



THE NON-PETROLEUM BASED FUEL INITIATIVE --NPBF--

Office of FreedomCAR and Vehicle Technologies



summarized from DOE EERE Fuels Technologies 5 year plan

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Outline of Talk

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- Origin of NPBF program
- What is NPBF
- NPBF and APBF
- Research plan
- Future goal



January 28, 2003

Key Initiatives in the President's State of the Union Message

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•President Bush announced a \$1.2 billion hydrogen fuel initiative to reverse America's growing dependence on foreign oil by developing the technology for commercially viable hydrogen-powered fuel cells to power cars, trucks, homes and businesses with no pollution or greenhouse gases. The hydrogen fuel initiative will include \$720 million in new funding over the next five years to develop the technologies and infrastructure to produce, store, and distribute hydrogen for use in fuel cell vehicles and electricity generation. Combined with the FreedomCAR (Cooperative Automotive

Research) initiative, **President Bush is proposing a total of \$1.7 billion over the next five years to develop hydrogen-powered fuel cells, hydrogen infrastructure and advanced automotive technologies.**

•Under the President's hydrogen fuel initiative, the first car driven by a child born today could be powered by fuel cells. The hydrogen fuel initiative complements the President's existing FreedomCAR initiative, which is developing technologies needed for mass production of safe and affordable hydrogen-powered fuel cell vehicles. Through partnerships with the private sector, the hydrogen fuel initiative and FreedomCAR will make it practical and cost-effective for large numbers of Americans to choose to use clean, hydrogen fuel cell vehicles by 2020. This will dramatically improve

America's energy security by **significantly reducing the need for imported oil**, as well as help clean our air and reduce greenhouse gas emissions.



Renewable Fuel Standard – RFS

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- Current Senate and House bills differ slightly
- Final passage not yet clear
- Amends the Clean Air Act to include 5 billion gallons by 2012 – 2015, ramping from 2004 - 2005
- Equivalent to about 5% of petroleum usage
- Can include ethanol, biodiesel, or other fuel blending components derived from biomass



DOE'S Office of Energy Efficiency and Renewable Energy Top Nine Priorities

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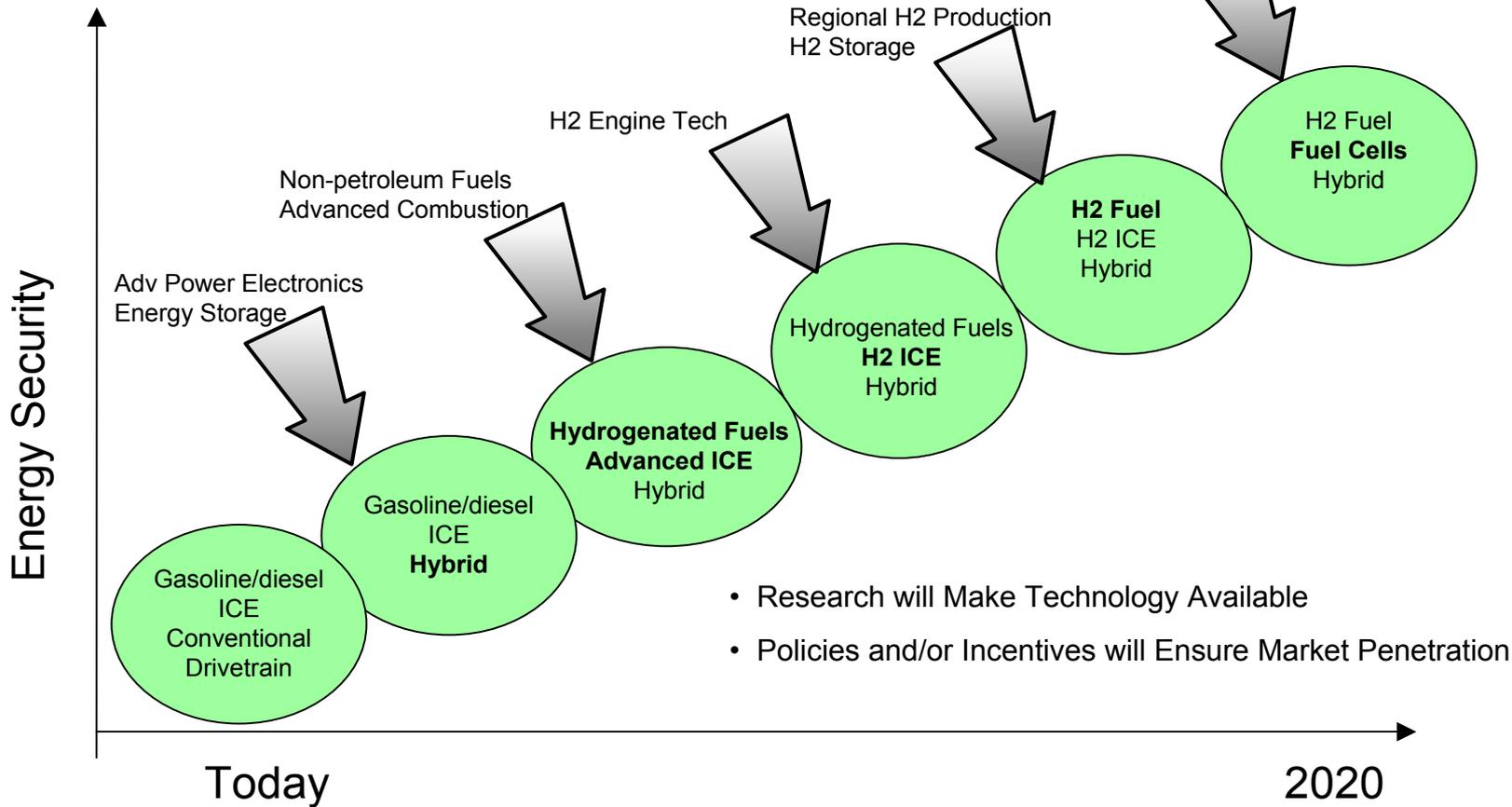
1. Dramatically reduce or even end dependence on petroleum

2. Reduce burden of energy prices on the disadvantaged
3. Increase viability and deployment of renewable energy
4. Increase reliability and efficiency of electricity generation, delivery and use
5. Increase the efficiency of buildings and appliances
6. Increase the efficiency/reduce the energy intensity of industry
7. Create the new domestic bioindustry
8. Lead by example through government's own actions
9. Change the way EERE does business



FreedomCAR and Fuel Initiative

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NPBF - Three Key Project Areas

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Enable immediate use of non-petrol fuels

Enable more efficient interim technologies

Stimulate transition to hydrogen

Conduct research to aid immediate use of non-petrol fuels

Identify fuel properties that can stretch ICE efficiency with near-zero emissions

Explore and identify fuels strategies for ICEs that can aid the transition to hydrogen & fuel cells



DEER 2003





Enable immediate use of non-petroleum fuels and blends

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Low renewable content blends (up to 5%)

- Biodiesel and biomass based
- Possible new renewables
- Petroleum displacement and global warming benefits

R&D focused on issues preventing market entry

- Distribution and blending
- Compatibility and durability
- Specifications and quality standards
- Regulated and non-regulated emissions
- Catalyst compatibility

Analysis of relevant policy questions

- Well-to-wheels analysis
- Air quality impacts
- Possible legislative drivers



Enable more efficient interim technologies

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Future engines will employ a range of advanced technologies:

- Variable valve actuation, multiple injection events, variable geometry turbo
- Variable compression ratio, internal EGR
- Advanced catalyst systems

These enable highly efficient, low emissions operating strategies:

- Low temperature combustion
- Rich – smokeless combustion
- Expanded range of HCCI operation
- Miller cycle and other valve timing strategies

R&D focused on identifying fuel properties enabling greater benefits:

- Renewables content
- Mixture formation, ignition, low temperature combustion
- Aftertreatment performance

Analyses to show benefits of new technologies



DOE Invitational Workshop on Advanced Combustion & Fuels

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- Advanced combustion regimes, fuel formulations, and interactions
- Argonne National Laboratory, June 2003
- 100 participants
 - industry, energy, DOE, national labs, universities
- Six discussion topics
 - **Base fuels**
 - **Blending agents**
 - Aftertreatment
 - Engines
 - Combustion modeling
 - In-cylinder combustion
- Final summary not issued yet



Input from Argonne Workshop

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- Low NOX combustion will probably not work under all operating conditions, necessitating the continued need for aftertreatment
- Everyone agrees on the importance of reducing sulfur in fuels, although there is not yet agreement as to the level needed
- There is not agreement relative to reducing aromatics
- Research is needed to determine optimal fuel properties for low NOX combustion engines.



General Fuels Issues from Argonne Workshop

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- Should sulfur be below current 15 ppm standard?
- Is it more economical to remove sulfur at refinery or on vehicle?
- Are lower aromatics needed?
- Refinery operating efficiency and maximizing refinery output must be considered in fuels decisions.
- Fuel safety must be considered in designing new fuels.
- Are there conflicting requirements for current and future engines?

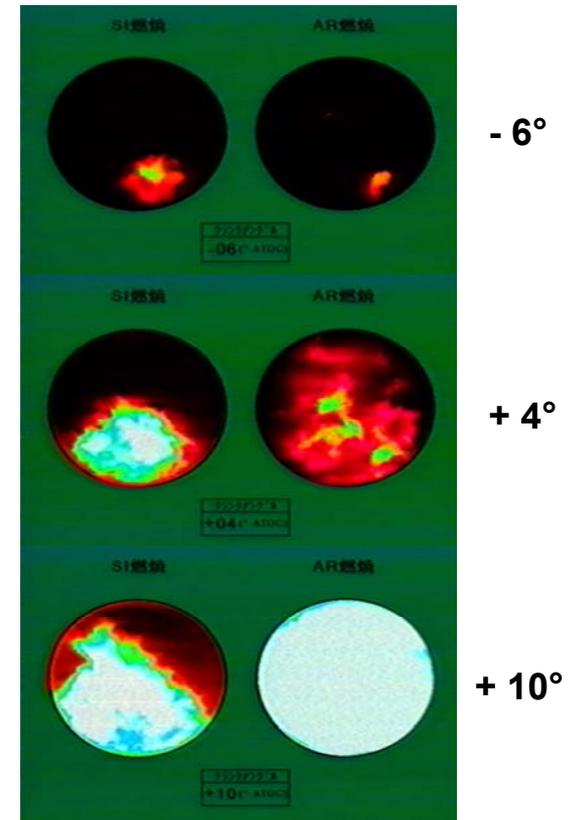


Possible fuel requirements for HCCI-type combustion

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- Lower cetane for longer mixing time?
- Higher octane for knock resistance?
- New measure for combustion characteristics?
- Less variation of fuel properties for better control?
- Narrower boiling range?
- More volatile fuel?





Fuels Technologies

to support FreedomCAR and 21st Century Truck

Advanced Petroleum Based & Non-Petroleum Based Fuels

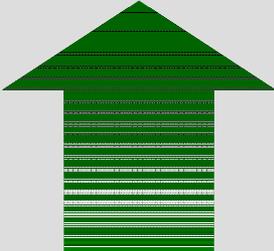
- Fuels for High Efficiency 2007-2010 Emission-Compliant Engines
- Fuels Advanced Combustion Regime Engines
- Hydrogen Transition Fuels
- Petroleum Displacement Fuels/Fuel Blending Components

New Technology Impacts

- Ecosystem Impacts of New Technologies

Fuels Technologies

Light-Duty Vehicles
Medium Trucks
Heavy Trucks



Collaboration

- H₂/Fuel Cells
- Biomass Energy
- Fossil Energy
- Advanced Engines
- Materials
- Vehicle Systems





NPBF and APBF – companion programs

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- APBF
 - Started in 2000
 - Multi-year research plan in place
 - Many accomplishments reported at DEER conferences
- NPBF
 - Started in 2003
 - Multi-year research plan beginning



Barriers and research needs

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Impact of fuel properties on combustion and engine optimization.

Impact of fuel properties on emissions and emission control systems.

Impact of new fuels on system durability.

Compatibility and infrastructure issues with new fuels.

Full cost analysis for new fuels.

Health and safety issues



Program Timeline

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- 2007
 - Fuel specifications for advanced combustion regime engines
 - Identify potential for 5% replacement of petroleum fuels
- 2010
 - Non-petroleum based fuels
 - Advanced engine concepts, high efficiency, low emissions
 - Validate 5% replacement of petroleum fuels over next decade
- 2020
 - Hydrogen-based transportation commercially viable



A child born today should have the option of a hydrogen vehicle for their first car

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