# Vehicle Technologies Office (VTO)

Office Overview


U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

**Michael Berube**
**Director, VTO**
**Office of Energy Efficiency and Renewable Energy**

# Today

- **What's New**
- **Office Vision and Strategy**
- **Goals and Successes**

# VTO Organizational Structure

**Michael Berube**
**Director**

**David Howell**
**Deputy Director**

## Electrification R&D
Program Manager

**Technology Managers**
- Battery R&D
- Electric Drive, Grid, and Charging R&D

## Materials Technology R&D
Program Manager

**Technology Managers**
- Lightweight Materials
- Propulsion Materials

## Advanced Combustion Systems and Fuels R&D
Program Manager

**Technology Managers**
- Advanced Combustion Engines and Systems
- Fuels and Lubricants

## Energy Efficient Mobility Systems
Program Manager

**Technology Managers**
- Energy Efficient Mobility Systems

## Deployment
Program Manager

**Deployment Managers**
- Clean Cities and Fueleconomy.gov
- Energy Efficient Mobility Systems and Electrification
- EPACT

## Operations
Operations Supervisor

- Analysis
- Budget
- Communications and Education
- Office Administration

# Why Energy Efficient Mobility Systems (EEMS)?

Connectivity

Automation

Ride-sharing

Car-sharing

New Powertrains


New Modes

How can disruption lead to new energy efficiency opportunities?

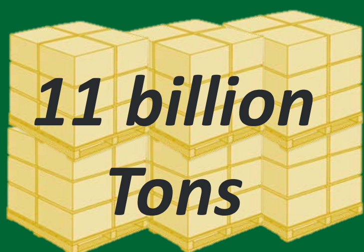
What are the most promising innovation levers?

What are the risks to energy use and how can we overcome them?

# VTO Mission

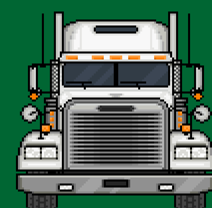
## *Growing our Economy Requires Transportation, and Transportation Requires Energy*

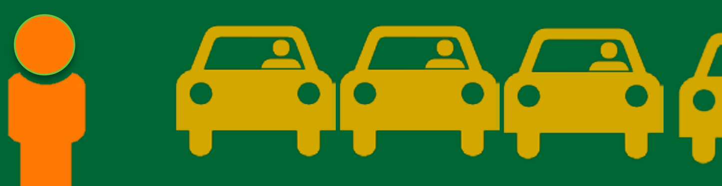
***Annually, transport…***



***11 billion Tons***

***Goods by***





***Over 3 Trillion Miles***

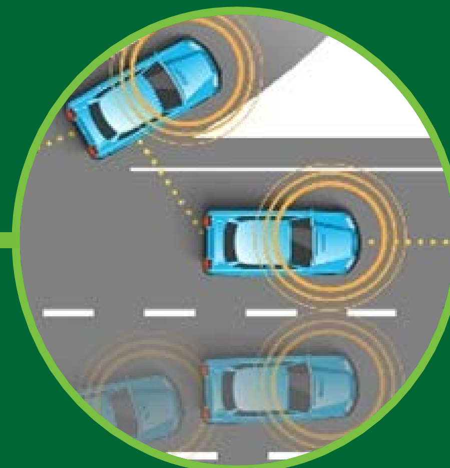
VTO providing **low cost, secure, efficient, and clean** energy technologies to transport people and goods across America

# FY 18 Program Focus and Strategy

## *Early Stage Research that Advances…*

**Fuel Diversification**
Domestic, Diverse,
Alternative, Clean Fuels

**Vehicle Efficiency**
Energy Efficient Vehicle
Technologies



**Mobility Systems**
Energy Efficient
Transport Systems

# VTO Budget

| FY 18 Budget Structure | FY 17 Enacted ($K) | FY 18 Request ($K) |
|---|---|---|
| Battery and Electrification Technologies | $140,530 | $36,300 |
| Energy Efficient Mobility Systems | $16,385 | $12,200 |
| Advanced Engine and Fuel Technologies | $83,979 | $22,000 |
| Materials Technologies | $23,565 | $7,500 |
| Outreach | $37,400 | $2,000 |
| Analysis | $5,100 | $2,000 |
| **TOTAL** | **$306,959** | **$82,000** |

# Ambitious Goals

+ 15% Fuel Economy from Fuels and Engine Cooptimization

Fuel Economy
+ 35%

55% Heavy-Duty Truck BTE

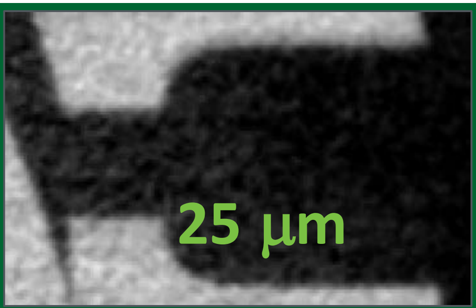
300 Mile Range

Weight
- 25%

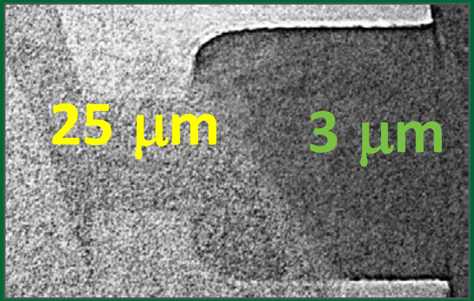
Costs:
Battery = ICE

15 min
Recharge Time

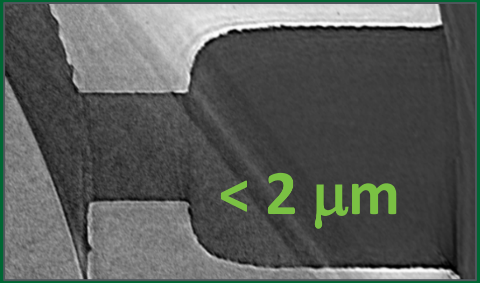
# All New Fuel Injector Visualization




Commercial Service




European Synchrotron




Argonne

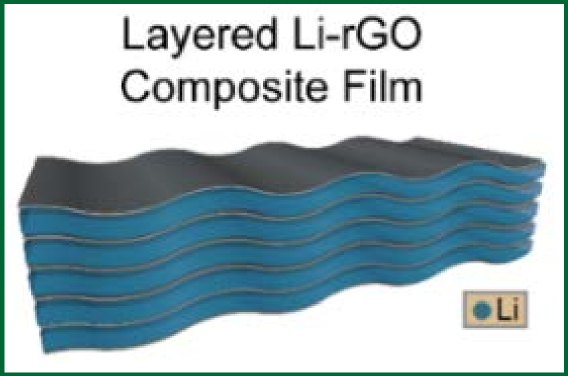
Fuel Injector Nozzle Geometry


World-class spatial resolution

**High Precision has been Achieved in Nozzle Geometry Visualization**

# New Concept to Enable Lithium Metal Anodes

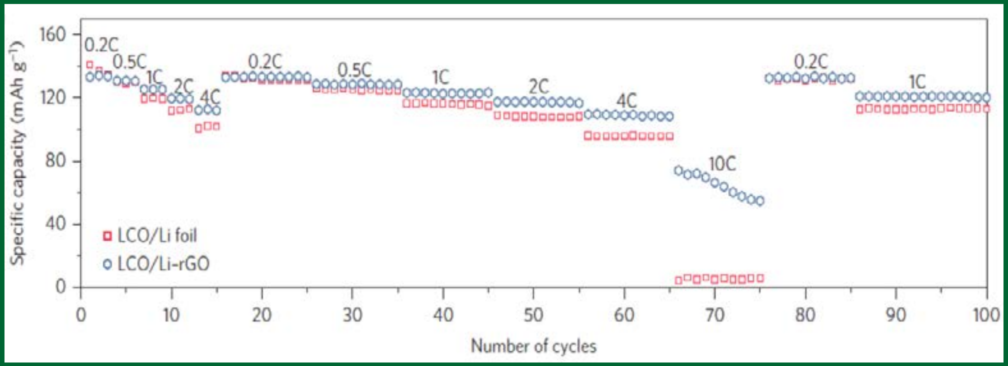
STANFORD UNIVERSITY




**Reduced Graphene Oxide (GO) with Nanoscale Interlayer Gaps as Stable Host for Li Metal**

**Novel Structure as Host for Storing Metallic Lithium**

**Could lead to** ↑ **Range** ↓ **Cost**

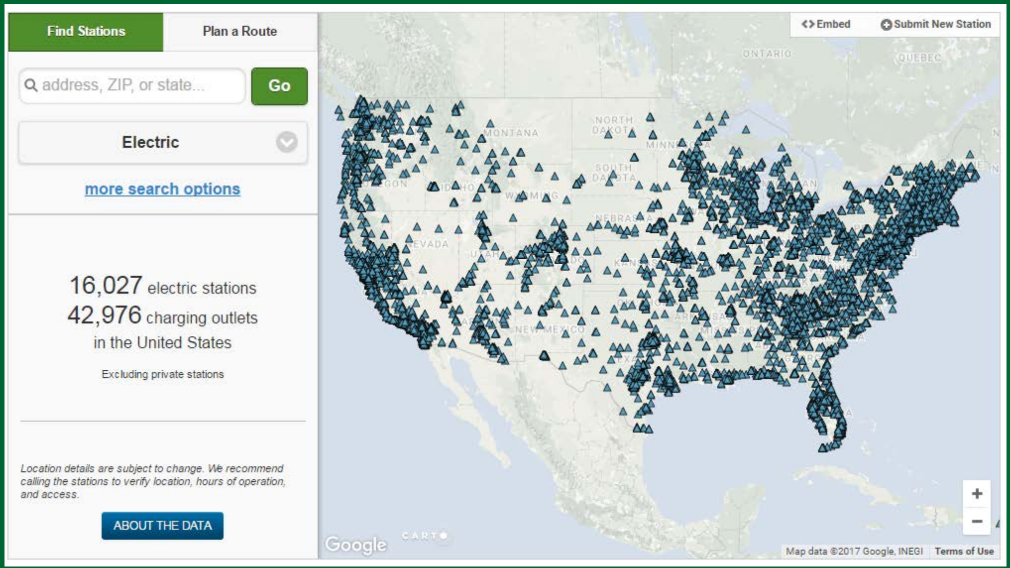



Y. Cui group, *Nature Nanotechnology* (2016)

**Cycling of Li–Reduced Graphene Oxide Electrodes**

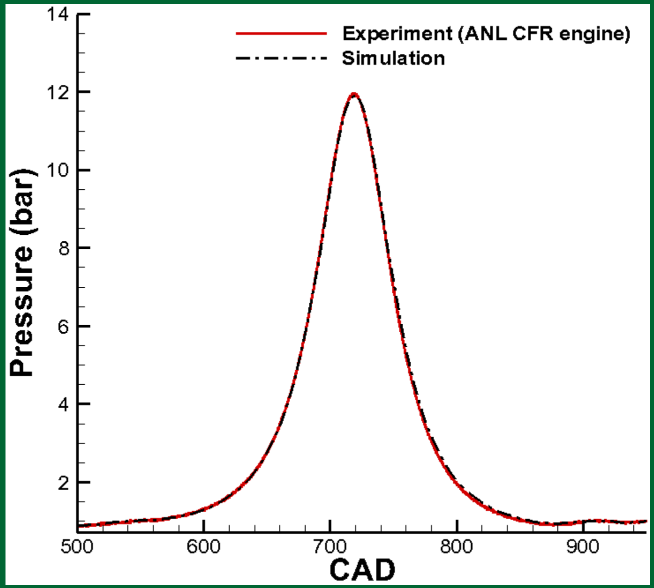
# Analysis of Consumer Trips to Understand Charging Needs

**Heat map of Columbus trip destination frequency derived from INRIX data set**

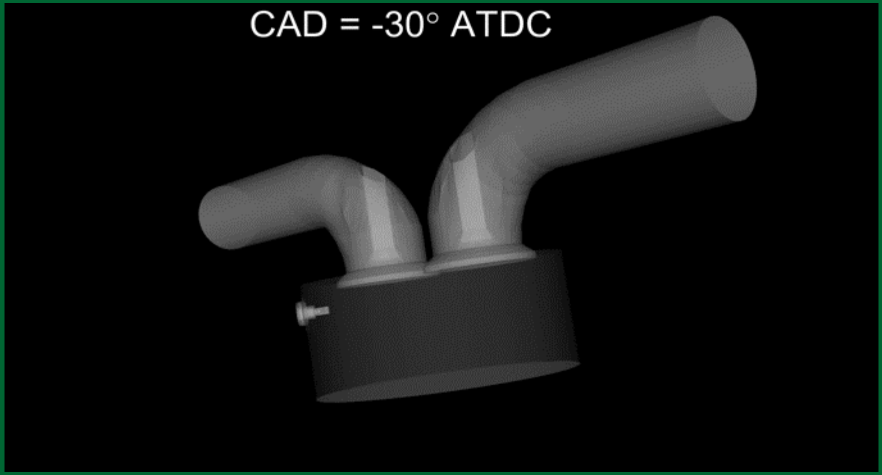



**Map of Electric Charging Stations from the Alternative Fuels Data Center**

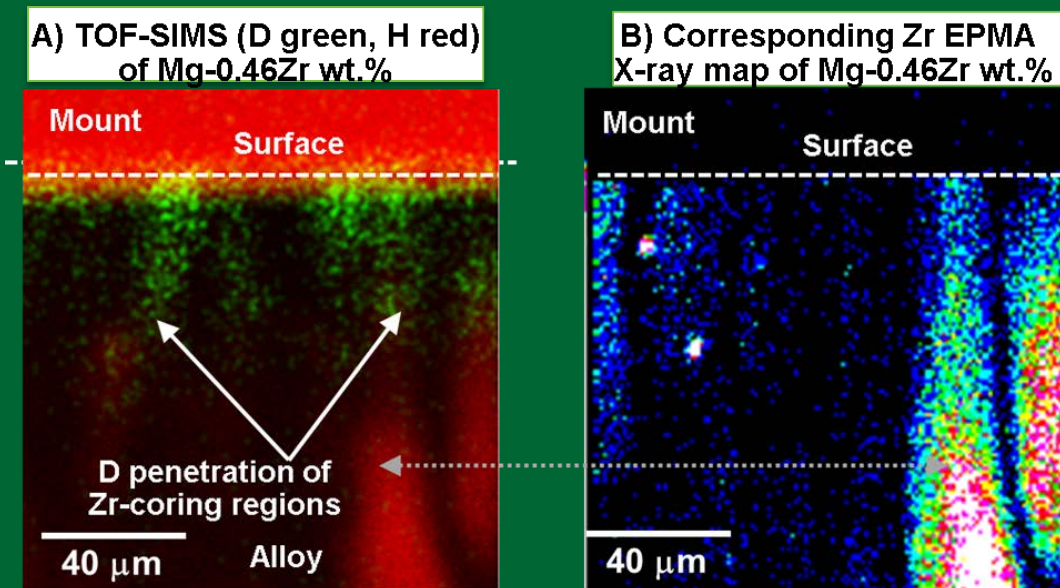
# Ability to Derive Knock Computationally


Knock visualization in CFR



# Atomic Level Observation Reducing Magnesium Corrosion



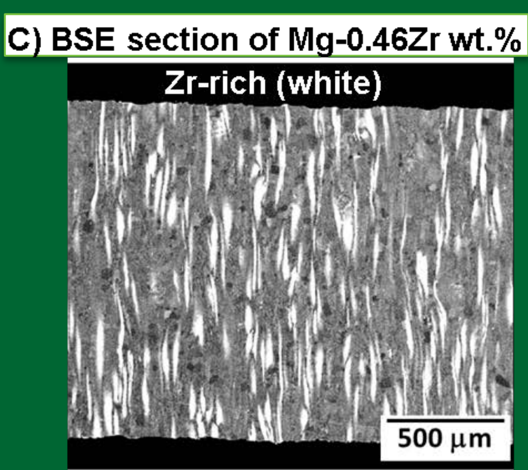
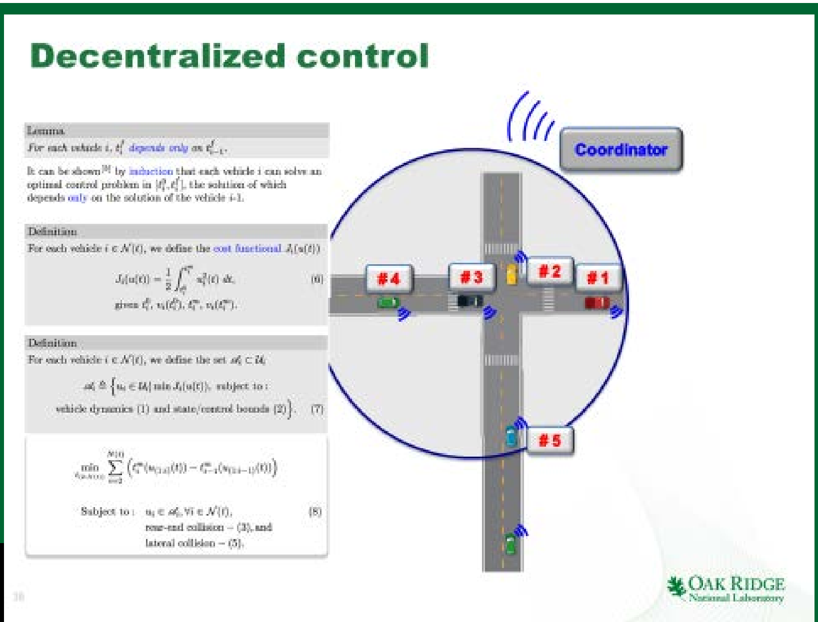
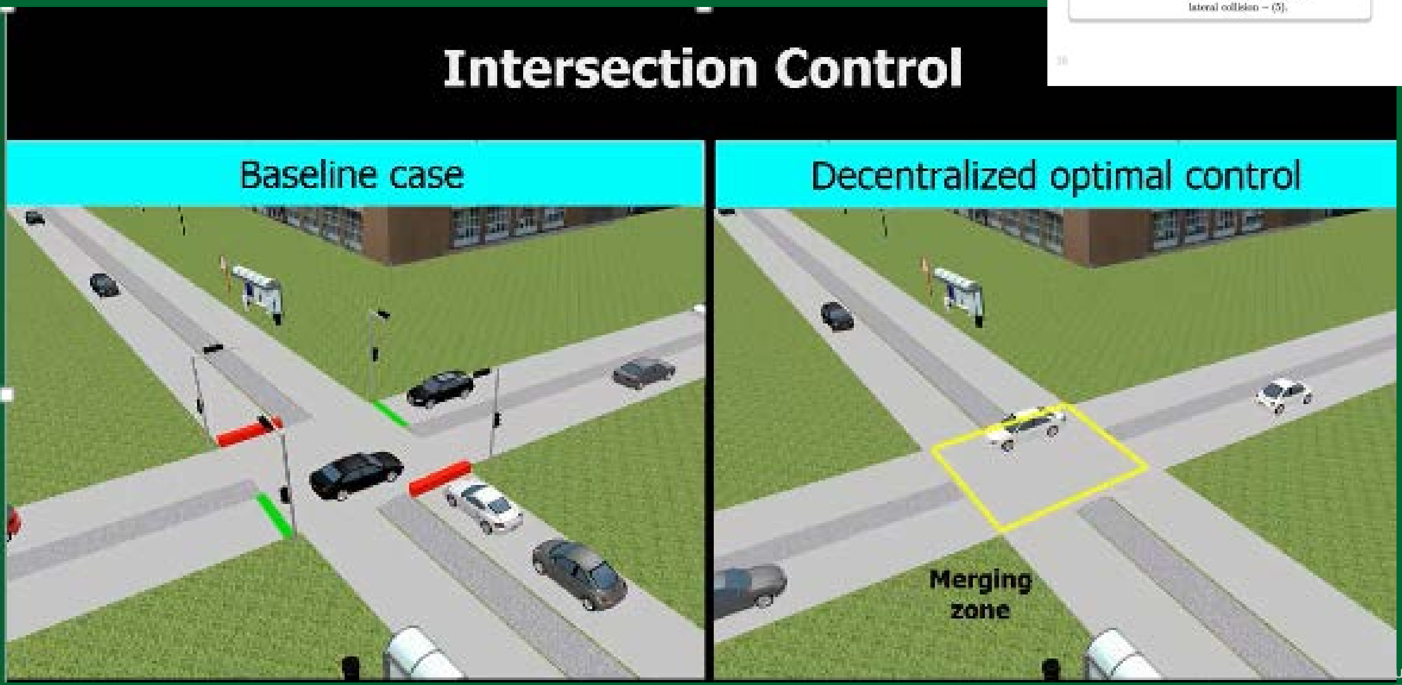




**Fig. 1.** Cross-section TOF-SIMS D map after 4 h in $D_2O$ for A) Mg-0.46Zr. Both D and residual H segregated to Zr-rich coring regions. B) Corresponding Zr EPMA X-ray map (thermal scale) for Mg-0.46Zr, and C) Backscatter electron EPMA image of entire Mg-0.46 Zr sample cross-section.

# New Math Based Models to Control Intersections



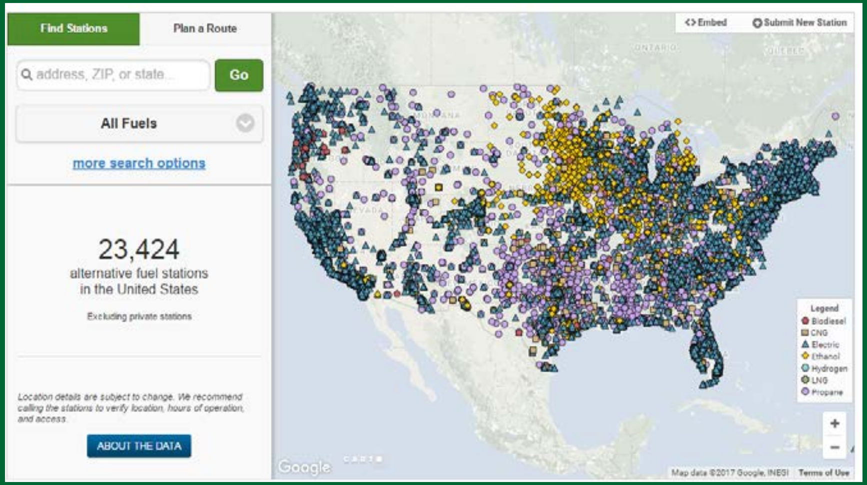



# Vehicle Technologies in Use

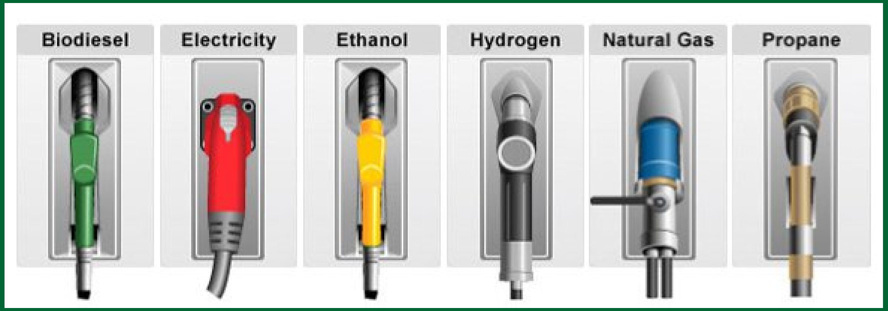
www.fueleconomy.gov
the official U.S. government source for fuel economy information

Clean Cities
U. S. Department of Energy

## EEMS Living Labs







# Keys for a Successful VTO

# Thank You