



# Sustainable TRANSPORTATION

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

## OPTIMA: Low Greenhouse Gas Fuels

Blake Simmons  
Bioenergy 2015  
June 24, 2015

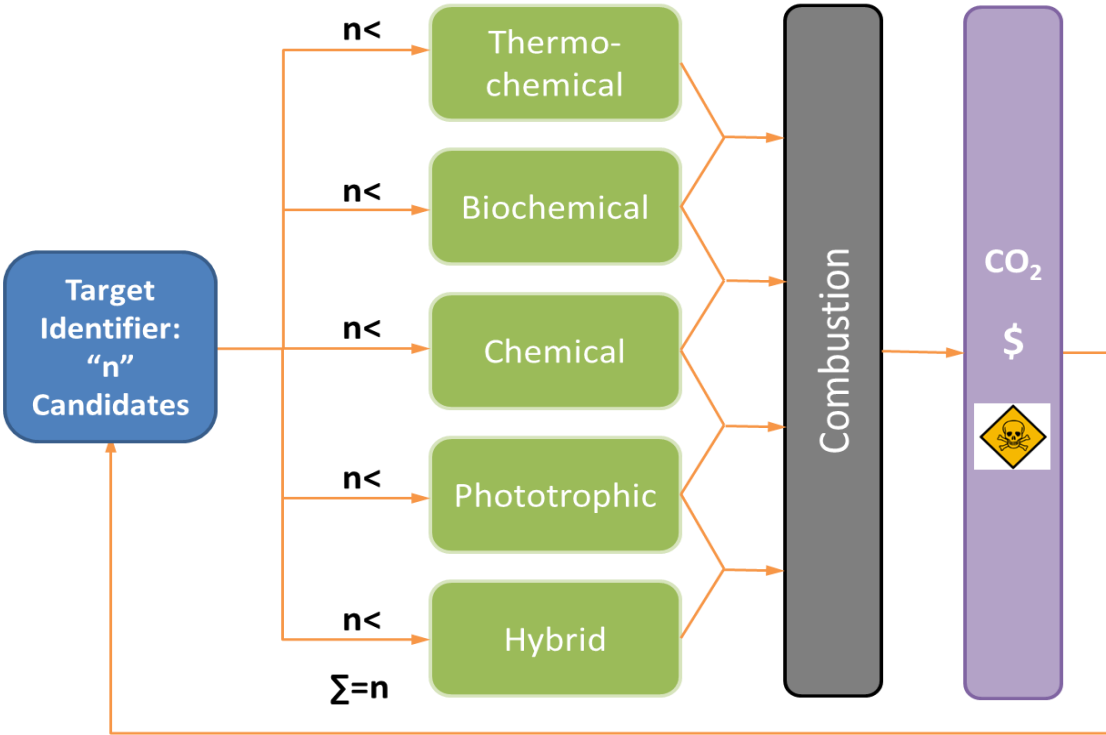
# Defining and Developing New Fuels

---

- Workflow
  - Survey what fuels are available today
  - Provide fuel components for testing (synthetic and real materials at small and large amounts)
  - Develop selection criteria for new fuels
  - Develop processes for producing desired fuel components
- Interactions
  - Characteristics of fuel blending components
  - Develop common framework for testing with fuel properties team
  - Receive emission profiles and performance
  - Correlate combustion properties with physical and chemical properties
  - Sustainability evaluation

# OPTIMA Low GHG Fuels: Approach and Priorities

- **Mission:** Co-optimize fuels and vehicles to yield better solutions with faster time-to-market
- **Thrust 1:** Initial focus on high octane, low GHG fuel blendstocks for SI engines with ethanol as the baseline oxygenate
- **Thrust 2:** Long-term focus on low GHG fuels that enable advanced high-efficiency combustion regimes beyond SI
- **Year 1:** Identify initial list of at least 20 targets beyond ethanol as a starting point for screening and engine validation effort
- Evaluate multiple conversion pathways and distribution endpoints to identify routes that maximize GHG reduction benefit and sustainability



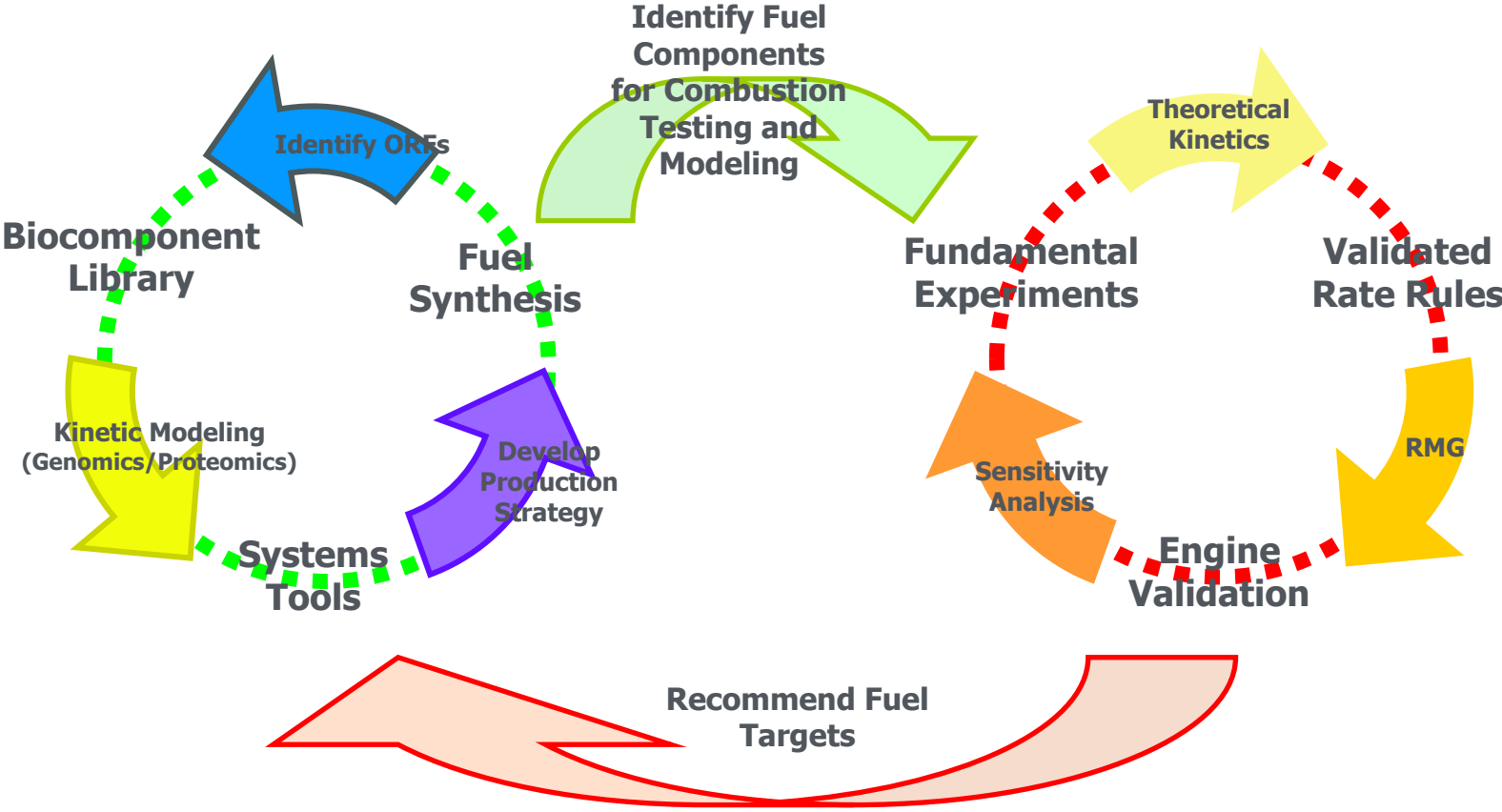
**OPTIMA workflow for identification of fuel targets being evaluated through different conversion pathways, evaluation and assessment through combustion platforms, performance, toxicity, TEA and LCA.**

# Example: Biochemical Conversion

---

- Screen outputs for use as better fuels
- Move endogenous pathways into biofuels hosts as needed
- Microbial fermentation using genetically tractable systems
- Metabolic engineering/synthetic biology as carve outs that can also leverage activities in DOE-Sc and ARPA-e
- Initial focus on model hydrolysates, but move to “real world” hydrolysates for every organism/pathway combination
- Lignin derived intermediates as a potential building block for unique chemistries
- Strain optimization and process intensification serve as linkages to industry
- Intersection with natural gas and H<sub>2</sub>

# Establishing Linkages between Fuel Production and Combustion



Starting points already set for both sides  
Specific strategy in any area can be modified if necessary  
– “links” are transferable