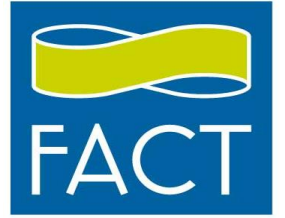


Financial and economic aspects

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For Indonesia Exchange in Biofuels and Bionerergy
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Sources: renewables global status report 2009 update;
FACT data

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Introduction

- Biofuels and bioenergy should be competitive with other options:
 - with other renewables like e.g. wind, water, solar;
 - with grid connection to central grid
 - Decision making depends on feasibility in financial aspects, but also on other aspects like
 - Reliability (functioning over time),
 - Ease of operation,
 - Storage features
-



Financial = part of wider appraisal

- Demand of target group for a activity/project
- Why there is such demand:
 - > Is priority of target group;
 - > Hear-say of success;
 - > Real need for energy, expressed as impediment for further progress;
 - > Obtaining side benefits (belong to..)
- Rapid Rural appraisal to find out?

Appraisal

Appraisal methods can be various:

- When evaluating: judging and ranking on first set criteria by the target group;
 - Straight voting of the target group;
 - Discussing and shaping to consensus;
 - More scientific approach of setting criteria, indicators and finally valueing criteria/indicators with different weights
 - Others
-

How to determine financial and economic feasibility



- Simple pay-back:
- Cash flow analysis: value future costs and income over the economic life of the project and see the
- Internal Rate of return: this is the interest rate at which the total of income of the project equals the costs of the project over the lifetime
- Return on Equity: If the costs of the loan part



Practical Cash flow approach focus

Cashflow approach with spreadsheet and sensitivity can be used to cover all needs:

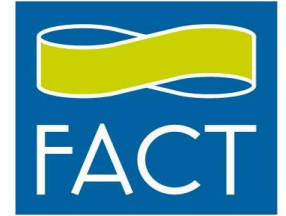
- Return on equity for investors,
- Economic viability,
- For taxation purposes,
- For special requirements of funders (PSO, ORET, etc..),
- Part of Due diligence,

Cashflow = ordering income and costs

- Ranking costs: Investment and operational costs over the years if costs are expected to grow faster than the that of the general economy, adaptation can be made
 - Ranking income streams over the years: if income e.g. due to price rise is expected that is higher than the regular, adaptation can be made for this.
 - Income and cost streams are subtracted;
 - Normally this leads to a negative in the first year due to investment ballast;
-

continued

- With the operating costs being less as the yearly revenues, this can be paid back: by adding a penalty year over year (interest because future values do not have the same as today's values), a Internal rate of return is calculated: this is an iterative process, today as a excel function.
 - The internal rate is the value at which the project over the years is zero sum.
 - That means e.g. that a project with 20 % IRR would in fact generate an interest of 20 % if the investment would not have a interest on it. Or differently said: such project would with a 10 % interest on capital, be able to cover that interest and still have 12 % additional.
-



Internal Rate of Return (IRR)

- IRR of 2 % with E price of 15 USDcents/kWh
- This is for small system, and likely reduced to 7 USDcents/kWh for systems of 100 ha



Some notes on income streams

Income streams:

- volume/ probability of price/probability of existence
 - Own target group use or markets
 - Examples of revenue streams
 - Sales of energy commodity
 - Sales of eg. carbon credits
 - Sales of residues avoid double counting or unsustainable systems (e.g. take out biomass and do not include nutrients recycling)
 - Sales of other by products
-

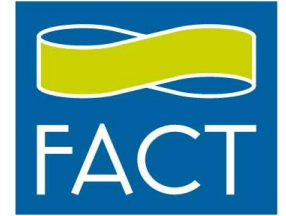
Some notes on cost streams

Cost streams:

- Conservative estimates on efficiencies or performances of technology is wise!
 - Investment costs: capital what costs are in the project, which outside : project boundary definition is important!
 - Investment costs: also the setting up (scan, prefeasibility, feasibility, design, financial engineering, etc..)
 - Capital costs: % equity % loans, conditions and terms
-

- Operating costs expectations
 - Operating costs: depending on what is to be delivered
 - > Feedstock costs;
 - > Storage costs ;
 - > Transport and handling costs;
 - > Personnel costs;
 - > Management costs;
 - > Energy and water input costs;
 - > Administrative fee collection costs;
 - > Office costs;
 - > Land costs;
 - > Building rental costs;
-

FACT examples



- FACT sheets internal use:
 - Jatropha full utilization from Jatropha planting to Jatropha PPO, biodiesel, electricity generation (from PPO and biogas from cake). organic manure from digestate
 - Gasification/steam/biogas for electricity
 - Biogas Grass system
 - Renewables for village power and industries

Jatropha full utilization

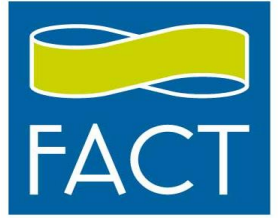
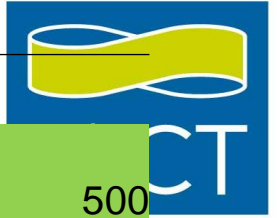


Table 1 General input data

Type of oil crop	Name	Jatropha
Size of Farm	ha	500
Financial data		
Interest rate of loan	%/yrs	6%
Duration of loan	yrs	10
Return on equity		25%
Investment		100%
Loan		70%
Equity		30%
Labor data		
Non Skilled labor	USD/manday	1.00
Skilled labor (30% above non skilled)		1.30
Staff labor (30% above skilled)		1.69
Fuel costs		
Diesel	USD/l	1.16
	USD/kWh	0.25
Harvest and distribution of seed		
kg oil	%	20%
kg cake	%	80%
Seed value at farm gate	USD/kg	0.14



Fertilizer efficiency: of the fertilizer only % is used by

Table 5 the plant, rest is lost

Type of	Type of	Efficiency
	N	50%
	P2O5	22%
	K2O	65%
	Ca	10%
	Mg	10%
	S	22%

Soil fertility and contribution to nutrient supply of

Table 6 Jatropha

Parameter	Units	Value	Observation
Contribution of soil to the plant development year 1 to 4 in %		70%	<p>Observation of fertility for all nutrients</p> <p>low medium high</p> <p>10% 40% 70%</p>

Example Gasification/steam/

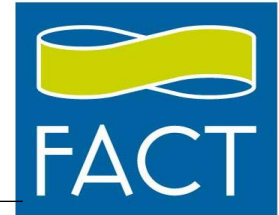


Table 1

Inverse calculation of biomass residue needs for output

Parameter	Unit	Value
Required Electricity Output	kW	50
Required hours of functioning/day	no/day	8
Required days functioning/week	no/week	6
Required weeks functioning/year	no/year	50
Total hours of functioning per year	no/year	2400
Load factor as compared to rated capacity	%	30%
Total in production requirement	kWh/yr	36000
Efficiency of conversion		
engine	%	25%
generator	%	92%
control system	%	98%
transmission	%	95%
distribution	%	95%
total efficiency	%	20%
Required brut energy for system	kWh/yr	176971
	MJ/yr	637095
Lower Heating value of Producer gas (CH ₄ H ₂ CO CO)	MJ/m ³	5.2
Requirement for producer gas	m ³ producergas/yr	122518

Gasification



Parameter	Unit	Case 1 Rice	
		husk	Case 2 Wood
	Year		
Investment	0	-119500	-119500
Electricity sales -Operating costs	1	12281	11440
	2	12281	11440
	3	12281	11440
	4	12281	11440
	5	12281	11440
	6	12281	11440
	7	12281	11440
	8	12281	11440
	9	12281	11440
	10	12281	11440
	11	12281	11440
	12	12281	11440
	13	12281	11440
	14	12281	11440
	15	12281	11440
	16	12281	11440
	17	12281	11440
	18	12281	11440
	19	12281	11440
	20	12281	11440
IRR (10 yrs)		0%	-1%
IRR (20 yrs)		8%	7%

Grass Biogas

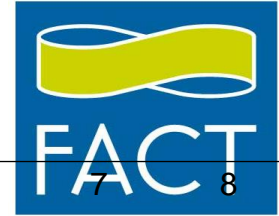


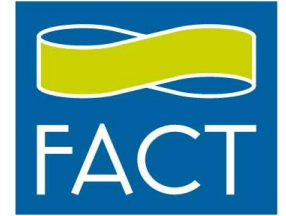
Tabla 12 Cash flow analysis

Financial Cashflow		year	1	2	3	4	5	6	7	8	9
Activity	Description										
Incoming	Sales of electricity		10587	10587	10587	10587	10587	10587	10587	10587	10587
	Others										
	Subtotal		10587	10587	10587	10587	10587	10587	10587	10587	10587
Investment											
	Land, preparation and sowing	7760									
	Irrigation pump and lines	5311									
	Chipper and mixer	4438									
	Biodigestor complete with cleaning and tubing and control	24033									
	Electric Generator complete with control	15257									
	Minigrid	5439									
	Sutotal	62238									
Operating costs											
	Operation of the energy grass land		2347	2347	2347	2347	2347	2347	2347	2347	2347
	Chipper and mixer		20	20	20	20	20	20	20	20	20
	Biodigestor		746	746	746	746	746	746	746	746	746
	Generador		640	640	640	640	640	640	640	640	640
	Mini grid		346	346	346	346	346	346	346	346	346
	Sutotal		4098	4098	4098	4098	4098	4098	4098	4098	4098
Subtotal costs		62238	4098	4098	4098	4098	4098	4098	4098	4098	4098
Benefits - costs		-62238	6489	6489	6489	6489	6489	6489	6489	6489	6489

IRR (10 Yrs) _____
 IRR (15 Yrs) _____

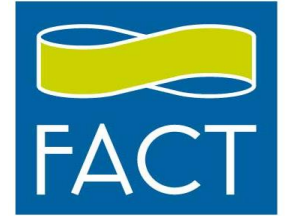
1%

Exercise



- Work with the FACT or other models to adapt those for Indonesia in hypothetical case
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Further study



- Basics on cashflow analysis in Wiki;
 - Handbooks on business economics;
 - Models of FACT in cashflow.
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Thank you for your attention.

Questions?