BIO ENERGY
U.S. DEPARTMENT OF ENERGY
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Co-Optimization of Fuels and Engines

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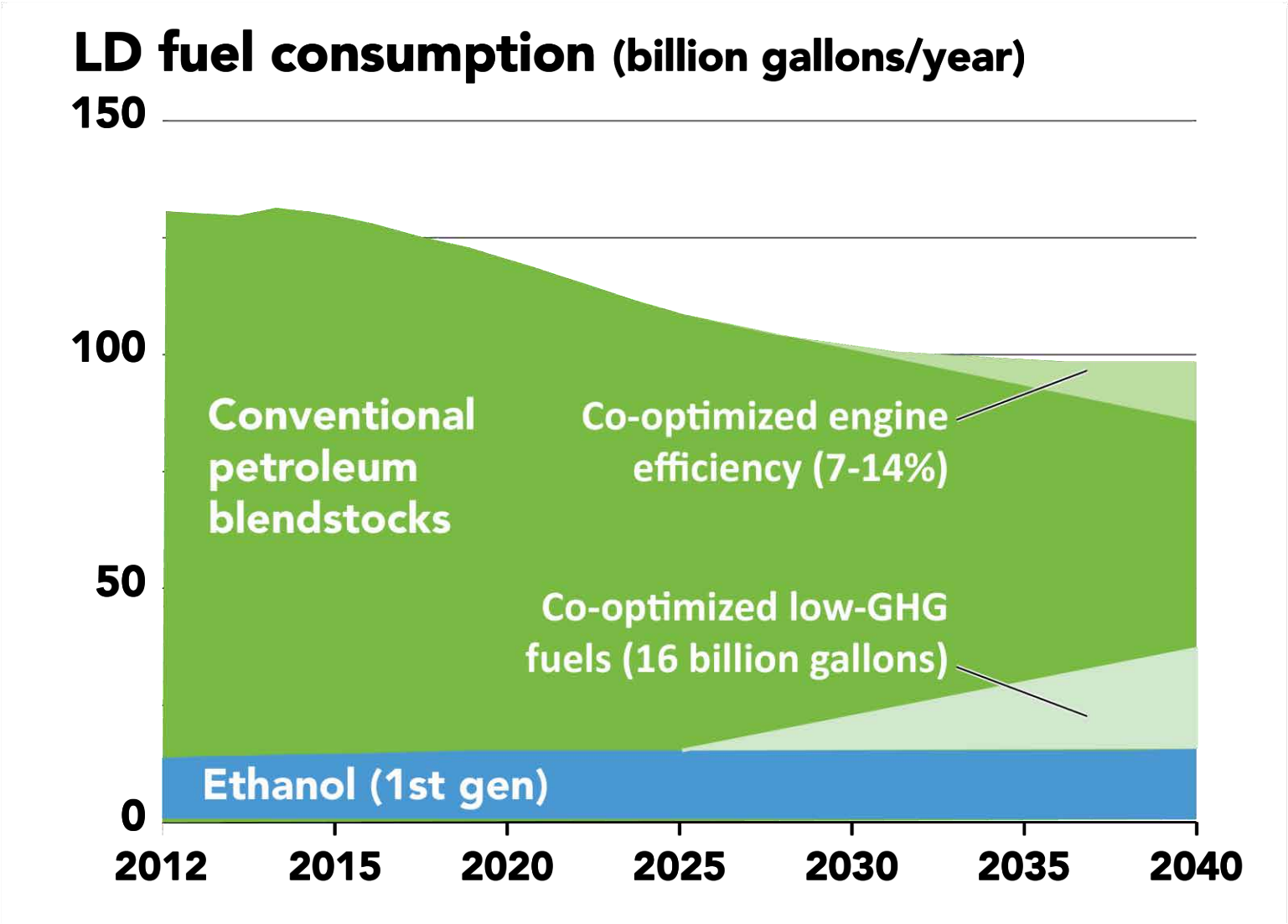
Goal: better fuels and better vehicles **sooner**

Fuel and Engine Co-Optimization

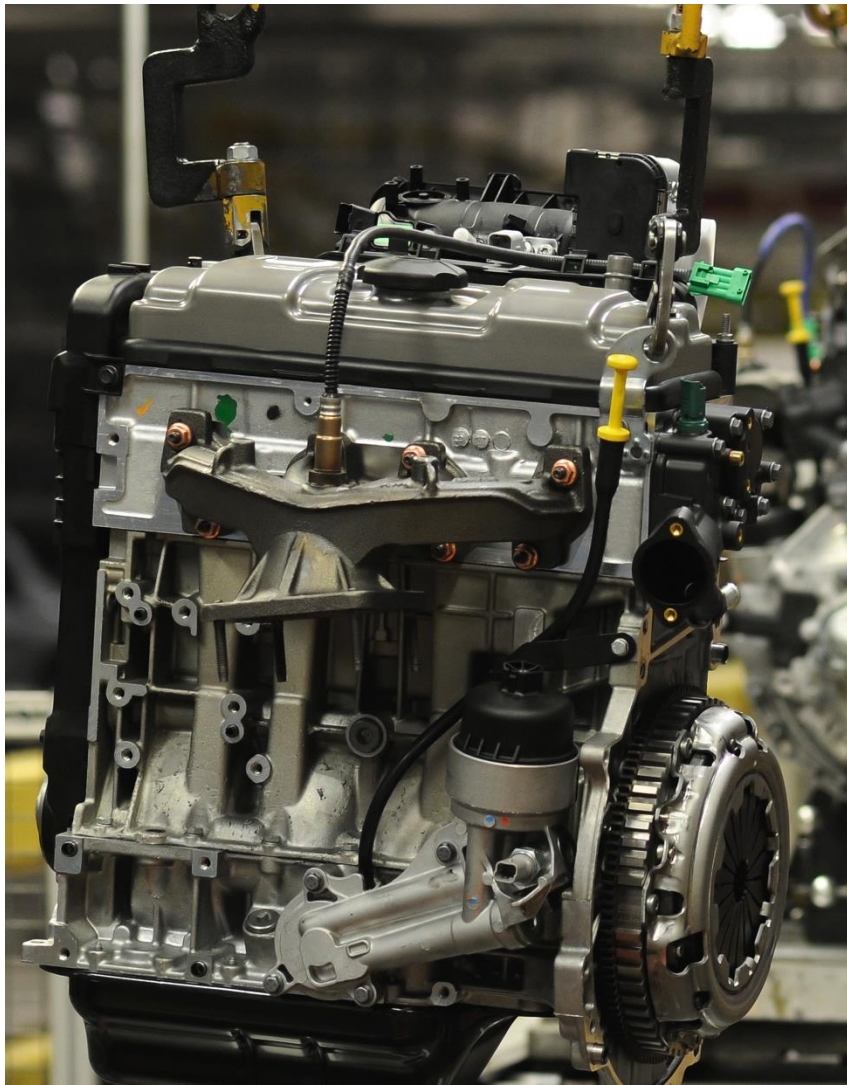
- What <u>fuel properties</u> maximize engine performance?
- How do <u>engine parameters</u> affect efficiency?
- What <u>fuel and engine combinations</u> are sustainable, affordable, and scalable?

30% per vehicle petroleum reduction via efficiency and displacement



Governing Co-Optima hypotheses:

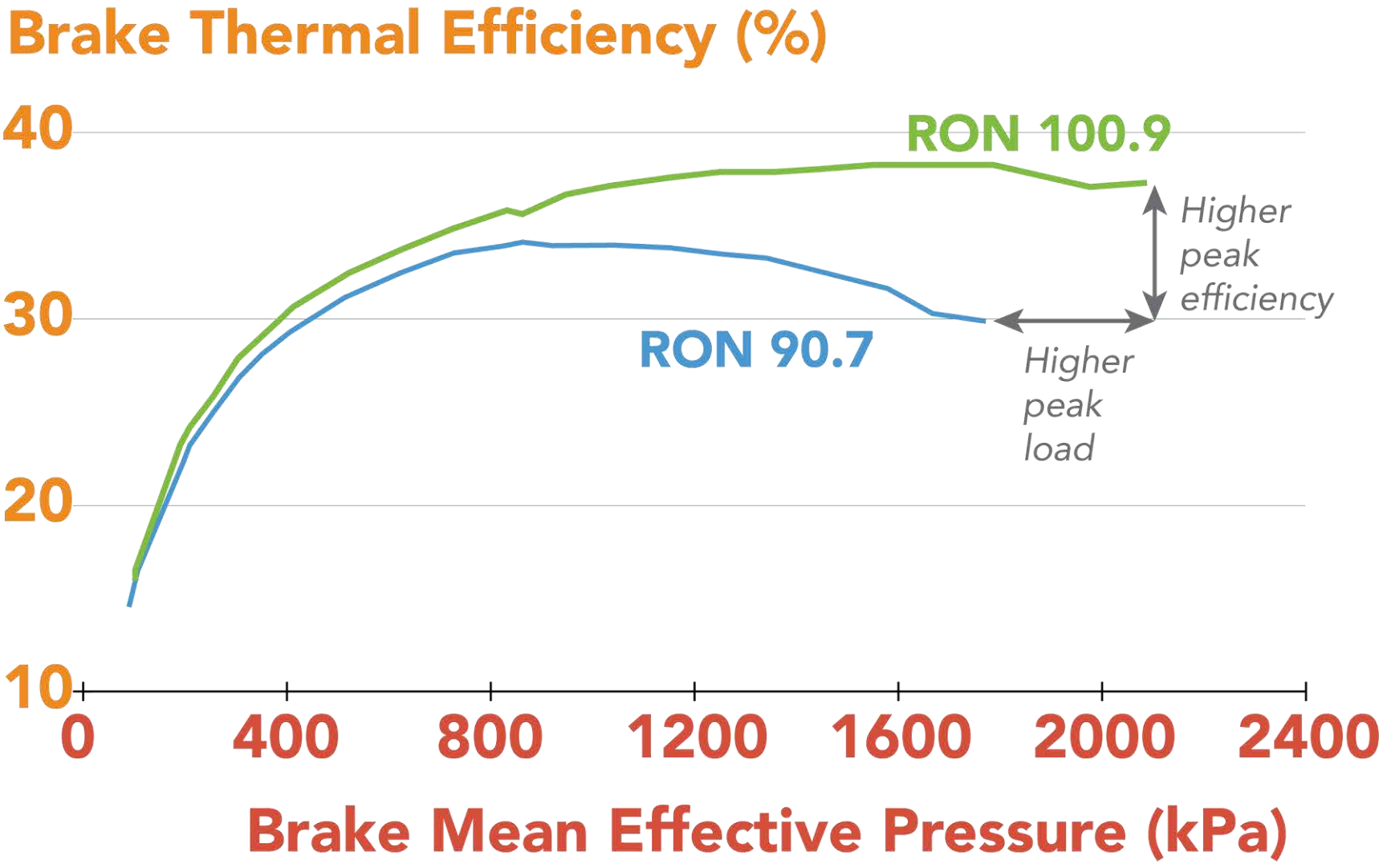
There are engine architectures and strategies that provide higher thermodynamic efficiencies than available from modern internal combustion engines; new fuels are required to maximize efficiency and operability across a wide speed/load range



Governing Co-Optima hypotheses:

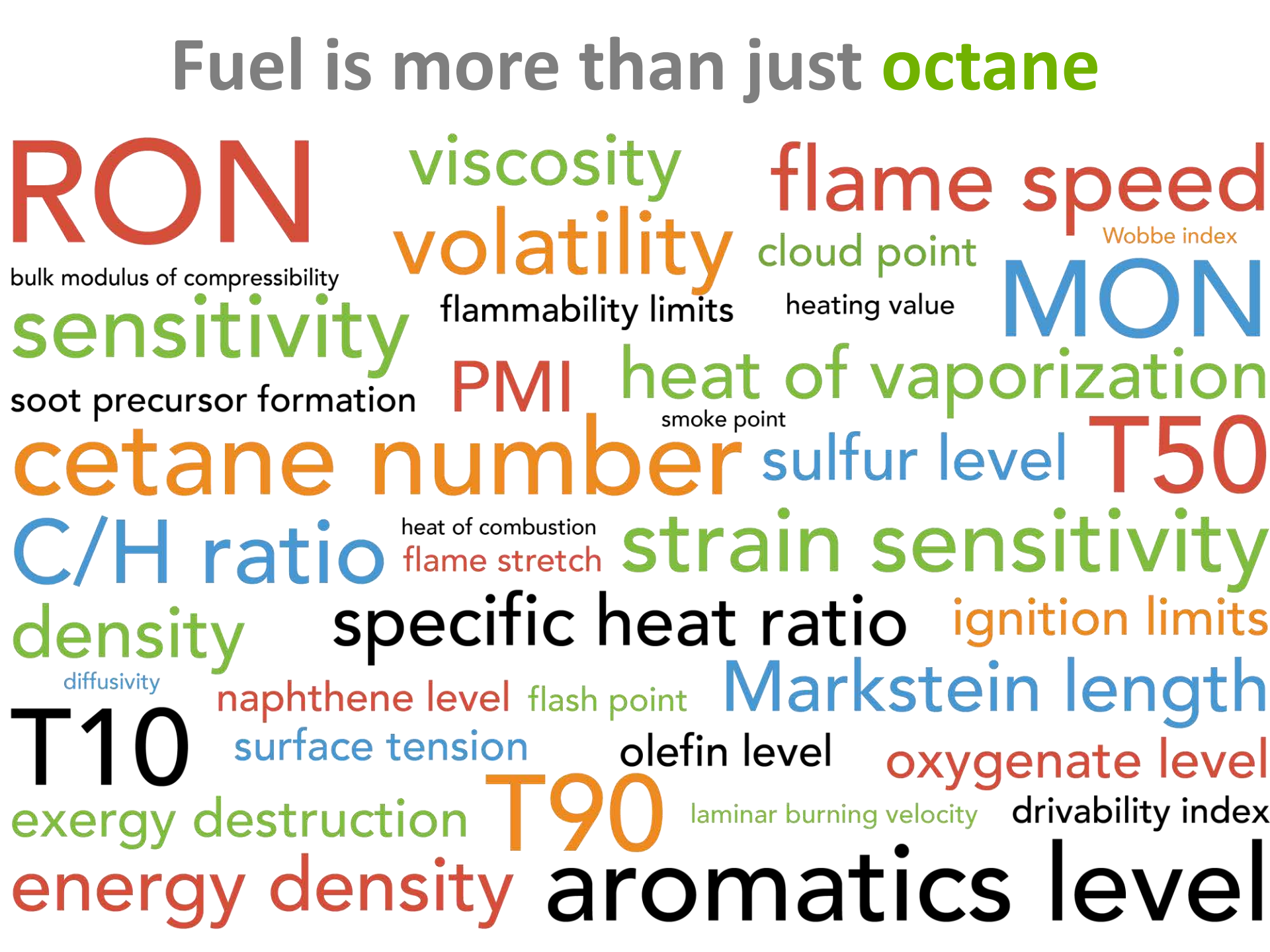
If we identify target values for the critical fuel properties that maximize efficiency and emissions performance for a given engine architecture, then fuels that have properties with those values (regardless of chemical composition) will provide comparable performance

Current fuels **constrain** engine design



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

Fuel is more than just octane



Leveraging expertise and facilities from 9 national labs

Integrated multi-lab teams with significant external stakeholder engagement

13 Light and heavy duty vehicle manufacturers

10 Oil companies/refiners

8 Biofuel companies

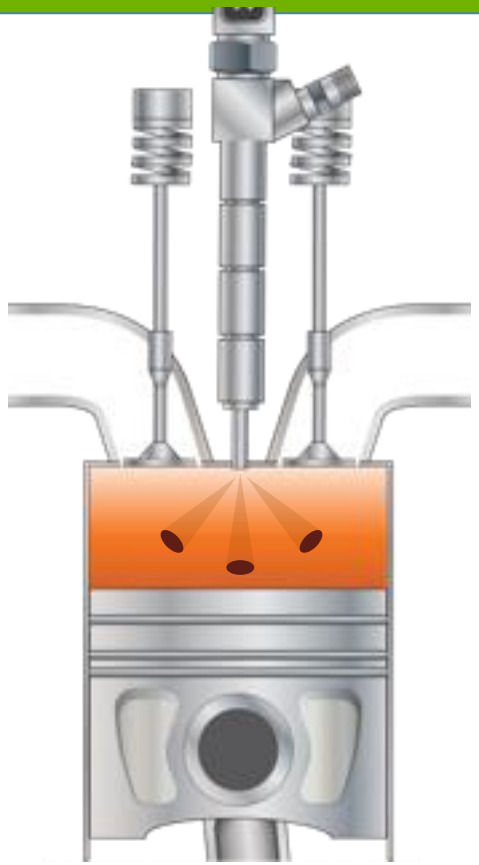
4 Regulatory agencies

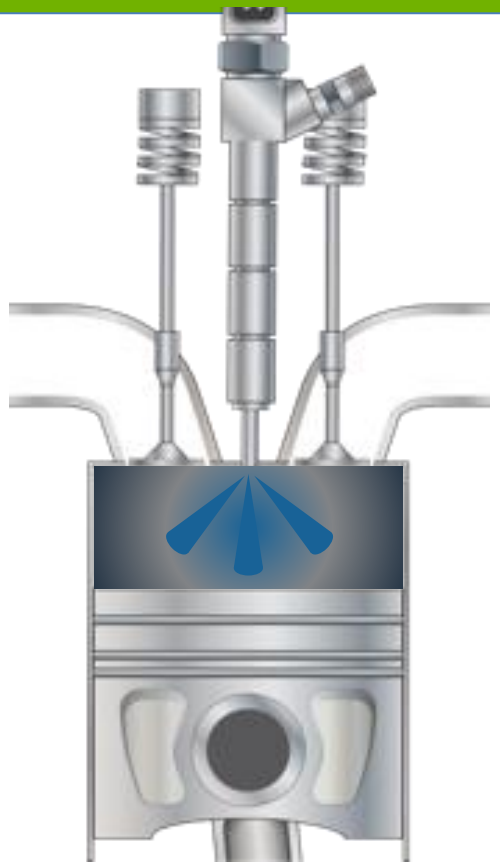
2 End consumer organizations

Parallel efforts underway

Thrust I: Spark Ignition (SI)

Thrust II: Advanced Compression Ignition
kinetically-controlled and compression-ignition combustion





Low reactivity fuel

Range of fuel properties TBD

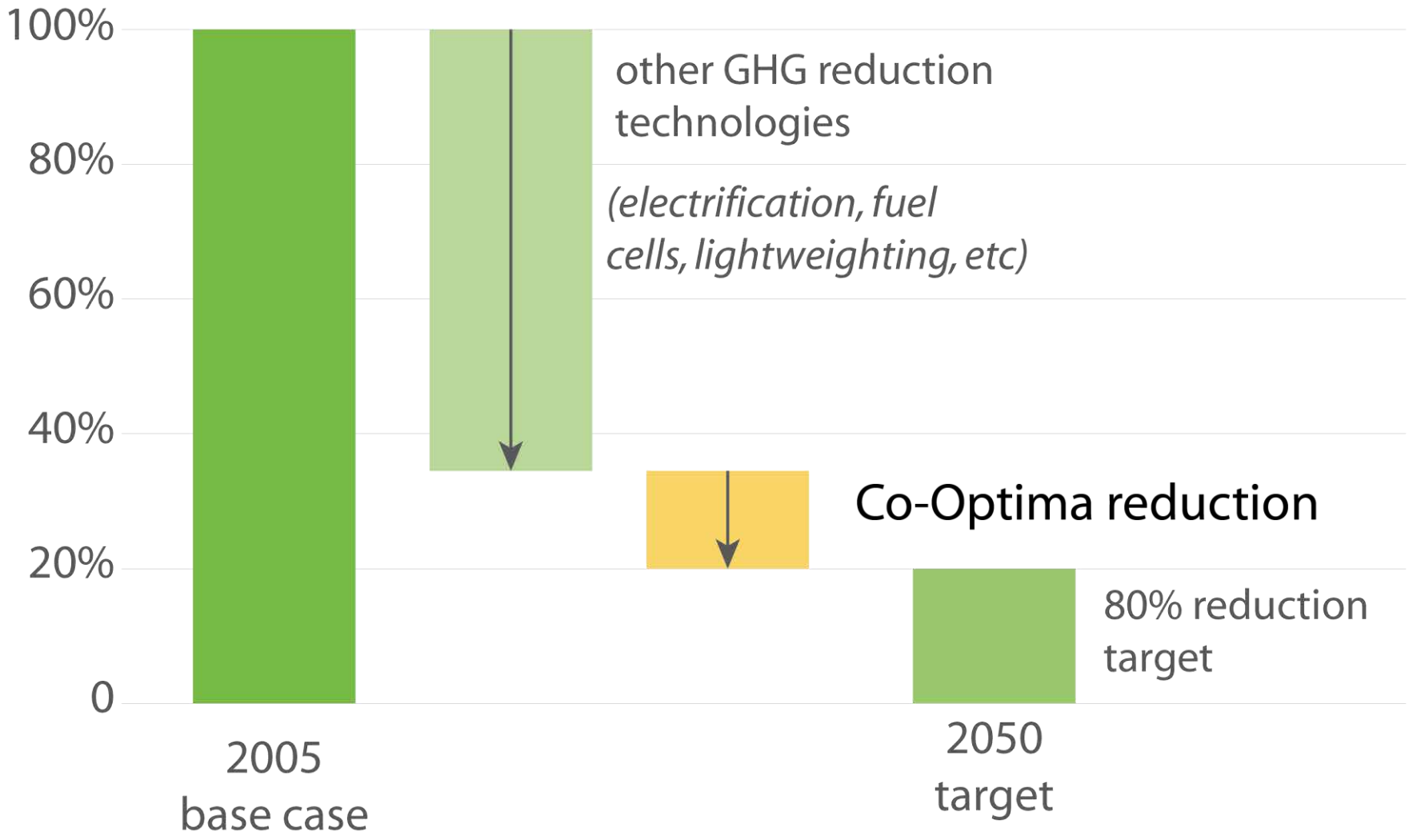
High reactivity fuel

Applicable to

light, medium, and heavy-duty engines

hybridized and non-hybridized powertrains

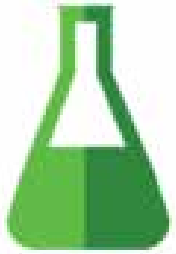
National goal: 80% reduction in transportation GHG by 2050



Six integrated teams

Low Greenhouse Gas Fuels

Advanced Engine Development



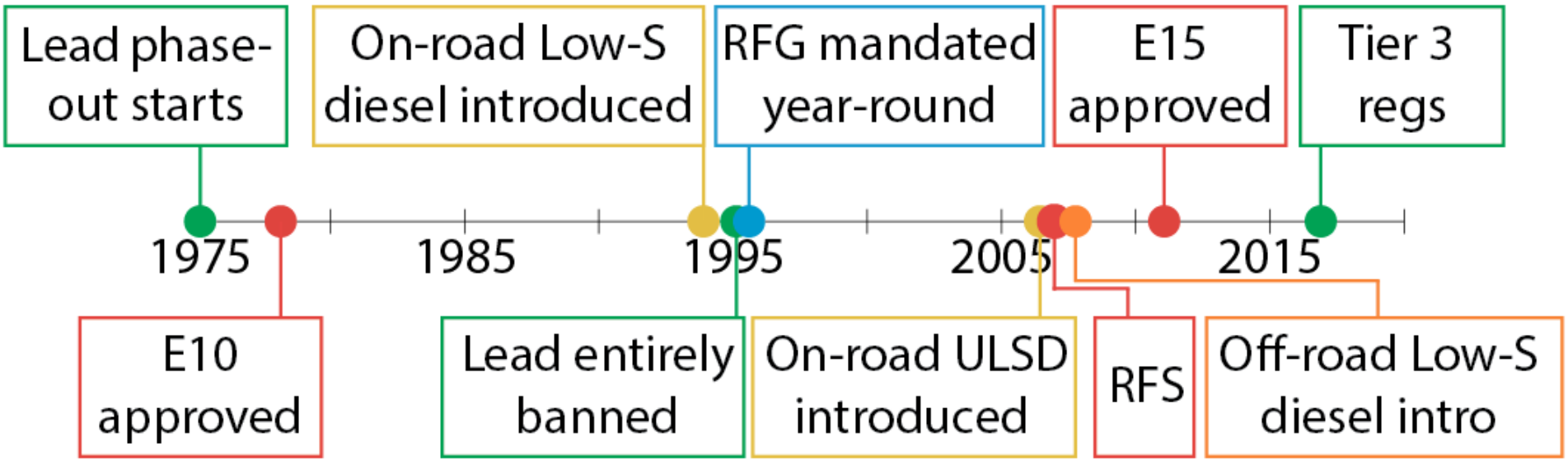
Fuel Properties

Modeling /Simulation Toolkit

Analysis of Sustainability, Scale, Economics, Risk, and Trade

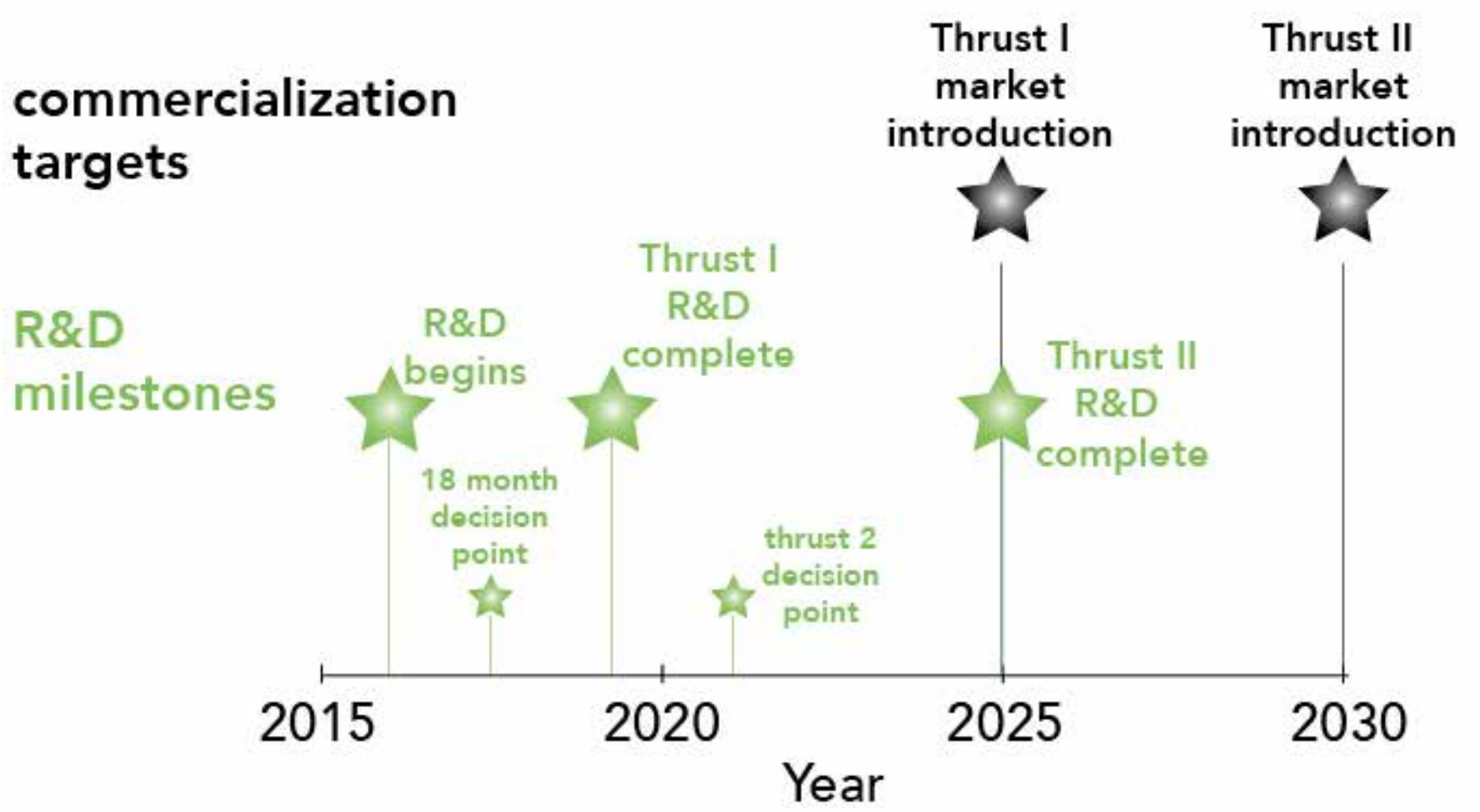
Market Transformation

Identifying/mitigating market barriers



Identify and mitigate challenges of moving new fuels/ engines to markets

Engage stakeholders across value chain


commercialization targets
R&D milestones
Thrust I market introduction
Thrust II market introduction
Thrust I R&D complete
R&D begins
Thrust II R&D complete
18 month decision point
thrust 2 decision point
2015
2020
2025
2030
Year

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Jennifer Dunn (ANL), Matt McNenly (LLNL), Doug Longman (ANL)

Other Co-Optima Leadership Team Members:

John Holladay (PNNL), Art Pontau (SNL), Robert Wagner (ORNL)

Thank You

Back-up Slides