
2012 Integrated Resource Plan



Appendix

3B-3

**Site C Clean Energy Project
Information Sheet:
Upgraded Project Design and Cost Update**

INFORMATION SHEET

UPGRADED PROJECT DESIGN AND COST UPDATE

During Stage 2 of project planning and evaluation, BC Hydro investigated outstanding technical issues related to the 1981 project design for Site C. This technical review concluded that the 30-year-old historic design required updating to meet current seismic, safety and environmental guidelines, and to address other technical issues.

Upgrading the project design has been a priority of BC Hydro's early Stage 3 work. At the end of 2010, an integrated team of BC Hydro and consulting engineers completed its work to develop an updated project design, which includes key design upgrades related to foundation stability, seismic protection, spillway safety, and generating capacity. In keeping with BC Hydro and international practice for major projects, an external technical advisory board was engaged. The advisory board, comprised of global experts in hydroelectric development, reviewed and provided feedback on BC Hydro's design choices for Site C.



ARTIST RENDERING OF THE UPGRADED DESIGN FOR THE PROPOSED SITE C CLEAN ENERGY PROJECT.

AN UPGRADED PROJECT DESIGN AND COST UPDATE

- 2 -

COMPARING THE HISTORIC AND UPGRADED DESIGNS

The proposed Site C project continues to be an earthfill dam located about seven kilometres southwest of Fort St. John, just downstream of the Moberly River. However, key design upgrades to the historic design have resulted in improved foundation stability, greater seismic protection, enhanced spillway safety, and additional generating capacity. These design upgrades to the historic design are described on the following page.

HISTORICAL SITE C DESIGN (1981)



- Design: 1981
- Type: Earthfill dam
- Capacity: 900 MW
- Energy: 4,600 GWh/yr.
- Key project components:
 - Spillway
 - Generating Station (six 150 MW units)
 - Power Intakes
 - Switchgear Building
 - Access Road
 - Maintenance Access Bridge (approximately 4 km downstream)

UPGRADED SITE C DESIGN (2011)



- Design: 2011
- Type: Earthfill dam
- Capacity: 1,100 MW
- Energy: 5,100 GWh/yr.
- Key project components:
 - Wider Divided Spillway
 - Auxiliary Spillway
 - Generating Station (six 183 MW units)
 - Power Intakes
 - Open Air Switchyard
 - Access Road
 - Maintenance Access Across Dam
 - Concrete Buttress

AN UPGRADED PROJECT DESIGN AND COST UPDATE

-3-

KEY DESIGN UPGRADES

Improved Foundation Stability

In the upgraded design, the generating station and spillway have been rotated and are now at right angles to the dam, parallel to the valley wall on the south bank. This minimizes the depth of the excavation required under the generating station and spillway, reducing concerns about foundation conditions. In addition, the south valley wall under the dam, the generating station and the spillway are reinforced with a long concrete buttress to improve foundation stability.

Greater Seismic Protection

There is a greater understanding of the seismicity of the region today than in the 1970s and 1980s, and the 30-year-old historic Site C design required changes to withstand a larger potential earthquake. As a result of upgrades to the project design, the Site C design meets current seismic standards and can withstand a significantly larger earthquake than the historic design.

Enhanced Spillway Safety

Spillways are key hydroelectric facility safety features, as they allow for the safe discharge of excess water from the reservoir — generally in times of flood. Several design upgrades have been made to the spillway for Site C to improve safety:

- An overflow auxiliary spillway has been added, which provides capacity to discharge water in the unlikely event that the spillway gates become inoperable.
- A centre wall has been added that divides the gated spillway into two sections. This wall allows either section of the spillway to be maintained or repaired, while retaining spill capacity in the other section.

Additional Generating Capacity and Energy

The generating capacity for Site C has increased by 22 per cent, from approximately 900 megawatts (MW) in the historic design to up to 1,100 MW in the updated design. This additional capacity, achieved through larger generating units, is similar to having more horsepower in a car. It provides improved capability for BC Hydro to meet winter peak loads, and allows for greater integration of intermittent renewable sources, such as wind.

In addition, the amount of energy from Site C has been updated. Site C would produce 5,100 gigawatt hours of energy per year, which is an increase of 11 per cent from the historical estimate. This would be enough energy to power more than 450,000 homes per year in B.C.

This increase in capacity and energy is achieved with no change to the maximum normal operating range for the Site C reservoir.

AN UPGRADED PROJECT DESIGN AND COST UPDATE

- 4 -

KEY PROJECT COMPONENTS

The proposed Site C Clean Energy Project would be located seven kilometres southwest of Fort St. John, just downstream of the Moberly River. The project includes the following major components:

- An earthfill dam, approximately 1,050 metres long and 60 metres high above the riverbed.
- A generating station with six generating units.
- One of the most stable reservoirs in the BC Hydro system with relatively little fluctuation in water levels during normal operations. The proposed maximum normal operating range for the reservoir would be 1.8 metres.
- An 83-kilometre-long reservoir that would be, on average, two to three times the width of the current river. There would be approximately 5,340 hectares of total flooded land, of which approximately 93 per cent is currently owned by the Crown and BC Hydro, and approximately seven per cent is privately owned land.
- The realignment of four sections of Highway 29 — in the Bear Flat, Halfway River, Farrell Creek and Lynx Creek areas — over a total distance of 25 kilometres. Further technical work is required, along with consultation with property owners and communities, to select the preferred route.
- Shoreline protection measures at Hudson's Hope to minimize land impacts. Consultation regarding a proposed berm at Hudson's Hope would be held specifically with the community of Hudson's Hope.
- Two new 500 kilovolt AC transmission lines would connect the Site C facilities to the existing Peace Canyon Substation over a distance of 77 kilometres. These lines are proposed to be located along an existing right-of-way. This right-of-way is currently occupied by two 138 kilovolt transmission lines; the two new 500 kilovolt lines would be constructed alongside these lines, requiring a widening of the right-of-way by approximately 35 metres.
- Access roads in the vicinity of the dam site and a temporary construction access bridge across the Peace River at the dam site. A number of other temporary roads would be established within the dam site, connecting the various work areas. Permanent operations and maintenance access to the generation station would be provided across the dam.
- Construction of two temporary cofferdams across the main river channel and diversion of the river through diversion tunnels to allow for construction of the earthfill dam across the river.
- Worker housing options are being studied and evaluated to provide the best balance of housing at the dam construction site and in nearby communities. Preliminary worker housing plans will be developed in consultation with local governments, communities, Aboriginal groups and stakeholders.

AN UPGRADED PROJECT DESIGN AND COST UPDATE

- 5 -

PROJECT COST UPDATE

A Cost-Effective Resource

Like other large hydro projects being developed across Canada, Site C would be cost effective because after an upfront capital cost, it would have low operating costs, and a long life of more than 100 years.

The last time a bottom-up cost estimate was produced for Site C was more than 20 years ago and it was based on the historic project design from 1981. In 2007, BC Hydro provided an escalated project cost estimate, which was up to \$6.6 billion. Based on the historical design for Site C, BC Hydro's 2011 Integrated Resource Plan provided a cost per megawatt hour of \$85.

The project cost for Site C has been updated to reflect key upgrades to the project design, and current market prices for labour, equipment and materials. The upgraded project would have an estimated capital cost of \$7.9 billion, and it would produce electricity at a cost between \$87 and \$95 per megawatt hour, based on a real discount rate ranging from 5.5 to 6.0 per cent. This would make Site C among the most cost-effective resource options to help meet B.C.'s future electricity needs. In addition, Site C provides significant additional benefits such as reliable capacity and flexibility.

Site C and BC Hydro Rates

BC Hydro rates are not affected by projects in the development phase, as these costs are deferred until the project begins producing electricity. In the case of Site C, this means that project costs would start being recovered in rates in fiscal 2021, assuming that the project is in service following environmental certification and other regulatory permits and approvals.

BC Hydro is committed to maintaining competitive electricity rates in B.C. To reduce the rate impact on customers, BC Hydro anticipates that the costs for Site C would be amortized over many decades. The amortization period and rate impact would be determined through a future regulatory process with the British Columbia Utilities Commission.

Economic Development

As one of the largest public infrastructure projects in British Columbia, Site C would contribute to the local and provincial economy through construction-related jobs and business opportunities.

Site C would create an estimated 7,000 direct person-years of construction employment over the seven-year construction period. In total, Site C is estimated to create up to 35,000 direct and indirect jobs through all stages of development and construction.

In addition, once operational, Site C would be expected to contribute revenues annually to the Province, regional districts and municipalities in the form of water rental payments, school taxes and grants-in-lieu of taxes.

AN UPGRADED PROJECT DESIGN AND COST UPDATE

- 6 -

ABOUT BC HYDRO

British Columbia is growing, and so is the need for electricity. BC Hydro is dedicated to meeting at least 66 per cent of the province's future electricity needs through conservation by 2020. But in order to meet the remaining demand and continue to ensure a clean, reliable supply of energy, BC Hydro is investing now in the projects that are needed to keep the lights on in B.C. for future generations.

More information on Site C can be found at: www.bchydro.com/sitec.