A MASTER DEVELOPMENT PLAN FOR THE BIOMASS RESOURCES OF:

FIJI
KIRIBATI
SAMOA
TONGA
TUVULU
VANUATU

Consultancy for SOPAC- South Pacific Applied Geoscience Commission on:

BIOMASS RESOURCE ASSESSMENT, UNTILISATION AND MANAGEMENT FOR SIX PACIFIC ISLAND COUNTRIES

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Structure of the Project

This biomass master development plan builds on the work carried out in the other five tasks of this project and from the data gathered during the visits to the region by Dr. Jeremy Woods, Dr. Sarah Hemstock and Prof. Kasiap Deepchand in 2002 and 2003. Dr. Frank Rosillo-Calle was in charge of the collation of the data and the production of the country and regional synthesis biomass resource assessment reports. All the above collaborated on the preparation of associated training materials.

The following project deliverables (tasks) were outlined in the 'description of work':

1. Prepare a training manual and associated training materials for biomass resource assessment techniques and methodologies.
   a. Developed using a unique web-based training system hosted by ICEPT and mirrored by SOPAC.
2. Conduct training for country participants in biomass resource assessment techniques and methodologies in the following six countries: Fiji, Kiribati, Samoa, Tonga, Tuvalu and Vanuatu.
   a. In-country training was carried out during May and June 2003 by Dr. Sarah Hemstock and Prof. K. Deepchand.
3. Conduct biomass resource assessment in all the six countries mentioned above in '1.2'.
4. Prepare individual country biomass resource assessment reports.
5. Prepare a regional synthesis report for biomass resource assessment.
6. Prepare individual country biomass resource development master plan (this document).

INTRODUCTION

Given the real opportunities for cost effective and sustainable energy provision from biomass in the islands of the South Pacific, but also the complexity of implementation, it is clear that careful planning is required. The site, temporal and physical heterogeneity and the sheer range of potential biomass energy conversion technologies available today can lead to an appearance of overwhelming complexity in the modern biomass energy sector. For example in a recent study carried to evaluate the potential for renewable transport fuels in the UK, 88 separate pathways (combinations of renewable energy resources and technologies) were identified, the vast majority of which were biomass energy pathways (Woods & Bauen, 2003). Therefore, the development plan outlined here can not be a comprehensive blue print for developing individual biomass energy projects or national policies / programmes, but should be regarded as a framework for their development which can account for the uniquely site-specific nature of biomass energy (see figure 1).

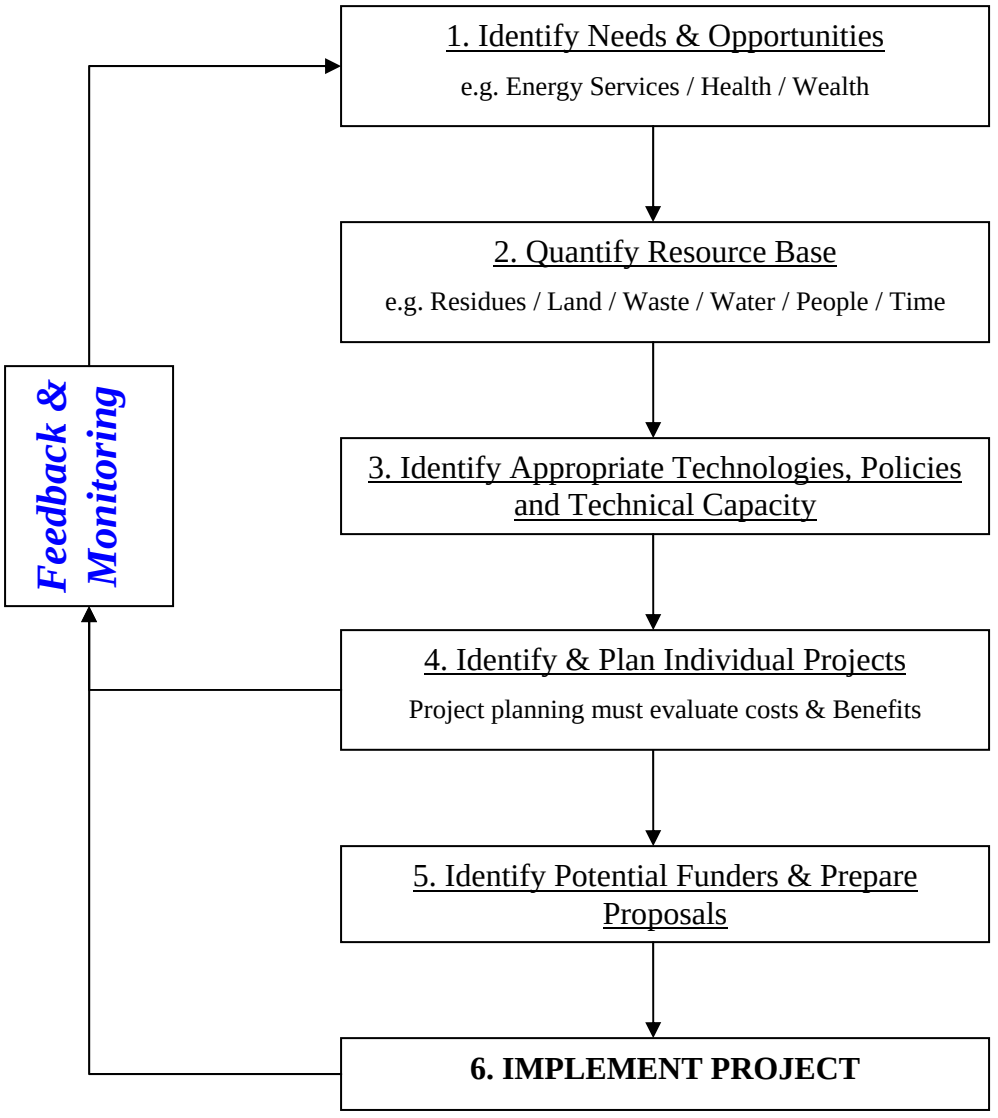
Biomass is a fuel that people are familiar with and currently provides the majority of energy to the domestic sector. However, although continued use of traditional biomass will provide for basic needs, it will not solve the problem of providing the modern energy services required for economic growth and improved living standards. It is likely that the modernisation of biomass energy use will involve some social and cultural changes, as people move away from traditional uses of biomass, in addition to political and techno-economic changes. This is certainly a major, but achievable, challenge.

During the preliminary biomass resource assessment work carried out for each of the six study countries by this project, it became clear that there are exciting and significant opportunities for the development of practical biomass energy projects and programmes in the South Pacific. Even where land is limited, residues, wastes and existing agricultural and forestry activities could be used as the basis for the provision of sustainable biomass energy resources for modern applications. In addition, by doing so, national climate change adaptation programmes would be greatly assisted. Because of its inherent energy storage biomass energy can also play a pivotal role in the wider implementation of renewable energy in general. It was also evident that there is insufficient data to fully quantify the biomass resource base, but initially at least, resources will not be a limiting factor in most cases. It is therefore evident that a programme for developing regional and national bioenergy programmes is required. This master development plan has been developed to assist this process but successful implementation will require significant local political and public support. It is now necessary to make modern biomass energy a reality for the island nations of the South Pacific and in doing so send a clear message that this region is determined to create a sustainable future for it's self.

Outlining a Master Development Plan

The following framework for the sustainable exploitation of indigenous biomass energy resources and the implementation of individual national bioenergy projects has been developed through this project.

Figure 1: Framework Master Development Plan



This project has made a significant contribution to steps 2 and 3 in Figure 1 and some preparatory work in steps 1, 4, 5 and 6. It is therefore clear that a considerable amount of work is still required before an enabling framework is established for successful on-the-ground biomass energy projects in the region. However, there are currently a number of

projects independently underway in the region from which a regional and national biomass energy programme can develop. In addition, through the work of this project a number of new projects have been identified which could form the basis of significant modern biomass energy programmes, some of these are developed from the existing projects mentioned above and in the case studies outlined on the project web site.

Successful bioenergy programmes require:

1. The development of reliable and well characterised biomass streams that do not entail excessive costs to exploit.
2. National and regional policy environments that:
   - do not distort energy markets through perverse subsidies or policy barriers,
   - enable the network of actors / stakeholders to work together to build a biomass energy supply and conversion chain,
   - encourage entrepreneurial activity,
   - enable innovation, primarily of the 'learning-by-doing' type,
   - encourage public participation and acceptance of biomass energy schemes,
   - ensure transparent accounting processes that clearly highlight the environmental benefits (or dis-benefits) of energy projects (renewable and non-renewable),
   - recognise externalities,
   - provide long term stability in policy.
3. Sources of finance that are not too risk-averse are made available for good modern biomass energy projects.
4. The establishment of networks of interested stakeholders and forums to share knowledge.
5. The establishment of technical support capacity.
6. Highlights examples of best practice and failures.
7. Is led from a bottom-up, end-user perspective that recognises the importance of gender, culture and need.

Each of the areas summarised above can play a critical role in the establishment and persistence of good biomass energy provision projects and schemes. Key elements required for successful implementation of the Framework (figure 1) on a national and regional basis are assessed in more detail below.

1. Understanding, Defining and Developing Biomass Resources and Supply Logistics

Understanding and quantifying the resource base is crucial to the successful implementation of any biomass energy scheme. Biomass resource availability is highly site-specific and dependent on cultural and developmental factors. Where projects are going to be developed, detailed ground-based sampling and surveying may be necessary to establish that the resource base exists, that it is accessible, and that other more suitable uses for the resource are not already being employed. A third aspect that needs to be evaluated regarding biomass resources is an understanding of the potential cultural and environmental impacts of exploiting those resources.

The bulleted list below outlines some of the aspects that are required to understand a potential biomass supply stream prior to its exploitation for biomass energy provision:

- Biomass resource surveys:
    - Standing stock.
    - Mass flow models.
    - Water use and hydrological impacts.
- Linkages with waste streams and environmental health programmes and systems.
- Understanding opportunity costs (alternative uses) and local cultural implications for the exploitation of biomass.
- Characterising the biomass resource: physical (energy content, moisture, proximate and ultimate analysis, etc) and temporal (rate of production, seasonality, longer term trends), decay rates.
- Evaluating the life-cycle consequences of exploitation
- Other- arising from specific sites and cultures, particularly with respect to land tenure issues.

2. Developing an Enabling National and Regional Policy Environment.

Biomass energy projects and programmes are often highly cross-sectorial; even more so than conventional energy programmes and policies. For example, the Tongan Energy Programme recognises at least 10 sub-sectors of which four are cross-sectorial in nature. When biomass energy is included it will be necessary to integrate energy, agricultural, forestry, health and water issues in a much more explicit and structured way into the national energy programme. Equally, biomass energy must be recognised in the energy, health, environment, agriculture, forestry and water policies and programmes so that contradictory or incompatible policy is not enacted or can be mitigated. For example, in Vanuatu, legislation was introduced as a means of generating revenue from a proposed oil refinery which has had a direct negative effect on the use of coconut oil as a vehicle fuel.

An enabling policy environment for modern biomass energy should include the following, much of which is not specific to biomass energy but to the sustainable provision of equitable energy services in general:

- Does not distort the energy markets through perverse subsidies or policy barriers.
- Enables the network of actors / stakeholders to work together to build a biomass energy supply and conversion chain(s).
- Encourages entrepreneurial activity.
- Enables innovation, primarily of the ‘learning-by-doing’ type.
- Encourages public participation and acceptance of biomass energy schemes.
- Understands and exploits beneficial gender issues.
- Ensures transparent accounting processes that clearly highlight the environmental benefits (or dis-benefits) of energy projects (renewable and non-renewable).
- Recognises externalities.
- Ensures that support / subsidies are provided on merit between the different energy technologies and that such subsidies are not indefinite unless they are being used to rectify market distortions.
- Provides long term stability in policy, so-called ‘persistence’.

3. Funding Biomass Energy Projects

Providing funding and incentives for modern biomass energy projects may be more complex than for other renewable energy technologies. As discussed above and elsewhere, the cross-sectorial nature of biomass energy may mean that the supply of energy services from these technology supply chains can involve a relatively large number of actors and provide benefits which are not necessarily recognised in conventional economic analysis. Although work is continuing into developing economic methodologies for quantifying such benefits (see for example Ekins (1998), Hamilton (2000), Constanza (1997)) it is important to recognise that a simple cost-benefit approach may unfairly discriminate against many potential bioenergy projects. On the other hand providing excessive incentives for biomass energy projects can result in the unsustainable or inappropriate exploitation of biomass resources. Therefore, a carefully developed policy programme and associated provision of incentives is a pre-requisite to modern, sustainable biomass energy projects.

Biomass energy projects may require a mixture of national and local government-based support and incentives, private sector venture capital and funding from international sources. In many cases private sector funding may not be available unless some of the risk of implementing renewable energy technologies can be overcome or can be demonstrated to be underwritten by explicit government agreements or indirectly through policy. For example, should national governments agree a tax rebate on renewable energy technologies and ensure that the rebate will last for decades or more the discount rate applied for gaining funding can be significantly reduced encouraging private sector funding.

The following direct and indirect sources of funding should be sought:

- Mixture of fiscal and capital funding, and/or mandated renewable energy targets.
- Time limited public support (e.g. sunset clauses and declining levels of tax exemption).
- Political initiative to promote projects through international mechanisms, e.g. Global Environment Fund (GEF), World Bank (WB), Clean Development Mechanism (CDM), Common Fund for Commodities (CFC), Regional Development Banks, AusAid, etc.
- Industry participation and networking.
- Entrepreneurial support and venture capital.
- Funding levels should be tied to scale of environmental benefits.

4. Networks of Excellence and Forums for Information Exchange

Methods for promoting information exchange and capacity building are likely to be important to the successful development of regional and national biomass energy resources. The work of this project has identified a number of critical biomass supply chains for the provision of modern biomass energy services in the region. These include:

- The use of anaerobic digestion to treat waste streams, primarily human and animal sewage.
- The use of coconut resources to provide liquid biofuels, particularly biodiesel.
- The development of small scale gasification programmes to exploit woody residues and dedicated biomass supplies.

The successful implementation of these technology supply chains may only be possible when the following support is developed at the regional level because the small size of many of the island nations of the South Pacific many not allow sufficient capacity to be developed individually:

- Primarily information exchange:
    - Technical
    - Best practice
    - Examples of failure
    - Examples of success
- Supply chain networks and cooperatives.
- Develop framework planning guidance.
- Exchange of information between project developers, local public, government and interested NGOs.
- Identify ‘productive uses of biomass energy’.
- Raise awareness of the fact that local energy needs can be met locally to promote “ownership” of biomass energy strategies on a local to regional basis.
- Coordination of support for, and communication between, stakeholders at all levels.

5. The Establishment of Technical Support Capacity

The development of regional and international support will also be necessary to underpin the successful development of biomass energy projects and programmes in the South Pacific.

- Promote the development of clusters of projects based around similar production, supply and conversion pathways- aim is to develop entrepreneurial capacity to carry out maintenance, repair and development of systems.
- Establish academic R&D programmes in Universities (e.g. USP, Imperial College London, Massey University, etc) and linkages with international groups already involved in bioenergy R&D.
- Develop capacity in local and regional government to support biomass energy projects and schemes.
- Enlist the support of NGOs and publicly active groups, particularly women's groups.
- Establish the technical capacity and presence to attend important international forums such as WTO, Kyoto (UNFCCC), FAO, etc and ensure that the development of future programmes supports the development of sustainable bioenergy schemes and recognises externalities.
- It is strongly recommended that the following Task Forces are established:
    - Regional Task Force with high level government participation.
    - National Biomass Task Forces (NBTFs) to coordinate interaction between all potential actors at the national / local level.

See 'next steps' at the end of this document.

6. Next Steps

It is clear from this work that simply encouraging more biomass energy projects at the national level may not result in the successful and sustainable exploitation of biomass resources for the provision of energy services. Coordination of points 1-5 above, via existing organisational structures within the region, is required on a local, national and regional basis in order to successfully implement the Framework (figure 1) developed as part of this initiative. We therefore recommend that:

1. A Regional Biomass Task Force (RBTF) is established as soon as possible to develop a regional framework for promoting biomass energy policies within an integrated renewable energy umbrella framework.
   i. This RBTF will require high level government and international body support (the FAO may be particularly important in this process- and preliminary contacts are being developed).
   ii. Funding should be sought for this activity immediately.
2. In parallel to the establishment of the RBTF, National Biomass Task Forces (NBTFs) should be established to identify national / local level capacity requirements for the development of biomass energy projects.
   i. The NBTFs should have strong cross-sectorial representation and should include all stakeholders, particularly women's groups.
   ii. Funding for the NBTFs should be predominantly from national governments and local interested parties to ensure sufficient local commitment.
3. Increase technical capacity within the region (via involvement with organisations such as Imperial College London / ICEPT, SOPAC, USP, etc).
4. A South Pacific and national programme of action for biomass energy should be promoted at an international level, particularly the upcoming SIDS+10 to be held in Mauritius in August 2004. This activity should be led by SOPAC in conjunction with the FAO, ICEPT and other interested parties.
5. The overall Framework outlined in Figure 1 should be developed with the primary aim of successfully implementing on-the-ground projects in the region with individual project activities commencing within a 2 year timeframe.