

Canadian Agri-Food Export Biodiesel Rendering System

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Energy sources, such as petroleum, are of the largest of imports into Nepal (OEC, 2014). These are expensive and non-renewable resources and have to be constantly imported for the continuous use. This is tolling on the Nepalese economy as the fuel must be purchased and transported in from other countries. An alternative and sustainable energy source would be beneficial to be produced in the country of Nepal (Woinaroschy, 2014).

As the Nepalese agriculture industry grows, many sectors under that umbrella follow, especially the various livestock industries (FAO, 2014). The typical Nepalese diet does not include meat on a daily basis (R. Khanal, personal communication, 2014), and so the meat sector of the industry reflects this low demand (FAO, 2014). An alternative to meat production of shipped, culled, and deceased animals from the various livestock sectors would be to utilize various rendering techniques. The observed increase in the dairy industry increases the livestock population which will also increase the supply of carcasses for rendering (FAO, 2014). Many products can be produced from the unwanted parts of an animal carcass that can be of great benefit. Biodiesel is a product manufactured from an animal carcass via rendering techniques which can aid in the energy demands issues in Nepal, as outlined above. This biofuel can usually be interchangeable or blended with other fuels, such as petroleum, that are used in various diesel powered motors (Feddern et al., 2011).

A small-scale biodiesel production system is proposed to be exported from Canada to Nepal. There are few Canadian companies which produce and supply biodiesel systems, in which basic systems range from \$600 - \$3000 CAN (PlantDrive, 2014; Alibaba, 2014). These systems could be marketed and exported to various industries and purchasers in Nepal, however, the high price point (52 760 - 87 930 NPR) will likely be deterring to the potential buyers. Therefore, it is further proposed that an alternatively produced home biodiesel rendering system is exported from Canada to Nepal. This will be done through a newly established organization or company in Canada. This potential organization will be further referred to as “Canada Biodiesel Systems” (CBS).

A simple biofuel production system can be made on a small scale, which would be what is produced for the targeted buyer (Feddern et al. 2011). A simple biodiesel manufacturing system based off of an apparatus designed by Wen et al. (2006) is proposed to be exported to Nepal. There are many required parts which need to be supplied to create the biodiesel rendering system and will require purchasing from different suppliers. Depending on the market for the components, non-Canadian suppliers will be chosen to allow for cost effective supplies. However, some of the materials required for the system can be obtained alternatively from Canadian recycling plants, such as the Region of Waterloo Waste Management, which would lower the costs associated with the production of the system. *Table 1* outlines the required components of the proposed rendering start up system, the possible manufactures/suppliers of the components with their prices, and if possible, the low cost alternatives of the components. It is estimated that the cost-price of the materials needed to create a biodiesel rendering system would cost just under \$300, whereas if some components are supplied through a recycling organization, and if an alternative heating source was used, the system would only cost just over \$90.

Components	Quantity	Supplier	Average Cost (\$CAN)	Alternative	Alternative Cost (\$CAN)
HDPE plastic container/tank	1	Century Packaging Ltd.	13	Recycled bulk sized oil container	0
Glass bottle	1	Great Western Containers Inc.	8	Recycled glass liquor bottle	.2 x 5 = \$1
Plastic bottles + caps	5	Century Packaging Ltd.	3	Recycled 2L soda bottles	0
Glass stir stick	1	Science-First	.5		
Electronic scale	1	EatSmart	20		
Digital thermometer	1	Amico	2		
Graduated cylinders	2	Canadawide Scientific	24 x 2 = 48		
Heating system (hotplate)	1	Canadawide Scientific	180	Established home cooking system	0
Meat strainer	1	Weston Supply	20		
Total system cost			294.5		

Table 1: Required components for a simple small-scale biodiesel rendering system with suppliers, costs and alternative suppliers and alternatives costs.

CBS will be in charge of collecting/purchasing all of the various components of the rendering system. These separate components will then be shipped in bulk (with their likewise components) to Nepal, where CBS will employ Nepalese people to assemble the complete systems. In order for this to plan to occur, CBS will also employ trained Canadians to travel to Nepal to manage the assembly of the rendering systems. The collection, assembly and management will be labour intensive allowing for a diversity of employees across both countries to be recruited for the project. This results in high labour costs of the project.

The inputs for the home biodiesel rendering system include animal fat, methanol, and a transesterification catalyst (e.g. lye). Plant oil is an alternative for the animal fat input and is discussed later in this proposal. These inputs, supplier and costs are show in in *Table 2*. These inputs are non-renewable and are required to be continually supplied to the system user (Wen et al. 2006). The animal fat is the input which is to be supplied by the livestock producers of the country and can be considered a “free” input. This is due to the fact that this input has no use or demand in a society which does not already have the facilities to take advantage of it. Chemical suppliers of the required inputs are also located in Canada, add to the exports of Canadian products to Nepal. *Table 2* outlines the chemical inputs and their respective suppliers and costs.

Input	Supplier	Cost
Animal Fat	Nepalese livestock farmer	
Methanol	Methanex	\$2/gallon
Lye	Certified-Lye	\$10/lb.

Table 2: Inputs of a biodiesel rendering system with their respective suppliers and costs (Methanex, 2014; Certified-Lye, 2014).

The small biodiesel rendering system will be a large investment for a single Nepalese farmer. As well, the typical subsistence farmer of Nepal will not continually “produce” animal carcasses to supply the animal fat needed for biodiesel production. Therefore, the biodiesel rendering system is targeted towards farm co-operatives (co-ops) and large livestock producers. These users would be best to target marketing of the product to as they are more likely to be able to afford the initial start-up cost and the continued purchase and import of the chemical components. These users are also able to supply a more continuous and substantial amount of animal fat required for effective biodiesel production. As trends reported by the FAO suggest, the agricultural industries of Nepal are growing. The various livestock industries are increasing the overall livestock population of the country (FAO, 2014). As the communities establish themselves, there will be more incidences of farming co-ops. Therefore the targeted consumer is growing in Nepal, suggesting an increase of success of the Canadian export.

Canada can benefit greatly from organizing, producing and exporting this product in many ways. Firstly, there are direct benefits from this project. CBS will make a profit from the selling of the product in Nepal resulting in the economic support of this new Canadian company. All the Canadian suppliers of the components of the system will be economically supported by CBS. Since it is proposed that some of the components of the rendering system are alternatively supplied through

collection and purchase of recycled components, the recycling organization chosen, Region of Waterloo Waste Management, will be supported economically by CBS. Many jobs will also be created to employ Canadians. This is mainly encompassed by all the positions of the newly formed CBS company which include managers, secretaries, shippers and receivers, marketing, overseas sales representatives, education providers, product maintenance, product improvement, etc. There are also indirect benefits directed towards Canada. With the establishment of this trade relationship between Canada and Nepal, the relationship has the potential to grow, becoming a strong partnership which will allow for increased trade between the two countries. This will result in increased export of other products from Canada to Nepal, strengthening the Gross Domestic Product (GDP) of Canada. In return, there will likely also be a potential to Nepal to increase their export into Canada, which will supply Canada with novel Nepalese goods for niche markets. This will also strengthen the GDP of Nepal while increasing the cultural diversity of goods available to Canadian consumers. Since the export product is used for the production of biodiesel, which is an environmentally friendly alternative to diesel, various green initiatives, like the Canadian Renewable Fuels Association (CRFA), and environmentally interested universities, like the University of Waterloo and the University of Guelph, are likely to become involved through interest. This will lead to increase of research in order to support and improve the environmental initiative which biodiesel production and use supports.

The various components of the rendering system are purchased from different suppliers as outlined in *Table 2*. Depending on where the components are being supplied from in Canada, they will be flown out of the Canada at its nearest freight airport. For example, all the components supplied by the Region of Waterloo Waste Management would be shipped by transport truck to Toronto airport (YTO), and flown by Air Canada Cargo to Hong Kong airport (HKG). From Hong Kong, the supplies would be shipped by train by Mass Transit Railway (MTR) to the established CBS location in Nepal.

The import of the biodiesel rendering system into Nepal will be greatly beneficial to the Nepalese people and to the overall country. Directly, for the users of the product, biodiesel will be produced from otherwise useless substances (animal fats) which allows for the production of cost effective fuel. This increase in the availability of diesel energy will allow for an increase in use of machinery, equipment and transportation powered by diesel motors. With the increase use of diesel powered equipment, such as hand tillers and other agricultural equipment, the agricultural potential of subsistence farmers and farming communities will be increasingly fulfilled. This results in prosperity of the various agricultural production systems, leading to further development of the communities and their agricultural industries. The opportunity for use of new equipment and machinery, such as various food processors, can also occur from the production of biodiesel. Transportation opportunities will also increase from the higher availability of fuel. This will allow for agricultural trade over distances to occur, further development of the agricultural industry. Additionally, this biodiesel production can support transport and use of non-agricultural machinery, which will benefit other sectors of the Nepalese country, such as education and health care. Lastly, the produced biodiesel can be sold, resulting in an additional source of income for the producer. In general, this rendering system will benefit farmers by allowing them to manufacture their own biodiesel for their own individual uses, instead of having to purchase it. If the project is successful and results in significant biodiesel production, the import of petroleum can be diminished, further strengthening Nepal's GDP. Therefore, the production of biodiesel is undoubtedly a direct benefit to the agricultural producers and industry of Nepal.

Aside from the benefits from the use of the produced biodiesel, the establishment of this trade will also benefit the people of Nepal in alternative ways. CBS will need to employ Nepalese people to aid in the development, labour and sales of the product. Employment opportunities, which include assembly, marketing, sales, distribution, education and training, and maintenance, will be made available to Nepalese people, directly employing and financially supporting them. There will be many indirect benefits to Nepal from the project as well. By providing the agricultural industry and producers with a way to make additional profit off of livestock, an incentive to raise livestock will occur. This will result in individual farmers to either initiate the production of livestock or to increase their herd sizes. Larger livestock producers will also likely increase their herd sizes drastically if they have purchased a biodiesel rendering system. Ultimately, this will result in an increase in the livestock industry, increasing meat, dairy and egg production, consumption and export. The development of livestock industry will make the overall agricultural standing of the country better and in the increase in exports will allow for a heightened GDP of Nepal.

As was mentioned as a benefit for Canada, Nepalese Universities will also likely become involved with the project. The Agriculture and Forestry University (AFU) and Tribhuvan University (with its Institute of Agriculture and Animal Science) will undoubtedly be interested in the development of the project as it is a clear benefit to the agricultural development of the country. This will result in an increase of research and education for the students and faculty of the universities, further resulting in an increase of agricultural knowledge and development for the country. Along with agricultural incentives, there is positive environmental impact with the production of biodiesel. Nepalese Universities with environmental interests, such as Kathmandu University, will present also support aiding in the development of environmental education and research in regards to the project. The project, therefore will lead to potential educational and discovery opportunities of the respective universities.

An additional indirect benefit of biodiesel production and its use is that fact that it will aid in environmental conservation. Biodiesel is a more environmentally friendly fuel than the common fuel, petroleum, used in Nepal. Cleaner emissions occur from the use of biodiesels (Coniglio, et al. 2014). This is positive factor in any country, but especially in population dense countries like Nepal (Trading Economics, 2014).

As previously described, this product is to be targeted towards farm co-ops and large livestock producers in Nepal. To get the export and marketing started in Nepal, CBS will contact the Ministry of Agriculture Development (MOAD) in regards to locating any various farm co-ops to market towards. To find the various larger livestock producers in Nepal, CBS can go through organizations such as the Dairy Development Corporation (DDC) or the Central Dairy Co-operative Nepal (CDCAN). From this, CBS will then send informative publications and representatives to visit the organizations, co-ops, and livestock producers to inform them of the biodiesel rendering system. If a co-op or a producer is interested in ordering a system, then they are added to the order. A substantial amount of consumers must order the system before the product will be shipped to Nepal, since the product is shipped as individual components in bulk as explained previously. Once the orders are shipped to Nepal, and all the components are received at a central location, the Nepalese people employed by CBS will assemble each individual system, under the supervision and management of a Canadian CBS employee. Once the rendering kits are complete, the product will have to be transported to each consumer. This distribution will be through means of truck to easily the accessible areas, and alternative transportation, such as by foot or mule, to the more inaccessible areas. Next, Canadian CBS education representatives will hold seminars and workshops for the consumers in order to train the rendering system users how to effectively and properly produce and

use biodiesel. Lastly, Nepalese people will be employed by the CBS for the maintenance and service of these systems. With the increase of purchase and presence of the CBS product in Nepal, CBS will eventually have an established office in Nepal and which will allow for increased Nepalese employment and eventually replacing the Canadian representatives with Nepalese employees. Through the export of the biodiesel rendering system, CBS has the potential to become a substantial company in Nepal, strengthening the Canadian-Nepal trade relationship.

It will be necessary for loans and grants to be provided for this project. Although the cost of the product is low, there is a large amount of labour required for the success of the project. The supplemental funding will be required until CBS is able to strongly establish its company. In terms of funding for this project, many organizations would be interested in being involved. Agriculture and Agri-Food Canada (AAFC) and the Ontario Agricultural College (OAC) should be interested in this initiative due to the agricultural development benefit of Nepal and the agricultural export benefit for Canada. Private environmental organizations, such as CRFA, and the environmentally focused universities, such as the University of Waterloo and the University of Guelph, would be inclined to aid as well as if it a way to raise environmentally-friendly awareness and practices. The Region of Waterloo Waste Management would of course be inclined to be involved as it can be a way to boost the incentive of recycling in the region. Ideally the Region of Waterloo Waste management would also supply the project with the alternative materials for the system at a reduced price.

There are many biodiesel rendering systems currently on the market. However, these commercially produced systems of about the same have a significantly higher price range of \$600 - \$3000 CAN (PlantDrive, 2014; Alibaba, 2014). These commercially produced systems are clearly not feasible for the purchase of a farming co-op and a livestock producer, making the CBS product, which could cost from \$90-\$300 CAN, more appealing to the consumer. Due to the expensive price range of the systems on the current market compared to the cost effective system from CBS, the competition for CBS is not high and should not be an issue.

In regards to a realistic prognosis of the project, I believe that there is potential for a successful relationship between Canada and Nepal with the export of a biodiesel rendering system. There are many hurdles to overcome in order to start this project. Support is needed from various organizations mostly in the form of finances, but also potentially with lowered cost of supplies. Effective marketing and education will be essential with the success of the product, in order for the users to be efficient producers of biodiesel.

There is, however, a major implication which could hinder this project. Hindu is the main religion in Nepal, in which those who follow the religion do not use the body or carcass of a bovine animal for consumption (NaturallyNepal, 2012). In regards to the use of a bovine carcass for rendering purposes, it is unclear if the Hindu population of the target group would comply with this use of a bovine animal (R. Khanal, personal communication, 2014). Biodiesel can be made from the fats of other animals, however, most rendering material is generally resulting from larger dairy and beef industries (Feddern, 2011). One way to avoid this hurdle would be to consider altering the biodiesel rendering system to instead produce biofuel. Biofuel is the production of a fuel through the rendering of plant oils from the by-products of certain crops like sugar cane and maize (Gressel, 2008). By altering the project to a biofuel rendering system, any religious concerns and implications can be avoided which may be in the best interest when trying to establish a strong and respectful relationship with Nepal. The biodiesel project will not have this same hurdle in other developing countries in which Hindu is not a main religion, such as Chad, and could be considered an export for

these developing nations. Comparison studies and investigations should be carried out to determine which type of project, biodiesel or biofuel, the initiative should develop for the export to Nepal. In conclusion, a small-scale rendering system would be of benefit to a Canada-Nepal Agri-Food relationship as there are many economical, agricultural and societal effects benefiting both countries. However, a significant level of financial support is required to initiate the project. As well, it should be strongly considered for the project to focus on developing a biofuel rendering system instead of a biodiesel system due to potential religious implication.

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