

CASE STUDY



PROJECT: *China Creek Micro-Hydro Power Plant*

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Hupacasath
First Nation

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Executive Summary

The China Creek Micro-Hydro Project began in 2001 when the Hupacasath First Nation focused on new forms of economic development. The primary goal of the project was to develop and build capacity amongst the Nation that could be applied in future opportunities. The project was also intended to create wealth and contribute to the economic and employment situation for future generations.

China Creek has been in operation since 2006, producing approximately 24 gigawatts of power annually. However, 2010 and 2011 were record years of production with 28 gigawatts of power in 2010, and 30.6 gigawatts in 2011.

The total cost of the project was approximately \$14 million. To date the gross sales have averaged \$1.6 million per annum. The Energy Purchase Agreement (EPA) with BC Hydro was entered into in 2006 with a twenty year term; the EPA will expire in 2026, the same time the project's financing will be fully repaid.

Project partners are Hupacasath First Nation (72.5%), Synex Energy (12.5%), Ucluelet First Nation (10%), and the City of Port Alberni (5%). The managing partner (General Partner) Upnit Power Corp. is responsible for day-to-day management of the operation.

Though expected to function for 40 years, major structural issues have shown up in less than 5 years of operation. Upnit Power Corp. and the Hupacasath First Nation (HFN) are in the process of resolving these issues.

Despite the issues with China Creek, this experience has shown Hupacasath First Nation the potential opportunities of micro-hydro development, and its potential contribution to economic development and diversification. The Hupacasath are pursuing other micro-hydro projects as a result.

This case study examines lessons learned to date.

Project Background

As early as the late 1990's Hupacasath First Nation started exploring renewable energy sources as a way to service the needs of a growing population on Vancouver Island.

In the summer and fall of 2001, the Hupacasath engaged the services of an engineering firm to identify watersheds within the Hupacasath territory that would be suitable for small hydro projects. The fieldwork analysis identified several streams that had economic potential for micro-hydro that could be linked to existing BC Hydro transmission infrastructure; demonstrated low risk to salmon spawning



areas; were accessible; had no impact to culturally significant areas; and had the sufficient elevation drop required to generate significant amounts of electricity. Five streams were shortlisted, but China Creek was deemed the most suitable with its long-established existing dam structure. Additionally, because the infrastructure at China Creek was already used by the City of Port Alberni to obtain drinking water, there was extensive and accurate data recorded that would provide the required information to estimate power generation from a hydro facility in the creek.

Before the project could proceed, the community needed to be sold on the investment. Rolled into the fieldwork analysis, Hupacasath completed a renewable energy assessment which engaged the community in numerous meetings to discuss current energy demands, interest in developing a micro-hydro facility on their traditional territory and environmental issues. At the time, this was a new venture for most communities, including Hupacasath, and not a lot was known about the risks associated with this type of venture. This assessment can be viewed on the Hupacasath website at this link: <http://www.hupacasath.ca/sites/default/files/Community%20Energy%20Plan.pdf>

Major Steps to an Operational Power Plant

Once the community agreed to the project concept, Hupacasath leadership and administration approached potential lenders to promote this green energy project concept and determine their interest. At the time this was the only project in the Province of BC where the proponent lead was a First Nation. Provincial and Federal grant monies were used to complete the planning elements of the project. This involved creation of visual material that could be left with the companies to consider. Because this was a new area of investment, this was a necessary step to ensure lenders understood the opportunities and the time frames to undertake and complete the various project elements.

A hydrology assessment was completed to ensure there would be enough flow to turn the turbines, and to confirm that sufficient water flow could be diverted from the stream without negatively impacting the natural system. It was determined that the China Creek penstock (large steel pipe) would be about 5 km long in order to meet the required minimum 200 metre elevation drop (head). The hydrology assessment projected that this project design would produce 24 gigawatts of power annually.

Based on this projected viability, a business case for the micro-hydro project was developed. This included creating a matrix that showed all the steps from hydrology study to actual operations. This was very important as there were 30-40 approval agencies for this project, and only 2 fisheries windows per year to work within.



BC Hydro was then contacted with the business case in order to pursue an Electricity Purchase Agreement (EPA) contract.

The next steps were to assess the environmental impacts of the project including fisheries and other considerations. These assessments and many other elements were required under the Standing Offer Program (SOP). Many of these elements were also essential to receiving and entering into an EPA with BC Hydro.

Funding was pursued using the business case with conventional lenders but also through various grant applications. See the section on page 8 on project financing for more detail.

Sigma Engineering was hired to provide the project management and engineering services required to build various elements of the China Creek Micro-Hydro project. Sigma was responsible for overall project management, including projecting income and estimating the budget for each component of the project. Sigma entered into service contracts with Eco-Fish Consulting to meet environmental and fisheries requirements. Sigma also hired other engineering firms to conduct geotechnical investigations and other work related to project development. The projected income based on generating 24 gigawatts of power was estimated at \$1.4 million annually.



Construction of the penstock started in 2004-2005. The intake chamber and weir were built during the July–September fisheries window, as construction involved in-stream works. Operations officially started in October 2006. Initially both generators and turbines were on-line, however there was a problem with one of the bearings for the number two machine. As a result, the plant's first year of operation was restricted to one machine — and thus production for the first year of operation was extremely low.

Operations and general maintenance have been conducted by Upnit Power Corp. Regular procedures have included checking the intake chamber and trash racks every morning to ensure that water flows are not restricted. It has been established that if power production drops below 700 kW then production is to be shut down to ensure compliance with water licensing for Upnit Power. The troubleshooting system is designed so that the CEO and the Plant Technician of Upnit Power Corp. receive immediate texts on their phones when there is an issue. The Plant Technician can monitor, and if necessary, shut the system down from his home computer.

Hupacasath continue to engage with community members, moving forward with what they have learned from China Creek. The experience has highlighted many of the risks and the benefits of this type of project, and resulted in community support for exploration of other micro-hydro projects in Hupacasath territory.

GENERAL PROCESS TIMELINES	
Steps Required	Time Required from 2001 to 2006
Gain community support for investment	6 months
Approach potential lenders to promote concept and determine interest	6-18 months
Hydrology study	Minimum 2 years, longer is better
Approach BC Hydro and set up contract for EPA	6-18 months
Develop business case, and lay out all the steps to implementation	12 months
Pursue funding and arrange financing and set up financial management system	12 months
Work way through all agency approval processes	12-24 months
Hire engineering firm	6-12 months, if RFP process is preferred option
Planning and design	12-18 months
Construction	Dependent upon project design, can be 6-18 months
Operation and general maintenance	Once operational, is ongoing

PROJECT SUMMARY TIMELINE	
Description	Completed
Summer-Fall 2001 Micro-Hydro survey and selection of China Creek	2001
December 2002 original project (2.2MW) submitted to BC Hydro's Request for Qualification (RFQ) and qualified to participate in their 2002-2003 Green Power Generation (GPG) Call for Tenders (CFT).	2002
February 2003 China Creek Project short-listed from 200 applicants to 30 for BC Hydro's Green Power Generation program	2003
June 2003 5.6 MW project was submitted to BC Hydro and qualified for the 2002-2003 GPG CFT	June 2003
August 2003 Submitted bid price and development security to BC Hydro	August 2003
Surveyed proposed penstock route	August 2003
September 2003 selected by BC Hydro as one of the 30 projects approved for their GPG project	September 2003
October 2003 Electricity Purchase Agreement signed with BC Hydro	October 2003
Engineering Firm Hired. Planning and Design	2004
Construction started in 2004-2005	2004-2005
Official opening	October 2006

Project Financing and Financial Management

As noted earlier, it cost approximately \$14 million to build the China Creek micro-hydro project.

Grant funding applications were developed to access various funding sources including Ecotrust Canada, and Western Economic Diversification Canada (WED). These funds were used to assist in determining the feasibility of the project, and developing a business case and other elements of the initiative. (Funds like the Clean Energy Fund didn't exist and weren't available for China Creek)

Various conventional lenders were approached by Hupacasath leadership as well as administration, well in advance of the project development. The hydrology study as well as other pertinent information was provided to each of the potential lenders to determine their interest for financing the project. Few lenders had experience or confidence in this sector (green energy), and especially in a project that involved more than one First Nation with no background or experience in the micro-hydro field. As a result, educating these lenders about the technology and the economic potential was a priority, and to some extent those efforts continue today.

In the end, Vancity Credit Union led a consortium of other lenders and investors in the remainder of financing of the project. Initially China Creek had a 40-year debt repayment amortization schedule. This was recently (2011) converted to match the 20-year EPA, so that by the end of the 20 years, all project debt financing will be fully repaid.

Source	Source Name	Description/Notes	Amount	Grant/Loan
Partner	Synex Energy Resources Ltd.	12.5% Share	\$500,000	Equity Investment
Provincial	Ministry of Energy and Mines		\$445,000	Grant
Federal	WED-CEDI	Repayable Loan	\$925,000	Loan
	Ministry of Indian Affairs and Northern Development	Economic Development Program	\$2,000,000	Grant
VanCity		Loan	\$1,700,000	Loan
VanCity	Debt Syndication	VanCity brought together 5 groups to form an investor consortium	\$8,430,000	Loan
Total			\$14 million	

Governance Structure

Based on legal advice, Hupacasath and the partners determined that the best approach to the ownership and governance structure was to form a limited partnership, and to create a vehicle to manage the operations once the project was completed.

The Board of Directors was created with the following representation: Hupacasath (3 directors), Synex Energy (1), Ucluelet FN (1), and City of Port Alberni (1).

Ownership of the limited partnership was created as follows: Hupacasath 72.5%, Synex Energy 12.5%, Ucluelet First Nation 10%, and City of Port Alberni 5%. It was determined that Upnit Power Corp. (General Partner) would be responsible for the day-to-day management of China Creek.

To minimize tax exposure, a limited partnership and a bare trust for each of the First Nation partners was established prior to the project being completed. This was suggested as the best way to structure the ownership from a First Nation perspective.



The Benefit of Hindsight – Lessons Learned

MICRO-HYDRO > HFN advises other First Nations to contemplate this sector as an economic driver. Green/Clean energy projects will be our only source of energy one day, and so we need to seek alternative energy sources for our future generations.

The Province of BC recently legislated the “Clean Energy Act”. This new Act sets out a number of initiatives for the Province. One requirement is that 93% of our future power needs to come from clean or green projects, thereby reducing our dependence on oil and gas.

NEW FUNDING AVAILABLE > The Clean Energy Act program also has funds set aside to assist First Nation proponents who have an interest in establishing their own projects — with partners, or on their own. Fifty-thousand dollars is available to First Nation proponents to determine feasibility elements of a particular project; a further \$500,000 is available to projects once an Energy Purchase Agreement is signed with BC Hydro. These and other new sources of funds will be a significant asset to other First Nations wishing to pursue these types of projects. HFN suggest proponents do a considerable amount of due diligence on funding sources and their conditions. In addition it would be a good idea to understand the Province’s Clean Energy Act to understand where their project might fit into this new policy direction.

GOVERNANCE > HFN recommends the ownership/governance structure mentioned above as the best way to avoid, or minimize, exposure and risk associated with these types of projects. It is also the most effective process to limit micro-management by partners in the day-to-day operation of the company.

FINANCIAL MANAGEMENT > Having a Certified General Accountant on staff with the First Nation will give lenders and partners more comfort in the First Nation’s ability to manage the project, once operational, and increase the level of their support. Having your own financial expertise will also be an asset for the Nation(s), when negotiating terms with lenders and others related to project development.

It is also a good idea to get the lender involved in the project development as early as possible, so that the lender has a good understanding of project components and requirements. Being better informed is never a bad thing — the lender understanding many of the project elements will only benefit the parties involved in any particular project.

Financial management related to post-construction issues is also important. The deconstruction of China Creek could cost \$300,000-500,000, and then subsequent reconstruction could cost up to another million dollars. From the start, financial management should consider the options for build-out and the likelihood of post-construction maintenance or replacement.

One of the biggest challenges for First Nations' development projects is to find equity. Sound financial management and planning require financing in order of 60-70% of debt, but many First Nations have challenges in finding the required 30-40% of equity. For this reason many projects either do not get off the ground, or have difficulty meeting the debt service ratio required by many financial institutions to approve financing.

Today it is possible to put together approximately one million dollars in grants per project from combined sources — Ecotrust Canada, Aboriginal Affairs and Northern Development Canada and the Clean Energy BC Fund, but this is still not enough. The Nuu-chah-nulth Economic Development Corporation and Aboriginal Business Canada recently created the Business Equity Program fund specifically for these kinds of projects. This is positive, but it does have interest rates attached to the program, and of course the equity funds have to be paid back during the course of the project.

Unfortunately for the China Creek project, this equity fund was not available, so the project financing was very tight in terms of maintaining the debt service ratio established by the lender. The few good years of production reduced the financial pressures, but if there were a couple of bad years of power generation the story could have been a lot different. The projected rate of return on the project was estimated at \$1.4 million per year, but has been averaging \$1.6 million per year, including some dry spells.

Financial management between HFN and Upnit Power Corp. is also important. Now that it is constructed, the day-to-day operations of China Creek are managed by Upnit Power Corp., the managing partner to the project. The CEO and CFO for the Nation is also the CEO and CFO for Upnit Power Corp. Upnit pays for the service via a service contract between HFN and Upnit Power Corp.

SYSTEM OPERATIONS > We recommend the system design that gives the CEO and the Plant Technician immediate feedback in case of a problem with operations or water flow. It is essential they have the ability to maintain, and if required, shut down the system from home.

HYDROLOGY > The hydrology study is the key and critical element of any micro-hydro project. If you do not have hydrology you do not have a project. The head, or the elevation drop the water makes, has to be sufficient. The hydrology study will tell you if the proposed location can provide the elevation drop, and the flow.

A study could cost approximately \$50,000. This includes putting several data loggers into the stream and monitoring them for a minimum of two to three years to get the overall year-round picture of flow along the stream.

It is natural to have dry periods and in the future there will be some significant dry spells due to climate change. For example, in 2009 it was so dry we only got 17 GW in China Creek. Planning the system must account for these dry spells. Typically the China Creek power plant would shut down each year from about mid-June or mid-July through to September, due to low flows. The power system design, agreements with BC Hydro and all other assessments are based on this schedule which is based on the hydrology. Despite the 2009 dry spell, proper planning now means that we have more water than needed.

Only if the hydrology predicts a successful project should you move on to the other concerns like approvals and financing, etc. If the hydrology study indicates the project won't work then move onto the next site option. **A number of projects have folded because the hydrology was not done properly at the beginning stages of the project, resulting in losses costing millions of dollars.**

PARTNERSHIPS > The partnership with the City of Port Alberni has resulted in regular communications about water flows. The City's drinking water supply intake structure is situated below the penstock for the China Creek power plant and so Upnit Power Corp. is in regular contact with City engineering staff regarding flow situations on the river. In return, the City notifies Upnit Power Corp. when and if they are adjusting their intakes below. This has also created opportunities for improved working relationships on other regional issues.

PLANNING > Planning in a matrix allows the CEO of Upnit Power Corp. to lay out two options, and within each option a Plan A, and a Plan B. This tool has been invaluable to show how everyone relates to each other and manage time and order of the project. A full list of elements for Standing Offer Program (SOP) and the Energy Purchase Agreement (EPA) provided a source for the project's to do list. BC Hydro has a handbook for both the SOP and the EPA. These sources offer additional guidance for project development.

EDUCATION > Education of potential partners and lenders was very important. The planning done for communications, including production of visual material to leave with lenders was very useful. BC Hydro and Clean Energy BC (member organization) are also good sources of information related to the industry.

CONTRACTOR > The Ministry of Environment (MOE) usually requires hiring of an independent environmental construction management company. They are needed to oversee the construction of new projects working in close proximity to waterways, including creeks or rivers. These contractors have the authority to shut down the project if one is not following the water use permit issued by the Ministry of Environment.

What would the Hupacasath First Nation Do Differently?

BUDGET > We would establish a more comprehensive and critical budget analysis prior to going ahead with the project to ensure a comprehensive financial and risk analysis of the project. This would ensure that the economics of the project are in line with debt service ratios.

For example, once you know what the hydrology of the project is, this translates into income based on the projected annual power generation. Once the annual projected power generation is known, the math is somewhat simple. For example, we are currently undertaking another run-of-river project with a projected power generation of 24 Gigawatts of power. The math is \$102,000/GW (SOP new base rate*) multiplied by 24 Gigawatts = approximately \$2.4 million of income annually. From there it can be determined that the project would support roughly \$18 million of debt; this provides some guidance in terms of required equity for the project. If the capital project cost projections are higher than \$18 million then the proponent/partners will need to inject the difference as an equity investment in order to be in line with financing requirements (debt service ratio for example).



Knowing as much as possible about project costs is better not worse. Currently, the estimated cost to build a project would be \$4–5 million per megawatt (MW). For example a 4 MW plant multiplied by \$4 million per megawatt would equal \$16 million of capital costs.

The 2006 base rate for projects of 10 MW or less from BC Hydro were in the range of \$58,000 per gigawatt hour of power produced. The “call for power” in 2010 changed the base rate as well as the minimum size of a project. The largest size project is now 15 megawatts or less, versus 10 for the 2006 call. In addition, the rate has increased from \$58,000 per gigawatt hour to the current rate of \$102,000 per gigawatt hour.*



CONTRACTOR MANAGEMENT > If we had to do it over again, more care and attention would be paid to the choice of company acting as project manager. We would also reconsider whether or not that firm was a partner to the project. In our case, the arrangement of having one of the project's financial partners also acting as the project construction manager has caused some issues for Upnit Power Corp.

The First Nation contract manager also needs strong project management skills in order to manage the requirements of 30-40 agencies, 2 fisheries windows, MOE and DFO conditions, and to hire and monitor the contractors.

This industry is in its infancy and this means there will be new technology coming along, so due diligence is vital. Contract managers must stay up-to-date, and double- and triple-check everything.

CONSTRUCTION > The HFN have been looking at other projects to see how they have been constructed. Some projects, such as Bear Creek near Sechelt, were intentionally over-built at the owner's request to potentially save time and money in the long run. This is to ensure there will be no need for post-construction replacement. We will consider taking this approach in future projects.

**Base rates from BC Hydro differ by region and with power demands. BC Hydro will not guarantee base rates will remain high for IPPs and so this should be researched for your region as part of your planning process.*

A video on the China Creek Micro-Hydro Power Plant and other Green Energy resource material can be found on the Green Energy as a Rural Development Tool Project website at <http://www.ruralbcgreenenergy.com>

For more information on the Hupacasath First Nation please visit <http://www.hupacasath.ca/>