

# IPRO 313: Refuelable Electric Cars

## Background

- Vehicles today use Internal Combustion (IC) motors, which cause air pollution.
- America's dependence on foreign oil due to use of gasoline in our vehicles.
- Current alternatives to IC motors are expensive and do not solve the air pollution problem.

Alternative	Downside
Biofuels	Emissions Land area to produce
Hydrogen Fuel Cell	Expensive, dangerous Hydrogen produced from Natural Gas
Plug-in Hybrid	Emissions Oil dependence
Electric	Battery expensive Range-limited
Zinc-Air Refuelable	No working prototype

Refuelable Zinc-Air batteries can provide the necessary power to operate a vehicle while providing zero emissions, while being safe and cost efficient.

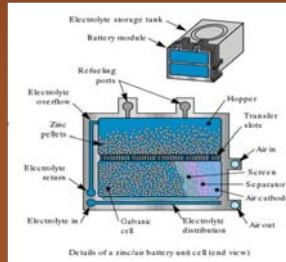
## Objectives

- Design a system which utilizes a Zinc-Air battery for vehicle applications.
- Convert a standard car or truck in which to implement our system.
- Obtain or build a Zinc-Air battery for testing and use in the vehicle.

## Methodology

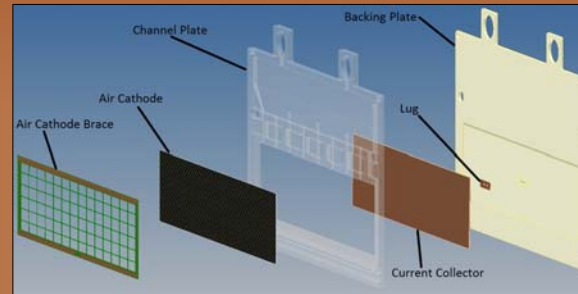


## Zinc-Air Battery

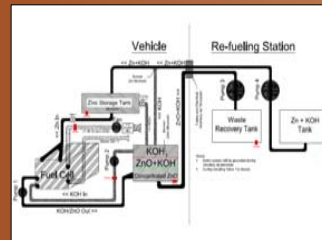


Cell Component	Materials
Air cathode/ Separator	Cobalt based catalyzed carbon, laminated porous Teflon film, and laminated micro porous film.
Current Collector	Copper
Anode	Zinc pellets
Electrolyte	12M Potassium Hydroxide
Encasement	Polycarbonate plastic

- High energy density.
- Terminal voltage does not drop until 80–85% depletion.
- Very long shelf lives when sealed to exclude oxygen.
- Zinc is cheap; mass production is inexpensive.
- Shunt current losses are found to be negligible for this design.



## Refueling System



- Fueling involves draining used fuel as well as adding new fuel
- Mechanical means must be used to propel solid fuel into or out of vehicle
- System must be well-sealed for safety
- Future cost estimation is required

## Vehicle Selection



- Selection criteria:
  - Available to average consumer
  - Pickup truck to accommodate battery
  - Mid-size for lower power requirements
- Two Chevrolet S-10 trucks was donated by Argonne National Laboratory.
- Required power approximately 45 kW for highway cruising.
- Additional power for acceleration supplied by Lithium Ferrous Phosphate battery.

## Future Work

- Perform extensive testing on the lab-scale battery.
- Retrofit the optimized design into the car for road testing
- Further promote the project with media releases.
- Devise a commercialization strategy upon successful testing.

## Conclusions

- Project requires a strategic advertising campaign to enhance funding options.
- Battery design still requires extensive testing and tweaking before it can be successfully implemented.
- Zinc-air battery is a green alternative energy for vehicles.
- Prototype can be made with sufficient support.
- Publicity is key to this technology gaining momentum.

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