

## The Full Financial Model for Mini-Grid Projects

This explanation relates to the Full Financial Model for Mini-Grid Projects provided at the **Mini-Grid Policy Toolkit Portal**. This Full Financial Model and further support tools are available for download at [minigridpolicytoolkit.euei-pdf.org/tools](http://minigridpolicytoolkit.euei-pdf.org/tools)

This **Full Financial Model** is a tool for project developers and policy makers used to understand the economics behind mini-grids and to calculate their profitability. A mini-grid project can consist of different project sites which have their own economic development. Thus the model considers the cash-flows of each of the sites (Tabs “Village 1” / “Village 2” / “Village 3”) and consolidates the cash-flows under the “Company” Tab. Here, overhead costs as well as financing conditions are added and the mini-grid company’s income statement and balance sheet can be thus illustrated. Finally, financial indicators like the project IRR, the equity IRR, the Net Present Value (NPV) and the Debt Service Coverage Ratio (DSCR) are calculated automatically.

### Inputs

**Inputs** can be provided in two sections of the Full Financial Model. First, the “Input” Tab summarizes all input opportunities that are related to the Mini-grid Company and to the overall project level.

**General Inputs** - For Diesel Fuel Cost and O&M Costs as well as for the Electricity Tariffs a change of the price with time can be considered. Users who do not want to enter a number for each year can simply use the indexation column and enter a number for the first year. Indexation means that the price of the related item will be increased by the index [in %] each year compared to the previous year.

	Indexation	2014	2015	2016	2017	2018	2019	...
Diesel Fuel	3%	1.10 €	1.13 €	1.17 €	1.20 €	1.24 €	1.28 €	...
O&M cost (relative to first year)	5%	1.00	1.05	1.10	1.16	1.22	1.28	...
Plan for discount [€]	3.5%	0.56 €	0.58 €	0.60 €	0.62 €	0.64 €	0.67 €	...
Pay as you go [€]	3.5%	0.85 €	0.88 €	0.91 €	0.94 €	0.98 €	1.01 €	...
Demand managed (daytime) [€]	3.5%	0.38 €	0.39 €	0.41 €	0.42 €	0.44 €	0.45 €	...
Load managed (pumping) [€]	3.5%	0.25 €	0.26 €	0.27 €	0.28 €	0.29 €	0.30 €	...

Other inputs are

Distribution grid efficiency	97%	
Collection rate	98%	
Percentage of sales from production	95%	
Grant	3,000,000 €	36%
Equity	1,592,100 €	
Debt from Investment Costs (minus Grant)	70%	
Debt amount in EUR	3,714,900 €	
Tenor [years]	10	years
Interest rate for Debt	8.0%	
Grace Period [years]	2	years
Private Investment	5,307,000 €	
TOTAL Investment	8,307,000 €	
Interest Rate Equity	18.0%	
WACC (discount factor)	11.0%	
Income tax	30%	

Cells marked in yellow are inputs that are hard coded and cannot be changed by changing the values on the input page. In this model, the project runtime is fixed to 15 years. Cells which contain a value calculated with a formula show interim results that are used for further calculations. If these cells are changed those inputs that were used to calculate the interim result lose their effect.

The project development costs can be entered accordingly:

Project development cost		
Feasibility Study		50,000 €
Environmental Impact Assessment		45,000 €
Generation / Distribution License Acquisition		25,000 €
Acquisition of Capital incl. Due Diligence		45,000 €
Company Foundation and Establishment		10,000 €
Acquisition of Land Rights		10,000 €
Set up of village and customer relationship		30,000 €
<b>TOTAL</b>		<b>215,000 €</b>

Under the Tab “Company” in cells A19:V27 the overhead costs of the company can be specified for each year.

Overhead Cost	Salary Managing Director [€]	42,000 €	46,305 €	48,620 €	...
	Management Staff [€]	28,800 €	31,752 €	33,340 €	...
	Bookkeeping [€]	9,600 €	10,584 €	11,113 €	...
	Travel and Vehicle Cost [€]	24,000 €	24,000 €	24,000 €	...
	Office Costs [€]	7,200 €	7,938 €	8,335 €	...
	Consultancy Cost and fees [€]	5,000 €	5,000 €	5,000 €	...
	Company Insurance [€]	6,000 €	6,000 €	6,000 €	...
	Misc [€]	6,000 €	6,000 €	6,000 €	...
	<b>Total overhead cost</b>	<b>128,600 €</b>	<b>137,579 €</b>	<b>142,408 €</b>	

The Depreciation duration of all components can be adjusted under Tab “Depreciation” in column D

	Cost for Village 1, 2 and 3	Depreciation duration [year]	Annual depreciation
Depreciation of generation assets	Solar PV [kWp]	2,100	
	Solar PV [€]	2,940,000	20 147,000 €
	Battery [kWh]	10,200	
	Battery [€]	1,836,000	10 183,600 €
	Converter [kVA]	1,080	
	Converter [€]	918,000	10 91,800 €
	Diesel Genset incl. tank 300 kVA	3	
	Diesel Genset incl. tank 300 kVA [€]	375,000	10 37,500 €
	Diesel Genset incl. tank 100 kVA	-	
	Diesel Genset incl. tank 100 kVA [€]	-	
	Diesel Genset incl. tank 200 kVA	-	
	Diesel Genset incl. tank 200 kVA [€]	-	
	Distribution, lightning protect, etc.	3	
	Distribution, lightning protect, etc. [€]	75,000	20 3,750 €
Shipping [€]	-		
	<b>6,157,386 €</b>		<b>463,650 €</b>
Depreciation of fixed assets	Distribution grid LV [km]		
	Distribution grid LV [€]	540,000 €	20 27,000 €
	Distribution grid MV [km]		
	Distribution grid MV [€]	450,000 €	20 22,500 €
	Power station building [€]	90,000 €	20 4,500 €
	Fencing [€]	30,000 €	20 1,500 €
	Foundations [€]	30,000 €	20 1,500 €
	Shipping [€]	- €	
	Installation [€]	- €	
	<b>1,140,000 €</b>		<b>57,000 €</b>
	Project development [€]	215,000 €	15 14,333.33 €
	<b>215,000 €</b>		<b>14,333 €</b>
	Grant	- 3,000,000 €	20 - 150,000 €
	<b>TOTAL for 3 villages</b>		<b>342,317 €</b>

**Site specific Inputs** - Besides the inputs under the “Input” Tab as explained above, additional inputs need to be made under each of the Tabs “Village 1”, “Village 2” and “Village 3”:

In cells A2:D11 the type of connections can be specified with number per type of connection and cost per connection for the specific site. Additionally, in case of the mini-grid operator pre-financing the in-house installations for its customers, this pre-financing can be entered here. The customers can repay parts of the in-house installations in cash and parts of it in instalments over a period of time (with or without interest).

Connection Fees and HH Instal.	Connection single phase 2 A	20 €	2000
	Connection single phase 10 A	40 €	400
	Connection three phase 10 A	120 €	150
	HH Instal. Sales Basic	25 €	500
	HH Instal. Sales Pro	50 €	300
	HH Instal. Sales Adv	75 €	100
	HH Instal. Repay. Basic	33 €	1200
	HH Instal. Repay. Pro	66 €	100
	HH Instal. Repay. Adv	99 €	50

In cells A15:V22 For each of the operational years a number of kWh sold under a certain tariff needs to be entered. To come up with these numbers, a hybrid power system simulation model can be used. All cells in italics are input cells.

Electricity Sales	<i>Plan for Discount [kWh]</i>				400,000	440,000	470,000	...
	Plan for discount [€]				220,387 €	250,911 €	277,399 €	...
	<i>Pay as you go [kWh]</i>				20,000	40,000	60,000	...
	Pay as you go [€]				16,726 €	34,622 €	53,751 €	...
	<i>Demand managed (daytime) [kWh]</i>				120,000	130,000	140,000	...
	Demand managed (daytime) [€]				44,865 €	50,304 €	56,070 €	...
	<i>Load managed (pumping) [kWh]</i>				153,000	153,000	153,000	...
	Load managed (pumping) [€]				36,360 €	37,633 €	38,950 €	...

In cells A29:V29 the diesel fuel consumption needs to be entered for each year, which can also be calculated using a simulation tool.

In cells A37:F69 the site specific investment costs are displayed. The site specific financial modelling approach with consolidation on the company level allows for varying power station and distribution grid setups from one site to the other. This reflects reality in mini-grid power systems well. Lines in italics show technical dimensions of components, other cells show financial cost data.

Invest. Generation Assets	<i>Solar PV [kWp]</i>				700
	Solar PV [€]				980,000 €
	<i>Battery [kWh]</i>				3400
	Battery [€]				612,000 €
	<i>Converter [kVA]</i>				360
	Converter [€]				306,000 €
	<i>Diesel Genset incl. tank 300 kVA</i>				1
	Diesel Genset incl tank 300 kVA [€]				125,000 €
	<i>Diesel Genset incl. tank 100 kVA</i>				
	Diesel Genset incl. tank 100 kVA [€]				
	<i>Diesel Genset incl. tank 200 kVA</i>				
	Diesel Genset incl. tank 200 kVA [€]				
	<i>Distribution, lightning protect, etc.</i>				1
Distribution, lightning protect, etc. [€]				25,000 €	
Shipping [€]					
Invest. Distrib. Assets	<i>Distribution grid LV [km]</i>				20
	Distribution grid LV [€]				180,000 €
	<i>Distribution grid MV [km]</i>				10
	Distribution grid MV [€]				150,000 €
	Power station building [€]				30,000 €
	Fencing [€]				10,000 €
	Foundations [€]				10,000 €
	Shipping [€]				
	Installation [€]				
Invest. Cust. Connect.	Connection single phase 2 A				200,000 €
	Connection sigle phase 10 A				52,000 €
	Connection three phase 10 A				42,000 €
Invest. HH Install.	HH Instal. BASIC				102,000 €
	HH Instal. PRO				36,000 €
	HH Instal. ADVANCED				18,000 €

## Calculation Results

**Site Specific Results** – The Site Specific Results are Total Revenues (Line 27), Total Expenditure (Line 76) and Gross Profit Contribution of the site/village (Line78). These results can be used to compare the villages with each other.

**Consolidated Mini-grid Company Results** – The consolidated results on the company level can be found under the Tab “Company”. The profit and loss calculation results in EBITDA (Line 29), EBIT (Line 32), EBT (Line 37), Annual Net Income (Line40). The cash-flow statement shows the Cashflow (Line

48) and the Free Cashflow (Line 51). The balance sheet shows on the Assets side: Depreciation & Amortization (Line 56), Total Tangible Assets (Line 57) and Cash (Line 58); on the Equity and Liabilities side: Equity (Line 61), Retained Earnings previous Years (Line 62), Retained Earnings actual Year (Line 63) and Long term Liabilities (Line 64) for each year.

As indicators the output shows the Operating Profit Margin in % (Line 67) and the Debt Service Coverage Ratio (DSCR, Line 69) for all applicable years. Other indicators are the Net Present Value under assumptions entered on the Input page (Line 71), the Project IRR (Line 72) and the Equity IRR (Line 73) as individual figures.