

# **Inexpensive Wind Powered Water Pump**

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## **Part I: Product Information**

### **Introduction to Product**

Wind powered water pumps are designed and manufactured to draw water from already existing supplies of water whether it be ground water, ponds or lakes, and pump it to a desired location for practical use. The water may travel down a mountain or hill to the greater population or be pumped across flatlands to settlements.

The export potential of these mechanisms from Canada to Nepal will be critically evaluated as well as the introduction of two Canadian companies that manufacture the necessary parts to construct a wind powered water pump. Different logistics such as the market for such a device, the advantages and disadvantages of the product, will be outlined including the cost and shipment details.

### **Description of Canadian Companies**

Canadian Pond, a Canadian company stationed out of Knowlton, Quebec has been developing cutting edge windmill blades to increase effectiveness and overall durability of their products, strive to achieve the most natural water safety and withdrawal by imitating natural water systems. Pond accessories, (Canadian Ponds, 2016).

Prolite Systems Inc. is a Canadian based company out of Maple Ridge, British Colombia with international manufactures and



Figure 1: Canadian Ponds logo found at <https://canadianpond.ca/store/>



Figure 2: Prolite Systems Inc. logo found at

distributors, that fabricate thermoplastics and pipes in many different sizes (1/2”- 144” diameter) and materials (polypropylene, polyvinyl chloride, fluoropolymer etc.) to ensure the right fit. They also produce a variety of products including ventilation, scrubbing, laboratory equipment and concrete protective liners (Prolite Piping Products, 2016).

### **Product Description**

The Wind Powered Water pump will turn like a wind mill on the upper half, generating energy from the blades turning to draw water up from the ground or more practically pump water down the mountain and into the lower lands for clean and fresh water access in abundance. Up on the mountains many large bodies of water are found due to the Glaciers melting and with great wind gusts due to the high elevation on the Himalayan mountain tops, the blades will spin with ease. The power produced by the wind turning the blades around will draw the water up from the lakes, ponds, rivers etc. and transport it down the mountain by force of gravity through steel pipelines to community taps for easy access by families.

### **Manufacturing Information of the Product**

The windmill will be designed and manufactured by Canadian Ponds and guaranteed to be made out of 100% Canadian products. Heritage is really important to Canadian Ponds as it originated from a small family business in Quebec that strived to preserve the environment and wanted to minimize pollution making the earth a better place for generations to come (Canadian Ponds 2016). The product includes the 16 meter all steel tower, 2.5 metre diameter blades, large compressor, automatic oil drip lubricant as well as the water pump and connecting pieces. The lifetime of this product is guaranteed 50 years with little to no maintenance.

The pipelines will be manufactured by Prolite Systems Inc. at an undeterminable cost due to the many variables. Approximately 150km of pipes will be needed to transport the water down

to the mountains to the Terai where it will be in high demand. Varying terrain, slopes and obstacles down the mountain are the main causes of the unpredictable cost to install a set of pipelines from the water source to the population.

### **Machinery Required**

To benefit the Nepalese community and their economy, the installation and assembly of the windmill mechanism will be completed by native companies to Nepal. Canadians will be creating the instruction manual and directions of assembly in a multi-language booklet for interpretation of both countries as well as any third party that may be involved in the process. Nepalese men and women will be presented with job opportunities to help secure the windmill and ensure it is structurally sound and sturdy. Helicopters are available in the Himalayan Mountain ranges for tourism and rescue therefore no addition machinery is needed to for transportation of the parts and items to more remote locations.

The pipeline installation will however require larger more technical machinery as trenches need to be dug, pipes need to be laid down and connected and some insulation is required at the higher elevations. Located in Nepal's capital; Kathmandu, is a large Construction company that has both sales and services in this town. Kabelco Construction Equipment was originated out of India, however have expanded their markets to the majority of countries in mid Asia. This branch of the company is operated by the Nepalese and will create more jobs for them and at the same time boost their economy because the workers will be paid by the company that has its headquarters in India, creating international trades and bonds (KCEI, 2016).

### **Market Opportunity and Benefits to Canada**

After 2007, the steel pipeline industry took a large deficit and has been gradually working

back to the number previously produced. As of 2010 Canada was once again increasing their steel pipe exports with 1.3 million tonnes from 828 000 tones in 2009 but still not back to the numbers of 2007 with 2.04 million tonnes (Government of Canada, 2013). By creating a new market for steel pipeline exports from Canada, the steel pipe export market will be benefitted with the potential to expand global trade and sales (Government of Canada, 2014).

Canada and Nepal have an already existing trade and sales relationship, mainly with Canada aiding in the improvement of Nepalese agriculture, thus in tern improving the overall quality of life. Products such as aviation, technologies, paper, healthcare items, eye glasses and equipment as well as certain vegetables and seeds are Canadian exports to Nepal to aid in the poverty and malnutrition (Anam, Rahman, 1991).

By exporting the parts necessary to put together this mechanism, Canadian companies benefit greatly from the international business and trade sector. Canadian companies can expand their global contracts. Enabling room for growth and improvement, the products will bring in profits and by having other manufacturing warehouses across the globe, shipment will be more convenient for the Canadian companies (Bailey 1986).

## **Part II: Export Potential to Nepal**

### **Brief Description of Nepal**

Landlocked by China and India, Nepal is located in mid-south Asia with Kathmandu as a capital city (Slusser, 1982). The population of Nepal has been steadily increasing according to records dating back to 1990, with a current population of approximately 29 million people and not enough resources available to feed the

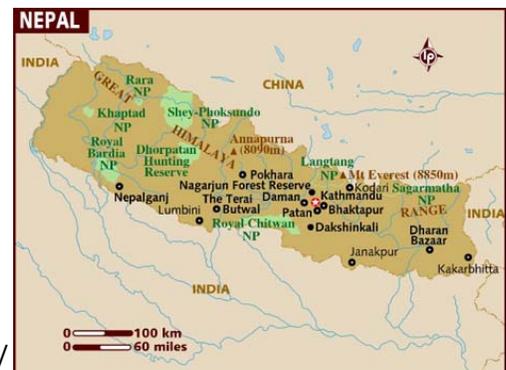


Figure 1: Map of Nepal, found at <http://www.lonelyplanet.com/maps/asia/nepal/>

growing population with over 2.2 million people undernourished (Somsak, 2016).

There are 3 major land regions in Nepal, each having a unique agro ecology. Northern Nepal is almost entirely part of the Himalayans and is the mountainous region, with its prime market being tourism. Nepal is home to many of the largest mountains including Mount Everest, the highest peak on earth (Rana et al. 2000). Below the mountains there is a transitional section known as the highlands or hills region. Here, forestry is a large industry on the elevated flat lands, as well as prime grazing land and pasture land in the rolling hills. The Terai is the smallest agroecology region and is most suitable for growing cereal grains as well as housing non-pastured animals.

**Brief Description of Water Pumps and Systems in Nepal**

Nepal’s water technologies have previously begun to improve with the introduction of additional water taps around mountainous villages that have access to clean abundant water. Upgrading from 4 taps per 150 families to an astonishing 27 allows for clean water to be more accessible to families (Adhikari, M et al., 2016). As of now, Nepal relies heavily on ground water however that is not renewable due to the uneven supply and demand. As of 2005, only 4.7% of surface and ground water in Nepal is renewable meaning it replenishes at the same rate as it is consumed (Food and Agricultural Organization of the United Nations, 2012).

Renewable fresh water resources	Year	Amount of water
Precipitation (long-term average)		1 500 mm/yr
	-	220 770 million m <sup>3</sup> /yr

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Internal renewable water resources (long-term average)	-	198 200 million m <sup>3</sup> /yr
Total actual renewable water resources	-	210 200 million m <sup>3</sup> /yr
Dependency ratio	-	5.71%
Total actual renewable water resources per inhabitant	2009	7 142 m <sup>3</sup> /yr
Total dam capacity	2009	85.3 million m <sup>3</sup>

Figure 2: The table as displayed above is outlining the amount of renewable fresh water and the year the statistic was taken.

Laying pipelines to run from the fresh glacier water in the Himalayas down to the Terai areas, the need for ground water withdrawal will decrease and allow for the ground water to replenish. With the addition of alternate water resources, ground water may once again be a renewable source in the future (Water Environment Partnership in Asia [WEPA], 2016)

### **Needs and Benefits to Importing Nation**

Through the extensive installation process, many Nepalese civilians will have the opportunity to be employed and assist in the labour behind the mechanism. An installation crew, maintenance team and construction employees are necessary for this product to be available in Nepal. Through creating jobs and work opportunities, the economy of Nepal will be positively impacted and could potential help a section of families graduate from a life of poverty (Lokshin et al., 2010). The supply of fresh water will aid in the betterment of their agricultural industry due to the potentially higher yields and healthier animals. Nepalese families would benefit from this product because if the insufficient water available right now, families would finally have enough water to carry out more sanitizations and cleaning practices, improving the overall health and wellness of civilians.

Due to the unsustainable ground water levels in Nepal and the great demand for irrigation in the Terai, Nepal is not seen to have an effective and renewable source of ground water as the  $12\text{km}^3$  is in greater demand than supply. Agriculture accounts for one of the greatest demands for available ground water as 57% of the crops grown in the Terai region are irrigated and with great demand, the depletion of ground water is evident. The high demand for irrigation of crops makes up 98% of water use in Nepal along with livestock, leaving only 2% of available water for non-agricultural purposes. Laying pipelines to run from the fresh glacier water in the Himalayas down to the Terai areas, the need for ground water withdrawal will decrease and allow for the ground water to replenish. By allowing the ground water to return to natural levels and in the meantime use imported water from other agro ecology regions, Nepal may be able to soon have a reliable source of renewable fresh water (Water Environment Partnership in Asia, 2016).

Nepal does however have many enclosed bodies of water in both the mountainous and Terai regions. Large glacier lakes in the mountains is where unused fresh water remains and is the prime target for the wind powered water pump. In addition to the 2323 Glacier Lakes, Nepal is also home to many 'watering holes' for wildlife. The majority of the water bodies in the Terai region are occupied by non-agricultural animals in the Koshi Tappu Wildlife Reserve located at the wetlands of Bairawa (Water Environment Partnership in Asia, 2016). This is just one of the many unusable bodies of water that could potentially be redirected to the agricultural industry to grow and maintain crops to allow crop yield to bounce back from ultimate lows (Dubin & Bimb, 1990). Snow covered peaks and deposits within the Himalayan also store an abundance of fresh water within the country of Nepal, yet it is not in the right state to be used in water consumption by animals, plants or humans (Water Environment Partnership in Asia, 2016).

### **Transportation Logistics**

Neither companies offer direct international shipment, an opportunity for a potential third party company to step in is available. Both Canadian Ponds and Prolite Piping will arrange shipment to the coast of New Brunswick where Mediterranean Shipping Company will transport the products across the Atlantic Ocean to India by means of cargo freighters. When Successfully across the ocean, the cargo containers will be trucked to Nepal and distributed accordingly.

For simplicity reasons, Mediterranean Shipping Company requires that you fill a cargo container if you wish to ship across the ocean. Prices are also ambiguous on the shipping containers due to the uncertainty of pipelines. For an average 40-foot-high cube container it is \$450 for the 31-day travel from St. John, New Brunswick to Mundra India and then Mediterranean Shipping Company with transport the shipping container by truck through India to Nepal (Mediterranean Shipping Company, 2016).

**Import/Export Documentation Required**

Import to Nepal documents	Export from Canada Documents
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<ul style="list-style-type: none"> <li>• Be in line with the Foreign Exchange Act section 1962 &amp; 1963</li> <li>• Customs processed documents</li> <li>• Authorization of border entry point</li> <li>• Fulfill duty insurance requirements</li> <li>• CTD (red for non-government imports)</li> <li>• Delivery Order</li> <li>• Letter of authority</li> <li>• Original invoice and packing list</li> <li>• Origin certificate</li> <li>• Authenticated L/C</li> </ul>	<ul style="list-style-type: none"> <li>• Canadian Revenue Agency export business number</li> <li>• Product identity</li> <li>• Approval from destination country that product is legal</li> <li>• Obtain an export licence and permit</li> <li>• Identify status of goods to be shipped as either controlled, regulated or prohibited by the Canada Border Services Agency and provide permits for oversized shipment</li> <li>• Obtain a B13A Export Declaration</li> <li>• Declaration of export and export code</li> <li>• Declare travel time to transport product to final destination</li> <li>• Packing slip</li> <li>• Product origin certificate</li> <li>• Bill of lading</li> </ul>
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Figure 3: The table as seen above outlines all of the relevant documentations, and authorizations mandated to import items into Nepal as exports from Canada. Notice export licences and permits are required to ship the product out of Canada, however the equivalent is not necessary to enter Nepal. The information for the tables is referenced from Government of Nepal Ministry of Commerce Trade and Export Promotion Centre (Pulchowk, 2016) and the Government of Canada Foreign Exports websites. (Government of Canada, 2016).

### **Regional and Global Competition**

Nepal's fresh water availability is an issue that is attempting to be resolved through different global organizations. The United Nations are eagerly investing money and resources into Nepal with the intention that water contamination and availability problems may be solved. Different from pumping in new clean water from glacier deposits and lake at higher elevation, the United Nations work towards purifying the already available water in the areas (Food and Agricultural Organization of the United Nations, 2012). Nepal has had some devastating water

contaminations, including the arsenic leaking into the ground water. It was observed that the contamination is largely due to the separation of ions in minerals containing arsenic. If the mineral stays intact than no contamination would occur, however since the compound is hydrophilic it will dissolve and dissociate when exposed to water (Pokhrel 2008). This process of purifying water and making more water usable is not necessarily a competition to the wind powered water pump but could serve as a parallel to it. One mechanism on their own would not be able to solve all of Nepal's water devastations, however if both worked simultaneously, then the water quality and abundancy could be greatly improved.

Some competition in terms of products could include the Hurhure Danda Agricultural Cooperative Organization for they are working to install windmills and smaller turbines. These products however are built to generate energy and transform it into electricity to run into households. The companies supplying the parts necessary to construct the windmills and turbines may compete with Canadian Pond, the Canadian company providing Nepal with all parts necessary to install wind powered water pumps (Hurst, 1990). Steel manufactures are located across the globe and many stationed out of Europe and Asia would provide more economical resources for Nepal to use for the wind powered water pump. The less the parts have to travel before installation the less they will cost and potentially the better shape they will be in.

### **Critical Analysis and conclusion**

To make this study more informational and improve the quality of statistics, future studies need to be done. Specific elevation points and terrain down the Himalayan Mountain range need to be accessible without travel there to enable an estimate on price and amount of pipeline required to transport water down the mountain. By knowing these facts and

observations, a more appropriate estimate can be conducted on the overall price and fees of the wind powered water pump to be exported to Nepal.

Studies on technology in Nepal would aid in the research process of this mechanism because if already existing products similar are currently being developed in Nepal, less of it may need to be transported cutting down overall cost while still benefitting both countries and their economies. Products such as all of the steel needed to assemble both the windmill and its base/ tower as well as the entire pipeline will be expensive to export due to their weight, so if Nepal manufactures steel then it will be more cost effective for the Nepalese.

The large price tag that comes along with the wind powered water pump well exceeds the income of communities of Nepalese farmers as they earn roughly \$1 CAD each day, totalling to under \$400 CAD a year. The National Government of Nepal would invest money into these technologies to aid in better health care, less malnutrition, higher yields, and healthier animals. Initially only one windmill will need to be installed and pipelines down to the villages and water wells/ taps in the Terai. If the product proves to be a success then there is the opportunity to install more and reach families and villages all across Nepal, along with multiple windmills at higher elevation pumping water out of various water reservoirs and lakes.

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