 EFFICIENCY IMPROVEMENTS
- 04 ROUTE OPTIMIZATION



# OUR PARTNERS

## MAKE US AN INDUSTRY LEADER

01

HIGH QUALITY

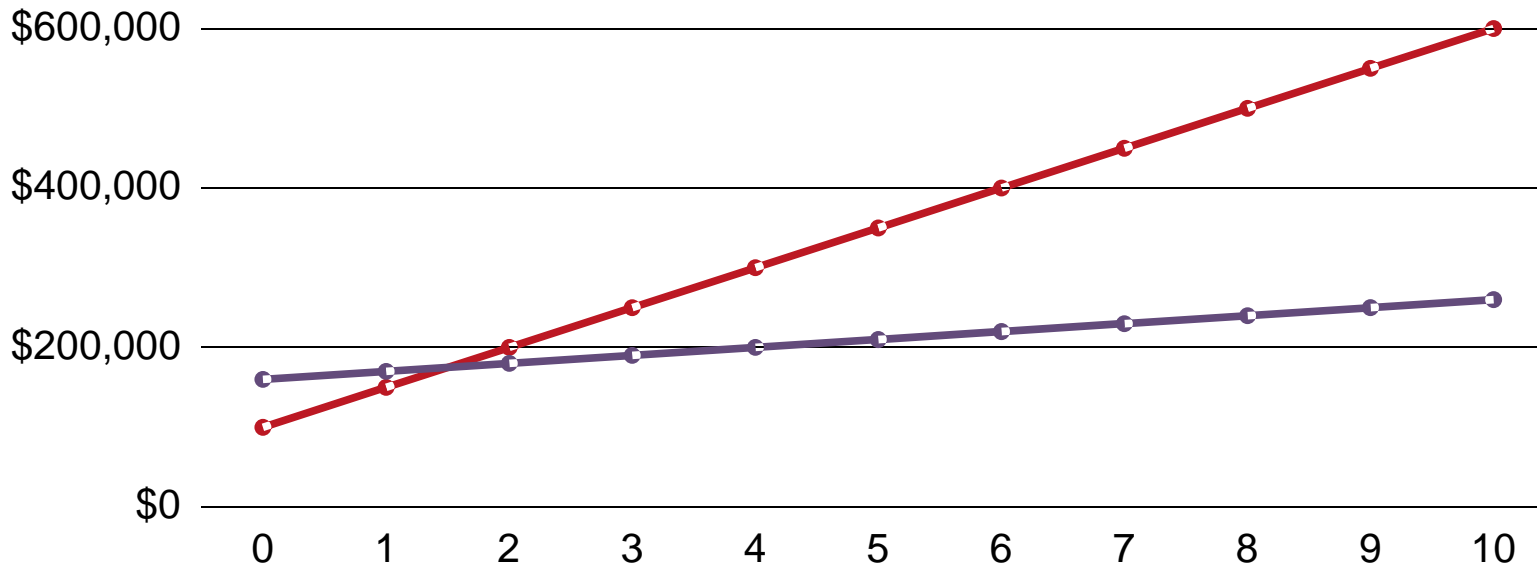
02

INNOVATIVE

03

EFFICIENT SUPPLY CHAIN

## COMBUSTION VS EV (YRS)



\*Based on 6,000 miles per month, 5 mpg gas average. EV charged with Endera station and energy management software. Figures assume \$90,000 CARB Subsidy.

# TOTAL 10 YR COST OF OWNERSHIP

- 01 HIGH EV ENERGY EFFICIENCY
- 02 FEWER PARTS REDUCE MAINTENANCE AND OPERATION COSTS
- 03 STABLE ELECTRICITY PRICES VS. VOLATILE FOSSIL FUEL PRICES



# ACCOMPLISHMENTS

Endera's premium, all-electric, zero-emission mid-size cutaway transit buses are in use at the San Diego International Airport (SAN) as part of the largest single order of electric vehicles purchased by an airport in U.S. history

37 Endera Model B and D vehicles support the San Diego County Regional Airport Authority's transportation efforts serving as employee, passenger, and transit connector shuttles operated by ACE, and off-airport parking operations by Aladdin Parking & SP+

6 Endera Model B5 vehicles support Illumina's corporate campus, operated by ACE Parking.

52 Endera Model L vehicles are planned to support IKEA's Southern California logistics operations

Endera is partnered with A-Z Bus Sales, one of the US's largest commercial transportation dealerships. 10 Endera vehicles plan to support IKEA's New York's logistics operations.

Endera is partnered with Pritchard Auto Company, the largest and oldest Ford Dealer commercial vehicle dealership in the United States and one of the largest commercial vehicle dealerships in the nation.





“With decreased down-time and economic efficiency of electricity, the San Diego International Airport will save up to nearly \$20,000 a year, per vehicle vs LPG or CNG vehicles. Additionally, these buses will enhance the rider and driver experience.”

*Kevin Hernandez, Managing Director of Ground Transportation for ACE Parking in San Diego.*

# CONTACT US

---

John Walsh  
CEO

PHONE  
O | 307.776.9400

EMAIL  
[John@enderacorp.com](mailto:John@enderacorp.com)



PROPRIETARY AND CONFIDENTIAL INFORMATION



Peter Bednar

[PBednar@albanyga.gov](mailto:PBednar@albanyga.gov)

229-430-5272

- Fleet Director for the City of Albany GA
- More than 30 years industry experience
- Under his leadership Albany GA seeks to modernize and create a sustainable replacement program and follow best practices to gain efficiencies and effectiveness in service delivery
- Started career at 15 working at an auto center
- Spent time as mechanic on heavy equipment and exotic cars before moving on to fleet management

# Fleet Management Department

## COVID-19 Safety Measures Implemented

Presented by:

Peter Bednar, Director

December 8, 2020

# Safety Measures Implemented

- Face mask provided and required for every employee
- Disinfectant provided to decontaminate work areas and equipment
- Protective gear readily available (ie disposable gloves and safety glass)
- Installed plexiglass to provide separation barriers during interaction
- Social distancing enforced

# Plexiglass Installation Parts Receiving Counter



# Plexiglass Installation Parts Counter



ed in Bumper

# Plexiglass Installation Parts Counter





# Plexiglass Installation Parts Counter



# Plexiglass Installation Front Lobby/Customer Entrance



# Plexiglass Installation Front Lobby/Customer Entrance



# Social Distancing Enforced

- Everyone is strongly encouraged to maintain at 6' distance
- Traffic in lobby area restricted to two (2) customers at a time
- No more than 1 customer allowed to reside in the waiting area
- Capacity limitations have been set for breakrooms and training room
- As reinforcement, extra chairs have been removed from common spaces

Thanks for your time  
&  
Stay safe

# City of Tulsa, OK





CITY OF  
**Tulsa**  
A New Kind of *Energy*



Gary Burr  
[gburr@cityoftulsa.org](mailto:gburr@cityoftulsa.org)  
918-596-8130

- Mechanical Shop Supervisor & Instructor Learning with a Wrench Internship Program for City of Tulsa OK
- Over sees two heavy equipment repair shops
- Serves on advisory committees for Tulsa Community College, Tulsa Technology Center and Oklahoma State University
- Manages the “Learning with a Wrench Internship Program” with has mentored over 100 area high school students with the City hiring two technicians for the program



# Students Impact Recycling

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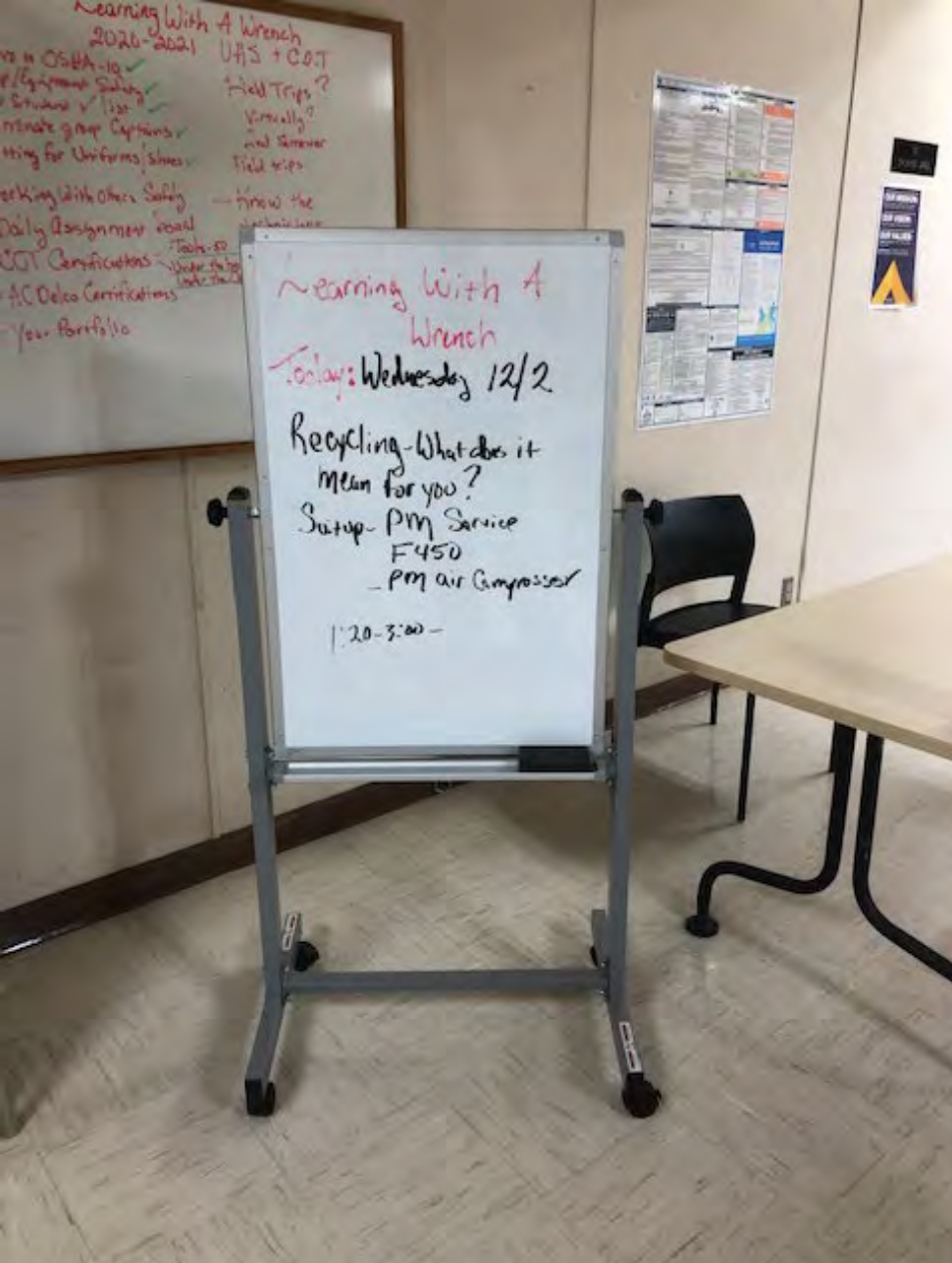
Learning with a Wrench  
– The City of Tulsa and  
Union High School



INTERNS







# The Students and Recycling

- In our seventh year, over one hundred students have been through our program. Recycling is introduced from the start and it is a part of their on-boarding experience.
  - Daily instructions guide the students with our shop activities
  - A new Student Checklist was designed to reinforce the need for recycling and awareness

Students learn how recycling impacts our operation



- Students discover what items to recycle
- Recycling bins are strategically located
- Students actively deposit material for recycling
- Both large and small items are offered for recycling



# Students learn by design

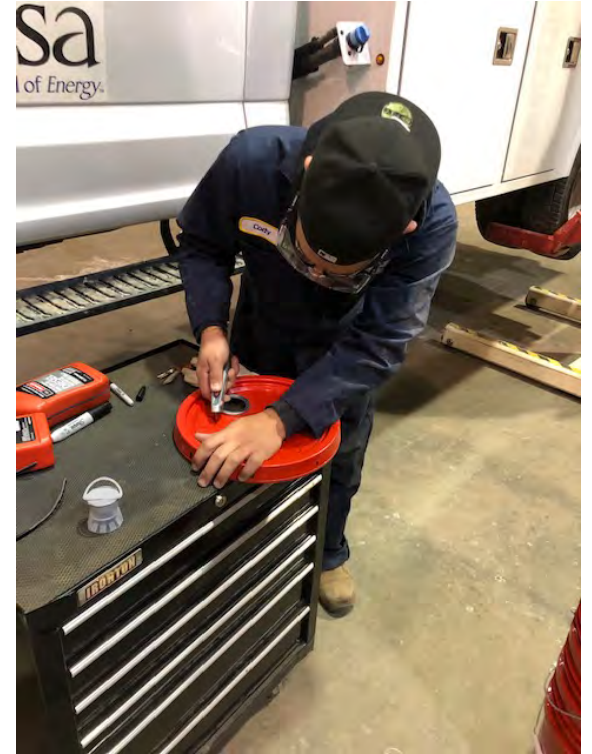
Students participate in the collection of materials

As an introduction to our program, students were given the instruction to design a device for collecting oil from quart containers

The idea was for the students to fit as many spaces for plastic quarts as they could

The results were 15 students who now believe in recycling and how it can help our shop





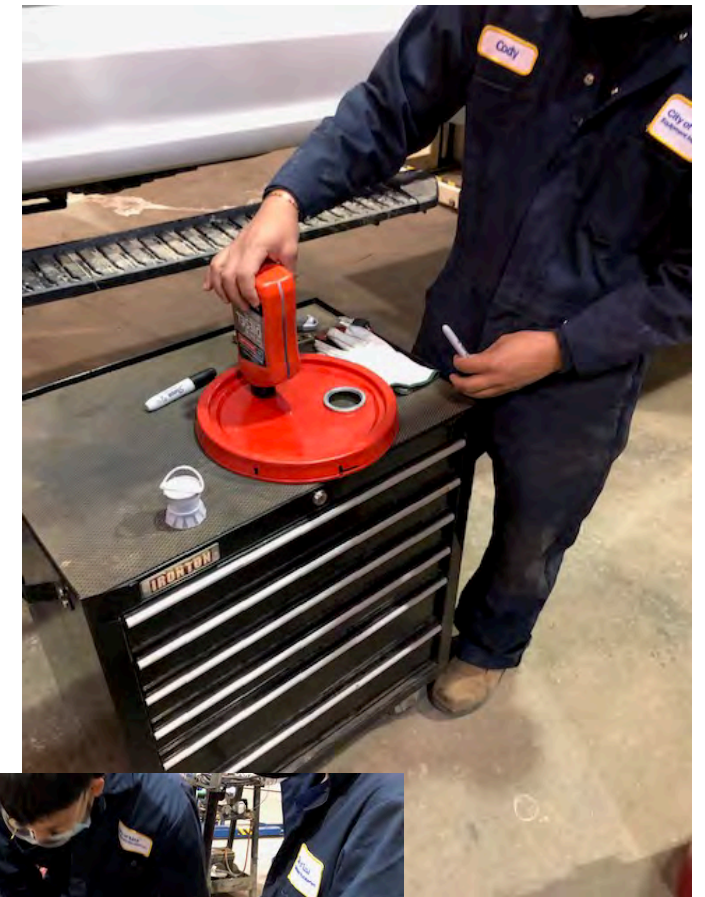
Students are asked to design for recycling

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It didn't take long to get students in the groove of recycling.

When you give a group of students an assignment you really aren't prepared for what comes next





# Students Do Impact recycling

The students have encouraged our technicians to think more about their material uses, how materials are handled and reduced waste.

# The Internship makes an Impact on recycling


- Shop wide participation in recycling improved
- Technicians became more aware of what was discarded. The students kept the technicians accountable.
- The student's participation in our recycling program influenced others and shop morale Improved
- Oil collection devices were built by the students which helped the technicians to remember to recycle.
- The students chose the location for the recycle collection bins in our shop
- Technicians suddenly became more aware of their own surroundings and how to handle materials such as waste oil, paper, plastic and cardboard

## Union Public Schools partners with city of Tulsa to train students as auto mechanics

Story Comments (7) Image (5) Print Font Size

Recommend 11 Tweet 8

Previous Next



By KIM ARCHER, Ward Staff Writer | 7 comments

Union High School senior Monica Elias one day wants to run her own garage and restore classic cars to their glory days.

"That's what I'm in love with. I love Japanese cars," she said, noting she is restoring her rusty but beloved 1981 Datsun 280ZX.

Elias is among nine Union High School students in the first year of a partnership with the city of Tulsa that allows them to learn auto mechanics.

They intern with city employees who maintain Tulsa's vehicle fleet of trucks, cars, backhoes and other equipment.

"It's a great opportunity. We haven't really started working on the trucks. But I honestly have learned so much already," Elias said.

Amanda Howell, with Union's Career Connect program, said the city approached Union over the summer to see if the district was interested in allowing students to intern at Tulsa's vehicle maintenance facility.

"The program fit nicely with our mission of 100 percent college and career ready," she said.



# Contact Information

**Gary Burr**

**Mechanical Shop Supervisor II &  
Instructor Learning with a Wrench Internship**

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**F:** 918-596-3244

**E:** [gburr@cityoftulsa.org](mailto:gburr@cityoftulsa.org)

[www.cityoftulsa.org](http://www.cityoftulsa.org)





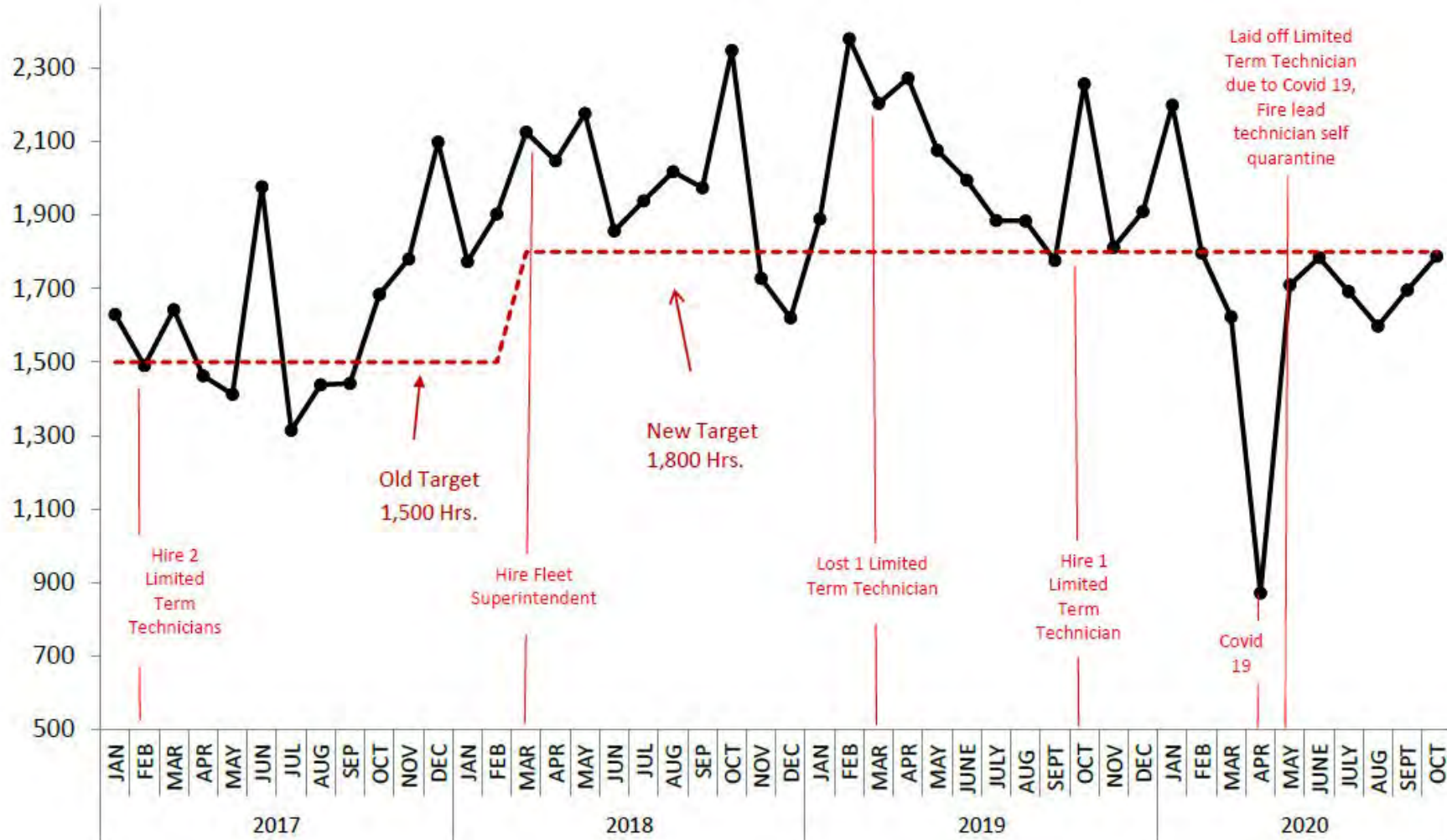
Dan Zenger

[dan.zenger@cityofvancouver.us](mailto:dan.zenger@cityofvancouver.us)

360-487-8205

- Fleet Services Superintendent for the City of Vancouver WA
- More than 27 years fleet industry experience
- Active member of various fleet organizations, American Public Works Association (APWA), Public Fleet Managers Association (PFMA), Columbia-Willamette Clean Cities and NAFA Fleet Management Association

### Total Monthly Billable Hours Fleet Services



# Laketrans (OH)





Keith Bare

[kbare@laketrans.com](mailto:kbare@laketrans.com)

440-350-1036

- Director of Maintenance for Laketrans, the regional public transit system for Lake County OH
- 29 years with Laketrans, starting his career as a mechanic
- Manages a fleet of 164 vehicles with a team of 24 mechanics, detailers, and porters
- Led the agency in alternative fuel conversions for CNG, propane and electrification—vehicle procurement and infrastructure installation

**LAKETRAN**

# Laketran's Motor Oil Recycling program

Laketran is the regional public transit authority in Lake County, Ohio as suburb 30 miles east of Cleveland.

Laketran operates a fleet of 164 vehicles and includes heavy-duty MCI coaches, New Flyer and Gillig transit buses, propane & diesel powered Ford transit vans, and utility vehicles

The logo for Laketran, featuring the word "LAKETRAN" in a bold, white, italicized sans-serif font. The logo is positioned in the bottom right corner of the slide, set against a dark blue background that is part of a larger decorative wave graphic at the bottom of the slide.

Laketrans uses 2,500 gallons of transmission fluid & motor oil each year.

- In 2006 – changed to synthetic transmission fluid. It cut our oil use in half and extend drain intervals
- 15W-40 oil in the Cummins diesel engines extends drain intervals and by almost 66%
- Laketrans only uses Re-Refined 5W-20 oil in gasoline & propane buses providing a “second life” to for oil
- Motor oil is then use a 3<sup>rd</sup> time to heat Laketrans 110,000 sq ft. headquarters including our maintenance bays



**LAKETRAN**

## Recycling Motor Oil to Heat Your Building

- 2009 – Purchased used oil boiler that produces 350,000 BTU to heat our maintenance bays consuming 2.5 gallons per hour
- 2019 – Purchased 2<sup>nd</sup> used oil boiler that produces 500,000 BTU to heat our Admin & Operations areas
- EPA considers it on-site recycling
- Reduces risks of spills in transport





## Financial Benefits to Recycling Oil

- Save \$7,500 annually in heating
- Gallon of waste oil equates 18 kilowatt hours of electricity
  - Laketran recycles 45,000 KWH of energy annually
- Fun Fact - Two gallons of waste oil can provide electricity to:
  - Run the average household for approximately 24 hours
  - Cook 48 meals in a microwave
  - Blow-dry your hair 216 times
  - Vacuum your house for 15 months
  - Keep your TV on for 180 hours.



Boilers offer a “third life” for motor oil

**LAKETRAN**

## Recycling Oil to the Last Drop

- After draining filters for 24 hours, Laketran crushes filters that forces out oil
  - Filters are recycled
  - Oil is re-refined or used for heat.



Crushed filters recycle every drop of oil

**LAKETRAN**

# Keith Bare

Director of Maintenance

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440-350-1036

Any Questions?



Part of the Laketran Maintenance Team

**LAKETRAN**



Monte McLeod

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803-609-1172

- Director of Autogas for ThompsonGas
- 20 years experience in the propane industry, 12 years with autogas
- Experience with 40 fleet alternative fuel deployments—vehicle conversions and infrastructure installation
- PERC speaker, committee member and alternative fuel proponent

# Green Garage

MONTE MCLEOD

THOMPSON AUTOGAS

*Let's Clear the Air...*

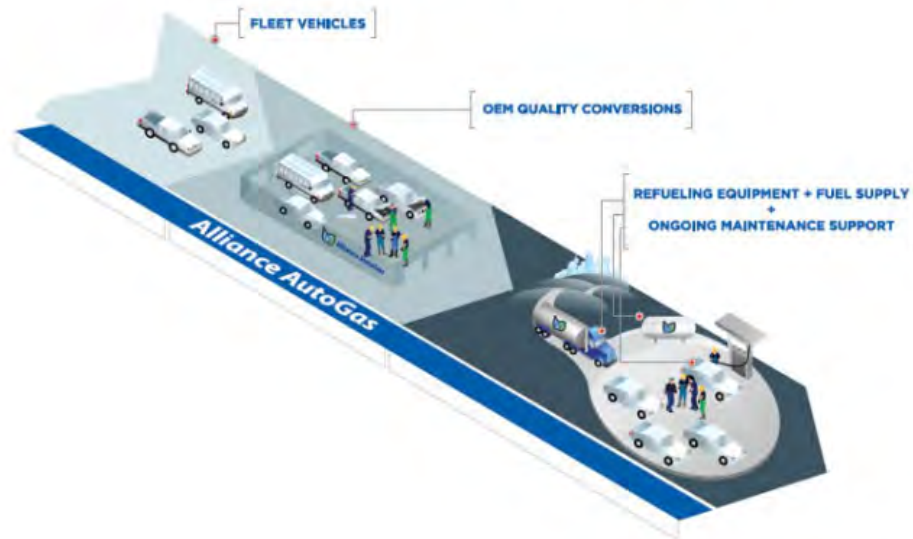
Propane autogas reduces NOx emissions by over 30%



# Who We Are



- ① Vehicle Technology
- ② Conversions
- ③ Refueling Infrastructure
- ④ Fuel Supply
- ⑤ Maintenance



Thompson Autogas offers a complete program to convert, maintain, fuel, and support autogas fleets.



# Our Systems



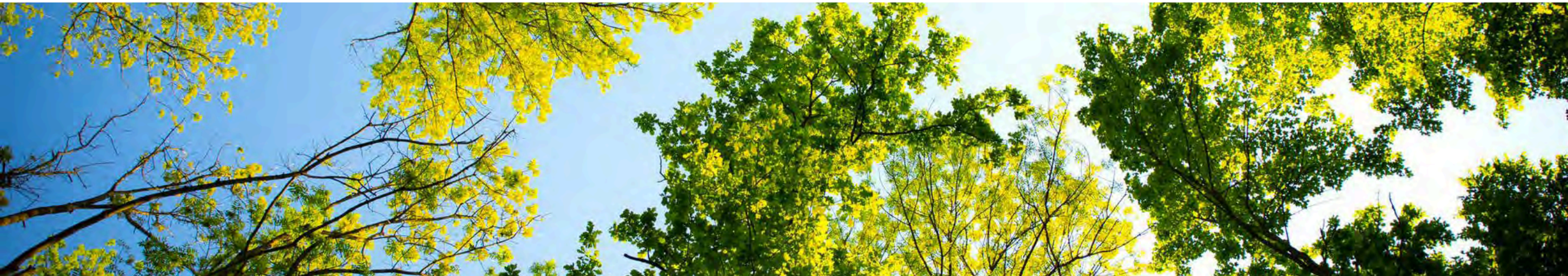
- Thompson Autogas offers a bifuel system, giving fleet vehicles the flexibility to run on either autogas or gasoline, eliminating range anxiety





# Why is Autogas Green?

- On average, using autogas reduces carbon monoxide emissions by 60%, carbon dioxide emissions by 12%, and smog and particulate matter by 80% when compared to diesel.
- Autogas school buses have up to 31% fewer NOx emissions, 79% fewer SOx emissions, and 27% less greenhouse gas emissions when compared to diesel.
- For bobtail trucks, greenhouse gas emissions were reduced by 13% and NOx emissions by 4% when compared to diesel.



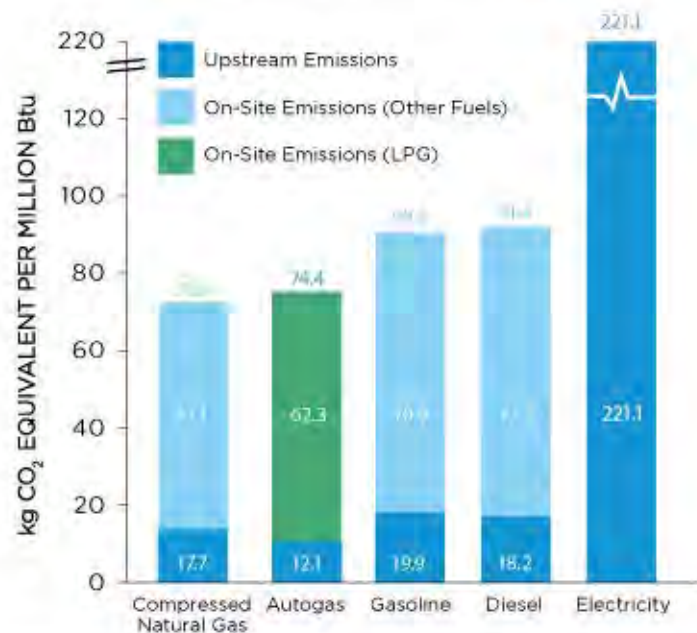




# Fewer GHG Emissions

## TOTAL CARBON EMISSIONS FOR VARIOUS FUELS

2009 PERC Study sourcing 2009 EPA and GREET Model



### PROpane-AutoGas-POWERED VEHICLES

Vehicle Type	Emission Reduction
LIGHT DUTY TRUCKS + UTILITY CARGO VANS SHUTTLE BUSES + TYPE A PARATRANSIT VANS	EMIT 11%
TYPE C BUSES	EMIT 18%

**FEWER GREENHOUSE GAS EMISSIONS THAN GASOLINE**

Propane Education & Research Council | Nexight Group and Energetics Inc., "A Comparative Analysis of Greenhouse Gas Emissions from Propane and Competing Energy Options," 2014.



# Less Is More

**79% LESS** CARBON MONOXIDE



**54% FEWER** SMOG-PRODUCING HYDROCARBONS





**42% LESS** NITROGEN OXIDE



**22% LESS** CARBON DIOXIDE



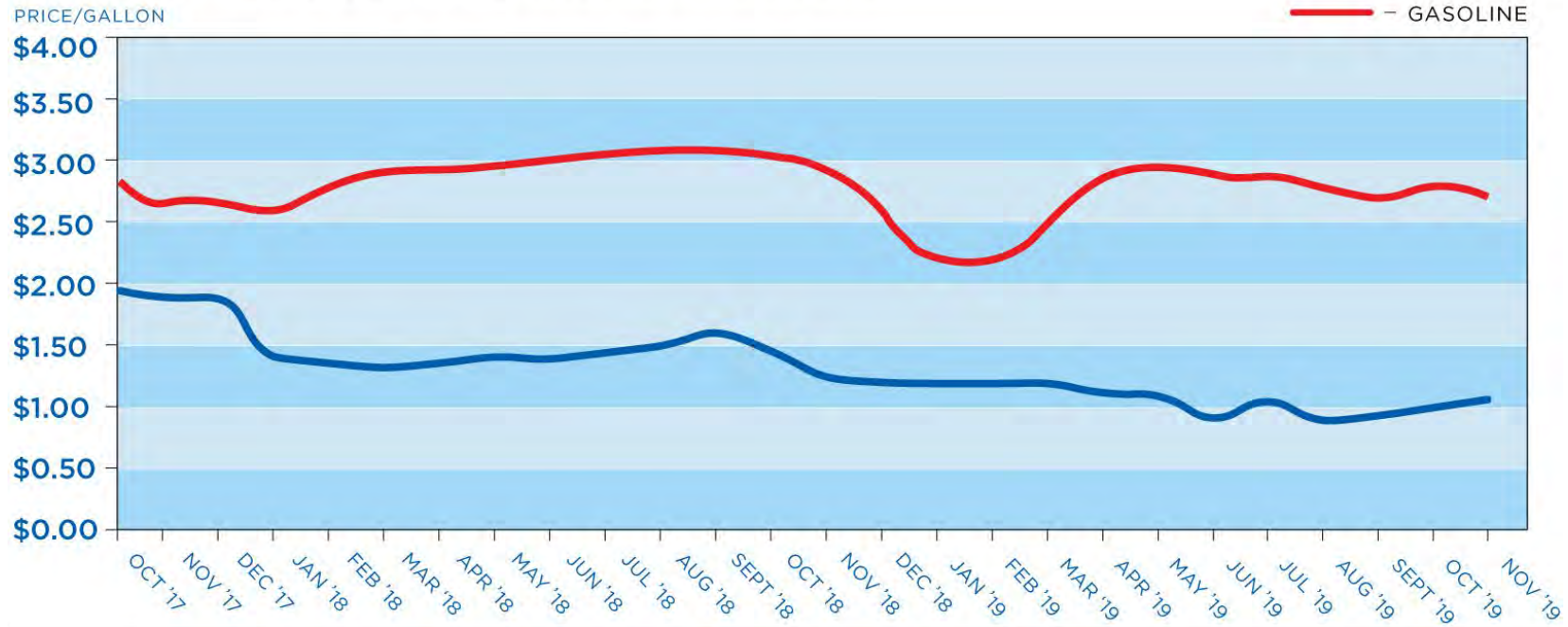
 Gasoline-fueled vehicle emissions

 Propane-autogas-fueled vehicle emissions

# Cost Savings



## AUTOGAS VS GASOLINE NATIONAL PRICES



Note: The figures above are based on national averages for autogas and retail gasoline prices (as listed by the U.S. Energy Information Administration) with the addition of a standardized average for state-level taxes on autogas (propane as a vehicle fuel). Many states allow the purchase of a vehicle decal to substitute in place of paying state level autogas taxes. *Autogas pricing includes alternative fuel tax credits for 2018-20 allowing 37 cents a gallon on the sale of propane when used in motor vehicles.*

# Top Benefits of Autogas

1. High Performance
2. Lowest Total Cost of Ownership
3. Safe
4. Abundant



# Refueling



**Thompson Autogas offers private, on-site refueling infrastructure scaled for customer needs, or take advantage of existing public or private refueling networks.**





# Simple Dispensing

- Exclusive “Quick Connect” Nozzle
  - Safe
  - Faster fill than gasoline



# Contact info



Monte McLeod

Director of Autogas

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# City of Roanoke Green Initiative



**Michael Crosby**

**Manger of Fleet Management**

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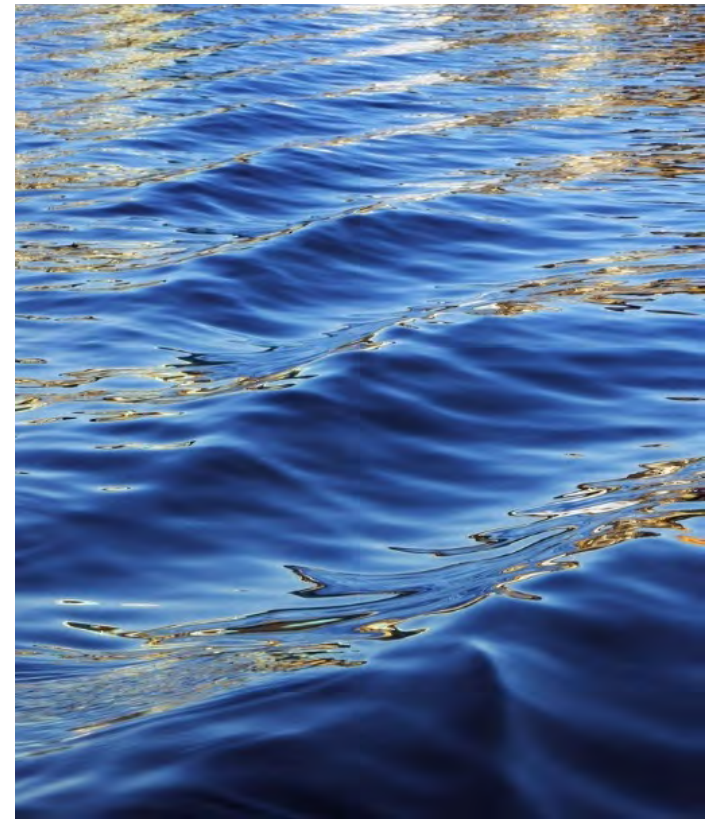
# West Valley Construction (CA)





# Green Garage Best Practices

Jolie Hughes, Fleet Administrator



# West Valley Construction Green Garage Best Practices

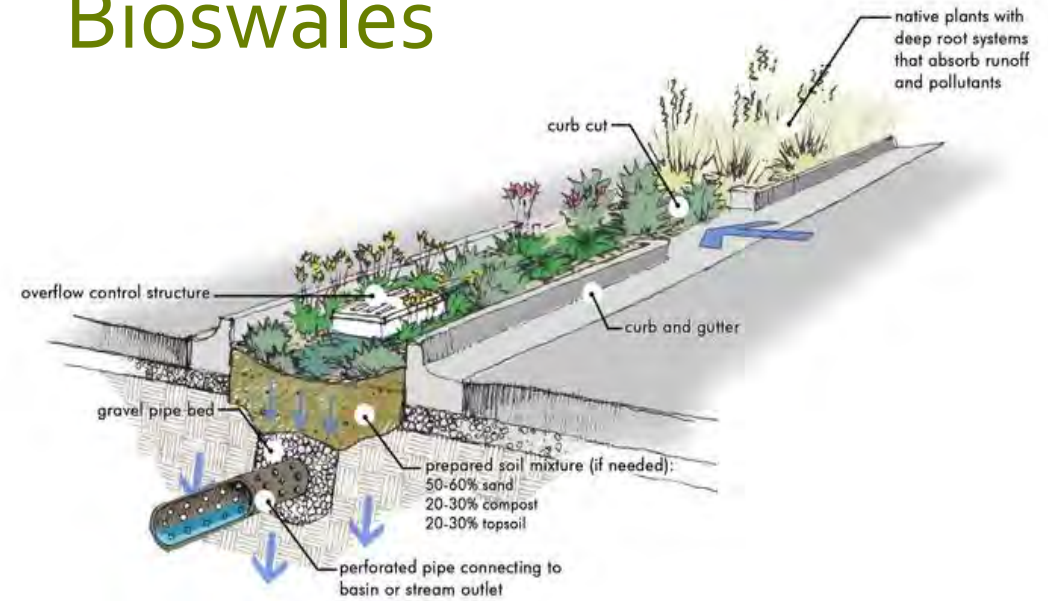
## How We Use, Save and Recycle Water



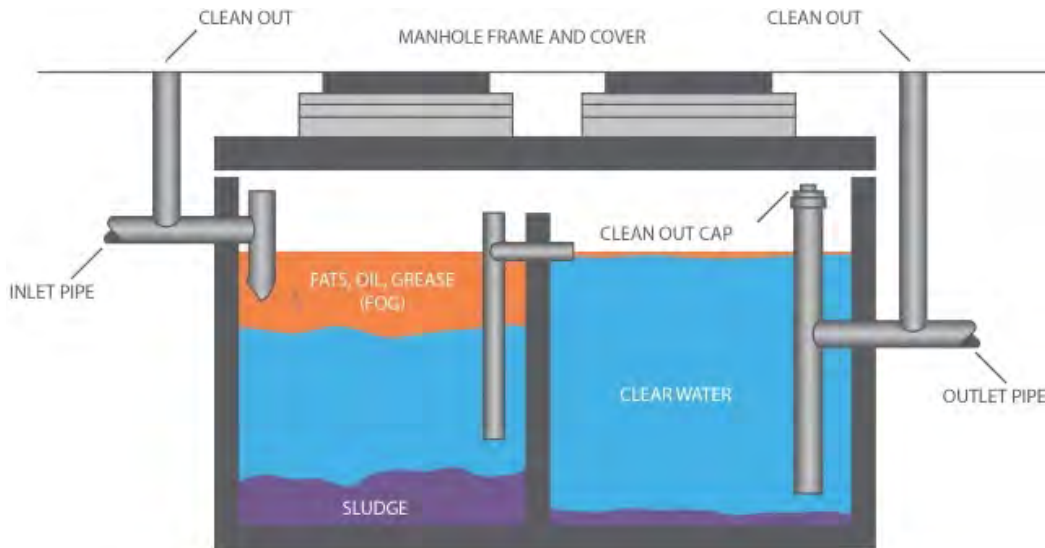
# Aqueous Parts Washers



# Bioswales



# Clarifier & Intercept Systems



# Chemical Water Treatment and Recycling Systems



Thank You 😊

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# Essential Utilities Company



**Charlie Stevenson**  
**Director of Fleet & Supply Chain Management**  
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**610-544-5433**

# Essential Utilities: Fleet Organization



## FAQs

1. How much waste oil must I generate to make a waste oil furnace a practical purchase?
  - a. The average minimum volume of waste oil you must generate each year is between 500 and 700 gallons. If you run short of waste oil, you can also burn #2 fuel oil
2. Does a waste oil furnace produce a black, sooty smoke that pollutes the air?
  - a. No. A waste oil furnace burns as cleanly as a #2 fuel-oil furnace
3. Won't various viscosities of crankcase or transmission oil affect the combustion efficiency of my furnace?
  - a. No. Today's state-of-the-art burners are designed to accommodate a range of oil viscosities from 10w to 50w.
4. How often will I have to clean the ash from inside the furnace?
  - a. Expect to clean your waste oil furnace every 1,000 hours of operation. Cleaning the furnace is a safe and easy procedure which typically takes about 30 minutes.

**CB-2500**



**MAX.  
BTU/HOUR:  
250,000 (73 KW)**



## FAQs Contd.

5. Are waste oil furnaces backed by any kind of warranty?
  - a. Yes. There is a 10-year limited warranty provided
6. What is the average length of time for payback on a waste oil furnace, and will I ever really enjoy free heat?
  - a. Depending on average temperatures in your region, your ROI will be between 18 and 24 months. Afterward, you will be rewarded with free heat.
7. What is “cradle-to-grave” liability and how can it affect the way I dispose of waste oil?
  - a. The federal government holds you directly and irrevocably responsible for pollution management, clean-up, and disposal control of waste oil. Simply put, the liability for waste oil exists until it is burned (i.e. recycled).
8. Is there any way to duct a waste oil furnace?
  - a. Yes, waste oil furnaces can be ducted, and are UL approved for this application



## 4 Big Benefits of Waste Oil Heating

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### 1) Waste Oil Heating Cuts Energy Costs

With a waste oil furnace that turns your used oil (transmission fluid, hydraulic fluid, etc.) into free heat for your facility, you can slash your energy expenses substantially.

### 2) Waste Oil Heating Eliminates Guesswork

Waste oil heating provides a way to evenly distribute and control heat through your building. Having that extra level of control makes it easy to adapt to unexpected changes in the weather, and to prevent pilot error.

### 3) Waste Oil Heating Allows You to Dispose of Used Oil Safely, Lawfully, and Cost-Effectively

Waste oil heating gives you a way to get rid of your used oil per EPA rules. Rather than put yourself at risk because of the mishaps that can potentially happen when transporting used oil off-site (either doing it yourself or hiring a third party), you can instead burn it in your waste oil furnace at your location.

### 4) Waste Oil Heating Does Right by the Environment

It's an environmentally friendly method of disposing of used oil. Being an eco-conscious company can help your business from a public image standpoint.

- Essential recycles all anti-freeze, waste oil, and utilizes retread tires for various applications. Essential has always drained oil filters after a PM was completed. We use a certified vendor to dispose of replaced oil filters so they don't end up in a landfill or trash dumpster.
- Essential has recycled tires with our tire manufacturer and we have retreaded many large truck tires in our fleet operations.
- Essential's fleet department diligently works with area managers to ensure the use of the most fuel efficient replacement vehicles.
- Essential purchased eleven aluminum utility bodies were placed in service in 2019 with good results. The lighter material allows a larger payload resulting in fewer trips and better fuel economy while traveling empty.

## ESG Continued

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- Most of our fleet facilities have been built in the 1980s or 1990s. Essential has upgraded to efficient, insulated windows, as well as efficient, insulated garage doors. Essential has added tint to some windows, as well as window shades in efforts to keep the heat out and run the HVAC more efficiently. Essential has upgraded HVAC units to be the most efficient unit available
- Essential has upgraded our lighting system to be triggered by movement and has also utilized LED fixtures in efforts to reduce operating costs and provide our mechanics better lighting while working and servicing our vehicles.
- Essential is most proud of the fact that we have installed six natural gas fueling stations and have over one hundred natural gas vehicles in our fleet operation. These vehicles burn approximately one hundred thousand gallons of gasoline equivalence of CNG per year. This initiative helps clean our environment and has been well-received by our employees.
- We have all learned a great deal about the various forms of alternative fuel vehicles we have in our fleet. This includes CNG, electric, biodiesel, propane, E-85 ethanol, and hybrids. We have updated best practices and policies in efforts to safely repair all of these alternative fuel vehicles in all of our shops.

# 2020 Winners



10	Essential Utilities Company (PA)	5	City of Vancouver, WA
9	West Valley Construction (CA)	4	Westerville Schools (OH)
8	Laketrans (OH)	3	University of California, Davis
7	City of Albany, GA	2	University of California, Irvine
6	City of Roanoke, VA	1	City of Tulsa, OK

# University of California, Davis





**Session #16: Green Garage Winners  
& Best Practices 2020**

**December 09, 2020**