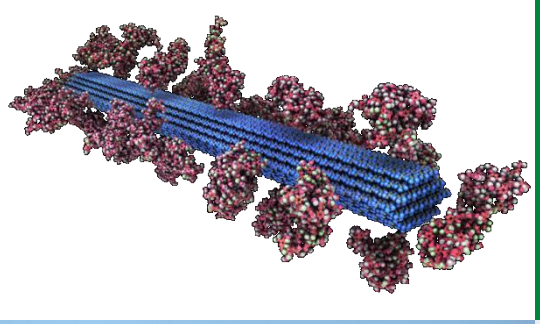
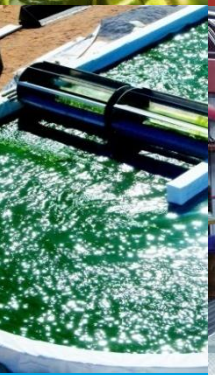




U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

2019 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

Feedstock – Conversion Interface Consortium

fcic
FEEDSTOCK-CONVERSION INTERFACE CONSORTIUM

Beau Hoffman (Conversion R&D)
Mark Elless (FSL)
Liz Moore (ADO)

Technology Managers

March 7th, 2019

FCIC Objectives

Vision: Quantify, understand, and manage variability in biomass from field through downstream conversion and to understand how biomass composition, structure, and behavior impacts system performance

Provide First Principles based knowledge related to unit operations

Provide transfer functions to bridge scales from bench to pioneer biorefinery

Provide valuation of intermediate streams which can be commoditized

TOOLS FOR TECHNOLOGY DEVELOPERS AND BIOREFINERY DESIGNERS

Quantifying, Understanding, and Managing Variability

Material Variables

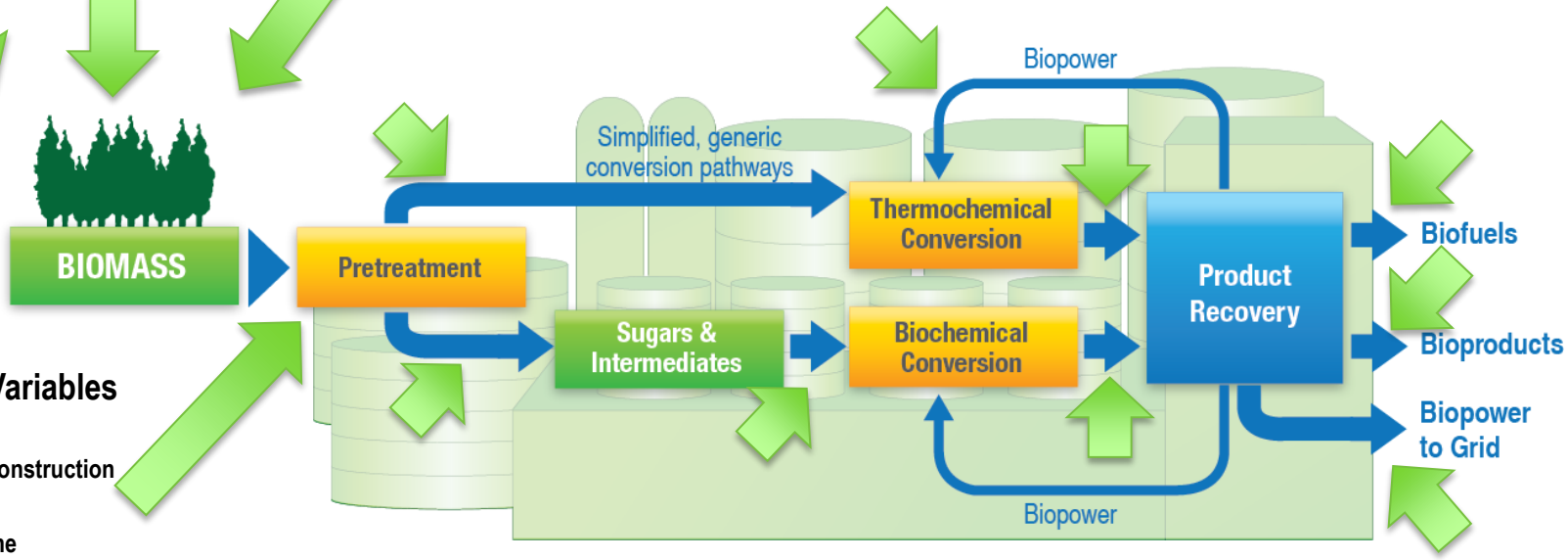
Physical
- Aspect ratio
- Particle size distribution
- Particle shape distribution
- Porosity
- Roughness
- Surface energy
- …

Mechanical
- Abrasiveness
- Corrosivity
- Dilatancy
- Rheopecticity
- Shear strength
- Viscosity
- …

Chemical
- Glucan
- Glass transition temp
- Inorganics concentration (Na, K, Si, etc.)
- Moisture content
- S/G ratio
- …

How will we know if we've succeeded?

- **Predictable operations:** Knowledge of the first scientific principles governing the material and process variables are sufficient such that the process will perform as expected, as proven through theory, models, and experiments
- **Reliable:** Across a span of material and process variables, the process performs as expected over an extended period of time
- **Scalable:** Across a span of material and process variables, the process performs as expected across a variety of scales (from bench to pilot)

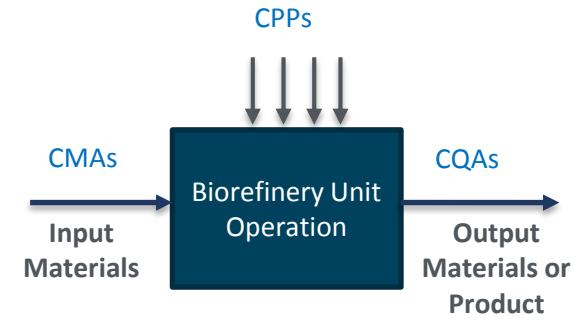


Process Variables
- Loading level
- Materials of construction
- Mixing rate
- Residence time
- Vessel geometry
- …

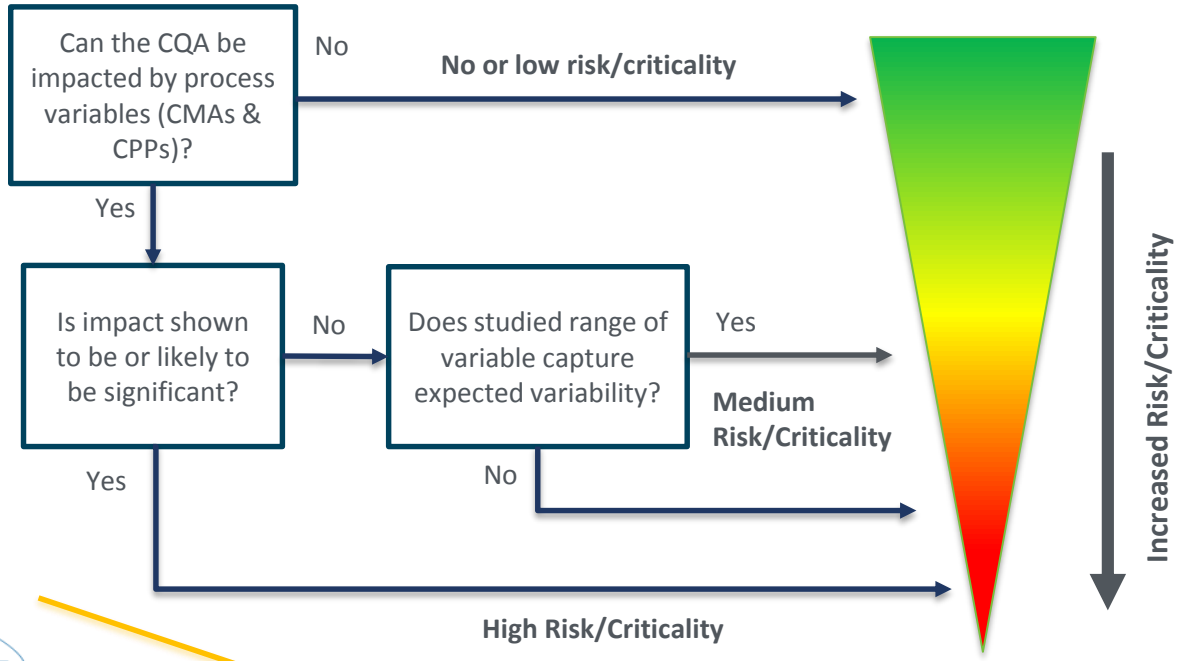
Interface is a verb, not a noun

Quality by Design: A framework for systematically managing variability

Schematic Flow Diagram for identification of CMAs/CPPs



$CQAs = f(CMA_1, CMA_2,\ldots, CPP_1, CPP_2,\ldots)$



Sandia National Laboratories · Argonne National Laboratory · Idaho National Laboratory · Pacific Northwest National Laboratory · Los Alamos National Laboratory EST.1943 · Oak Ridge National Laboratory · Berkeley Lab · NREL National Renewable Energy Laboratory · National Energy Technology Laboratory

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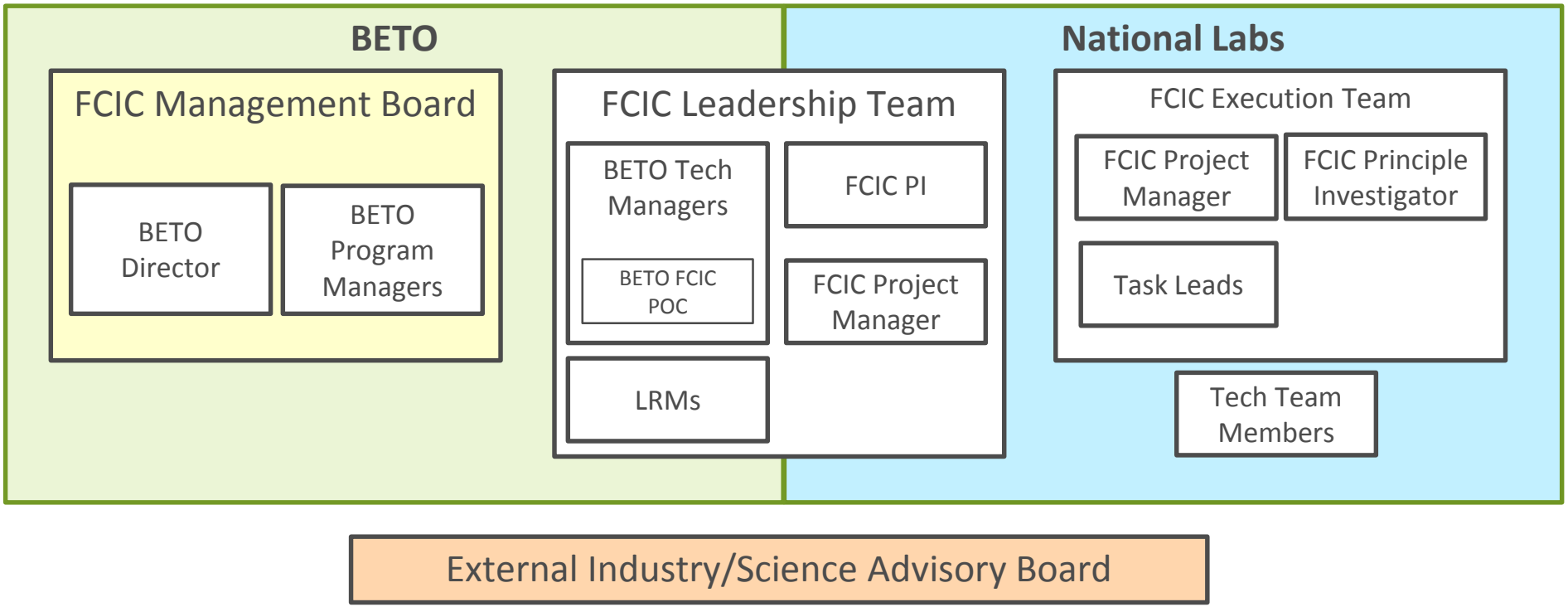
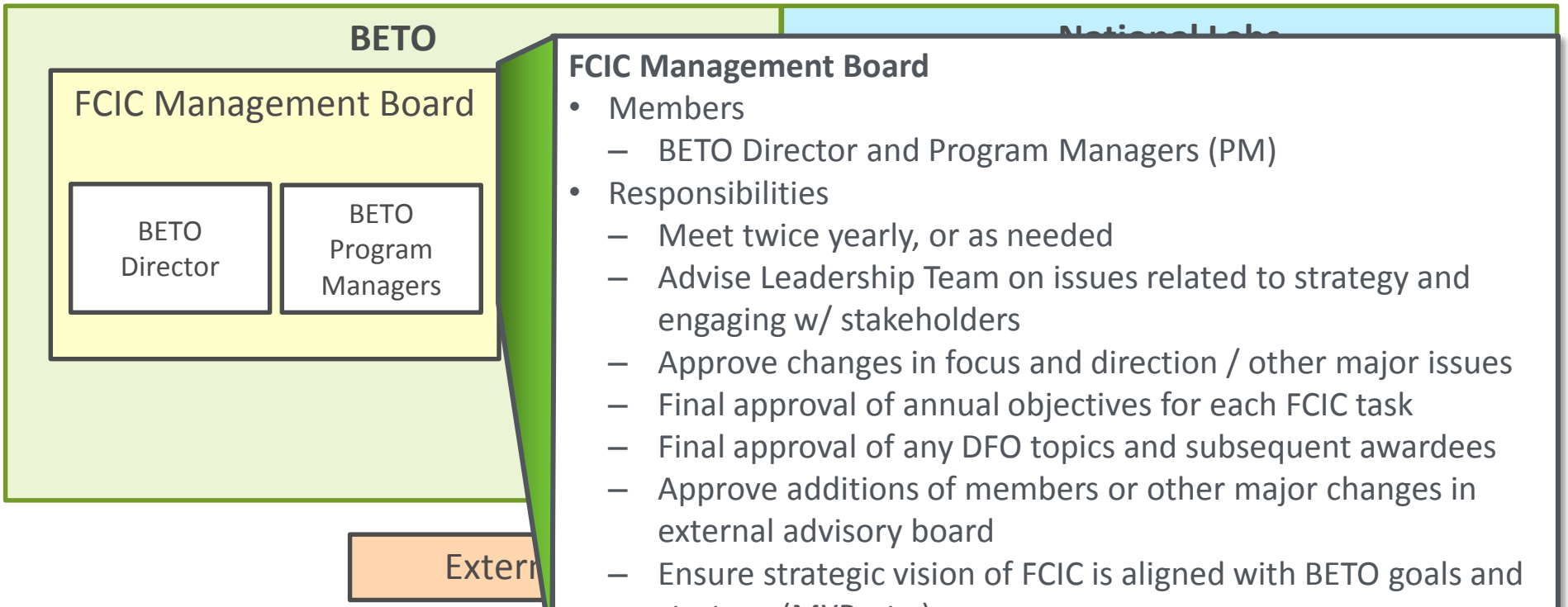
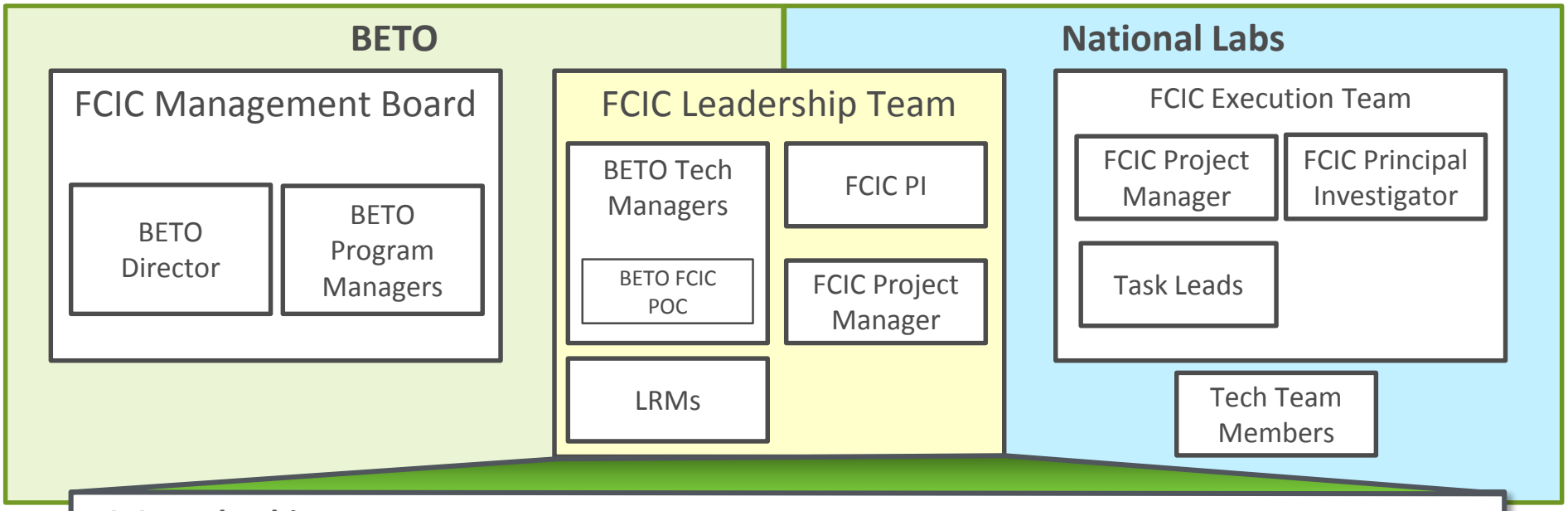
FCIC Leadership Structure



FCIC Leadership Structure



FCIC Leadership Structure



FCIC Leadership Team

- Members
  - BETO Technology Managers, LRMs, FCIC PI, and FCIC PM
- Responsibilities
  - Set vision for FCIC and maintain focus on vision throughout the consortium's membership
  - Assess performance against goals at least annually, w/ input from External Advisory Board
  - Celebrate team successes and recognize contributions
  - Provide frequent feedback to team
  - Make decisions on funded tasks and budget breakdown

BETO FCIC Team


Alison


Kevin


Jim


Mark


Beau

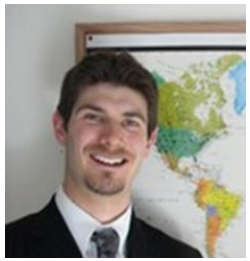

Liz

DOE Staff	
Program Managers	**Technology Managers**
Alison Goss-Eng (FSL)	Mark Elless (FSL)
Kevin Craig (Conversion)	Beau Hoffman (Conversion)
Jim Spaeth (ADO)	Liz Moore (ADO)
ORISE Fellows	**Support Contractors**
Shaina Aguilar	Owen Goldstrom
	Andrew Kobusch
	Art Wiselogel


Shaina


Art


Andy


Owen

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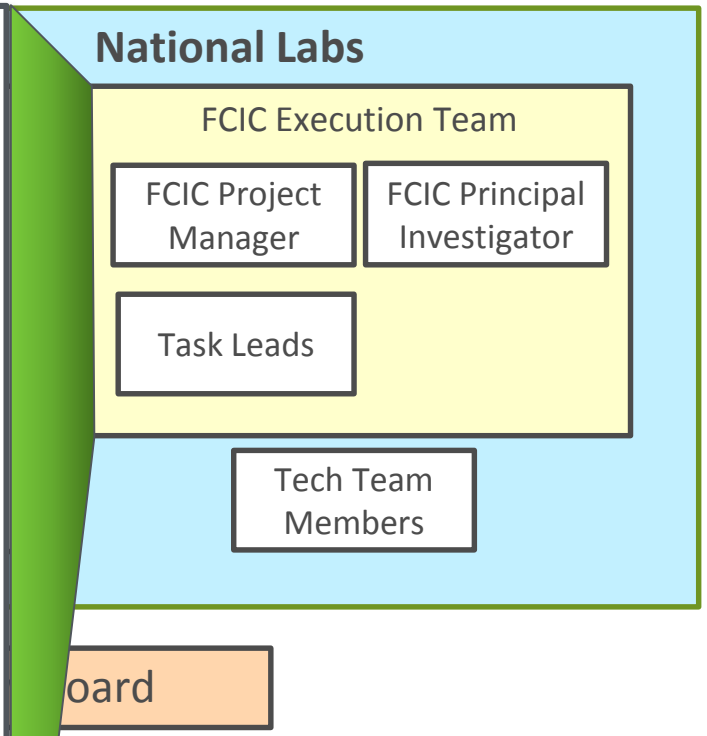
FCIC Leadership Structure

FCIC Execution Team

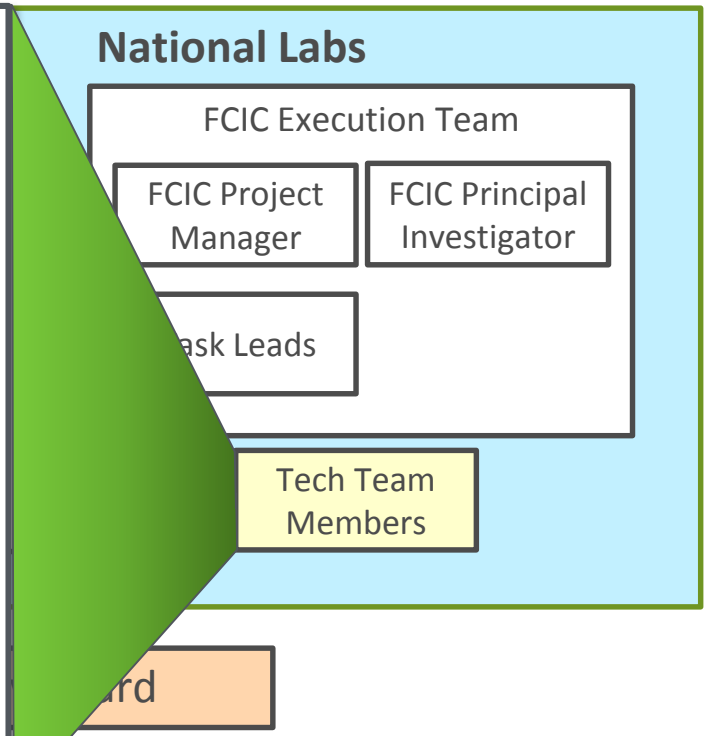
- Members
  - FCIC PI, PM, task and sub-task AOP PI's, Co-PIs
  - At least one member per lab
- Selected Responsibilities
  - Lead research execution under AOP
  - Identify gaps / overlaps and recommend mitigation
  - Look for cross collaboration opportunities and minimize 'silos'
  - Update changes in FCIC priorities, strategies, and operations with lab staff and management
  - Take responsibility for resolving personnel issues
  - Communicate staffing and personnel changes/concerns to the FCIC Leadership Team in a timely manner
  - Manage AOP development and responses to lab calls (if necessary)
  - Establish and work with External Advisory Board
  - Mentor team leads and PIs; arbitrate and resolve disagreements between PIs



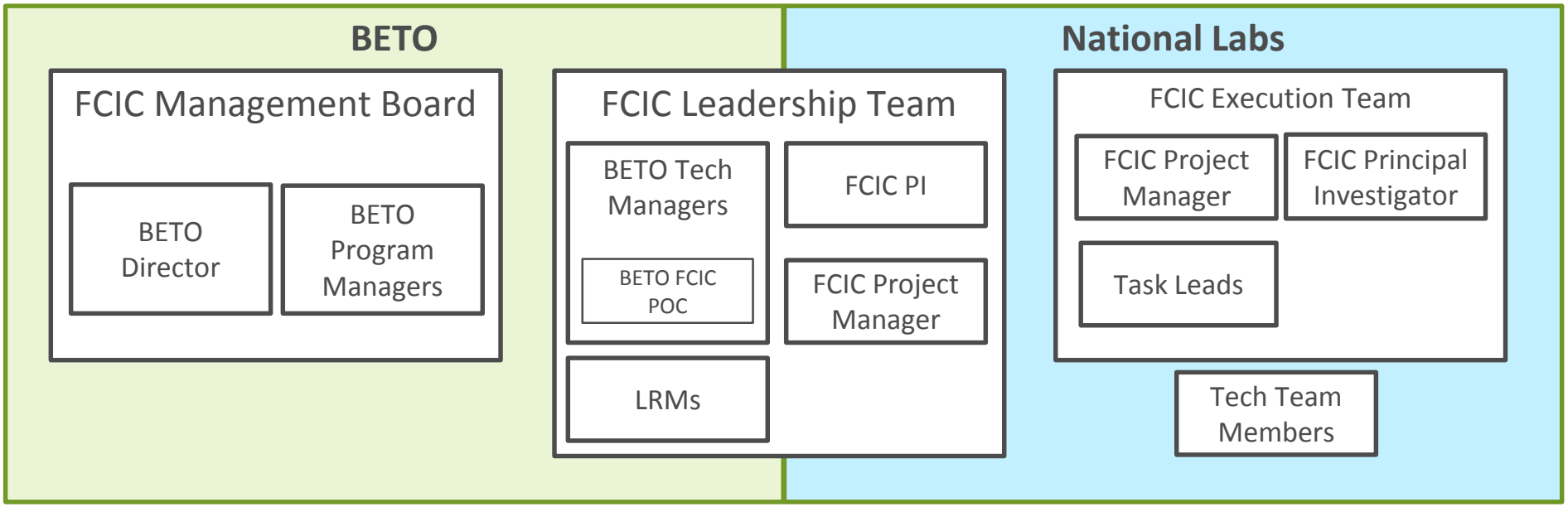
FCIC Leadership Structure

FCIC Team Skills

- Technical
  - Chemical Engineering
  - Mechanical Engineering
  - Materials and Metallurgical Engineering
  - Tribology (friction& wear)
  - Microbiology, Synthetic Biology
  - Chemistry
  - Physics
  - Thermodynamics
  - Analytical (Physical, chemical, biological)
  - Modeling (CFM, FEM, DEA, NN, AI, Process)
  - Data management / data analysis
  - Statistical analysis.
  - Techno economic analysis
  - Life Cycle Analysis



FCIC Leadership Structure



External Industry/Science Advisory Board

External Industry/Science Advisory Board

- Members
  - Biomass industry experience
  - Adjacent industry experience
  - Science background

Peer Reviewer Introductions

Name	Affiliation	Previous Peer Review Experience
Brandon Emme	ICM	FCIC Reviewer 2017
Glenn Farris	AGCO	New
Dr. Lorenz (Larry) Bauer	Consultant	TC Reviewer 2017
Andrea Slayton	Consultant, Slayton Technical Services	DMT Reviewer 2017
Dr. Benjamin Levie	Formerly Weyerhaeser	New, w/MR experience

Session Agenda

FCIC					
Day 4 - Thursday, March 7, 2019					
Start Time	End Time	Presentation	ID#	Organization	PI
8:15	8:30	FCIC Session Welcome and Overview of Session		BETO	Beau Hoffman
8:30	8:50	FCIC Overview Presentation – 2017 and 2018	530	NREL	Dr. Michael Resch
8:50	9:30	Feedstock Variability and Specification Development	15	INL	Dr. Allison Ray
9:30	10:00	Break			
10:00	10:40	Process Integration	121	NREL	Dr. Ed Wolfrum
10:40	11:20	Feedstock Physical Performance Modeling	22	INL	Dr. Tyler Westover
11:20	12:00	Process Controls and Optimization	302	INL	Dr. Quang Nyugen
12:00	1:00	Lunch			
1:00	1:40	System-wide Throughput Analysis	25	INL	Dr. David Thompson
1:40	2:20	Industry Engagement and Project Management	31	NREL	Dr. Michael Resch
2:20	3:00	FCIC Future Plans (FY19 and beyond)	531		Dr. Zia Abdullah
3:00	3:15	Break			
3:15	3:45	Pretreatment and Process Hydrolysis	126	NREL	Dr. Mel Tucker
3:45	4:30	Reviewer / Lead Reviewer De-briefing			

FY18 Work

Future Work

Project relevant to FCIC
(being scored in Biochem Conversion)