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# Remanufactured All Electric Buses

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## About Us

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- Complete Coach Works has proudly served the transit industry for the past 27 years with headquarters in Riverside, California.
- CCW is the largest bus remanufacturing company in the United States
- CCW operates two facilities in California. The southern CA facility is located in Riverside and northern CA facility is located in Alameda
- We strongly believe in the Reduce-Reuse-Rebuy-Recycle philosophy and implement it in every project
- The Zero Emission Propulsion System (ZEPS) powered all electric bus was launched last year and has been tested for more than 18,000 severe duty miles.
- Two more buses are deployed in service since our product launch last year.





## Basic Specifications

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- 40 Foot Low Floor Bus
- Use of existing low floor chassis from Gillig, New Flyer or Other manufacturers
- Full remanufacturing including mandatory replacement of all moving/wear items on the bus
- New light weight composite subfloor, light weight finish flooring, light weight energy efficient windows, state of the art light weight seats,
- Energy efficient LED Interior and exterior lighting.
- Low rolling resistance tires
- Energy Efficient Air Conditioning system
- 242kWh lithium iron phosphate battery pack
- 40kW onboard charger
- Less than 5 hrs. charge time
- 130 mile range on a single charge



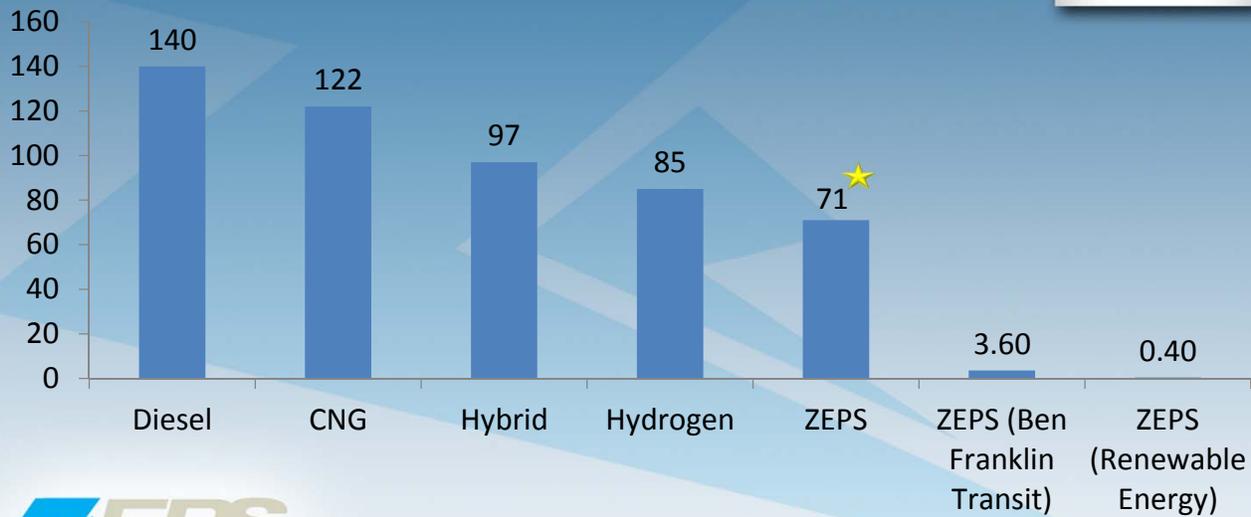
Reduced Complexity  
 Rugged industrial components  
 No Transmission  
 No Hazardous chemical handling



No fluid check  
 No Belt driven alternator  
 No Belt driven HVAC system

**Emissions (Short Tons Per Bus Per Annum)**

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★ Using electric grid for charging the electric bus. Based on current California Energy Grid Fuel Mix With 100% renewable energy emission is due to electricity transmission losses

## Remanufacturing – Ultimate in Sustainability

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- Reduce-Reuse-Rebuy-Recycle
- Conserving more than 10,000 pounds of steel
- Smaller carbon footprint than a new bus
- Responsible reuse of an existing bus chassis vs. needless disposal
- Eliminating landfill waste
- Significant cost savings over a new bus
- Significant savings on spare parts as the bus chassis is common to Diesel and CNG chassis



## Production Capabilities

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- CCW offers a shorter deployment cycle- 3 Months from date of receipt of Purchase order
- CCW is the largest bus remanufacturing company in the United States and can easily scale up to meet the customer demand
- Trained staff and 27 year experience in building buses
- Manufacturing facilities located in California
- Buy America Compliant with a solid network of local suppliers



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# Transit Duty Cycle Performance



## BEN FRANKLIN TRANSIT PROJECT

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## Operation profile

Total Distance covered in the morning and evening shift : 122 miles

Routes used: Route 23 and Route 26

Total operation time : 7 hrs.

Total time between morning shift and evening shift : 5 hrs.



Route	23
Distance per loop	7.8 miles
Total time	27 minutes
Layover time	5 to 8 minutes
Average speed	15 MPH
Grade	-7 / 8 %

Route	26
Distance per loop	15 miles
Total time	51 minutes
Layover time	5 to 8 minutes
Average speed	17 MPH
Grade	-11 / 12 %

## On-road Operation Data

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Test Parameter	Diesel	Electric	Improvement
Distance Covered per day (miles)	122	122	
Fuel Consumed (Gallons/ kWh)	24.45	199	
Cost of fuel (\$/Gallon) / (\$/kWh)	3.6	0.035	
Total Cost of Fuel	\$88.02	\$6.96	<b>92%</b>
Cost Saving (Fuel/ day)	\$0	\$81.06	
MPGe	4.5	22.4	<b>397%</b>
Cost per Mile (Fuel only)	\$0.72	\$0.057	<b>92%</b>
<b>Fuel Cost per Annum</b>	<b>\$22,885</b>	<b>\$1,809</b>	<b>\$21,076</b>

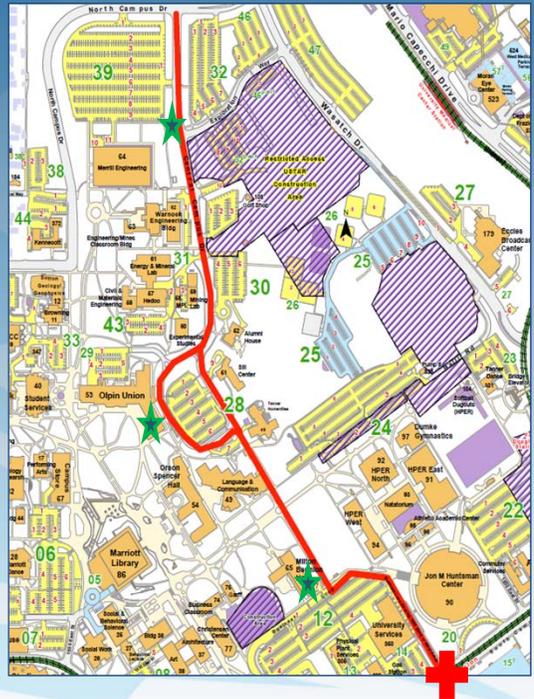
# University of Utah

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# Operation profile

Route	Campus
Distance per loop	1.5 miles
Total time	10 minutes
Layover time	5 minutes
Average speed	9 MPH
Wireless Inductive Charging	50kW
Daily Hours of Operation	13 hrs.
Daily Distance	80 miles



## Road Ahead

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- Four major areas of focus
  - Battery energy density and weight reduction
  - Range on a single charge
  - Efficiency of HVAC system and Auxiliary systems
  - Reducing Cost of the system



## Road Ahead

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- Continuing to evaluate different battery chemistries
- Potential move to higher energy density lithium ion chemistry to reduce weight and improve the range on a single charge
- Improving performance of HVAC system for cabin heating



## Game Changing Technologies Available in next 2 to 3 years

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- Wireless inductive charging
  - No contact, no wires to plug in, completely concealed under the road
  - Power transfer of 80kW with >90% efficiency
- Electric bus with 200 mile range on a single charge
- Electric bus with 350 mile range with low power opportunity charging for 10 minutes at end of each loop and 5 hour overnight charging.



## Thank You for your attention

Contact Information

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