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Renewable Biomass: Suggestions and Proposed Alternatives

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Abstract:

Albania records 300 sunny days of typical sub tropical/Mediterranean climate. 70% of the mountainous regions may pose not-so-suitability for typical cultivable agricultural food crops so there are possibilities to look at non-food crop sectors to harness renewable biomass energy for better livelihood of Albanians, the country marching towards renewable biomasses and estimates that by 2025 the penetration of family market heaters alone shall be of an average of 80% yield. On the contrary Albania is faced with soil erosion due to overgrazing and removal of forests through illegal logging in the hilly mountain regions. The authors after a crucial study suggest to go in for cultivation of thornless and flowerless Bamboo for sustainable renewable biomass energy as biofuels to harness not only electricity but also as gasification and as ready briquetts for cooking and water heating purposes. As of now the country is progressing with reforestation programs with economically viable option. According the authors cultivation of bamboo has two other purposes as soil rejuvenation by the enormous leaf fall that undergo natural decomposition to re-make of forest soils and to enter into faster reforestation programs by employing rural communities having tradition knowledge (tk) for economically sustainable cottage industrial programs for economic as well as socio-cultural improvements. The estimated energy potential from biomass residues from agricultural residues and animal wastes was calculated at approximately 43,000 GW and 12,700GJ respectively and of urban wastes was calculated as approx. 405.615Toe. However, these bulky organic residues must be re-processed back through aerobic composting and/or vermicomposting (rather than burning out) to feed back to the cultivable lands to enhance organic matter in the soil for the balance of soil-microbe relationships and thereby to enhance better harvests as has been the scenario in India. As of now farmers are not aware about using the renewable energy production as resources to increase farm income since they are also facing big challenges to produce food crops. Sustainability through cultivation of thornless bamboo as renewable fuel biomass has been the current trend in India.

Keywords: Biomass residues, bamboo biofuels, composting/vermicomposting, reforestation, soil productivity.

1. Introduction:

Albania is in Southeast part of Europe bordered with Montenegro in to the Northwest, Kosovo to the Northeast, the Republic of Macedonia to the East and Greece to the South and Southeast. The total area of 28,748 Km^2 lies between latitudes 39° and 43°N and mostly between 19° and 21° E (Karaj *et* al., 2010; Toromani, 2010). As per the details the population in July 2011 is at 2,994,667 and the advantage of young population (at 29.5 years) with low labor costs and 53% live in rural area are the only indicative for initiation of sustainable renewable energies thro' biomass. In contrast to population growth rate and socio-economic development the energy demand, particularly for electricity is growing rapidly. Due to rapid increase in domestic energy demand has forced Albania to apply some energy priorities by security through better exploitation and utilization of energy sources and energy diversification (Karaj *et al.*, 2010). Cultivation of thornless bamboo for the same would be the better alternatives rather than burning of bulky organic biomass rather that could be diverted for composting and/or vermicomposting as value addition to return back to the productive soils to enhance organic sustainable food productions and relying on bamboo plantations for a viable and sustainable electricity in terms of renewable energy sources as "green coal" which by its growth in the mountainous regions and unproductive soils overcome the problems of overgrazing and soil erosion by the multi-layered deciduous leaf fall **(see Fig. 1).** The salient features of the specialized bamboo can be summarized as follows:

1. A specialized bamboo that is thornless and flowerless meant for non-renewable fuel consuming industries, agro-industries and cottage industries.
2. 100% instantaneous utilization without any processing as ready and natural briquettes.
3. Simple harvesting methods without intensive labor force. 1oo tons of bamboo can be harvested per hectare.
4. 1Kg of bamboo generates 4,500K calories of energy by burning over other biomass which approximates to av. 1,800K calories per kg.
5. The percent ash will be only 2% after burning.

Worldwide, several technologies and techniques of renewable sources of energy like wind, solar power, geothermal, hydropower and biomass energy have been adopted to meet the required demand since the oil crisis started in 1970s (Gokcol *et al.*, 2009). In recognition of this issue, like other countries, According to Lushaj, 2012 Albania must increase use of renewable energy sources, especially through renewable biomass technologies that can be used to meet up energy needs, including generating electricity, heating homes, fueling vehicles and providing process heat for industrial facilities. India has been one of the major bamboo-producing countries, with 130 species covering 96,000 km^2 or about 13% of the total forested area. Bamboo species belong to the family: Poaceae and sub family: Bambusoideae under high light conditions higher water use and nutrient use efficiencies are seen. Tall bamboos are effective biomass resources. Bamboos of temperate regions are monpodial that is spreading types.

Bamboos in general adapt to varying environments but require relatively warm and humid conditions say mean annual temp. av.18° C and annual precipitation of av.1250mm. Bamboo species in India: 10 species of Bambusa (*B. balcooa*; *B. nutans*; *B. tulda*; *B. vulgaris*; *B. vulgaris* var. *striata*; *B. arundinacea*; *B. polymorpha*, *B. blumieana* and *B. heterostachya*); 5 species of Dendtrocalamus (*D. asper*; *D. strictus*; *D. hamitonii*; *D. gigantean*; *D. apser*); 4 species of Gigantochloa (*G. levis*; *G. ligulata*, *G. scortechinii* and *G.* wrayi); 3 species of Schizostachyum (*S. brachycladum*; *S. grande* and S. zollingeri); 2 species of Pleioblastus (*P. variegates* and *P. distichus*); one species each of *Pseudoxytenanthera stocksii*, *Ochlandra travancorica* and *Thyrsostachys oliveri*. Growmore Biotech Ltd. is propagating Thornless Bamboo species by Tissue Culture Method. We have species which are non-flowering, non-thorny, high yielding, suitable for wide range of climate, light to heavy soil, excellent yield obtained under irrigated condition, ready for harvest in 4 years and an average yield of 10 culms / clump / year is obtained. Respond very well for fertilizer application.

The consumption of energy has been growing trend making Albania an energy importer, a crucial factor to economic and social development (Saraci and Leskoviku, 2009). Currently the main indigenous energy resources of Albania are hydro, coal, oil, natural gas and biomass. Table 1 shows total primary energy products (TPEP) by resources for 2008. The term of biomass refers to a mass of organic material that has stored sunlight in the form of chemical energy. Plants are able to create biomass in the form of carbohydrates through photosynthesis (Quaschning, 2010; Hall *et al.*, 1993). Although bio-energy from biomass as a replacement of fossil fuel resources under sustainable renewable energy for multiple purposes that fulfill most of the energy demand, satisfying environmental, commercial, technical, socio-economic and political requirements (Silveira, 2005), this biomass source is wealth of one's country that must be transformed in bulk under semi-scientific processes back to earth to stabilize bio-geo-chemical cycles. As of now in India, the bulky organic biomass as garbage (Sunitha, 2011a; 2011b) agro-industrial wastes like cocopith, distillery effluents, pomace waste can be used along with sewage sludge and other nitrogenous wastes for the productions of valuable vermicompost has been a possibility (Sunitha, 2012b; 2012e; 2012h). The practice of thornless bamboo cultivation for fuel biomass concept shall be an innovative realization. Albania still has a negative trade balance for agriculture products. According to FAO (web access) the economy of Albania remains highly import-dependent in food and raw materials for agro-processing due to low agricultural productivity. Currently Albania is foreseeing agriculture and rural development and agro-processing enterprises (Web Access). As a National Development Programme (NDP) re-distribution of agricultural lands and collective farms to the individuals has been implemented. Over half of the Albanian population lives and works in Small and medium size enterprises (SMEs) in Albania. These populations could be encouraged for the alternative biofuels like thornless bamboo plantations as has been developed in India by Growmore Biotech Ltd., Collective and State Farms are the existing scenario with very low loan facility from the ruling Government in Albania. As of now there is no big farms/co-operatives (as in India) and no processing plants for industrial production of bio fuels as well as incentive policies from government. There is a lack of tradition and of know-how by farmers and agricultural institutions which should advise farmers in regard with utilization of bamboo biomass for gaining energy and utilization of other agricultural and animal waste biomass for transformations into organic manure through the processes of aerobic composting/vermicomposting.

2. Importance of Biomass as an Energy Source:

Biomass is one of the major future renewable energy sources considered to be alternative to conventional energy sources such as: oil, natural gas, etc. and is a native resource for Albania. The main sources of biomass are forests, agro-industrial plantations, bush trees, urban trees, farm trees, crop residues and domestic wastes. The use of biomass as renewable energy in industry, heat, electricity and for the production of fuels can reduce oil-based energy sources share of total energy production because it is clean energy and could improve environment, generates low air emissions compare to fossil fuels. The production of biomass in the world is approximately 985 million tons per year. Biomass fulfills 26.23% of primary energy consumption in non-OECD countries, while it accounts for only 3.4% of primary energy consumption in OECD countries. The significance and the breakdown of biomass in energy consumption in different world regions are given in Table 2. surplus sunlight in Albania (300 sunny days) can be the sustainable value-addition for the growth and yield of non-food crops as affordable energy source by engaging rural and the same propositions have been put forth by Demirbas, (2010). Biomasses into bio-fuels are the current innovative trends by combustion/ biochemical/thermo-chemical processes that generate as either heat/gas/liquid/electricity for lighting and heating purposes. Bio-diesel generally is produced by trans-esterification of vegetable oils such as soybean and canola and is used in transport vehicles with compression ignition engines. Most automobile manufacturers recommend up to 10% ethanol by volume, although some experts maintain that modern gasoline vehicles can handle up to 17% ethanol by volume (OECD). However the productions through food crops may pose limiting factors and thus alternatives of non-food crops under barren lands, hilly ranges could be futuristic options.

New renewable fuel standard and renewable fuels are named as motor vehicle fuels produced from plant or animal products or wastes from Environmental Protection Agency. According to this classification, two different forms of diesel fuel are specified: biodiesel and renewable diesel. Each is classified according to the process by which it is produced. Chemically biodiesel is fatty acid methyl ester (FAME). Bio-diesel is chemically different from petroleum diesel, has different properties and meets different quality standards. However, Bio-diesel can be blended with regular diesel oil up to 5% biodiesel by volume without major problems. It is also less energy intensive than ethanol from corn because fermentation and distillation is not required (Quaschning, 2010).

Green diesel, also known as renewable diesel is a form of diesel fuel which is derived from renewable feed stock, by using oil and animal fats but processed through other chemical processes and commonly referred to as non-esterifies renewable diesel (NERD). The most advanced of these alternatives is produced through hydro-treating, a process which is being utilized in today's petroleum refineries. During this process hydrogen replaces other atoms such as sulfur, oxygen and nitrogen and converts the oil's triglyceride molecules into paraffinic hydrocarbons. Renewable and petroleum fuels could be blended at existing petroleum refineries to create a renewable diesel blend during hydro-treating process, while stand alone facilities can produce 100% renewable diesel to be used directly or to be blended with petroleum diesel. The advantages of renewable diesel blend versus fuel produced with the FAME process are: reduction of waste and by-products, higher energy density and improved cold flow properties. The process also increases the storage of blended fuel and stability of the finished bio-fuel product. From an environmental view point, biodiesel and renewable diesel fuels can diminish emissions of hydrocarbons, carbon monoxide and particular matter. So far diesel vehicles are 20-40% more energy efficient compares to gasoline vehicles as a result GHG emissions is reduced 10-20%. Taking into account the usage of biodiesel and renewable diesel fuels can further enhance reduction of carbon dioxide emissions anywhere (Demirbas, 2008).

3. Biomass Conversion Technologies:

Different researches have revealed that only some technology improvements could make the energy production from biomass more efficient and exceed its usage, maintain high productivity of biomass plantations on a sustainable basis and diminish health and environmental issues related with biomass production and use. The most important technology options are summarized in Tale 3 and are described below. According to the form of energy requirements and biomass source and all technologies have their own advantages (Chang *et al.*, 2003). Combustion is the most common technology of energy production from biomass by converting solid fuels into several forms of useful energy such as: hot air, hot water, steam and electricity. Furnace that burns the biomass in a combustion turbine is the simplest combustion technology. Biomass combustion facilities that generate electricity from steam-driven turbine generators have low conversion efficiency but cogeneration can increase this efficiency to almost 85%. High quality fuels are more frequently used in small applications systems, while low quality fuels are mostly used in large-scale combustion systems. Combustion conditions have to be determined, including type of oxidant, oxidant to fuel ratio, type of combustor, emission limits, etc. The efficiency and reduction of emissions are the most important goals. Recently, the interest in wood-burning appliance for heating and cooking such as: heat-storing stoves, pellet stoves and burners, central heating furnaces, boilers etc, are growing (Lampe.V *et al.*, 2010; Rosillo-Calle, 2007).

Gasification is classified as thermal conversion technology of organic material to combustible gases. In research areas for power generation from biomass, gasification is very important for the reason that it is the main option to direct combustion. The main advantage of the advanced turbine design and heat recovery steam generators technology is that high energy efficiency can be achieved (Rosillo-Calle, 2007). The main attractions of gasification are:

- In contrast to combustion with 30%, gasification has higher electrical efficiency 50% while cost can be similar.
- Advanced gas turbines and fuel cells have shown important developments.
- Potential alternative of natural gas or diesel fuel used in industrial boilers and furnaces.
- Displacement of gasoline or diesel in an internal combustion (IC) engine.

Co-firing technology can achieve relatively high efficiency conversion of biomass into electricity. Co-firing involves burning a portion of biomass instead of coal in a coal-fired power plant. Many developed countries have been attracted to Co-firing of biomass with lignite, coal and fossil fuels. Biomass can be added up to 2% to the coal in a coal-fired power station without any adaptation of the plant. Most forms of biomass, including biomass wastes and energy crops, are suitable for co-firing. Usually unit size of Coal plant is up to 600 MW, where 15% co-firing would give 90 MW of biomass capacity, which will be considered 90 MW of green generation capacity (Breeze, 2005; Rosillo-Calle, 2007). The main advantages of co-firing are:

- Co-firing can reduce sulphur emissions since biomass has lower sulphur content compare to coal;
- Co-firing has very simple and cheap techniques;
- Favorable environmental impacts compared to coal only plants;
- Higher efficiency for converting biomass to electricity compared to 100% wood-fired boilers;
- Planning approval is not required in most cases.

CHP is an old technology; process has been used for almost two centuries. Energy efficiency can be significantly improved where the heat from combustion fuels can be captured and utilized through combined heat and power generations. Large scale CHP technologies usually utilize steam while smaller scale utilizes a range of technologies in the drive to maintain energy conversion efficiency. Energy conversion efficiencies about 85% are possible with CHP operations. CHP is becoming attractive as technology for the following reasons (Rosillo-Calle, 2007). Energy efficiency-CHP is about 85% efficient, in contrast to the 35-55% of the most traditional electricity utilities; Growing environmental concerns-it is estimated that each MWe of CHP saves approximately 1000t/C/yr; Energy decentralization-recent world market projections indicate that the market for generators below 10 MW could represent a significant proportion of the 200 GW of new capacity expected to be added by 2005 worldwide.

Table1: Albania's Total Primary Energy Products

Type of resources (2008)	Ktoe	%
Hard coal	23	1.09
Oil	1324.8	62.53
Natural Gas	8	0.38
Nuclear	0	0
Wind	0	0
Solar	0	0
Fuel-wood	215	10.15
Electricity	535.8	25.3
Others	12	0.56
Total	2118.6	100

(Source: Saraci and Leskoviku, 2009)

Table 2: The share of biomass in energy consumption in different world regions in 2000

Country/Region	Share of biomass in final energy consumption (%)
Africa	58.4
Asia	42.3
Bhutan	89
Cambodia	80
China	18.5
Denmark	10.3
Enlarged EU, EU 25	3.7
Finland	19.6
Germany	2.1
Laos	80
Latin America	19.57
Latvia	30.3
Nepal	86
OECD countries	3.4
The old EU countries, EU 15	3.7
Total non ECD	26.23
World	14.2

(Source: RWEDP, 2000).

Table 3: Main characteristics of biomass conversion technologies

Conversion technology	Biomass type	Example of fuel used	Main product	End-use	Technology status
Combustion	Dry biomass	Wood logs, chips and pellets other solid biomass, chicken litter	Heat	Heat and Electricity (steam turbine)	Commercial
Co-firing	Dry biomass (woody and herbaceous)	Agro-forestry residues (straw, waste)	Heat/electricity	Heat and Electricity (steam turbine)	Commercial (direct combustion). Demonstration stage (advanced gasification and pyrolysis)
Gasification	Dry biomass	Wood chips, pellets and solid waste	Syngas	Heat (boiler), electricity (engine, gas turbine, fuel cell, combined cycles), transport fuels (methanol, hydrogen)	Demonstration to early commercial stage
Pyrolysis	Dry biomass and Biogas	Wood chips, pellets and solid waste	Pyrolysis oil and by-products	Heat (boiler) and electricity (engine)	Demonstration to early commercial stage
CHP	Dry biomass	Straw, forest residues, wastes and biogas	Heat and electricity	Combined use of heat and electric power (combustion and	Commercial (medium to large scale) and commercial

				gasification processes)	demonstration (small scale)
Etherification/pressing	Oleaginous Crops	Oilseed rape	Biodiesel	Heat (boiler), electricity (engine) and transport fuel	Commercial
Fermentation/hydrolysis	Sugar, starches and cellulosic	Sugarcane, corn and woody biomass	Ethanol	Liquid fuels and chemical feedstock	Commercial. Under development for cellulosic biomass
Anaerobic Digestion	Wet biomass	Manure, sewage sludge and vegetable waste	Biogas	Heat (boiler), electricity (engine, gas turbine, fuel cell)	Commercial, except fuel cells

(Source: Chang *et al.*, 2003)

Fig. 1 - Systematic cultivation of Bamboo

Fig. 2 – Bamboo as a natural briquette

Table 4: Recoverable biomass energy potential in Albania

Type of biomass	**Energy Potential (ktoe)**
Animal wastes	47.623
Dry agriculture residues	1,818
Firewood	6,393
Forestry and wood processing residues	7,937
Total	16,195.6

Table 5: Crop production and energy potential from residues in Albania

Crop	**Production 2006 (kt)**	**Approximate residues (kt)**	**Energy potential (toe/yr)**	**Energy potential (Gj/yr)**
wheat	508	1,016	417	17,429
Barley	6	12	5	206
Rye	3	6	2	103
Oats	23	46	19	789
Maize	245	1,470	603	25,217
Vegetables	688	1,032	423	17,703
Potatoes	163	326	134	5,592
Beans	24	48	220	823
Tobacco	2	10	4	172
Sunflower	2	4	2	69
Total	1,895	4,432	1,818	76,028

(Source: Toromani, 2010)

Table 6: Biogas potential from animal wastes

Type of animal	**2006 (K head)**	**Energy potential (toe/yr)**	**Energy potential (Gj/yr)**
Cattle	634	13,337	558,006
Sheep	1,830	17,787	744,191
Goats	940	6,835	285,978
Pigs	152	491	20,563

Horses	132	7,686	321,590
Poultry	6,200	1,487	62,216
Total	9,888	47,623	1,992,542

(Source: Toromani, 2010)

Table 7: Albanian forest parameters

Forest type	Area (ha)	%	Volume (m^3)	%	Volume (m^3/ha)
High forest	454,572	44	61,965,000	75	136
Coppice forest	327,220	31	11,533,000	14	35
Shrub forest	261,925	25	8,163,000	11	31
Total	1,043,717	100	81,662,000	100	202

(Source: Toromani, 2010)

Fig. 3 – Bamboo under managed cultivations

4. Current Status of Biomass Energy in Albania:

Since 1970's when energy prices went up the use of renewable energy has developed to diminish the negative impact of energy crises.

Biomass potentials are very important in Albania's energy sources. Albania has relatively high biomass potential to provide rural energy services based on forest, agricultural residues also animal and urban wastes. Domestic energy consumption in Albania is approximately 53% of Albania's total energy consumption. Various agricultural residues such as grain dust, wheat straw, hazelnut shell and municipal solid wastes are economical energy sources that are available in Albania (Lushaj *et al.*, 2012; Toromani, 2010). Total recordable bio-energy potential in Albania in 1998 is shown in Table 4. Biomass energy sources including municipal solid wastes, forest residues and biogas from organic wastes are commonly used to generate electricity, space heating and cooling houses, fueling vehicles etc (Lampe.V *et al.*, 2010).

4.1 Agricultural Residue Potential of Albania as a Biomass Energy Source:

Agriculture is the mainstay of Albania's economy and accounts for 25% of the GDP and 60% of the total employment; in meantime have to be considered as an important factor on energy production from biomass (Toromani, 2010). Exploited agricultural area is approximately 1,122,000 ha, which is about 39% of the total Albanian's land (arable land is 578,000 ha; permanent grassland is 423,000 ha; crops land is 121,000 ha). Sources of biomass from the agricultural production are: the residue after harvesting and the waste produced during processing of the agricultural products into industrial products. The highest amounts of residues are from maize, wheat followed from barley. The total annual amount of agricultural residues in the country is estimated about 1800 toe (Toromani, 2010). Crop production and energy potential from residues in Albania are presented Table 5.

4.2 Urban Solid and Animal Wastes Potential of Albania as a Biomass Energy Source:

The energy reserves produced from urban solid wastes in 2005 are about 1.8 Mtoe, while predictions show that trend will grew up to 9.5 Mtoe in 2020 (National Strategy of Energy). Urban solid waste potentials in some main cities of Albania have been calculated to be about 890 Ktoe in 2010. The study done by the Energy and Environment for Sustainable Development Center (EESDC) in 2008 shows that taking in consideration biogas from animal, the energy potential is about 585 GWh/yr or 2100 TJ. Table 6 gives the total bio-energy potential of animal wastes available from farms in Albania.

4.3 Wood Potential of Albania as a Biomass Energy Source:

Fuel-wood is main source of energy in rural part and one of the largest sources of energy of Albania. Forest parameter of Albania for 2007 are presented in table 7 The total forest potential of Albania is estimated to be approximately 125 million m^3 or 14.3 Mtoe biomass reserve. Forests are classified in these categories: high forest, with 44% of the total reserve; coppices, which represent 31% of total reserve and bushes, with 25% of total reserve. From these categories, 10% of the high forest, 50% of the coppices and 100% of the bushes are used as fuel-wood (Jaupaj and Lushaj, 2010; Bregasi, 2011).

5. Albania, Two-Way Path towards Biomass Energy Conversions and Productions:

Due to worldwide changes in the energetic area, new prospect and challenges are created for renewable energy in wide-ranging and bio-energy specifically. Studies conducted in market-based support made us think differently at energy production and management. Obviously the energy demand will continue in proportional to the increasing trend be it agricultural, food processing, industrial and socio-scientifically levels. Therefore, there are several questions to be answered, what will be the most important resources? Is renewable energy, and more specifically biomass energy, finally reaching maturity? How can this demand be met? In nowadays renewable energy is growing certainty in many areas of the world and not just in niche markets. It is essential to point out that the development of biomass energy will basically be dependent on the development of the renewable energy industry as a whole. Taking in consideration the long-term future, bio-energy has to prove sustainability in both environmental and social aspects. Even though bio-energy development is still "young", the R and D is focused on the development of fuel supply and conversion methods in order to minimize environmental impacts (Rosillo-Calle, 2007). However, the production of bio-energy and bio-fuels are less harmful concerning environmental aspect and assisting countries in fulfill their GHG reduction targets at the same time (Demirbas, 2010). According to Global Bioenergy Industry News (web access, 2012) Biomass energy could be important in Albania's future, consisting of the following four main resources: Urban wastes, agricultural residues, forest residues, and animal wastes. From the personal experiences (Sunitha, 2011a, Sunitha, 2011b, Sunitha, 2011c, Sunitha, 2011d and Sunitha, 2011e; Sunitha, 2012b, Sunitha, 2011c, Sunitha, 2011d, Sunitha, 2011e, Sunitha, 2011f and Sunitha, 2011h) in the field of vermicomposting of bulky organic residues like urban wet wastes, agricultural residues, forest residues and animal wastes, it has been found that these wastes are organic wealth that need to be processed and to be replenished back into the agricultural lands for nutritional upliftment to enhance healthy productivity; moreover organic wastes do contain moisture anywhere between 70 – 90% and burning (for biomass energy) them is exorbitantly high and a loss for the country's wealth. Hence it could be well suggested that all forms of bulky biomass wastes can go in for aerobic vermicomposting and for the generation of biomass energy one can solely rely on Bamboo cultivations.

5a. Procurable Biomass Wastes Into Composting and/or Vermicomposting to Replenish Productive Soils:

As per the estimates in Albania, biomass residues from agricultural residues and animal wastes was calculated at approximately 43,000 GW and 12,700GJ respectively and of urban wastes was calculated as approx. 405.615Toe (Toromani, 2010; Karaj *et al.*, 2010). This research paper stresses from the point of view of composting and/or vermicomposting of these bulk mass into productive organic manure to replenishment of Albanian agricultural and forest lands as well as has been the scenario in India. Energy generation from the bulky biomass waste is contradicting waste affair and also a costly affair. According to FAO (web access, 2012) the economy of Albania remains highly import-dependent in food and raw materials for agro-processing due to low agricultural productivity. The country can rely on transformation of biomass waste into vermicompost to enhance agricultural productivity from the current 21% of value added to GDP. Currently Albania is foreseeing agriculture and rural development and agro-processing enterprises (Web Access, 2012).

5b. Productions of Renewable Biomass Energy by Thornless Bamboo Plantations:

Availability of fuel-wood from the forest is continually increasing with relatively low growth rate due to slow generation (Toromani, 2010; Jaupaj and Lushaj, 2010). Based on the data served from the Forest Cadastre, the annual forest growth is about 1.44 million m^3 while the annual allowable cut is about 1.15 million m^3, 20% lower than the annual increment. According to (Toromani, 2010) the forests of this country are characterized by comparatively low yielding capacities. The authors in the current research paper suggest thornless bamboo mass multiplications for energy generations. As per the details of the Global

Bioenergy Industry News (Albania) – 85% of the total electric capacity is thro' hydro-electric facilities. The recent plan is to build a 140-megawatt liquid biomass energy plant and two 234MW wind farms with an investment of $1.3 billion and $2.5 billion respectively (web access, 2012).
As explained above, the forest reserves in terms of biomass energy can be considered as non-renewable energy sources hence marching towards sustainable green energy (green coal) by way of bamboo cultivations for the generation electricity could be the mandatory which can be harnessed by Small and medium size enterprises (SMEs) in Albania who accounts to half of the country's population. As per the estimates of Bharathi (Web Access, 2012), India, utilization of bamboo culms to generate 1-megawatt per day the incurred approximate cost would be $1.3 million (inclusive of bamboo cultivation, harvesting and plant erections. **See Fig. 2 – showing natural briquette form**). Albania has a dry, temperate climate of between 22-30 degree C with over 180 days of sun a year. Sunshine amounts are quite high, averaging over eleven hours a day in July and four hours a day in January. The yearly rainfall is accounted in winter season of 4 – 6 months and summers are rather dry without significant precipitation (Web access, 2012), there seems to be a better possibility for the cultivation of bamboo in Albania, provided the selection of the suitable species is a mandatory factor.

The required bamboo culms per day would be only 22 tons and on annual cycle required bamboo culms would be 8,130 tons with only 80 hectares of productive land. The required land for bamboo productions can be of hilly terrain regions of Albania (that makes difficulty for agricultural productions) and the regions of overgrazed and worn out soils to replenish back to sustainable soil structure since rural sectors are facing big challenges to produce crops for food. Moreover, there is a lack of tradition and of know-how by farmers and agricultural institutions which should advice farmers with utilization of biomass and animal residues instead for gaining energy can go in for valuable organic matter replacements and can workout thornless bamboo cultivation for energy generations. There are no big farms, processing plants for industrial production of bio-fuels as well as incentive policies from government. In this regard thornless bamboo becomes a boon to Albanians because the bamboo can be harvested and utilized without any processing and can be an instant source for energy generation as ready made product **(Fig: 3).**

- Sustainability of thornless bamboo as renewable fuel biomass has been the current trend in India: The practice of thornless bamboo cultivation for fuel biomass concept shall be an innovative realization. However, the naturally existing bamboos are unsuitable from the economic perspectives of drawbacks in harvesting, non-availability on continual basis, inaccuracy in yield, death of bamboo plantations after flowering, impossibility of intensive cultivation and the presence of thorn makes difficulty in handling. The development of Beema bamboo (Bharathi, (Web Access, 2012) in India is an innovative ventures which can be summarized as follows: 1. Existing thornless bamboo production in nature is a rarity that is without flowering (sessile nature) 2. The newly cultivated bamboo under tissue culture cultivation has longevity of 100 years. 3. Indigenous cultivation practices have to be adopted. 4. 2,500 bamboo saplings requires an area of 2.5 Hectares under specific agro-climatic conditions and the harvests of the cultivated thornless bamboo will be ready at the end of 2^{nd} year onwards. 5. The economics of the production of the thornless bamboo must be worked out. 6. One time non - recurring cost is involved and later recurring costs of minimal labor, fertilizers and irrigation as maintenance is needed. River map of Albania is an indicative for the inland river systems that can be utilized for the intensive cultivation of Bamboo plantations to harness sustainable energy. The hilly terrains which set back the agricultural activity could be utilized. Albania has stressed upon intensive reforestation and Bamboo cultivation can enhance natural soil protection as well as reforestation. The collective/state farms also could be one of the alternatives for the implementation of the bamboo cultivation. At present the co-operatives are accounted for 74% of the total agricultural production. In 2001 agriculture provided 50% of GDP (web access, 2011). Thus the possibility of agricultural wastes, agro-industrial wastes and animal wastes must be enormous. The fertilizer trend has fallen from 145Kg/ha in 1983 to 13Kg/ha in 2000. The trend of sustainability and organic agriculture can be enhanced by aerobic composting and vermicomposting by use of biomass wastes rather than going in for energy productions (Sunitha and Seenappa, 2012). Albania's mountainous terrain limits the amount of land available for agriculture;

however these areas could be diverted for intensive bamboo cultivation for sustainable energy output. Its soils and a climate favorable to an extensive timber industry. There is a large amount of reforestation underway. Bamboo intensive cultivation can also be considered as a process of reforestation. River Map of Albania is an indicative for the inland river systems that can be utilized for the intensive cultivation of Bamboo plantations to hareness sustainable energy. The hilly terrain which sets back the agricultural activity could be utilized. Albania has stressed upon intensive reforestation and Bamboo cultivation can enhance natural soil protection as well as reforestation **(Fig. 3)**. Thus this research paper calls for the initiation and continual basis of two-way options of composting and/or vermicomposting of biomass wastes and productions of bamboo for energy.

6. Conclusions:

Albania has an abundance of renewable energy sources but has not evaluated them sufficiently for technical and economical reasons to meet energy demand. In the future, biomass has the potential usage providing a cost-effective and sustainable supply as:

- As safer aerobic conversions of biomass wastes into vermicompost/compost.
- Cultivations of bamboo biomass as required energy for all purposes.
- Native energy sources like bamboo biomass can be evaluated sufficiently and efficiently, to avoid/minimize energy dependence on foreign countries.
- Bamboo biomass can be a boon to meet a variety of energy needs, including generating electricity, heating homes, fueling vehicles and providing process heat and fuel for industrial facilities.
- Over half of the Albanian population lives and works in rural faculties who could be involved in energy production through Bamboo cultivation which can be considered as a promising tendency due the fact of the very low agricultural wages and thus land availability is high.
- Farmers are not aware about using the renewable energy production thro' bamboo plantations as a resource to increase farm income on one side and procurement of bulky biowastes generated at varied levels to composting and/or vermicomposting to return fertile wealth back to agricultural land and to march towards organic agriculture as of now Albania is encouraging it.
- Semi-scientific protocols are required for productions of organic manure from bulky biomass wastes and also for the generation of fuel thro' cultivation and harvesting of thronless bamboo in mass throughout the year on sustainable basis.

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