A parameterized life cycle model for rapid quantification of bioenergy sustainability metrics

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Key Points

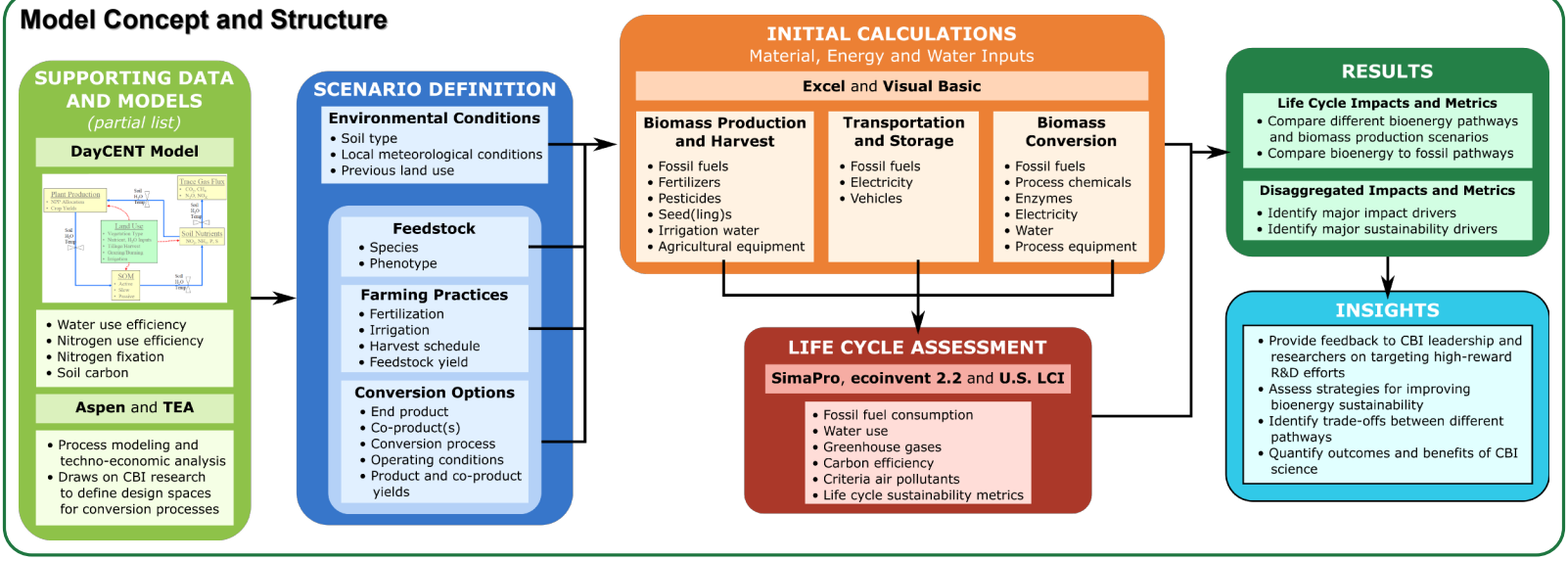
- User-friendly, parameterized life cycle modeling tool
- Provides low-effort, rapid quantification of key sustainability metrics for advanced biofuel life cycles
- Being developed using Excel and Visual Basic connected to SimaPro
- Will integrate with a similar techno-economic analysis tool
- To be publicly released as a Year 4 deliverable

Background

Life cycle assessment (LCA) is a method for assessing all environmental impacts associated with provisioning a good or service. A life cycle encompasses the system which directly produces a good, as well as all systems and processes on which that system is dependent.

The objective of this work is to develop a flexible, parameterized model representing a superstructure of life cycles for advanced biofuel production. Parameterizing the model allows users to define a variety of biofuel production scenarios and assess key sustainability metrics, without needing to acquire additional data or perform separate life cycle assessments. Within the model, parameters will include feedstock species and phenotype, a range of farming and harvest practices, feedstock pre-processing, and operating conditions within the biomass conversion process. The model will be used to identify major impact drivers within bioenergy life cycles and aid CBI researchers and leadership in targeting areas where additional R&D efforts will have the most beneficial impacts.

Model Concept and Structure



Data Requirements

	CBI Teams	Data and Information
Biomass Production and Harvesting	Rapid Domestication – Poplar	• Input on the pathway scenarios of most interest • Data and other information to develop relationships between scenario parameters, *e.g.* how feedstock composition is affected by phenotype
	Rapid Domestication – Switchgrass	
	Sustainable Feedstocks	
Biomass Conversion	Consolidated Bio-Processing	• Data for the development techno-economic models of several biomass conversion processes • The life cycle model will draw on process information and models developed from techno-economic analysis
	Cotreatment and Pretreatment	
	Deconstruction Fundamentals	
	Rapid Domestication – Microbes	
	Lignin Valorization	

Next Steps

- Model development has begun based on preliminary information from researchers across CBI.
- Additional scenario definition parameters and intermediate results are being added to the model as techno-economic modeling and other CBI efforts progress.
- By the end of Year 1, a preliminary model version with limited functionality will be complete and available throughout CBI.
- By the end of Year 4, the model will be fully functional and available for sustainability analyses to CBI researchers and to the general public.

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