AgriGrid

Financial model

The EnAccess Foundation

ANKA MADAGASCAR

1

GETTING PREPARED

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1.1

Preparing the modeling

Objective
Model and assess the operational and financial viability of the basic proposed AgriGrid concept

Activities
- Agronomic input
- Supply chain and operations modeling
- CAPEX, revenues and OPEX estimations
- Comparison of mini-grid (stand-alone) vs. integrated AgriGrid model - small and large size

Data Sources
- Crop researchs
- Literature
- Proprietary data
- Employees, partners, business networks

Results
- 25-year financial model for the proposed AgriGrid concept
- **Improved financial indicators from AgriGrid**

DEVELOPER INSIGHT

Agronomic input
- Crop yield high-season/off-season to determine peak production & power capacity required
- End product content
- Chemical & physical processes
- By-side products

Supply chain & operations
- Collection and purchase of rough commodities
- Transport to processing facility
- Storage
- Processing activities
- Packaging activities
- Marketing activities
- Both direct and indirect sales
- Electricity flows

Financial modeling
- CAPEX
- Gross margin from main end product
- Gross margin from extra sold electricity
- Adjusted overhead
- Model simulation
- Funding simulation

Results
- Improved equity IRR, NPV and payback period compared to pure mini-grid
- Improved project IRR & NPV
- Profit sharing between AgriGrid and community

1.1

Preparing the modeling

Building a financial model and assessing the economic viability of the AgriGrid concept needs technical input from specialized agronomists, for instance related to:

- Chemical composition and characteristics of both interim and end products;
- Special treatment and processing steps to get the final product determine the production function and related costs;
- Required technologies and engineering knowledge;
- Required additional inputs and input-output ratios.

On the other side, a good understanding of realities on the ground is fundamental with regard to harvesting seasons and yields, logistics and distances, or shipment channels are required.

It is also important to validate the final product in terms of competitiveness compared to existing (imported) products in the market.

Local or international providers of other supplies along the value chain, for instance for packaging, need to be determined and can affect the economic viability of the entire concept.

1.2

Supply chain and operations – AgriGrid side

DEVELOPER INSIGHT

Financial modeling of the agricultural supply chain will try to translate on-the-ground activities into (simplified) data points for volumes and financial figures. Some financial figures may be still based on estimations or assumptions and may require additional research and validation before implementation. Scalability of the financial model may also be limited if the economies of scale are not fully known. For instance, logistics with local means may be an appropriate means for a small-scale approach but not feasible for a large-scale model.

Translate supply chain data points into financial model

Yields

Sales

Agribusiness production

Agribusiness1 rice bran				Year 1
Number of local rice huskers	#	29	Number of months	
Average rice bran processed during HIGH SEASON per	MT p.m.	20,0	3	
Average rice bran processed during LOW SEASON per h	MT p.m.	7,0	9	
Average volume of rice bran per husker	MT p.a.	123,0	*based on communal tax records*	
TOTAL rice bran production	MT p.a.	3567,0		
Purchasing price from rice dehuskers	MGA/MT	300 000		
Rice husker inclusion rate	%			50,00%
Total annual rice bran yield	MT p.a.			1 784
Losses and wastage	%	10,0%		
Net annual production volume	MT p.a.			1 605
Rice bran oil content	%	20,0%		
Rice bran oil volume p.a.	MT p.a.	642,1		**321**
Sales price for rice bran oil to local shops	MGA/MT	1 495 200		
Sales price for rice bran oil to external wholesalers	MGA/MT	1 869 000		
Reveue from sales of rice bran oil	MGA p.a.			540 004 563
	USD p.a.			144 464

1.2

Supply chain and operations – AgriGrid side

Logistics

Storage

Processing

Complementary costs of farming				
Costs of inputs	MGA		not relevant for rice bran	
Costs of irrigation	MGA		not relevant for rice bran	
Personnell costs	MGA		not relevant for rice bran	
Miscellanous	MGA		not relevant for rice bran	
Total complementary farming costs	MGA			–
Costs of 'internal' transport on own account				
Non-personnel-costs	MGA			
Trip capacity per zebu cart	MT	1,0		
Number of trips per day during high season	# per day	20,0		
Number of trips per day during low high season	# per day	7,0		
Total number of trips during high season	# p.a.	1440		
Total number of trips during low season	# p.a.	1512		
Service fee per trip during high season	MGA	15 000		
Service fee per trip during low season	MGA	40 000		
Total zebu transport service expenses	MGA			41 040 000
Personnell costs	MGA	n.a.		–
Total additional transport costs	MGA			**41 040 000**
Costs of warehousing				
Non-personnel-costs	MGA	*special equipment for rice bran requied?*		
Personnell costs	MGA			
Number of warehouse administrators	#	1,0		
Salary	MGA/year	2 400 000		
Total annual pay				1 200 000
Total complementary warehousing and storage costs	MGA			**1 200 000**
Costs of processing				
Non-personnel-costs	MGA	*needs to be broken down further*		
Rice bran stabilization / degumming inputs				
Physical pressing inputs				
Other?				
Personnell costs	MGA	*needs to be broken down further*		
Total processing costs	MGA/MT	897 120		**288 002 434**

1.2

Supply chain and operations – AgriGrid side

Packaging

Shipping

Costs of packaging				
Non-personnel-costs				
Large drum capacity	kg	160,0		
Share of local sales	%	50,00%		
Shelf life	days	14		
Drums per cycle	#	2		
Total number of drums	#	1813		
Cost per drum	MGA	16	added to CAPEX	
End consumer bottles/tins		*needs to be broken down further*		
Personnell costs	MGA			
Number of filling line operators	#	2,0		
Salary	MGA/year	2 400 000		
Total annual pay	MGA p.a.			2 400 000
Total packaging costs	MGA			**2 400 000**
Shipment costs				
Non-personnel-costs				
Transport service provider fee per trip	MGA	600 000		
Capacity per truck/trip	MT	7,5		
Number of trips per year	#			214
Total non-personell costs	MGA p.a.			128 412 000
Personnell costs	MGA	*needs to be broken down further*		
Number of filling line operators	#	1,0		
Salary	MGA/year	2 400 000		
Total annual pay	MGA p.a.			2 400 000
Total shipping costs	MGA			**130 812 000**

1.2

Supply chain and operations – AgriGrid side

how we did it

The case study focuses on **crude oil made from rice bran (paddy).**
Here are some data points collected for the purpose of the modeling:

For rice bran oil yield:

- Number of local rice huskers
- Average rice bran processed during HIGH SEASON (three months) per husker
- Average rice bran processed during LOW SEASON (nine months) per husker
- Purchasing price for rice bran from rice huskers per metric ton
- Harvest losses and wastage
- Rice bran oil content in rice bran

For rice bran oil sales:

- Sales prices for rice bran oil per metric ton (differential pricing both for local shops and for wholesalers)

For rice bran logistics:

- Capacity per trip in metric tons
- Roundtrip duration
- Number of trips per day

For storage:

- Stock turnover time
- Required storage capacity

For processing:

- Maximum processing capacity per day in metric tons
- Processing time (per batch)

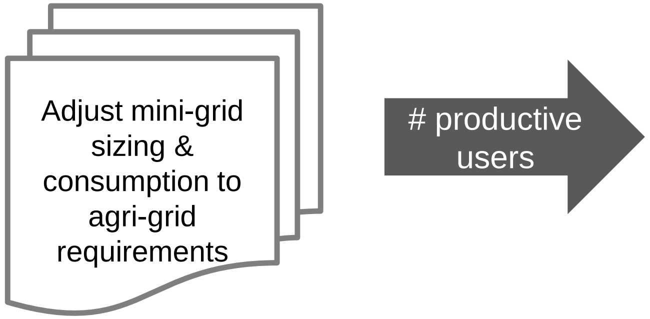
1.3

Supply chain and operations – mini-grid side

DEVELOPER INSIGHT

The AgriGrid model is supposed to stir both the sales of value-added agricultural products processed with electric power and the sales of electricity from that additional agri-business income. Specific mini-grid engineering expertise is required to determine additional loads as well as production or distribution capacity expansion. Consumption needs to be carefully broken down into sales to third party productive users along the supply chain and consolidated consumption on own account.

Also, seasonal peaks are very likely to be encountered during the harvesting season if the end-product cannot be stored for several weeks or months*. In this case the question is which energy mix will be used to meet peak demand; an increased PV production capacity can be considered to have reserve capacity during off-season for other productive use activities instead of installing peak diesel capacity.



Portfolio Inputs

Phase 1 portfolio		Growth rate	Total/site	Households	Shops	Restaurants	Schoo
Mini-grid	#	2,70%	1 354	1 331	1	5	
Rice bran oil	#		–	–	–	–	
Agri-pyramid**	#		–				
not determined**	#		–				
Total			1 354	1 331	1	5	

Phase 3 portfolio		Growth rate	Total/site	Day consumption			
				Agri-grid production	Agri-grid Packaging	Leisure	Lodge/Hotel
Mini-grid	#		14		–	–	–
Rice bran oil	#		13				
Agri-pyramid	#		–				
not determined	#		–				
Total			27	–	–	–	–

*If rice bran is not stabilized, e.g. by enzymatic degumming, within four days after husking it will not be able to be processed into edible oil anymore

**The model can be built to simulate the integration of several agri-components as part of the overall AgriGrid model

1.3

Supply chain and operations – mini-grid side

Capacity adjust.

Sizing Assumptions - adjusted to higher load demand from agri-grid		Probability	Technology: Unit:	Solar PV kWp	Battery kWh	Inverters kW	Diesel Genset kVA
Mini-grid	#	100%		192	252	170	140
Rice bran oil	#	100%		88	88	80	90
Agri-pyramid	#	0%					
not determined	#	0%					
Total				280	340	250	230

Fees, Tariffs and Charges

Connection & Installation Fees		Phase 1	Phase 3
Connection fee	MGA/Connection	30 000	50 000
Upfront contribution indoor installation	MGA/Connection	50 000	50 000
Reimbursement of indoor installation	MGA/Connection	100 000	350 000

Tariff adjust.

Tariffs & Charges

Phase 1 tariffs and annual charges		Phase 1	Growth Rate	Year 1	Year 2	Year 3	Year 4
Day Tariff	MGA/kWh	1 500	7,0%	1 500	1 717	1 717	1 966
Basic Tariff	MGA/kWh	1 800	7,0%	1 800	2 061	2 061	2 359
Night Tariff	MGA/kWh	2 000	7,0%	2 000	2 290	2 290	2 622
Fixed Charge	MGA/customer/year	40 000	7,0%	40 000	45 796	45 796	52 432
Metering Costs	MGA/customer/year	–	–	–	–	–	–
Tariff review period	Years	2,0		-	1	-	1

Phase 3 tariffs and annual charges		Phase 3	Growth Rate	Year 1	Year 2	Year 3	Year 4
Day Tariff	MGA/kWh	1 500	7,0%	1 500	1 717	1 717	1 966
Basic Tariff	MGA/kWh	1 800	7,0%	1 800	2 061	2 061	2 359
Night Tariff	MGA/kWh	2 000	7,0%	2 000	2 290	2 290	2 622
Fixed Charge	MGA/customer/year	200 000	7,0%	200 000	228 980	228 980	262 159
Metering Costs	MGA/customer/year	–	–	–	–	–	–
Tariff review period	Years	2,0		-	1	-	1

1.3

Supply chain and operations – mini-grid side

Productive use penetration

Phase 3 customers

Penetration Rate (by year of operations)

		Year 1	Year 2	Year 3	Year 4
Mini-grid	% phase 3 population	18,7%	37,4%	68,8%	75,0%
Rice bran oil	% phase 3 population	60,0%	80,0%	100,0%	100,0%
Agri-pyramid	% phase 3 population				
not determined	% phase 3 population				

All phase 3 customers - connections by site

		Year 1	Year 2	Year 3	Year 4
Mini-grid	# connections	3	5	10	11
Rice bran oil	# connections	8	10	13	13
Agri-pyramid	# connections	–	–	–	–
not determined	# connections	–	–	–	–

All phase 3 customers - new connections by site

		Year 1	Year 2	Year 3	Year 4
Mini-grid	# connections	3	3	4	1
Rice bran oil	# connections	7,8	2,6	2,6	–
Agri-pyramid	# connections	–	–	–	–
not determined	# connections	–	–	–	–

Productive use consumption

Electricity consumption

Phase 3 flat customers - overall consumption

		Year 1	Year 2	Year 3	Year 4
Mini-grid	kWh/year	–	–	–	–
Rice bran oil	kWh/year	–	–	–	–
Agri-pyramid	kWh/year				
not determined	kWh/year				

Phase 3 day customers - overall consumption

		Year 1	Year 2	Year 3	Year 4
Mini-grid	kWh/year	22 857	36 961	52 258	63 332
Rice bran oil	kWh/year	22 857	36 961	52 258	63 332
Agri-pyramid	kWh/year				
not determined	kWh/year				

Phase 3 night customers - overall consumption

		Year 1	Year 2	Year 3	Year 4
Mini-grid	kWh/year	–	–	2 154	2 176
Rice bran oil	kWh/year	–	–	–	–
Agri-pyramid	kWh/year				
not determined	kWh/year				

1.4

CAPEX assumptions

DEVELOPER INSIGHT

Based on the increased mini-grid capacity, additional CAPEX for production and maybe also distribution mini-grid equipment need to be added to the financial model.

While this is rather business as usual for a mini-grid developer, the determination of CAPEX for the agri-processing and supply chain equipment can be a challenge if specific technical or industry expertise is not available in the mini-grid company and maybe not even in the entire country: e.g. rice bran oil is a very well established product in India, China or Bangladesh but not known in Sub-Saharan Africa.

Depending on the technical and economic lifetime of agri-processing equipment, ongoing CAPEX in the future, e.g. after ten years, also need to be considered in the financial model.

Adjust CAPEX to AgriGrid model – both on mini-grid and AgriGrid side

Production CAPEX assumptions

Elt. Production & Agri Capex Investment Assumptions	Solar PV	Battery	Storage&proc	Processing
Cost Assumptions	*MGA/kWp*	*MGA/kWh*	*MGA/MT*	*MGA/MT*
Mini-grid	1 608 440	1 922 138		
Rice bran oil	1 608 440	1 922 138	2 000 000	37 380 000
Agri-pyramid				
not determined				

Distribution CAPEX assumptions

Elt. Distribution Capex Investment Assumptions	LV grid	MV grid
Cost Assumptions	*MGA/km*	*MGA/km*
Mini-grid	47 148 600	0
Rice bran oil		
Agri-pyramid		
not determined		

1.4

CAPEX assumptions

Initial Capex

Actual production CAPEX

Elt. Production & Agri Capex Investments

		Solar PV	Battery	Storage&processing facilities	Processing equipment
Mini-grid	'GA/site	308 820 480	484 378 776		
Rice bran oil	'GA/site	141 542 720	169 148 144	439 830 716	774 300 000
Agri-pyramid	'GA/site	–	–	–	–
not determined	'GA/site	–	–	–	–

Actual distribution CAPEX

Distribution Capex Investments

		LV grid	MV grid
Mini-grid	'GA/site	669 510 120	–
Rice bran oil	'GA/site	–	–
Agri-pyramid	'GA/site	–	–
not determined	'GA/site	–	–

Ongoing Capex

Production Capex

Production reinvestments

Investments by site class

		Solar PV	Battery	Storage&processing facilities	Processing equipment
Mini-grid	*MGA*	92 646 144	193 751 510	–	–
Rice bran oil	*MGA*	–	–	439 830 716	774 300 000
Agri-pyramid	*MGA*	–	–	–	–
not determined	*MGA*	–	–	–	–

Distribution Capex Investment Assumptions

Distribution reinvestments

Investments by site class

		LV grid	MV grid	Power house	Fencing	Foundations
Mini-grid	*MGA*	401 706 072	–	51 326 404	128 214 370	1 654 800
Rice bran oil	*MGA*	–	–	–	–	–
Agri-pyramid	*MGA*	–	–	–	–	–
not determined	*MGA*	–	–	–	–	–

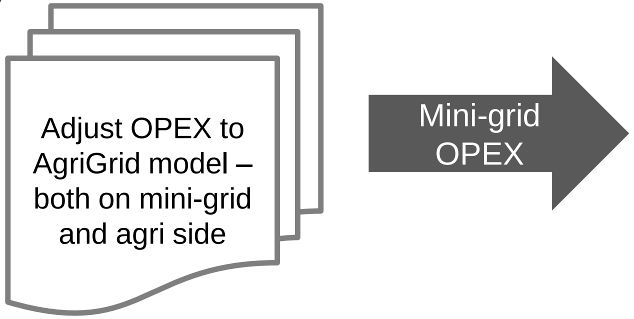
1.5

OPEX assumptions

DEVELOPER INSIGHT

The combined AgriGrid model also needs to consider direct OPEX on both levels: for the mini-grid and for the AgriGrid. However, even overhead OPEX may have to be adjusted to the expended nature of the business.

On a consolidated level it is important to avoid counting for revenue on the side of the mini-grid which is OPEX on the agri-processing side since this will be reflected incorrectly in cash flows and profitability figures. Only revenues from and expenditures to third parties to the combined model will show the true wealth surplus created for the rural population involved in the AgriGrid.



Operating costs

Mini-grid operational site costs		1	1	1	1	1
Diesel Fuel	*MGA*	122.097	6.230.809	21.339.673	37.963.321	60.359.399
Service & Maintenance	*MGA*	50.000.000	52.000.000	54.080.000	56.243.200	58.492.928
Local operational management	*MGA*	11.250.000	11.700.000	12.168.000	12.654.720	13.160.909
Guards	*MGA*	3.000.000	3.120.000	3.244.800	3.374.592	3.509.576
Insurance	*MGA*	12.288.000	12.963.840	13.676.851	14.429.078	15.222.677
Miscellaneous	*MGA*	10.400.000	10.972.000	11.575.460	12.212.110	12.883.776
Metering License	*MGA*	3.588.500	5.792.322	7.750.585	10.468.823	12.145.959
Vendors	*MGA*	3.312.462	5.346.759	7.154.386	9.663.529	11.211.654
Mobile payment fee	*MGA*	3.312.462	5.346.759	7.154.386	9.663.529	11.211.654
Regulator fee	*MGA*	–	–	–	–	–
Communal Tax	*MGA*	–	–	–	–	–
Total	*MGA*	**97.273.520**	**113.472.488**	**138.144.140**	**166.672.902**	**198.198.532**

1.5

OPEX assumptions

AgriGrid OPEX

Agri 1 rice bran		1	1	1	1	1
Diesel Fuel	MGA	-	-	-	-	-
Service & Maintenance	MGA	-	-	-	-	-
Local operational management	MGA	-	-	-	-	-
Guards	MGA	-	-	-	-	-
Insurance	MGA	-	-	-	-	-
Miscellaneous	MGA	-	-	-	-	-
Complementary costs of farming	MGA	–	–	–	–	–
Costs of 'internal' transport on own account	MGA	41.040.000	82.080.000	82.080.000	82.080.000	82.080.000
Costs of warehousing	MGA	1.200.000	2.400.000	2.400.000	2.400.000	2.400.000
Costs of processing	MGA	288.002.434	576.004.867	576.004.867	576.004.867	576.004.867
Costs of packaging	MGA	2.400.000	4.800.000	4.800.000	4.800.000	4.800.000
Shipment costs	MGA	130.812.000	259.224.000	259.224.000	259.224.000	259.224.000
Total Agri 1 costs	MGA	**463.454.434**	**924.508.867**	**924.508.867**	**924.508.867**	**924.508.867**

Overhead costs

Overhead Costs						
Salary Managing Director	MGA	8.000.000	8.440.000	8.904.200	9.393.931	9.910.597
Management and technical staff	MGA	6.000.000	6.330.000	6.678.150	7.045.448	7.432.948
Rural marketing	MGA	6.000.000	6.330.000	6.678.150	7.045.448	7.432.948
Accounting	MGA	1.500.000	1.582.500	1.669.538	1.761.362	1.858.237
Transportation and travel	MGA	6.000.000	6.330.000	6.678.150	7.045.448	7.432.948
Office costs	MGA	2.500.000	2.637.500	2.782.563	2.935.603	3.097.062
Consultancy cost and fees	MGA	2.500.000	2.637.500	2.782.563	2.935.603	3.097.062
Company insurance	MGA	1.500.000	1.582.500	1.669.538	1.761.362	1.858.237
Miscellaneous	MGA	2.000.000	2.110.000	2.226.050	2.348.483	2.477.649
Vehicle	MGA	20.000.000				
Agribusiness 1 overhead	MGA	20.000.000	20.000.000	20.000.000	20.000.000	20.000.000
Agribusiness 2 overhead	MGA	–	–	–	–	–

Depreciation & interest paid

EBITDA	MGA	**92.927.517**	**219.451.160**	**261.199.982**	**310.690.729**	**326.598.067**
Depreciation	MGA	279.966.470	279.966.470	279.966.470	279.966.470	279.966.470
EBIT	MGA	**(187.038.953)**	**(60.515.310)**	**(18.766.487)**	**30.724.259**	**46.631.597**
Interest Expense	MGA	103.247.982	108.129.824	97.089.876	84.161.889	70.044.319
FX (profit)/loss	MGA	58.998.847	61.788.471	55.479.929	48.092.508	40.025.325
EBT	MGA	(349.285.782)	(230.433.604)	(171.336.292)	(101.530.138)	(63.438.048)

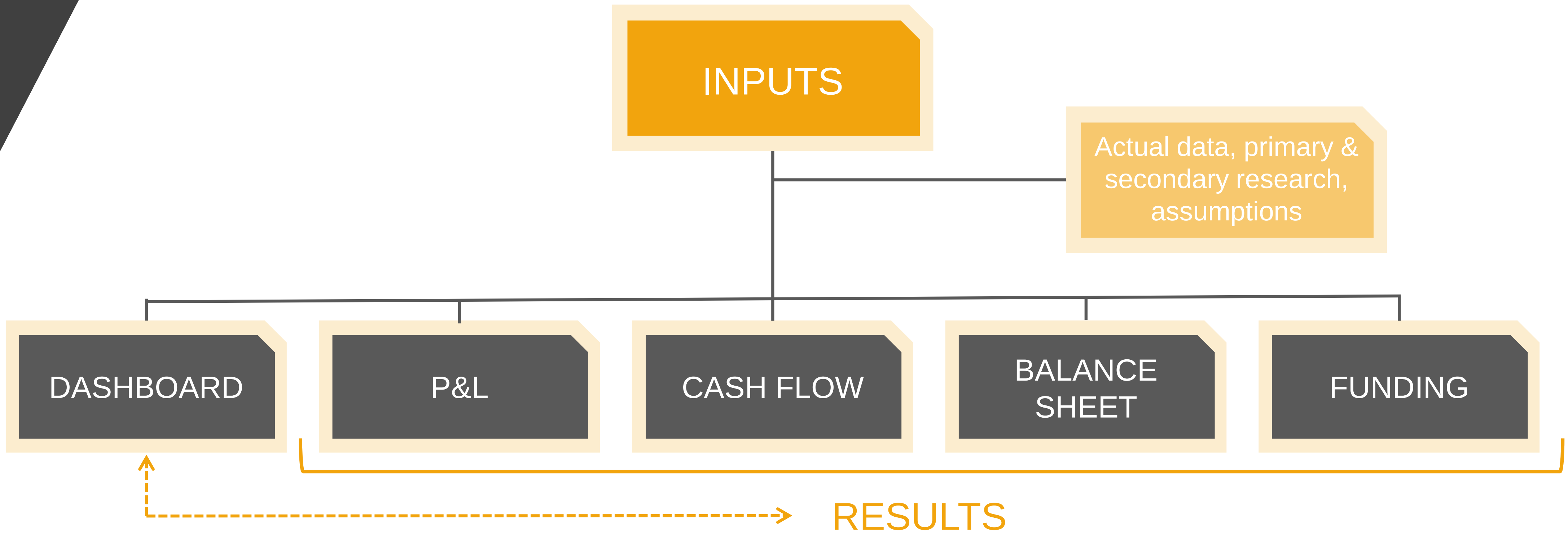
1.6

Flow of the financial model

DEVELOPER INSIGHT

A state-of-the-art integrated financial model should be used, as follows:

- An input section for factors, drivers and assumptions determining CAPEX, sales, OPEX and cash flows;
- A P&L section;
- A balance sheet section;
- A funding section considering grants (incl. first loss tranches), equity and debt;
- A cash flow statement;
- A Dashboard, highlighting the major results and assumptions (e.g. for funding).



1.2
MODELING

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1.2

Modeling and reviewing the performance indicators

DEVELOPER INSIGHT

The financial results need to be determined on two levels over a period of 25 years:

- On the project level based - on local currency ;
- On the equity level based - on hard currency (USD).

On both levels, calculation is needed:

- The internal rate of return (IRR) in %;
- The payback period in years;
- The net present value (NPV) in currency units (local and USD): for the calculation of the equity NPV, the discounting rate of 12% can be used, and for the project NPV, the specific weighted average cost of capital (WACC) of the project as a discounting factor is calculated;
- The average operational profitability (EBIT in % of revenue).

Performance and Returns

Operational profitability	**Performance**		Average
	Operating profit margin	%	**12,1%**
Performance on equity	**Equity**		
	Equity IRR - USD	%	14,40%
	Equity payback	years	10 yrs
	Cost of equity	%	12,00%
	Equity NPV	USD	67.299
Performance on project	**Project**		
	Project IRR - MGA	%	17,29%
	Project IRR - USD	%	13,32%
	WACC - MGA	%	12,48%
	NPV - MGA	MGA	871.186.786
	WACC - USD	%	8,75%
	NPV - USD	USD	228.438

2

KEY OUTPUTS

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2.1

Results – Comparison with pure mini-grid case

how we did it

DEVELOPER INSIGHT

On the small scale with procuring rice bran from a limited number of 29 rice huskers around the targeted village, with local means of transportation (zebu carts), the combined processing and sales of rice bran oil does NOT add value to mini-grid operations.

More specifically, this means that:

- The internal rate of return (IRR) is lower than for the mini-grid alone;
- The payback period does not change, but it is also not reduced;
- The net present value (NPV) in local currency is almost the same.

Forecast period - 25 years

		Mini-grid case	AgriGrid case	Deviation
Average EBIT margin	%	19.1	12.1	-7
Equity IRR	%	17.3	14.4	-2.9
Equity NPV	USD	101,793	67,299	-34,494
Equity payback	years	10	10	0

2.2

Results – Interpretation of the comparison

how we did it

DEVELOPER INSIGHT

The question to ask is **"why the addition of agri-processing activities does not add value to equity investors who take the highest risk together with the developer?"**

The major explanation is that the CAPEX for the combined AgriGrid case are more than half a million USD, higher than for the mini-grid only while at the same time the operational profitability (EBIT margin) of agricultural and also agri-processing activities in sub-Sahara Africa suffer form thin margins in general.

There is, however, over the years more available in absolute currency figures to be distributed to shareholders (see cumulated flow to equity in the table below) which is good news for the local communities if they participate from profits in a smart governance model.

Nevertheless, the question remains if the effect of the additional agri-business to the mini-grid can be increased. The answer lies in **UPSCALING**!

Performance	.	Mini-grid case	AgriGrid case	Deviation
Average EBIT margin	%	19.1	12.1	-7
Equity IRR	%	17.3	14.4	-2.9
Equity NPV	USD	101,793	67,299	-34,494
Equity payback	years	10	10	0
Cumulated flow to equity	USD	1,036,323	1,240,415	204,092
Funding		**Mini-grid case**	**AgriGrid case**	**Deviation**
Grants for assets	USD	543,089	885,238	342,149
Grants for first loss	USD	83,727	130,901	47,147
Village contribution	USD	0	0	0
Senior debt	USD	243,636	400,137	156,501
Equity	USD	131,188	215,458	84,270
Total	USD	1,001,640	1,631,734	630,094

2.3

Upscaling effects

how we did it

DEVELOPER INSIGHT

In a simulation we have expanded agri-processing activities with rice bran oil from a maximum production capacity of 20 metric tons (small AG case) per day to 150 tons per day (large AG case).

The results are striking and in line with the recommendations provided by specialized engineers: although operational profitability does not change substantially and although the CAPEX more than three times higher than in the small case, equity IRR jumps from 14.4% to 34.5% (+20.1%) and equity NPV is more than 1 million USD above the small case while there is no first loss.

The simulation shows that scale and economies of scale matter and can substantially increase attractivity of the AgriGrid concept to investors but also the positive impact on the livelihoods of the rural population.

Performance	.	Mini-grid case	Small AG case	Large AG case	Deviation L-S
Average EBIT margin	%	19.1	12.1	**12.6**	0.5
Equity IRR	%	17.3	14.4	**34.5**	20.1
Equity NPV	USD	101,793	67,299	**1,364,551**	1,297,252
Equity payback	years	10	10	**5**	-5
Cumulated flow to equity	USD	1,036,323	1,240,415	**6,364,811**	5,144,396
Funding		**Mini-grid case**	**Small AG case**	**Large AG case**	**Deviation L-S**
Grants for assets	USD	543,089	885,238	**3,701,417**	2,816,179
Grants for first loss	USD	83,727	130,901	**0**	0
Village contribution	USD	0	0	**0**	0
Senior debt	USD	243,636	400,137	**1,420,588**	1,020,451
Equity	USD	131,188	215,458	**764,932**	549,474
Total	USD	1,001,640	1,631,734	**5,886,937**	4,255,203

2.4

Sensitivity analysis

how we did it

DEVELOPER INSIGHT

The question is **“to which extent the grants portion can be reduced in the larger, more profitable case while preserving as a promising investment for equity investors?”**

The sensitivity analysis in the table below shows that approximately below a grant threshold of 25% the equity IRR falls below the cost of equity of 12% (as assumed in this model; however, this threshold may vary from business to business and from country to country).

Grant funding can be reduced from 55% considerably by 1.5 million USD and the equity portion increased by half a million USD while debt compensates for the remaining approximately 1 million USD.

Grants (in %)	Equity IRR (% USD)	Equity payback (yrs)	Project IRR (% MGA)
55%	34.5%	5	27.2%
50%	27.3%	6	24.1%
40%	18.6%	9	19.6%
30%	13.4%	10	16.5%
25%	11.6%	10	15.2%

2.5

Key Impacts Indicators

how we did it

Full-time jobs created (#)	New jobs will be created at the RBO processing facility and throughout the entire supply chain (i.e. transporters, security guards, etc.).
Households and micro-enterprises provided with electricity access (#)	Hundreds of new customers will be connected to the mini-grid installed by the AgriGrid operator – in this case, ANKA Madagascar.
Average household energy savings (USD/year)	Households will save money by switching from battery-powered flashlights, 3rd party phone charging, kerosene lights, and candles to electricity.
Average ´micro-enterprise energy savings (USD/year)	Micro-enterprises will save money by switching from diesel to electricity.
Average household income increase (USD/year)	Household incomes will increase as a result of the profit sharing enabled by the AgriGrid model.
Average household consumption (kWh/year)	Household energy consumption will increase as a result of cheaper energy services and a higher incomes.
Avoided food imports (USD/year)	The national food import bill will decrease due to domestic RBO production.
Avoided GHGs (tCO_2eq)	GHG emissions will decrease due to solar PV generation.

AgriGrid

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