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**Bioenergy Capacity  
Building Programme (BIOCAB) –  
Development of a training concept**

**Activity Report – Final Draft**

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## 1 INTRODUCTION

### 1.1 BACKGROUND

The production and use of bioenergy has entered a new era of global growth, with both the scale of the industry and the number of countries involved reaching unprecedented levels. Surging investments in biofuels production are being driven by a variety of factors, that include the development of more efficient conversion technologies, the introduction of sound new government policies, growing international trade and of course, the rising price of oil.

UNIDO has received information from multiple sources that more and more national governments in developing countries decided to promote bioenergy development. This requires that local stakeholders develop the capacity to take informed decisions on this very complex subject.

To address this need for capacity building on bioenergy issues UNIDO is considering developing a large Biomass Entrepreneurship Promotion Programme, or BEPP. This BEPP would serve as the umbrella of a number of project initiatives, including e.g.:

- The Bioenergy Capacity Building Programme, or BIO CAB.
- The Biomass Conversion Technology On-line Information Platform, or BIOTIP.
- The Biomass Energy Finance Directory, or BIOFIN.

### 1.2 SCOPE

The aim of the Bioenergy Capacity Building Programme (BIO CAB) is to raise awareness and provide training for representatives at the level of government, institutions, civil society organizations<sup>1</sup> and the private sector to enable their effective decision-making in technology-related aspects of bioenergy by making them conversant with key bioenergy issues”.

The preparatory phase of BIO CAB will achieve two outcomes. The first outcome is a project document, which in detail analyses the training needs that are being addressed by the main phase project and determines the modalities for implementing that project. The second outcome is a Bioenergy Sourcebook, which will provide basic, pragmatic and easy to understand information on bioenergy issues.

The underlying report is linked to the first outcome (Lot 1). Its deliverables will include:

- The current Activity Report
- A visually attractively presented brochure containing an outline of the BIO CAB bioenergy training package
- Outline of the Project Document (ProDoc) for the implementation phase

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<sup>1</sup> Civil Society Organizations (CSO's), earlier referred to as Non-Governmental organisations (NGO's)

The implementation phase of BIOGAB will be able to make use of the outcome of the other projects (to be) initiated under BEPP, in particular the Biomass Conversion Technology On-line Information Platform.

### 1.3 METHODOLOGY AND APPROACH

At the kick-off meeting, held in Vienna on 25 June 2008, initial discussions on the most suitable methodology and approach were held. This led to fine-tuning of the ToR dated 21 April 2008 and the consultant's interpretation as detailed in its offer dated 3 June 2008.

Core activity of the assignment is the development of a BIOGAB training concept. The training concept shall take into account:

- The current availability of relevant bioenergy courses, as assessed by the consultant
- The results from two needs assessments, carried out by UNIDO
- The feedback on the consultant's initial findings from his assignment, as presented at the first progress meeting and at the Expert Group Meeting (EGM), held back-to-back in Vienna on 6 and 7 August 2008.
- The feedback on the draft Activity Report, as discussed at the second progress meeting held in Vienna on 15 October 2008.

The two progress meetings served to discuss the consultant's findings in close detail. The EGM served to get general feedback on the preliminary training course set-up and to get specific suggestions on the availability of existing bioenergy training courses and training materials. Figure 1 presents a simple flow sheet illustrating the process.

Figure 1: Flow sheet and timetable for developing the BIOGAB training concept

Assessment		Survey	Timeline
Early needs assessment results	→	←	25 June 2008
	<b>Kick-off Meeting</b>		
	Preliminary report with "initial findings and specs"		
Final needs assessment results	→	←	6/7 August 2008
	<b>Progress Meeting/ Expert Group Meeting</b>		
	Final draft		
	• Activity report		
	• Attractive brochure		
	• ProDoc		
	<b>Final Meeting</b>		mid-October 2008

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#### **1.4 COUNTRY COVERAGE**

BIOCAB would initially cover up to nine countries in Latin America, Africa and Asia, including Peru, Colombia and Ecuador in Latin America and Tanzania, Uganda, and Mozambique in Africa. Additional countries in Asia are being considered.

In a next phase coverage of BIOCAB may be scaled-up. Ultimately BIOCAB may cover a large number of UNIDO recipient countries where modern bioenergy for industrial applications is a relevant energy option.

#### **1.5 READING GUIDE**

This Final Draft Activity Report builds on the Interim Report that was prepared in early August 2008 and the Draft Activity Report that was prepared in September 2008. It integrates the feedback given and comments made on these reports by the UNIDO project team on 6 August and 15 October 2008. It also takes into account the feedback received from the Expert Group Meeting, held on 7 August 2008.

Chapter 2 describes the preliminary outcome and findings of the two needs assessments, carried out by UNIDO. Chapter 3 introduces the results of surveying existing bioenergy training course providers and bioenergy training materials.

Training course development is covered in Chapters 4-6. Chapter 4 focuses on target groups (beneficiaries), Chapter 5 on training course coverage including themes and topics, and Chapter 6 on training materials and delivery modes.

Considerations regarding designing and implementing BIOCAB are covered in Chapters 7 and 8 respectively<sup>2</sup>. The budget and planning for the BIOCAB implementation phase are given in Chapter 9 whereas Chapter 10 will contain conclusions and recommendations.

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<sup>2</sup> The discussion on different scenarios for training course set-up that was part of the main text body of the Interim Report has been moved to the Annexes.

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## 2

## CAPACITY BUILDING NEEDS ASSESSMENTS

### 2.1 INTRODUCTION

Between June and September 2008 two capacity building needs assessments were completed, covering Peru, Colombia and Ecuador in Latin America and Tanzania, Uganda, and Mozambique in Africa respectively. UNIDO's Manuel Caballero-Alarcon, under supervision of Claudia Linke-Heep, carried out the needs assessments.

The needs assessments served a range of purposes, including:

- Involvement of the National Cleaner Production Centres (NCPCs)
- Gather support from stakeholders
- Obtain confirmation of the themes to be covered in the capacity building programme
- Collect justification to be used in the Project Document (ProDoc)
- Develop new project ideas

The needs assessments involved interviewing selected stakeholders in the target countries<sup>3</sup>. In each continent some two weeks were spent i.e. 3-4 working days per country. In Latin America a total of 38 stakeholders and in Africa 66 stakeholders (including 33 from Uganda) were interviewed in the country capitals<sup>4</sup>. In Latin America the majority of the stakeholders (15, or about 40%) originated from the *public* sector whereas in Africa the majority of the stakeholders (33, or 50%) originated from the *private* sector.

Using guidelines prepared by UNIDO the national cleaner production centres (NCPC's) together with UNIDO Field Offices selected stakeholders from different sectors: (public and private) industry, institutions (such as sectoral associations, universities, and international co-operation institutions), and government ministries. A structured questionnaire was used for, and completed, when holding the interviews with these stakeholders. Interviewees were also asked to rate which elements of the bio-energy value chain they considered the most important to be included in the BIOCAB training programme.

### 2.2 GENERAL OBSERVATIONS

Not surprisingly, stakeholders with different backgrounds expressed different interest ("different baselines with different expectations"). However, for both regions (Latin America and Africa) some general observations can be made from the interviews.

In Latin America, stakeholders:

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<sup>3</sup> For Asia a needs assessment may still be completed. For efficiency reasons the assessment may be less intensive. Possible not all target countries may be visited. Instead, stakeholders may be interviewed by telephone and email.

<sup>4</sup> In Colombia, Medellin was also visited.



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- Gave the highest priority to the following themes: (i) production of liquid biofuels and (ii) pre-processing (pre-treatment) of biomass.
  - Were open to using Internet and computer tools as training instruments
  - Indicated that they would like to learn from the experience of others
  - Confirmed the demand for (i) “how-to manuals” and (ii) Best Practice examples
  - Indicated that the Inter American Development Bank (IADB) and the World Bank (WB) do not provide training that addressed the key bioenergy issues. Any (training) workshop these banks provide either address wider (“RE in general”) or more focused (“liquid biofuels”) issues.

In Africa, the development status of bioenergy and stakeholder opinions on training needs differed much more between the 3 visited countries than they did in Latin America. Having said that, the current focus in the bioenergy sector throughout Africa would seem to be almost entirely on liquid biofuels production. Government officials and investment agencies in Tanzania and Mozambique see themselves confronted with a large number of foreign proposals to invest in energy cropping and liquid biofuels production in their countries; in Uganda this is much less the case. Obviously this trend is reflected in the expressed training needs.

Stakeholders in Africa:

- Gave highest priorities to: (i) production of liquid biofuels and (ii) pre-processing (pre-treatment) of biomass.
- Strongly prefer classroom-type training

## 2.3

### CROSSCUTTING ISSUES

Turning to crosscutting issues, a comparison of the feedback from Africa and Latin America confirms that the current bioenergy focus in Africa is mainly on liquid biofuels. Another observation is that in Africa the width of the crosscutting issues considered of interest by stakeholders is somewhat broader.

African stakeholders consider the following crosscutting issues the most relevant (most mentioned issues listed first):

- Sustainability criteria for biofuels production:
- Quality standards for biofuel production
- Available financial mechanisms for bioenergy projects, including access to carbon credits such and success stories focused on SMEs and household applications
- Policy development and implementation issues.
- Trade issues: domestic vs. export of biofuels, access to international markets, adequate strategies to compete with neighbouring countries.
- Training at R&D level and international R&D coo-operation on biofuels, and bridging the gap for technology transfer from R&D institutions to industry level
- Develop of private company business plans.
- Social impact of access to energy in rural areas.

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Stakeholders in Latin America consider the following crosscutting issues the most relevant:

- Support on renewable energy policy development
- Awareness raising on the economic advantages of bioenergy
- Sustainability of biofuels
- Certification and standards for improving competitiveness.
- Trade issues and market access (especially for liquid biofuels).
- Financial mechanisms for bioenergy (or renewable energy) projects.
- Fiscal policies and incentives.

Some stakeholders in Latin America considered technology (horizontal) issues as more important, as they felt that there are other international organizations that could take the lead on crosscutting issues. Or they argued that crosscutting issues should be specifically addressed to the government.

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### EXISTING BIOENERGY TRAINING COURSES

In June and July 2008 the Consultant carried out a survey on the availability of bioenergy training courses on the Internet. At the kick-off meeting in June 2008 it was agreed that long term Master Courses and similar academic training courses need not be included in the bioenergy training survey.

The survey covered training course providers and training materials available in any of the following three languages: English, French or Spanish. The results of this survey of training course providers and training materials available online is presented in Annex C. In this Annex the following information is provided:

- Web-based databases on bioenergy training and education
- Websites describing individual bioenergy training courses
- Websites containing bioenergy training course material

Although some scattered training material covering bioenergy issues was identified, this was without exception of a different type, scope and nature to be of direct use and relevance to BIOCAB (see Chapter 6). On the Internet no set of suitable bioenergy training materials can be found that can be used without major modification for BIOCAB. Few, if any, of the material is considered practical and non-academic, whereas this is the intended focus of BIOCAB.

When presenting his findings to the Expert Group Meeting, the EGM confirmed the Consultant's conclusion that little if any suitable existing training material can be found on the Internet. Besides, it will always be necessary to add "local content" when fine-tuning the bioenergy course curriculum in a specific country. For this reason the Consultant recommended that BIOCAB would focus on developing its own training materials.

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## TARGET GROUPS

The BIOCAB training is intended to lead to better and more-informed decision-making and investments in the bioenergy field. It is targeted primarily at the persons that are directly involved in making such decisions and investments, and at the persons that can make an important contribution as information packagers and multipliers.

In the light of this target, BIOCAB will primarily address the following target groups:

**Industry, in particular SME's:** Entrepreneurs should receive training aimed at getting them involved in the biomass business. They are in need of clear guidelines on the development of a bioenergy project or business. The skills of engineers should be strengthened to source, integrate, install, operate, maintain and service bioenergy systems and projects for industrial applications. They need tools and criteria to assess and screen biomass technologies.

**Institutions**, including national investment bureaus, chambers of commerce, sectoral business associations, and international co-operation institutions. These play an important role as information packagers and multipliers.

**Government officials**, at ministerial, national, regional and community levels. These are responsible for the development, implementation and administration of policies and programmes for accelerating the adoption of bioenergy, and need to aggregate and integrate bioenergy into national development strategies in agriculture, forest conservation and sustainable use, rural development, poverty alleviation, energy, rural electrification etc. All relevant Ministries shall be included in BIOCAB. Government officials are also responsible for permitting the construction and operation of bioenergy plants.

**The local finance and banking sector:** Financing is consistently mentioned a bottleneck by developers of bioenergy projects. Senior bank management and loan officers should become more familiar with the risks and rewards of financing bioenergy projects.

**Civil Society Organizations (CSO's):** in some regions –in particular Africa- a driving force to bring modern bioenergy applications forward. CSO's assume a natural role in capacity building.

**Academia:** As centers of (technical and local) knowledge and expertise, universities and research institutes can play an important role in outreach. Academia may be the main source of future bioenergy instructors.

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## TRAINING COURSE COVERAGE

### 5.1 INTRODUCTION

The guiding principle in designing the BIOCAB course content is that the training should be practical in nature and should address the expressed needs of the trainees (as determined/validated in the needs assessment, see Chapter 2). Each training course should make the participating trainees clear what they can do with the acquired skills and knowledge.

To cater for the needs of trainees from various target groups from up to nine different beneficiary countries the BIOCAB training course should cover an extensive number of themes and topics. However, for practical and cost considerations the number of subjects that can be covered needs to be restricted.

Based on discussions at the kick-off and progress meetings, and deliberations at the EGM, the Consultant developed and fine-tuned a “need to know checklist”. This checklist contained a list of key bioenergy issues that beneficiaries should become conversant with, and formed the basis for this chapter.

### 5.2 TRAINING COURSE CONTENT: THE FOUR TRAINING CLUSTERS

In Chapter 1 the BIOCAB objective was defined as “to raise awareness and provide training for representatives at the level of government, institutions, civil society organizations and the private sector to enable their effective decision-making in technology-related aspects of bioenergy by making them conversant with key bioenergy issues”.

Phrased in more practical terms, it can be said that BIOCAB should produce a guide to **realistic** bioenergy opportunities and that it should empower trained persons to make **effective** investment, or policy, **decisions**.

Taking into account this objective, the various BIOCAB target groups, their training needs, and UNIDO’s mandate to stimulate industrial development, the main target of BIOCAB will be to generate, make available and utilise industry-specific bioenergy training course materials. This focus is reflected in four complementary training clusters that together comprehensively cover the key bioenergy issues. These four training course clusters are:

- Cluster A: Technologies & processes (the biomass-to-energy value chain)
- Cluster B: Policy, socio-economic and environmental issues
- Cluster C: Financial and project development issues
- Cluster D: Industrial applications for productive use

Each of these clusters represents a competency. They are interlinked as follows. Cluster A covers the biomass-to-energy chain (vertical issues) and Cluster B covers cross cutting issues (horizontal issues). Cluster C zooms in on the cross cutting issue that is quoted as

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the main barrier to bioenergy deployment (financing) and Cluster D covers bioenergy application in those industries considered to have the best potential for bioenergy deployment. Jointly the four clusters present a comprehensive generic overview of the key bioenergy issues. To become conversant in bioenergy issues, target groups will need to learn and know about each of the four clusters.

The central element of BIOCAB is Cluster D, the industry-specific application of bioenergy systems. However, to fully appreciate and understand the potential for bioenergy in this sector it is adamant that target groups grasp the basic bioenergy knowledge covered in Cluster A-C.

***Box 1: The four training clusters***

**Cluster A** covers the biomass-to-energy value chain, comprising biomass feedstock collection, biomass feedstock pre-treatment, biomass conversion technologies, and biomass end uses and applications. It also includes general guidelines how to build a bioenergy project or business. This module is of general relevance to all target groups and of particular relevance to the target groups in industry (entrepreneurs and engineers).

**Cluster B** sketches the potential role and contribution of bio-energy and the relevance of bioenergy in different policy fields (agriculture, rural development, energy supply, climate change, etc.). It also addresses vertical or cross cutting issues including environmental, socio-economic and sustainability issues. This module is of general relevance to all target groups and of particular relevance to government officials charged with developing, implementing and administrating bioenergy policies and programmes.

**Cluster C** zooms in on the cross cutting issue that constitutes a main barrier to bioenergy deployment i.e. project financing. It covers financial and project development issues. Typical for this module is that much of the issues covered are not specific to bio-energy. Rather they are relevant to any (renewable) energy project. This module is of general relevance to all target groups and of particular relevance to those stakeholders wanting to get a more detailed insight in the viability of bioenergy projects and applications, and the potential income from carbon credits<sup>5</sup>.

**Cluster D** can be seen as the culmination of the Cluster A-C and covers the application of biomass energy for productive use in selected industries i.e. (a) coffee industry, (b) coca industry, (c) rice industry, (d) sugar industry, (e) wood processing industry, (f) palm oil industry and (g) vegetable and fruit processing industry. In each of these industries biomass residues can generate part of the required process energy. Mostly this involves the production of power and process steam, or heat. In the palm oil sector the emphasis will be on the production of liquid biofuels (biodiesel). In the vegetable and fruit-processing sector the emphasis will be on the production of biogas (from fermentation).

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<sup>5</sup> Quite possibly useful training material on these subjects can be sourced from existing UNIDO capacity building initiatives, e.g. in the Cleaner Production area.

### 5.3 TRAINING COURSE PRODUCTS: TWO TYPES OF TRAINING

Within the four clusters introduced above, a total of 17 modules have been identified, as detailed in Table 1 and in the text boxes on the next pages.

**Table 1: Overview of the BIOCAB training course clusters and modules**

Cluster	Modules
Cluster A: Technologies & processes (the biomass-to-energy value chain)	A1. Bioenergy resources A2. Bioenergy technologies A3. Bioenergy end uses and applications A4. Building a bioenergy project or business
Cluster B: Policy, socio-economic and environmental issues	B1. Bioenergy policy and support B2. Environmental issues B3. Socio-economic issues B4. Sustainability issues
Cluster C: Financial and project development issues	C1. Economics and financing of bioenergy projects C2. Carbon emission reduction credits as a source of bioenergy project income
Cluster D: Industrial applications for productive use	E1. Bioenergy use in the coffee industry E2. Bioenergy use in the cocoa industry E3. Bioenergy use in the rice industry E4. Bioenergy use in the sugar industry E5. Bioenergy use in the palm oil industry E6. Bioenergy use in the wood processing industry E7. Bioenergy use in the vegetable and food processing industry

As explained in Section 5.2 above, clusters A-C represent the key horizontal and vertical bioenergy issues, and the ten modules contained therein are considered the minimum for a trainee to build a competence in bioenergy in general. The seven modules in cluster D are each industry-specific. Individual modules are primarily of relevance to trainees serving or working (or aspiring to serve or work) in the industry under consideration. Training in these modules is considered to build a competence in industry-specific bioenergy applications.

Trainees from target groups that are less directly involved in (policy or investment) decision making on bioenergy issues can still stand to profit from BIOCAB. The Expert Group Meeting recommended not limiting BIOCAB training to competence building only but to include awareness raising as well, so that trained persons can develop an opinion.

The main purpose of awareness raising is to present an overview of basic bioenergy knowledge that everyone that has to deal with bioenergy should have. Awareness raising training entails more general and less rigorous coverage of the key bioenergy issues covered in the competence-building course. With relatively modest effort, awareness raising training material can be extracted from the training materials that will be developed for competence building. For awareness raising, summaries (extracts) from the four training cluster textbooks will be combined into a single introductory text.

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The awareness-raising training can be considered an attractive BIOGAB bonus, offering an added benefit at a small cost. BIOGAB will thus produce two main training products:

- Detailed, thorough, tailor-made and industry-specific bioenergy training materials
- Introductory, more general bioenergy training materials

The content of each of the four clusters is listed in text boxes on the next few pages.

**Cluster A: Technologies and Processes (the biomass-to-energy value chain)**

**A1. Bioenergy resources**

- Biomass classification, Woody and non-woody biomass, Residues and wastes
- Biomass characteristics: heating values, energy quality, efficiency
- Competing uses of biomass, resource assessment, available bioenergy

**A2. Bioenergy technologies<sup>6</sup>**

- Biomass harvesting and pre-processing technologies
- Technologies to convert biomass into electricity and heat
- Technologies to convert biomass into liquid biofuels
- Second generation biofuel production processes and biorefineries

**A3. Bioenergy end uses and applications**

- Products: charcoal, liquid/oil, fuel gas, heat, electricity
- Small scale urban and rural enterprises using biomass (e.g. fish smoking, bakeries, tea industry)
- Medium and large scale industries using biomass (e.g. steel rolling mills, cement production, sugar industry, lime production, etc.)
- Matching fluctuating load (and steam) demands
- Stand-alone rural application including mini grids
- Product standards and specifications, biofuel quality aspects

**A4. Building a bioenergy project or business**

- Tools and criteria to assess and screen biomass technologies (pro's and con 's of different applications, typical costs levels, orders of magnitude for scale of operation, maintenance requirements etc.)
- *"How entrepreneurs can get involved in the biomass business"*: guidelines on the development of a bioenergy project or business

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<sup>6</sup> In 2007 UNIDO commissioned an opportunity study entitled "Biomass Conversion Technology On-Line Information Platform (BIITIP) – Phase I". The study explored bioenergy conversion pathways that are (a) commercially available, (b) applicable in the small-to-medium capacity range (electric power demand < 10 MW<sub>e</sub> and total energy demand < 50 MW<sub>th</sub>), and (c) appropriate for use in developing countries. When implemented ahead of BIOGAB, BIITIP will be an excellent source for technological information.



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**Cluster B: Policy, socio-economic and environmental issues**

**B1. Bioenergy policy**

- Objectives of bioenergy policies
- Policy challenges and opportunities
- The need for biomass energy strategies
- Main barriers to sustainable management of the biomass energy sector
- Development of a national biomass energy strategy
- Institutions and key elements for implementation & replication of bioenergy projects
- Aggregation and Integration of policies
- Support instruments (including incentive schemes)

**B2. Environmental issues**

- Energy Balances
- Emissions
- Life Cycle Assessments
- Biodiversity
- Other impacts

**B3. Socio-economic issues**

- Meeting the Basic Needs of the Rural Poor
- Creating Opportunities for Income Generation
- Gender Impacts
- Land Use Competition and Land Tenure
- Socio-economic Indicators

**B4. Sustainability issues**

- Claimed advantages of and disadvantages of bioenergy
- Bioenergy sustainability criteria and certification
- Trade aspects

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**Cluster C: Financial and project development issues**

**C1. Economics and financing of bioenergy projects**

- Techno-economic assessment (TEA): costs, benefits, risks, TEA methods
- Cost comparison with fossil-fuel based alternative
- Project financing: access to finance for bioenergy projects (equity, bank loans, tax incentives, etc.)
- Potential income from carbon credits

**C2. Carbon emission reduction credits as a source of bioenergy project income**

- Carbon Emission Reduction (CER) schemes: Kyoto-type schemes (Clean Development Mechanism, or CDM), voluntary schemes, post-Kyoto schemes
- Developing bioenergy projects as carbon emission reduction projects
- Commercial aspects of carbon credits: costs, markets, prices, risks
- CER opportunities for smaller-scale projects: project portfolios
- Screening CER project ideas
- Glossary of CER terminology

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**Cluster D: Industrial applications for productive use**

**D1. Bioenergy use in the coffee industry**

- Main processing steps and their energy consumption
- Residue availability and characteristics as a fuel
- Suitable bioenergy conversion technologies
- Technical potential for energy self sufficiency: matching energy demand and supply
- Financial potential: economics for different residue utilization scenarios
- Good practices/case studies

**D2. Bioenergy use in the cocoa industry**

- Main processing steps and their energy consumption
- Residue availability and characteristics as a fuel
- Suitable bioenergy conversion technologies
- Technical potential for energy self sufficiency: matching energy demand and supply
- Financial potential: economics for different residue utilization scenarios
- Good practices/case studies

**D3. Bioenergy use in the rice industry**

- Main processing steps and their energy consumption
- Residue availability and characteristics as a fuel
- Suitable bioenergy conversion technologies
- Technical potential for energy self sufficiency: matching energy demand and supply
- Financial potential: economics for different residue utilization scenarios
- Good practices/case studies

**D4. Bioenergy use in the sugar industry**

(Same subjects)

**D5. Bioenergy use in the wood processing industry**

(Same subjects)

**D6. Bioenergy use in the palm oil industry**

(Same subjects)

**D7. Bioenergy use in the vegetable and fruit processing industry**

(Same subjects)

**5.4**

**TAILORING TRAINING COURSES**

A full BIOCAB training course would consist of all three Clusters A, B and C plus one or more industry-specific modules from Cluster D. However, depending on the training needs of the person to be trained it may be decided not to cover all the three Clusters in a training event. When for a particular target group certain issues are of lower relevance it makes sense not to include these in a specific training event. For example, for

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representatives of local banks and financial institutions the vertical issues in Cluster B may be of lower relevance.

A training event will therefore consist of any combination of Clusters A, B and C, plus one or more optional industry-specific modules from Cluster D. Adopting a pick-and-mix approach, training courses will be tailored so that the target group's needs are optimally and cost-effectively met. The picking-and-mixing approach will be limited to the cluster level.

For trainees that consider a general introduction in bioenergy issues sufficient for their needs an introductory awareness-raising course will be on offer, along the lines discussed in Section 5.2 above.

**6.1 TRAINING COURSE MATERIALS NEEDED**

Various modes can be chosen when delivering training. Common options include:

- Classroom lectures
- Practical sessions in working groups
- Field trips/site visits
- CD or DVD (with films and videos)
- Computer- or internet-based learning

The first two options refer to group-wise, classroom-based training. In the case of lectures the audience can be somewhat larger, and the audience will mainly listen. In the case of working groups a much more active contribution from the audience is expected, and therefore the size of the training group will tend to be smaller. For practical reasons, field trips/site visits also take place in somewhat smaller groups. They are commonly used to illustrate practical and real-life illustration of the classroom theory. Site visits/field trips may not always be possible to organise locally; in such case showing a film may be a useful alternative<sup>7</sup>. Films and videos can be watched as a group or on an individual basis. The last training delivery option, computer- or internet-based learning, is the most individual of the learning modes. In this case there is little or no direct interaction with the lecturer or the other trainees.

All but the last of the delivery modes could be important elements of a BIOCAB training course. What delivery modes are selected for a given training course depends amongst others on the local availability (e.g. the practical possibility to organise a local site visit, or the access to a relevant film), the local culture and what trainees are used to. A mix of delivery modes shall be used, as different settings and situations demand for different approaches. Within BIOCAB computer/Internet-based learning is considered not realistic, considering that in general access to personal computers is still rather poor in the case of e.g. Africa. It is furthermore understood from the EGM that in China lecture-style training (in the Chinese language) is the norm. The common delivery mode will need to be taken into account when organising BIOCAB training events in China or in other countries with a similar educational culture.

The training material that is applied should fit the different delivery modes. Training materials shall not be restricted to textbooks. For the practical sessions in working groups e.g. calculation tools and case studies are required. For the field trips/site visits background documentation on the projects and organisations to be visited will be useful. To be able to show films and videos relevant footage will need to be collected and/or compiled.

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<sup>7</sup> UNIDO's Cleaner Production training course is a good example of a training course that makes use of video materials.

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Training materials needed for lecture-style training courses include:

- A set of PowerPoint presentations for use by instructors
- A training manual (textbook) for use by trainees

When training of trainers is considered, as is the case in BIOCAB (see later chapters), a training manual (textbook) for use by future trainers shall also be provided.

The following items are considered always useful and may also be included:

- An overview of documents and websites suggested as recommended reading for further study
- Terminology: Definitions and important terms
- Common biomass classification methods
- Quick Guide on bioenergy project development
- Selected case studies / showcases / lighthouse projects / best practices

Training materials will initially be developed in English and may be translated as required in Spanish, French, or other languages (e.g. Portuguese) as deemed relevant.

## 6.2 TRAINING COURSE MATERIALS AVAILABLE

From the Internet survey (see Chapter 3) it had become clear that little bioenergy training course material is available online that addresses a significant share of the BIOCAB training themes and topics. And even where and when training material is found and available a lot of work will still be required to make the material suitable for use within BIOCAB, like (1) adding topics not yet addressed, (2) updating existing training modules, (3) fine-tuning existing training modules to meet the needs of the BIOCAB target groups, and (4) translating training modules. Furthermore, existing training materials are likely to be copyright-protected and commonly will not be freely available for use by a third party.

The EGM mentioned various organisations that had developed training material related to bioenergy issues, including<sup>8</sup>:

- The East Africa Programme of Gesellschaft für Technische Zusammenarbeit (GTZ)
- The Eastern and Southern Africa Management Institute (EASMI)
- The Centre for Regional Integration and Management Development (MANANGA)
- United Nation Environment Programme (UNEP), both UNEP Risoe Centre on Energy, Climate and Sustainable Development (URC) and the Energy Branch of UNEP DTIE (Division of Technology, Industry, and Economics) in Paris.
- COMPETE initiatives (BEPITA and BEPINET),

However, the EGM also held the opinion that there is not a lot of existing training course material that could be used more or less right away by BIOCAB. The materials developed by the organizations above tend to be aimed at the academic level, rather than that of skilled workers.

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<sup>8</sup> The list is probably far from complete but the general picture is considered clear.

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Considering the limited availability and relevance of existing training materials as well as the various limitations to the potential of using these within BIOCAB the Consultant concluded it would be best to develop BIOCAB training course modules more or less from scratch. A possible exception is Cluster C. Quite possibly training materials covering the economics/financing of (bio-) energy projects and/or carbon credit schemes can be made available from earlier or ongoing human capacity building projects and activities of UNIDO or its sister UN Agencies.

### **6.3 TRAINING COURSE MATERIAL DEVELOPMENT AND VALIDATION**

When developing dedicated BIOCAB training modules obviously existing training materials can serve as inspiration and starting point, in particular when an expert/consultant that has prior experience developing bioenergy training course material is involved. To develop industry-specific and country-specific modules significant involvement of local experts may be required.

At the kick-off meeting it had already concluded that it would be advantageous to test and validate any newly developed training material before using and distributing it on a wider scale. The same observation was made by the EGM, which stressed the importance of field-testing and subsequent fine-tuning of developed training materials.

### **6.4 TRAINER QUALIFICATION REQUIREMENTS**

The quality of the BIOCAB training lies not only in the scope, type and content of the training materials and the delivery modes. It also depends on the type and skills of the trainer (instructor). Considering the many different target groups that BIOCAB aims to address an instructor with a flexible lecturing style is called for.

Ideally, BIOCAB instructors presenting any of the detailed clusters should meet the following criteria:

- Instructors need to be able to adjust their training style to the cultural setting (in other words, be culturally-sensitive)
- Instructors need to have practical experiences in the subject area and as a teacher
- Instructors shall be capable to share the perspective of the trainee
- Instructors can deal with interactive training style (covering case studies, working groups, discussion groups etc.)
- Instructors can adjust the training material to local conditions/circumstances

In addition to these versatile and experienced cluster instructors two more types of trainers may be involved in BIOCAB. For the modules in Cluster D, resource persons from e.g. industry may be involved, to bring in hands-on experience to the training course. And for the introductory awareness-raising course BIOCAB may rely on generalists, rather than specialised instructors. An option worth considering is to involve UNIDO's own staff in the awareness-raising courses.

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## BIOCAB IMPLEMENTATION APPROACH

The **rationale** for UNIDO to implement the BIOCAB training package is that it will lead to better and more-informed decision-making and investments in the bioenergy field. BIOCAB will produce a guideline to realistic bioenergy opportunities, and will empower trained persons from selected target groups to make effective bioenergy investment and policy decisions.

The leading question in designing the detailed BIOCAB work programme, elaborated in the next Chapter, is what mechanisms need to be put into place for BIOCAB to be a (long-term) success. This question can be answered as follows:

- The **central element** and one of the main outputs of BIOCAB is a technically sound training package with objective, assessed information on modern bioenergy technologies for industrial applications and productive end-uses. The training package has a **sectoral focus**, and will specifically target seven or so agriculture, forestry-based and food processing industries, that have a good potential to provide modern bioenergy.
- The BIOCAB **target groups** belong to the main stakeholders in the bioenergy field. BIOCAB will cater to practioners (engineers and operators) from leading industries. It will also provide policy guidance to government officials charged with the development, implementation and administration of policies and programmes for accelerating bioenergy deployment. Thirdly it will target information packagers and multipliers servicing players in the bioenergy field (such as e.g. trade associations).
- BIOCAB has a hands-on nature, and focuses on providing **practical and non-academic** material. The BIOCAB training material will be steered towards bioenergy applications in developing countries. The training will be delivered using a tailor-made **mix of delivery modes**, taking into account that different cultural settings and country situations demand for different approaches. Only part of the BIOCAB training will be in the form of classroom lectures. Practical sessions in working groups, case studies of success stories, field trips to flagship bioenergy projects and users, and audiovisual material such as films and video's will also be applied.
- A further important BIOCAB element is **South-South co-operation and knowledge transfer**. Specialists from the own continent will deliver the training. Case studies will focus on success stories from the own region. Field trips and audiovisual material will concentrate on applications in developing countries.
- To ensure that the training materials meet the needs and demands of trainers these will be invited to give feedback that will be used to **validate** and further improve drafted training materials (see Section 6.3 above).



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- In addition to training target groups to make better and more-informed decisions and/or to become better aware of the key bioenergy issues, BIOCAB will act as a catalyst to local bioenergy development by bringing together target groups from different backgrounds. By making it part of the training programme BIOCAB will explicitly offer the opportunity for **networking and interaction** between these groups. Taking an interest in the drivers of other target groups will help to build mutual trust and confidence. Such interaction will take place at all levels that BIOCAB training is offered, be it international, regional, national, or local.
  - Another key factor of BIOCAB is that after the initial (start-up) phase regional or national counterparts run further BIOCAB training courses themselves. Considering the current level of bioenergy training capacity this calls for the **training-of-trainers**. Through the international training-of-trainers BIOCAB will create capacity at the level of national cleaner production centres or similar institutes. In each BIOCAB country a training structure, including a focal point and a **network of training partners** that can sustain the BIOCAB training programme and develop country-specific training materials will be set-up. Training partners can consist of universities, industry experts, local consultant and other resource persons.
  - To enhance the perspective on long-term sustainability and success BIOCAB will co-operate and collaborate with multilateral development organizations and other stakeholders<sup>9</sup>. Such collaboration shall go beyond the mere exchange of general information on the BIOCAB programme.
  - To ensure quality control, the users of the training materials and a **Steering Committee** will be involved. The role of the Steering Committee is that of guardians of the BIOCAB training modules, and to help keep BIOCAB implementation on track. They may also assist to reach-out to other donor agencies.

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<sup>9</sup> To give some examples of such stakeholders: in Africa this may include UNCTAD, UNDP, UNEP, FAO, the International Fund for Agricultural Development, the UN Foundation 's International Bioenergy Initiative as well as other UN system agencies including some that are joined in UN-Energy; the African Development Bank (AfDB), the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), the Kreditanstalt für Wiederaufbau (KfW), the Italian Ministry of the Environment, Land and Sea, the Directorate General of International Cooperation (DGIS) of the Government of the Netherlands, the European Union Energy Initiative (EUEI) and its Africa BioEnergy Fund, the Renewable Energy and Energy Efficiency Partnership (REEEP), the Global Village Energy Partnership (GVEP), et cetera.

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## 8 IMPLEMENTING BIOCAB

### 8.1 INTRODUCTION

Implementation activities have been grouped into six blocks, as follows:

1. Developing the BIOCAB training infrastructure
2. Defining the national BIOCAB training curriculum
3. Developing/validating “core” BIOCAB training material and training-of-trainers
4. Adding “local” content and training of target groups
5. Ensuring long-term self-sustainability of BIOCAB
6. BIOCAB follow-up activities

In the first block, *developing the BIOCAB training infrastructure*, the Steering Committee will be established and the main partners that will contribute to the implementation of the BIOCAB training programme will be identified and contracted.

In the second block, *defining the national BIOCAB training curriculum*, the national bioenergy training curriculum will be determined and the capacity to develop local training content assessed. In the third block, *developing/validating “core” BIOCAB training material and training-of-trainers*, the core bioenergy training course material will be developed and validated and future instructors will be trained. In the fourth block, *adding “local” content and training of target groups*, local content for the bioenergy training course will be developed and validated and beneficiaries will be trained. The fifth block covers the activities aimed at making BIOCAB “fit for the future” and involves co-operation with the development assistance community, the fine-tuning of the BIOCAB training module, and the development of national strategies for the follow-up phase. The sixth block covers follow-up activities.

### 8.2 IMPLEMENTATION OUTLINE

#### 8.2.1 Developing the training infrastructure

A Steering Committee will be established to. The role of this Steering Committee is that of guardians of the BIOCAB training modules, and to help keep BIOCAB implementation on track. They may also assist to reach-out to other donor agencies. An international consultant, or consortium, will be selected and recruited to assist UNIDO with the implementation of the BIOCAB training programme. In each BIOCAB country a training infrastructure, including a focal point and a network of training partners that can run the training programme and develop local (country-specific) training materials, will be set-up. Training partners may include experts from universities, local consultants, industry specialists, NGOs and other sectors of society.

#### 8.2.2 Defining the national BIOCAB training curriculum

The needs assessment carried out at the preparatory stage will be expanded and updated, to determine up-to-date training needs. The capacity of in-country specialists to develop local training content will be assessed. Building on these two assessments above, the focal point, with support of the local training partners, will prepare a market plan and

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develop a local training curriculum. This curriculum shall describe identified target groups, expected number of participants, identified training partners/resource persons, venues, timing, frequency etc. for all BIOCAB training events proposed to be implemented in the country.

### **8.2.3 Developing/validating “core” BIOCAB training material and training-of-trainers**

Training materials will be developed, in two or more stages e.g. by initially developing only the materials needed for lecture-style classroom sessions, or to just 1-2 bioenergy conversion technologies and/or applications. An alternative approach is the cluster-wise development of training material. Drafted training materials will be presented to UNIDO and the focal points for review. Relevant feedback will be incorporated. Finalised training materials will be field-tested and validated at a regional train-the-trainers course. The main purpose of these courses, however, is to train BIOCAB focal points or their network partners to become an instructor themselves. Such course may last up to one week. One course will be given per region (Latin America, Africa or Asia). Later a refresher course may be given. This can be a single training event serving all three continents.

### **8.2.4 Adding “local” content and training of target groups**

Building on the base set of “core” training materials, additional “local” of country-specific content will be developed. Examples of country-specific content include (i) the availability of financing for bioenergy projects or (ii) detailed case studies on industrial applications for productive use. Additionally the training materials may be translated. The focal point shall take the lead developing (translating) such content. An in-country training course will be used to validate the content. The newly trained persons will take on the role of instructor. They may be assisted by regional/national experts. Comments and feedback received from trainees will be incorporated in the country-specific training material<sup>10</sup>. The main purpose of these courses, however, is to train target groups. In each country a set of different training courses, each with their own target group, scope, content, duration etc. will be held, as defined in the national BIOCAB training curriculum.

### **8.2.5 Ensuring long-term self-sustainability of BIOCAB**

The focal points in the BIOCAB countries will establish contact with agencies and offices of development assistance organizations (including (AfDB, AsDB, ECLAC, ESCAP, ECOWAS, EU, etc), and with other bioenergy training stakeholders (e.g. industries) actively operating in their countries and continents to inform them on the BIOCAB programme and to access the potential for collaboration in one way or the other.

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<sup>10</sup> An interesting feature of developing local content like case studies is that it may also be useful for use in other countries. With a view of promoting South-South co-operation it is worth considering to set-up a central database of case studies and other relevant locally developed material for use beyond a single country.

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The international consultant, working closely with the national focal points in the demonstration countries and UNIDO, will evaluate whether the BIOCAB training module operates satisfactorily and whether any fine-tuning is required. In parallel, each focal point will develop a strategy how to self-sustain BIOCAB for a minimum of 3-5 years. The strategy will contain similar elements as the market plan and course curriculum initially developed, and take into account the lessons learned during BIOCAB implementation. The strategy may focus on continuation in a specific demonstration county, but ambitious focal points may also consider covering additional countries.

#### **8.2.6 BIOCAB follow-up activities**

It is recommended that the training infrastructure (focal point and network of training partners) and training materials (“core” content supplemented with “local” content) be kept up to date. Or that these are newly developed, in case a new country joins the BIOCAB training mechanism. Training sessions may be used to collect feedback (suggestions and input) for improving and/or finalising updated training materials.

The activities in this last block will be implemented beyond the original duration of the BIOCAB project (36 months).

**BUDGET AND PLANNING****9.1 INDICATIVE BUDGET**

Based on the initial participation of up to nine (9) countries, the cost associated with the implementation of the activities described in Chapter 8 above are estimated at some EUR 1,250,000. This includes a substantial allocation of seed-money for the follow-up phase.

The main costs are summarised in Tables 8-11 below. The Excel spreadsheet used to determine the budget allocations is available as a separate Excel document.

**Table 2: BIOCAB budget: Services of the international consultant**

<b>International consultant</b>		<b>Euro</b>
BIOCAB project management	2 mm	32000
International content and training-of-trainers	14 mm	224,000
Support to national focal points	9 mm	144,000
<b>Subtotal professional services</b>	<b>25 mm</b>	<b>400,000</b>
Trips to Vienna	10 trips	7,500
Intercontinental trips	26 trips	65,000
<b>Subtotal travelling</b>	<b>36 trips</b>	<b>72,500</b>
Organization of regional courses	4 courses	20,000
<b>Subtotal courses organization</b>	<b>4 courses</b>	<b>20,000</b>
<b>Contingency</b>		<b>7,500</b>
<b>Total international consultant</b>		<b>500,000</b>

**Table 3: BIOCAB budget: Services of the national focal points**

<b>National focal points</b>		<b>Euro</b>
No. of BIOCAB countries		9 countries
Manpower per country	6 mm	30,000
<b>Subtotal manpower</b>	<b>54 mm</b>	<b>270,000</b>
Participation in regional courses		5,000
<b>Subtotal travelling</b>	<b>9 countries</b>	<b>45,000</b>
Organization of national curriculum		10,000
Subcontracting local specialists		10,000
<b>Subtotal courses organization</b>	<b>9 countries</b>	<b>180,000</b>
<b>Contingency</b>		<b>5,000</b>
Contingency	<b>9 countries</b>	<b>45,000</b>
<b>Total national focal points</b>		<b>450,000</b>

**Table 4: BIOCAB budget: Other costs**

<b>Other costs</b>	<b>Euro</b>
Seed-money follow-up phase	160,000
Miscellaneous (mid term review; steering committee etc.)	50,000
<b>Total other costs</b>	<b>210,000</b>

**Table 5: BIOCAB budget: Summary**

<b>Summary</b>	<b>Euro</b>
International consultant	500,000
National focal points	540,000
Other costs	210,000
<b>Total budget</b>	<b>1,250,000</b>

## 9.2

**PLANNING**

Based on the initial participation of up to nine (9) countries, the duration of the activities described in Chapter 8 above is estimated at up to 36 months (3 years, see Table 12). This does NOT include the time associated with implementation of the follow-up phase.

**Table 6: Planning for implementation of BIOCAB**

<b>#</b>	<b>Activity</b>	<b>Period</b>
<b>A</b>	<b>Developing the BIOCAB training infrastructure</b>	<b>Q1-Q2</b>
A1	Selection of international consultant	Q1
A2	Selection of focal points in beneficiary countries	Q1
A3	Developing the in-country training infrastructure	Q2
<b>B</b>	<b>Defining national BIOCAB training content and curriculum</b>	<b>Q2-Q3</b>
B1	Updating the needs assessment	Q2
B2	Assessing the capacity to develop local training content	Q2
B3	Finalizing the local BIOCAB training curriculum	Q3
<b>C</b>	<b>International content and training-of-trainers</b>	<b>Q2-Q5</b>
C1	Development and testing of international training course material	Q2-Q5
C2	International train-the-trainers courses	Q4-Q5
<b>D</b>	<b>Local content and training of target groups</b>	<b>Q4-Q10</b>
D1	Development and testing of country-specific training materials	Q4-Q8
D2	Target group specific training courses	Q5-Q10
<b>E</b>	<b>Ensuring long-term self-sustainability of BIOCAB</b>	<b>Q3-Q16</b>
E1	International co-operation and promotion	Q3 onwards
E2	Updating BIOCAB training materials	Q11-Q12
E3	Develop and implement a strategy to self-sustain BIOCAB	Q11-Q12
<b>F.</b>	<b>BIOCAB Follow-up activities</b>	<b>Beyond</b>
F1	Maintaining BIOCAB training materials	Beyond
F2	Producing additional BIOCAB training materials	Beyond
F3	Running additional BIOCAB training course	Beyond

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## A. OUTCOME OF THE KICK-OFF MEETING

Outcome of the kick-off meeting held at UNIDO headquarters, Vienna, 25 June 2008.

Attendees: Claudia Linke-Heep (UNIDO), Manuel Caballero Alarcon (UNIDO), Yoon Young ("Angela") Choe (UNIDO), Douwe van den Berg (BTG) and John Vos (BTG).

The needs assessment report will not be available for some time. BTG shall not wait for its completion.

The Latin American stakeholders interviewed for the needs assessment

- Gave the highest priority to (i) production of liquid biofuels and (ii) pre-processing (pre-treatment) of biomass.
- Indicated that they would like to learn from the experience of others
- Confirmed the demand for (i) how-to "manuals" and (ii) Best Practice examples
- Said that the IADB and WB do not provide training that addressed broader bioenergy issues. Any (training) workshop always addressed wider ("RE in general") or more focused ("liquid biofuels") issues

BIOCAB will include practical training courses for policy makers, institutions and engineers. Two extremes on the training scale:

- On the one hand of the scale vocational training for (small) industries
- On the other hand of the scale non-academic training for National Productivity Centers (NPC's) and Ministries

Technology is always key to UNIDO's contribution and shall also be key in the training modules.

Which (training) institutes from developing countries will be involved in BIOCAB is a political decision and will not be determined until the first phase of the implementation phase. A MOU will be signed with the selected institute(s).

For a more focused approach the meeting agreed that it should first be determined how the training course could look like (Task 1.2) before the current availability of training courses is checked (Task 1.1).

In the Task 1.1 assessment of (long-term) Master Courses and other academic training need not be included.

Claudia thinks FAO and UNEP do not have suitable bioenergy training materials.

Angela was asked to check with (other) UN Agencies (see pg. 7 of the BTG proposal) Suitable candidate sources for training material may include (forestry) associations.

Tentative dates for the next meeting in Vienna:

- 6 August 2008 - Meeting with UNIDO staff; 7 August 2008 – Expert Group Meeting
- BTG will send UNIDO some suggestions for suitable experts by 27 June the latest
- UNIDO will invite people to the EGM

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- In case many experts are not available the EGM may be postponed by 1 week

Items to be presented at the Expert Group Meeting (EGM)

- Contents of the training modules
- Proposed implementation modalities
- A first draft of this information will be sent to UNIDO by Monday 21 July 2008 (later revised to Wednesday 23 July 2008)

Training materials (based on the ALTENER bioenergy course approach)

- Textbook
- Overhead sheets
- Background information could be contained in a general database, accessible online
- In addition country-specific material would need to be developed by/for the trainers

Training approach (compare the ALTENER course!)

- Three large training-of-trainers programmes (1 per continent)
- Learn what training material needs improvement
- Adjust the training material
- Make the revised training material available to the trained trainers

Training module structuring

- General technology conversion
- Separate modules for selected agro-industries each (coffee, rice, sugar, palm oil etc)

**Possible bioenergy training module set-up**

***Vertical issues (following the value chain)***

1. Biomass resources (residues, energy crops), characteristics, harvesting and logistics
2. Physical pre-processing (comminution, densification, mechanical extraction)
3. Conversion technologies, including liquid biofuel production (re. BIOTIP)
4. End uses (applications, matching fluctuating load (and steam) demands, stand-alone rural application including mini grids, biofuel quality aspects, etc.)

***“Horizontal issues”***

5. Financial issues (e.g. feasibility, financing, CDM)
6. Sustainability and environmental issues (e.g. sustainability, emissions, Life Cycle Assessments, trade/certification/standardization)
7. Policy issues (e.g. required legislation, national biomass plan, minimum elements of a biomass energy policy, incentive schemes etc.)

***“Industrial applications for productive use”***

8. Bioenergy use in the coffee industry
9. Bioenergy use in the rice industry
10. Bioenergy use in the sugar industry
11. Bioenergy use in the palm oil industry
12. Bioenergy use in the wood processing industry



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The training should address the needs from trainees, and “what they can do with it”. The last of the listed modules will make the trainees aware of the options in the economic sector that they work in.

The type of trainer needed is someone who is familiar with and knows about the sector/ industry (conversion rules of thumb; cost/price of biomass residues, prices of electric power, alternative biomass uses) **AND** about the technology → The modules would need to be written/taught by different persons and ideally the person comes from the country/region covered.

Because it is impossible to find someone that is specialized in all bioenergy details each training module may require its dedicated trainer. In other words for 6 modules up to 6 different training could be needed!

Claudia concluded that this training-of-trainers approach rules out using local experts when first giving the training course.

Angela suggested, and the meeting concluded, that a framework needs to be developed what trainees need to know. Douwe concurred and said it is good to include some simple tools (like the viability check – a set of simple financial evaluation tools - suggested in the BIOTIP project). Claudia really likes BIOTIP’s “lessons learned” (best practices??? – JV) module.

#### Basic agreement on the training approach

- Training of trainers
- This training will last 1-2 days
- There may be separate trainers for each training module
- Training material will basically be prepared from scratch (also to circumvent copyright infringement!)
- Training material will be placed online
- Training material will be prepared in three languages (English, French and Spanish)
- Interactive training

#### Deliverables expected from BTG

- Attractive looking brochure (Task 1.2)
- Report on WP 1 (Task 4.1)
- Contribution to the ProDoc for the BIOCAB implementation phase (Task 4.2)

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## B. HIGHLIGHTS OF THE PROGRESS MEETING

Outcome of the progress meeting held at UNIDO headquarters, Vienna, 6 August '08.  
Attendees: Claudia Linke-Heep (UNIDO), Manuel Caballero Alarcon (UNIDO), Yoon Young Choe (UNIDO), Douwe van den Berg (BTG) and John Vos (BTG).

**Target groups:** different needs and expectations. How to deal with this ? Technicians may want to know the nitty-gritty and the bolts and nuts of a technology but this is not of interest to the policy makers. Solution?: TG-Training module matrix

**Phased course development.** Phase 1a: develop a generic comprehensive bioenergy training package. Aimed at a broader group, with different backgrounds.  
Phase 1b: Validation of the training material. Adding case studies/country examples.  
Phase 2: Develop/add regional focus → (lots of) adjustments.  
Phase 3: One institute in the region takes the lead adapting the training material and running the course

**Training structure per country:** focal point (e.g. NCPS) plus network of training partners (Universities, experts, etc.). Manuel gave an example from a talk he had earlier the week with a UNIDO colleague on Cluster Development.

### **Impact indicators:**

- (1) Number of trainees
- (2) Network of cooperation partners (in the demo countries)

Involve regional organisations (AfDB, AsDB, ECLAC, ESCAP, ECOWAS, EU, etc) in the dissemination of the programme. The REEEP/UNIDO training course on "Sustainable Energy Regulation and Policy-making for Africa" made the mistake not to promote itself properly.

### **Promotion, advertising BIOGAB:**

- To reach out to the donor community
- Has it own "speed" and may have to be run in a parallel track with course implementation. (New idea John: work package approach)

### **Training scenarios (implementation modalities)**

How to **sustain** the training programme?

- What training structure should be built up in the region?
- What mechanisms do we need to put in place to ensure long-term self-sustainability of BIOGAB?

Should BIOGAB participants pay? Claudia gave example of Tanzania innovation course. Lasted 3 weeks, participants paid USD 4000.

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If the course material is put online nobody will pay for the course sec, unless you make an attractive package around it (including lectures, case studies, field visits, etc.)

Douwe: it would be nice if the needs assessment could help to determine:

- How much interest is their in the country
- How many people from which target groups

Project structure could include:

Steering Committee (meets 1x/year)

(Groom them to be the guardians of the training modules)

### **PRACTICAL ARRANGEMENTS**

**EGM reporting:** UNIDO will make a summary. Manuel and Angela will split the work. Rather than inviting even more UNIDO colleagues to the meeting the EGM report will be used to get their feedback. The info will go into the ProDoc.

**Sexy brochure:** (*colourful little leaflet thing*)

What should it contain? Detailed implementation arrangements. Example: see Biosafety training programme and distant learning brochures for an idea on possible look & content.

#### **Planning Lot 1:**

Manuel will start working on the Project Document.

27 September 2008: deadline for submitting (i) the Activity report and (ii) the Initial outline/text for the sexy brochure.

7 October 2008: UNIDO to give its comments.

15/16 October 2008: 2-day final meeting in Vienna; make final decisions.

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## C. INITIAL FINDINGS FROM RESEARCHING WEB-BASED INFO

The early results of the web research are categorised as follows:

- Web-based databases on bioenergy training and education
- Websites describing individual bioenergy training courses
- Websites containing bioenergy training course material

### **1. Web-based databases on bioenergy training and education**

#### **RETScreen International®**

<http://www.retscreen.net/ang/universities.php>

RETScreen contains a list with the names of 162 active Universities & Colleges, grouped by country. Unfortunately no details whatsoever are available at the website, and it is not clear what it means that an institution is included in the list.

The training calendar [www.retscreen.net/ang/11\\_form1.php](http://www.retscreen.net/ang/11_form1.php) lists 3 courses, all starting in 3Q 2008. None of these is aimed at bioenergy.

#### **REEEP Training and Education Database (TED)**

[ted.reegle.info](http://ted.reegle.info)

The Training and Education Database (TED) was initiated by the Vienna-based REEEP (Renewable Energy and Energy Efficiency Partnership) as a registry of available courses and training in the field of renewable energy and energy efficiency.

The TED Catalogue currently contains a brief description and contact information of some 336 courses, educational, vocational and university, on renewable energy and energy efficiency. In addition to the name of the education provider the Catalogue specifies: (a) Mode of course delivery, (b) Course Type, (c) Coverage/ scope (keywords), and (d) Type of certificate awarded. A list of all courses is presented at [ted.reegle.info/show-all-available-actors.14.htm](http://ted.reegle.info/show-all-available-actors.14.htm).

TED covers 3 course type categories (i.e. Education, University and Vocational) and 3 thematic sectors (i.e. Climate Protection, Energy Efficiency and Renewable Energy). Within the thematic sector “Renewable Energy” courses on the subject “Biogas, Biomass and Biofuels” can be selected. If done so, only 6 courses are found, of which 4 have a predominant bioenergy focus. All of these are university-level courses i.e.

- Bioenergy Specialisation Diploma (Zaragoza)
- Biomass Energy Processing (Iowa Lakes Community College)
- Clean Energy Distance Learning online courses (Willis College of Business and Technology, Canada)<sup>11</sup>

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<sup>11</sup> Not considered a well-reputed institution at university level in Canada by UNIDO

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- Energie- und Recyclingmanagement (University of Applied Sciences - Nürtigen-Geislingen)

### **Bioenergy Network of Excellence**

[www.bioenergy-noe.com](http://www.bioenergy-noe.com)

In the frame of the EU funded Bioenergy Network of Excellence (Bioenergy NoE) a review was completed in 2005 and updated in spring 2008 investigating bioenergy undergraduate, postgraduate and research training in the European Union.

The 2005 study<sup>12</sup> found that 55 out of the 60 Masters courses teaching bioenergy surveyed in Europe began between 2000 and 2005. The Bioenergy NoE surveyors commented that “*short seminars and short courses in bioenergy topics market is poorly served, in comparison to the growing market in renewable energy and bio-energy masters’ courses or similar*”.

### **ThermalNet<sup>13</sup>**

[www.thermalnet.co.uk](http://www.thermalnet.co.uk)

In the frame of the EU funded ThermalNet project the University of Florence held an on-line survey assessing (a) the existing and anticipated educational need from the bioenergy industry and public sector stakeholders, and (b) the currently available biomass education and training activities in Europe. The results of the survey were presented at the final ThermalNet meeting held in Vienna in April 2008 and can be accessed at [www.thermalnet.co.uk/Resources/user/docs/12%203C%20TNetCREAR.pdf](http://www.thermalnet.co.uk/Resources/user/docs/12%203C%20TNetCREAR.pdf). An article on the survey<sup>14</sup> can be found in the final issue of the ThermalNet Newsletter, published in June 2008.

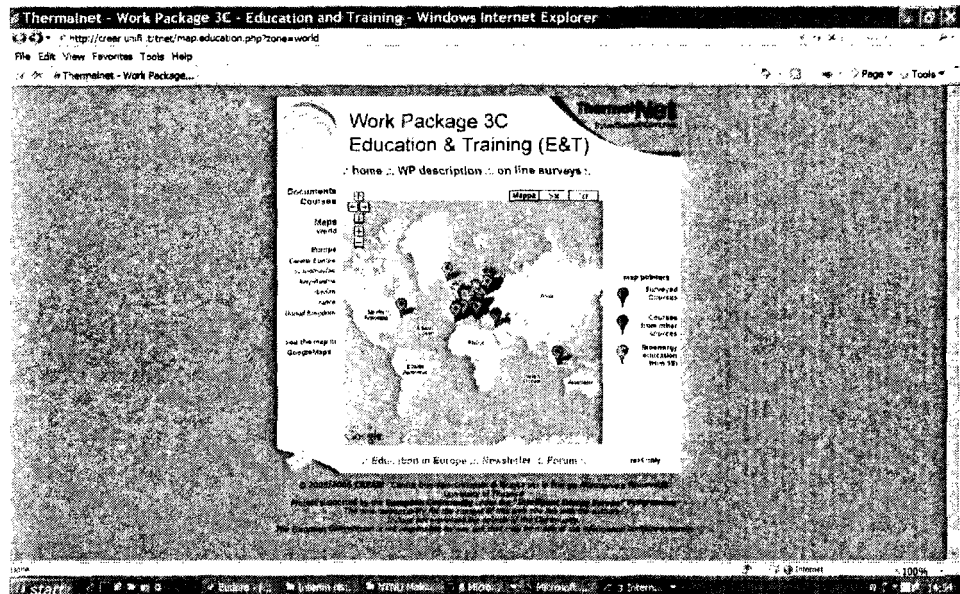
Until December 2007, the University of Florence identified a total of 44 courses. A web map of the courses surveyed can be found at <http://crear.unifi.it/tnet/map.education.php?zone=world>. See Figure below.

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<sup>12</sup> It is understood that the results of the spring 2008 survey will become publicly available sometime in August 2008.

<sup>13</sup> Full title: An integrated network on thermal biomass conversion for power, heat and transport fuels.

<sup>14</sup>



## **II. Bioenergy education and training courses**

In the European Union, several Master Courses cover the issue of bioenergy, usually as part of a larger curriculum. Some examples that were found using the above mentioned ThermalNet database are listed in Box @@ below. As Masters Courses are not targeted in BIOGAB these courses will not be analysed in detail.

### **Box @@:**

#### **A few samples of Masters Courses in EU countries covering bioenergy issues**

<http://crear.unifi.it/imes/index.eng.php>

International Master in Bioenergy and Environment.

University of Florence, Italy

In Italian and English.

<http://crear.unifi.it/tnet/download/ViennaUniversity.pdf>

Renewable Energy in Central and Eastern Europe

Vienna University of Technology, Vienna & Energiepark Bruck/Leitha, Austria M.Sc.

Program Renewable Energy in Central and Eastern Europe

<http://crear.unifi.it/tnet/download/VaxjoEducationalPlanBioenergy.zip>

Programme in Energy Technology with emphasis on Bioenergy Systems

Växjö Universitet, School of Technology and Design, Växjö, Sweden

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*Summer courses*

**Energy in minds! Project Bioenergy Use Summer Course**

[www.energy-in-minds.de](http://www.energy-in-minds.de)

Contact Mr Göran Sidén, email: [goran.siden@hh.se](mailto:goran.siden@hh.se), Phone +46 35 16 71 19.

Full-time (100%) two weeks summer course in English, held from 9-19 June 2008 in Falkenberg, Sweden. The course gives an overview of available bioenergy resources and the environmental, economic and technical aspects on bioenergy use. Up to 25 students per course, basic eligibility requirements. Organised in the frame of the CONCERTO project "energy-in-minds"

*Internet-only courses*

**Course on Bioenergy Technology at Växjö Universitet (Sweden)**

<http://www.student.vxu.se/utbildning/pdf/200706282007030001.pdf>

This is an introductory course to Bioenergy Technology treating fuel properties, production and logistics as well as fuel upgrading processes, combustion/gasification and environmental aspects only in a very shallow way. The course is only offered in English and only as a web based distance-learning course (individual studies supported by recorded lectures). There are no physical meetings in the course.

*Courses and projects specifically targeted at developing countries*

**Energibærere og energisystemer i utviklingsland**

(Energy Carriers and Energy Systems in Developing Countries)

[folk.ntnu.no/lekangso/kurs2005/kurs.htm](http://folk.ntnu.no/lekangso/kurs2005/kurs.htm)

Four-week training course, jointly organised by Norwegian Institute of Science and Technology NTNU and Makerere University in Kampala, Uganda. Held between 18 July and 12 August 2005. Two-weeks of lectures in the classroom and laboratory included 3 days covering bioenergy issues. The 3<sup>rd</sup> week covered field trips and the 4<sup>th</sup> week covered project work.

**BEPITA (Biomass Energy Platforms Implementation for Training in Africa)**

[www.bepita.net](http://www.bepita.net)

COOPENER programme (European Commission) supported bioenergy training project that ran from 2005 –2007. Coordinated by CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement des Pays du Sud), Montpellier, France. BEPITA sought to establish perennial training platforms for biomass technologies that allow their uptake by local operators within two African zones, the "dry zone" and the "wetland zone", each of them covering several countries with common specific energy needs and constraints. Platforms were based in Burkina Faso ("dry zone" base) and Cameroon ("wetland zone" base),

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**BEPINET** (Biomass Energy Platforms Implementation for Training in Latin America)  
[www.bepinet.net](http://www.bepinet.net)

COOPENER programme (European Commission) supported ongoing bioenergy training project that runs from January 2006 until December 2009. Coordinated by CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement des Pays du Sud), Montpellier, France. Seeks to establish perennial regional training platforms for biomass technologies that allow their uptake by local operators within the “Andes zone” and the “Amazonian zone”. Platforms would be clustering a wide range of training activities and services undertaken by experts in training at master level and post graduate as well as professors and professionals.

**ENEFIBIO** - Removal of non-technological barriers to encourage SME energy efficiency by the rational use of biomass  
[www.enefibio.com](http://www.enefibio.com)

The ENEFIBIO project, which was co-financed by the COOPENER Programme and the Walloon Region and coordinated by CRA-W (Walloon Agricultural Research Centre, Agricultural Engineering Department), aimed at removing non technological barriers to encourage SME energy efficiency by the rational use of biomass (agriculture, forest, agro- and wood industry by-products and residues) to produce heat and/or power with efficient technologies. The target countries were Senegal and Cameroon. These two African countries, even if very different regarding their climate, resources and biomass use potential, are representative to their Region, respectively, Sahel and Equatorial Africa.

**COMPETE** - Competence Platform on Energy Crop and Agroforestry Systems for Arid and Semi-arid Ecosystems- Africa  
[www.compete-bioafrica.net](http://www.compete-bioafrica.net)

The objective of COMPETE is to stimulate bioenergy implementation in arid and semi-arid regions in Africa. COMPETE provides a platform for policy dialogue and capacity building and identify pathways for the sustainable provision of bioenergy. Among others, COMPETE enhances the equitable exchange of knowledge between EU and developing countries. COMPETE is co-funded by the European Commission in the 6th Framework Programme – Specific Measures in Support of International Cooperation (INCO-CT-2006-032448). Coordinated by WIP Renewable Energies (Germany).

**DESIRE-net: e-learning platform for Development and Sustainability with International Renewable Energies network**  
[www.desire-net.enea.it](http://www.desire-net.enea.it)  
Last accessed Thursday 26 June 2008.

An initiative of ENEA (Italy) in close collaboration with UNESCO + African Engineering Association. The DESIRE-net project is targeted at 1) Technical officials and Decision makers; 2) Designers; and 3) Technicians. Amongst others, DESIRE-net contains a training module on “Biomass energy”.



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### **Further projects and courses**

Other organisations that have organised bioenergy training courses in/ for developing countries in the past, and may be interested to organise these again, include -to name but a few-:

- Practical Action (founded in 1966 as the Intermediate Technology Development Group, ITDG), <http://www.practicalaction.org/>
- The Bioenergy Group (BEG), Centre for Energy Policy and Technology (ICEPT), Imperial College London
- BTG Biomass Technology Group BV, in collaboration with the University of Twente (Enschede, the Netherlands)

### **III. Bioenergy education and training materials**

From the following bioenergy courses training material is or will be available online:

**BEPITA** (Biomass Energy Platforms Implementation for Training in Africa)

Didactical material can be found at <http://www.bepita.net/materiels/index.htm>

This material is predominantly if not complete in French. Issues covered include:

French	English
Généralités	General information
Energies renouvelables	Renewable energies
Biomasse	Biomass
Cogénération	Co-generation
Audit énergétique dans l'industrie	Energy audits in industry
Gestion de l'énergie dans l'industrie	Energy management in industry
Biomasse et MDP (Mécanisme pour un développement propre)	Biomass and CDM (Clean Development Mechanism)
Production de pellets	Pellet production

**BEPITA** (Biomass Energy Platforms Implementation for Training in Africa)

Material on projects is listed at <http://www.bepinet.net./projetos.html> (but at the time of accessing the site not available). This material would appear to be predominantly in Spanish although some is in English.

**Energy Carriers and Energy Systems in Developing Countries**

[http://folk.ntnu.no/lekangso/kurs2005/presentations/Presentations\\_overview.htm](http://folk.ntnu.no/lekangso/kurs2005/presentations/Presentations_overview.htm)

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## D. SCENARIO OUTLINES

### *Scenario A: The minimum scenario*

In the minimum scenario UNIDO supports capacity building of target groups by using existing bioenergy training courses and materials *only*. After all, there is extensive material already available on the market.

The advantage of this approach is that it is relatively cheap. However, it requires an excellent insight in the supply of bioenergy training courses and the availability of training materials. More importantly, UNIDO would not be able to leave its mark. In this scenario the UNIOD contribution would be more or less limited to providing financial support only.

### *Scenario B: Web based training course*

Scenario B consists of web based distance-learning course i.e. individual studies supported by recorded lectures. This requires the production of recorded lectures, in addition to traditional training materials. There will be no physical meetings and no direct interaction between trainer and trainee.

A big advantage of this approach is that an unlimited number of trainees can be reached, and that once the course has been developed the costs of accommodating an extra trainee are negligible. A major disadvantage is that unless a facility for direct interaction is included (like e.g. email correspondence or Skype) this approach would appear only suitable to convey shallow information.

Examples include the Course on Bioenergy Technology at Växjö University (Sweden)<sup>15</sup> and the DESIRE-net project<sup>16</sup>.

### *Scenario C1: Traditional training course – international venue*

The first type of “traditional” training course concerns the international version. This is commonly given at an established training institute in the participating continent or elsewhere in the world (consultant’s home base, Vienna, etc.). The duration is typically at least one week.

The advantage of this approach is that in such a specialised course a fair amount of detail, catering for the different needs and expectations of the trainees, can be covered. Disadvantages are that a different experienced bioenergy instructor for each training cluster may be required, and that there is a limited contribution from regional/national experts. It also requires trainees to travel considerable distance and to stay overseas for the duration of the training.

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<sup>15</sup> <http://www.student.vxu.se/utbildning/pdf/200706282007030001.pdf>

<sup>16</sup> E-learning platform for Development and Sustainability with International Renewable Energies network, [www.desire-net.enea.it](http://www.desire-net.enea.it)

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Examples include the two weeks Bioenergy Use Summer Course that was organised in the frame of the CONCERTO project Energy in minds! ([www.energy-in-minds.de](http://www.energy-in-minds.de)) in Falkenberg, Sweden in June 2008.

***Scenario C2: Traditional training course – national venue***

The second type of “traditional” training course concerns the national version. This course is given in-country and caters for a national audience. The duration is typically two or three days (including an optional one-day field visit).

The advantage of this approach is that it can look in a fair amount of detail into the local situation, catering for the different needs and expectations of the trainees. Potentially regional/national experts can make a significant contribution, and it is fairly simple to include field visits to bioenergy stakeholders and/or operating bioenergy plants. Disadvantages are that international bioenergy instructors need to travel considerable distance and to stay overseas for the duration of the training. Furthermore, the more individual courses are fine-tuned to local demand (see Section **Error! Reference source not found.**) the more expensive training course preparation and implementation becomes.

Examples include various bioenergy courses of different duration (anywhere from 2 days to 2 weeks) that BTG and similar specialists implemented around the world. Worth mentioning is the course on Energy Carriers and Energy Systems in Developing Countries jointly organised by Norwegian Institute of Science and Technology NTNU and Makerere University in Kampala, Uganda in 2005. ([folk.ntnu.no/lekangso/kurs2005/kurs.htm](http://folk.ntnu.no/lekangso/kurs2005/kurs.htm)). This four-week course included 3 days specifically targeting key bioenergy issues.

***Scenario D: Train-the-trainers course***

In the train-the-trainers scenario a combination is made between the two types of “traditional” training courses discussed above. At the regional course international bioenergy experts teach local persons to become an instructor on a specific bioenergy subject. At the national course the newly trained persons takes on the role of instructor.

An advantage of this approach is that a higher level of capacity building is achieved as not just regular trainees but also instructors are trained. A disadvantage is that training someone to become an all-round bioenergy instructor may be very time-consuming (much longer than the time available). Possibly this problem can be tackled by training instructors in just one or two, rather than all 5, clusters.

***Scenario E: Regional follow-up course***

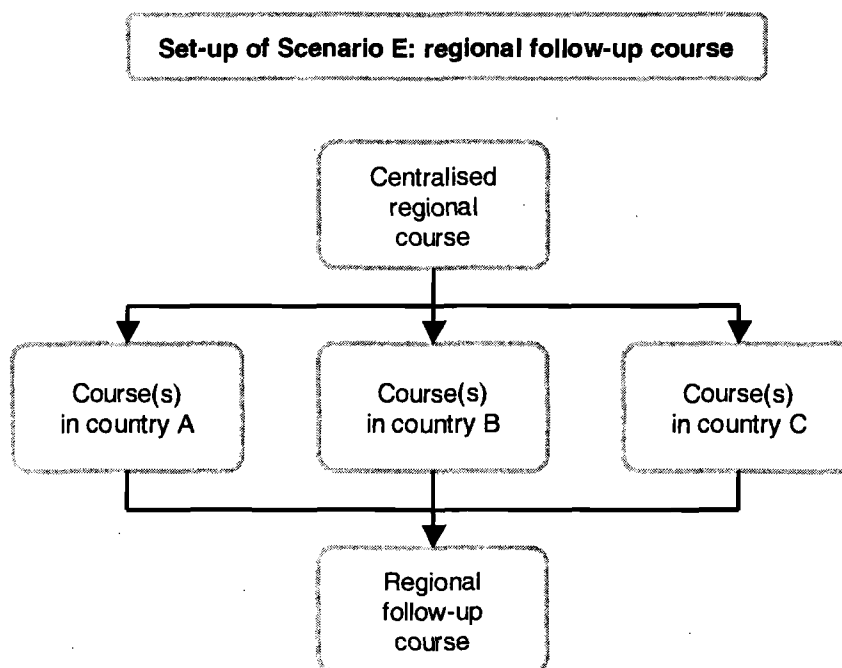
This is not really an independent scenario but more of a variation on the traditional and train-the-trainers scenarios by adding on a regional follow-up course. Such follow-up course would be open to selected trainees only that have received earlier BIOCAB training and that already worked or since they received BIOCAB training have started to work professionally on bioenergy issues on a more or less daily basis.

The purpose of this regional follow-up course is threefold:

- To provide hands-on support to persons implementing bioenergy actions
- To intensify knowledge transfer by deepening selected subjects from the earlier course
- To exchange ideas and experience, among trainees and between trainees and instructors

An advantage is that detailed training is only given to those persons actively working in the bioenergy field (maximum focus). A disadvantage is that no extra people are trained.

The Figure below graphically illustrates the training set-up in this scenario.



**Scenario F: Building a regional training platform**

This scenario entails setting-up a regional training base as a platform for running various specialist bioenergy courses and catering for a regional audience. The training courses are held in various countries and will be of different duration (from a few days to a few weeks). The courses explicitly target a significant role for regional/national experts.

This set-up requires long-term co-operation and knowledge transfer between international consultant and national/regional institutes. It would seem more suitable for cooperation with only 2 or 3 countries within 1 continent.

Examples include the COOPENER projects **BEPITA** (Biomass Energy Platforms Implementation for Training in Africa, [www.bepita.net](http://www.bepita.net)), **BEPINET** (Biomass Energy Platforms Implementation for Training in Latin America, [www.bepinet.net](http://www.bepinet.net)), and **ENEFIBIO** (Removal of non-technological barriers to encourage SME energy efficiency

by the rational use of biomass, [www.enefibio.com](http://www.enefibio.com)). BEPITA organised *inter alia* targeted training sessions (for private sector, public sector and professional organisations/NGO sector) within Burkina Faso and Cameroon. A common characteristic of these COOPENER projects is that each targeted a particular continent (Africa or Latin America) and established perennial training platforms for biomass technologies in two different zones, each covering several countries with common specific energy needs and constraints. The platforms cluster a wide range of training activities and services undertaken by experts in training at master level and post graduate as well as professors and professionals.

### **Scenario comparison**

Some comparative information for the main scenarios is presented in the table below. Training courses within the traditional, the train-the-trainers and the regional follow-up course scenario have a fairly well defined set-up, and an estimate can be made how many trainees can benefit and how many trainers are required. For the other scenario's this is much more difficult to determine, if at all.

Note that the table does not include Scenario D, as this is basically a combination of scenarios C1 and C2.

<b>Characteristic</b>	<b>A: Min. scenario</b>	<b>B: Online course</b>	<b>C1: internat. course</b>
Venue	Not specified	At home or at local institute (decentralised)	At regional or global institute (centralised)
# trainees / course	Not specified	Unlimited	Up to 20 or so per course
# trainees overall	Not specified	Unlimited	Up to 40 per continent (2 courses); 120 overall
Trainers	None	No face-to-face contact	1 trainer/cluster (5 in total) + industry expert
Duration (typical)	Not specified	Not defined	One week or longer
Depth	Not specified	Shallow	Detailed introduction

<b>Characteristic</b>	<b>C2: national course</b>	<b>E: Follow-up course</b>	<b>F: Training platform</b>
Venue	At provincial or national institute (dec.)	At regional or global institute (centralised)	At the regional training platform
# trainees / course	Up to 20 or so per course	Up to 20 or so per course	differs
# trainees overall	Up to 40 per country (2 courses); 300 overall	Up to 40 per continent (2 courses); 120 overall	many
Trainers	2 trainers (incl. 1 internat.) + industry expert	1 trainer/cluster + industry expert	many
Duration (typical)	Two or three days	Up to one week	Various
Depth	Basic introduction	Specialist courses	Specialist courses