



DOE Bioenergy Technologies Office (BETO) 2019 Project Peer Review

Fulcrum Sierra BioFuels, LLC
Technology Session Area Review

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Sierra BioFuels Project

Goal Statement

- Generate a Renewable Transportation Fuel that Lessens the Reliance on Fossil Fuels
- Convert MSW-Derived Feedstock Into Renewable Transportation Fuels
- Commercialize the Fulcrum Technology that was Demonstrated at a Pilot Scale to Produce Renewable Transportation Fuels from MSW derived Feedstock

Sierra BioFuels – Key Milestones

Item	Date
Pilot Demonstration Unit Operations	Dec 2013 – Jul 2014
Biorefinery – Front-End Engineering Design Package	May 2013 – Mar 2014
LNTP Engineering Design	May 2015 - Aug 2017
Detailed Engineering	Sep 2017 -
Feedstock Processing Facility (FPF) Design Package	Aug 2014 – Aug 2015
Stage 1 FPF Construction	Jan 2016 – Aug 2016
Stage 1 FPF Performance Testing	Jul 2017

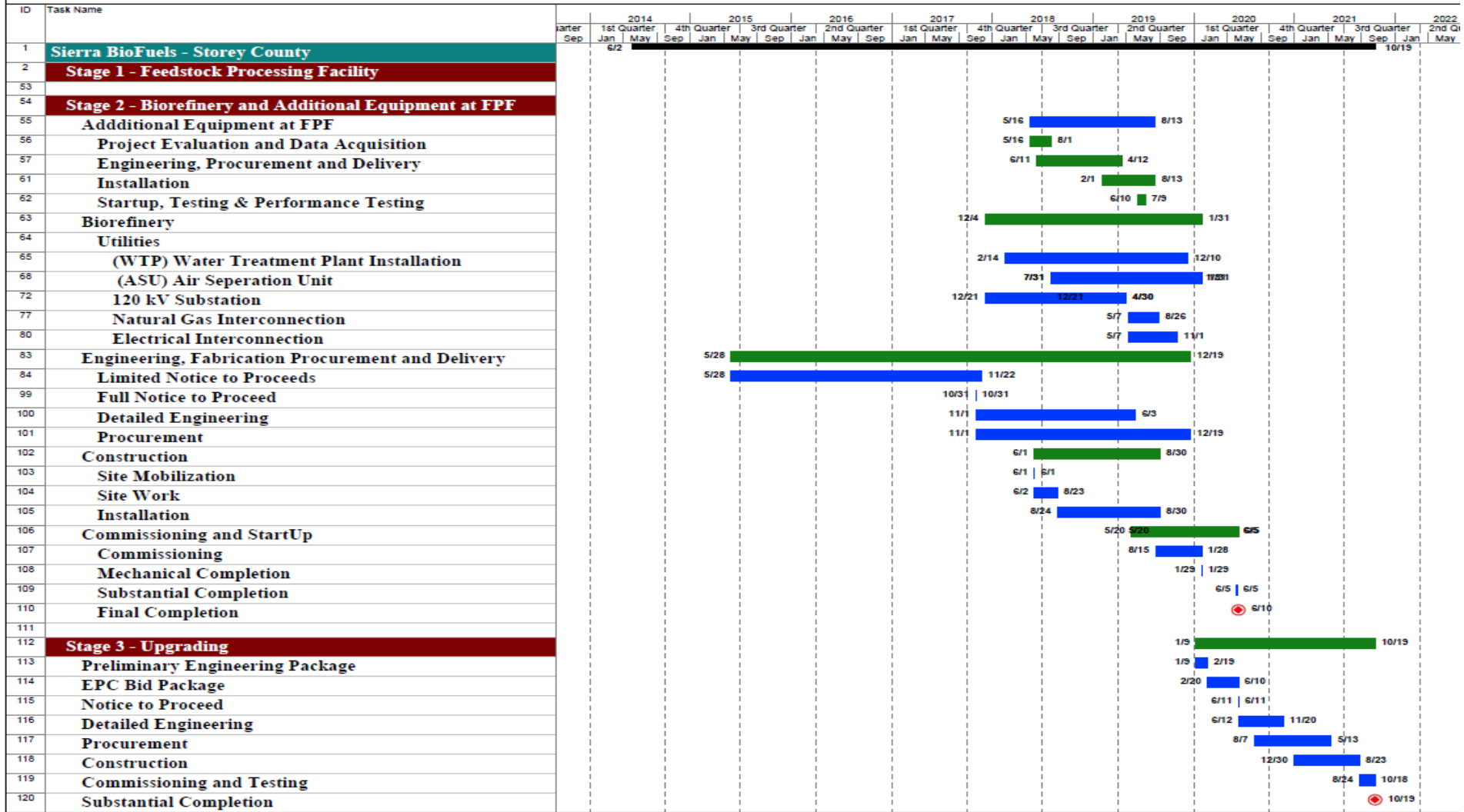
Sierra BioFuels – Key Milestones, cont'd

Item	Date
Stage 2 FPF Design	Aug 2018 – Jan 2019
Stage 2 FPF Construction and Testing	Feb 2019 – Jul 2019
Biorefinery Construction	May 2018 – Jan 2020
Biorefinery Performance Test	Jan 2020 – Jun 2020
Stage 3 Upgrading	Sep 2019 – Jun 2021

Sierra BioFuels – Master Schedule

Fulcrum Sierra BioFuels, LLC
Summary of Master Schedule

February 2019



Quad Chart Overview

Timeline

Construction Start: 2Q 2018

Production: 2Q 2020

Budget

Approximately \$205 MM

- DoD: \$70 MM
- Fulcrum: Approximately \$135 MM

Barriers

- Produce On-Spec Feedstock
- Complete Stage 3 of the Project and Upgrade F-T Liquids into SPK

Project Participants

- Fulcrum Sierra BioFuels, LLC
- DoD
- Various Technology Providers

Project Overview

Project Overview

- Overview
 - Convert MSW-Derived Feedstock Into Renewable Transportation Fuels
- Approach
 - Secured Feedstock Contracts
 - Demonstrated Technology at Pilot Scale That Minimized Scale-Up Risk
 - Secured Fixed Cost Engineering, Procurement and Construction (EPC) Contract With Process Guarantees
- Technical Accomplishments/Progress/Results
 - Pilot Demonstration Unit Successfully Demonstrated Technology

Fulcrum – MSW to Low-Carbon Fuels



Technology Performance Guaranteed

Zero-Sulfur Fuel

80% Carbon Emissions Reductions

Cost Competitive with Fossil Fuel

MSW Available Worldwide

Technical Approach

- Technical Approach
 - Develop Process to Convert Feedstock into Fuel
 - Demonstrate Process at Pilot Scale
 - Utilize Commercially Available Technologies
 - Engage EPC Contractor that will Provide a Process and Cost Guarantee (based on Fulcrum Process)
- Critical Success Factors
 - Incorporate Lessons Learned from First of a Kind Process to Future Projects
 - Optimized FPF Process
 - Meet Production Goals
 - Meet Schedule and Budget Constraints

Technical Approach- Cont

- Potential Challenges
 - Skilled Construction/Operations Labor Force in Reno Area
 - Material Inflation
 - Offtake Agreement for F-T Liquids Product

MSW – A Strategic Feedstock

Changing the way Garbage is Handled and Disposed



- Large Volumes, Ideal Locations
- Established Infrastructure
- Carbon-Rich Feedstock Ideal for Biofuel Production
- Predictable Cost
- No Competing Uses
- Resolves Waste Disposal Problems

Feedstock Processing Facility



- In Operations; Stage 1 Construction Completed on Schedule and on Budget
- MSW Delivered by Waste Service Partners Waste Management and Waste Connections
- 350,000 Tons of Waste Processed Each Year
- 175,000 Tons of Prepared MSW Feedstock Produced per Year
- Capacity up to 120 Tons per Hour of Waste Processing

Feedstock Processing Facility Photos



Truck Tipper



MSW Tip Floor

Feedstock Processing Facility

Photos, cont'd

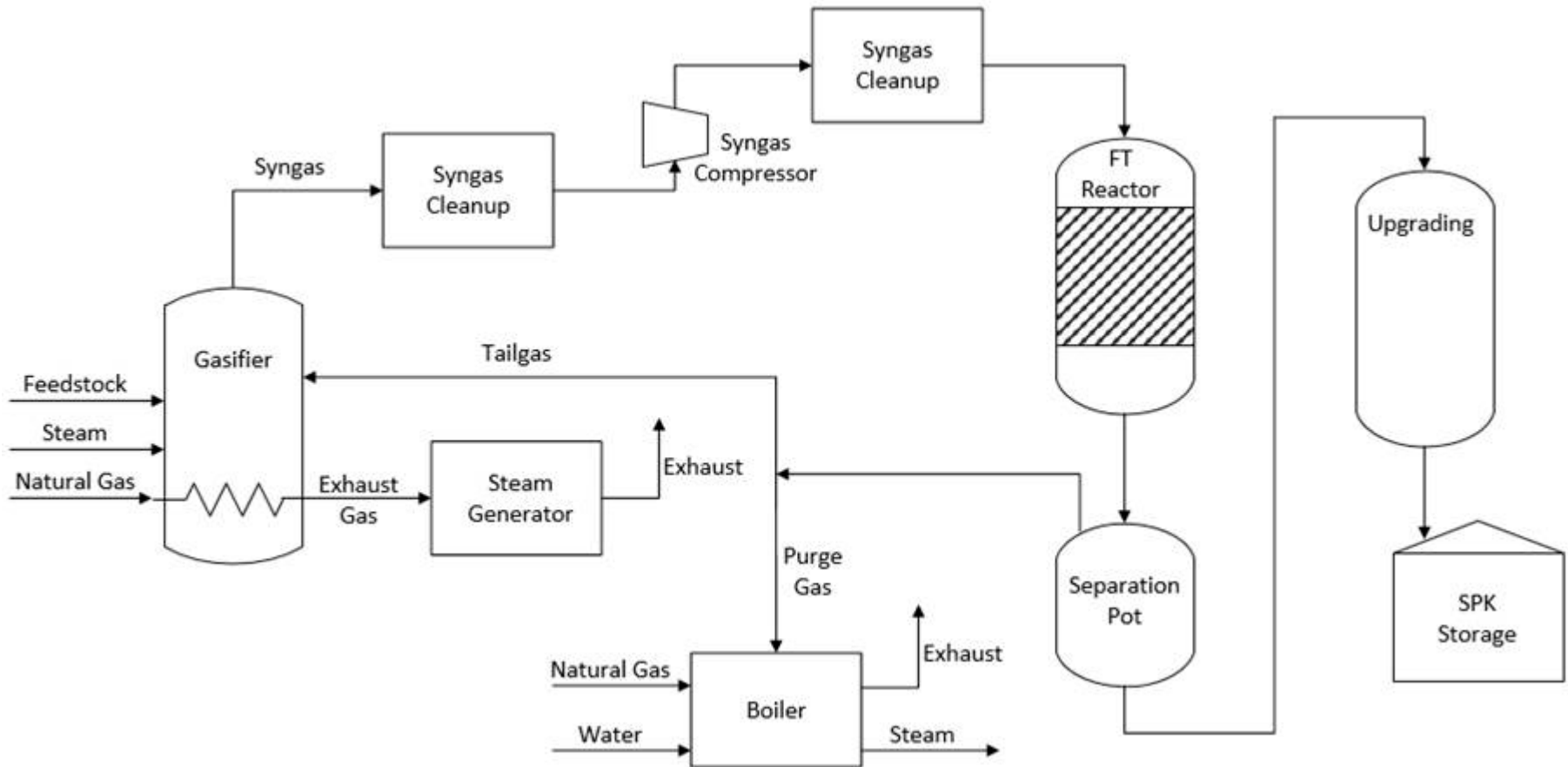


Processing Equipment

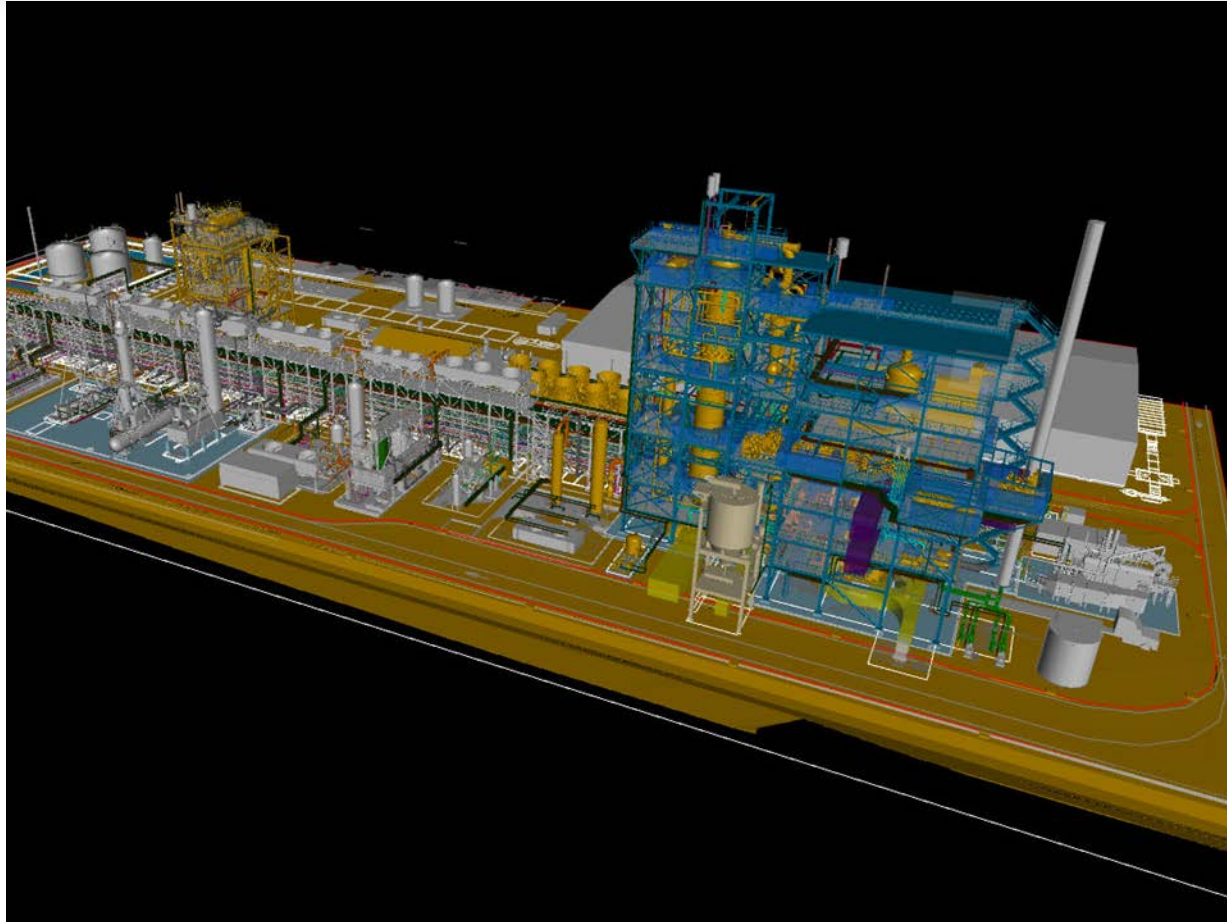


Processing Equipment

Sierra BioFuels Plant Block Diagram



Sierra BioFuels Plant



Project Management

- EPC Contractor
 - Design, Procurement, Construction and Commissioning with a Fixed-Price and Guaranteed Cost and Production Yield
- Fulcrum Project Management
 - Engaged With EPC Contractor on Daily Basis
 - Weekly Project Review Meetings Ensure Executing Project in Accordance With Project Requirements
 - Conducting Management Oversight to Execution in Accordance With Project Scope, Cost and Schedule

Project Management, cont'd

- Owner's Engineer
 - Provides Supplemental Technical Support to Fulcrum Technical Staff
- Lender Independent Engineer
 - Ensures EPC Activities are Executed in Accordance With Project Requirements
- Research and Development
 - Fulcrum
- Operator
 - Fulcrum

Technical Progress and Accomplishments

Technical Progress

Highlights

- Pilot Demonstration Unit Operated Successfully, Met or Exceeded the Performance Metrics and Demonstrated the Bio-Refinery Technology
- Scale up Risks Minimized due to the Design of the Pilot Demonstration Unit
- Completed 75% of the Detailed Design for the Bio Refinery
- Started Construction on the Bio Refinery
- Feedstock Processing Facility (FPF) Stage 1- Operated for 12 Months and Highlighted Required Processing Changes to Produce In Spec Feedstock

Construction Status

Highlights

- Completed Stage 2 FPF Process Improvements and Have Begun Construction
- Biorefinery EPC is Advancing With Procurement Nearing Completion, Foundations Being Poured and Equipment Arriving at the Site
- Installation of 120 kV Substation has Began
- Water Treatment Plant Civil Work Began in January 2019
- ASU Civil Work Began in February 2019

Feedstock Processing Facility

Stage 2 Construction Highlights

- Construction / Demolition
 - Contractor Mobilized to the Site in December 2018
 - Residual Truck Load-Out Structure Dismantled
 - Concrete Floors Saw Cut for New Trommels and Shredder Foundations
 - Tipping Floor Dust Collector Dismantled
- Procurement
 - Five Containers of Processing Equipment Delivered to the Site Including the Three Secondary Shredders

Biorefinery

Construction Site Update

- Construction Activities Completed Since November 2018
 - Gasification Structure Foundations Poured
 - Auxiliary Boiler Foundation Poured
 - Auxiliary Boiler Main Body and Economizer Delivered to the Site and set on Their Foundations
 - Installed Underground Sewage, Water and Grounding Network
 - Material Handling Equipment Delivered to the Site

Biorefinery

Photos – Construction Progress, cont'd

Overview of Concrete Pour



Placement of Auxiliary Boiler



Biorefinery

Photos – Construction Progress



Auxiliary Boiler Main Body



Economizer

Relevance and Future Work

Relevance

Fulcrum's Process Will Reduce Greenhouse Gas Emissions by More Than 80% Compared to Traditional Petroleum Production

- Creates an Excellent Source of Domestic Renewable Fuels
- Reduces Greenhouse Gas Emissions by More Than 80%
- Lowers Methane Gas Emissions From Landfills
- Reduces Carbon Emissions From Fuel Products
- Very Low Emissions Profile From Fulcrum's Facilities
- Mitigates Need for New Landfills and Greatly Extends Life of Existing Landfills
- Creates a New Generation of Green Jobs

Future Work

- Sierra BioFuels Feedstock Processing Facility
 - Complete Phase 2 Construction and Commissioning
- Sierra BioFuels Biorefinery
 - Complete Construction Activities, Commission and Start-Up of Phase 2 Activities
 - Complete Design of Phase 3 - Upgrading
 - Construction of Phase 3 - Upgrading

