



# Sustainable Manufacturing for Future Automotive Propulsion Technologies

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# Current Technology has a Base Already Installed for Remanufacturing and Recycling



Cylinder  
Heads

Blocks

Crankshafts

Water  
Pumps

Catalytic  
Converters

Throttle  
Bodies

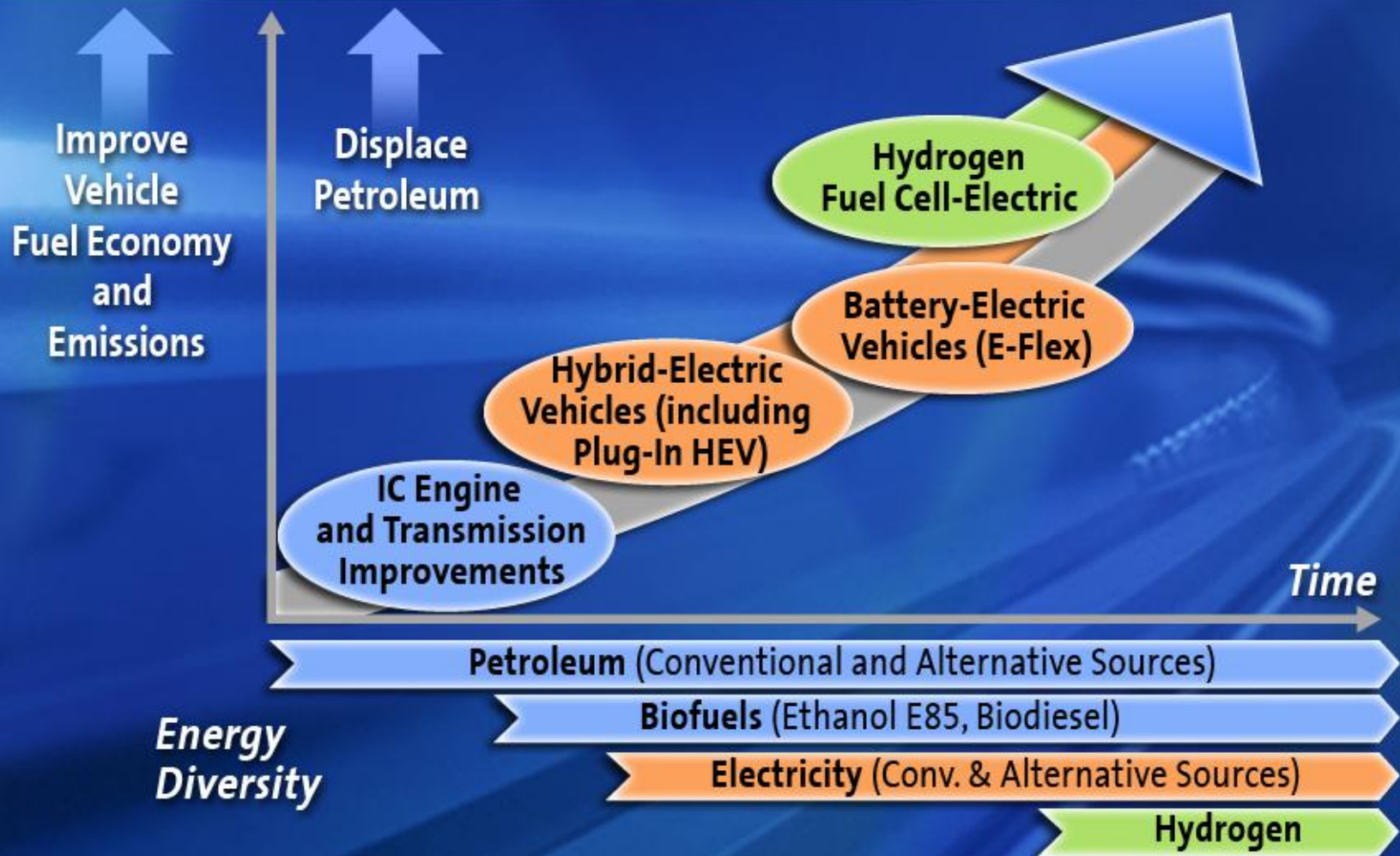
Short  
Blocks

Complete  
Engine  
Assembly

# ***Future Propulsion Technologies***

- Will drive new requirements
- Will provide new “business” opportunities
- Require strategies to be developed
- Involve materials and components not typically used today in the auto market
  - Power Electronics
  - Batteries
  - Fuel Cell “Materials”

# Advanced Propulsion Technology Strategy



# Fuel Cell Specifics



# Fuel Cell Component Basics

## Membrane Electrode Assembly

### Key Materials

- Polymer Membrane
- Platinum Catalysts
- Need to Recover Precious metals

## Diffusion Media

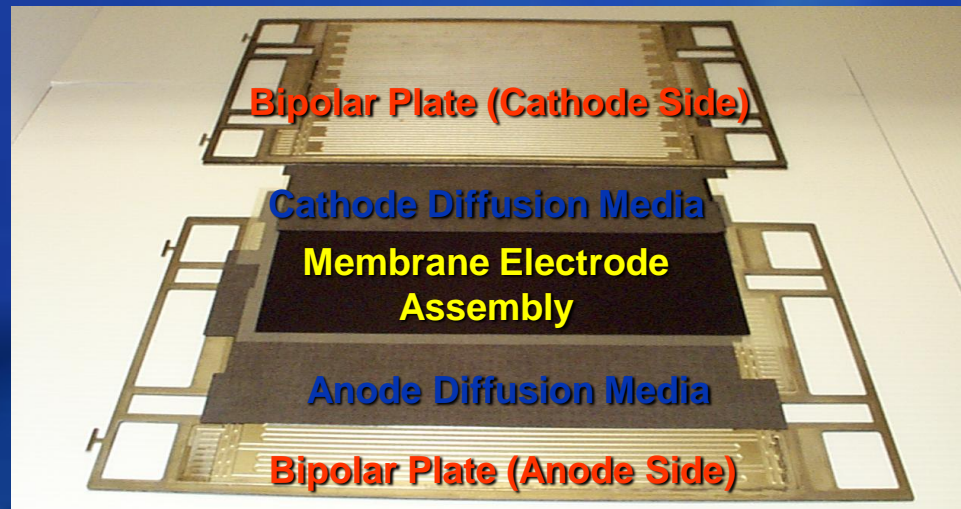
### Key Materials

- Carbon fiber based
- What can be recovered?

## Bipolar Plate

### Key Materials

- Welded Stainless Steels
- Design for mfg and/or re-use
- High volume capable (Millions/day)



# ***What is Next?***

- Determine High volume Mfg Processes based on materials and function
- Weigh trade-offs between 1<sup>st</sup> time quality and capability for remanufacturing (ex: Int Circuit)
- Develop methods for reclaiming high cost materials and business models that incorporate these “values”