



Clean Energy

# Clean Energy Consulting Overview

January 2018

At Clean Energy Consulting, we strive to understand our Customer's purpose, culture, and values to ensure that our approach and criteria for success are fully aligned.

Our goal is to identify practical opportunities, evaluate options, and implement outstanding projects that enable our customers to:

- Achieve their business objectives
- Safeguard their employees
- Reduce their energy requirements
- Improve their profitability and long-term sustainability
- Minimize their environmental impact



- ❑ Founded in 2008
- ❑ Offices in Prince George and Vancouver, BC
- ❑ 25 person team plus contract & specialist resources
- ❑ Target is industrial/energy projects up to 150 Million CAPEX
- ❑ Renewable energy power generation specialists from concept to completion





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# CEC - Project Delivery Model

## Phase Gate Approach



- Five distinct phases (I-S-D-E-O)
- Appropriate activities and approval criteria for each phase
- Optimize projects during development and execution
- Enhance customer value through participation during opportunity identification, evaluation, and selection process
- Allows selection of preferred projects based on consistent comparison criteria



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**Services**

- Opportunity identification
- Feasibility studies
- Plant audits
- Energy studies
- Option evaluation
- Capital cost estimating
- Front-end engineering design
- Economic modeling
- Business case development
- Risk management
- Contract negotiation
- Project financing support



- Project Execution Plan implementation
- Budget & cost control
- Progress tracking & schedule management
- Scope change management
- Reporting
- Procurement
- Construction supervision
- HSSE coordination
- Quality assurance & control
- MMS implementation
- Operating plans
- Commissioning
- Tuning & optimization



## Project Examples:

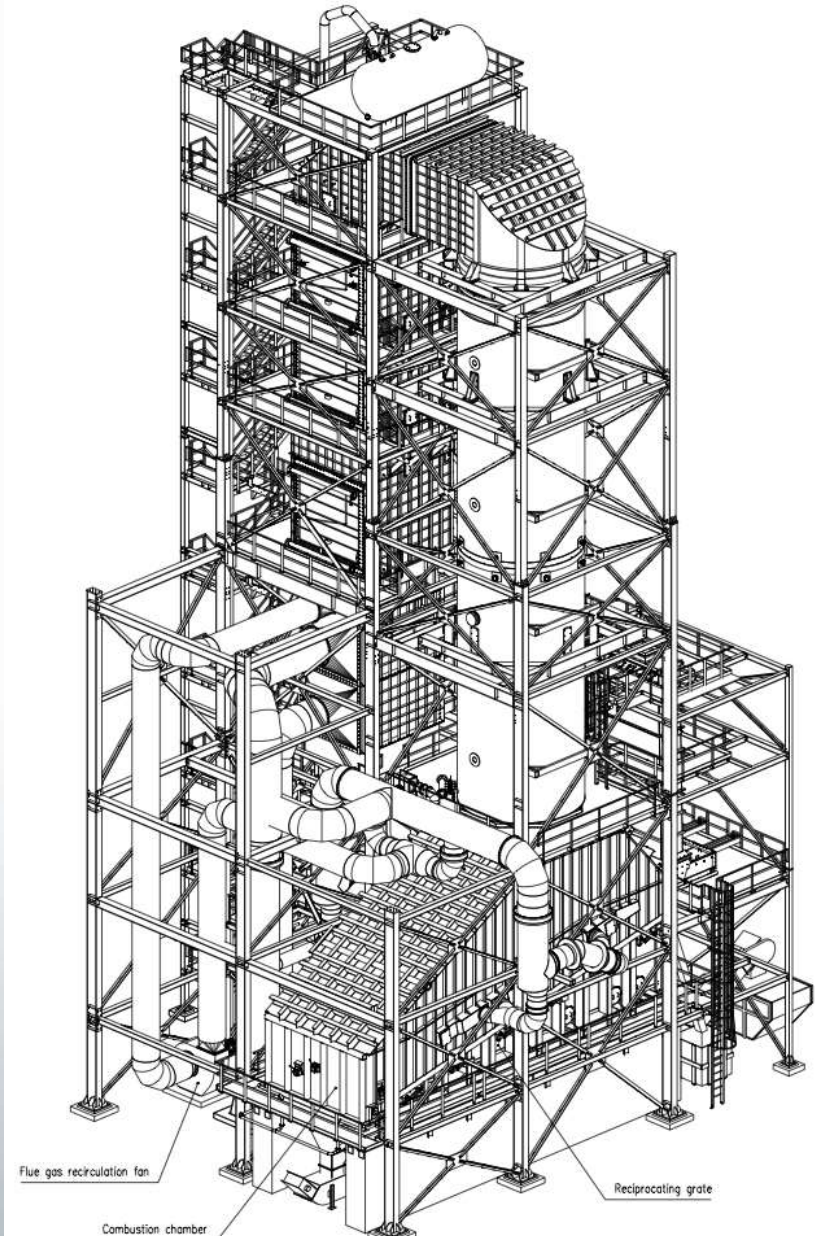
- ✓ Conifex Mackenzie Biomass
- ✓ Skookum Run of River
- ✓ CPLP NWD TG Upgrade
- ✓ CPLP O2 Delig
- ✓ CPLP Chiller Replacement
- ✓ CPLP Pulp Machine Scanners



- Combustor design
- Thermal oil system design
- Material handling systems
- Beehive burner replacement
- Thermal energy supply to dryers & lumber kilns
- Heat recovery systems
- Thermal oil piping
- Burner Management Systems
- Boiler Branch registration
- Troubleshooting & optimization
- Performance monitoring

## Project Examples:

- ✓ Nechako Lumber
- ✓ West Fraser ORC
- ✓ Maine Pellet ORC
- ✓ Canfor Sawmills
- ✓ West Fraser Sawmills



- Project development
- Technology evaluation
- Heat recovery systems
- Combustor design
- Thermal oil
- Steam generation
- Turbine selection
- Fuel studies
- Biomass receiving and processing
- Balance of plant systems
- EPCM services
- Contracts and interconnection
- Troubleshooting and optimization
- Performance monitoring



## Project Examples:

- ✓ Nechako Lumber
- ✓ West Fraser ORC
- ✓ Maine Pellet ORC
- ✓ Conifex Mackenzie
- ✓ Northwood TG upgrade

- Process
- Mechanical & Piping
- Electrical & Instrumentation
- Controls
- Structural
- T&D Line Design

## Industries:

- ✓ Small Hydro
- ✓ Biomass Power
- ✓ Pulp & Paper
- ✓ Sawmills
- ✓ Industrial facilities





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**Reference Projects**

## Conifex Power Mackenzie Generating Station

Scope: Project Development  
Full EPCM Services

Duration: 36 months

Start-up: April 2015

- Conversion of a decommissioned newsprint facility into a modern bioenergy generating station
- EPCM approach managed risk and minimized capital cost
- Non-recourse debt financing on a brownfield project with project execution plan that effectively mitigated technical & business risks



## Concord Green Energy Skookum Hydro Project

Scope: Project Development  
Project & Construction Mgmt  
Transmission Line Design  
Control System, Tuning, Optimization

Duration: 24 months

Start-up: May 2014

- 27.5 MW run of river, small hydro project located on Skookum Creek near Squamish, BC
- Challenging winter construction in mountainous terrain
- 138 kV transmission line design
- Remote access for monitoring, O&M
- Single PLC architecture



## Canfor Pulp Two Stage O2 Delignification Project

Scope: Project Management,  
Controls & Reporting  
Shutdown Construction Mgmt

Duration: 15 months

Start-up: December 2016



## Conifex Fort St. James & Mackenzie Sawmills Dust Containment & Extraction System

Scope: EPCM Services

Duration: 8 months

Start-up: December 2014

- Direction of a complex sawdust containment and extraction system within an operating sawmill facility
- Completed on time and on budget with aggressive schedule
- Zero lost production during installation





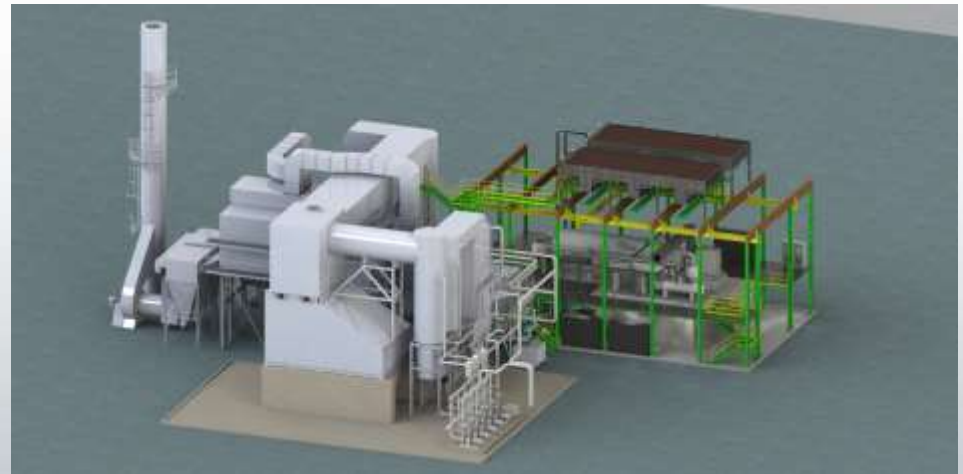
## Nechako Green Energy Vanderhoof, BC

Scope: Project Development,  
Interconnection,  
Mechanical, Process,  
Start-up, Commissioning &  
Optimization Assistance

Duration: 24 months

Start-up: 2012

- First biomass ORC in North America
- Waste heat recovery from sawmill residuals in thermal oil combustor
- 2.2 MW ORC CHP turbine generator to offset site electrical consumption



## West Fraser ORC Plants Fraser Lake & Chetwynd Biomass Power

Scope: Project Development  
Process & Mechanical  
Electrical & Controls  
Start-up, Commissioning

Duration: 24 months

Start-up: Dec 2014 / Mar 2015

- Convert sawmill and forest residuals to electricity & heat
- 13 MW, 88 GWh/yr each
- Largest ORC biomass power projects in the world
- Significant air quality improvements in the local communities due to elimination of Beehive Burners



## Athens Energy, Maine, USA Biomass ORC System

Scope: BOP design  
Process engineering, piping design,  
structural for TOP and ORC  
cooling tower selection

Duration: 18 months

Start-up: 2016

- 8 MW biomass power generation system integrated with pellet mill
- Provides thermal energy for drying pellet plant feedstock using hog fuel
- Overall site efficiency >70%



- ❑ Biomass and ORC Specialists
- ❑ Seasoned development team
- ❑ Practical, results focused, project implementation
- ❑ Strategic input, aligned with business objectives, during project development
- ❑ High quality, professional services





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