Project Verification Process

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Bioenergy Technologies Office (BETO) 2021 Peer Review

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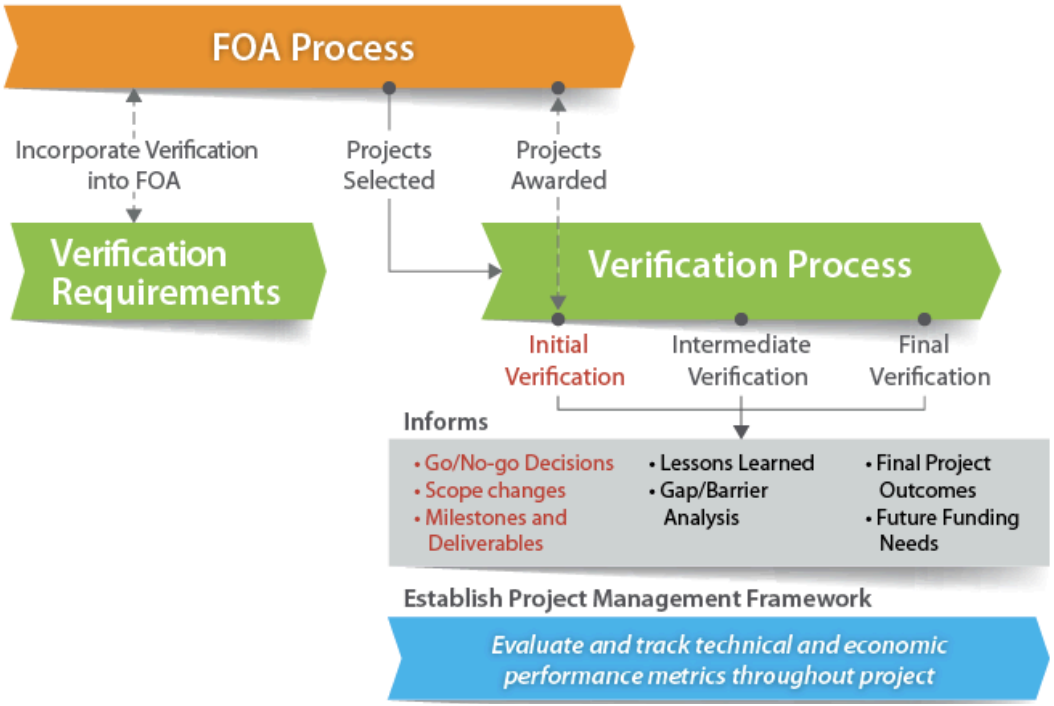
Introduction to Verification Processes

- Verifications (also known as validations) are a well-established project management tool within the discipline of systems engineering and are routinely applied within the defense and aerospace sectors
- The specific verification methodology as applied here was adapted by the National Renewable Energy Laboratory (NREL) verification team and others from these traditional practices to track the technical and economic performance of developing chemical process technologies
- *However, the overarching verification process goal of applying a systematic approach to supplant project risk over time remains consistent in this manifestation of the verification process as applied to developing chemical processes*

1. **Verification process is an established methodology in systems engineering which has been adapted to fit the needs of BETO.**
2. **Verification process applies a systematic approach to supplant project risk over time.**

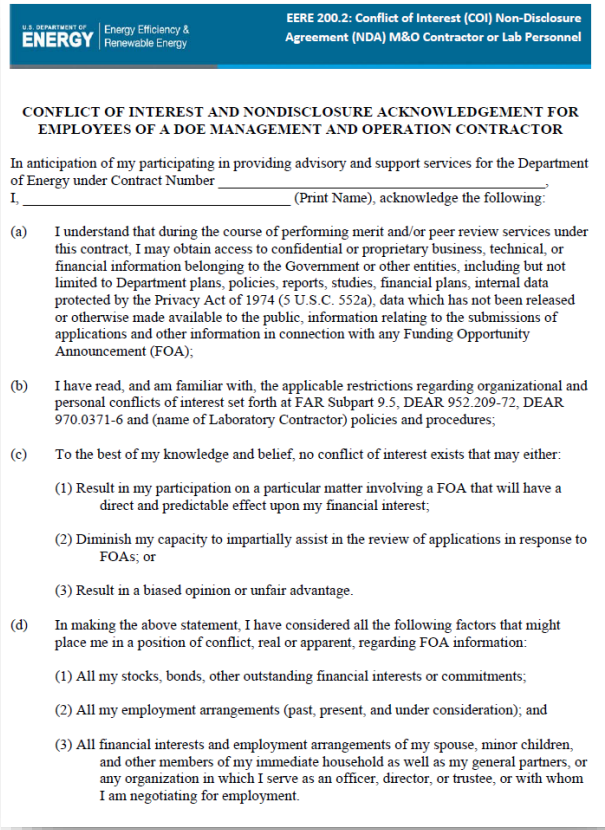
Verification Process as Implemented at BETO



1. **Verification process is a 3-phased process incorporated into BETO's FOA process. It helps inform BETO's Go/No-Go decisions and provides feedback to the project team and BETO.**
2. **Establishes a common understanding of performance metrics between the project team and BETO.**
3. **Tracks progress during the life of the project.**
4. **Initial verification is an opportunity for scope/milestone changes, if needed.**

Data Protection and Confidentiality Agreements

- Before accessing any project-related data or performing any verification work, all members of the verification team enter into a written confidentiality agreement that covers any confidential and business sensitive information that the verification team may be exposed to during the verification process
- All communications between BETO, the verification team, and the project team personnel related to the verification adhere to the stringent conflict of interest and non-disclosure agreement conditions covering the work



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EERE 200.2: Conflict of Interest (COI) Non-Disclosure Agreement (NDA) M&O Contractor or Lab Personnel

CONFLICT OF INTEREST AND NONDISCLOSURE ACKNOWLEDGEMENT FOR EMPLOYEES OF A DOE MANAGEMENT AND OPERATION CONTRACTOR

In anticipation of my participating in providing advisory and support services for the Department of Energy under Contract Number _____,
I, _____ (Print Name), acknowledge the following:

(a) I understand that during the course of performing merit and/or peer review services under this contract, I may obtain access to confidential or proprietary business, technical, or financial information belonging to the Government or other entities, including but not limited to Department plans, policies, reports, studies, financial plans, internal data protected by the Privacy Act of 1974 (5 U.S.C. 552a), data which has not been released or otherwise made available to the public, information relating to the submissions of applications and other information in connection with any Funding Opportunity Announcement (FOA);

(b) I have read, and am familiar with, the applicable restrictions regarding organizational and personal conflicts of interest set forth at FAR Subpart 9.5, DEAR 952.209-72, DEAR 970.0371-6 and (name of Laboratory Contractor) policies and procedures;

(c) To the best of my knowledge and belief, no conflict of interest exists that may either:

(1) Result in my participation on a particular matter involving a FOA that will have a direct and predictable effect upon my financial interest;

(2) Diminish my capacity to impartially assist in the review of applications in response to FOAs; or

(3) Result in a biased opinion or unfair advantage.

(d) In making the above statement, I have considered all the following factors that might place me in a position of conflict, real or apparent, regarding FOA information:

(1) All my stocks, bonds, other outstanding financial interests or commitments;

(2) All my employment arrangements (past, present, and under consideration); and

(3) All financial interests and employment arrangements of my spouse, minor children, and other members of my immediate household as well as my general partners, or any organization in which I serve as an officer, director, or trustee, or with whom I am negotiating for employment.

Algae Verification Expertise and Experience

- Education in Biochemistry with Biotechnology (BSc), Microbiology (PhD)
- 14 years of algae research experience in academia, industry, and consulting
- Specific algae experience in genetic engineering, crop protection, and cultivation
- Joined Allegheny Science and Technology (AST) as contractor to DOE in August 2020

- Education in Chemical Engineering (MS)
- 8 years of experience in biofuels research and process engineering
- Process design, scale-up and integration
- Program management, planning, and strategic execution
- Process development and scale up
- Techno-economic analysis
- Bioenergy supply chain and market analysis

- Education in Chemical Engineering (PhD)
- 25 years of research and product development experience across specialty chemical, pharmaceutical, software development, and energy sectors
- Industrial experience ranging in scale from start ups to commercial petrochemical facilities
- Techno-economic analysis and process design

The verification team will bring in additional subject matter experts if a project involves a technology requiring specialized knowledge, or there is a conflict of interest for this current core team.

Value Proposition of Verification Process

- **Bioenergy Technologies Office**
  - Gains valuable in-depth technical and economic insight into the project
  - Can identify serious barriers to success and result in a No-Go decision for a project
  - Can identify large gaps in technology readiness
  - Reduces surprises to funding agency later in project
  - Establishes clear metrics for a “successful” project
- **Project Team**
  - Gains valuable third-party analysis of technology and receives valuable input they may have not considered
  - Has access to verification team knowledge and experience
  - Can be used in subsequent due diligence processes
  - Establishes clear understanding of expectations

1. **Verification process is intended to benefit the project and ensure that BETO is achieving its FOA objectives.**
2. **Transparency and No Surprises - Ensures clear metrics between project team and BETO to increase probability for success.**

Verification Process Objectives

- Validate baseline data as described in the application
- Establish a framework to evaluate and track progress of the project over time
  - Update the data and performance metrics in the technical tables and Statement of Project Objectives (SOPO) document if necessary
- Clarify assumptions used to establish baseline and target values. Examples include:
  - Where is literature data used versus experimental data?
  - How was data included in the technical tables obtained?
  - Have any extrapolations been made (from smaller to larger scale)?
  - How many replicates have been run, and over what time frame?
- Identify potential showstoppers
- Align project goals with BETO's expectations and FOA requirements
- Provide independent and objective technical and economic analysis to inform decisions

Roles Within the Verification Team

- **Verification Team**: Provide BETO with third party verification of performance results and process economic projections
  - **Technical Lead** – Responsible for leading the technical verification process, being the point of contact, and overall management of reporting to BETO
  - **Subject Matter Expert** – Responsible for documenting and reporting technical verification results, providing technical advice and input on all aspects of the technical elements of the project
  - **Process Design and Economics Expert** – Responsible for documenting and reporting results, determining if economic and commercial considerations are being used to direct and inform research and development activities as appropriate for the technology readiness level of the project

1. **Verification team is comprised of independent experts.**
2. **Verification team provides a report to BETO of observations and recommendations.**

BETO Team Versus Verification Team

- **Verification Team** is responsible for:
  - Facilitating transparency, conducting analyses (as required) and documenting observations and recommendations in a report to BETO
  - Providing support and analysis for project-based decisions

- **BETO Technology Managers and Project Monitors** are responsible for:
  - Considering verification team's analyses and recommendations
  - **Making final decisions with respect to project specific metrics, targets and requirements**
  - Reviewing verification report, making final Go/No-Go decision recommendations
  - Making final decisions with respect to administration of the financial assistance award management

1. **BETO is responsible for all final technical/financial/Go No-Go decisions.**
2. **BETO considers observations and recommendations from verification team.**

Phases of the Verification Process

Pre-Verification Phase

Set expectations with verification requirements document

Align project metrics with FOA requirements and program objectives

Develop framework to document, evaluate, and track performance

Verification Meeting

Review project data, accomplishments, and challenges

E.g., experimental results, hours of operation, number of tests, scale, duration, schedule, budget, techno-economic analysis (TEA), life-cycle assessment (LCA)

Post-Verification Phase

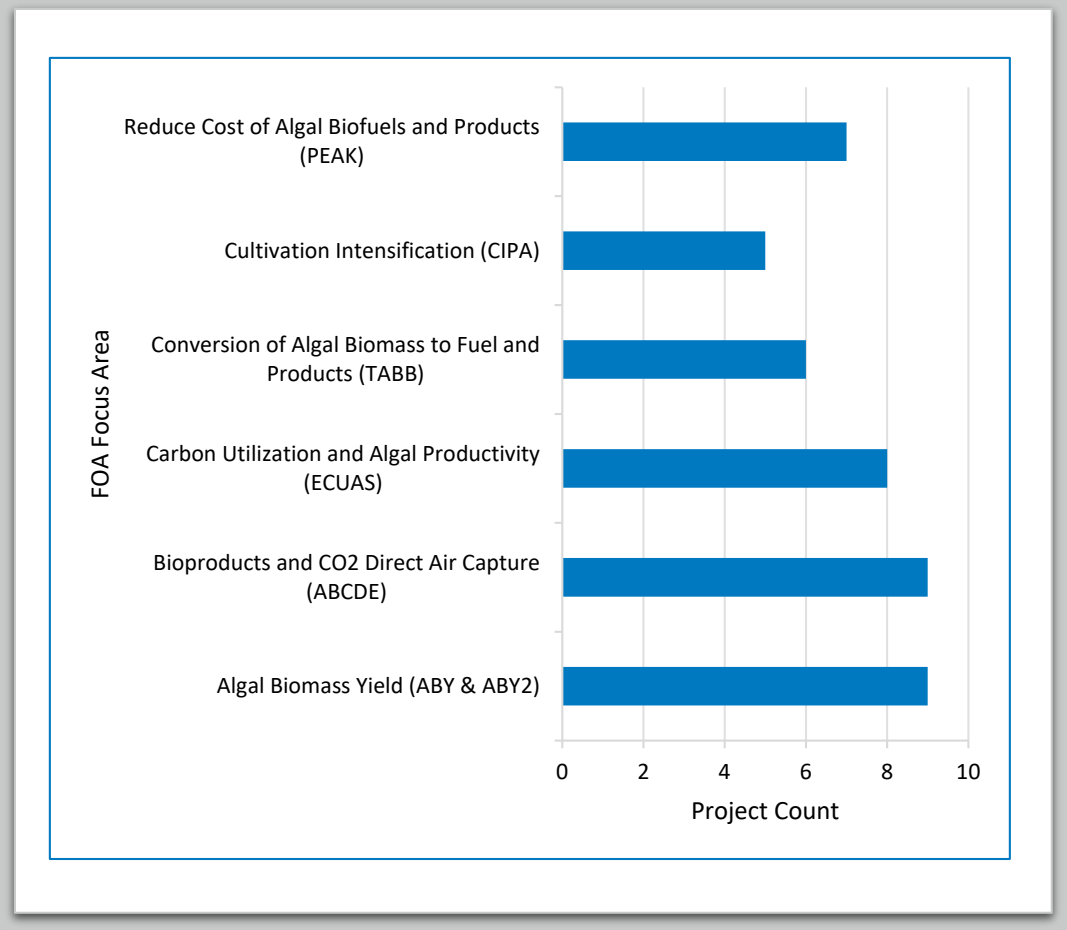
Provide independent, credible and objective analysis

Compare results to project and program targets

***Output Product**: Written report of observations and recommendations to BETO that supports the Go/No-Go decision process*

Verifications Across Multiple Algae Technologies & FOAs

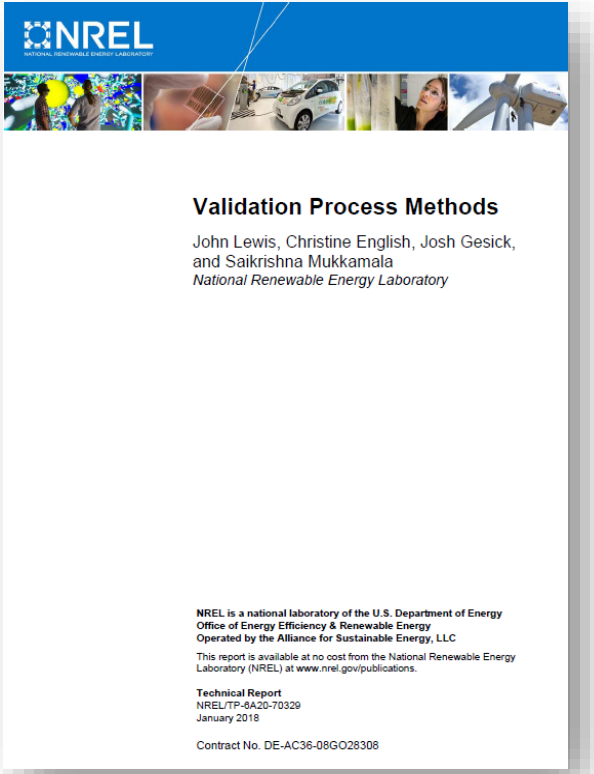
- Verification process implemented across 7 Algae FOAs (ABY, TABB, ABY2, PEAK, ECUAS, CIPA, and ABCDE) from 2013 to present
- 44 algae FOA projects have gone through the verification process
- Federal cost share for these individual projects have ranged from $1M to $9M



2017 Peer Review Panel Recommendation

Peer Review Panel Observations and Recommendation:
"DOE continues to require a technical validation step that is conducted by a third party, NREL, to review the projects upon award, and validate the actual status. This validation not only informs DOE on the status of the project but also provides valuable feedback to the projects themselves. The Peer Review Panel was unanimous regarding the importance of the validation process, and considers it to be strength of the program, and *recommends that the process be continued, and the overall procedure accurately documented*."

Verification Team Response:
The verification team documented the overall verification procedure and published it as an NREL technical report in 2018. (https://www.nrel.gov/docs/fy18osti/70329.pdf)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Validation Process Methods

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Technical Report
NREL/TP-6A20-70329
January 2018

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Project Verification Process Summary

Benefits for Funding Entity
In-Depth Technical and Economic Project Assessment

- Maximizes value of research dollars
- Informs project and programmatic planning

Benefits for Projects
Independent Technical and Risk Assessment

- Results can be used in due diligence
- Encourages the applicant to use TEA to drive research decisions

Decision Making and Project Success

- Reduces surprises later in project
- Establishes clear metrics for success

- **The verification process is a project management tool used by BETO for competitively awarded projects**
- **Verifications are a well documented and transparent mechanism for strengthening projects and increasing the probability of project success for all stakeholders**

Thank You

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