"USE OF BIOMASS RESOURCES FROM FOREST AND INDUSTRIAL RELATED ACTIVITIES FOR GENERATION OF ENERGY IN THE ALUMINE AREA, PROVINCE OF NEUQUEN"

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Abstract

The global context shows a significant increase in terms of energy consumption and dependence on fossil fuels, leading to high costs for the population, and its natural and social environment as well. This situation should be tackled in the very short term. Currently, the environmental impact registered has further led to the generation of new alternatives aimed at reducing this impact and maximizing sustainability. Focus has been placed on the development of renewable energy from biomass sources. In Argentina, one feasible proposed alternative consists in using forest waste for the development of bio-energy. The available inventories carried out in the Aluminé area, province of Neuquén, reveal a wide availability of suitable land for forest crops, building the necessary conditions for the forestry sector to become one of the productive activities with greater development possibilities in the Neuquén area. It is thus necessary, to introduce a paradigm shift in the energy matrix, through the use of these biomass resources derived from the forest industry activity. This change will replace, in the mid and long term and to a certain level, fossil fuels which the region currently depends on, and will make possible to achieve, in the near future, the necessary self-sufficiency and sustainability for energy development. This is initially intended for the region, and potentially nationwide.

Keywords: Biomass, forest-industrial sector, sustainability, self-management, energy paradigm.

Introduction

In any change process, it results essential to know the territory carrying capacity, its limitations, vulnerabilities and its sustainable suitability, as well. It is further necessary to identify and assess natural resources and specific ecosystems to be protected and preserved.

In terms of biomass resources, a wide range of new alternatives is identified due to the addition of the new energy matrix paradigm. All these factors demands a political approach based on the medium and long term in relation to interests, needs and constraints from the regional-local scope; that is, to be aware, from this territorial scale, of the responsibilities in the development and management.

"Indeed, the transformation of biomass is technologically relevant, not only for energy production (which can be sustainably produced by other renewable resources: solar, wind, geothermal ...); but due to the fact that biomass is the only renewable source available on a massive scale for the manufacturing of products, materials and carbon-based fuels"[2]

In 2006, Law 26,190 launched the "National Program for the promotion of renewable use of energy for electric power generation." Section 1 of this Law states: "Be it declared of national interest the generation of electric power from the use of renewable energy sources for the provision of public services, as well as the research for technology development, and the manufacture of equipment for this purpose."[3] It further states that within a 10-year term, an 8% of the electricity consumption should be supplied from renewable energy sources.

Therefore, it results necessary to have an innovative approach with regards to the model of resources use, particularly in terms of energy, being capable of harmonizing economic, social, environmental and ecological variables in the regional context.

Under this premise, the main objective is to promote growth, protection and enhancement of the forestry activity and heritage in the Area of Aluminé, Province of Neuquén, as well as to increase the quantity and quality of the subsequent industrialization of the area.

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[2] J. Arauzo y otros. "*Introducción a las tecnologías de aprovechamiento de biomasa"* [*Introduction to Biomass Use Technologies] Available at: www.gecarbon.org/listnl.asp*

3 Law 26.190 - Régimen de Fomento Nacional para el uso de fuentes renovables de energía destinada a la producción de energía eléctrica [National Program for the Promotion of Renewable Sources Use of Energy for Electric Power Generation]. Purpose. Scope. Application. Authority of Application. Policies. Investment Scheme. Beneficiaries. Benefits. Approvals. Trust Fund for Renewable Energy. Passed on December 6, 2006. Enacted on December 27, 2006. Ministry of Economy and Public Finances, Argentina. Available at: http://infoleg.mecon.gov.ar/infolegInternet/anexos/120000-124999/123565/norma.htm.

Likewise, the Project makes possible to develop and apply the best available technology, to promote the development of sector–related private investment, and of those companies providing associated services to every link of the industrial and forest production chain, thus ensuring social, economic and environmental sustainability of the activity. This project implies:

- An increase of areas subject to pruning and thinning in the implanted forest.
- Improved working conditions of pruning and thinning crews.
- Increased production of Abra Ancha Sawmill.
- Improved product quality of Abra Ancha Sawmill.
- Improved quality of power supply within the Project area.
- Making socially and environmentally sustainable the use and final disposal of forestry industrial waste.
- Improving environmental and social conditions in the urban area.
- Replacing local power generation, through internal combustion engines, for power generation through biomass, thus reducing the environmental impact which results from the use of fossil fuels.

Aluminé and its characteristics:

The province of Neuquén is one of the main generators of electricity in the country through hydroelectric plants located throughout the Limay and Neuquén Rivers. Furthermore, the electricity generated by the province using other sources, such as hydrocarbon resources in thermoelectric plants, mainly from the West of the province, results a relevant factor.

Neuquén has 60,000 planted hectares with exotic conifers[4]. This initiative has been developed over the last 40 years by the provincial Government, in response to the search for alternatives to the primary activity of hydrocarbon extraction.

According to the Provincial Strategy for the Agri-food industry of Neuquén, the forestry industry is considered one of the priority sectors to improve life quality of the population, pointing to the economic development related to the procurement of resources from productive activities and industrialization processes.

In order to achieve this goal, several actions are stated in different initiatives associated to the promotion of forest nurseries, forestry promotion through subsidies, implementation of plans for small producers, development of road networks for forest product transport, forest health, fire management,

[4] Provincial Forest Plan Neuquén 1999-2006. Available at: http://copade.neuquen.gov.ar/intranet/files/documentos/Produccion_sustentable/7.pdf

fire protection, investments for the development of the forest industry, land use and promotion of wood for building houses.

The Municipality of Aluminé is the state administrative center of the City, permanent residential location and supply center for primary and secondary services. The administrative offices of the CIP [Corporación Interestadual Pulmarí] are therein located. The main population settlement was planned by the provincial government as a tourist village for second homes throughout the northern shore of the Aluminé Lake, in order to encourage controlled land supply in the region.

There is a deficit in the management of plantations due to the lack of capital for pruning and thinning activities. Whereas there are several sources for funding, as it appears from Law 25,080 on the promotion of forest plantations, or Provincial Law 2,482 in terms of promoting plantations, pruning and thinning, in many cases these incentives result insufficient, because the financial resources are not available when the producer needs them, therefore resulting in the self-financing of the producer; or in other cases the amounts received are lower than those required by the work to be performed. This situation is much more serious when it involves medium or small forest producers.

In terms of service offering, there are few forestry workers, poorly trained to perform the required activities. A 75% of the total forested hectares in Aluminé, is included in the stage where the thinning activities are essential to achieve a healthy forest at final cut stage, and with a relevant valuable wood volume, in terms of quantity and quality.

In connection to products resulting from management activities, the main issue that arises is the insufficient demand for these products, fact that directly impacts the decisions of producers. Therefore, as producers have no clear sales target, they opt to carry out no activities involving costs which they are not sure will be covered. The same situation occurs when the final cut should be performed on plantations. As a consequence, producers show lack of motivation to forest new areas.

In addition, the failure in the appropriate management of the forest vegetation has a direct impact on the quality of wood, which shows a significant amount of knots, unsuitable diameter classes, presence of pests and diseases, thus affecting commercialization.

Issues concerning the Mapuches communities and forestation

Eight communities live in Aluminé: Norquinco, Currumil, Lefiman, Aigo, Wiñoy Tayiñ, Hiengueihual, Catalan and Puel.

In general, the Mapuches communities consider forestry as a threat, since the introduction of exotic species changes, according to Mapuches'

beliefs, the balance of the ecosystem. Moreover, it also hampers the normal development of their traditional farming-related activities.

Many communities accept the fact that forest plantations are established in the region, often within the communities, and therefore, they seek to reconcile this exogenous activity with the work developed by them, especially considering the significant migration of young people to the center of Aluminé, in search of working opportunities.

Skilled labor for forestry activities is scarce. The experience of communities in forest use is limited to the use of dead wood, either as logs, posts, firewood and reeds procurement.

There exists background information related to the creation of a forest crew in the Currumil community, which was in charge of performing forest management, and providing pruning and thinning services to third parties in the community, with the possibility of producing a direct benefit for the community members through the income earned.

However: "…own social policies implemented throughout the last decades by the Neuquén provincial government, seek to "territorialize" the indigenous population through various programs. This fact has been worsened for more than a decade due to the rising unemployment and/or precarious working conditions in wage employment, situation that caused a significant flow of the indigenous population from rural to urban areas in past decades. This 'territorialization' and revaluation process of identities and ethnicities, with increasing demands from this indigenous population, seek to create a growing confrontation with forestry activities, thus redefining the relations against this exploitation (of high importance in the analyzed region)."[5]

Industrialization of products

Abra Ancha sawmill, established in Aluminé, is the only sawmill intended for coniferous processing throughout the center area of the province.

There is another small-scale production sawmill, which uses poplar wood as input during summer season, and there are a couple of small-scale portable sawmills, which process poplars wood.

5 Stecher, Gabriel and Sebastián Valverde. Los proyectos de desarrollo rural y forestal en contextos de pluriculturalidad. Las comunidades indígenas en la jurisdicción de la "Corporación Interestadual Pulmarí", [Projects of Rural and Forest Development in multicultural contexts. Indigenous communities in the jurisdiction of "Corporación Interestadual Pulmarí"]. Province of Neuquén, Argentina. In: NTERAÇÕES, Campo Grande, v. 13, n. 2, p. 169-180, jul./dez. 2012.

In connection to the Abra Ancha sawmill, an investment process started in 2010 resulted in the extension of the warehouse, and the addition of a new sawmill line of Brazilian industry (2011), designed with the aim of processing logs from of the first thinning of conifers. Thus, the demand for wood to third parties increased, pulling the different links in the forest industrial chain.

Whereas, raw material from native forest has been used in the activity during the early stages, in recent seasons own forest product began to be industrialized with the purpose of obtaining most profitable products in the timber market.

Current processing accounts for 350,000 p2/month to 390,000 p2/month, in an eight-hour shift and using an average of 1,700 m3 per month.

The products obtained are planks and blocks for pallets, sold as green wood and sent to the Valley area for the assembling of fruit bins. Planks are used to produce tongue and groove boards, and braces, dried in the Industrial Park of Junín de los Andes, about 100 km away. As Abra Ancha sawmill has no drying facilities, this transportation increases costs. Wood drying allows offering higher value products.

Other products manufactured in Abra Ancha are wooden blocks used for construction works, as developed through the building system of embedded blocks (BME, for its acronym in Spanish) used by Corfone. The houses and camping cabins built by the Choroi Lake is an example of this kind of works.

As a result of the new facilities, the higher volume of processed wood gave rise to an increase of lingo-cellulosic waste (woodchips and sawdust). This waste, resulting from the industrial process, has no specific destination and is collected in the nearby property, causing significant environmental drawbacks.

If the sawmill production is estimated in a range of 1000 -1400 m3/month, waste generation would be about 1780-2500 tons. per month. This issue should be solved in the short or medium term. Furthermore, the energy project contemplates the use of forest waste as branches and trims which are not usually used and represent a significant fire risk.

Another problem to be considered for the normal sawmill operation is the precarious quality of the electric supply and the restrictions to comply with the increased demand. Electric supply in the Aluminé area is not sufficient to cover the potential demand of Abra Ancha Plant, together with the population demand, especially during the peak tourist season.

Power and Energy Supply. Pros and Cons

This section which constitutes the subject matter of the project focuses on the main Positive Impacts of biomass use, pointing out a number of converging aspects:

- **Macro perspective:** The Kyoto Protocol has given this type of undertaking the nature of 0 balance in terms of CO2 emissions, taking into account that said emissions would equally occur due to the natural decomposition of biomass; however, they produce no additional benefit, provided that the maintenance of soil quality, which could be affected by a partial removal of waste from the forest, is ensured
- **Replacement of fossil fuels**: Given that the energy matrix of Argentina is mainly made up of natural gas and oil-related products, its use is limited in terms of the energy production of the new plant, or it replaces new undertakings with such energy base. In the specific case of Aluminé, the current power supply system, due to the low quality of its product and service, has been locally complemented with two diesel power generators installed in Aluminé. This situation should be considered as an additional local benefit, given that polluting emissions coming from these units could be avoided.
- **Improved service and product quality in the area of influence**: According to electrical studies made, based on EPEN [for its acronym in Spanish for Provincial Energy Agency of Neuquén] information, the Aluminé node is Electricity Importer, even assuming the whole operation of its thermal and hydraulic infrastructure. This fact makes the area sensitive and dependent on the reliability of the connection to the Zapala node. The incorporation of the new plant would transform the Aluminé node into an energy exporter, thus improving the regional system.
- **Response to further energy own demands**: The new sawmill production lines comprise an installed capacity of approximately 400 kW, with an actual demand of 250 kW. Furthermore, the wood drying process using steam, extracted from the power generator turbine, could be included in the future. This process would constitute an efficient electricity-steam co-generation system.
- **Economic benefit:** The feasibility study showed the benefits of the project from the economic and financial viewpoints.
- **Generation of direct and indirect jobs:** Job positions will be created during construction, as well as direct jobs required by the plant operation and the system of transformation and transport of energy, management of biomass for energy use, labor and equipment required by technical and logistic services.

- **Improvements to current working operations and risk reduction:** The new equipment required provides improvement in the operation and reduction in fire risk due to the removal of waste from the forest.

In addition, the facilities required for energy transformation and transport during the operation process and maintenance of the system, are not free from negative impacts to be removed, cleared or mitigated:

- **Electric and magnetic fields:** While medium voltage lines do not generate high intensity fields, rules on safety distances and prevention of risks and limitations on other infrastructure must be complied with.
- **Restrictions on land use:** Conditions stated within the right-of-ways areas shall be observed, and right-of-ways for maintenance purposes or contingencies shall be ensured.
- **Impact on flora and fauna:** Impact on flora and fauna is reflected on a reduced scale in the maintenance operations of right-of-ways areas, due to cleaning or selective pruning requirements. Regarding the fauna, main impacts are observed in birds, due to the risk of impact with conductors or by electrocution; the latter will depend on the geometry adopted for the laying of conductors (maximum distances among conductors represent minimum electrical risk).
- **Impact on the Socioeconomic Activity**: Already in the construction phase, visual impact, and some inconveniences to the farming activity are observed due to the restrictions imposed by the right-of-ways areas. Road system obstructions may further be considered in case of contingencies, or the eventual transport of biomass from other sources.
- **Contingency Risks:** Main contingencies are related to fire, unscheduled plant shutdowns, service exits from the transmission line due to technical, climatic or accident-related reasons.

Conclusion

In general, forest biomass can be used for energy production, as well as other organic resources with a positive environmental impact and high energy use. "It is important to emphasize that the potential use of biomass energy in Argentina is greater than its current use. In this sense, and for its future development, it results necessary to perform an important diffusion of the existing opportunities and available using technologies."[6] Furthermore, it is a renewable resource, whose use contributes to the environmental conservation, allowing:

- The development of energies in line with the environment
- The reduction of greenhouse gases emissions

[6] Pinasco, Horacio *"Generation of Energy with forest waste and crop"*. Available at: http://inta.gob.ar/

- The development of the regional and national industry

In the specific case of this project, the following actions, covering the industrial and productive process, are proposed and may be further translated into public policies, promoting social and environmental development of the region. These actions are as follows:

Sustainable management of the forest (associated with the primary production

With regards to the primary production sector, this project aims to improve the quality of the wood produced in Aluminé, through a sustainable management of plantations. In this sense, it is important to increase the number of producers carrying out the necessary forestry work, thus improving production. The activities consist in performing a timely pruning, thinning, application of herbicides, pest and disease controls.

Moreover, the project will promote the creation and technical training of crews for pruning and thinning activities. Said crew will be able to provide services to third parties, causing a direct impact on the increase of job positions, as higher labor would result necessary.

Technical assistance and training to beneficiaries will be also provided, as well as the necessary tools for the development of productive activities. In this sense, consulting services may be hired for the drawing of a sustainable forest management plan in the project area, allowing the solution of incorrect operation issues, due to the lack of technical knowledge.

In terms of the Mapuches communities that live in places where there are forest plantations, the project will aim to make a proper forest-gazing management, so that they can further develop their farming activities according to a scheme whose main focus will be the sustainable development of resources.

Construction of a Biomass plant of power generation from biomass waste, with the installation of a dryer in the sawmill and the incorporation of an additional production line

As a result of the set up of the plant and ancillary facilities, a greater demand for wood will be produced, increasing the purchases made by CORFONE to third parties. This fact would generate an increased processing capacity, rising from 390,000 p2/month to 600,000 p2/month, and will encourage producers to properly manage their plantations in order to deliver quality wood in a timely manner.

The construction of the plant will also make possible to solve the lignocellulosic waste accumulation, giving solution to the environmental problem.

The processing facilities of residual biomass will make available steam which could feed the drying chambers in Abra Ancha. The set up of drying chambers will avoid the disadvantage of transporting wet boards, and would also increase the production value without additional energy cost.

The plant operation will allow the production of electric energy which will ensure energy supply to the plant and the sawmill facilities, reducing restrictions in terms of power, frequency duration and current cuts. Surplus may be further delivered to the public electric system.

Therefore, it can be assumed then that the implementation of the project will achieve among others, the following important effects: the replacement of fossil fuels with residual biomass, resulting from wood processing; the improvement of the availability and quality of the electric supply in the area of influence; the reduction of fire risks through the partial reuse of scattered waste produced by forest exploitation, and the solution to the environmental threat caused by the accumulation of forest industrial waste at the plant. Another effect to be included is the additional direct and indirect labor demand, as well as the production of additional economic resources associated to the profitability of this undertaking.

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