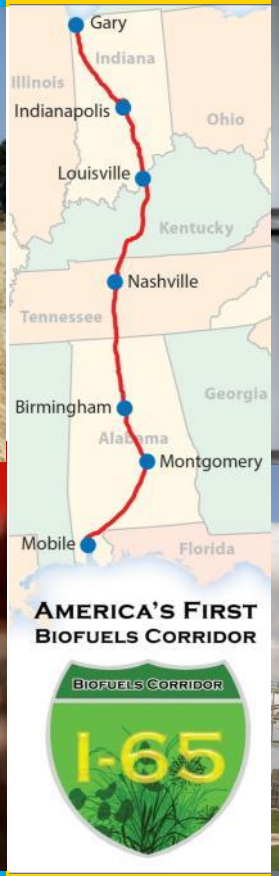
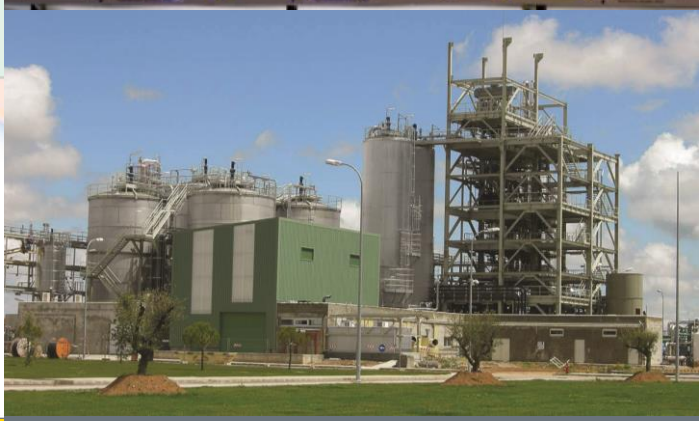
BETO Active Project Management

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





Bioenergy Technologies Office – Program Management Review

6/25/15

Liz Moore
Technology Manager

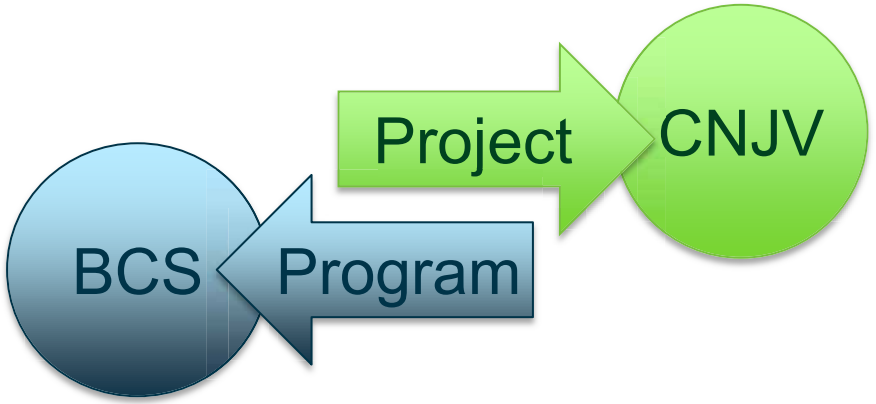
Roles & Responsibilities

Program Managers

- Manages portfolio within their technology area
- Establishes technical and cost goals
- Strategic planning for technology area
- Budget preparation/justification for technology portfolio
- Identifies needs for workshops and FOAs
- Oversees portfolio reviews including high-level project status

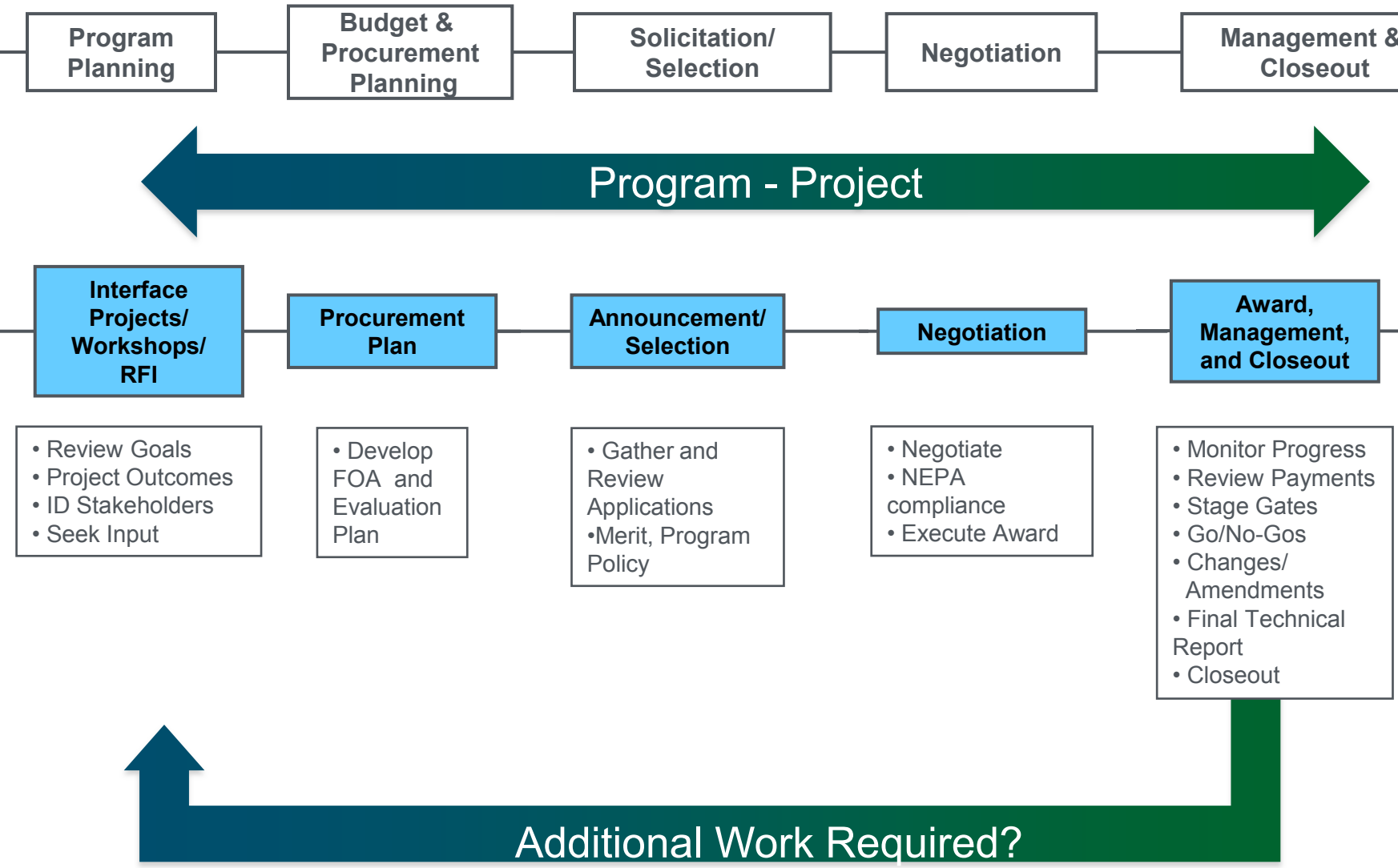
Technology Managers

- Plans/conducts workshops and portfolio reviews
- Participates in strategic/budget planning, portfolio reviews
- Contributes to setting goals
- In-depth knowledge of project status/accomplishments/issues
- Manage AOP and FOA/ competitive project life cycle

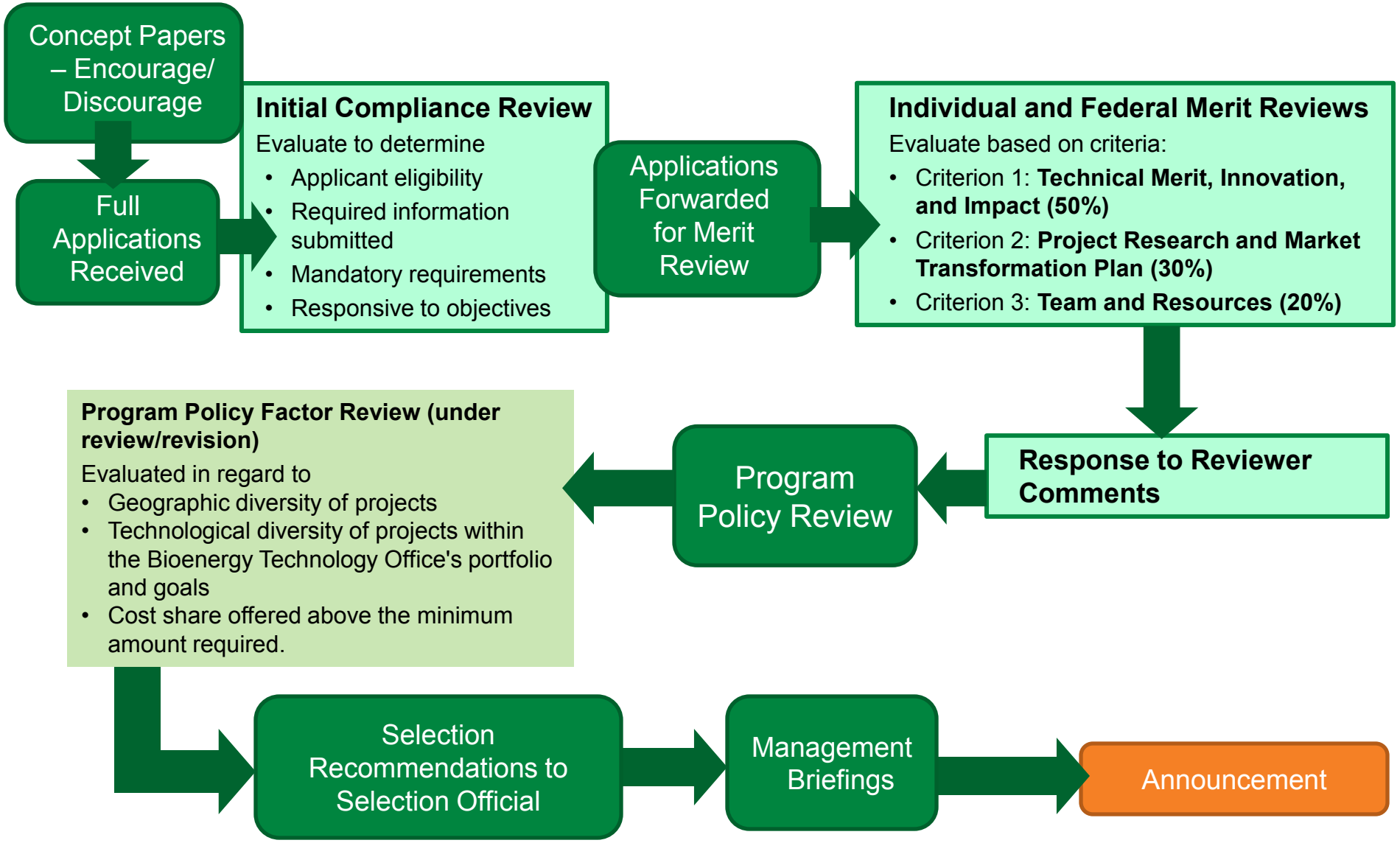


Management Lifecycle

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



FOA Process


Concept Papers – Encourage/ Discourage
Full Applications Received
Initial Compliance Review
Evaluate to determine
• Applicant eligibility
• Required information submitted
• Mandatory requirements
• Responsive to objectives
Applications Forwarded for Merit Review
Individual and Federal Merit Reviews
Evaluate based on criteria:
• Criterion 1: Technical Merit, Innovation, and Impact (50%)
• Criterion 2: Project Research and Market Transformation Plan (30%)
• Criterion 3: Team and Resources (20%)
Response to Reviewer Comments
Program Policy Review
Program Policy Factor Review (under review/revision)
Evaluated in regard to
• Geographic diversity of projects
• Technological diversity of projects within the Bioenergy Technology Office's portfolio and goals
• Cost share offered above the minimum amount required.
Selection Recommendations to Selection Official
Management Briefings
Announcement

AOP Process

- Labs submit concept papers for new projects giving BETO the opportunity to request a full AOP proposal for review
- Ongoing projects are forwarded to the MRC process depending on where they fall in the review cycle
- Our goal is to have 100% of our lab research reviewed by external stakeholders by FY2017
- We began the external merit review process with our FY15 projects and are on track to review a third of our projects each year
- This process, along with identifying lab core capabilities and our Peer Review, ensures that we are funding the best research at the national labs
- The AOP merit review involves written comments and scores from at least three reviewers from a variety of expertise areas for each proposal
- MRC Criteria include
  - Criterion 1: Technical Merit, Innovation, and Impact (50%)
  - Criterion 2: Project Approach (30%)
  - Criterion 3: Team, Resources and Inter-Lab Collaboration (20%)
- After receiving external merit review comments, BETO evaluates the strengths of each project in the portfolio and makes decisions based on available budget
- AOPs can be modified through a change control process once the projects are active

Project Management

- Manage project progress against Program goals/SOW/milestones
  - Conduct site visits and project reviews
  - Maintain on-going relationship/communications with Principal Investigator and team members
  - Review invoices/reimbursements
  - Review and analyze progress reports
  - Ensures projects are conducted within the requirements and regulations
- Graded Approach
  - More funding & higher risk = greater oversight/control
  - Low dollar/“risk” -> appropriate SOW, review costs for allowable, allocable, reasonable; review deliverables
  - High dollar or “risk”/ Capital Projects -> Tailored use of management tools (informed by DOE O 413.3)

Project Management – All Projects

Internal Management Documents:

- Project Management Plan
  - Contact information
  - Tracking information
  - Stage/status
  - Description/Objectives
  - Annual work plan
  - Subcontractor information
  - Current and out-year budgets by task
  - Milestones
- Standardized quarterly reports
  - Milestone status/variance
  - Budget status/variance
  - Modified/simplified earned value
  - Narrative
- Data-mining to inform goals and progress
- Validations
- Go/No-Go Reviews
- Critical Decision Reviews

Biomass Project Management Plan (PMP)

The Project Management Plan (PMP, Excel Workbook)

Features

1. One-page summary of project, contact information, partners, locations, analysis of recent progress.
2. Annual estimated spending plans, out-year funding requests & historical obligations & spending (by task & subcontractor)
3. Summary of milestones, deliverables and links to program level C milestones and technical barriers, performance metrics
4. Gantt charts, narrative AOP for that fiscal year

Applications & Use

1. Project management and tracking, links to high-level program milestones and targets, program planning and defining current and out-year milestones. Measures and performance metrics for project management needs.
2. Contains project and DOE contact information, assignments to platforms by Program WBS, CPS & B&R numbers, non-proprietary statement of objectives, detailed annual plans, overview of project structure and schedule.
3. Data calls, information for requests and budget planning, feed into Biomass Database (MS-Access) for BETO budget planning. Resources broken out by tasks
4. Milestones and project summary for CPS, provides better understanding of project and annual plans, allows DOE to see how the project is organized by tasks, annual narrative for operating plans

PMP Section A – Project General Information

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

FY15 Project Management Plan

A. Project Information

OBP WBS		**Title**					
Contact Information	Name	Phone	Email	Program Element/Area		CTG (Critical Technology Goal Area)	
DOE Technology Manager				Project Initiated (dd/mm/yy)		CID or Laboratory Designation	
DOE Technical Project Officer (TPO)				Planned Project Completion Date (dd/mm/yyyy)		CPS Agreement #	
PMC Project Monitor				Date of Last Gate, Project or Peer Review (dd/mm/yy)		Insert Text File (Word) of Full SOW ►►	
Company Contact or Lab Relationship Manager				Project Location Zip Code		Insert Gantt Chart (or equivalent) ►►	
Principal Investigator				Performing Organization (Only Prime Recipient)		Project Technology Readiness Level (TRL)	
Co-Principal Investigator (if applicable)				Funding Partner(s) [Any partner or subcontractor who provides cost share]		Subject to Stage Gate Review?	
Project Description (non-proprietary)							
Summary of Project Objectives & Tasks (at the A, B, C, etc.level from Section C of PMP, non-proprietary)							
Annual Work Plan FY2015 (typically 1-4 paragraph lengths of text or about 1/2 to 3/4 page of text)							
Summary of Work to date (typically 2-6 paragraphs or about 1-2 pages of text)							

PMP Section B – Financial Information

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

Section B. Financial Description of Project

Prime Recipient Name	Location (zip code)	Total DOE Funds Obligated to date	Carryover of DOE funding into FY15 (if applicable)	FY15 DOE Obligations Planned	Requested DOE FY Obligation (if applicable)				Current Approved DOE Total	Comments/Issues
					FY16	FY17	FY18	FY19		
Subcontractors or Lab Partners										
Funding by task number at the major task level (A,B,C,D, etc.) as specified in section C below (columns E-H)	Percent Recipient Cost Share	Total Project Funds Spent to date		FY15 Total Spend plan (DOE & Cost Share)	Fiscal Year Estimated Spending Plan (if applicable, including Cost Share)				Current Approved Spend Plan Total	Comments/Issues
					FY16	FY17	FY18	FY19		
									$ -	
									$ -	
									$ -	
									$ -	
									$ -	

PMP Section C - WBS/Task Information

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

C. Project Plan with tasks, subtasks, milestones, deliverables, Go No/Go decision points and including performance requirements and metrics

Project WBS Number	Number of Task, Subtask, Milestone, Deliverable and Go No/Go Decision Points	Title - Tasks, Subtasks, Milestones, Deliverables including Go No/Go Decision Pts	*For milestones* provide type	Performer(s)	Program Pathway C Milestones Link	Start Date (Tasks, Subtasks Only)	Planned Completion Date (Tasks, Subtasks and Milestones)	TRL Starting Level	TRL Finishing Level	Barriers Addressed	Milestone & Decision Point Completion Criteria & Metrics	Task, Subtask or Milestone Description	Mark as proprietary or confidential
			C - Project Level Supports a B ML										
			D - Project Level - Supports a C Level										
			E - Project Internal Tracking										
			DL - Project Deliverable										
			GN - Go No/Go Decision										
			JL - Programmatic Joule Milestone										

The Quarterly Report – *Excel Workbook*

Features

1. One-page summary of project, contact information, partners, locations, "one glance" status and analysis of recent progress.

2. Financial update and summary by quarter for current FY plus historical data

3. Summary of milestones, deliverables and links to program level C milestones and technical barriers

4. Quarterly narrative progress report (based on a template)

Applications & Use

1. Tracking technical progress, ability to show links to high-level program milestones and targets, self-evaluation by applicant on progress

2. Source of information upon which to base analysis of recent progress, info on outreach and publications, insights into variances and project issues

3. Tracking costs, uncosteds, cost share, feed into Access database for BETO budget planning

4. HQ data calls, contact information, summary suitable for CPS, assignments to platforms by WBS, CPS & B&R numbers, short statement of objectives, overview of project structure.

Biomass Project Management Tools - Quarterly Report Technical Section

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

A. Quarterly Project Description & Analysis (FY15)

OBP WBS		**Title**					Select Current Reporting Period:	**FY15_Q1**
Contact Information	Name		Phone	Email	Program Element/Area		CTG (Critical Technology Goal)	
DOE Technology Manager					Project Initiated (dd/mm/yy)		CID or Laboratory Designation	
DOE Technical Project Officer (TPO)					Planned Project Completion Date		CPS Agreement #	
PMC Project Monitor								
Company Contact or Lab Relationship Manager								
Principal Investigator								
Co-Principal Investigator (if applicable)					Performing Organization (Only Prime Recipient)		Funding Partner(s) [Any partner or subcontractor who provides cost share]	
Project Description (non-proprietary)							Insert Text File (Word or Other) of Quarterly Report ►►	
For GO & NETL Use Only: DOE Project Officer Summary Analysis								
For Laboratory Relationship Managers (LRM) Use Only: LRM Summary Analysis								

C. Progress within tasks and milestones for reporting quarter

Project WBS number	Number of Task, Subtask, Milestone, Deliverable including Go No/Go Decision Points	Title - Tasks, Subtasks, Milestones, Deliverables including Go No/Go Decision Pts	For milestones provide type	Performer(s)	Status of Progress in Task or Milestone (G,Y,R)*	Start Date (Tasks, Subtasks Only)	Original Planned Completion Date (*tasks and milestones*)	Approved Updated Completion Date	% Completion Planned	% Actual Completion	Schedule Progress Factor	Actual Milestone/deliverable/decision Completion Date	Task or Milestone Completion Criteria (to include cost and performance metrics)	Budget by Task (report for task level only, subtasks are not required)				Mark as Proprietary or Confidential
														Original (baseline)	Approved Updated Budget	Actual (Amount spent to date per task)	Comments	
											0.0							
											0.0							
											0.0							
											0.0							
											0.0							
											0.0							
											0.0							

Biomass Project Management Tools - Quarterly Report Financial Section

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

CPS #:	0	**Recipient Comments:**	
CID #:	0	Please put any comments you may have in this field. Thanks.	
DOE Project Total:	$ -		

Project Spend Plan and Estimate of Future Spending (excludes National Laboratory Spending)

			Current Approved Spend Plan			Obligated	Estimated Future Spend Plan			Funds Expended to Date			
Period (by **Federal** Fiscal Year)			DOE Amount	Cost Share	Total	DOE Amount	DOE Amount	Cost Share	Total	DOE Amount	Cost Share	Total	
	From	To											
FY05 and Prior Years		9/30/2005			0							0	
FY06	10/1/2005	9/30/2006			0							0	
FY07	10/1/2006	9/30/2007			0							0	
FY08	10/1/2007	9/30/2008			0							0	
FY09	10/1/2008	9/30/2009			0							0	
FY10	10/1/2009	9/30/2010			0							0	
FY11	10/1/2010	9/30/2011			0							0	
FY12	10/1/2011	9/30/2012			0							0	
FY13	10/1/2012	9/30/2013			0							0	
FY14 - Qtr 1	10/1/2013	12/31/2013			0							0	
FY14 - Qtr 2	1/1/2014	3/31/2014			0							0	**EOFY FY15 Estimated Uncosted Amount**
FY14 - Qtr 3	4/1/2014	6/30/2014			0							0	
FY14 - Qtr 4	7/1/2014	9/30/2014			0							0	$ -
FY15 - Qtr 1	10/1/2014	12/31/2014			0				0			0	
FY15 - Qtr 2	1/1/2015	3/31/2015			0				0			0	
FY15 - Qtr 3	4/1/2015	6/30/2015			0				0			0	
FY15 - Qtr 4	7/1/2015	9/30/2015			0				0			0	
FY16 - Qtr 1	10/1/2015	12/31/2015			0				0			0	
FY16 - Qtr 2	1/1/2016	3/31/2016			0				0			0	
FY16 - Qtr 3	4/1/2016	6/30/2016			0				0			0	
FY16 - Qtr 4	7/1/2016	9/30/2016			0				0			0	
FY17 - Qtr 1	10/1/2016	12/31/2016			0				0			0	
FY17 - Qtr 2	1/1/2017	3/31/2017			0				0			0	
FY17 - Qtr 3	4/1/2017	6/30/2017			0				0			0	
FY17 - Qtr 4	7/1/2017	9/30/2017			0				0			0	
FY18 - Qtr 1	10/1/2017	12/31/2017			0				0			0	
FY18 - Qtr 2	1/1/2018	3/31/2018			0				0			0	
FY18 - Qtr 3	4/1/2018	6/30/2018			0				0			0	**Current Estimated Uncosted Amount:**
FY18 - Qtr 4	7/1/2018	9/30/2018			0				0			0	
Totals			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Biomass Project Management Tools - Data Mining

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

Process Indicators for Pyrolysis Production of Biofuels — **PROPRIETARY/BUSINESS SENSITIVE**

PROJECT TITLE:: <Enter Project Name Here>

EVALUATION DATE:: <INSERT DATE COMPLETED>

USE PROCESS DESCRIPTION TAB to provide a block flow diagram and brief (one paragraph) description of the major process steps/unit operations. Include the type of major equipment. Include relevant process information (e.g. temperatures and pressures.

TECHNICAL DATA INPUTS

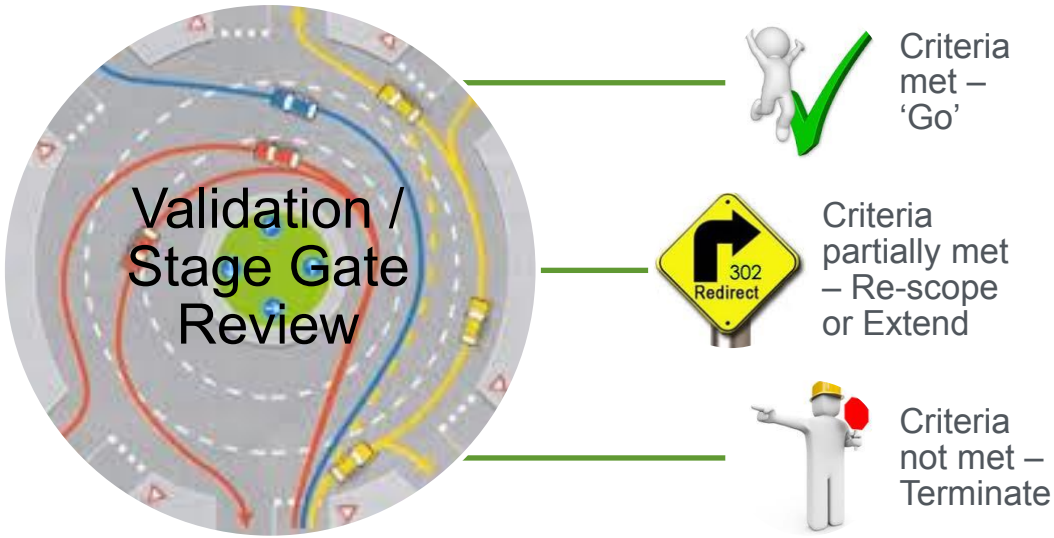
Section	Parameter	Units	Value(s)*		Basis/Justification**
Instructions READ!!!!	Use this column to list key process parameters. **If key process parameters are not included, please add key parameters by inserting rows.** If suggested parameter is not appropriate for your process, populate with N/A. If data is appropriate, but no data, populate with ND.	Use suggested when possible, otherwise change units in to match your data.	Use these columns to provide data for key process parameters. Under the "Operational Data or Best Available Data" heading, populate with the average value achieved to date based on actual operating data/ If no operational data is available, please provide best available data (design basis, simulation, etc.). Use the "Basis/Justification" column to define how data was generated. Provide commercial targets for key parameters (non-greyed out fields) under the "Nth Commercial Plant Targets".		Use this column to briefly describe the basis or justification for current best result and scale it was achieved at for the accompanying performance metrics. Examples of basis include: performance tests, integrated pilot data, PDU data, lab data, etc. Include number of hours at steady state (steady state typically defined as continuous operation of the integrated process for ≥3 residence times), or the results of a number of replicate short runs of the isolated process step, etc. Include how the measurement was made (e.g. analysis of the gasifier outlet stream using gas chromatography). If multiple parameters use the same basis, you may reference a footnote that describes the basis rather than repeat the basis.
			Operational Data or Best Available Data	**Nth Commercial Plant Targets**	
Process Metrics	Commissioning Period	days			
	Start-up Period	days			
	Feedstock Throughput Design	BDMT/day			
	Max Throughput during Data Collection	BDMT/day			
	Avg Throughput during Data Collection	BDMT/day			
	Hours on Stream during data collection	hrs			
	Is the facility used to generated data integrated	yes/no			
	Longest Continuous Run	hrs			
	What stopped the run	Text Description			
Main Product(s)	List all products (biofuels and biofuel intermediates) and by-products serving as revenue				
By Product(s)	By-Product 1				
	By-Product …				
Feedstock (as delivered)	Feedstock Type				
	Feedstock Energy content (dry basis)	LHV/kg			
	Feedstock Cost	$/BDMT			
	Nominal form or size	inch			
	Feedstock Moisture as Received	%			
	Ash content (dry basis)	wt %			
	C (dry basis)	mol%			
	H (dry basis)	mol%			
	N (dry basis)	mol%			
	O (dry basis)	mol%			
	S (dry basis)	mol%			
Drying and Grinding	Grinding energy use	kWh/BDMT			
	Final Moisture (required for process)	wt %			
	Final Nominal particle size	inch			
Pyrolysis	Temperature	deg C			
	Pressure	psia			
	Residence Time	seconds			
Pyrolysis Exit Yield	% inlet C as usable for biofuel [all C except char, losses]	%			
	Energy Efficiency across pyrolysis (LHV)	%			
	Gas Yield	kg/BDMT			
	Char Yield	kg/BDMT			
	Water Yield	kg/BDMT			
	Pyrolysis Oil Yield	kg/BDMT			
	Pyrolysis Oil TAN	mg/g			
	Pyrolysis Oil Oxygen Content	wt %			

Project Validations & Stage Gates

- BETO has been *actively* utilizing various go/no go processes since 2007.
- Currently employ 3-4 “flavors”
  - Biochemical Conversion utilizes a technical validation process throughout all projects, including a stage gate review and go/no go within first 2/3 of each project, at the end of BP1.
  - Thermochemical Conversion utilizes a stage rate review and go/no go at the end of BP1.
  - DMT utilizes technical validations and gates between budget periods.
  - Algae utilizes a validation process similar to Biochemical Conversion
- Decision to utilize such processes were based on past lessons learned from poor performing projects as well as unsubstantiated claims made by recipients (both publically and to DOE).

Biological Conversion - Process

- Validations verify technical and economic performance related to technical data provided in the FOA applications—benchmark and targets for each review point.
- Stage Gate review meetings are held with a panel of external, independent reviewers (4-5). Recommendations are provided to DOE to help inform the go/no go decision.
  - 3 outcomes are possible: GO, Termination, Re-Scope (all 3 outcomes have occurred within this program)



Biochemical Validation – Example Technical Table

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

Biological Upgrading Technologies for Advanced Biofuels & Products

Table A1	*Example*		From Applicant		
Parameter/Performance	*Benchmark*	*Target*	Benchmark (Current)	Intermediate Target	Final Target
Feed (hydrolysate of what feed, conditioning process)	*Corn stover hydrolysate*	*Corn stover hydrolysate*			
Process type (*e.g.*, **SSF, Ferm, HHF)**	*SSF*	*HHF*			
Biofuel or product	*Biofuel*	*Biofuel*			
Enzyme loading					
Inoculation level (g dry cell mass/L)					
Temperature (C)					
pH (pH units)					
Scale demonstrated (>1L, >10L, >100L, etc.)	*>1L*	*>100L*			
Final Product					
Type of product (biofuel or product)	Biofuel	Biofuel			
Specific product type (alcohol, hydrocarbon, specialty, etc.)	Alcohol	Alcohol			
Biofuel or product name	n-butanol	n-butanol			
Type(s) of subsequent separation(s) required	Distillation	Distillation			
Biofuel quality (please fill out for biofuels only):					
Btu content (Btu/gal)	100,000	110,000			
Oxygen content (wt%)	25%	22%			
TAN (total acid number)					
Net biofuel yield (gal fuel/ton dry biomass)	90	95			
Product quality (please fill out for non-biofuel products only):					
Product purity (%)	N/A	N/A			
Net product yield (kg product/ton dry biomass)	N/A	N/A			
Initial concentrations:					
Total Solids (%)	*20%*	*20%*			
Insoluble Solids (%)					
Catalyst loading (g/L)					
Glucose (g/L)	66	66			
Xylose (g/L)	25	25			
Arabinose (g/L)	7	7			
Other monomeric sugar (g/L)	2	2			
Gluc + C6-oligomers (g/L)					
Xylo + C5-oligomers (g/L)					
Furfural (g/L)					
HMF (g/L)					
Other sugar-derived oxygenates, convertible (g/L)					
Solubilized lignin (g/L)					
Acetate (g/L)					
Other organics, non-convertible (g/L)	*10*	*11*			
Sugar Utilization					
Glucose (%)	*100*	*100*			
Xylose (%)	*85*	*94*			
Other sugars (%)	*0*	*90*			
Final Concentrations					
Total Solids (%)					
Insoluble Solids (%)					
Catalyst loading (g/L)					
Glucose (g/L)	63	60			
Xylose (g/L)	24	20			
Arabinose (g/L)	7	5			
Other monomeric sugar (g/L)	2	2			
Gluc + C6-oligomers (g/L)					
Xylo + C5-oligomers (g/L)					
Furfural (g/L)					
HMF (g/L)					
Other sugar-derived oxygenates, convertible (g/L)					
Solubilized lignin (g/L)					
Acetate (g/L)					
Other organics, non-convertible (g/L)					
Biofuel Yields (% theoretical)					
Glucose to fuel (%)	*95*	*95*			
Xylose to fuel (%)	*75*	*85*			
Other sugars to fuel (%)	*0*	*85*			
Final fuel titer (g/L)	*50*	*62*			
Robustness					
Reaction rate (time to achieve yields above) (hours)	*84-168*	*36-48*			
Avg. Volumetric Productivity (g/L-h)					
Max. Vol. Productivity (g/L-h)					
References/Notes	***example only.***	***example only.***			

- Biological Upgrading Technology Table
- Technologies Tables not shown:
  - Chemical Upgrading
  - Hybrid Upgrading Technologies
  - Separation Technologies
- Technology tables used to fully understand recipient's process
- Can be adjusted to better fit specific technology

Technology Table

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

Biological Upgrading Technologies for Advanced Biofuels & Products

Table A1	*Example*		From Applicant		
Parameter/Performance	*Benchmark*	*Target*	Benchmark (Current)	Intermediate Target	Final Target
Feed (hydrolysate of what feed, conditioning process)	*Corn stover hydrolysate*	*Corn stover hydrolysate*			
Process type (*e.g.*, SSF, Ferm, HHF)	*SSF*	*HHF*			
Biofuel or product	*Biofuel*	*Biofuel*			
Enzyme loading					
Inoculation level (g dry cell mass/L)					
Temperature (C)					
pH (pH units)					
Scale demonstrated (>1L, >10L, >100L, etc.)	*>1L*	*>100L*			
Final Product					
Type of product (biofuel or product)	Biofuel	Biofuel			
Specific product type (alcohol, hydrocarbon, specialty, etc.)	Alcohol	Alcohol			
Biofuel or product name	n-butanol	n-butanol			
Type(s) of subsequent separation(s) required	Distillation	Distillation			
Biofuel quality (please fill out for biofuels only):					
Btu content (Btu/gal)	100,000	110,000			
Oxygen content (wt%)	25%	22%			
TAN (total acid number)					
Net biofuel yield (gal fuel/ton dry biomass)	90	95			
Product quality (please fill out for non-biofuel products only):					
Product purity (%)	N/A	N/A			
Net product yield (kg product/ton dry biomass)	N/A	N/A			
Initial concentrations:					
Total Solids (%)	*20%*	*20%*			
Insoluble Solids (%)					
Catalyst loading (g/L)					
Glucose (g/L)	66	66			
Xylose (g/L)	25	25			
Arabinose (g/L)	7	7			
Other monomeric sugar (g/L)	2	2			
Gluc + C6-oligomers (g/L)					
Xylo + C5-oligomers (g/L)					
Furfural (g/L)					
HMF (g/L)					
Other sugar-derived oxygenates, convertible (g/L)					
Solubilized lignin (g/L)					
Acetate (g/L)					
Other organics, non-convertible (g/L)	*10*	*11*			
Sugar Utilization					
Glucose (%)	*100*	*100*			
Xylose (%)	*85*	*94*			
Other sugars (%)	*0*	*90*			
Final Concentrations					
Total Solids (%)					
Insoluble Solids (%)					
Catalyst loading (g/L)					
Glucose (g/L)	53	60			
Xylose (g/L)	24	20			
Arabinose (g/L)	7	5			
Other monomeric sugar (g/L)	2	2			
Gluc + C6-oligomers (g/L)					
Xylo + C5-oligomers (g/L)					
Furfural (g/L)					
HMF (g/L)					
Other sugar-derived oxygenates, convertible (g/L)					
Solubilized lignin (g/L)					
Acetate (g/L)					
Other organics, non-convertible (g/L)					
Biofuel Yields (% theoretical)					
Glucose to fuel (%)	*85*	*85*			
Xylose to fuel (%)	*75*	*85*			
Other sugars to fuel (%)	*0*	*85*			
Final fuel titer (g/L)	*50*	*62*			
Robustness					
Reaction rate (time to achieve yields above) (hours)	*54-168*	*36-48*			
Avg. Volumetric Productivity (g/L-h)					
Max. Vol. Productivity (g/L-h)					
References/Notes	*example only.*	*example only.*			

Technology Table

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

Biological Upgrading Technologies for Advanced Biofuels & Products

Table A1	*Example*		From Applicant		
Parameter/Performance	*Benchmark*	*Target*	Benchmark (Current)	Intermediate Target	Final Target
Feed (hydrolysate of what feed, conditioning process)	*Corn stover hydrolysate*	*Corn stover hydrolysate*			
Process type (e.g., SSF, Ferm, HHF)	*SSF*	*HHF*			
Biofuel or product	*Biofuel*	*Biofuel*			
Enzyme loading					
Inoculation level (g dry cell mass/L)					
Temperature (C)					
pH (pH units)					
Scale demonstrated (>1L, >10L, >100L, etc.)	*>1L*	*>100L*			
Final Product					
Type of product (biofuel or product)	Biofuel	Biofuel			
Specific product type (alcohol, hydrocarbon, specialty, etc.)	Alcohol	Alcohol			
Biofuel or product name	n-butanol	n-butanol			
Type(s) of subsequent separation(s) required	Distillation	Distillation			
Biofuel quality (please fill out for biofuels only):					
Btu content (Btu/gal)	100,000	110,000			
Oxygen content (wt%)	25%	22%			
TAN (total acid number)					
Net biofuel yield (gal fuel/ton dry biomass)	90	95			
Product quality (please fill out for non-biofuel products only):					
Product purity (%)	N/A	N/A			
Net product yield (kg product/ton dry biomass)	N/A	N/A			
Initial concentrations:					
Total Solids (%)	*30%*	*30%*			
Insoluble Solids (%)					
Catalyst loading (g/L)					
Glucose (g/L)	66	66			
Xylose (g/L)	25	25			
Arabinose (g/L)	7	7			
Other monomeric sugar (g/L)	2	2			
Gluc + C6-oligomers (g/L)					
Xylo + C5-oligomers (g/L)					
Furfural (g/L)					
HMF (g/L)					
Other sugar-derived oxygenates, convertible (g/L)					
Solubilized lignin (g/L)					
Acetate (g/L)					
Other organics, non-convertible (g/L)					
Sugar Utilization					
Glucose (%)	*100*	*100*			
Xylose (%)	*85*	*94*			
Other sugars (%)	*0*	*90*			
Final Concentrations					
Total Solids (%)					
Insoluble Solids (%)					
Catalyst loading (g/L)					
Glucose (g/L)	63	60			
Xylose (g/L)	24	20			
Arabinose (g/L)	7	5			
Other monomeric sugar (g/L)	2	2			
Gluc + C6-oligomers (g/L)					
Xylo + C5-oligomers (g/L)					
Furfural (g/L)					
HMF (g/L)					
Other sugar-derived oxygenates, convertible (g/L)					
Solubilized lignin (g/L)					
Acetate (g/L)					
Other organics, non-convertible (g/L)					
Biofuel Yields (% theoretical)					
Glucose to fuel (%)	*95*	*95*			
Xylose to fuel (%)	*75*	*85*			
Other sugars to fuel (%)	*0*	*85*			
Final fuel titer (g/L)	***50***	***62***			
Robustness					
Reaction rate (time to achieve yields above) (hours)	*84-168*	*36-48*			
Avg. Volumetric Productivity (g/L-h)					
Max. Vol. Productivity (g/L-h)					
References/Notes	***An example only.***	***An example only.***			

Techno-Economic Table

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

Process Details and Costs				
Feedstock Type				
Feed Rate (dry ton/day)		Benchmark or Current Process	Intermediate Target	Final Target Process (36 months)
Biofuel Yield (gallons/dry ton)				
BioProduct Yield (if applicable, gal/dry ton)				
Line 1: Annual Biofuel of Product Production (MM gallons)				
Line 1a: Annual BioProduct Production (MM gallons)				
Equipment Costs (2013$) (Biochemical)	**Description**	**Installed Capital Cost (MM$)**		**Installed Capital Cost (MM$)**
Feedstock Storage and Handling				
Pretreatment and Conditioning				
Enzymatic Hydrolysis, Hydrolysate Conditioning, & Bioconversion				
Cellulase Enzyme Production				
Product Recovery and Upgrading				
Wastewater Treatment				
Product and Feed Chemical Storage				
Combustor, Boiler, and Turbogenerator				
Utilities (include steam/electricity here or in operating costs)				
Line 2: Total Installed Capital				
Total Installed Capital per Annual Gallon (line 2 divided by line 1)				
Operating Costs (2013$)	**Description**	**MM$/yr**		**MM$/yr**
Feedstock Storage and Handling				
Pretreatment and Conditioning				
Enzymatic Hydrolysis, Hydrolysate Conditioning, & Bioconversion				
Cellulase Enzyme Production				
Product Recovery and Upgrading				
Wastewater Treatment				
Product and Feed Chemical Storage				
Combustor, Boiler, and Turbogenerator				
Waste Disposal				
Steam				
Electricity				
Labor and Maintenance				
Line 3: Total Operating Costs				
Line 4: Co-product Credits				
Line 5: Net Operating Costs (line 3 minus line 4)				
Net Biofuel or Product Production Costs ($/gal) (line 5 divided by line 1)				
Energy[1] Balance Information		Annual Value/Units	Annual Value/Units	Annual Value/Units
Inputs:[2]	Purchased Electricity			
	Purchased Steam or Hot Water			
	Coal			
	Natural Gas			
	Diesel			
	CHP			
	Others (specify):			
Outputs:	Excess Electricity Generated			
	Others (specify):			

- Used to measure current economic viability versus targeted economic viability.
- Can be modified to better suit each technology
- CapEx and OpEx are broken out
- Estimation methods and assumptions are recorded.

Techno-Economic Table

Process Details and Costs	
Feedstock Type	
Feed Rate (dry ton/day)	
Biofuel Yield (gallons/dry ton)	
BioProduct Yield (if applicable, gal/dry ton)	
Line 1: Annual Biofuel of Product Production (MM gallons)	
Line 1a: Annual BioProduct Production (MM gallons)	

Equipment Costs (2013$) (Biochemical)	Description
Feedstock Storage and Handling	
Pretreatment and Conditioning	
Enzymatic Hydrolysis, Hydrolysate Conditioning, & Bioconversion	
Cellulase Enzyme Production	
Product Recovery and Upgrading	
Wastewater Treatment	
Product and Feed Chemical Storage	
Combustor, Boiler, and Turbogenerator	
Utilities (include steam/electricity here or in operating costs)	
Line 2: Total Installed Capital	
Total Installed Capital per Annual Gallon (line 2 divided by line 1)	

Operating Costs (2013$)	Description
Feedstock Storage and Handling	
Pretreatment and Conditioning	
Enzymatic Hydrolysis, Hydrolysate Conditioning, & Bioconversion	
Cellulase Enzyme Production	
Product Recovery and Upgrading	
Wastewater Treatment	
Product and Feed Chemical Storage	
Combustor, Boiler, and Turbogenerator	
Waste Disposal	
Steam	
Electricity	
Labor and Maintenance	
Line 3: Total Operating Costs	
Line 4: Co-product Credits	
Line 5: Net Operating Costs (line 3 minus line 4)	
Net Biofuel or Product Production Costs ($/gal) (line 5 divided by line 1)	

Energy[1] Balance Information		Annual Value
Inputs:[2]	Purchased Electricity	
	Purchased Steam or Hot Water	
	Coal	
	Natural Gas	
	Diesel	
	CHP	
	Others (specify):	
Outputs:	Excess Electricity Generated	
	Others (specify):	

Process Details and Costs	
Feedstock Type	
Feed Rate (dry ton/day)	
Biofuel Yield (gallons/dry ton)	
BioProduct Yield (if applicable, gal/dry ton)	
Line 1: Annual Biofuel of Product Production (MM gallons)	
Line 1a: Annual BioProduct Production (MM gallons)	

Equipment Costs (2013$) (Biochemical)	Descripti
Feedstock Storage and Handling	
Pretreatment and Conditioning	
Enzymatic Hydrolysis, Hydrolysate Conditioning, & Bioconversion	
Cellulase Enzyme Production	
Product Recovery and Upgrading	
Wastewater Treatment	
Product and Feed Chemical Storage	
Combustor, Boiler, and Turbogenerator	
Utilities (include steam/electricity here or in operating costs)	
Line 2: Total Installed Capital	
Total Installed Capital per Annual Gallon (line 2 divided by line 1)	

Techno-Economic Table

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

Process Details and Costs	
Feedstock Type	
Feed Rate (dry ton/day)	
Biofuel Yield (gallons/dry ton)	
BioProduct Yield (if applicable, gal/dry ton)	
Line 1: Annual Biofuel of Product Production (MM gallons)	
Line 1a: Annual BioProduct Production (MM gallons)	

Equipment Costs (2013$) (Biochemical)	Description
Feedstock Storage and Handling	
Pretreatment and Conditioning	
Enzymatic Hydrolysis, Hydrolysate Conditioning, & Bioconversion	
Cellulase Enzyme Production	
Product Recovery and Upgrading	
Wastewater Treatment	
Product and Feed Chemical Storage	
Combustor, Boiler, and Turbogenerator	
Utilities (include steam/electricity here or in operating costs)	
Line 2: Total Installed Capital	
Total Installed Capital per Annual Gallon (line 2 divided by line 1)	

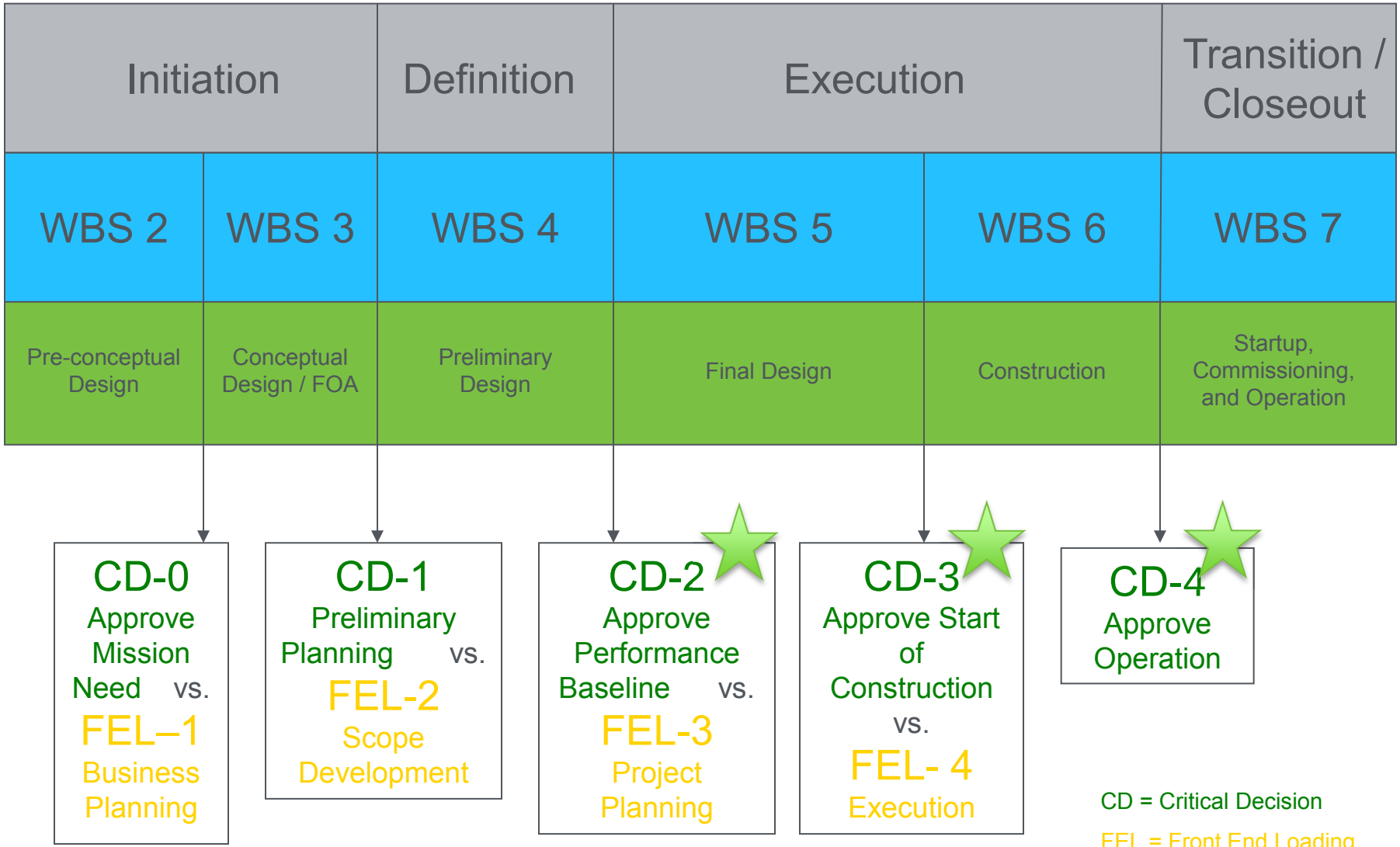
Operating Costs (2013$)	Description
Feedstock Storage and Handling	
Pretreatment and Conditioning	
Enzymatic Hydrolysis, Hydrolysate Conditioning, & Bioconversion	
Cellulase Enzyme Production	
Product Recovery and Upgrading	
Wastewater Treatment	
Product and Feed Chemical Storage	
Combustor, Boiler, and Turbogenerator	
Waste Disposal	
Steam	
Electricity	
Labor and Maintenance	
Line 3: Total Operating Costs	
Line 4: Co-product Credits	
Line 5: Net Operating Costs (line 3 minus line 4)	
Net Biofuel or Product Production Costs ($/gal) (line 5 divided by line 1)	
Energy[1] Balance Information	
Inputs:[2]	Purchased Electricity
	Purchased Steam or Hot Water
	Coal
	Natural Gas
	Diesel
	CHP
	Others (specify):
Outputs:	Excess Electricity Generated
	Others (specify):

Thermochemical Conversion Process

- Negotiation Strategy
- Interim targets & timing based on statements in applications
- Incorporated into SOPO, T&C
  - Clearly define basis, metrics to avoid confusion later
- Presentation to BETO at conclusion of BP1
  - BP1 accomplishments
  - BP2 plans
    - Memo-to-file
    - Continuation application

DMT - Process

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



CD = Critical Decision

FEL = Front End Loading Phase

CD-3 – Construction Readiness Review

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

Independent Engineer's Document Description	EIR1 Status	EIR2 Status	IE Comments - *Acceptable* indicates that the document or information was appropriate for the IE to undertake a due diligence review. It does NOT mean that the document or information was accepted by the IE for design, procurement or construction purposes	Risk *(yellow: product of impact X probability ≥3; red: product of impact X probability ≥6)*	Impact Ranking (1-3)	Probability Ranking (1-3)	Mitigation strategy	Condition/DOE Go-No decision/Milestone/ Stage-gate/RRS performance EV or milestone?
Detailed Resource Loaded Schedule								
Detailed Cost Estimate								
Systems Functions & Requirements Document								
Final Design								
Design Criteria								
Permits and Environmental								
Project Execution Plan / Project Management Plan								
Performance Test Plan								
Hazards Analysis								
Risk Management Plan								
Acquisition Strategy								
Value Engineering / Engineering Report								
Pro Forma								
Comparison to Previous Independent Review (if applicable)								
Cost share								

Document that defines basis of project design and definition of project boundaries/interfaces

Design assumptions including applicable and governing codes and standards

Technical Assumptions and Inputs to the Project Pro Forma

Include operational ranges (sensitivity analysis with respect to the sale price of produced fuel).

Capacity Factor

Updated Resource Loaded Schedule

Milestones

Performance Based Metrics

Critical Path

Start up plan including start up schedule

Plant performance testing and acceptance criteria, including procedures intended to verify performance guarantees

Plant guarantees provided by EPC Contractor/Technology Provider (if applicable)

Planned operator shift schedule and job descriptions

Comprehensive Project Reviews - Objectives

- Annual review throughout period of performance for IBR projects
- Current reviews of ARRA-funded projects are focused on project closeout and comparing **project outcomes** to the **initial project application**. The goal is to review **project** outcomes to inform future DOE **program** activities.
- Project management outcomes
  - Actual scope, schedule and budget compared to initial estimates
    - Prior scale R&D, preliminary design
    - Design through construction
    - Start-up and operation
    - Contingencies (construction, start-up) – planned vs. actual
- Technology outcomes
  - Targets vs. results
  - New technology risk overview
  - Describe next steps for technology development
- Lessons learned
- Project success metrics and results