// FACT SHEET

RUN-OF-RIVER HYDRO POWER

Run-of-River Hydroelectric (ROR hydro) projects generate electricity by using part of natural stream flows and natural elevation differences found in mountainous regions like British Columbia. With ROR hydro, a portion of the mountain stream is diverted by an intake structure into a buried pipe (called "penstock") where it is channeled downstream into one or more turbines. The flowing water causes the turbine(s) to spin. A generator is directly attached to the turbine and creates electricity. The water from the turbine is released unaffected back into the stream.

Only the projects that are both ecological and economical will deliver clean energy in the future.

ROR Hydro differs from conventional storage hydro (the majority of BC Hydro facilities are the conventional storage type) in several ways:

- In conventional storage hydro, a dam is placed across a river to create a reservoir. All (or almost all) of the water is impounded behind the dam and the flow downstream is regulated, which changes the natural variation of flow significantly for the entire length of the downstream river.
- With ROR hydro, only a portion of the stream flow is affected, and even then, only a short length of the river experiences reduced flows (the so called "diversion reach" between the intake and the powerhouse). The volume of water a ROR project may divert through the penstock to run the turbine depends significantly on a stream's morphology and environmental characteristics, but a typical power plant would utilize less than two-thirds of a river's total annual flow.
- Immediately below the powerhouse, all flows diverted to produce power are returned to the stream and the natural downstream flow patterns are preserved.
- ROR hydro has a much smaller environmental footprint compared to traditional reservoir storage hydro projects. ROR projects typically have very little water storage capacity (the so called "pondage"), compared to many weeks and months of storage found at conventional Large Hydro dams. The advantage of not having a large amount of water storage is that less land has to be flooded and therefore the potential footprint impacts are reduced, but without storage ROR hydro are able to supply electricity only as the flow allows (and flow conditions conducive to ROR power generation do not always correspond to times when electricity demand is high). Accordingly, both technologies have advantages and disadvantages and should be viewed as complementary resources.

RUN-OF-RIVER HYDRO IN BC

- Small Hydro projects have long been used historically throughout BC to power mines, mills and towns.
- As of late 2014 there are 56 independent Run-of-River projects supplying electricity to BC Hydro and another 25 that are anticipated to reach operation by 2018 in British Columbia.
- Nearly two-thirds of these projects have an installed capacity of less than 10 megawatts (MW) and around 15% are projects with 50 MW or more.
- Although there are countless rivers and streams in the province, not all are suitable for ROR hydro projects. Potential sites must have:
  - → the right balance between water flow and steepness of the terrain;
  - → cost effective transmission access;
  - → the ability to be constructed in a cost effective manner; and, most importantly,
  - → the ability to operate with minimal or no negative impacts on aquatic and terrestrial life.
- While developers make efforts to obtain a water license on hundreds of streams in BC and the theoretical potential for ROR hydro in BC is very high, in reality only a small percentage of this potential will be developed because not all sites fulfill the above mentioned requirements. Only the projects that are both ecological and economical will deliver clean energy in the future.

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Our mandate is to develop a viable independent power industry in BC that serves the public interest by providing cost-effective electricity through the efficient & environmentally responsible development of the province's energy resources.

WHY RUN-OF-RIVER?

- ROR hydro is a readily available source of renewable electricity in carefully selected watersheds. It plays a prominent role in helping British Columbia to meet its growing energy needs in a sustainable manner and helps to meet greenhouse gas emissions reduction targets as a part of worldwide efforts to reduce the impacts of climate change.
- ROR hydro projects directly distribute economic benefits to a larger number of communities and municipalities compared to large hydroelectric projects.
- Being situated closer to points of electricity demands reduces transmission losses.
- The scattered locations lower the overall power system risk by the distributed nature of multiple sources of electricity versus large electricity generation sources located in a single location.

ENVIRONMENTAL & REGULATORY CONSIDERATIONS

- All ROR hydro projects undergo a comprehensive environmental assessment process. This process typically requires three or more years of field study followed by an extensive review process by provincial and federal government agencies. It takes 5–6 years to bring a typical ROR hydro project to construction and it requires around two years to build. Many projects take more than ten years from idea to operation.
- Each ROR hydro project requires over 50 permits, licenses, approvals and reviews from over a dozen government agencies, involving extensive public and First Nations consultation, before they can be built and operated. A recently constructed project had over 1,500 permit conditions to comply with.
- Projects that are successful in achieving environmental approval must adhere to strict operational parameters. As a result of the environmental assessment and permitting process, every project must comply with dozens of operational commitments and/or conditions, which are monitored by independent, third-party engineers and compliance officers to ensure a high standard of environmental protection and mitigation. Among many others, these commitments include the amount of water that must be left in the stream (the in-stream flow requirement) and consequently, how much water can be diverted, and the rate at which the diversion amounts may be changed to prevent "ramping conditions" that may harm fish in the stream.
- Water licenses for power generation purposes issued by the provincial government typically run for a 40-year term. Over this period, the operator pays an annual water rental levy as well as land lease payments to the provincial government.
- When a water license expires, the developer has the opportunity to apply for a renewal of the license. If it is not granted, the right to use the land and water revert back to the provincial government.
- A typical BC 10 MW Run-of-River power plant producing 40,000 megawatt hours (MWh) of green energy annually would displace approximately 13,700 tons of carbon dioxide, the equivalent of taking about 3,000 cars off the road.

SOCIOECONOMIC BENEFITS

- ROR hydro projects ensure environmentally sustainable development of local resources.
- Diversification of economic activity in remote areas.
- Provide training and employment opportunities for First Nations and communities.
- Continuous source of clean and green renewable energy with minimal environmental impact.

INNOVATION IN BC

- In striving to meet the strict environmental assessment and approval standards in the Province of BC, the developers, consultants and equipment suppliers in the BC ROR hydro industry have become some of the most knowledgeable in the world on minimizing the operational impacts of hydroelectric power on fish and fish habitat.
- This expertise resulted in innovations such as turbine designs and operation measures to ramp up and down in a safe manner to ensure minimal impact on fish and fish habitat and innovations like energy dissipation chambers to meet strict environmental operations requirements to ensure an environmentally sustainable development of local resources.

KEY LINKS

Environmental Assessment Office
www.eao.gov.bc.ca

BC Hydro
www.bchydro.com

BC Utilities Commission
www.bcuc.com

BC Ministry of Energy, Mines & Petroleum Resources
www.gov.bc.ca/empr