BEST PRACTICES FOR LONG-TERM JATROPHA DEVELOPMENT


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Growing concerns about climate change, energy security and rural development are key drivers pushing innovative solutions to an equitable socio economic model in developing economies. Needless to say that biofuels are an inherent part of these processes.

Nations that have embarked on a biofuel driven model for economic development need to evolve the right protocols and systems to plan and implement such initiatives in a sustainable manner. This would mean factoring the impact of competition for other land uses, such as production of food or other crops at the concept stage itself. Feedstocks for biofuel remain at the core of any biofuels venture.

Among all the oil bearing crops, Jatropha has emerged as the focal point for the biofuel industry with rapid R&D investments flowing into its cultivation, processing and conversion into biodiesel. With growing emphasis on the sustainability of the biofuels value chain from feedstocks to consumer, there have been pressures on regulators and governments to set in place sustainable models for Jatropha cultivation and use as a biofuel feedstock.

There are three key issues concerning Jatropha:

- Plant agronomy demands, production complexities and ways to resolve them
- Business models suitable for small land holders
- Environmental and social benefits

Ensuring sustainability standards for Jatropha projects, particularly in developing economies involve a detailed assessment of economic, ecological and social dimensions at the planning and pre-project stages.

Though heralded as the most preferred non food crop, Jatropha is yet to deliver on its promises.

In an update to the previous position paper, ‘Sustainable Biodiesel Feedstock. Jatropha--A Strategic Option’ [KnowGenix Position Paper, Nov 2007]. This paper discusses the initiatives in developing a sustainable position in Jatropha production and the need for sustainability criteria to be developed for all large Jatropha projects.

Jatropha production and its use need comprehensive sustainability criteria just as other food crops.
Besides, land resource management, water management and cultivation practices need better understanding in light of reported variations in Jatropha practices worldwide. Leveraging Jatropha’s other beneficial qualities for improving rural economy is a facet which needs closer scrutiny with mega ventures being planned by large corporations in developing economies.

Primary issues favouring Jatropha over other crops are its non food nature, reported ability to grow on marginal lands and the need for limited rainfall. There are also claims of Jatropha assisting in preventing deforestation and desertification, and improving soil fertility. However, experiences across the developing world have been quite varied reflecting complexities in local practices, soil, water and climatic factors.

Jatropha projects today are characterised by new agronomical and technological challenges posed by new production and conversion processes. Emergence of new rural business models and novel environmental and social models are related issues impacting the long term sustainability.

Alerts concerning large Jatropha projects and their potential impact on land, water, soil, and GHG balance have been raised by leading multilateral agencies as also social organisations. Though amenable to growing on marginal land, commercial pressure to maximise yields are likely to result in best lands being appropriated for Jatropha. Similarly pressure for irrigation to be intensified as also the accompanying impacts of indiscriminate extraction of ground water in fragile zones will have to be dealt with.

It is evident that the choice of the crop and the technology pathways affects the carbon dioxide balance of crops grown for biofuels. Nett balance of carbon dioxide savings from Jatropha projects depends on the amount of energy used for cultivating, harvesting, transporting and converting the plants. To assess this a detailed Life Cycle Assessment (LCA) for different pathways needs to be carried out. It is equally critical to determine the suitability of each Jatropha type for different regions.

Economies of scale change the economics of any crop based project and also bring about environmental impacts. It is essential to modify traditional approach of cost benefit analysis to develop better models for judging project profitability and sustainability.

Documentation and disseminating information regarding Jatropha has been a well debated issue. By
end 2008, the early stage Jatropha projects would have attained maturity of 5-6 years. In countries where Jatropha projects are being planned there are a variety of types of Jatropha plants, with different oil content, yields, maturity periods, resistance to drought and pests, and rainfall requirements. The data collected from these projects will prove useful to assess the overall sustainability of Jatropha projects.

DEVELOPING SUSTAINABILITY CRITERIA FOR JATROPHA
There are key factors to be evaluated in any Jatropha project. These are:

- Integrating socio economic perspectives into large projects
- Creating local value chains
- Finance services for community initiatives
- Leveraging carbon finance potential
- Application and agronomy research on Jatropha

Despite the potential qualities of Jatropha as a sustainable feed stock for biofuel there are specific issues pertaining to translating it into commercial and social benefits. Jatropha projects are very location specific and it has been noted that experiences are not transferable across borders.

CRITICAL SUSTAINABILITY COMPONENTS FOR JATROPHA
Three key issues determine the sustainability of such projects are:

- Adopting best practices in production systems
- Planting, harvesting and processing
- Socially and environmentally sound protocols
- Policies synergising with the needs of local area
- Carrying capacity of the land
- Optimising jatropha value chain processes
- Yields, conversion efficiencies, value added products

KEY FACTORS DRIVING SUSTAINABILITY CRITERIA
Sustainability of biofuel feedstock production is not a given, and critical focus on the following factor form key criteria and need to be addressed.

- Land use patterns
- Water usage
- Soil impacts
- GHG balance
- Biodiversity loss
- Social dimensions
LAND USE PATTERNS: A NEGLECTED DOMAIN

and resource management and usage pattern is, perhaps, the most critical parameter in Jatropha production in developing economies. Though Jatropha is reported to grow on marginal lands it is noted that it does need good quality land to give the level of yields which can make the project viable in the long term. Experiences in India, South East Asia and Africa have been varied leading to much debate on its viability.

Increasing pressure from commerce to optimise yield per hectare have also tended to force food production off the best land to make way for Jatropha. Land for jatropha cultivation needs to be evaluated against food or other productive uses of land.

WATER USAGE: THE CRITICAL COMPONENT

Claims that Jatropha can grow well in low rainfall regions are being increasingly questioned as experiences have shown that for optimum yields Jatropha does need a higher level of water usage.

It is more likely that commercial pressures to higher yields will drive the use of large scale irrigation which will enable multiple harvests. Near and long term impacts of depletion of ground water resources need to be evaluated for all mega Jatropha projects many of them being planned in ecologically fragile zones. Rising level of shortage of water and projections for further reduction will prove to be a major limiting factor in Jatropha production.

SOIL QUALITY

Reports of Jatropha enabling quality improvement of the soil and acting as a binding agent have to be substantiated in different Jatropha growing regions. In mega ventures needing large scale clearances the impact on soil quality can be long term.

GHG BALANCE

In terms of best GHG balance the choice of the crop and the technology pathways play a key role. Net balance of carbon dioxide savings depends on the amount of energy used for cultivating, harvesting, transporting and converting the plants. It is also noted that production of Jatropha pressed into Straight Vegetable Oil allows for maximum carbon dioxide savings as compared to conversion into biodiesel which involves large chemical inputs. It is essential to carry out a detailed LCA of all the pathways at planning stage itself to ensure sustainability.

“Rising level of shortage of water and projections for further reduction will prove to be a major limiting factor in Jatropha production.”
Biodiversity Loss

Decrease in biodiversity is a natural fall out of biofuel crop production as is exemplified by experiences with Palm oil and Soy, where large forested areas have been cleared for energy crops. Besides, large energy crop farms resort to monoculture cropping thus replacing valuable biodiversity. Resolutions to these issues are being sought through crop mixing, rotation schemes, and scaling down the magnitude of cultivation.

Social Dimensions

Perhaps, the most significant factor in ensuring sustainability lies in developing a correct model of socio economic systems related to rural employment and economy. Options to funnel fuel revenues back into the community, inequities in land tenure and poorly implemented resettlement plans pose further challenges for sustainable Jatropha production.

Yet another aspect determining sustainability is to ensure the rights of indigenous people facing displacement from their habitats. It is imperative to set in place properly designed value sharing models in the initial stage itself. Emergence of 2nd generation biofuels will impact the 1st generation fuel feed stocks and long term viability of Jatropha based projects will also need to be evaluated from a socio economic angle.

Developing Sustainable Economic Models

Jatropha cultivation as is practised the world over comprises a variety of business models ranging from large scale with involvement of smallholders, smaller and small-scale production to mega ventures by big corporations.

Optimising economies of scale will alter the environmental impacts. In the case of Jatropha, yields will be higher on good quality soil and with sufficient watering than on marginal arid lands and low water usage.

As discussed earlier economic viability will demand better quality land and higher water usage when based on traditional cost benefit analysis. Once other benefits are integrated there is more likelihood of small scale projects on marginal lands being more economical. Apparently traditional approach of cost benefit analysis needs a reassessment to evolve a comprehensive tool for determining project profitability and sustainability.

Environmental benefits need to be considered in this new means of evaluation, including increased productivity from intercropping and the creation of a better more humid microclimate, reduced soil erosion, protection against desertification, and availability of press cake which is also a good quality...
organic fertiliser.

FUTURE CHALLENGES IN MEGA JATROPHA PROJECTS

Developing sustainable Jatropha projects do pose challenges of varied nature and some critical ones are discussed below.

AGRONOMIC CHALLENGES

Plant agronomy poses key challenges to the viability of Jatropha projects and key among them is the diversity in Jatropha types in each region. In most Jatropha driven regions there exists a wide variety of Jatropha plants. Each of these is defined by differences in oil content, yields, maturity periods, resistance to drought and pests, and rainfall requirements. It is critical to make the right choice of Jatropha type for any given region and assess its overall suitability to ensure long term sustainability.

TECHNOLOGICAL CHALLENGES

Existing technological utilities for Jatropha needs closer attention. Most technologies for biofuel have been based on rape seed or palm. However, very few of these technologies have been extended for Jatropha. There is a need for further research on process technologies and design of equipment to scale up the Jatropha projects.

FINANCE BARRIERS

A major challenge for Jatropha projects is related to financing options available. Today, there is widespread reluctance on the part of financial institutions of all hues and shapes to approve projects related to crops and it is necessary to sensitize regional and international financial institutions on the economics of Jatropha. Jatropha start up have a 3 year gestation period before the first significant harvest making it a risky investment.

POLICY BARRIERS

In countries where Jatropha based biofuel could be produced, there is often a lack of appropriate policy support to small-scale Jatropha development at the local level.

Policies are needed to ensure that local households, businesses, and communities receive the benefits of energy services from Jatropha based biodiesel development, as well as associated income and job opportunities. It is essential to engage small farmers and producers in the policy formulation discussions.

Policy support will need to consider a range of issues. These are:

- Feedstock production methods, transformation
• Jatropha biofuel quality standards and testing
• Ensuring quality product
• Evolve guidelines for suitable available technology, logistics, etc
• Pricing mechanism
• Incentivise biofuels usage
• Favourable tax regimes
• Capacity building in executive bodies

GUIDELINES FOR SUSTAINABLE JATROPHA PROJECTS
A set of guidelines are suggested by GEXSI for Jatropha projects for ensuring sustainability. Some key ones are discussed below.

1. SETTING MINIMUM STANDARDS
Early start up Jatropha projects did not take into account the ecological and sociological complexities involved in large ventures. At present there are several large scale investments in jatropha based biofuel plants. Since Jatropha grows mostly in developing economies ensuring their rights becomes a key component.

It is important to decide on minimum standards for large scale investments in Jatropha that are shared and agreed upon by all stakeholders. These minimum standards are expected to protect local population and their environment.

2. DEVELOPING LOCAL VALUE CHAINS
A large variety of technologies makes use of Jatropha oil such as local diesel electricity generators that run on jatropha oil, jatropha stoves and lamps. However, no systematic approaches to link these technologies to jatropha production have been negligible.

Linking the production of these goods to the local production of Jatropha allows generation of regional value chains that expand employment opportunities.

3. COMMUNITY BASED INITIATIVES
Social enterprises require some initial support during start-up, but become financially sustainable after this phase. Social enterprises at the community level offer income opportunities for those in desperate need. This income is spent locally creating positive feed-backs for the local economy.

It is important to make existing decentralized Jatropha activities and grassroots enterprises fit for the market to allow their up-scaling.

“Linking the production of these goods to the local production of Jatropha allows generation of regional value chains that expand employment opportunities.”
4. LEVERAGING JATROPHA CARBON FINANCE

It is important to identify conditions afforestation and fossil fuel substitution with Jatropha oil may be included in carbon finance schemes.

It is also essential to develop Jatropha projects by identifying carbon co-financing opportunities.

5. AGRONOMY RESEARCH ON JATROPHA (AND ITS BY-PRODUCTS)

In comparison to other cash crops Jatropha has a huge untapped potential. Potential for Jatroha cake as organic fertilizer, as pellet to burn, as fodder for animals is equally high.

It is critical to increase the profitability of Jatropha projects through improved, high-yielding Jatropha crops and through the sales of by-products based on Jatropha press Cake.

6. REGULATORY FRAMEWORK AND JATROPHA VENTURES

The regulatory framework in different parts of the world (taxation, subsidies, quality standards) determine the profitability of specific Jatropha uses. These frameworks will determine whether it is more profitable to export Jatropha or to sell it on the home market or whether to refine Jatropha oil into biodiesel or whether it is more profitable to use the oil to run diesel engines for off-grid energy services.

It is essential to understand how national policies impact on the profitability of Jatropha investments. Based on this understanding, it is imperative to derive recommendations regarding best policy practices for specific Jatropha related development objectives.

Currently, countries adopt a large variety of policies that provide a sound basis for future policy development.

F. SUSTAINABILITY ASSURANCE SYSTEM FOR GROWING BIOFUEL FEED STOCKS

UNEP, in close cooperation with partners in governments, industry and civil society, is in the process of defining sustainability criteria and recommendations for decision-makers in industry and governments that should help reduce the risks while the bioenergy market continues to develop. These criteria need take into account and build on criteria used in existing national and commodity-based systems.

UNEP is working with the Roundtable of Sustainable Biofuels (RSB), an initiative set up by the Ecole Polytechnique de Lausanne. The RSB process brings together a large variety of stakeholders to
develop the criteria of sustainable biofuels production. UNEP will provide the link between the technical findings of the RSB and the GBEP and other intergovernmental processes.

**G. WAY FORWARD**

Jatropha oil and Jatropha biodiesel can bring many benefits for developing countries by providing access to clean energy services. In this context, many developing countries are attempting to maximize their biofuel potential.

To ensure sustained use of natural resources, the development of biofuel needs to be carefully planned and managed. Issues such as agricultural land competition, scarce water resources, soil erosion, biodiversity concerns, food versus fuel competition issues, equity concerns of large versus small-scale biofuel development, and biofuel trade issues need closer attention.

Coherent and responsible policies and legislation, capacity building, technology transfer and technological development are needed to ensure that a part of developing countries’ growing energy needs can be met through sustainable production of Jatropha biofuels. Biofuel projects, which are driven by local ownership, in which small farmers produce fuel for their own use or for community use, appear likely to produce and sustained benefits for a rural community.

However, these would need new policy initiatives and policy corrections to fructify.

Some key issues which have to be resolved are as follows:

- Blending requirements, tax incentives, R&D support for biofuel-compatible infrastructure and technologies.

- The economics of bioenergy production are site- and situation-specific, and each country and even location will need appropriate policies.

- Take into account the lifecycle benefits and costs of biofuel production as well as the global production potential, particularly in developing countries.

- Integration with agricultural, land use and energy planning policies.

- Development of International set of standards to facilitate international trade.
• Establishing a biomass trade market can benefit both importing and exporting countries.

• Participation of stakeholders is key to sustainable development and should be taken into account in policy formulation and development of policy instruments.

• Sustainability standards have to be developed tailored to Jatropha, based on general sustainability principles for bioenergy.

• Different business models - small scale and large scale production.

• Ensuring participation of small farmers into large scale production through participatory concepts.

• Involvement of the local population to reduce social or environmental risks related to feedstock production.

BIBLIOGRAPHY


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JatrophaWorld Hamburg 2008, to be held on 20-22 October 2008 in Hamburg, GERMANY brings together Jatropha experts to EXCHANGE RESEARCH FINDINGS & SHARE PERSONAL INSIGHT on KEY STRATEGIES for Long-Term Jatropha Success!

Some of these KEY STRATEGIES Include:

- **KEY STRATEGY # 1**: Choosing the best location for Jatropha Projects in terms of local legislation, funding, agro-climatic conditions, labor & logistics.
- **KEY STRATEGY # 2**: Pinpointing the Scale of Operations & Organization Strategies for Jatropha as per local conditions.
- **KEY STRATEGY # 3**: Going Environmentally Friendly & Carbon Positive for Jatropha Projects
- **KEY STRATEGY # 4**: Mapping Global Biofuel blending specifications & demand for Jatropha Oil
- **KEY STRATEGY # 5**: Complete Utilization of Jatropha Curcas L, including biowaste, seedcake & waste.
- **... Plus Many More!**

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