
National Petroleum Council

Future Transportation Fuels Study

Progress Report

September 15, 2011

Reminder: NPC Request from Energy Secretary Chu

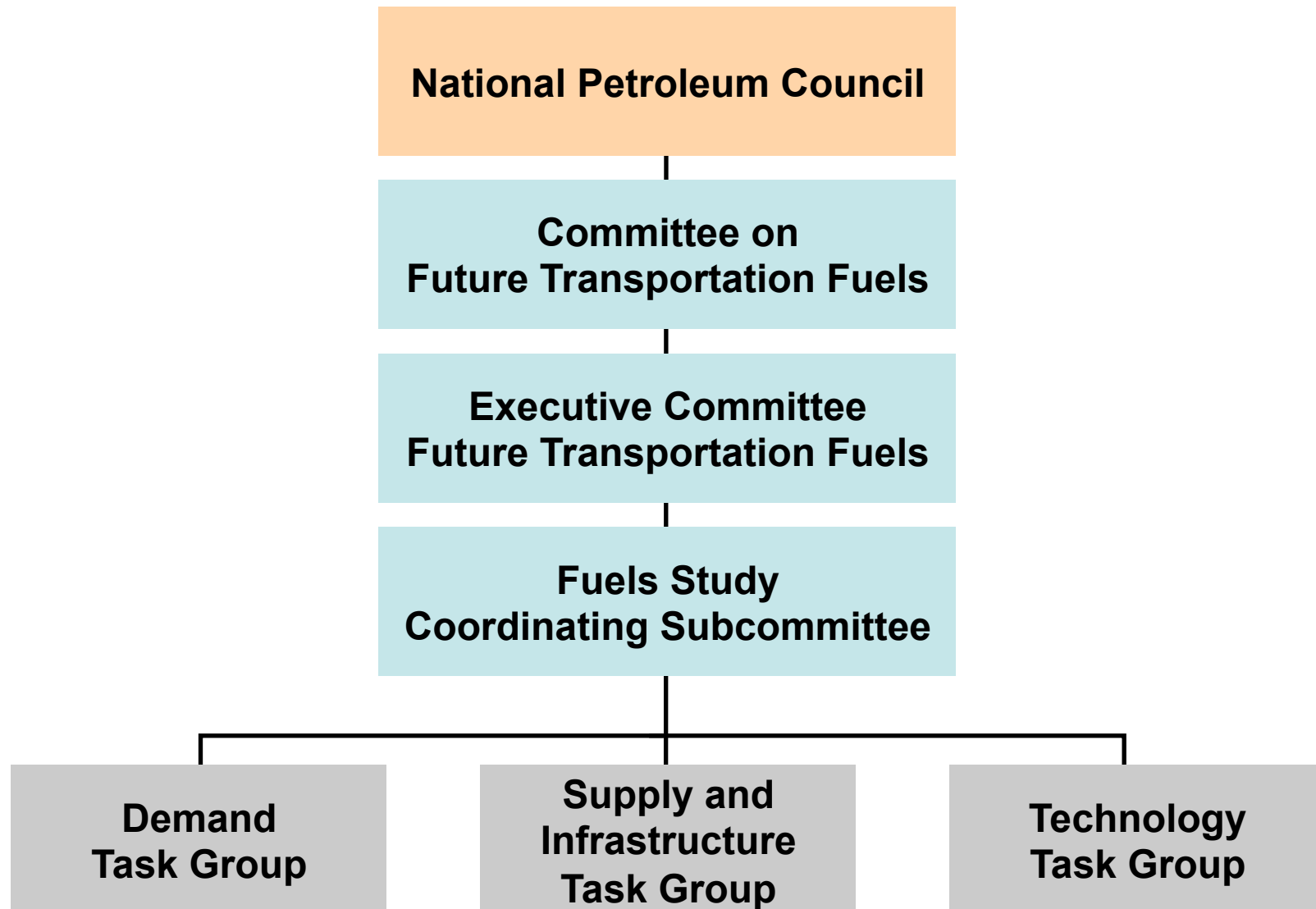
- **Study Future Transportation Fuels prospects through 2035/2050 for auto, truck, air, rail, and waterborne transport**
- **Address fuel demand, supply, infrastructure, and technology**
- **Advise on policy options and pathways for integrating new fuels and vehicles into the marketplace, including infrastructure development**
 - **Address the transition to an expanded suite of reliable, secure, and clean, low-carbon transportation fuels**
 - **Evaluate options, risks, and consequences**

(continued)

Reminder: NPC Request from Energy Secretary Chu (continued)

- **Factors to consider include:**
 - Technological advances
 - Energy efficiency
 - Environmental, e.g., impact on carbon, land, and water
 - Economic competitiveness and market dynamics
 - Cost/benefit tradeoffs
 - Manufacturing, distribution, and infrastructure
 - Customer expectations and acceptance
- **Additional question:** (Supplemental Letter April 30, 2010)
 - What actions could industry and government take to stimulate the technological advances and market conditions needed to reduce life-cycle greenhouse gas emissions in the U.S. transportation sector by 50 percent by 2050 relative to 2005 levels, while enhancing the nation's energy security and economic prosperity?

Reminder: Fuels Study Structure



Reminder: Fuels Study Leadership

Study Executive Committee Leadership

Chair	Clarence Cazalot (Marathon)
Government Cochair	Daniel Poneman (DOE)
Demand Vice Chair	James Owens (Caterpillar)
Supply & Infrastructure Vice Chair	John Watson (Chevron)
Technology Vice Chair	John Deutch (MIT)
Secretary	Marshall Nichols (NPC)

Coordinating Subcommittee

Chair	Linda Capuano (Marathon)
Government Cochair	Steven Koonin (DOE)
Alternate Government Cochair	David Sandalow (DOE)
Supply & Infrastructure Task Group Chair	Shariq Yosufzai (Chevron)
Demand Task Group Chair	Deanne Short (Caterpillar)
Technology Task Group Chair	Stephen Brand (ConocoPhillips)
Secretary	Andy Oliver (NPC)

Members

Anthony Boccanfuso (University of S.C.)	Peggy Montana (Shell)
Chris W. Erickson (ExxonMobil)	William Reinert (Toyota)
Michael Gallagher (Westport Innovations)	Arthur Rypinski (Dept of Transportation)
Mitch Jackson (FedEx)	Paul Sankey (Deutsche Bank)
Henry Kelly (DOE)	Chris Sultemeier (Walmart)
Deron Lovaas (National Resource Def Council)	Alan Taub (General Motors)
Jan Mares (Resources For the Future)	Todd Werpy (Archer Daniels Midland)

Update: Teams & Subgroups Supporting CSC and Task Groups

Supply Chain Teams

Team / Subgroup	Leader	Organization
Biofuels	Todd Werpy	Archer Daniels Midland
Hydrocarbon Liquids	Chris Erickson	ExxonMobil
Natural Gas	Michael Gallagher	Westport Innovations
Hydrogen	Anthony Boccanfuso	University of South Carolina
Electric	William Reinert	Toyota
Engines & Vehicles	Alan Taub	General Motors

Support Teams

Team / Subgroup	Leader	Organization
Report Integration	Peggy Montana	Shell
Data Integration	Gene Tunison	ExxonMobil
Integrated Vehicles	Clay Phillips	General Motors
Infrastructure	Nick Karim	ExxonMobil
Heavy Duty Vehicles	John Wall	Cummins
Fuels/Vehicles Characteristics	Michael Leister	Marathon
Carbon & GHG Emissions	David Rogers	Chevron

Subject Matter Experts

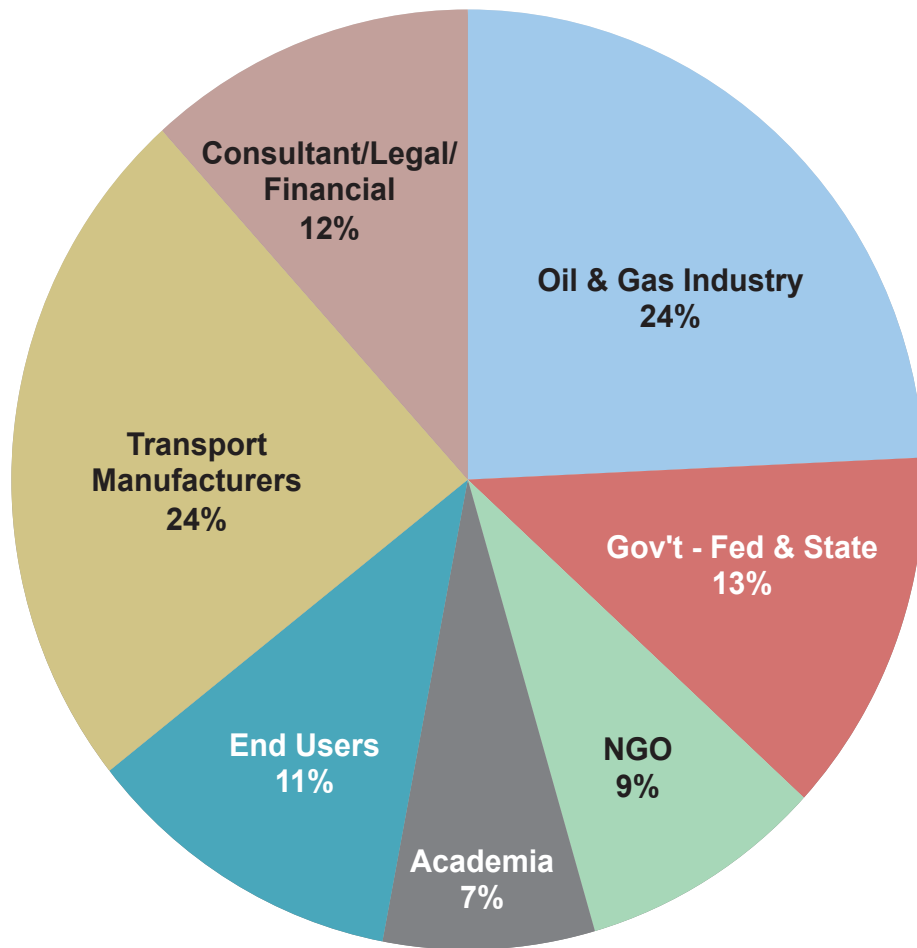
Area	Expert	Organization
Energy Security and Policy (Chair)	John Deutch	Massachusetts Institute of Technology
Agriculture – Biofuels	Robert Fraley	Monsanto
Applied Physics and Policy	Venkatesh Narayanamurti	Harvard University
Batteries/Electrochemistry	Yet-Ming Chiang	MIT/A123 Systems
Biotechnology	Jay Keasling	UC Berkeley/JBEI
Cryogenic Storage	Tom Drube	Chart Industries
Economics	Robert Topel	University of Chicago
Economics	Severin Borenstein	UC Berkeley
Energy Efficiency	Amory Lovins	Rocky Mountain Institute
Engines	John Heywood	Massachusetts Institute of Technology
Engines	Robert Dibble	UC Berkeley
Hydrogen/Fuel Cells	Henry White	University of Utah
Materials Science/Nanotechnology	George Whitesides	Harvard University
Solar Fuels	Daniel Nocera	Massachusetts Institute of Technology

Update: Fuels Study Demographics

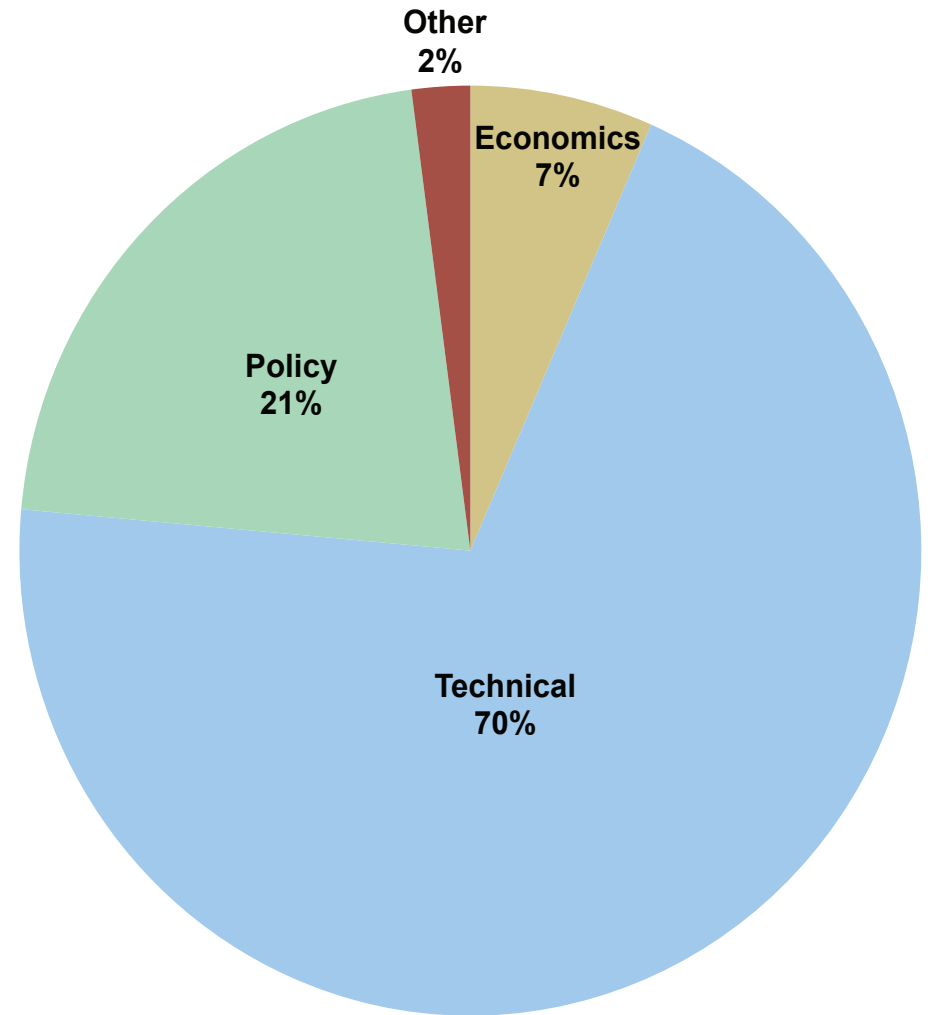
334 Participants

September 2011

By Organization Type



By Skill



Technology Briefings

Vehicle Technologies

Briefing Topic	Sponsoring Organization
Plug-in Electric Vehicle Pilots	Accenture
Carbon Fiber for Vehicles	BMW/SGL Automotive Group
Vehicle Electrification	General Motors
Light Duty Vehicle Technologies	National Academies
Medium and Heavy Duty Vehicles	SAE International

Fuel Technologies

Briefing Topic	Sponsoring Organization
Biofuels/Artificial Photosynthesis	ANSER Solar Energy Research Center
Advanced Biofuels	Defense Advanced Research Projects Agency
Advanced Biofuels	Iowa State University
Future of Natural Gas	Massachusetts Institute of Technology
Alternative Liquid Transportation Fuels	National Academies
Hydrogen, Biofuels, Advanced ICEs/HEVs/PHEVs	National Academies
Coal and Fuels Program	National Energy Technology Lab
XTL Technologies (e.g. coal-to-liquid)	Noblis/Pennsylvania State University
Biomass	U.S. Department of Energy
Fuel and Lubricant Technologies	U.S. Department of Energy
Fuel Cell Technologies	U.S. Department of Energy
Renewable Natural Gas	U.S. Department of Energy

Technology Briefings

Environment and Efficiency

Report Topic	Sponsoring Organization
Potential Transportation Energy Efficiency	Carnegie Mellon University
Light Duty Vehicle GHG Technical Activities	Environmental Protection Agency
FreedomCAR	National Academies
Reducing GHG Emissions from U.S. Transportation	Pew Center on Global Climate Change
Transportation Options for Reducing GHG Emissions	Precourt Institute of Energy

Infrastructure and Investment

Report Topic	Sponsoring Organization
Transportation Fuel Technology Investment	Advanced Research Projects Agency - Energy
Visualizing U.S. Urbanization and Transportation Trends	Toyota Research Institute
Clean Cities	U.S. Department of Energy
Electric Vehicle Infrastructure Initiatives	U.S. Department of Energy
Hybrid/Electric Systems R&D Investment	U.S. Department of Energy

Method of Analysis

Step 1: Individual Fuel / Vehicle Options

Assessed potential to maximize commercial availability of individual supply chain technology pathways based on review of available reports and literature

Reference Case (EIA AEO 2010)	Biofuels Fuel / Vehicle System	Electric Fuel / Vehicle System	Hydrocarbon Liquids Fuel / Vehicle System	Natural Gas Fuel / Vehicle System	Hydrogen Fuel / Vehicle System
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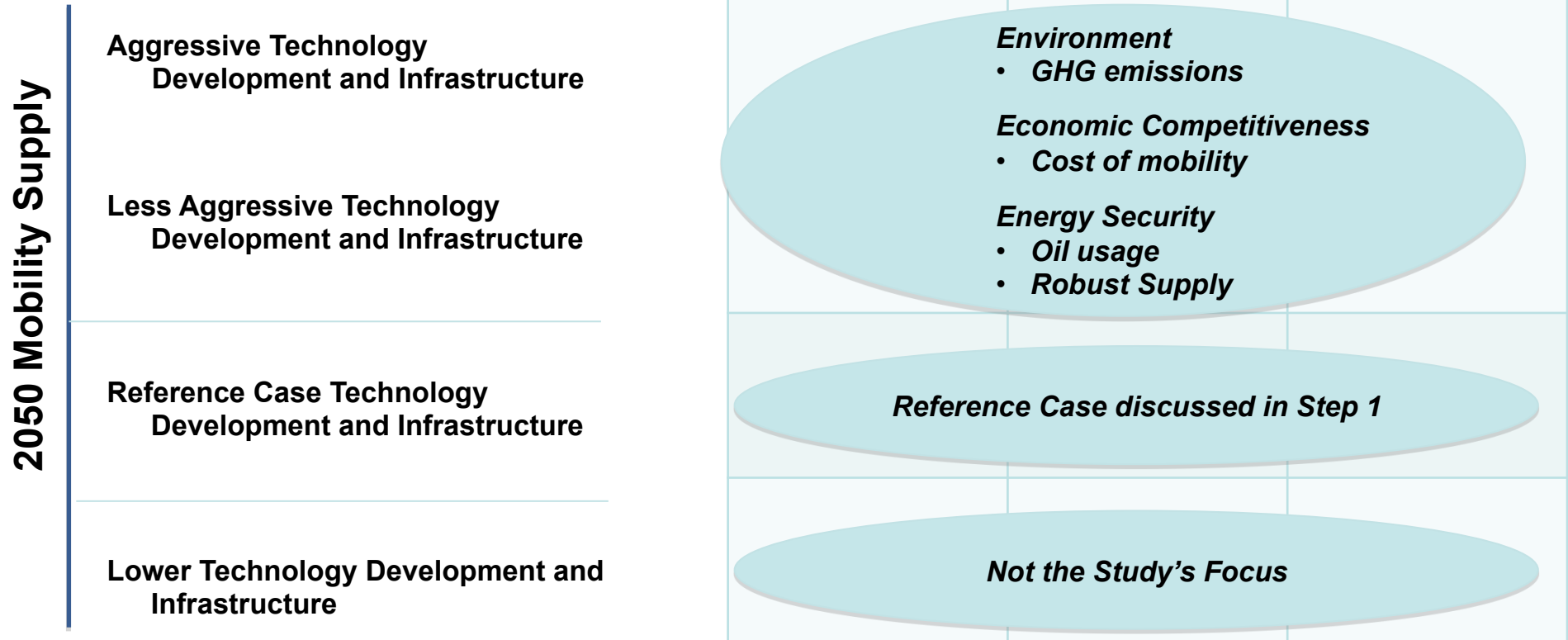
Based on available research, for each fuel/vehicle supply chain:

- Described fuel/vehicle supply chain pathways and supporting infrastructure
- Identified opportunities and described technology options which significantly enhance supply with improved environmental, economic, and energy security characteristics
- Established upper and lower cost bounds for individual fuel and vehicle technologies
- Developed “supply curves” and associated environmental impacts

Method of Analysis

Step 2: Demand / Supply Integration

- Describe an illustrative range of mobility demand for passenger and freight
- Describe potential commercially available fuel/vehicle portfolio mixes meeting 2050 mobility demand in an environmentally desirable, economically competitive, and energy secure way



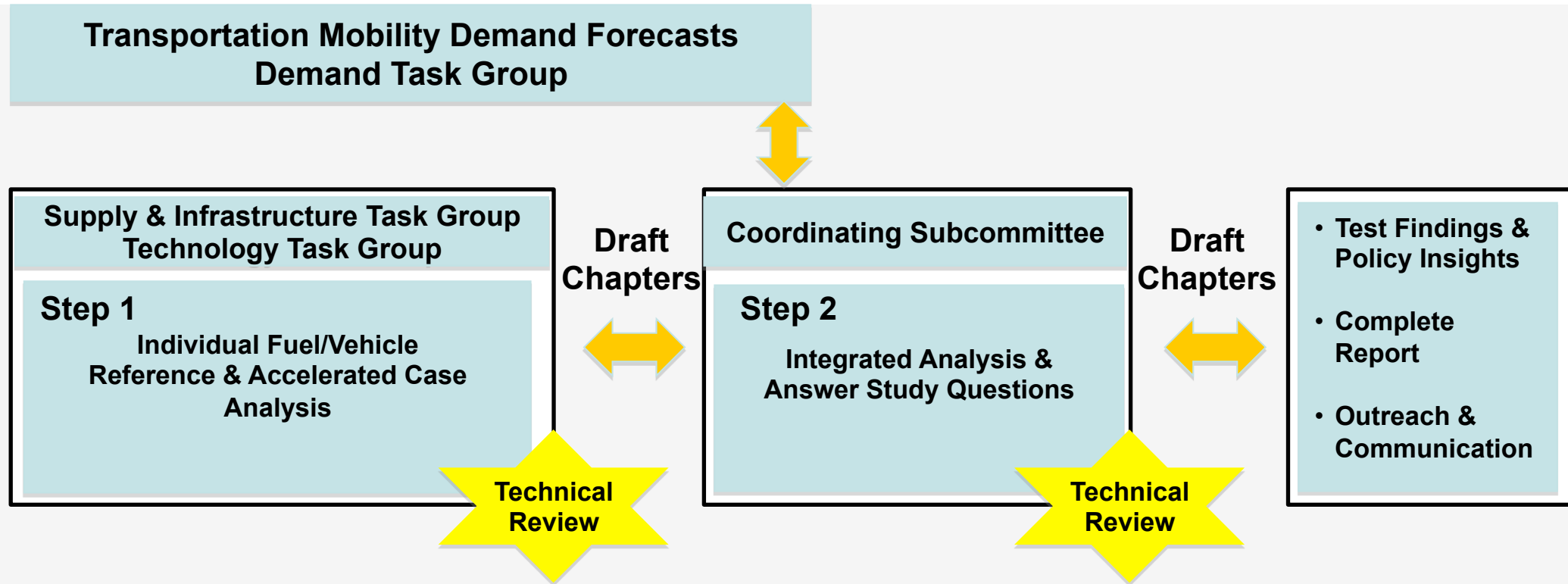
Achievements To Date

- **Executing study plan**
 - 2050 Mobility Demand and Supply Framework and Framing Questions
 - Process Methodology and Project Plan
- **Added specialized teams to improve focus and detail**
 - GHG, Infrastructure, Heavy Duty and Vehicle Integration
- **Drafted 2050 Mobility Demand Chapter**
 - Insights into auto, truck, air, rail, and waterborne transport demand
- **Drafted Reference Case Chapter documenting use of AEO 2010 data**
- **Drafted individual supply chain chapters for “uncompeted” fuel/vehicle systems**
 - Described accelerated supply chains and attributes, including infrastructure
 - Subject Matter Expert and Coordinating Subcommittee review Feb-Mar 2011

What's Next

- **Standardize engine/vehicle pathways, barrier analysis, uniformity, and priority**
 - **Apply quantitative methods to summarize and compare relative economic and greenhouse gas reduction performance between portfolios**
 - **Develop insights, findings, and recommendations**
 - **Draft final report**
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Future Transportation Fuels Study Process Flow



Ongoing Outreach and Review Process

✓ Dec 3	L1 Technical Review (Cambridge, MA)
✓ Jan 18	NGO Outreach Event (San Francisco, CA)
✓ Feb 15	Cell Hydrogen Energy Association (Washington, DC)
✓ Feb 16	Fuels/Resources: NGO Outreach Event (Washington, DC)
✓ Feb 22	Fuels/Resources: Natural Gas Round Table (Washington, DC)
✓ Mar 3	CSC Review (Washington, DC)
✓ Mar 9	L1 Technical Review (Cambridge, MA)
✓ Mar 21	National Research Council (Washington, DC)
✓ Apr 5	Toyota Sustainability Conference (La Jolla, CA)
✓ Apr 7	CSC Review (La Jolla, CA)
✓ May 4	Montreux Global Energy Roundtable (Washington, DC)
✓ May 20	Univ. of Chicago: Future of Transportation (Chicago, IL)
✓ Jun 14	Automotive News Green Car Congress (Novi, MI)
✓ Jul 14	Aspen Institute Forum on Global Energy (Aspen, CO)
Oct 3-5	North American Gas Summit (Washington, DC)
Oct 25	L1 Technical Review (Cambridge, MA)
Dec 7	World Petroleum Congress (Doha, Qatar)
Jan 25-26	World LNG Fuels Conference (Houston, TX)

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Status Update

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