Driving Biofuels End Use: BETO/VTO Collaborations

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






BETO FY 2015 Peer Review

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Alexandria, Virginia

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EERE Vehicle Technologies Office

Oil Dependency is Dominated by Vehicles

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- Transportation is responsible for **66%** of U.S. petroleum usage
- **27%** of GHG emissions
- On-Road vehicles responsible for **85%** of transportation petroleum usage

- **16.0M** LDVs sold in 2014.
- **240 million** light-duty vehicles on the road in the U.S
- **10-15 years** for annual sales penetration
- **10-15 years** to turn over fleet

Poses significant economic, energy and environmental risks to U.S.



It takes decades of sustained effort to turn over the fleet

Fuels and Engines R&D

Expanding the use of alternative fuels and fuel-controlled combustion

Approach to increasing fuel economy

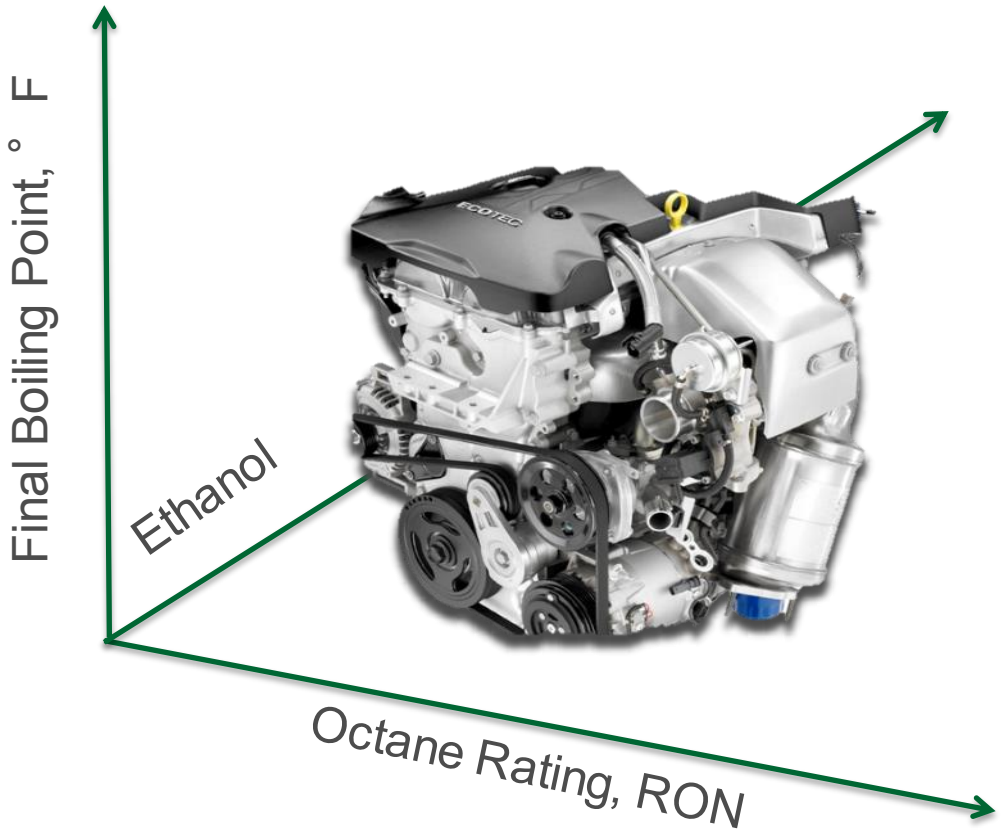
- **Downsizing is reduction of engine displacement.**
- **Downspeeding is reduction of engine speed.**
- **These are limited by knock, retaining acceptable power and torque.**
- **Require improving the engine power density.**
  - Turbochargers, superchargers
- **Power density is limited by available fuel octane rating.**

Ford Fusion:

1.6L Turbo	**2.5L NA**
24/37 MPG	22/34 MPG
178 HP	175 HP

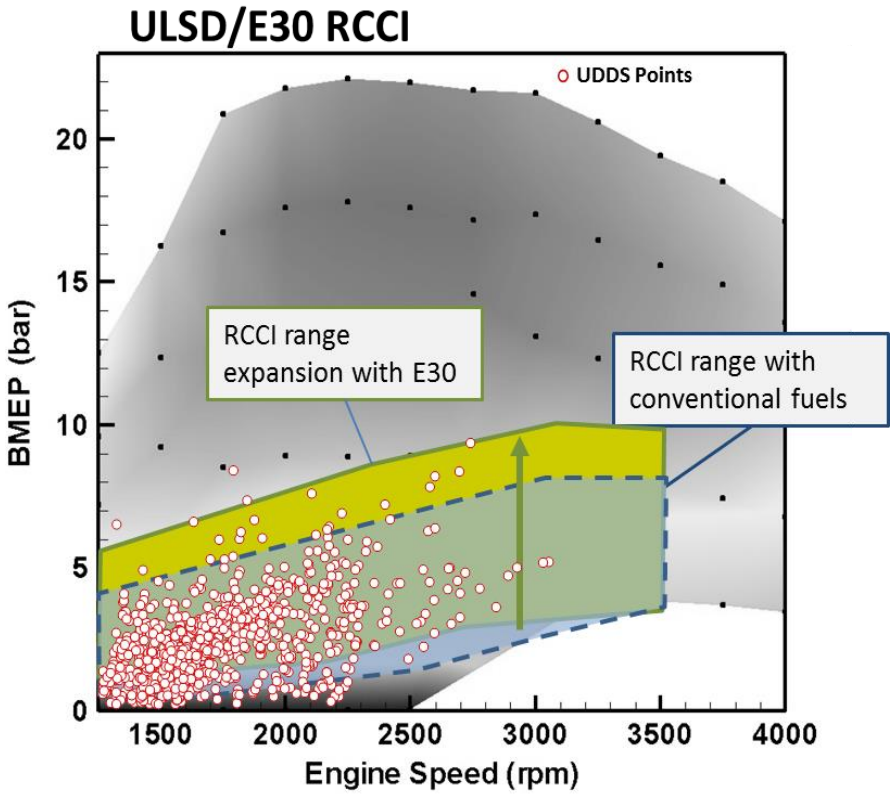
New reality: Fuel octane rating now influences fuel economy rather than just off-cycle engine power.

Gasoline Engine and Fuels Offering Reduced Fuel Consumption and Emissions (GEFORCE)

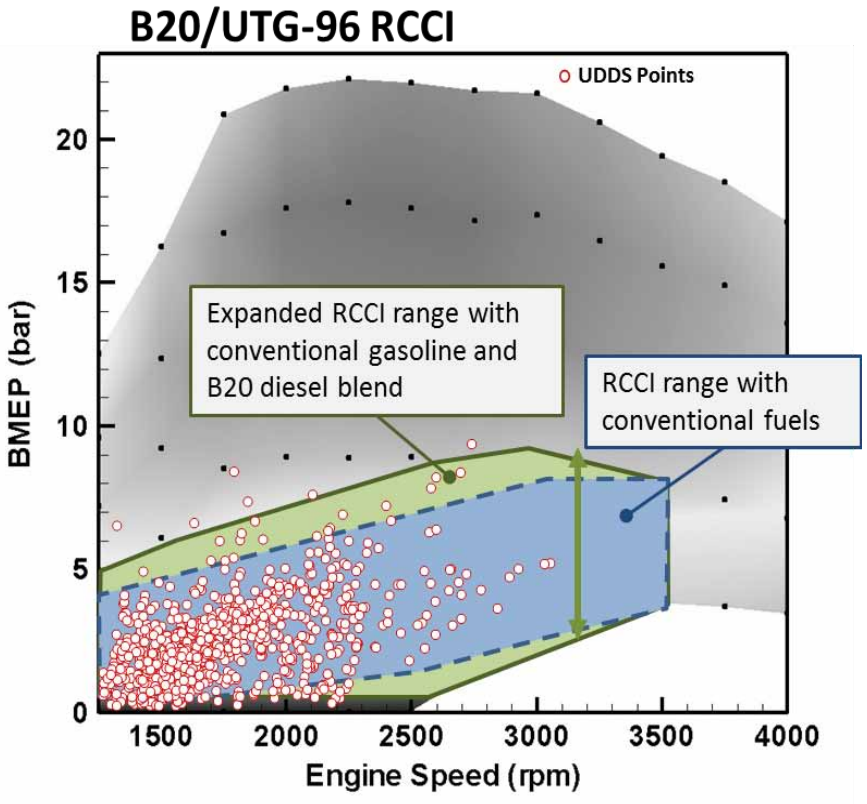


Advanced Conventional Engine + Realistic Fuels

Biofuel blends enhance kinetically controlled combustion



E30 - Higher fuel economy potential



B20 - Higher drive cycle coverage potential

the

CHALLENGE

Perfect Storm?

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Renewable Fuels Standard

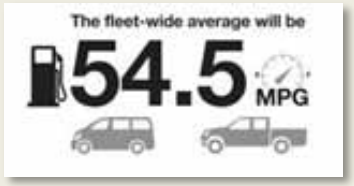
36 billion gallons by 2022

(EISA 2007)

Fuel Economy Standards

2025 CAFE Standards

(U.S. EPA and U.S. NTSA standards)



Emissions Regulations

70% NO_x & PM, 85% NMOG

< 10 ppm sulfur in gasoline

(U.S. EPA Tier 3 regulations)

EPA

- **Regulatory environment very challenging**
- **Goals of policy instruments partially conflicting under BAU**
- **Presents unique opportunity for biofuels**

ICEs

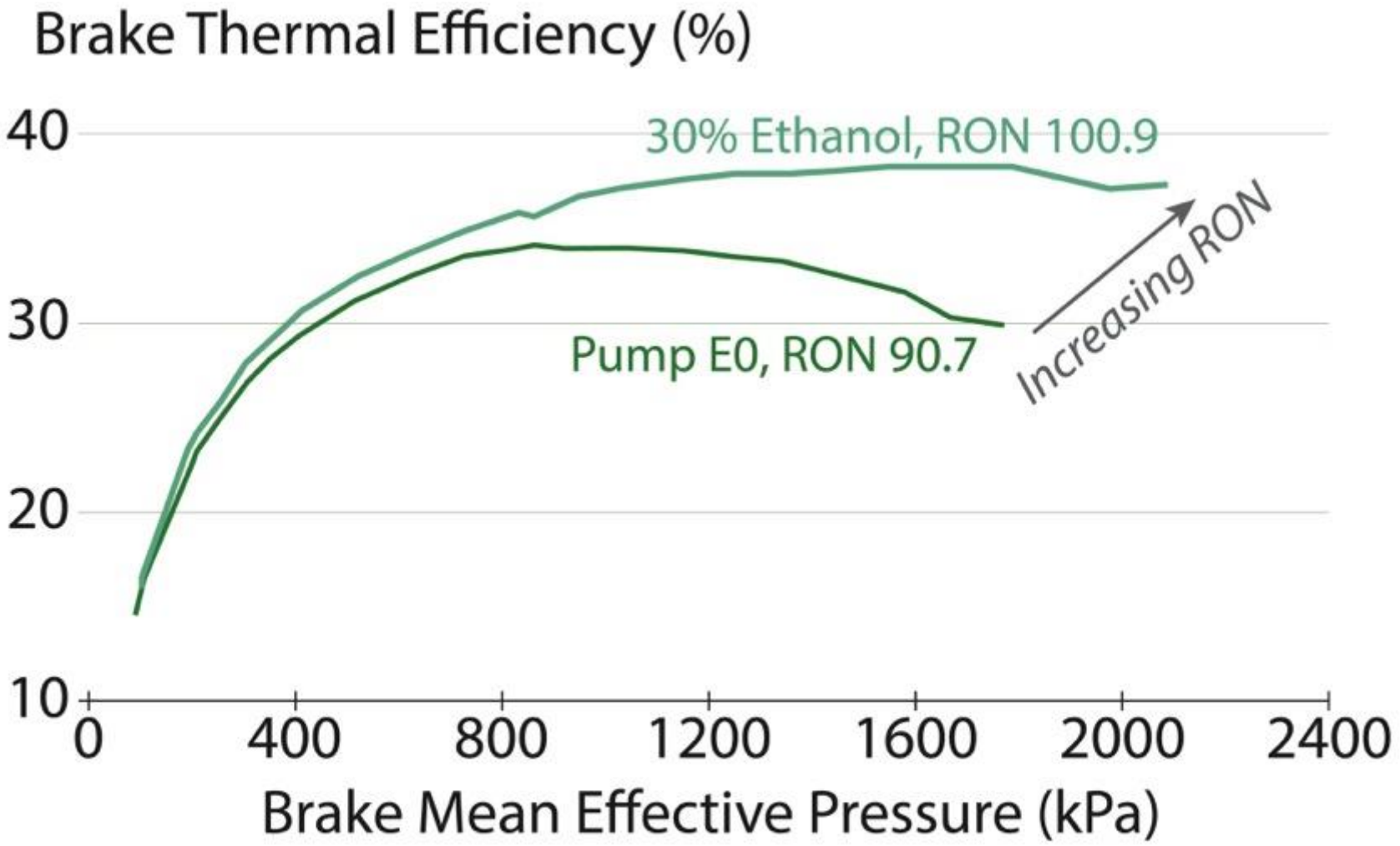
will

dominate

fleet

for decades

current fuels constrain engine design

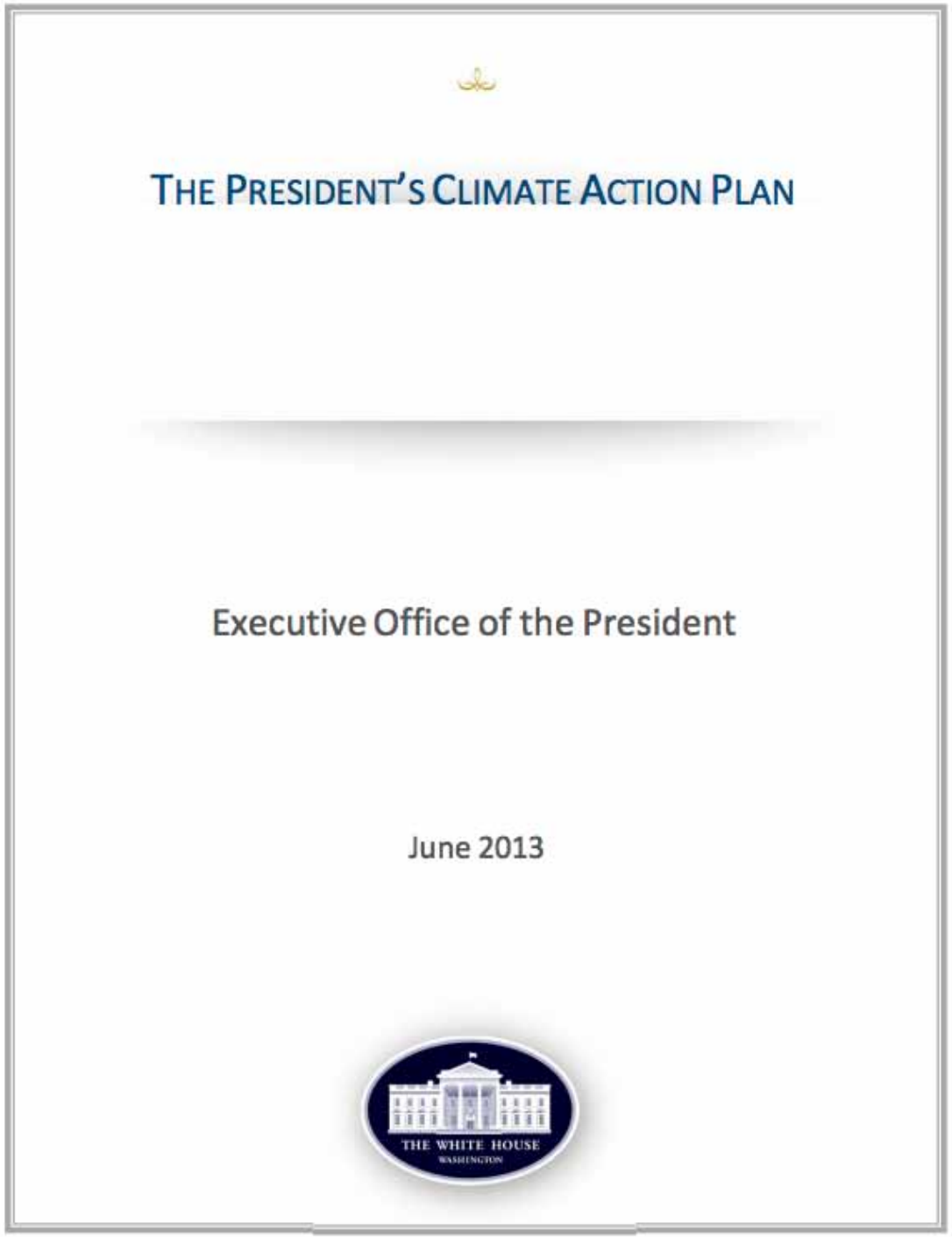


Engine: Ford Ecoboost 1.6L 4-cylinder, turbocharged, direct-injection, 10.1 CR
Source: C.S. Sluder, ORNL

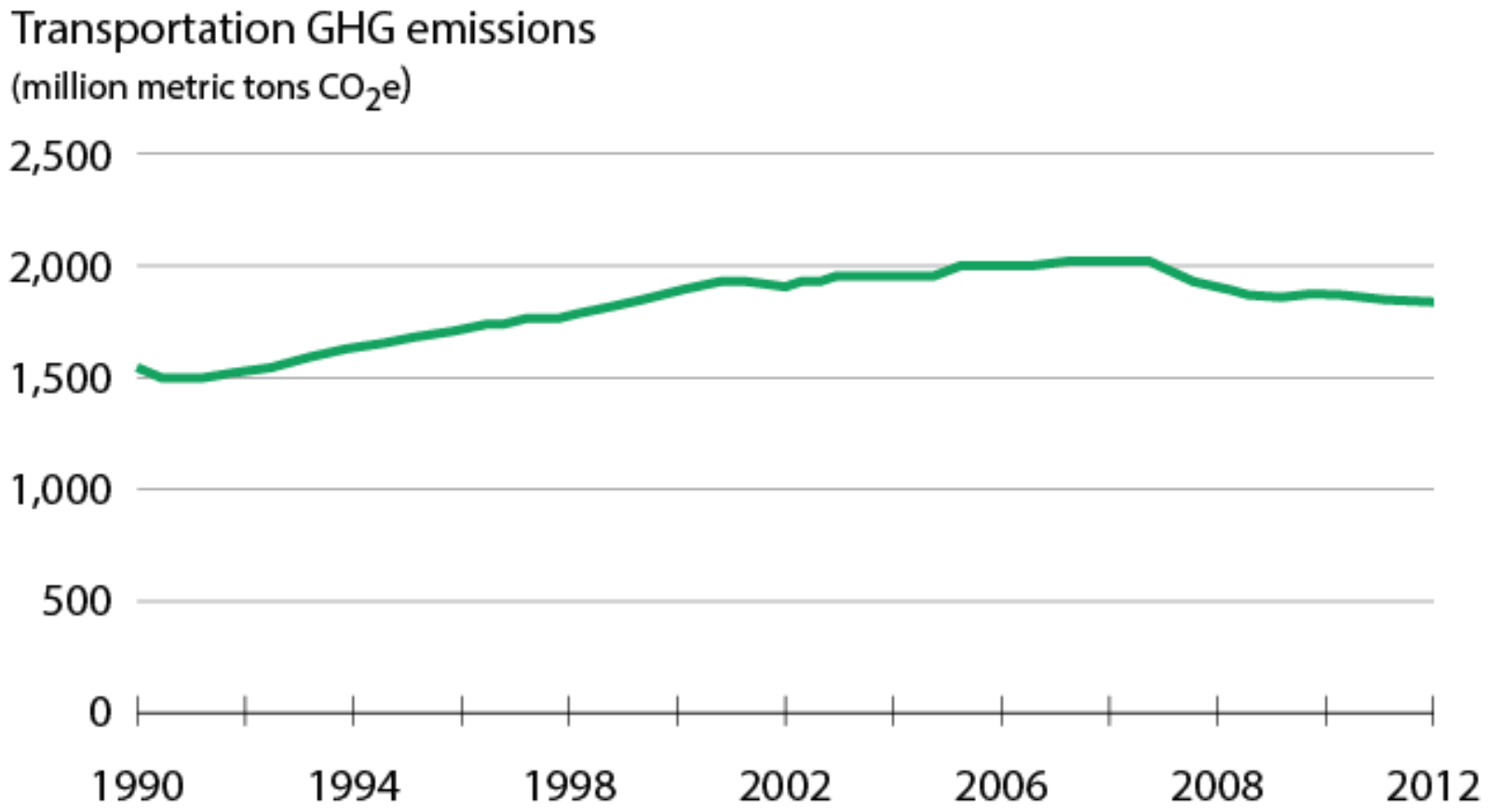
80%

reduction in transportation GHG by

2050



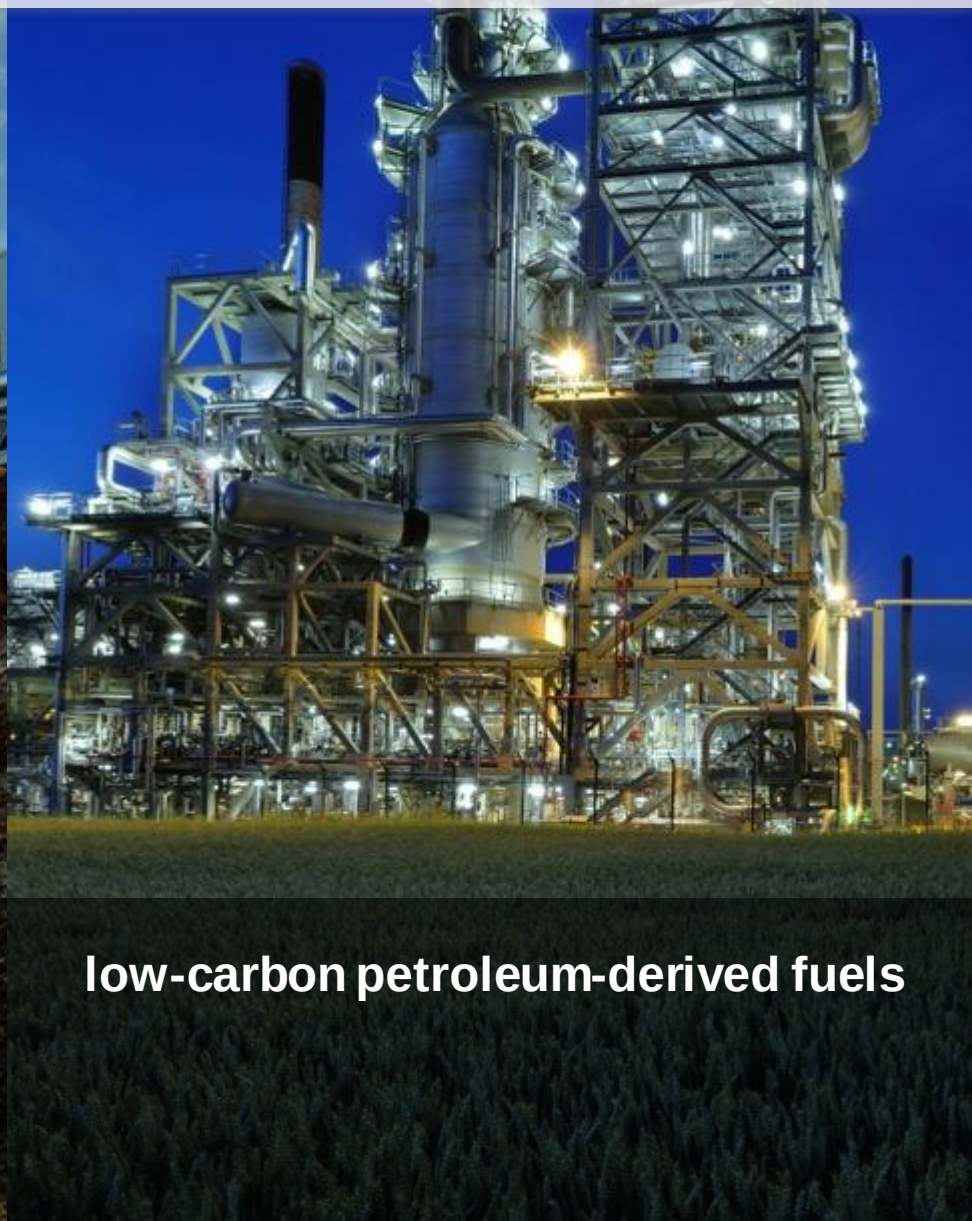
fuel and engine development
not progressing fast enough
to meet energy/climate goals



source: EPA

lower GHG fuels are essential

biofuels (biochemical and thermochemical)



low-carbon petroleum-derived fuels

substitutes for petroleum

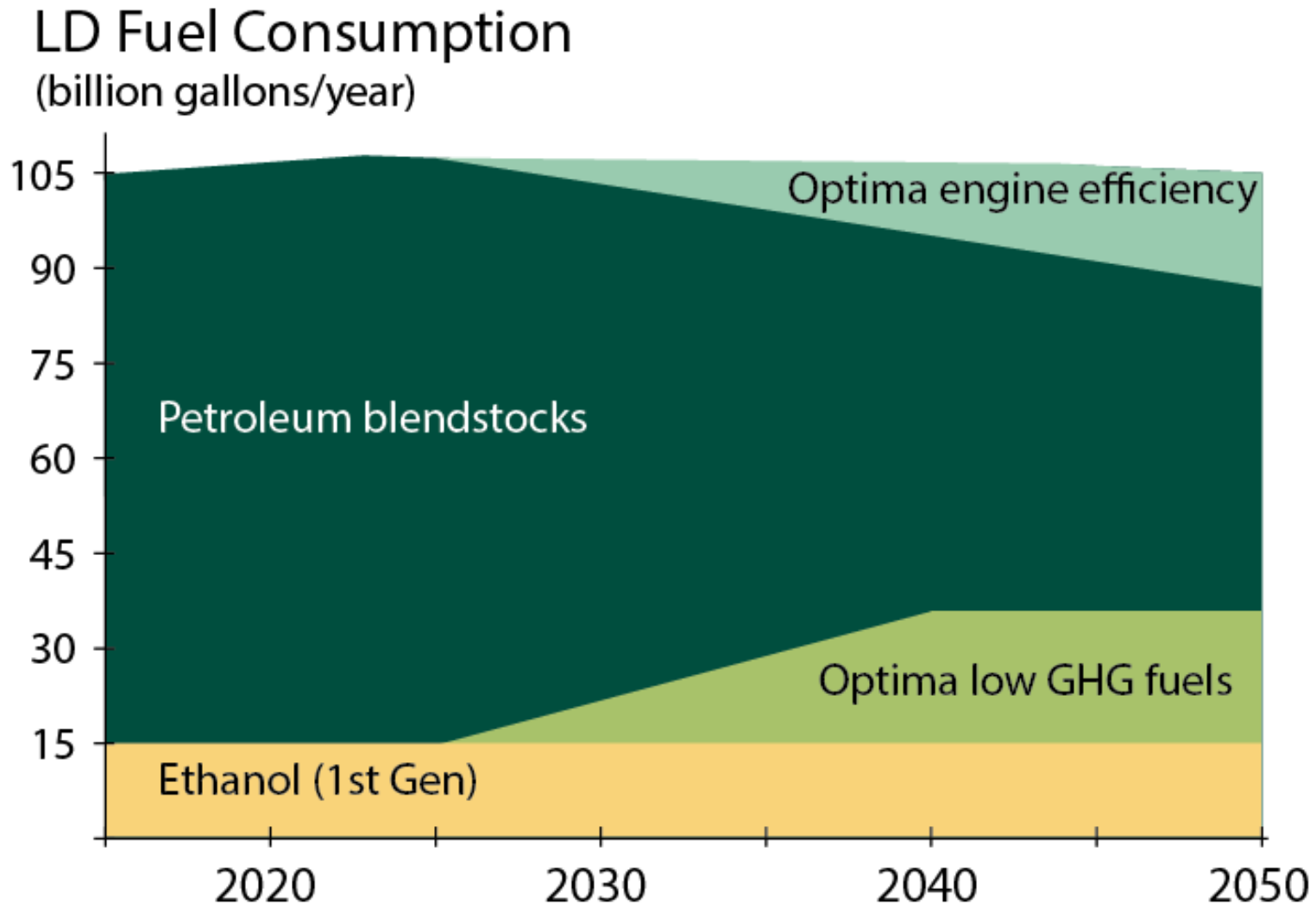
are deploying too slowly

the

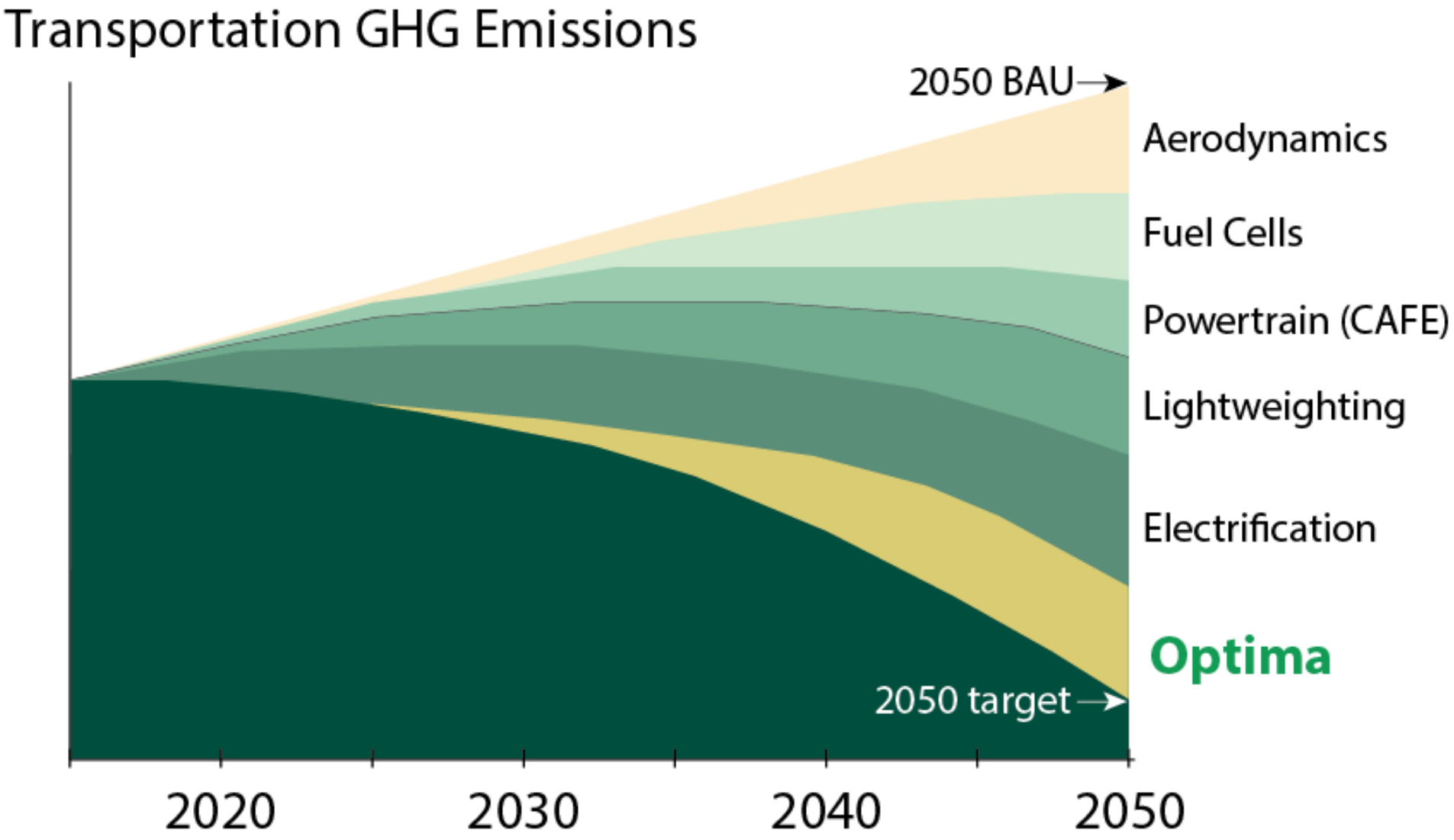
OPPORTUNITY

co-optimize
fuels and engines

30% petroleum reduction through efficiency and displacement



9-14% GHG reduction



New Fuels-Vehicle Systems Optima Approach

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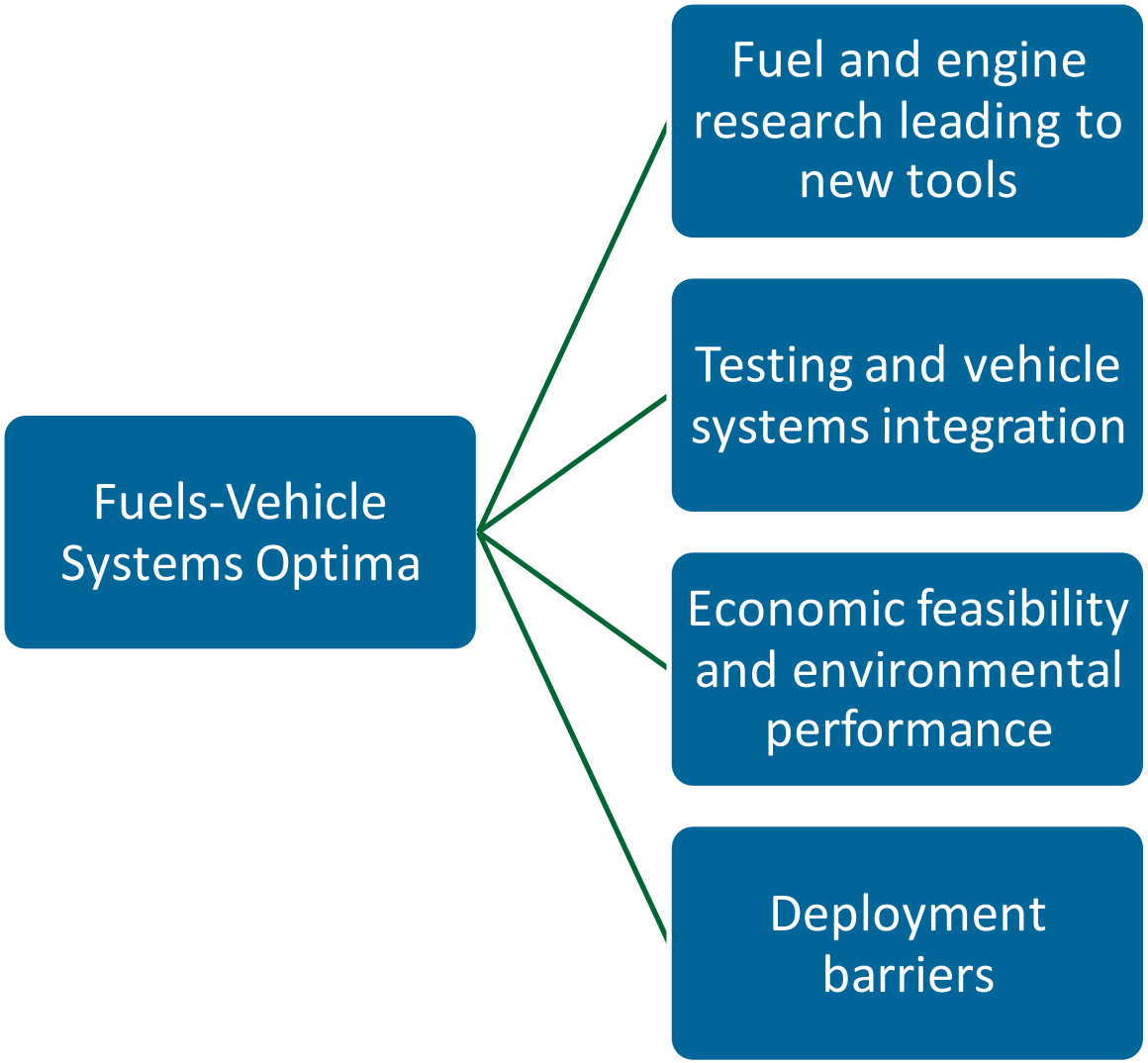
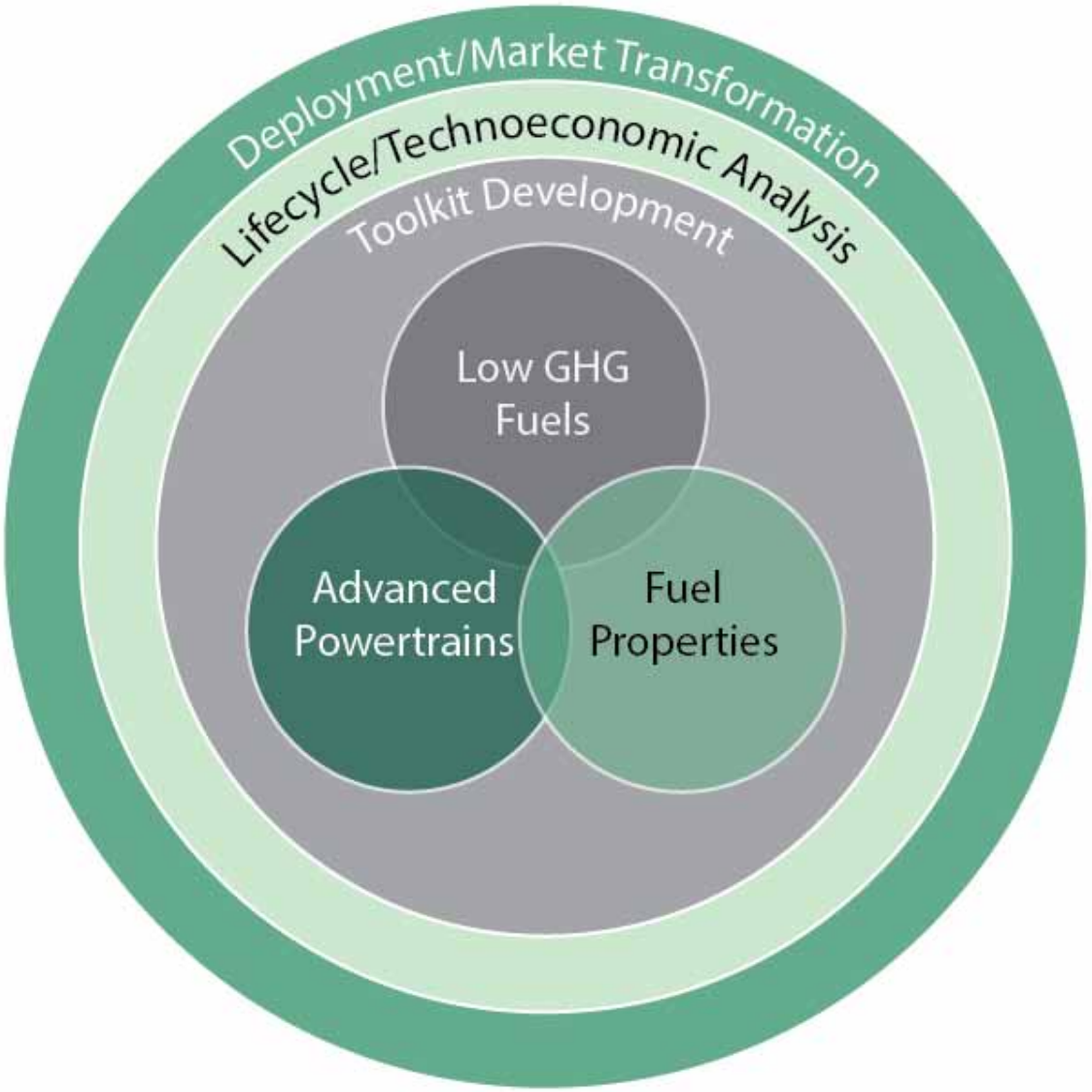


Target market entry of solutions within 10 years

integrated R&D efforts



comprehensive

end-to-end

approach

solutions for
light, medium, and heavy-duty
vehicles that catalyze biofuel markets

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jennifer dunn
scott curran
steve ciatti
robert wagner
david thompson
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bob mccormick
kevin kenney
kristi moriarty
paul miles
blake simmons
sibendu som
john storey
aaron brooker
taek lee
paul leiby
tim murphy
andy sutton
brian west
chuck mueller
teresa alleman
alicia lindauer
russell whitesides
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mary biddy
gurpreet singh
michael heitkamp
anthe george


better fuels
and
better vehicles
sooner