

## 6. CONCLUSION

The WG of ERIA, through an extensive research and elaborate discussions, developed the guidelines for “Sustainability Assessment of Biomass Utilisation in East Asia,” which are based on the three pillars of sustainability i.e. social, economic and environmental perspectives. The WG members hope that this report would assist worldwide discussions on sustainable biomass utilisation and enhance understanding of the East Asian opinion and approach.

These guidelines will be tested with the help of some pilot scale studies on actual biomass utilisation projects to be conducted in 2009. The WG is planning to come out with the results of these studies and present them in an international workshop in 2010. The announcement will be uploaded on homepage of the ERIA. We invite the participation of individuals who would like to contribute to this effort.

## QUESTIONNAIR

### Appendix [1] PILOT STUDY - ENVIRONMENT

#### Introduction

Life Cycle Assessment is a compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle (ISO 14040). The LCI data can be used to establish the environmental sustainability of the specific bioenergy with respect to green house gas emission and climate change.

In developing the LCI GHG database on Biomass derived bioenergy, ERIA Project Team seeks your cooperation to fill in the attached questionnaire to the best of your ability. The questionnaire has been divided into the various compartments of the life cycle of a bioenergy beginning from:

- Feedstock supply (crop production/ cultivation)
- Processing/ treatment of feedstock material
- Intermediate conversion(s)
- Biofuel production
- Storage/ packaging
- Utilisation
- Transportation and distribution is needed for every stage as part of the product system

Not every stage is needed and conversion/transformation to the final form of the biofuel from the agricultural feedstock material can take more than one stage.

#### I . GENERAL COMPANY INFORMATION

1.1. Name	
1.2. Address	
Phone	
FAX	
1.3. Name/position of contact person	
E-mail	
1.4. Type of biomass feedstock material:	
1.5. Completed by:	
1.6. Date of data compilation	

#### II . Seedling Stage

2.1. Name of nursery	
2.2. Location	
2.3. Type of nursery	

2.4. No. of cycles/ year (single stage/ two stages etc.)	
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2.5. Information on Nursery Management and Practices (Please provide figures or information for three consecutive years if available, otherwise approximate current figures are also acceptable)				
<b>No. of bags/ per hectare</b>				
200_				
200_				
200_				
General average				
<b>Number of seedling / hectare</b>				
200_				
200_				
200_				
General average				
Average success rate (seedlings to plant)				
<b>Consumables consumption / year</b>				
Consumable	200_	200_	200_	General average
Water (litre)				
Electricity (kWh)				
Diesel (litre)				

2.6. Data Treatment to Estimate Electricity Consumption Use of electric-powered equipment and systems	
No. of sprinklers/hectare	
Motor power of sprinkler, kW	

2.7. Data Treatment to Estimate Diesel/Fuel Consumption Transportation	
Distance, km	
Truck capacity, ton	
Actual load, ton	
Empty return	<input type="checkbox"/> Yes <input type="checkbox"/> No
No. of trips/day	

2.8. Agrochemicals consumption / year				
Consumable	200_	200_	200_	General average
Fertiliser				
• Muriate of potash				
• ammonium nitrate				
• phosphate				
• _____				
• _____				
• _____				
• _____				
• _____				

Pesticides • Methyl metsulfuron, isopropylamine, • _____ • _____ • _____ • _____				
• Others • _____ • _____ • _____				

Note: \*Please fill in according to use

### III. Plantation Stage Information on Plantation Management and Practices

Company Information (If different from Section II)	
3.1. Name	
3.2. Address	
Phone	
FAX	
3.3. Name/position of contact person	
E-mail	
3.4. Name of plantation	
3.5. Location	
3.6. Plantation Size (hectare)	

Additional information (if applicable)	
3.7. Success rate (%)	
3.8. Capacity of palm tree/hectare	
3.9. Duration from seedling to harvest	
3.10. Annual crop/ perennial crop	
3.11. Life span of perennial crop (years)	
3.12. Land-Use prior to current crop (at time of data collection) - Forest land to cropland - Grassland to cropland - Cropland to cropland (same crop) - Cropland to cropland (different crop, please specify) - Peatland to cropland	(Please tick ✓) <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
(Please provide figures or information 3 years if available, otherwise approximate current figures are also acceptable)	
3.13.	Plantation yield as average metric tons of biomass resource material for bioenergy e.g. (fresh fruit bunches per hectare/per year or per month for oil palms)

	200_				
	200_				
	200_				
	General average				
3.14.	Weight of fronds/stems fell per hectare / per year				
	200_				
	200_				
	200_				
	General average				
3.15.	Consumables consumption / year				
	Consumable	200_	200_	200_	General average
	Water (litre)				
	Electricity (kWh)				
	Diesel (litre)				

Data Treatment to Estimate Electricity Consumption

3.16.	Use of electric-powered equipment and systems	
	No. of sprinklers/hectare	
	Motor power of sprinkler, kW	

Data Treatment to Estimate Diesel/Fuel Consumption

3.17	Transportation from plantation to feedstock processing/ mill	
	Distance, km	
	Truck capacity, ton	
	Actual load, ton	
	Empty return (yes/no)	
	No. of trips/day	

3.18.	Agrochemicals consumption / year				
	Consumable	200_	200_	200_	Average
	Fertiliser				
	• _____				
	• _____				
	• _____				
	• _____				
	Pesticides				
	• _____				
	• _____				
	• _____				
	• _____				
	Others				
	• _____				
	• _____				
	• _____				

3.19. Waste Use or Produce	
<b>Biomass Waste</b> <ul style="list-style-type: none"> <li>• Weight of frond fell/hectare/year</li> <li>• Agriculture waste/hectare/year</li> <li>• Wastewater/year</li> </ul>	
Hazardous waste produce/year	

#### V. Processing of Feedstock Material

Milling Stage/ Processing Stage (to convert biomass stock to first bioenergy feedstock)

Company Information (If different from preceding sections)	
4.1. Name	
4.2. Address	
Phone	
FAX	
4.3. Name/position of contact person	
E-mail	

#### 4.4. Production Data

Please provide information for three years if available, otherwise approximate current values are acceptable

Production volume (metric tons/year)				
Types of Products	200_	200_	200_	Average
E.g. CPO				
E.g. Palm kernel				

#### 4.5. Consumption Data

Raw material consumption (metric tons/year)				
Types of Raw Materials	200_	200_	200_	Average
E.g. Fresh fruit bunch				

Utilities & fuel consumption on yearly basis				
Utilities	200_	200_	200_	Average

Electricity (kWh/year)				
<ul style="list-style-type: none"> <li>• Grid</li> <li>• Self generated</li> </ul>				
Water (m <sup>3</sup> /year)				
<ul style="list-style-type: none"> <li>• Piped water</li> <li>• Recycling</li> </ul>				
Fuel (litre/year)				
<ul style="list-style-type: none"> <li>• Medium Fuel Oil</li> <li>• Diesel</li> </ul>				

#### 4.6. Environmental Data

Air Emission

Flue gas volume/production day (m<sup>3</sup>/day) =

(Please sum up all volumes if more than one stack):

Parameters	Concentration
<ul style="list-style-type: none"> <li>• Carbon dioxide CO<sub>2</sub></li> <li>• Carbon monoxide CO</li> <li>• Methane CH<sub>4</sub></li> <li>• Nitrogen monoxide N<sub>2</sub>O</li> <li>• Nitrogen dioxide NO<sub>2</sub></li> </ul>	
Compliance to local regulations (state name of regulations) _____ _____	

#### 4.7. Waste Generation

Types of Waste	
Waste produce (metric ton/year)	
Wastewater treatment sludge	
- organic (metric ton/year)	
- inorganic ( <i>Please state type of mineral sludges e.g. hydroxide or carbonate etc.</i> ) (metric ton/year)	
Fiber (metric ton/year)	
Shell (metric ton/year)	
Boiler ash (metric ton/year)	
Hazardous waste:	

#### 4.8. Wastewater Discharge

Wastewater discharge after treatment (m<sup>3</sup>/year) =

Parameter	Concentration (mg/l)
<ul style="list-style-type: none"> <li>• BOD</li> <li>• COD</li> </ul>	

<ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>	
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**V. Refinery Stage (if applicable)**

Company Information (If different from preceding sections)	
5.1. Name	
5.2. Address	
Phone	
FAX	
5.3. Name/position of contact person	
E-mail	

**5.4. Production Data**

Production volume (metric tons/year)				
Types of Products	200_	200_	200_	Average

**5.5. Consumption Data**

Raw material consumption (metric tons/year)				
Types of Raw Materials	200_	200_	200_	Average

**5.6. Utilities & fuel consumption on yearly basis**

Utilities	200_	200_	200_	Average
Electricity (kWh/year)				
• Grid				

<ul style="list-style-type: none"> <li>• Self-generated</li> </ul>				
Water (m <sup>3</sup> /year) <ul style="list-style-type: none"> <li>• Piped water</li> <li>• Other source _____</li> </ul>				
Fuel <ul style="list-style-type: none"> <li>• Medium Fuel Oil (litre/year)</li> <li>• Diesel (litre/year)</li> <li>• Natural Gas (vol/year)</li> <li>• Coal (ton/year)</li> <li>• Biomass (ton/year)</li> </ul>				

**5.7. Environmental Data**

Air Emission

Flue gas volume/production day (m<sup>3</sup>/day) =

(Please sum up all volumes if more than one stack) :

Parameters	Concentration
<ul style="list-style-type: none"> <li>• Carbon dioxide CO<sub>2</sub></li> <li>• Carbon monoxide CO</li> </ul>	
<ul style="list-style-type: none"> <li>• Methane CH<sub>4</sub></li> <li>• Nitrogen monoxide N<sub>2</sub>O</li> <li>• Nitrogen dioxide NO<sub>2</sub></li> <li>•</li> <li>•</li> <li>•</li> </ul>	
Compliance to local regulations?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Name of regulation _____	

**5.8. Waste Generation**

Types of Waste	
Waste produce (ton/year)	
Wastewater treatment sludge <ul style="list-style-type: none"> <li>- organic (metric ton/year)</li> <li>- inorganic (<i>Please state type of mineral sludges e.g. hydroxide or carbonate etc.</i>(metric ton/year)</li> </ul>	
Hazardous waste (ton/year)	

**5.9. Wastewater Discharge**

Wastewater discharge after treatment (m<sup>3</sup>/year) =

Parameter	Concentration (mg/l)
• BOD	
• COD	
•	
•	
•	
•	
•	
•	
•	
•	

**VI Transformation to Biofuel**

Company Information	
6.1. Name	
6.2. Address	
Phone	
FAX	
6.3. Name/position of contact person	
E-mail	

**6.4. Production Data**

Production volume (metric tons/year)				
Types of Products	200_	200_	200_	Average
Biodiesel				

**6.5. Consumption Data**

Raw material consumption (metric tons/year)				
Raw Materials	200_	200_	200_	Average

6.6. Utilities & fuel consumption on yearly basis				
Utilities	200_	200_	200_	Average
Electricity (kWh/year) <ul style="list-style-type: none"> <li>• Grid</li> <li>• Self-generated</li> </ul>				
Water (m <sup>3</sup> /year) <ul style="list-style-type: none"> <li>• JBA</li> <li>• Other source</li> </ul>				
Fuel <ul style="list-style-type: none"> <li>• Medium Fuel Oil (litre/year)</li> <li>• Diesel (litre/year)</li> <li>• Natural gas (vol/year)</li> <li>• Coal (ton/year)</li> <li>• Biomass (ton/year)</li> </ul>				

**6.7. Environmental Data**

Air Emission

Flue gas volume/production day (m<sup>3</sup>/day) =

(Please sum up all volumes if more than one stack):

Parameters	Concentration
<ul style="list-style-type: none"> <li>• Carbon dioxide CO<sub>2</sub></li> <li>• Carbon monoxide CO</li> <li>• Methane CH<sub>4</sub></li> <li>• Nitrogen monoxide N<sub>2</sub>O</li> <li>• Nitrogen dioxide NO<sub>2</sub></li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>	
Compliance to local regulations? _____	<input type="checkbox"/> Yes <input type="checkbox"/> No

**6.8. Waste Generation**

Types of Waste	
Waste produce (metric ton/year)	



## QUESTIONNAIRE FOR TRADERS/PROCESSORS

### Appendix [2]

#### Appendix [2-1] PILOT STUDY - ECONOMICS

##### I. GENERAL INFORMATION

1.1. Name (optional) (First Name)						
(Middle Name)						
(Last Name)						
Age						
Gender		<input type="checkbox"/> Male			<input type="checkbox"/> Female	
Educational Attainment		<input type="checkbox"/> Elementary <input type="checkbox"/> Vocational		<input type="checkbox"/> College <input type="checkbox"/> Post Graduate		<input type="checkbox"/> High school
Civil Status		<input type="checkbox"/> Married		<input type="checkbox"/> Widowed		<input type="checkbox"/> Single
1.2. Main Source of Income						
Monthly Income						
Other Sources						
Monthly Income						
1.3. Years in Farming: _____		Source of capital _____			Initial capital(P) _____	
1.4. Membership in Organization						
Name of Organization		Position	Number of Years		Involvement in Organization	
1.5 Are you involved in community activities?				<input type="checkbox"/> Yes		<input type="checkbox"/> No
1.5a. If yes, what activities?						
1.6. Household information						
Relationship with Respondent	Gender	Age	Civil Status	Educational Attainment	Occupation	Monthly Income

##### II. Plant/Firm Inputs

2.1. Plant size		2.2. Acquisition Cost	
2.3. Total number of employees		2.4. Plant capacity	
2.5. Raw material(s) processed		2.6 Products produced	

2.7. Initial Investment Cost				
Inventory of Fixed Assets	Quantity	Year acquired	Life span	Acquisition cost
Land				
Building				
Tools and Equipment				

Work Animals				
Others				
<b>Sub-total</b>				

2.8. Operating Cost			
Cost Item	Quantity	Salary/month	Total Cost
Permanent Labor			
Manager			
Supervisor			
Bookkeeper/Accountant			
Secretary			
Others			
<b>Hired/Contract Labor (<i>in man days</i>)</b>	<b>Mandays/month</b>	<b>Wage/day</b>	<b>Total Cost</b>
Purchase of raw material			
Processing			
<b>Sub-total</b>			
<b>Material Cost</b>	<b>Quantity/month</b>	<b>Cost/Unit</b>	<b>Total Cost</b>
Raw materials			
Other inputs (Specify)			
Marketing Cost			
Hauling/transportation			
Fees and others			
<b>Sub-total</b>			
Taxes paid			
Other costs			
<b>TOTAL</b>			

2.9 Procurement of raw materials				
Sources/Location	Product kind/form	Qty. / proc.	Frequency/month	Price/unit

IV. Disposal				
MODE OF DISPOSAL	QUANTITY	PRICE	BUYER	MODE OF DISPOSAL
	Per cycle	Lean Months	Peak Months	
Form of processed				
a.				
b.				
Other sales such as by-products				
Given Away				
Outlets Name/Location	Type of outlet/buyer	Quantity (unit)& type	Price/unit	Frequency /vol. of sale
<b>TOTAL</b>				

## QUESTIONNAIRE FOR PRODUCERS

### Appendix [2-2] PILOT STUDY - COCONUT

#### I. GENERAL INFORMATION

1.1. Name (optional) (First Name)							
(Middle Name)							
(Last Name)							
Age							
Gender		<input type="checkbox"/> Male			<input type="checkbox"/> Female		
Educational Attainment		<input type="checkbox"/> Elementary		<input type="checkbox"/> College		<input type="checkbox"/> High school	
		<input type="checkbox"/> Vocational		<input type="checkbox"/> Post Graduate			
Civil Status		<input type="checkbox"/> Married		<input type="checkbox"/> Widowed	<input type="checkbox"/> Single	<input type="checkbox"/> Separated	
1.2. Main Source of Income							
Monthly Income							
Other Sources							
Monthly Income							
1.3. Years in Farming: _____		Source of capital _____		Initial capital(P) _____			
1.4. Membership in Organization							
Name of Organization		Position	Number of Years		Involvement in Organization		
1.5 Are you involved in community activities?				<input type="checkbox"/> Yes		<input type="checkbox"/> No	
1.5a. If yes, what activities?							
1.6. Household information							
Relationship with Respondent		Gender	Age	Civil Status	Educational Attainment	Occupation	Monthly Income

1.7. Did you encounter problems in planting coconut? <input type="checkbox"/> Yes <input type="checkbox"/> No		
<b>Problem</b>	<b>Check if Yes (✓)</b>	<b>Solution Adopted</b>
<b>Planting Materials</b>		
High rate of mortality	<input type="checkbox"/>	
High cost of planting materials	<input type="checkbox"/>	
Non-availability of planting materials	<input type="checkbox"/>	
<b>Technology</b>		
Difficult to adopt	<input type="checkbox"/>	
<b>Financial</b>		

Lack of financial support	<input type="checkbox"/>	
Higher interest rate on loans	<input type="checkbox"/>	
<b>Market</b>		
Lesser access to market	<input type="checkbox"/>	
<b>Pest and Diseases</b>		
<b>Harvest/Post-Harvest</b>		
<b>Processing</b>		

## II. Farm Inputs

2.1. When did you first plant coconut? _____ No. of pieces planted: _____ Source: _____
2.2. After your 1 <sup>st</sup> purchase did you buy more? How many? _____ Comment on Price _____
2.3. When was the last purchase? _____ Qty _____ Amount paid: _____
2.3.1. If price is lower, how many would you buy?
2.4. Farm size: _____ 2.4.1. Acquisition Cost: _____ 2.4.2. Total number of palms: _____ 2.4.3. Number of bearing palms: _____ System of planting: <input type="checkbox"/> Monocrop <input type="checkbox"/> Backyard planting <input type="checkbox"/> Intercrop with other crops (specify) _____ <input type="checkbox"/> Intercrop with coconut (specify number of macapuno relative to coconut) _____

### 2.5. Investment Cost

Cost Item	Quantity	Price/Unit	Total Cost
<b>Labor</b>			
Land preparation (man day)			
Planting (man day)			
Fertilization (man day)			
Weeding (man day)			
<b>Material Cost</b>			
Seedlings or any planting material			
Fertilizer (bag)			
Pesticides (bag)			
Other chemicals			
<b>Other Establishment Costs</b>			
Ex. Fencing, licensing etc.			

<b>Sub-total</b>			

Inventory of Fixed Assets	Quantity	Year acquired	Life span	Acquisition cost
Land				
Building				
Tools and Equipment				
Work Animals				
Others				
<b>Sub-total</b>				

<b>2.6. Operating Cost</b>			
Cost Item	Quantity/month	Cost/Unit	Total Cost
<b>Hired Labor (<i>in man days</i>)</b>			
Farm overseer (man day)			
Grass cutting (man day)			
Watering (man day)			
Ringweeding			
Fertilization			
Deleafing			
Pesticide spraying			
Harvesting			
Collecting/piling			
<b>Sub-total</b>			
<b>Material Cost</b>	<b>Quantity/month</b>	<b>Cost/Unit</b>	<b>Total Cost</b>
Water (liters)			
Fertilizer (bag)			
Pesticides (bag)			
Other inputs (Specify)			
<b>Marketing Cost</b>			
<b>Sub-total</b>			
<b>TOTAL</b>			

### III. Production

Area planted by parcel	Type	Number of trees		Average yield/ palm/ harvest		Number of harvests/yr		Total produce / year	

- 3.1. Months of low yield \_\_\_\_\_ 3.1.1 harvest/mo \_\_\_\_\_  
 3.2. Months of high yield \_\_\_\_\_ 3.2.1 harvest/mo \_\_\_\_\_  
 3.3. Contribution of produce to household income (%) \_\_\_\_\_

### IV. Disposal

MODE OF DISPOSAL	QUANTITY	PRICE		BUYER
	Per harvest	Lean Months	Peak Months	
Sold as fresh				
Sold as mature nuts				
Sold as copra				
Planting material				
Payment in kind				
Home Consumption				
Given Away				
Used as planting materials				
<b>Total</b>				

### V. SOCIO –ECONOMIC CONDITION

5.1. Please check if the following items are available in the household			
a. Residential lot	<input type="checkbox"/> Owned	<input type="checkbox"/> Rented	<input type="checkbox"/> Others, pls pecify _____
b. House ownership	<input type="checkbox"/> Owned	<input type="checkbox"/> Rented	<input type="checkbox"/> Others, pls pecify _____
c. Housing materials	<input type="checkbox"/> Concrete	<input type="checkbox"/> Wood	<input type="checkbox"/> Wood and cement
	<input type="checkbox"/> Nipa	<input type="checkbox"/> Others, pls specify _____	
d. Source of water	<input type="checkbox"/> Artesian well	<input type="checkbox"/> Pump	<input type="checkbox"/> Others, specify _____
e. Toilet Facility	<input type="checkbox"/> Flush	<input type="checkbox"/> Manual flush	<input type="checkbox"/> Others, specify _____
f. Lighting Facilities	<input type="checkbox"/> Electric	<input type="checkbox"/> Lamp/gas	<input type="checkbox"/> Others, specify _____
g. Cooking facilities	<input type="checkbox"/> Wood	<input type="checkbox"/> Kerosene	<input type="checkbox"/> Charcoal
	<input type="checkbox"/> LPG	<input type="checkbox"/> Electricity	<input type="checkbox"/> Others, specify _____
5.2. Household items bought because of biomass planting? _____ _____			
5.3. How would you describe your level of living before planting biomass? _____ _____			
5.4. How would you describe your level of living after planting biomass? <input type="checkbox"/> Better than before Reason: _____ <input type="checkbox"/> Same as before Reason: _____ <input type="checkbox"/> Worse than before Reason: _____			
5.5. What is/are your aspiration(s) for your family? _____ _____			

5.6. Do you think the planting of biomass will help you with the attainment of your aspirations?  
Yes No

If yes, in what way? \_\_\_\_\_  
 If no, why not? \_\_\_\_\_

## VI. CHANGES IN THE ENVIRONMENTAL CONDITIONS/ELEMENTS

Please check based on your perception and state reasons for the choice/response

### 5.7. Are there changes in the following properties of the soil in your farm after you planted biomass?

BA = Before Adoption

AA = After Adoption

Soil properties		Rating (please check) (5-very dark, 4-dark, 3-slightly dark, 2-light, 1- very light)					Reason for the Rating
		1	2	3	4	5	
<b>1.1. Color</b>	BA						
	AA						
Soil properties		Rating (please check) (5-very fast infiltration, 4-fast infiltration, 3-slightly fast, 2-slow, 1-very slow)					Reason for the Rating
		1	2	3	4	5	
<b>1.2. Porosity or ease of infiltration of water</b>	BA						
	AA						
Soil properties		Rating (please check) (5-very abundant,4-more abundant, 3-abundant,2-less, 1-least)					Reason for the Rating
		1	2	3	4	5	
<b>1.3. Abundance of humus or organic matter</b>	BA						
	AA						
Soil properties		Rating (please check) (5-least acidic,4-less acidic, 3-acidic,2-more acidic,1-very acidic)					Reason for the Rating
		1	2	3	4	5	
<b>1.4. Acidity</b>	BA						
	AA						
Soil properties		Rating (please check) (5-very low,4-low,3-high, 2-moer high,1-very high)					Reason for the Rating
		1	2	3	4	5	
<b>1.5. Occurrence and extent of soil erosion</b>	BA						
	AA						
Soil properties		Rating (please check) (5-very deep,4-moredeep,3-deep, 2-shallow,1-very shallow)					Reason for the Rating
		1	2	3	4	5	
<b>1.6. Depth of litter/gradient of</b>	BA						
	AA						

decomposition							
Soil properties		Rating <i>(please check)</i> (5-very fertile, 4-more fertile, 3-fertile, 2-less, 1-least)					Reason for the Rating
		1	2	3	4	5	
1.7.General fertility	BA						
	AA						

**5.8. Are there changes in water properties in nearby streams or creeks after the adoption of biomass technology?**

*BA = Before Adoption*

*AA = After Adoption*

Water properties		Rating <i>(please check)</i> (5-very clear,4-more clear,3-clear, 2-dark,1-very dark)					Reason for the Rating
		1	2	3	4	5	
1.1. Color of Water	BA						
	AA						
Water properties		Rating <i>(please check)</i> (5-very abundant,4-more abundant, 3-abundant,2-less abundant, 1-least abundant)					Reason for the Rating
		1	2	3	4	5	
1.2. Quantity	BA						
	AA						
Water properties		Rating <i>(please check)</i> (5-very abundant,4-more abundant, 3-abundant,2-less abundant, 1-least abundant)					Reason for the Rating
		1	2	3	4	5	
1.3. Abundance of organic matter	BA						
	AA						
Water properties		Rating <i>(please check)</i> (5-least acidic,4-more less acidic, 3-acidic,2-more acidic, 1-very acidic)					Reason for the Rating
		1	2	3	4	5	
1.4. Acidity	BA						
	AA						

**5.9. Changes in abundance and variety of plants and animals**

*BA = Before Adoption*

*AA = After Adoption*

Properties		Rating <i>(please check)</i> (5-very many, 4-many, 3-just enough, 2-few, 1-very few)					Reason for the Rating
		1	2	3	4	5	
1.1. Number of animals							
1.1.a Beneficial (e.g. butterflies, bees, dragonflies, etc.)	BA						
	AA						

1.1.b Harmful (e.g. snakes, rodents, mosquitoes)	BA						
	AA						
Properties	Rating (please check) (5-very many, 4-many, 3-just enough, 2-few, 1-very few)					Reason for the Rating	
	1	2	3	4	5		
1.2. Number of plants							
1.2.a Vegetation	BA						
	AA						
1.2.b Undergrowth	BA						
	AA						

#### 5.10. Other changes in the environment

Properties	Before adoption ✓	Reason	After adoption	Reason
Presence of chemicals not properly disposed	( )		(✓)	
Presence of waste not properly disposed				
Littered plastics and other non-biodegradable materials like plastics				
Presence of impermeable structures (e.g. pathways, buildings, cemented structures)				

## QUESTIONNAIRE

### Appendix [3] PILOT STUDY - SOCIAL

#### I. PERSONAL AND GENERAL INFORMATION

1.1. Name of the Respondent (individual/ firm)	
1.2. Address	
Phone	
FAX	
E-mail	
1.3. Age /Date of incorporation	
1.4. Qualification (Self/ Head)	
1.5. Occupation (Self/ Head)	
1.6. If individual, total number of family members Males _____ Females _____ Children _____ Infants _____	
1.7. In case of individual, Income per month (in Rs) Personal _____ Family _____ Expenditure _____ Savings _____	
1.8. For Individual, how much do you spend your income (in percent) Food _____ Cloth _____ Housing _____ Education _____ Health _____ Other items(specify) _____	
1.9. In case of Firm, Type of Facility _____ No. of workers _____ Annual Turnover _____ Expenditure _____ Net Income _____	
1.10. Location of Biofuel crops farm	
1.11. Location of Biodiesel production unit	

#### II. CULTIVATION AND SEED COLLECTION STAGE

2.1. Are you a Farmer or Worker at Biofuel Crops Farm?	
2.1.1. If farmer, how did you hear about Jatropha/ Oil-Tree cultivation?	
2.2. Do you own biofuel crop farms?	<input type="checkbox"/> Yes <input type="checkbox"/> No _____
2.2.1. If yes, what is the type of crop Jatropha/ Pongamia/ others _____	
2.3. Is your farm rainfed or irrigated?	
2.4. What are other input? (water/ fertilizers/ pesticides etc.)	
2.5. Is it on a waste land or cultivable land or both?	
2.6. What is the size of your farm?	Waste Land _____ cultivable land _____

2.7. When did you start cultivation?	
2.8. Wherefrom do you obtain seedlings, seed and planting material? (tick where appropriate) <input type="checkbox"/> Own nurseries <input type="checkbox"/> Govt nurseries (district or regional authorities)-NGO nurseries <input type="checkbox"/> Community nurseries (owned by a group of people) <input type="checkbox"/> College nurseries <input type="checkbox"/> Individual farmers' nurseries <input type="checkbox"/> Others	
2.9. Are the seeds/seedlings sold/given free?	<input type="checkbox"/> Yes <input type="checkbox"/> No
2.9.1. If No, prices range from _____ to _____	
2.10. How many persons are involved in Jatropha Cultivation at your farm? Total _____ Your own family members _____ others (hired) _____	
2.10.1. If hired, how much do you pay them per day?	
2.11. If you have used all of your land for biofuel crops, what is the alternate source of income during gestation period of 2-4 years? _____	
2.12. If diverted cultivable land, how do you meet your daily needs of food grain, vegetables, etc. that you were gaining from your farms earlier _____	
2.13. What is the amount of Seed Collection per day?	
2.14. Where are the seeds consumed?	
2.15. How much do you pay/ are you paid for seed collection?	
2.16. If you are involved in oil extraction how much are you paid per day?	
2.17. How much is your income per day / month/ year from biofuel crop cultivation? Expenditure on wages _____ other Expenses _____ Net earnings _____	
2.18. If you are a worker, what is your income from working in the farm for cultivation / seed collection Personal _____ Family _____	
2.19. How do you spend the increased income? Cloth _____ Housing _____ Education _____ Health _____ Other items(specify) _____	
2.20. Do you face any problem after starting cultivation of biofuel crops/ working in the farm? (Specify) _____	
2.21. What measures do you suggest to tackle above problems	

### III. OIL EXTRACTION AND BIODIESEL PRODUCTION STAGE

3.1. Status of Company (Govt., Pvt., Partnership, etc.)		
3.2. Production Capacity (TPD)	Installed _____	Actual _____
3.3. Technology available for biodiesel conversion (indigenous/ imported)		
3.3.1. If imported, wherefrom?		
3.4. What is the electricity consumption of the biodiesel plant, MWh/year		
3.5. What is the fossil fuel consumption of the biodiesel plant, if any, tones/year? And what kind of fuel(s) (gas, coal, diesel, biodiesel, other:)?		
3.6. What is the mass of methanol consumed in the biodiesel plant, tones/year?		
3.7. Quality of Biodiesel produced (as per standards of)		
3.8. Quality of by-products produced (as per standards of)		
3.9. Raw Material Requirement per day _____ seed _____ oil _____		
3.10. Type of Raw Material required Jatropha _____ Pongamia _____ Others (specify share of each) _____		
3.11. Source of Raw Material (oil /seeds) (Owned/ Contract Farming/other) _____		
3.11.1. If Owned / contract farming, areas under cultivation _____		
3.12. Cost incurred per hectare / ton on raw material, if owned _____		
3.13. Cost of Raw material per ton if purchased from market _____		
3.14. Raw material available is just enough/ insufficient/ over supplied _____		
3.15. No. of workers employed in Cultivation _____ wage per day _____		
3.16. No. of workers employed for Seed Collection _____ wage per day _____		
3.17. No. of workers Employed in Oil Extraction _____ wage per day _____		
3.18. No. of workers Employed in Biodiesel Production _____ wage per day _____		
3.19. No. of workers Employed in Other Activities _____ wage per day _____		
3.20. List the output (quantity and name like biodiesel & main by-products) _____ _____		
3.21. Producing biodiesel for local market or exports _____		
3.21.1. If exports, to which country (ies) _____		
3.22. If for local market, how do you reach consumers (self/ through distribution chain, specify details) _____		

3.23. Net savings from per ton of products and by products _____	
3.24. Existing support by the govt/ any other agency _____	
3.25. If you feel some barriers, what are those?	_____
3.26. What solutions you suggest to remove these barriers?	_____
<p>3.27. Any initiative for the farmers / workers / community as a part of your CSR? (Please name the activity and indicate expenses towards it and direct and indirect and indirect benefits achieved by you/ community). Some of the examples are as follows.</p> <p>Does your company/ activity -</p> <p>i) Help in promoting sustainable livelihoods and achieve self sufficiency in energy in the local region (how?) _____</p> <p>ii) Creates employment (how much?) _____</p> <p>iii) Promotes contract farming by marginal, small, medium and large farmers in the area _____</p> <p>iv) Initiates Ancillary Activities such as Vermicompost and Apiculture. Or Set up Tiny Industries such as Distillation, Drying, Soap making and Rope making. _____</p> <p>v) Creates additional income through Certified Emission Reductions (Carbon Credits). _____</p> <p>Any other (please specify) _____</p>	

#### IV. SURVEY OF CONSUMPTION STAGE

4.1. Does your facility use Biodiesel?	<input type="checkbox"/> Yes <input type="checkbox"/> No
4.2. Reasons for your facility using Biodiesel ( <i>Check all that apply</i> )	<input type="checkbox"/> Satisfy Mandate <input type="checkbox"/> Environment <input type="checkbox"/> Energy Policy <input type="checkbox"/> Safety Issues <input type="checkbox"/> Energy Bill <input type="checkbox"/> Agency Direction <input type="checkbox"/> Any other (please specify) _____
4.3. Types of Biodiesel being used. ( <i>Check all that apply</i> )	<input type="checkbox"/> B100 <input type="checkbox"/> B50 <input type="checkbox"/> B20 <input type="checkbox"/> B10 <input type="checkbox"/> B5 <input type="checkbox"/> Other (specify) _____
4.4. Estimated Monthly Volume of each type.	B100 _____    B50 _____    B20 _____    B5 _____    Other _____    Total _____
4.5. What applications are you using Biodiesel for? (vehicles/ generators/ others)	_____
4.6. Number of vehicles that use biodiesel.	_____
4.7. Where do you purchase your biodiesel from?	_____
4.8. How much cost do you pay for biodiesel? ( <i>Per Litre</i> )	_____
4.9. Have you encountered problems from biodiesel usage? ( <i>If yes, please explain</i> )	<input type="checkbox"/> Yes <input type="checkbox"/> No _____
4.10. Do you have a biodiesel success story you would like to share? ( <i>If yes, please explain</i> )	<input type="checkbox"/> Yes <input type="checkbox"/> No _____

**V. OTHER INFORMATION**

5.1. Do you know about merits and demerits of biodiesel over petro-diesel? <input type="checkbox"/> Yes <input type="checkbox"/> No	
5.1.1. If yes, what are those?	
5.2. Is biodiesel available locally/ nearby easily?	
5.3. Price of biofuel that you are paying_____	
5.4. Is government providing any help in Biodiesel promotion? <input type="checkbox"/> Yes <input type="checkbox"/> No	
5.4.1. If yes, what are those?	
5.4.2. If not, what do you expect?	
5.5. Do you feel there is any change in Eco restoration and land degradation(preventing) due to use of biofuel crops cultivation_____	
5.6. Is any extra effort necessary for biofuel crop in comparison to other crop?	
5.7. Do you see any change in rural electrification and energy security due to use of biofuel in your areas_____	
5..8. Any additional information that you may want to provide here, _____	