Strategic Spatial and Temporal Design of Advanced Biofuel Supply Chains: Case Study of California

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Content

Introduction: Military Biofuel Mandates

- Navy: **50% of total energy** consumption from sustainable sources **by 2020**
- Air Force: **50% of jet fuel** consumption to come from drop-in cost competitive alternative fuels **by 2025**

The big picture

- Can biofuels, produced from local feedstock at a competitive price, meet the military mandates?
- Are these military biofuels reliable, given the uncertainties in feedstock availability and crude oil price volatility?
- Is there a significant environmental merit associated with meeting the military mandates? And what are the environmental and economic tradeoffs associated with military biofuels?

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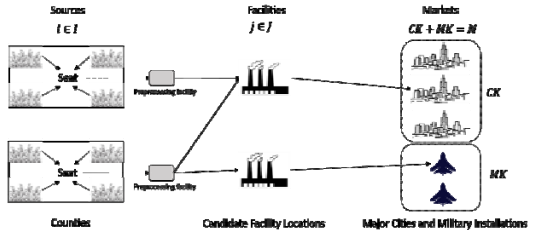
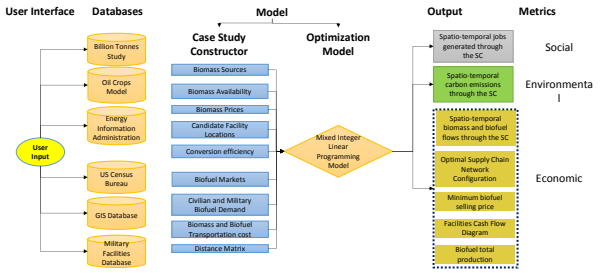
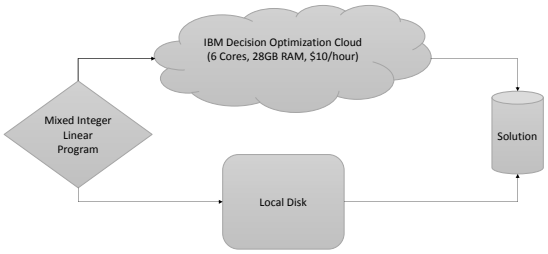
BioGeSTO: Supply chain overview



BioGeSTO: Model Architecture

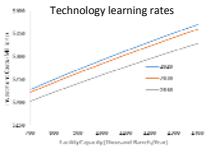


BioGeSTO: Model Architecture



What is new about BioGeSTO?

Mixed Integer Programming Model



Implementation

Theme

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Research Questions

- What is the optimal strategic design for a military drop-in biofuel supply chains in California?
- How does the supply chain perform under different oil prices incentives scenarios?
- How does the supply chain performance respond to changes in parameters such as feedstock availability and cost?

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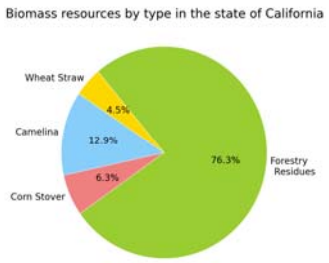
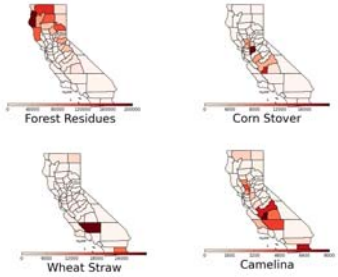
Case Study: Feedstock



Case Study: Biomass



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1. Introduction
2. The Biofuel Geospatial and Temporal Optimizer (BioGeSTO)
3. Research questions
4. **Case study of California**
   - 4.1 Feedstock
   - **4.2 Markets**
   - 4.3 Technology
5. Results
   - 5.1 California's Advanced Biofuel Potential
   - 5.2 Supply chain performance under different scenarios
     - 5.3 Sensitivity analysis
6. Conclusions and future work

Case Study: Spatially explicit demand

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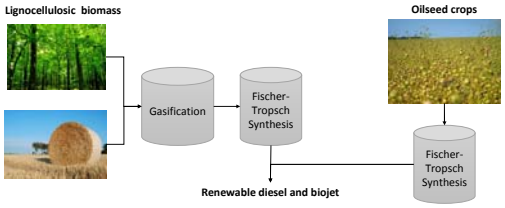
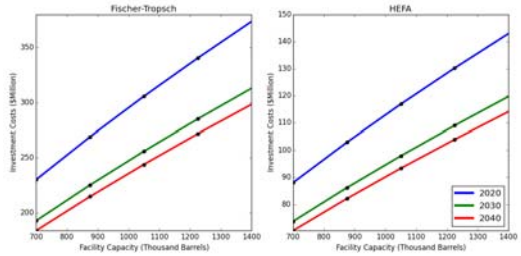
Case Study: Technology



Case Study: Learning Curves



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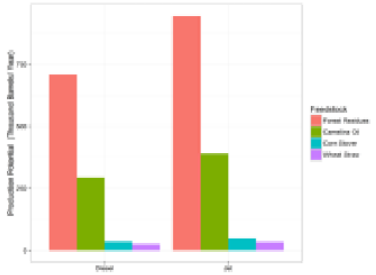
Results: California's advanced biofuel potential

Amounts to 42.7% of the state mandates



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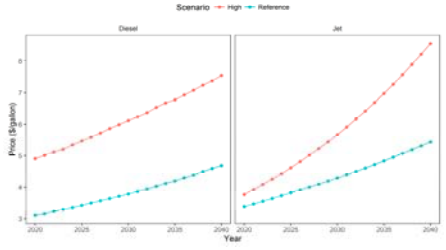
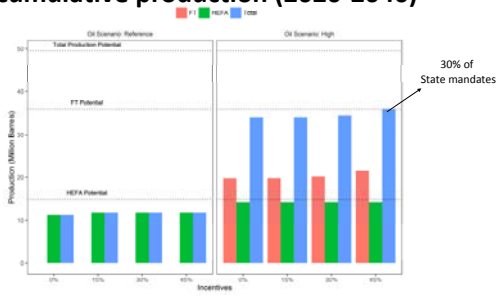
EIA crude oil price scenarios

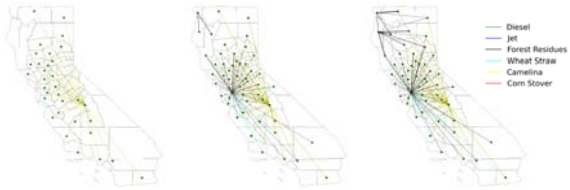


Total cumulative production (2020-2040)



Results: Network design

2020 2028 2029



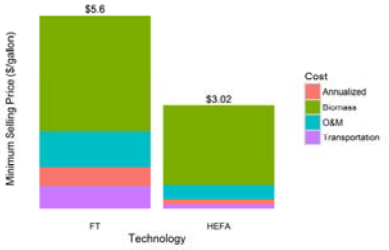
Feedstock flow to conversion facilities

Results: Network design

2020 2028 2029

Fuel flow to military installations

Results: Cost breakdown



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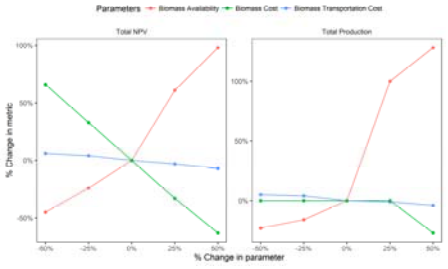
Sensitivity analysis



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Conclusions:

- California's biomass resources can theoretically meet up to **42.7%** of the state military targets
- Under low crude oil price scenario, no Fischer-Tropsch facilities will be profitable
- Under high crude oil price scenario, and a 45% capital investment subsidy, military biofuel supply chain can meet up to **30%** of the state military targets
- Biomass availability and cost are the most influential parameters

Thank You
Questions?

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