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Africa, Seeds, and Biofuel

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Abstract

Quantity depletion and harmful gas emissions associated with fossil fuels have caused scientists and global attention to focus on the use of alternative, eco-friendly fuel substitutes such as green energies (wind, solar, water, bio) as replacements. *Africa, Seeds and Biofuel* will highlight *Jatropha*, a biofuel source seen by many as a conduit for cutting global dependence on fossil fuels as well as an emerging cash crop that can boost rural incomes, infrastructure, and development in poor countries. *Jatropha* (scientific name *Jatropha curcas*), a tree (known by more than 200 multi-language names) growing in abundance in Africa, Central & South America, the Caribbean, India and Southeast Asia, produces seeds which contain oil (37% average content per seed) that is convertible to a Diesel fuel substitute; it has many other attractive qualities, e.g. long seed production life (50 yrs.), drought-resistance, and multi-use applications (soap, insecticide, various medicinal cures). Optimal use of *Jatropha* seeds as a biofuel are predicted to produce a cheap, abundant and eco-friendly fuel source for transport systems, electricity production, and the powering of cellular networks.



Introduction

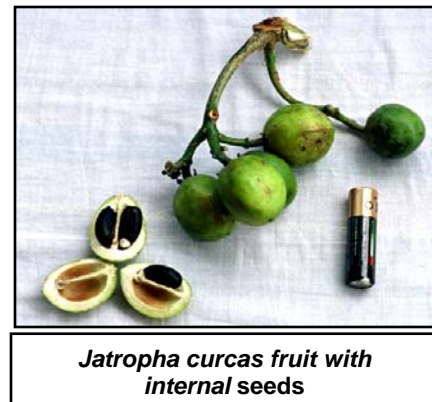
Fossil fuels represent any number of combustible, hydrocarbon materials (e.g. petroleum or coal) used for power that are derived from the accumulated remains of ancient plants and animals (Fossil fuel, n.d., Introduction section, entry 4). As the supply runs out and their continued use and mass-scale processing are deemed environmentally harmful (i.e. contributing to global warming and pollution) by scientists, global attention has now focused on the development of eco-friendly alternatives. Despite the downfalls and hazards associated with fossil fuel, industrialized nations, particularly the U.S., Canada, Japan and the EU countries, have the economy, finances, and technical infrastructure to afford the high costs of crude oil imports and refining; however, developing nations, having fragile economies and infrastructures, are financially drained in the purchase of imported, refined petroleum oil. At present, refined oil as a commodity is a key component in generating electricity; subsequently, the availability of electricity facilitates a high standard of living and industrialization, e.g. agricultural irrigation, purification of water, improvement of food cleanliness, refrigeration of food & medicine, and telecommunications systems (just to name a few). Developing regions of the world, including Africa, can improve their future economic viability/status and maintain clean ecological environments by investing now in the use and production of green energy, i.e. environmentally friendly energy sources that are renewable and non-polluting, as cheap and available power sources (Green energy, n.d., Introduction section, para. 1).

Overview of Major Green Energies

The major green energies touted by scientists as viable and/or capable of meeting mass-scale needs are water (electricity derived from flowing or free-falling water), solar (power generated from the sun's radiation), wind (electricity derived from wind), and biofuel (any power derived from biomass, i.e. recently living organisms, e.g. corn, sugarcane, timber) as cheap and available sources of power (hydroelectric power, n.d., Introduction section, entry 1); (solar energy, n.d., Introduction section, entry 3); (wind energy, n.d., Introduction section, entry 2); (biofuel, n.d., Introduction section, entry 1). Africa, comprised of 53 nations, is the world's poorest continent in terms of economic instability, inadequate healthcare systems, vulnerable ecosystems, and technical infrastructure decay; thusly these deficits are all the more reason why its nations, as a matter of socioeconomic advancement, energy security, currency conservation and clean air initiatives, should vigorously pursue research on and optimal use of green energies. However, much more research will have to be conducted to make these alternative energy sources viable as replacements to petroleum and other fossil fuels because of some inherent limitations: water power use is restricted to environments with massive waterfalls and fast-moving streams, solar power use involves expensive equipment and is restricted to geographical areas with high sunlight abundance and intensity, wind power use via turbines needs to be operated in vast and/or unpopulated windy territories, and biofuel use is restricted to identifying oil-producing crops and/or organic waste which have quick regenerative growth, are cheap and/or are in great abundance. Optimal use of multiple green energy sources within regions should be used wherever feasible.

Jatropha: Its Description and Ecological Qualities

Africa, Seeds and Biofuel will highlight *Jatropha*, a biofuel source with great potential that is now just beginning to be spotlighted; this plant is seen by many in scientific and industrial circles as both a conduit for cutting global dependence on fossil fuels and an emerging cash crop that can boost rural incomes and the economy as well as to alleviate high fuel costs associated with transport systems and power production in poor countries, particularly African ones. Linguistically, *Jatropha* (scientific name *Jatropha curcas*, family *euphorbia*) is derived from the Greek 'jatos' (doctor) and 'trophe' (food or nutrition), which implies medicinal uses; the genus *Jatropha* contains approximately 170 known species (*Jatropha-Plant Profile*, n.d., Introduction section, para. 1; *The Father of Jatropha System*, n.d., Section 2-Description of the plant, distribution, ecology). The tree is thought by many scientists and researchers to have originated in Central America and the Caribbean and spread by 15th - 16th century Portugese explorers to Africa and Asia via the Cape Verde Islands and Guinea Bissau; today, *Jatropha*'s widespread growth in many tropical regions is indicative of it being known by more than 200 multi-language common names worldwide, e.g. mbono (Kiswahili), purgante (Spanish), physic nut or Barbados nut (English), inhlakuva (Zulu), pignon d'Inde (French), and bakrenda (Hindi), just to name a few (*Jatropha curcas – Common Names*, n.d., Species Identity). It, like other biofuels, can be used to create a renewable biodiesel fuel, i.e. energy source derived from renewable organic matter like hydrocarbons (oils and fats) for use in an internal-combustion engine (originally designed by early 1900s German inventor Rudolph Diesel) not needing a large water supply water and featuring fuel ignition via air compression, (biodiesel, n.d., Introduction section, para. 1-2); (diesel engine, n.d., Introduction section, para. 1-3) as an alternative to conventional petroleum-based diesel; therefore, the fuel produced is cleaner burning, producing fewer harmful emissions than conventional diesel and is biodegradable (i.e. can be decomposed by biological agents), meaning that the environment is unharmed if fuel spillage occurs (biodegradable, n.d., Introduction section, entry 2); (Fitchard, 2006, para. 3). Diesel is used widely as a fuel source for cars, aircraft, trains, boats, trucks, and agricultural/industrial machinery.



Biofuels are in part a solution to such issues as sustainable development, energy security, and a reduction of greenhouse gas emissions. *Jatropha* is a small tree or tall bush (up to 5 meters in height) which grows in abundance in Africa, Central & South America, the Caribbean, India and Southeast Asia; it, with a seed production lifespan of 50 years, is a fast-growing, drought-resistant perennial producing seeds having an oil content of about 37%. This shrub has thick glabrous branchlets, smooth gray or reddish bark masked by large white patches, large green to pale-green leaves (alternately arranged) and exudes a whitish-colored, watery latex when cut; additionally, a bunch of approximately 10 or more ovoid fruits are yielded per inflorescence, i.e. flowering (*About Jatropha Plant*, n.d., Introduction section; *The Father of Jatropha System*, n.d., Section 2-Description of the plant, distribution, ecology; inflorescence, n.d., Introduction section, entry 2). In Africa, these crops, like others grown to produce

biofuel, combat global warming in that planted fields absorb more carbon dioxide from the atmosphere than the vast stretches of eroded or barren land. The plant can grow on poor-quality land unsuitable for food crops and needs little water or fertilizers (Mkoka & Shanahan, 2005, Food vs. fuel, para. 4); they also thrive in rock crevices and in a variety of climates (i.e. tropical, subtropical, slightly cool, tolerant of light frost) and soils, i.e. gravelly, sandy, saline, stony, semi-arid, arid, (Jatropha (Bio Fuel/Bio Diesel), n.d., Brief Introduction about Jatropha, para. 1); (Jatropha (Bio Fuel/Bio Diesel), n.d., Jatropha-Wonder Crop, para. 2); (Plant Profile, n.d., Ecological Requirements, para. 1). There are other advantages as well: pest-resistance; high absorbency rate of carbon dioxide (CO₂) from the atmosphere; doesn't cause any displacement of food crops in an intercropped arrangement; acts as a rodent-repellent and livestock buffer when planted as a fence; not eaten by animals such that seed oil production efforts are not compromised; exhibition of phyto-protective action against pests and pathogens, thusly providing additional protection to intercropped plants (BioKing offers Africa a greener future and is turning poor farmers into Oil Barons, n.d., Why Jatropha?, para. 1), (Jones, 2004, para. 13).

Jatropha's Use in Products, Medicine, and Biofuel Production

The harnessing process for Jatropha oil is environmentally safe and cost-effective; moreover, the seed oil, once refined, can be used as fuel for transport systems and power. Other uses and by-products from the plant include soap, glycerine, insecticide, candles, and an assortment of medicinal cures such as malaria, constipation, piles, dropsy, and snakebite poisoning, etc. (Mkoka & Shanahan, 2005, Introduction Section, para. 2); (Ogwang, 2006, Introduction Section, para. 7-9, 16). Because of their shallow spreading root system, Jatropha trees reduce soil erosion and can be useful in reclaiming eroded land; additionally, their shed leaves enhance earthworm activity in the soil around their root-zones, leading to soil fertility improvement and the growth of food crops in close proximity (Plant Profile, n.d., Ecological Requirements, para. 1).

Not only is Africa's climate ideal for cultivating Jatropha, but over 50% of that continent's 29 million sq. km. in land space is suitable for the plant's growth (BioKing offers Africa a greener future and is turning poor farmers into Oil Barons, n.d., Why Africa?, para. 1). Agriculturalists estimate that approximately 1660 million hectares of Africa's land (about 57% of the total) are viable as growing regions for Jatropha (Parsons, 2005, For growing Jatropha?, para. 2-3). If just 3% of this amount (about 49.8 million hectares) were optimally used in the growing and cultivation of Jatropha, 119.52 million tons (108.6 billion liters) of biodiesel would be produced annually along with an associated revenue of \$38.25 billion if calculations are based on parameters of 8 tons of seeds harvested per hectare, an oil yield of 30% per seed (conservative rate), and an oil revenue value of \$320 per ton (Parsons, 2005, How much revenue per hectare can Jatropha generate per year?, para. 1-2). 108.6 billion liters of biodiesel is at least 6 times the quantity needed to currently meet Europe's annual 18 billion liter fuel demands (Jones, 2004, para. 9). If a quarter of Africa's Jatropha growing regions were optimally cultivated (about 415 million hectares), the biodiesel produced from Jatropha seed oil would be 238.9 billion gallons, an output matching the current annual oil consumption in the United States (Parsons, 2005, Introduction section, para. 5). If Africa takes the lead in the production of biofuel, particularly from Jatropha, the Continent's efforts in this endeavor will position it as an exporter of biodiesel, thusly increasing its economic and political leverage in the global society. Ironically, Jatropha's popularity is seeing money being pumped into African agriculture, but once again not for food, just for biodiesel production. The long-living plant is being viewed as the spark that can revive the African economy. Africa could potentially become the world's biggest supplier of biodiesel with many multi-national companies, particularly Norwegian, Indian and British ones, moving quickly to secure massive tracts of land on the continent for Jatropha plantations (Muldoon, 2007, para. 4; Palmer, Feb. 19, 2007, para. 4; Palmer, Feb. 21, 2007, para. 1). As a result of global interest and potential foreign investment, many private and government-sponsored Jatropha mass-planting initiatives have begun in selected African nations, e.g. Benin, Egypt, Ethiopia, Ghana, Guinea, Madagascar, Mali, Mozambique, Namibia, Senegal, South Africa, Sudan, Tanzania, Uganda, Zambia, Zimbabwe (Jatropha curcas L. in Africa, n.d., Jatropha promotion in selected countries).



Jatropha Plantation

Additional Applications to Telecommunications

As an application of biofuel use, research, and innovation, wireless communication giants Ericsson, GSMA, and MTN are making plans to combine their expertise and funds in a partnership to use Jatropha, pumpkin, groundnut and palm seed oils as Diesel oil substitutes to power cellular network base stations in the developing world

(Walko, 2006, para. 1, 5). A huge, untapped market of potential mobile users in these nations are in rural areas; however, these areas, from which most new mobile phone subscribers in emerging countries come, are often not connected to the electricity grid, therefore requiring that the network stations there be powered by generators (van Grinsven, 2006, Africa takes the lead, para. 4). Cell phone use is generally not affordable and accessible to the majority of the populations not living near metropolises due to the high cost of supplying/transporting fuel long distances across remote areas to base stations there where the frequent occurrences of poor roads and inhospitable terrain make access difficult. Use of locally-produced biofuels, i.e. those produced from crops grown in close proximity to a mobile base station, would significantly reduce the operating costs of rural cellular networks, thereby making cell phone usage rates affordable; an estimated 80% of the operational cost of a rural cellular network can be attributed to associated costs with fuel transport, security and protection (van Grinsven, 2006, Introduction section, para. 6). D1 Oils, a UK-based oil production technology company, could be immensely helpful to the efforts of the tri-partners by supplying its self-designed portable biofuel refineries as part of the local oil production infrastructure; these refineries are easily transportable, produce minimal emissions, use virtually no water, and can be powered in remote locations by its own biodiesel (Jones, 2004, para. 10).

The projected use of seed fuels as conceptualized by Ericsson, GSMA, and MTN, starting by 2008 in Nigeria as a forecast, will also be piloted in Rwanda, Uganda and Kenya, with eventual duplications all over Africa if the pilot analyses are favorable; essentially, Africa will become an international model and test case for commercial biodiesel production in powering cellular base stations. Because the model is to be centered around local biodiesel production, the tri-partners believe that their initiative will create rural area agri-business employment and simultaneously reduce costs and measures associated with transportation, logistics, and security; additionally, the clean-burning nature of biofuels extends the life of a base station generator, thereby contributing to further reductions in operation costs (Khan, 2006, para. 5, 10). The biofuel generators used to power the base stations can also be used to supply power, i.e. electricity, to surrounding areas (Fitchard, 2006, para. 8).

The extension of mobile networks into rural areas will boost the socioeconomic level of the developing nations. The main reasons that many developing countries have shown great interest in the opportunity to get involved in commercially growing *Jatropha* as a biofuel source are: strengthening of domestic transport industry; domestic power generation capabilities; reduction in expensive oil imports; pollution prevention; conservation of currency; and biodiesel export capabilities (Jones, 2004, para. 9). The early adoption of biofuel-powered cellular networks would place Africa at the forefront of a new wave of innovation that takes economy and eco-friendliness into consideration (van Grinsven, 2006, Africa takes the lead, para. 1).

Conclusion: A Sociological Perspective and Analysis

Jatropha biofuel has the potential to assist in any nation's development because of its utility in giving mobile operators direct access to a sustainable power supply (Walko, 2006, para. 6); anthropologists and sociologists such as James Henslin have said: "technology sets the framework for a group's nonmaterial culture" (Henslin, 2007, p.58). If a culture's technology changes so do people's ways of thinking and how they relate to one another. In light of this, the implementation of widespread biofuel (and other green fuel) use (particularly into non-industrialized nations) must be tempered with sociological sensitivity, analysis, and policy safeguards such that these new catalysts for industrialization do not generate negative (perhaps catastrophic) social consequences as a by-product, e.g. a "materialism above morality" attitude amongst the masses, an uncaring & unfriendly society, greed, "super materialism" mentality, corporate worker exploitation (i.e., no employment benefits, no health care packages, no vacation time, hazardous working conditions, creation of pseudo 19th century "sweat shop" environments), involuntary/forced removal of ethnic groups from indigenous lands, and many other ills. Technology inevitably changes people's attitudes, habits, and views in a given society, but must not be allowed to proliferate at the expense of the indigenous social ideas and moral fabric. Improved health, socioeconomic status and the overall enhanced quality of life for a nation's masses should be the major objectives for use of mass societal technologies.

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