



Domestic Biogas

Design of a Scale-up Domestic Biogas Programme for Pakistan

International Conference on Alternative Energy & Power ICAEP 2008
Karachi Expo Center Pakistan
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Organizational (biogas) CV

Winrock International



- Linking renewable energy and developing markets
- Pioneering CDM for biogas in Nepal
- Micro-finance and revolving fund arrangements for biogas in Nepal
- Africa Biogas Initiative (2006)
- Feasibility studies and programme formulation (Uganda, Pakistan)

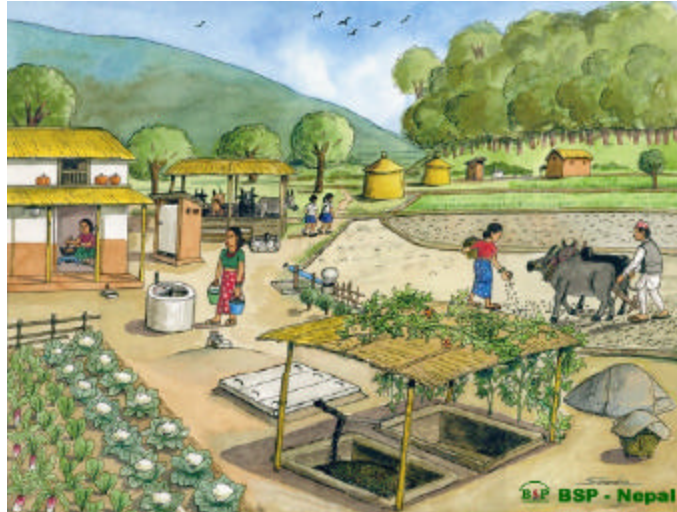
SNV-Netherlands Development Organization



- Biogas sector development
- Design & implementation (TA) Nepal(1989), Vietnam (2002)
- Asia Biogas Programme (2004)
 - TA support in Nepal, Vietnam, Cambodia, Bangladesh, Laos
- Africa Biogas Initiative (2006)
 - TA support in Rwanda, Ethiopia, Senegal (Mali, Tanzania)

Accomplishments

Domestic biogas



Expected results

Point of departure



Feasibility study (Jan 2007):

- Domestic biogas is financially feasible and socially acceptable
- Pakistan has a huge technical potential of 5 million households.
- Barriers:
 - Scaling up approach
 - Private sector not involved
 - Track record previous initiatives
 - Competition with (expected) gas grid extension
 - High upfront investment costs
 - Limited access to credit
 - Insufficient appreciation bio-slurry value

IRR graph

Follow up

Recommendations of the feasibility study:

Develop a National Domestic Biogas Programme

- 1st phase: 4 years, 30,000 installations
- Limited subsidy component: marketing / quality leverage
- Credit component
- Quality management component

Subsidy & quality

Formulation of the Programme Implementation Document:

- Assessment of the current technology
- Assessment of the potential of private sector involvement
- Outline institutional and organizational arrangements
- Explore financing opportunities for such a programme

Assessment of the current technology

Separate report, draft circulated

Conclusion: In the context of the limitations of demonstration-type biogas programmes, the selected approach and choice of technology are probably the best possible fit.

- Many visited plants are functioning, and the functioning plants are a good tool for promotion of the technology.
- However, the non-functional plants damage reputations of domestic biogas technology and demotivate neighbours to invest;

Ample room for organizational and technological improvement.

Main recommendations for large scale dissemination:

- Introduce **quality management** system
- Involve **private sector** in primary process (supply side).
- Multi actor approach at **demand side**
- User training (operation and maintenance and bio-slurry use)
- Fixed dome design preferable**
 - (Floating drum installations – modified-, remain an option)

Plant pics

Objective

“to further develop and disseminate domestic biogas in rural areas with the ultimate goal to establish a sustainable and commercial biogas sector in Pakistan”

- To develop a commercially viable, market oriented biogas sector;
- To further strengthen institutions for sustainable development of the biogas sector;
- To increase the number of quality biogas plants by 30,000 in a period of four years;
- To ensure the continued operation of all biogas plants installed under the programme;
- To maximise all benefits of the biogas plants, especially related to gender aspects.

Supply and demand

Provide “off the shelf” high quality domestic biogas plant

Ensure continued operation of constructed biogas plants

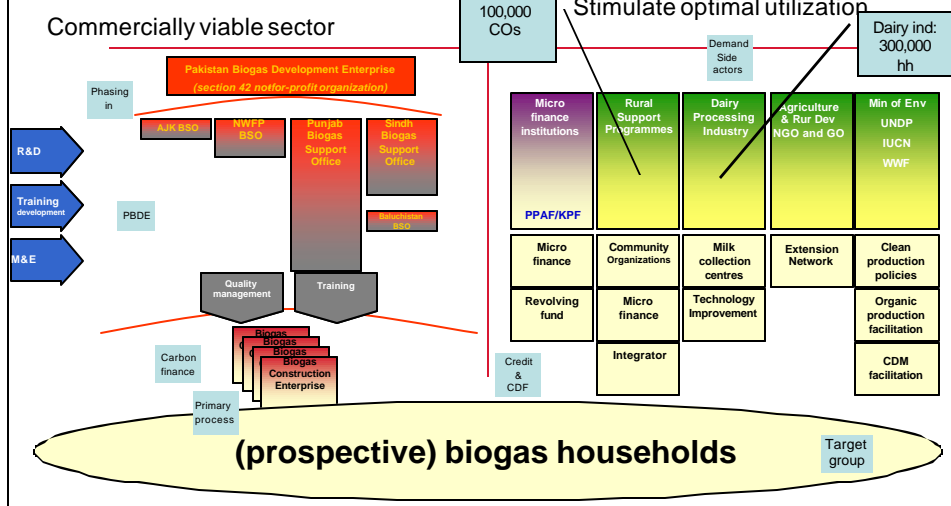
Commercially viable sector

Organize potential target group

Promote domestic biogas

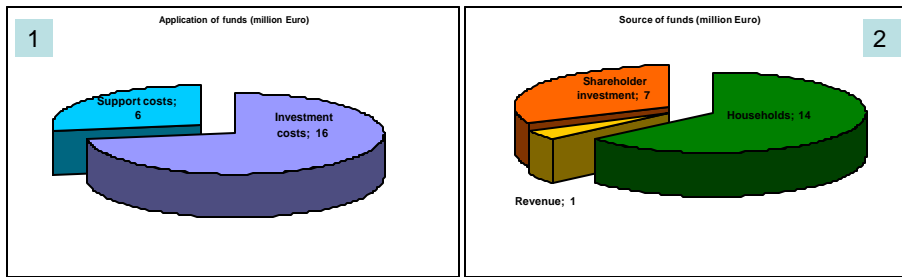
Integrate in rural development

Stimulate optimal utilization

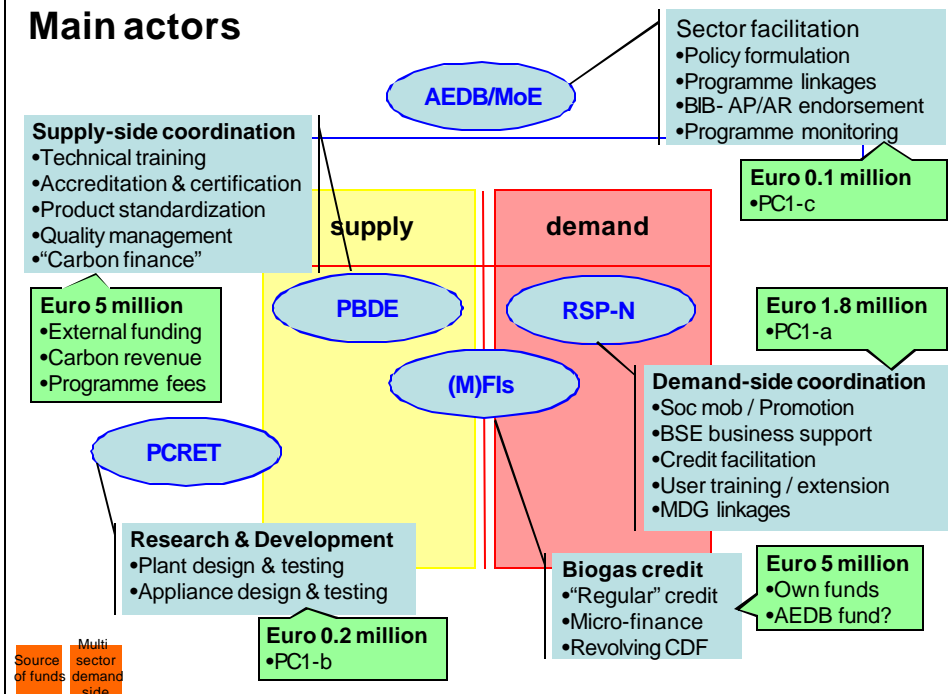


Programme budget

Summary programme budget		[Euro]		[Euro]		
	/ plant	share	/ project budget			
			3	4	total	
Forecast production			8800	17200	30000	
1a Household investment	388,13	54%	3.291.636	6.976.868	11.643.880	
1b Credit financing costs	64,93	9%	491.863	1.303.176	1.947.995	
1c Carbon rebate (investment subsidy)	77,13	11%	678.712	1.326.574	2.313.791	
	530,19	74%				
2a Supply side support	119,70	17%	1.087.163	1.168.470	3.590.930	
2b Demand side support	59,95	8%	576.585	747.490	1.798.624	
	179,65	25%				
3a Research & development	6,47	1%	45.731	-	194.174	
3b Monitoring and evaluation	2,45	0,3%	26.639	19.971	73.493	
	8,92	1,2%				
Total programme	718,76	100%	6.198.329	11.542.549	21.562.886	
	<i>million PKR</i>		<i>565,1</i>	<i>1.033,6</i>	<i>1.931,0</i>	



Main actors



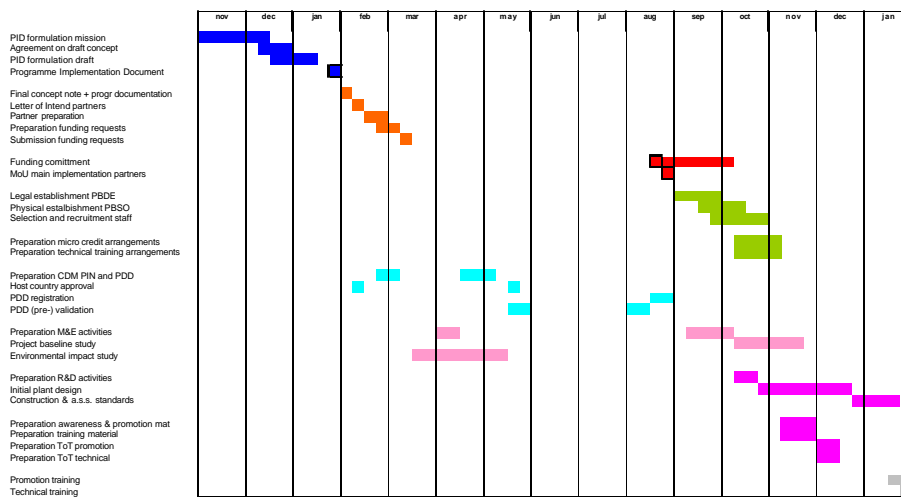
Actor – activity matrix

Actor - activity	Promotion & marketing	Investment financing	Construction and/ASS	Quality Management	Training	Extension	Institutional Support	Monitoring & Evaluation	Research & Development	Programme Coordination
Biogas Board										●
AEDB / MoE								●		
PBDE	●	●	●	●	●	●	●	●	●	●
Credit providers		●								
RSP-N	●	●				●	●			●
RSPs / NGOs	●	●			●	●	●			
Dairy orgs / Nat gas suppliers	●									
PCRET									●	
Voc Training centres					●					
Biogas Branch org	●		●		●					
Biogas Constr Enterprises	●		●							
Consultancy orgs					●			●	●	

Initiating / coordinating	●
Executing	●
Supporting / assisting	●

Programme functions

Steps from now



Thank you for your attention

Accomplishments

- BSP Nepal: 170,000 plants, growth ~ 20,000 p.a.
- BSO Vietnam: 40,000 plants, growth ~ 18,000 p.a.
- Bangladesh: target 60,000 plants by 2011
- Cambodia: target 17,000 plants by 2011
- Laos: target 2,000 plants by 2010

- BSP Nepal:
 - 2 CDM project activities, 19,500 plants, registered, ~ 100,000 ER p.a.
 - Establishment biogas micro finance: fund / 300 mfi trained, 4000 hh received



Impact areas & expected results

Pakistan Biogas Programme		<i>expected results (provisional)</i>
Agriculture & livestock	Family health, Sanitation & gender	Biogas plant construction 30.000 [plants]
Environment	Energy	Energy
		Energy production 17.786 [toe / yr]
		Power installed 60.084 [kW]
		Environment
		GHG emission reduction 214.557 [t CO ₂ e / yr]
		Deforestation reduction 8.218 [ha of forest / yr]
		Soil nutrification 70.350 [t(DM) bio-slurry / yr]
		Fuel substitution
		Biomass 164.660 [t biomass / yr]
		Fossil fuel 2.392 [t / yr]
		Socio-economic
		Persons reached 300.000 [persons]
		Workload reduction (women & children) 4.690 [pers years]
		Exposure to indoor air pollution reduced 150.000 [women & children]
		Toilets attached 6.000 [toilets]
		Productive slurry use 24.000 [households]
		Employment generation (direct) 2.100 [person years]
		Training
		User training 42.000 [person days]
		Professional training 12.855 [person days]

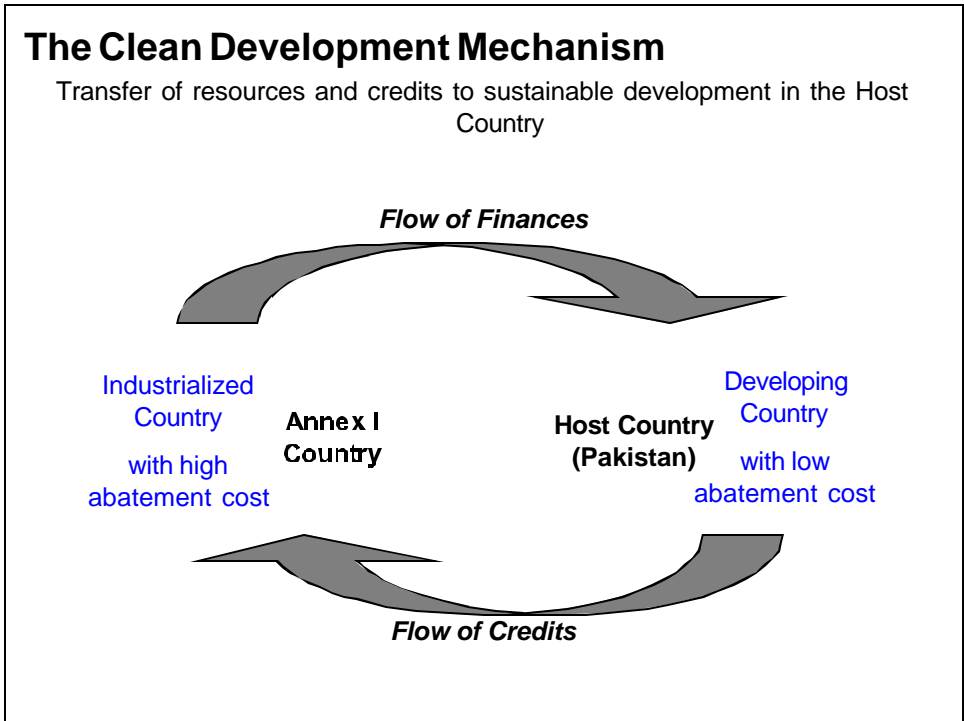
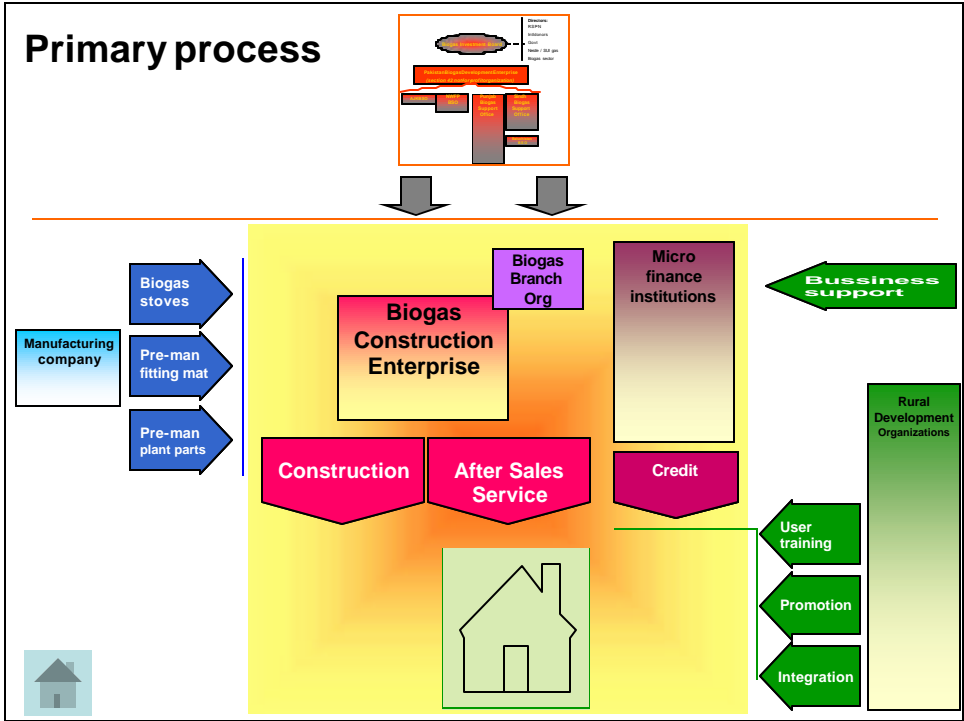


Target group

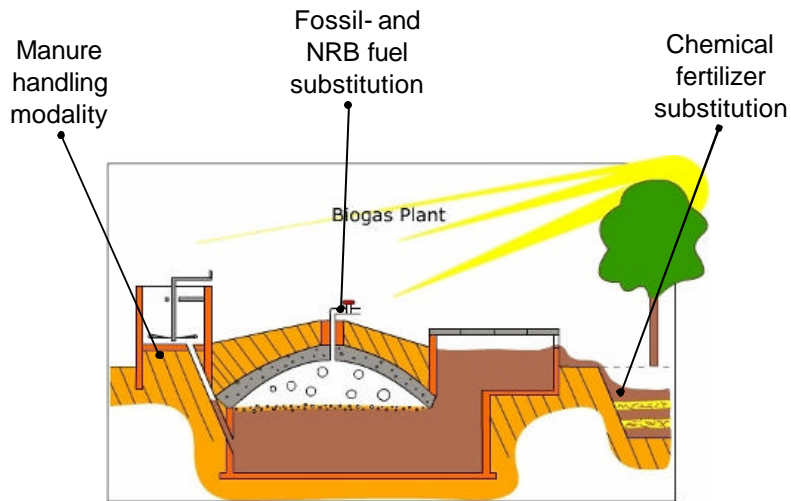


- Farming households
- 2 – 10 heads of cattle
- No gas grid connection (expectations)
- (organized) commercial dairy production
- Demand for alternative domestic energy
- Using (partially) commercial domestic energy
- Bio-slurry opportunity
- Organized for micro credit
- Organized as women- or rural development groups



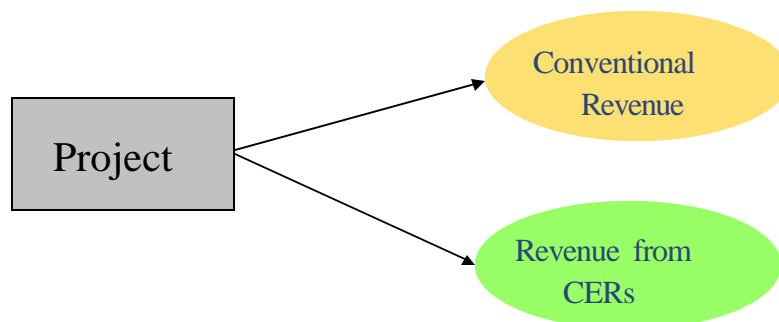


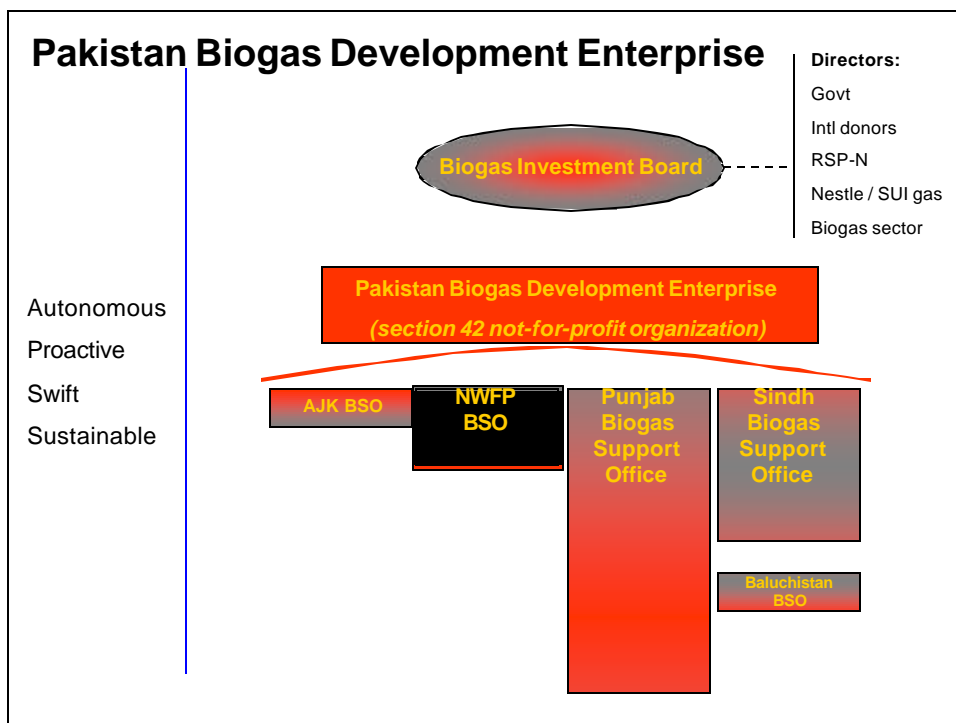
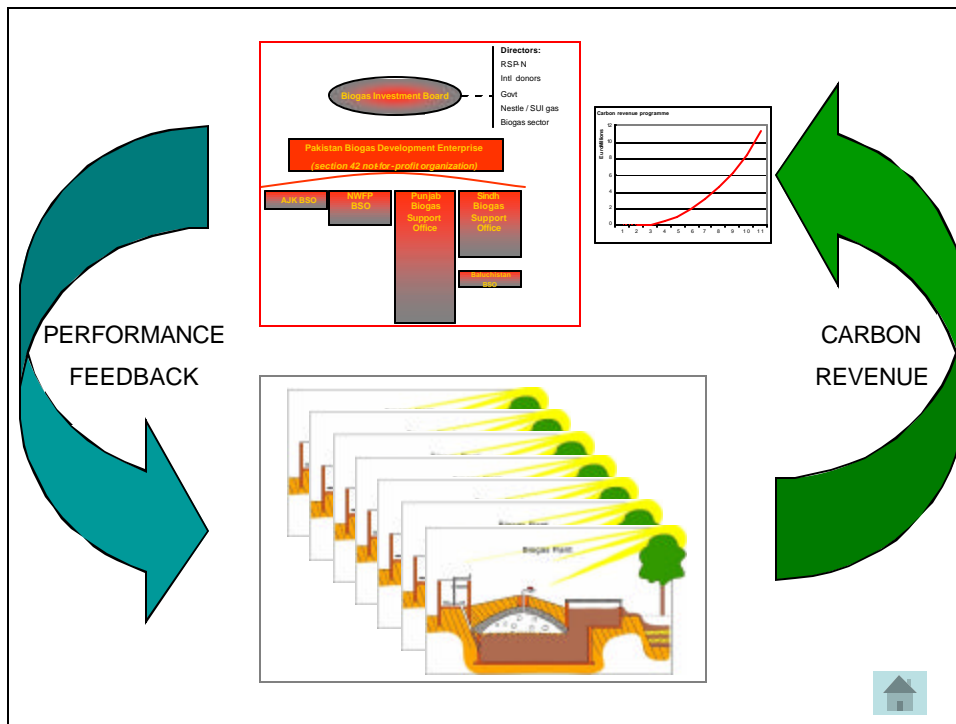
Biogas & GHG reduction



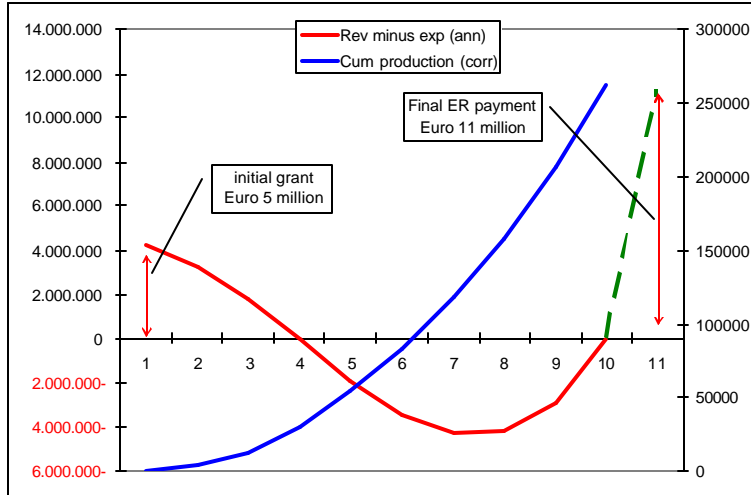
Estimated greenhouse gas reduction = 4 to 5 tons of CO₂ eq / plant / year

What does it mean for projects?

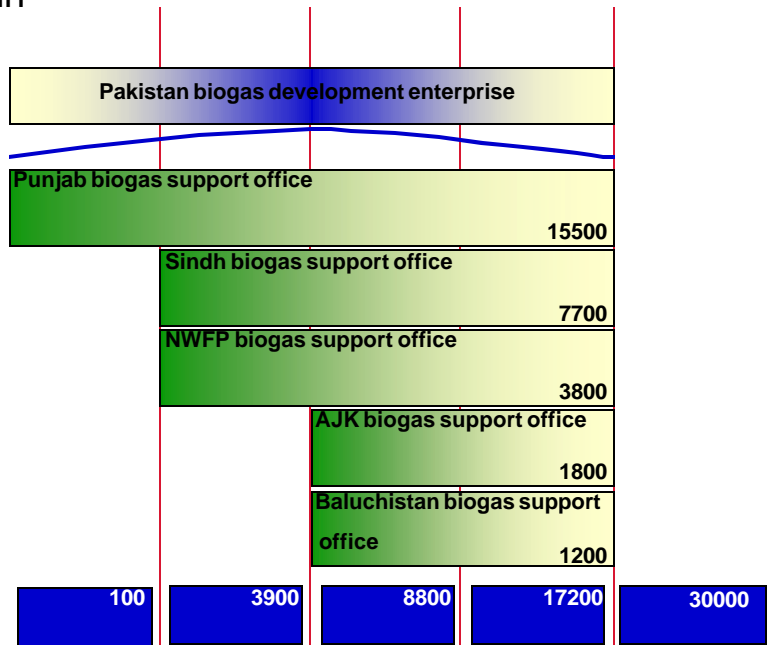




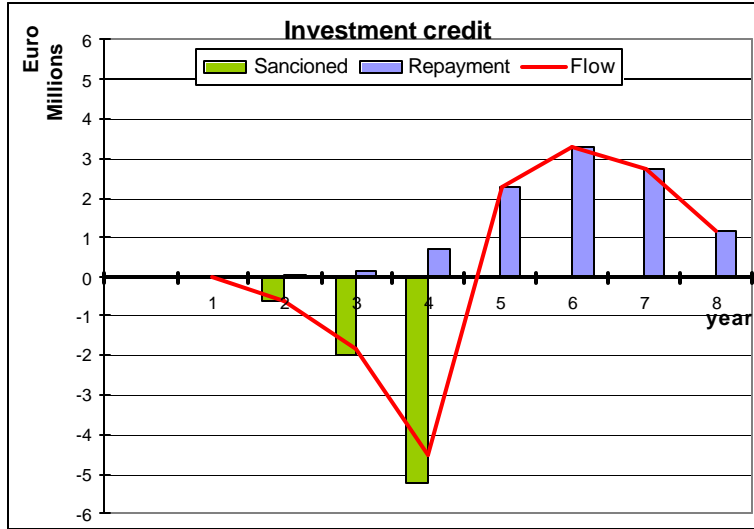
PBDE cash flow



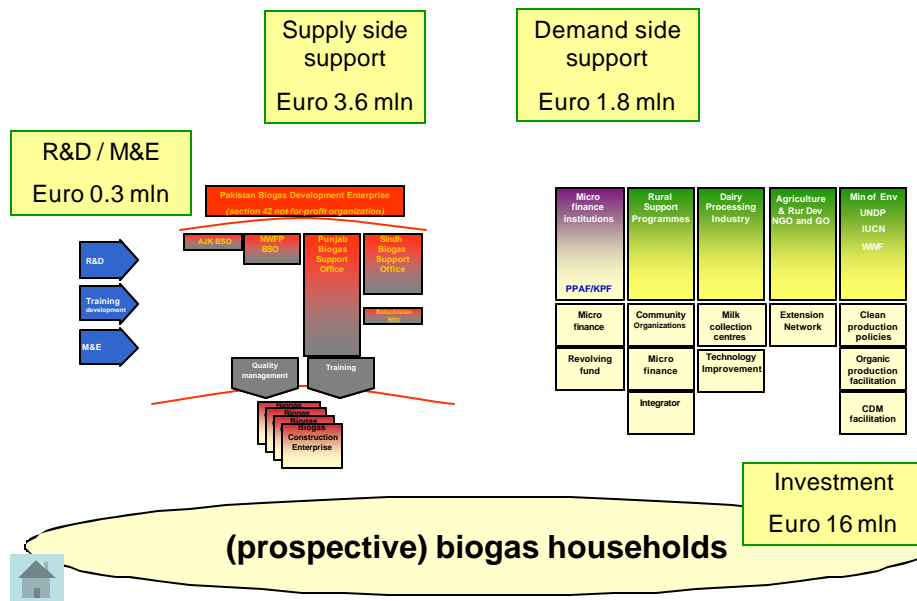
Phasing in



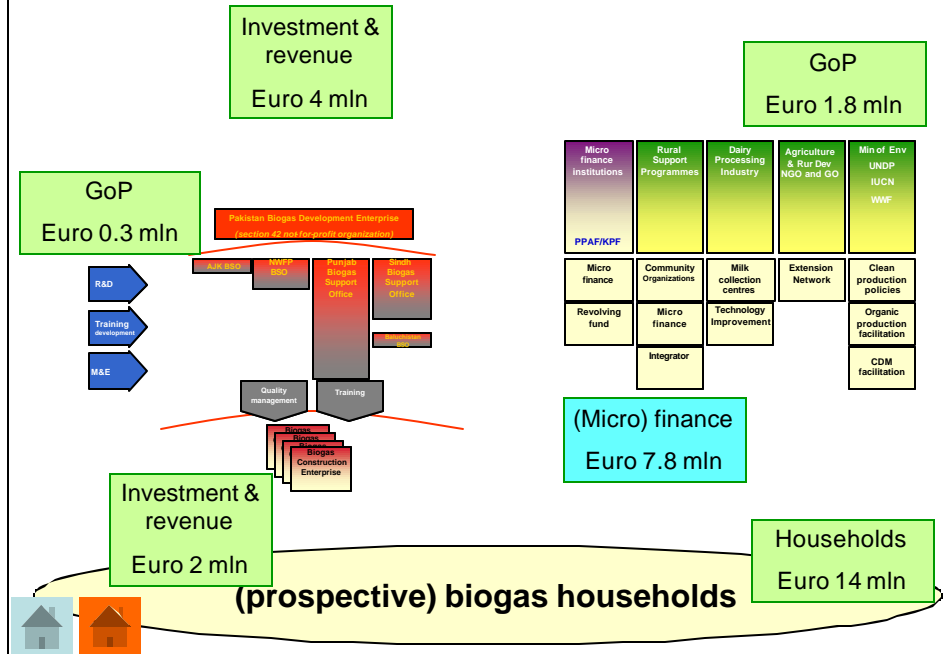
Credit fund requirement



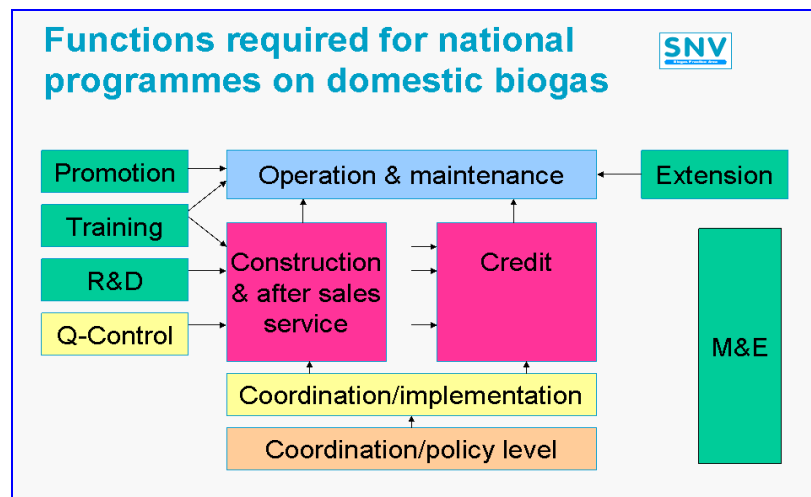
Application of funds



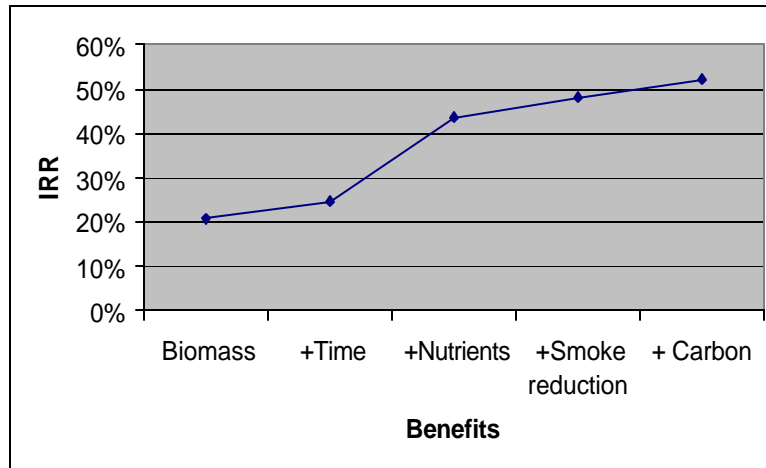
Source of funds



Functions



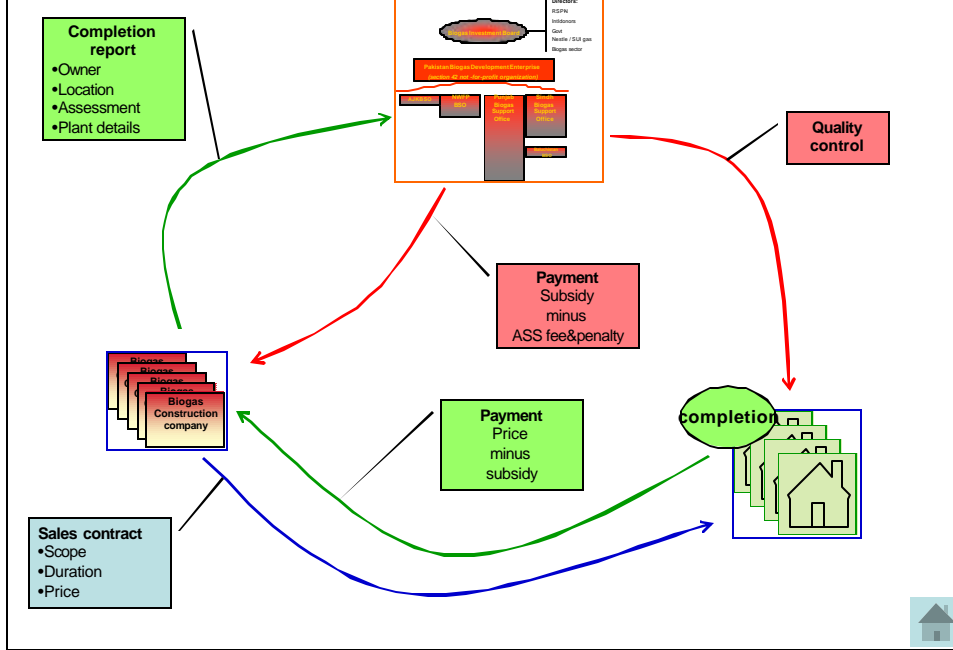
Domestic biogas economic analysis



Technology



Subsidy & quality management



Investment costs GGC 2047 biogas plant for Pakistan for construction in bricks [ZAR]													
	unit	4 m ³ digester			6 m ³ digester			8 m ³ digester			10 m ³ digester		
		qty	costs	total	qty	costs	total	qty	costs	total	qty	costs	total
1 Contribution farmer in kind													
1.1	Unskilled labour	(person days)	20	4,000		25	5,000		30	6,000		35	7,000
1.2	Sand	(bags)	60	3,600		70	4,200		80	4,800		90	5,400
1.3	Gravel	(bags)	30	1,050		35	1,225		40	1,400		50	1,750
1	Total farmer contribution			8,650		10,425		12,200		14,150			
2 Supplied materials													
2.1	Cement	(bags)	12	2,700		14	3,150		16	3,600		20	4,500
2.2	Bricks	(piece)	1200	3,600		1,400	4,200		1,650	4,950		1,750	5,250
2.3	Reinforcement rod	(kg)	11	440		11	440		14	560		14	560
2.4	Fitting material	(set price)		3,385			3,385			5,495			5,495
2.5	Appliances	(set price)		400			400			800			800
2	Total materials			10,525		11,575		15,405		16,605			
3 Technical services													
3.1	Skilled labour	(person days)	2	800		2	800		2	800		2	800
3.2	Semi skilled labour	(person days)	8	2,400		9	2,700		11	3,300		12	3,600
3.3	Annual maintenance fee	(fee per visit)	4	2,000		4	2,000		4	2,000		4	2,000
3	Total services			5,200		5,500		6,100		6,400			
4 Company fee													
4.1	Overhead	(person days)	1	200		1	400		1	400		1	400
4.2	Risk coverage	(share of 2)	5%	526		5%	579		5%	770		5%	830
4.3	Company profit	(share of 2+3)	20%	3,145		20%	3,415		20%	4,301		20%	4,601
4	Total company fee			4,071		4,394		5,471		5,831			
5 Programme fee													
5.1	QC contribution fee	(fee per visit)	2	800		2	800		2	800		2	800
5.2	Participation fee	(lump sum)		400			400			400			400
5	Total programme fee			1,200		1,200		1,200		1,200			
Total investment					29,646		33,094		40,376		44,186		
Total investment [Euro]					333		372		454		496		
Operational costs													
			min		max		min		max		min		max
Feeding	(kg dung/day)		24	36		36	48		48	60		60	90
Water requirement	(l/h water/day)		24	36		36	48		48	60		60	90
Cattle (night stabling only)	(heads)		4	6		6	8		8	10		10	15
Gas production	(m ³ /day)		0,96	1,44		1,44	1,92		1,92	2,4		2,4	3,6