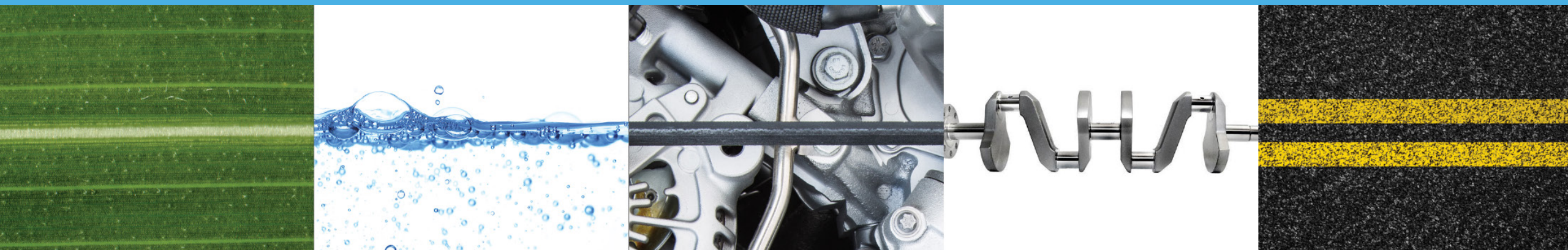
Co-Optima Initiative
Directed Funding Opportunity (DFO)

Anthe George

December 3, 2020

CO-OPTIMIZATION OF
FUELS & ENGINES

better fuels | better vehicles | sooner



U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Directed Funding Opportunity Process and Content

Definition of a Directed Funding Opportunity (DFO) and Schedule

Competitive process to identify externally-driven projects performed by the Labs

- Labs develop call
- Partner proposes work to be performed at the Labs
- Partner and Lab agree on joint scope of work and execute CRADA
- No DOE funds to partner
- Partner provides non-federal 20% cost share of total award (may be cash or in-kind)
- Labs and DOE will use external peer review during proposal evaluation
- US-based organizations only*

**Exceptions can be made through a DOE waiver*

Timeline for Co-Optima Directed Funding Opportunity	
Date	Action
November 13, 2020	Co-Optima DFO announcement
Weeks of November 30th and December 7th	Industry-requested teleconferences where potential proposers can interact with all Co-Optima researchers interested in collaboration with that particular company
December 3, 2020	Webinar describing Co-Optima DFO opportunity
January 14, 2020 (5:00 pm ET)	Proposal submission deadline
March 1, 2020	Anticipated final selection decisions and notification
May 1, 2021	Anticipated project kickoffs

Direct questions or partnership inquiries to co-optima-dfo@googlegroups.com

How are the projects structured?

Projects will be CRADAs

- The DOE funds will go to the Labs - no DOE funds to proposing organization
- Joint Work Statement and non-negotiable, fixed-term CRADA (i.e., no modifications; templates provided)
  - Partner must be willing to accept CRADA terms
- White Paper/Proposal template
  - http://blogs.anl.gov/cooptima/wp-content/uploads/sites/85/2020/10/2-Co-Optima-DFO-White-Paper-Template-Including-JWS.docx
  - Total proposal length <12 pages
  - Maximum file size – 8 MB

Key Program Elements	
Duration	12-18 months
Expected # Awards	4
DOE Share of Each Project	$250K
Cost Share of Each Project	20% of total project ($50K)
Contract Type	Fixed Term CRADA
Who receives DOE funds?	One or more national labs currently part of Co-Optima
Cost Share Types	Cash or in-kind (labor, supplies, equipment, etc.) from non-federal sources

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Participant requirements

1. For-profit entities, educational institutions, and nonprofits that are incorporated (or otherwise formed) under the laws of a particular State or territory of the United States and have a physical location for business operations in the United States are eligible to apply for funding. Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995, are not eligible to apply for funding.

2. All Co-Optima partner Labs are eligible to perform work

How is the Lab participant determined?

- The proposer may specify one or more Lab(s) in proposal. If proposer specifies Lab(s), the Lab(s) specified will do the work. No additional Labs will be added by Co-Optima.
- If no Lab is specified, the Steering Committee will propose one or more Labs based on capability statements that have been developed over the past several months
- Interested parties can visit cooptima.org to see a list of capabilities and contacts
- Interested parties can also request a teleconference with the participating national laboratories.
    - Co-Optima researchers interested in collaboration with the organization will participate and provide information on Lab capabilities

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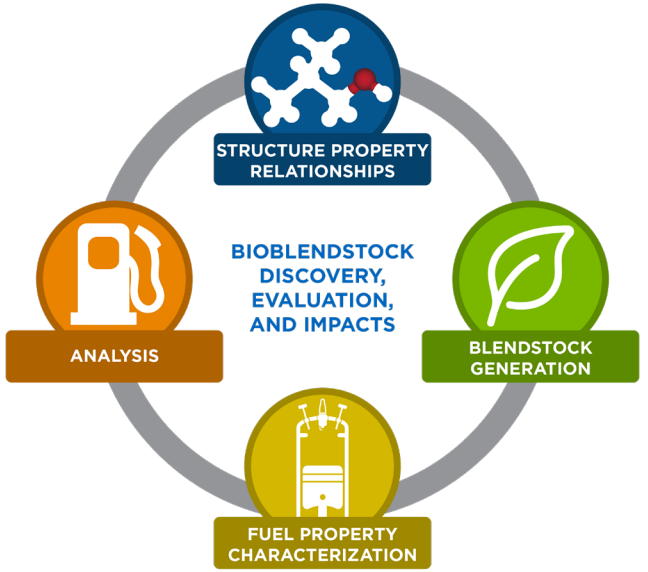
Topics specifically of interest to this DFO

- **Foundational and applied R&D at the fuel-engine interface**
  - This call seeks proposals to advance foundational knowledge at the fuel-engine interface, as well as applied R&D focused on advancing technologies that move promising bio-blendstocks and combustion approaches identified in Co-Optima closer to commercial adoption.

The primary purpose of this call is to accelerate adoption of new fuels and blendstocks from renewable resources, along with advanced combustion approaches, which enable higher efficiency and lower emissions in on-highway vehicles by leveraging national laboratory resources to overcome key technical challenges.



Topics specifically of interest to this DFO

We are particularly interested in proposals leveraging the following capabilities found at cooptima.org:

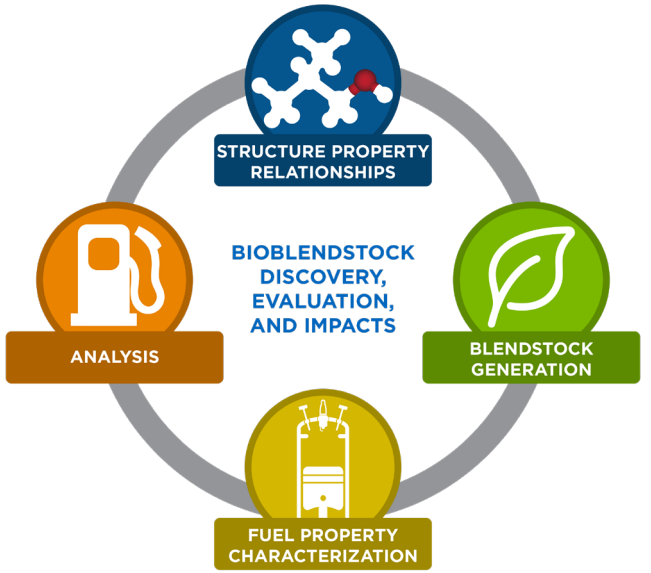
Experimental:
https://cooptima.org/capabilities/bio-blendstock-fuel-production-research/
https://cooptima.org/capabilities/bio-blendstock-fuel-property-research/

https://cooptima.org/capabilities/bio-blendstock-fuel-performance-and-combustion-research/

Computational:

https://cooptima.org/capabilities/kinetic-models-and-surrogate-mixtures-needed-for-simulation-of-combustion-in-engines/
https://cooptima.org/capabilities/target-identification/
https://cooptima.org/capabilities/properties/
https://cooptima.org/capabilities/impact/

https://cooptima.org/capabilities/performance/



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Co-Optima Background

Co-Optimization of Fuels and Engines (Co-Optima) Initiative

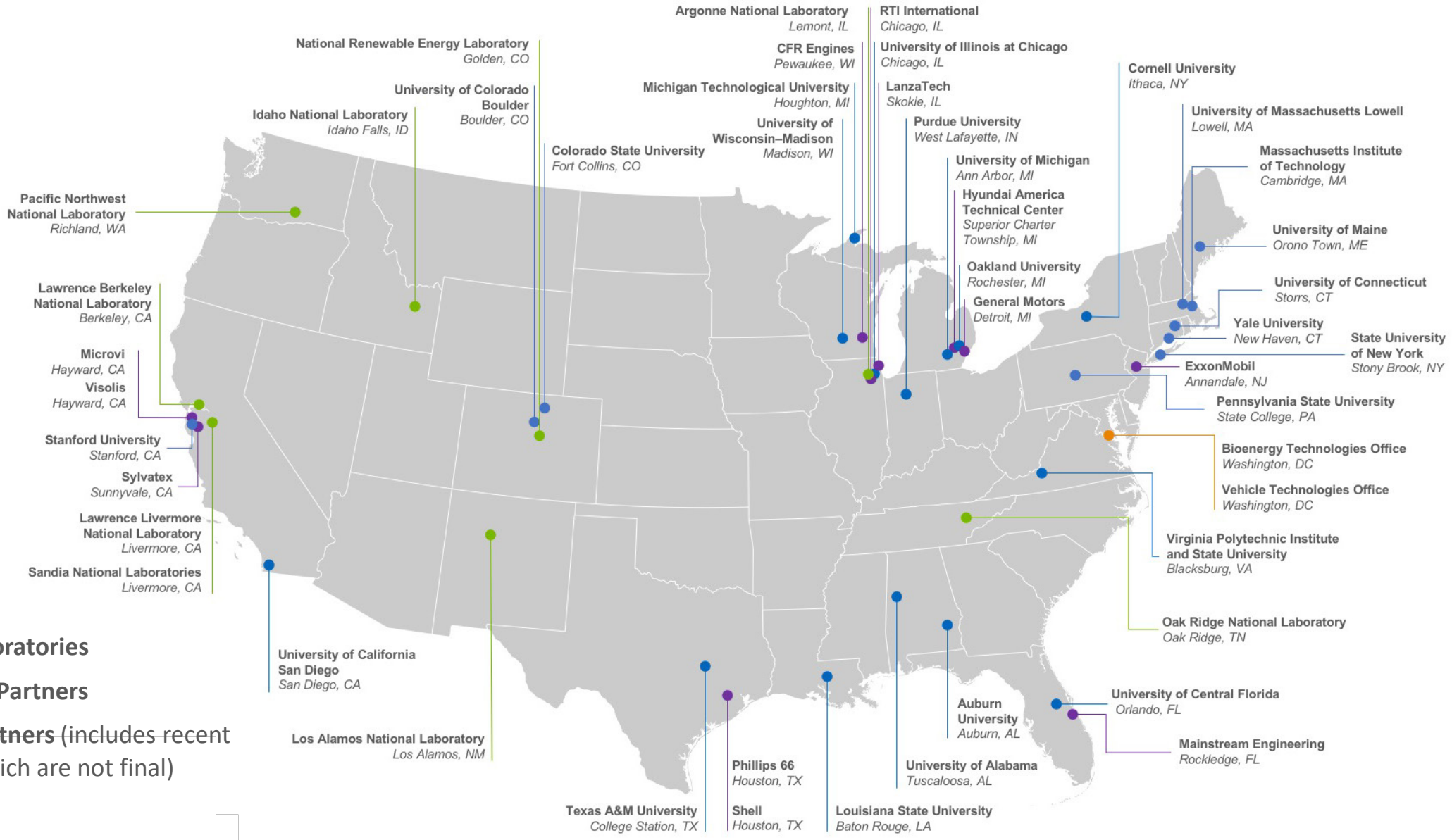
Co-Optimized Solution

Engine R&D Fuel R&D

Co-Optima: better fuels and better vehicles ***sooner***

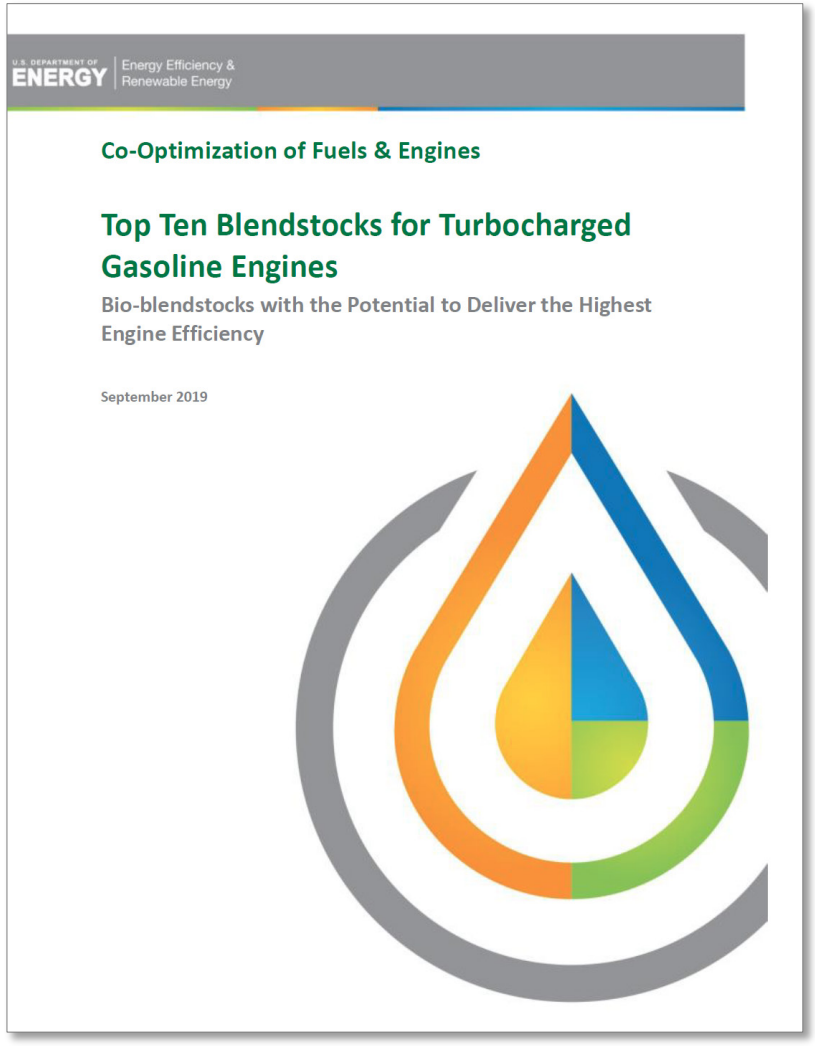
Objective: Advance the underlying science needed to develop fuel and engine technologies that will work in tandem to achieve significant efficiency and emissions benefits

Alignment of broad and deep expertise and facilities across the United States



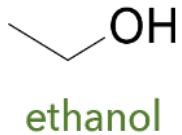
- **2 DOE Offices**
- **9 National Laboratories**
- **20+ University Partners**
- **8+ Industry Partners** (includes recent DFO awards which are not final)

Co-Optima Boosted Spark Ignition Fuels and Engines

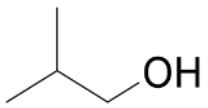


Blendstocks with highest merit function score

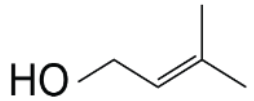
Alcohols



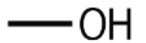
ethanol



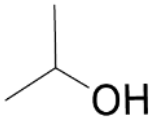
isobutanol



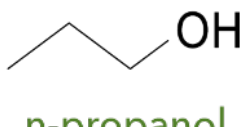
prenol



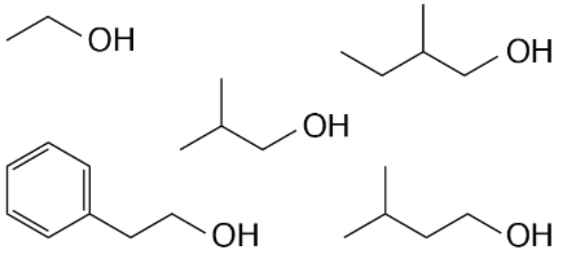
methanol



isopropanol

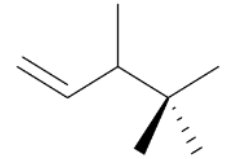


n-propanol



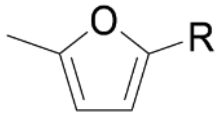
fusel alcohol blend

Olefins



di-isobutylene

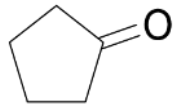
Furans



R= H, -CH_3

furan mixture

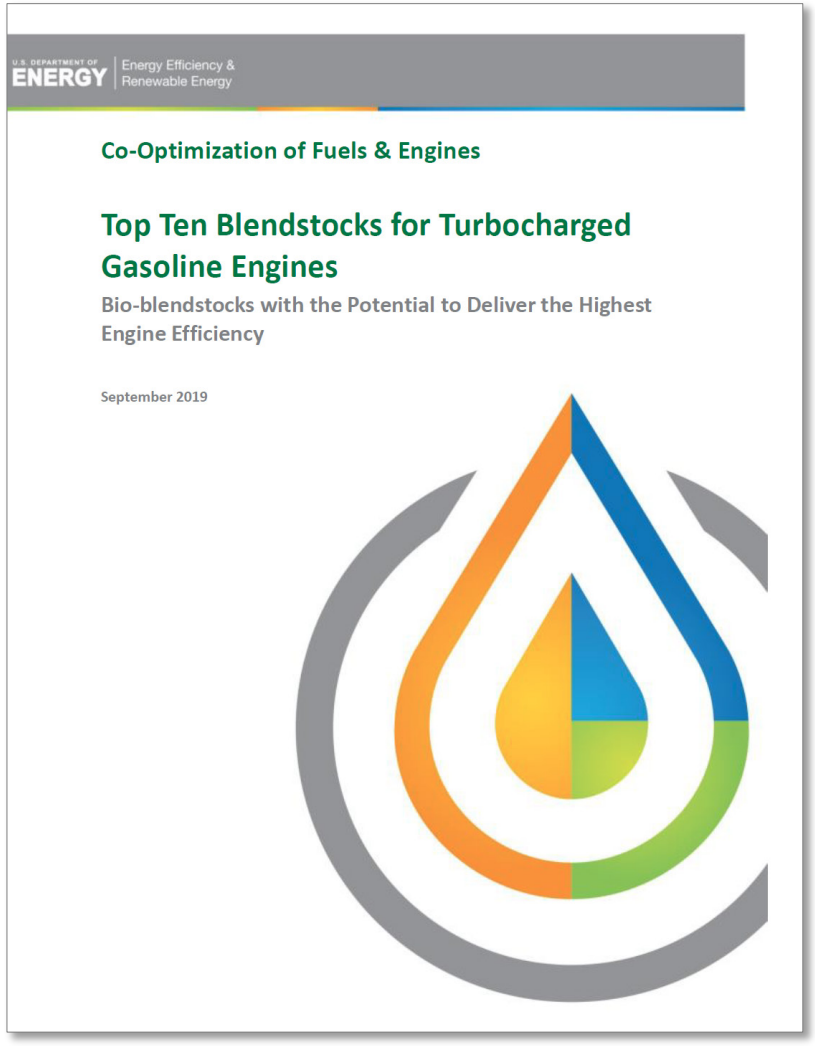
Ketones



cyclopentanone

Gaspar et al., https://www.osti.gov/biblio/1567705/

Co-Optima Boosted Spark Ignition Fuels and Engines



Highest efficiency blendstocks with fewest barriers

Alcohols	Olefins
ethanol, isopropanol, n-propanol, isobutanol, fusel alcohol blend**	di-isobutylene

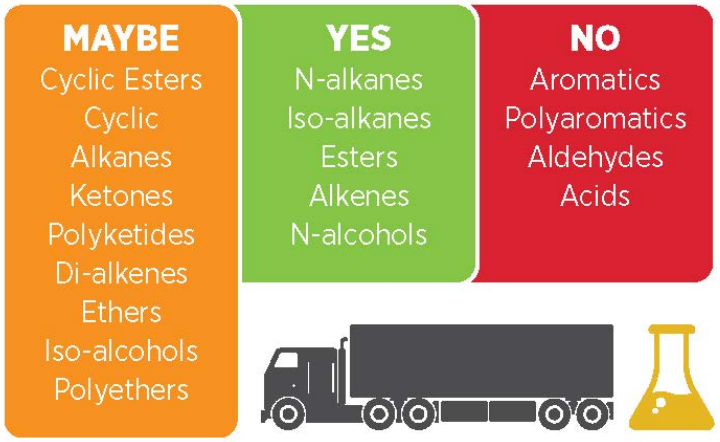
Gaspar et al., https://www.osti.gov/biblio/1567705/

Heavy-Duty Mixing-Controlled Compression Ignition

- Identifying candidate bioblendstocks with the potential to:
  - Decrease criteria pollutant emissions
  - Exploring emissions reductions in conventional diesel combustion and ducted fuel injection
  - Targeting MD/HD efficiency gains and emissions reductions via advanced combustion approaches using both diesel- and gasoline-boiling-range fuels
- Exploring potential for ducted fuel injection to improve engine-out emissions

Tier Criteria	Greatly Exceeds	Exceeds Criteria	Meets Criteria	Barriers Exist
Cetane	> 50	46 to 50	40 to 45	< 40
LHV (MJ/kg)	> 40	31 to 40	25 to 30	< 25
Flash Pt (°C)	> 70	61 to 70	52 to 60	< 52
Melting Pt (°C)	< -50	-50 to -26	-25 to 0	> 0
Water Sol (mg/L)	< 5	5 to 501	500 to 1000	> 1000
YSI	< 50	50 to 151	150 to 200	> 200

MCCI merit table for blendstock screening



Initial screening identified promising functional groups for MCCI blendstocks

Tools and data that may be of interest, including an online YSI prediction tool, can be found here: https://cooptima.org/tools-and-data/

DOE website includes background information and publication database

CO-OPTIMIZATION OF FUELS & ENGINES

Home » Research & Development » Advanced Development and Optimization » CO-OPTIMIZATION OF FUELS & ENGINES

Better Fuels.
Better Engines.
Sooner.

While vehicles with more efficient and sophisticated engines are hitting the road in ever-greater numbers, their performance is limited by the properties of today's conventional fuels. Researchers with the U.S. Department of Energy Co-Optimization of Fuels & Engines (Co-Optima) initiative are exploring how simultaneous innovations in fuels and engines can boost fuel economy and vehicle performance, while reducing emissions—advancing the underlying science needed to deliver better fuels and better engines sooner.

Learn More

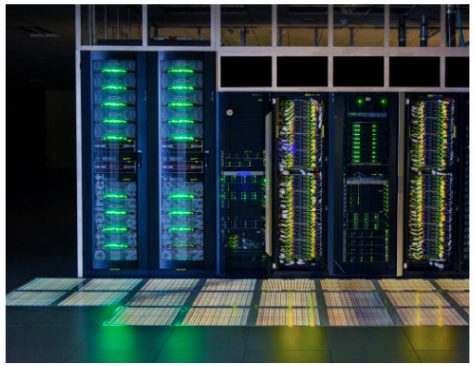
CO-OPTIMA RESEARCH

Learn more about Co-Optima research targets.

CO-OPTIMA NEWS

Read news about the Co-Optima initiative.

CO-OPTIMA TOOLS AND DATA



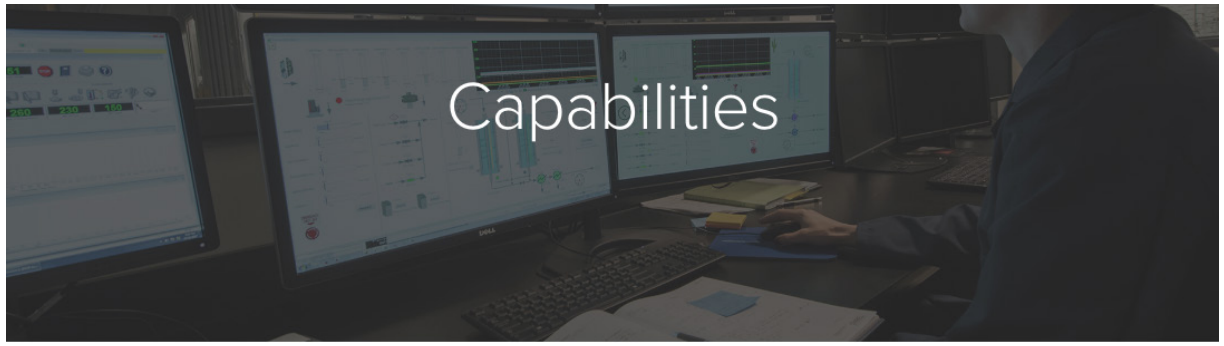
Learn more about Co-Optima tools and data.

CO-OPTIMA PUBLICATIONS

Find select Co-Optima Publications.

https://www.energy.gov/eere/bioenergy/co-optimization-fuels-engines

Co-Optima capability website describes capabilities available for DFO



Experimental Capabilities

BIO-BLENDSTOCK/FUEL PRODUCTION RESEARCH

Producing, recovering, and purifying bio-derived materials of interest for advanced fuels, including production at a scale sufficient for property and performance testing.

- Synthetic biology & Advanced Fermentation Strategies for biofuels
- Thermochemical process development
- Catalytic process development and blendstock production
- Fully equipped organic synthesis capabilities

BIO-BLENDSTOCK/FUEL PROPERTY RESEARCH

Computational Capabilities

PERFORMANCE

Modeling of combustion in engines or under conditions relevant to engine performance.

- Multi-dimensional simulations and combustion modeling in engines or under engine-relevant conditions

PROPERTIES

Development of predictive models based on molecular structure or based on correlations of properties of bio-blendstocks alone and in blended fuels.

- Physical and chemical fuel property prediction

https://cooptima.org/

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