

SUMMARY OF PRELIMINARY LESSONS AND CONCLUSIONS

There are many lessons contained in the case studies provided in Annex 1 and in addition there are many further questions which could be asked and will be asked of these initiatives over the coming years as some of them mature further and market conditions change locally and in the broader environment. With the early nature of some the biofuels cases in particular, care must be taken in drawing conclusions about the longer term sustainability of the initiatives. With that said, the following is a list of preliminary conclusions which may be drawn from the cases at this time, which it is hoped can contribute to informing debate on the contribution of Small-Scale Bioenergy Initiatives to Rural Livelihoods.

5.1 NATURAL RESOURCE EFFICIENCY IS POSSIBLE IN SMALL-SCALE BIOENERGY INITIATIVES

The cases studies all emphasise whole cycles of resource production, processing, and application including reuse and recycling of by-products. In Bioresidues cases new energy value and use is put to wastes which would otherwise rot, pollute or be burnt thereby increasing the resource efficiency of the production cycle. In Bioresource cases alternative natural resources are harvested and used more efficiently at sustainable extraction levels replacing fossil fuels. In Biofuels cases intercropping and use of marginal land for hardy crops and trees appears to create new natural and financial capital with cycles of growth and use of by-products as fertilizer contributing to new growth and soil fertility.

In these ways and more described in more detail in the cases, approaches are being developed in Small-scale Bioenergy Initiatives which incorporate technologies, knowledge and practices offering high levels of natural resource efficiency. The extent of this for a selection of initiatives, which generally do not have strong quantified analysis on this topic, could usefully be further analysed as discussed in Section 6 of this report.

5.2 LOCAL AND PRODUCTIVE ENERGY END-USES DEVELOP VIRTUOUS CIRCLES

In all the cases covered, even those with a commercial orientation towards a wider market in the longer run, a focus on providing improved energy services in the producer regions is clearly in evidence. In the market mapping and livelihoods analysis the benefits that flow from the use of the improved energy within the local communities are key in delivering livelihoods benefits through improved energy services in households, communal spaces, public buildings, services and enterprises. Direct uses contributing to improved quality of life are important for building human and social capital in particular while use in



enterprises for productive uses has the added benefit of developing additional financial capital within communities which supports ability to pay tariffs for the energy services which in turn support the viability of the Small-Bioenergy Initiatives.

In this way virtuous circles of development are shown to develop within communities enabling access to the energy services needed for development without money flowing out of the community for fossil fuels or drawing down local natural resources. As strength of communities and initiatives grow, some mention that wider markets may be a source of new revenue which may enable a further step out of subsistence production. However, cases covered in this study focus on local markets first, which appear more stable in general and less open to distortion by foreign governments and firms, and with an appropriate enabling environment this strategy appears to develop more cyclic and distributed benefits to livelihoods than an export-first orientation.

5.3 WHERE FOSSIL ENERGY PRICES DOMINATE, PARTIAL INSULATION IS AN OPTION

In almost all cases cited fossil energy prices are a dominant factor in the Enabling Environment and much of the enthusiasm in the Bioenergy sector, especially amongst the private sector, can be traced to recent historically high fossil fuel prices. This is particularly the case in the Biofuels sector, but also slightly less directly across the whole Bioenergy sector. For example a removal of subsidy on kerosene in Ethiopia drove an increase in unimproved fuelwood use in the country. This dominance is not a new situation and in many countries significant biofuels developments have taken place over the last 30 years or so since the first oil crisis. In general these have fallen by the wayside as fossil fuel prices dropped, with the notable exception being Brazil which persevered in bioethanol development with government support.

In some of the Small-Scale projects covered in this study a primarily economic argument is made for Bioenergy production based on the high fossil energy price. In all however evidence is presented about wider benefits of local production and consumption of a resource derived from the sun, earth and water. These benefits take the form of human, social, natural and physical capital gains, which are not seen by communities or priced in to fossil fuel use. In this respect a strong argument is made in several initiatives for partial insulation of the market chain and this has been done at local level through co-operatives, social structures or local by-laws. This has especially been the case in emerging technology sectors to enable community Bioenergy projects to establish themselves, protected from the relatively unstable, externally regulated and distorted world fossil fuels markets which in any case were generally only partially accessible in the rural communities concerned.

5.4 LONGER TERM PLANNING AND REGULATION WILL HAVE A CRUCIAL ROLE IF SMALL-SCALE BIOENERGY PROJECTS ARE TO SUCCEED

In any emerging sector which offers potential social and human benefits which are not currently priced into a market system, and especially in the Bioenergy sector where that

market system is the dominant fossil fuels sector, it is likely that planning and regulation to support the development of these benefits will be required based on a longer term vision. Longer term trends which governments in the case countries are notably responding to in planning and regulation include diminishing supplies and increasing competition for global oil supplies, and longer term environmental degradation locally in terms of forests and globally in terms of climate change. Emerging recognition of these trends are shown in the cases to drive policy interventions that create market potential for the stable development of new Bioenergy sectors among more vulnerable rural communities where for example agreed pricing systems can provide the stability required for longer term productive investments by reducing risk cost. This type of stability is also shown in the cases to attract local capital and private sector involvement and to reduce the vulnerability of rural producers to wider market forces which they are ill-equipped to respond to.

Another regulatory issue coming through in the cases which is key to biofuels developments serving local energy access is the issue of “leak-through” of Bioenergy products”, particularly liquid biofuels, into unproductive uses of richer consumers particularly cars. Several project cases considered for this study were found to have run aground because a rise in the fossil fuel price had forced locally produced biofuels out of rural energy access markets and into richer consumer automobiles. Cases selected show how local action by local-government, co-operatives and producer groups have created agreements which retain the energy product within the rural energy market system at prices which work for producers, processors and users such that energy benefits are not lost but spread more widely and put to productive use in agricultural machinery for example. Even where a target market is vehicle transport, all cases selected show mechanisms where access to the energy service is enabled for rural producers, households and co-operative members.

However, the functioning of systems such as this, whether regulated from local or national level and through whatever organisational system, requires an adherence to contracts enforced both from local levels within communities and from the general legal system. This is a key challenge in many countries, but several of the cases provide optimism that, within market chains that are at least partially delimited within systems incorporating representation and negotiating power for rural producers and consumers, social and legal contracts can be strong factors in supporting mutually beneficial and efficient market relationships.

5.5 FLEXIBILITY AND DIVERSITY CAN ALSO REDUCE PRODUCER RISK

While stability in terms of pricing for Bioenergy products can be an important source of resilience and an enabling factor in investment for rural producers or collectors, another common theme visible in the cases is the importance placed on flexibility and diversity in the face of changing market and environmental conditions. All Biofuels projects covered involving rural producers incorporate strategies such as intercropping of various food and other cash crops along with Bioenergy, which provide different natural characteristics in

terms of pest and drought resistance and maturation and harvesting times for example, as well as different market characteristics in terms of demand or self-consumption. These measures are intended to promote both income and food security through diversification and risk minimisation and appear to be compatible with supporting regulation and tax systems for example on the Biofuel crops.

These strategies are generally most relevant for Biofuels and particularly in cases where initiatives are working with currently single crop farmers, especially for export markets vulnerable to trends such as with the cotton farmers in Mali, where adding a Bioenergy dimension adds resilience through diversity in markets. This diversification benefit is slightly less strong in Bioresidue or Bioresource cases which tend to be more fixed in terms of the available resources and markets. However income diversity for wood collectors (now gaining new revenue for their home garden trees) and an element of replanting for example, is crucial in spreading natural load and increasing security of supply to the end user in the Sri Lanka Spice Drying case for example.

5.6 COLLABORATION IN THE MARKET CHAIN IS KEY AT START UP

Another clear finding from the cases was the frequent instance of a coalition of enabling environment, market chain and/or supporting service actors being involved with the initiation of the chain. This is an important finding in terms of recognising the interrelationship of actors within a market system and the importance of their collaboration in the establishment of chains. Typically at least two types of actor such as Public/private, NGO/Private or University/Co-op were seen to be required to start initiatives and in general support early from local and/or national level government appeared to be crucial.

In developing rural chains supplying energy services there appears to be an especially important requirement for collaboration between supply and demand sides. For example if a product such as cooking ethanol is to be produced there must be suitable and appealing stoves available. Equally if stoves are to be available then cooking ethanol must be available at a suitably attractive price to avoid a chicken and egg scenario. In the cases selected it is clear that significant collaboration between fuel supply and appliance supply is necessary in initiating market chains, although this can open out more as awareness rises, markets become more established and volumes increase.

Another notable form of collaboration which emerged in several case studies was where larger Bioenergy processors and smaller producers were linked in what appear to be mutually beneficial relationships. This has apparently been an effective strategy for both in initiating the new chains for example in Tanzanian Palm Oil and Guatemala Biofuels cases. This is reported to enable the larger firms to provide economies of scale in processing, investment in key physical capital, training and improved quality processes while securing a cost effective and reliable raw material supply. This model is attractive to outgrowers and producers as a stable additional revenue opportunity is created under agreements negotiated between the larger processors and sometimes newly established co-operatives and producer associations.

This relationship can enable connection with wider markets bringing money into the community from outside, as well as attracting donor/government support to what is a more social-enterprise approach. It is the emphasis on benefit sharing via shared-bargaining by producers, provision of local energy access benefits and regulation/oversight on the larger processors which differentiates the approach described in the cases from what in other situations could be an exploitative relationship.

5.7 LONG LOCAL MARKET CHAINS SPREAD BENEFITS

It is notable in cases where initiatives develop market chains with greater numbers of processes, linkages and by-products, each responding to a demand then they are increasing the resource efficiency of the whole system, and at the same time spreading livelihoods benefits more widely within rural communities. Both direct and indirect benefits are noted in jobs at producer, processor, appliance and distribution levels within market chains as well as in the supporting services required by the chains. In addition to the benefits in terms of local revenue creation important benefits also noted in cases include development of virtuous circles of collaboration, trust and social capital. These are developed through formal and informal relationships established between different types of actor such as government, private firms, NGOs and producers, as well as between different participants in similar groups such as in the creation or reinforcement of a co-operative or producer association. These gains in trust and social capital visible in the Small-Scale initiatives are crucial for collaboration in other initiatives, to reduce transaction costs and to avoid “market blocking” behaviours.

Within these market chains it is important to differentiate between livelihoods benefits in a more complex way than simply counting number of jobs created, and several cases bring out challenges in this in terms of the difficulty of associated jobs which will need to be relieved if the initiatives are to spread. These issues are usually related to the access to production or processing technologies needed to increase time and work efficiency, increase margins and thereby attract more producers into the sector. Efficiency on the supply side includes in production practices which balance job creation with productivity and effort level. If the work is too hard and margins are not high enough, it will not be sustainable and an increased level of mechanisation to a viable level may be required.

5.8 MOVING BIOENERGY RESOURCES UP THE ENERGY LADDER ADDS VALUE

In general an energy end use is an extremely reliable demand and the only instance in which a consumer will switch is if another source higher up the energy ladder becomes available at a price point within reach, and is considered as good value in terms of utility for the extra money. The energy ladder represents the continuum between the most basic wood energy burnt in a three stone fire at the bottom up to the most flexible, clean to use and convenient source of energy i.e. electricity, at the top. Barriers to switching to steps up the ladder, such as charcoal, gas (biogas or LPG) or liquid fuels, can involve capital costs

of appliances as well as the costs of the fuel itself. In general one important feature of the cases selected is that there has been a focus on converting lower grade Bioenergy resources, residues and crops into energy vectors higher up the energy ladder such as charcoal, biogas, liquid fuels and electricity. This appears to be an important feature of the attractiveness and viability of Bioenergy initiatives as well as contributing to the health and labour saving (e.g. wood collection) benefits which are key to livelihoods improvements, particularly for women.

5.9 ANY NEW ACTIVITY RAISING DEMAND RAISES PRICES, EVEN FOR WASTE

It is notable although perhaps unsurprising that in several cases the development of new economic activities around about a resource, even if that resource was previously a waste resource, implies an increase in price for that resource. This is particularly marked in Bioresidues cases such as the Peru Waste Oil-Recycling and the Senegal Chardust Briquettes examples where success of an initiative using waste leads to more competition for that waste. While from a user and natural resource perspective this is positive, from the perspective of the initiating institutions this is not.

Rising price features like this however are to be expected at national or local level where an increase in economic activity around a resource is occurring. If this increase is occurring, as in these cases, through more effective exploitation of resources this contributes to a positive overall trend as long as prices for the raw material do not rise to a point above the level of viability for the individuals and businesses involved. This should largely be regulated by the market itself but in some of the cases covered, some level of price controls or export restrictions have been a feature of initiatives.

5.10 CASES DO NOT APPEAR TO SHOW LOCAL STAPLE FOOD SECURITY TO BE AFFECTED

The issue of rising prices due to new Bioenergy activities in rural areas affects the inputs and outputs from the Bioenergy market chains however in the Small-Scale Bioenergy initiatives covered, there appear to be only limited connections to food security, in terms of access and availability, which are particular to certain Bioenergy types and regions within the countries. This is largely due to the specific circumstances in the case regions where decisions have been made on a case by case, a crop by crop, region by region and even locale by locale basis which is the only way in which food security linkages to small-scale initiatives may be established. However there are some general preliminary conclusions which may be drawn as follows:

In all **Bioresources and Bioresidues** cases there is no discernible link between the initiatives and food production, prices or security. If a linkage is detectable it is to reduce the costs of cooking by providing lower cost cooking fuels and time-saving to households or increased revenues to restaurants through reuse of oil wastes.

The **Biofuels** cases fall into two main categories with respect to linkages with food production as follows:

■ **Non-food cash-crop/intercropping**

In all the *Jatropha* cases a non-food crop is being used to produce the biofuel and all initiatives are promoting one or all of a series of measures to decouple this activity from food production including: Intercropping with food and/or using presently unfarmed land unsuitable for other crops. In cases such as the Mali *Jatropha* case, small producers are switching from a previous reliance on a non-food cash crop, namely cotton, to *Jatropha* production intercropped with food products. Residues from the processing of the *Jatropha* plants are used as fertilizer and the plants are selected for their low water requirements which limit competition for inputs to local food production. In the case of the Kenya plantations of *Acacia* trees as a biofuel, these are neither a food crop, nor do they use land otherwise normally used for food crops, however in the first 3 years of the cycle intercropping is done with short-season food crops which should add supply resiliency. Providing these approaches remain in place, for these cases an increase in food prices would only be expected to come from an increase in producer incomes rather than pressure on food production. Whether the approaches do remain in place will depend on the economic viability of the biofuel crops in what may not be prime conditions, and as such further more detailed economic and agricultural analysis as well as follow-up studies on the initiatives will be important to monitor this. Particularly in the case of *Jatropha*, which is not currently fully developed as a “crop”, longer term yields in the cases must be tracked and probably improved.

■ **Non-staple food crops as fuels**

In the cases of ethanol production from sugarcane in the Ethiopia Stoves and Brazil Micro-distilleries cases, the initiatives put an emphasis on the use of molasses, the waste residues from sugar processing as a main feedstock for ethanol production and in this case both projects would be Bioresidue projects and have no impact on sugar availability. However in these cases use of sugarcane for the ethanol is not ruled out but this is set in the context where both countries are large producers and exporters of sugarcane, and diversion of part of the ethanol output into local household fuels is not expected to have any impact on prices which are currently driven at international levels. In the Tanzania Palm Oil case, the entry of the initiative onto the local market is expected to have an impact on Palm Oil prices locally which are used in cooking. In response to this the initiative is proposing measures to limit outgrower purchases to only large Fresh Fruit Bunches (FFBs) to leave abundant small FFBs for local consumption, as well as promoting intercropping with food-crops in early years before the canopy prevents this. Again, the region has abundant natural and cultivated palm production and the market is currently linked to world market prices.

In Bioresources and Bioresidues cases therefore the Small-Scale Bioenergy initiatives covered do not have a discernable link with staple food prices and in the Biofuels cases an emphasis is given to non-food crops replacing non-food cash crops, intercropped with food or on uncultivated land, which exhibit limited or no apparent linkages to food prices.

In cases where non-staple food crops such as Palm Oil or Sugarcane are used then a linkage is more likely to these complementary foods, although this is seen to be mitigated by specific supply and production circumstances in case localities where export crops locally in surplus are used in local energy applications.

5.11 SMALL-SCALE BIOENERGY INITIATIVES CAN OFFER NEW CHOICES IN RURAL COMMUNITIES

In all case studies a significant point is made about the potential of Small-Scale Bioenergy initiatives to bring additional Livelihoods opportunities to rural areas, and as such act to reinforce the viability of communities and so reduce pressures towards forced urbanisation of community members to find work. This is described as being delivered, amongst other mechanisms described in section 4.4, through a combination of increases in financial capital opportunities via job and productive activity creation, and increased social capital created through development of producer groups, co-operatives and rural market systems.

These gains are supported by, and in turn support, increases in human capital in rural areas through skills creation and improved energy service availability which has in turn been shown more generally to increase retention of more skilled and able individuals along with professionals such as teachers and health care practitioners. Creating viable choices for these individuals to stay in rural areas through a combination of improved revenue opportunities and living conditions within villages is an important contributor to rural development and the cases examined in this study offer optimism that appropriately implemented Small-Scale Bioenergy Initiatives can contribute to this outcome.