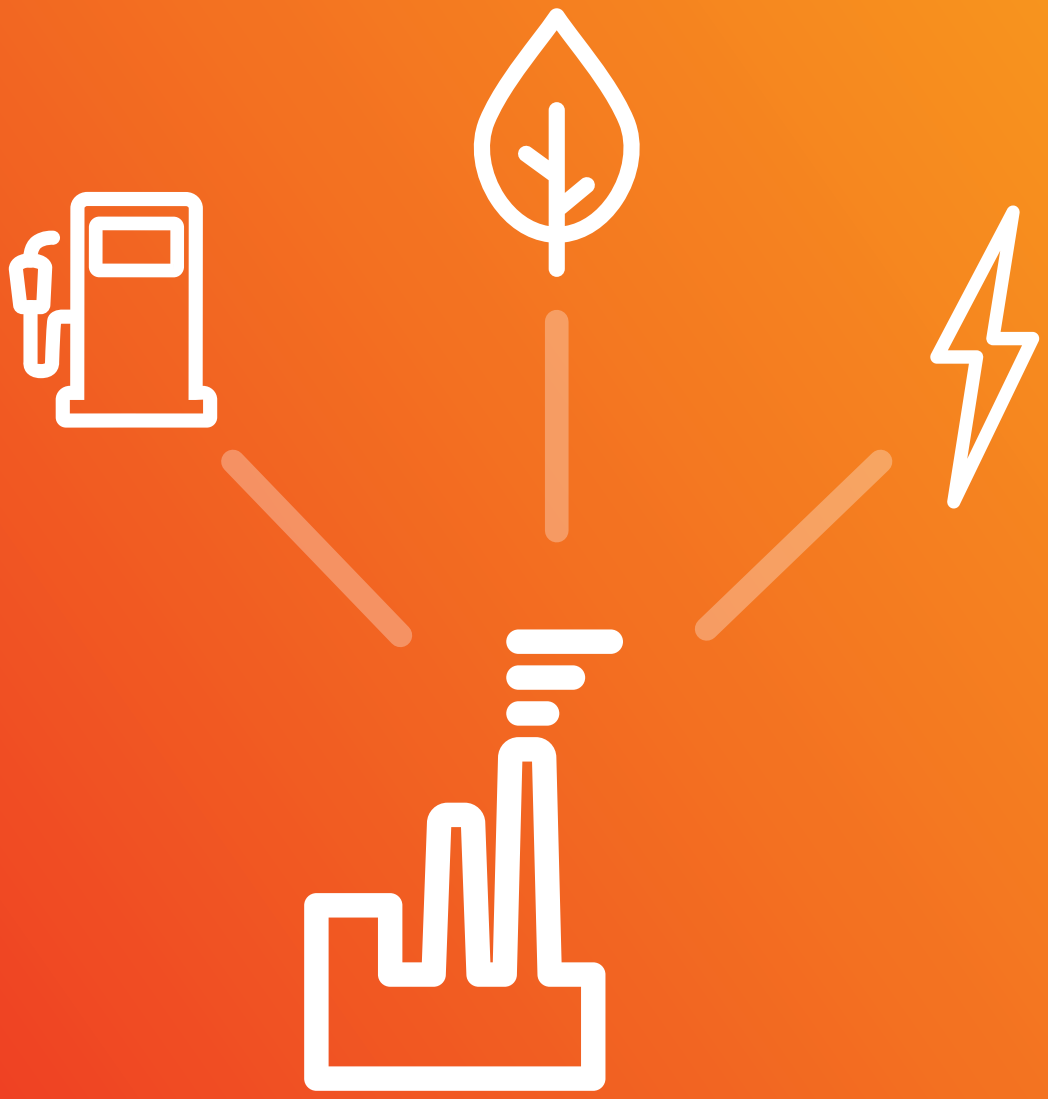
Sundance Plant

Natural Gas to Gasoline Feasibility Study

Canadian Consulting Engineers Award
2016



Stantec

What is typically generated as "waste" energy in the production of methanol, will be used at the Sundance Plant to power greenhouses that will supply fresh produce

What's inside

The new Sundance Plant will be powered by a wind farm

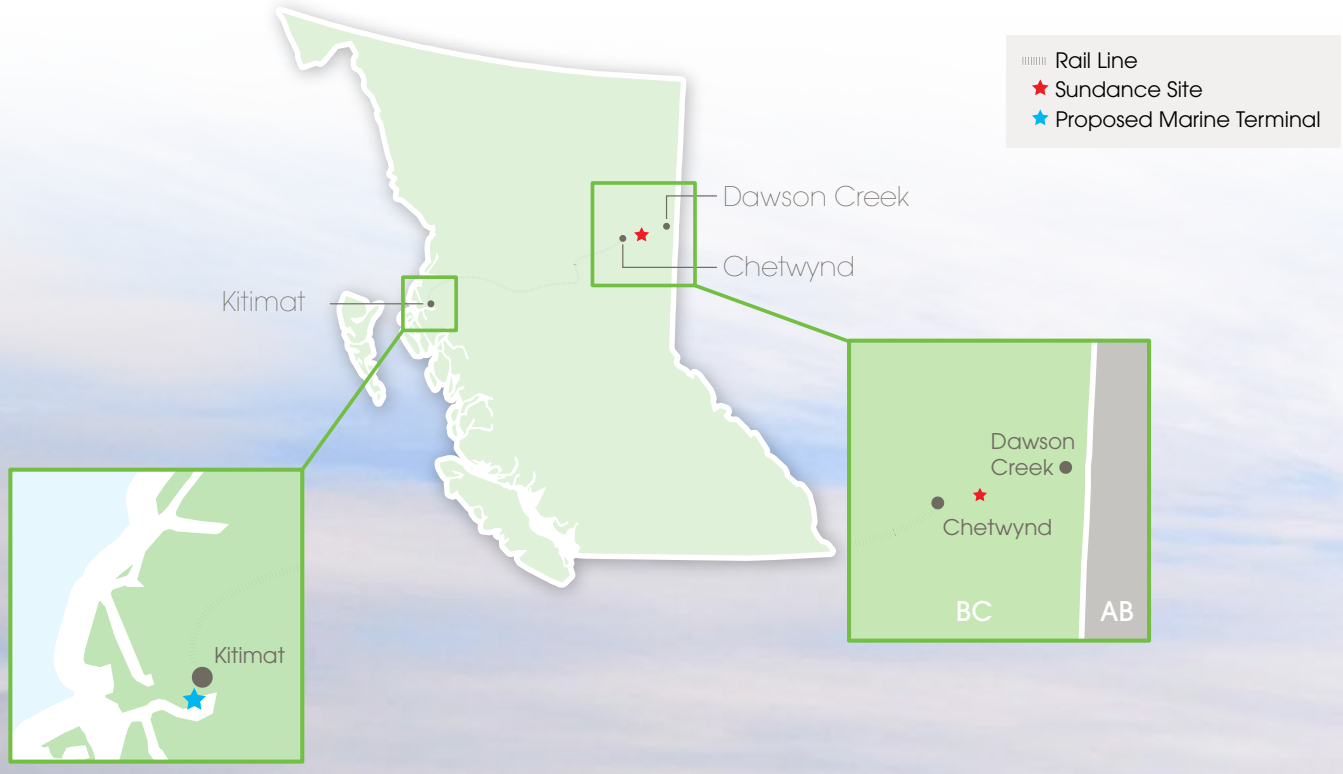


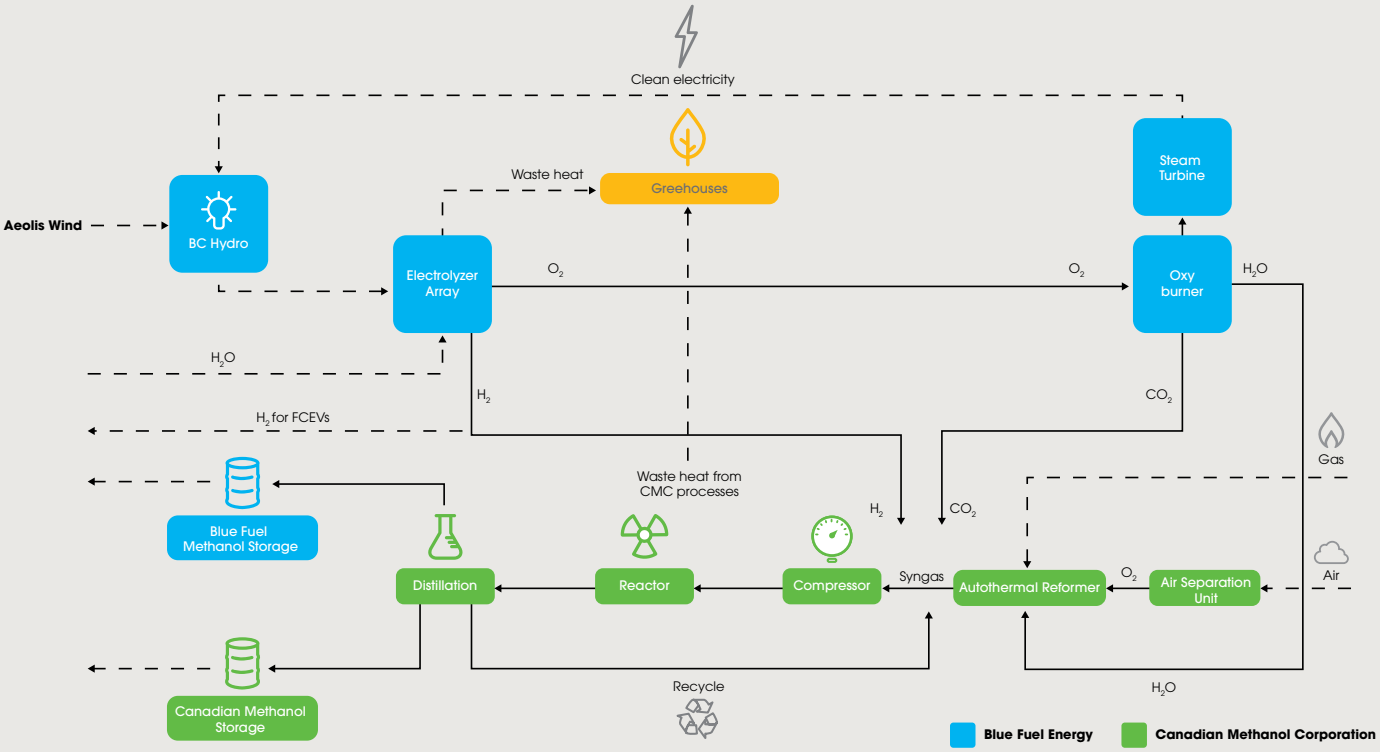
Figure 1 - Sundance Plant site locations will be connected by an existing rail line

Full project description

75-word project summary

Methanol. What role will it play in a sustainable vision for our future? Stantec's Sundance Plant feasibility study, developed for the Canadian Methanol Corporation (CMC) and Blue Fuel Energy (BFE), demonstrates how methanol is not only a lucrative business, but has proven to be a green one too. Through our reports and studies, we designed an integrated solution that is economically viable, technically feasible, environmentally sound, and provides significant benefit to the community.

Figure 2 - Integrated production process flow chart



Project highlights

Innovation

Canadian Methanol Corporation (CMC) desires to build a world-class methanol plant with connections to rail and adjacent liquids pipelines, as well as a marine export terminal in northern British Columbia. The plant has been designed with environmental and social benefit in mind, with two streams of production. The first would turn natural gas into methanol for export. Second, a portion of this methanol would be refined into a green gasoline using wind power and electrolyzers—aspects addressed by CMC's sister company, BFE. The Sundance Methanol Plant would be able to produce approximately 20% of British Columbia's demand for gasoline.

We're a one stop shop—that means we work more efficiently, more effectively, and more sustainably. With specialists from multiple fields connecting under the same umbrella, we were able to create a unique solution that put CMC at the forefront of clean energy. The very nature of the proposed facility is both innovative and complex—for instance, it will feature the largest electrolyzer array in the world. CMC and BFE knew that Stantec's integrated approach to project development was critical to the project's success.

Stantec prepared a series of reports on a number of elements, which combined, provided the sustainable result. These elements included reports for logistics of the marine terminal, front end engineering design (FEED), a technical overview of electrolyzer plant, and the greenhouse and fish pond study. We didn't stop at a good solution; we pushed for the best one.

To attain the best result, we looked at many scenarios to use waste heat produced in the methanol facility. We examined the feasibility of heating fish ponds as well as greenhouses and found that, while the greenhouses were a strong financial and sustainable option, the fish ponds were unfeasible due to the major capital requirements and limited market for the resulting product. The result will be some of the largest organic greenhouse operations in Canada, all warmed with recycled waste heat.

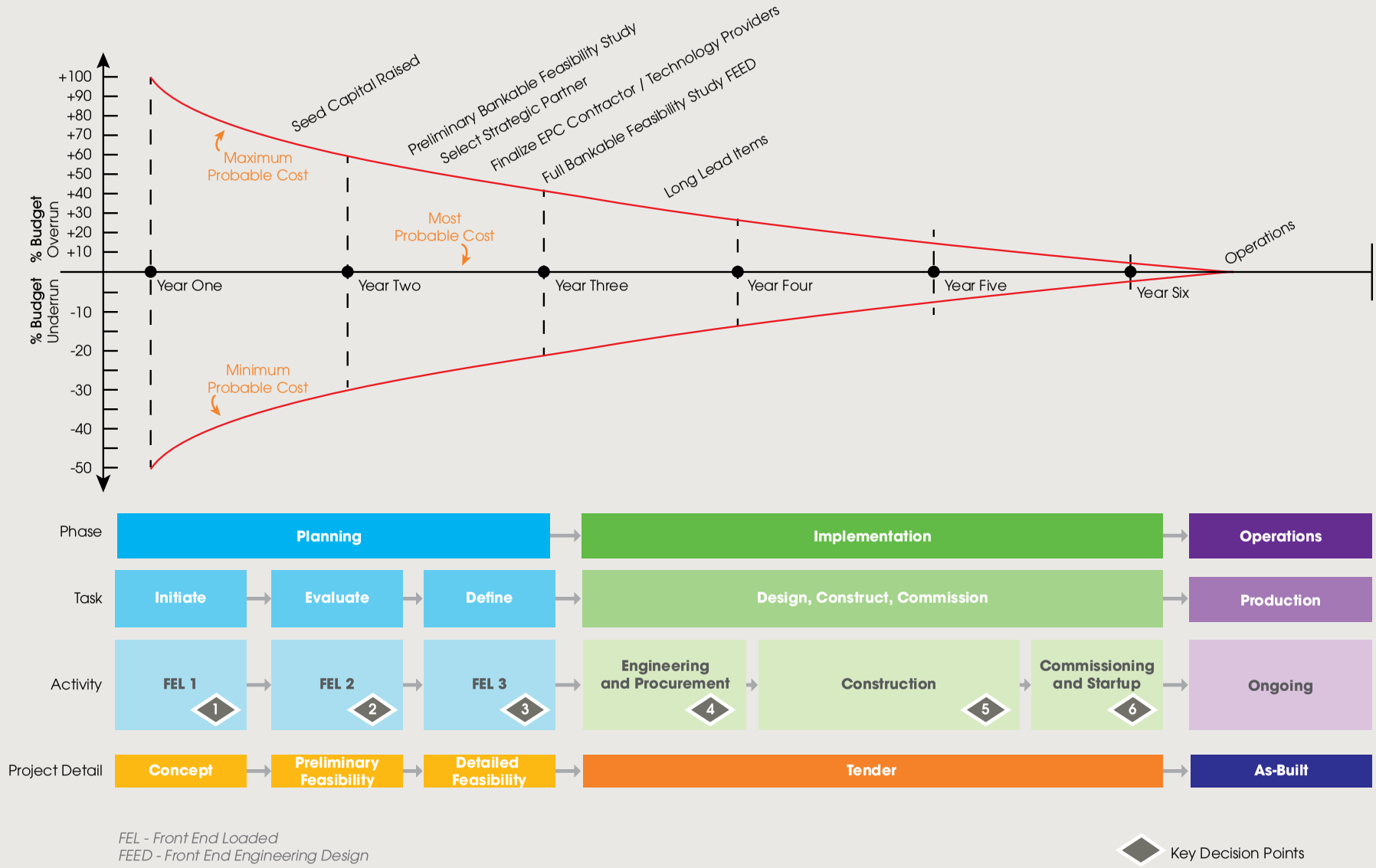
The series of reports that Stantec produced on behalf of CMC covered the full breadth of the project ranging from the product facility to the marine terminal, as well as sustainable alternatives to the plant's by-products. It was Stantec's unique combination of internal experts that allowed for these types of reports to be developed at a singular consultancy in a collaborative fashion.

Complexity

Because our team is local and works together under one roof, knowledge and ideas are naturally shared through daily interactions—and that synergy of creativity and collaboration drives a successful project. When CMC wanted an integrated team to provide insight into the viability of their vision they turned to Stantec where one of our values is to do what is right. Because we are one of Canada's largest industrial, transportation, and environmental consulting firms, our vast network of resources provides clients with an advantage on complex projects requiring a high degree of technical and local knowledge. This project clearly demonstrates that we are better together.

The development of a methanol production facility of this caliber is a very complex undertaking, with a myriad of differing, and at times competing, requirements. For this feasibility study, diverse expertise and skills had to work together towards the same goal. Project economics, financial modelling (i.e. scenarios, lifecycle costing, net present value analysis, and financial performance metrics), logistics, engineering (i.e. technology selection and design basis), risk management, and project management all had to collaborate seamlessly in order to provide the best service for CMC. Because of Stantec's fully integrated service delivery model, with all disciplines working under the same umbrella, we were able to efficiently and collaboratively provide these services, thus responding to the complexity of this project and delivering quality results.

Figure 3 - Stantec's project development cycle



FEL - Front End Loaded
FEED - Front End Engineering Design

Key Decision Points

Social/economic benefits

We're active members of the communities we serve, that's why we always design with community in mind. Effective planning that balances our community needs to support industrial growth is essential for building sustainable healthy communities in which we live, work, and play. In producing this set of studies for the Sundance Plant, our focus was on doing what's right. In this case, that meant developing a solution that bettered the community and the environment. Our recommendations will allow consumers to feel good about filling up their tanks; plus greenhouses powered by waste heat will produce food and jobs to better the community.

In addition, the presence of greenhouses provides year round low-skill labour positions for the local economy. This aspect of the project was of particular importance to the local First Nations communities, as it provides employment opportunities for members as well as generating fresh local produce. These actions to improve the outcomes within the community were imperative for gaining the social license required to undertake this project.

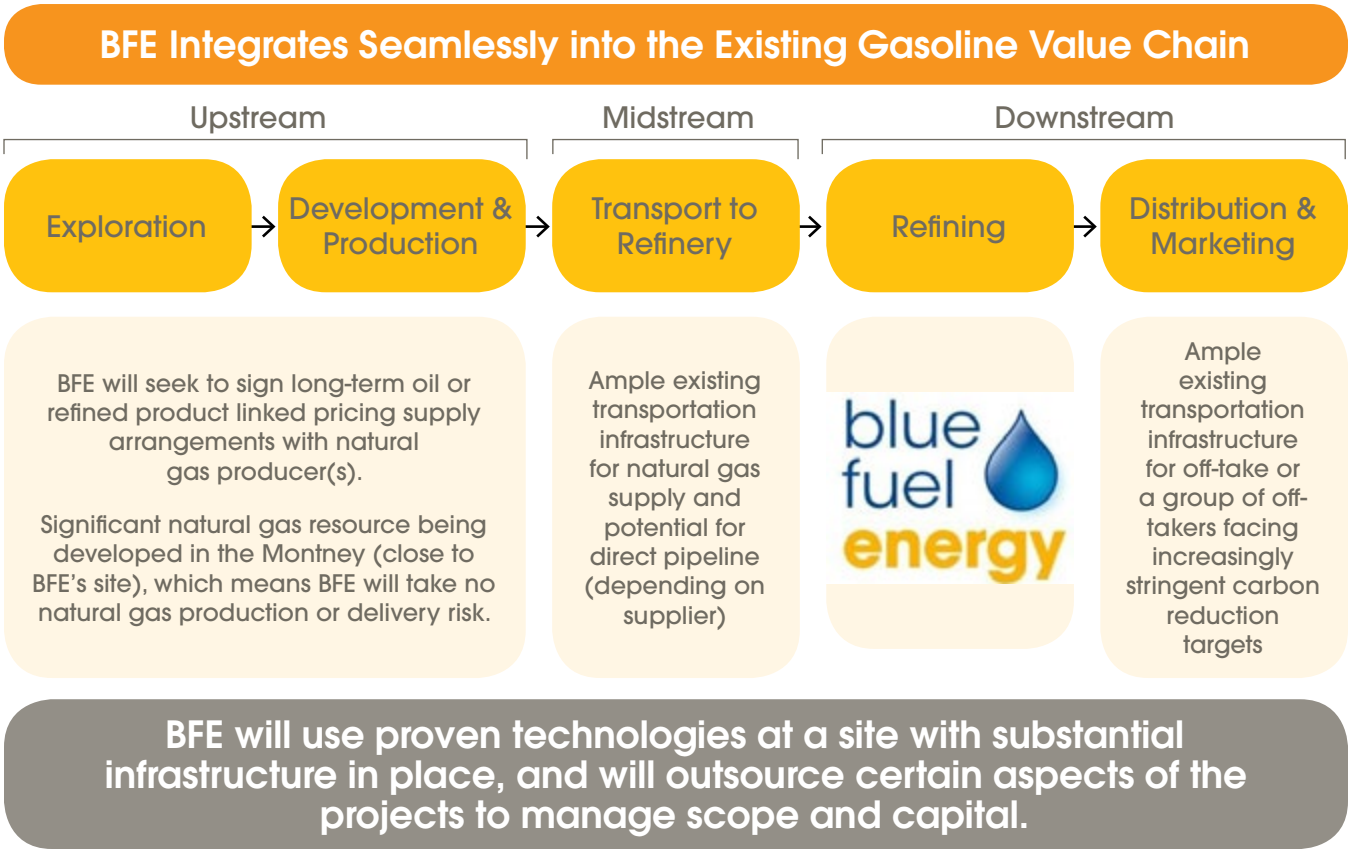
Environmental benefits

At Stantec, one of our core values is to do what is right. This value drives our philosophy when it comes to sustainability and we seek to work with clients who share this commitment. Stantec, CMC, and BFE feature strong initiatives to ensure sustainable business. Many of the components associated with this project have gone the extra step to achieve sustainability not only during the project process, but continuing on throughout its lifecycle. This includes relying upon renewable energy, such as wind and hydro power, to fuel plant operations.

In keeping with the CMC's commitment to the environment, we ensured that the integrated solution to use the waste heat generated from the production of the methanol could be used in an environmentally sound, as well as economically viable fashion. Our experts determined that the optimal solution would be to heat greenhouses that will produce food products, such as tomatoes and cucumbers. This action not only provides fresh vegetables for the benefit of the local community and regional market. It also provides additional long-term employment opportunities for the community, including the local First Nations.

In addition to this, the green gasoline produced by BFE meets both British Columbia and California requirements for green fuel. This indicates that the BFE gasoline would assist these governments in obtaining their goals of reducing their carbon intensity by 10% by 2020, while being fully functional with gasoline refined from conventional sources.

Figure 4 - How BFE fits into the existing gasoline value chain



Meeting client's needs

At Stantec, we're used to exceeding needs and expectations, which is what our clients have come to expect. That's exactly what we did with the Sundance Plant feasibility study. For CMC, we contributed a depth of knowledge and breadth of expertise to deliver multiple services in an efficient and effective manner that provided a high value product. Our detailed reports outlined a solution for CMC to produce methanol and green gasoline in a cost competitive manner as well as decrease the environmental footprint and gain social license by using the waste heat as a means to warm greenhouses.

Using the results of our feasibility study, CMC and BFE were able to present a strong business case to prospective investors and strategic partners, and bring their goal of developing these facilities closer to reality. Using this feasibility study, CMC was able to engage banks and strategic investors to raise the capital necessary to bring this project to fruition. Ultimately, Stantec acted not merely as a consultant to CMC and BFE, but rather as a trusted advisor forging a mutually beneficial relationship.

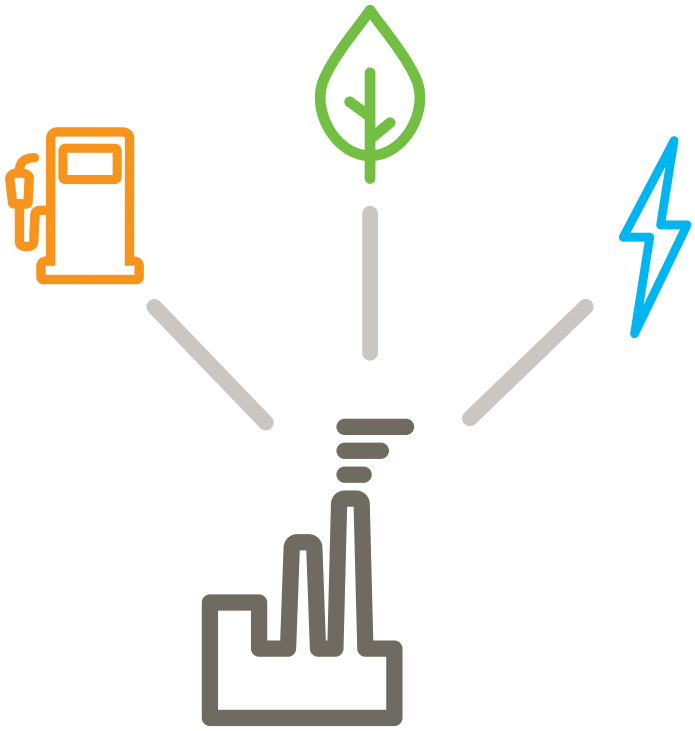


Figure 5 - Integrated production process infographic

The new Sundance Plant will refine methanol into certified green fuel, and use what is normally waste energy to heat greenhouses and provide power to the grid. Plus, these greenhouses will not only provide fresh local produce, but also year-round employment for the local economy.

20%

The Sundance Methanol Plant would be able to produce approximately 20% of British Columbia's demand for gasoline

BFE Gasoline is the Superior Alternative for Meeting Low Carbon Fuel Standards

	Conventional Gasoline	BFE Gasoline	Ethanol	Biodiesel or HDRD	Advantage for Blue Fuel
Description	Gasoline produced from crude oil	Fully fungible low CI gasoline produced from natural gas by BFE	Ethanol produced from organic sources	Diesel-like fuel derived from plant oils	✓✓✓
Carbon Intensity	87.3 g CO_2/MJ	77.6 CO2/MJ	53.1 g CO_2/MJ to 72.9 g CO_2/MJ	22.3 g CO_2/MJ to 45.4 g CO_2/MJ	✓
Volume/ CI Reduction Limitations	n/a	None	~15% Ethanol blend	~20% Diesel blend wall	✓✓✓
Energy Content	34.69 MJ/L	Equal to conventional refinery gasoline	23.58 MJ/L	36.94 MJ/L (Biodiesel) 36.51 MJ/L (HDRD)	✓✓
Fuel vs. Food Exposure	None	None	Significant	Significant	✓✓✓
Other Considerations	Sustained trend towards low carbon intensity fuels(1)	Completely fungible with conventional gasoline	Subject to regulated blending limitations of 10%	Diesel pool volumes significantly smaller than gasoline, thus, biodiesel and HDRD impact on total fuel CI limited	✓✓✓

Figure 6 - BFE gasoline is a superior alternative to ethanol and biodiesel as it is fully interchangeable with conventional gasoline, while possessing no impact to the global food supply