The SAVi Academy

Module 3: Project Finance Modelling
Tutorial on Project Finance Modelling

What are project finance models used for?

The main purposes of a project finance model are: (i) to identify the optimal capital structure, (ii) to assess the financial viability of the project, and (iii) to calculate the expected return on investment under different operational and risk scenarios.

I. Project sponsors use financial models to determine the optimal debt-equity split used in the financing of the project. This largely depends on the project's revenue and cost profile: the timing and size of incoming cash flows during operations and the associated costs in each period. Most infrastructure projects follow a so-called "J-curve": having high upfront costs and relatively small but steady revenue streams. The "J" represents a certain number of years before the project breaks even and generates a return on investment.

II. Project finance models can also calculate whether the cash flows generated by the project will be sufficient to service the debt and generate an attractive risk-adjusted return for both equity and debt investors. This assessment includes the calculation of key performance indicators, such as the internal rate of return and the net present value. The definition of these indicators can be found in the glossary.

III. Project finance models are also well placed to stress test projects and assess how the expected return changes under certain operational and risk scenarios. This is calculated by a so-called "scenario table," which modifies key project assumptions and shows how key financial indicators react to these changes. Scenarios could be simple operational events, such as an increase in the price of feedstock, disruption in operation, or more complex climate events, such as heatwaves, sea-level rise, or a carbon tax.

The project finance model used in SAVi is built in Microsoft Excel and follows Corality SMART best practices in order to improve the readability and auditability of the model by a third party. The outputs of the system dynamics model in SAVi are used as inputs in the project finance model and vice versa. The system dynamics model quantifies and monetizes the relevant environmental, social, and economic externalities associated with the project. It also helps to identify the scenarios used in the scenario table. Depending on the purpose of the assessment and the target audience, some of the externalities are included as costs or benefits in the scenario table. Outputs of the system dynamics model can also change some of the key assumptions of the project finance model.

The main outputs of the project finance model are the financial indicators mentioned earlier. During the customization of the model, the list of indicators can be changed or extended as needed. Project-specific data, such as the cost of financing, can also be extracted from the project finance model and fed back into the system dynamics model.

How to use the SAVi project finance model

In this tutorial, we provide a step-by-step guide on how to integrate environmental, social, and economic externalities into project finance modelling. While there are different ways to do it, the following example demonstrates the approach we used for the majority of SAVi applications to date.

Step 1: Is there a financial model available?

First, we need to determine whether we need to develop a financial model ourselves or use an existing model developed by the asset owner. The answer to this question often depends on at what stage we get involved in the project. If it is very early in the project cycle, a financial feasibility assessment might not have been done yet. This can happen when we are asked to provide input on project selection, for example. On the other hand, even if a project finance model already exists, the stakeholder/asset owner we work with might not have access to it or, simply, might not be comfortable sharing it with us for confidentiality reasons. At other times, we might only get access to parts of the model, for example, only to the profit and loss or cash flow statements. Again, this could be due to the sensitive nature of the information included in these models. Based on our experience, for the majority of applications, we have to develop our own financial model.

On the SAVi Academy website, you can find a simplified financial model, titled "Project finance model - Wind power example.xlsx," that represents a hypothetical onshore wind farm. In this tutorial, we will go through the main steps of integrating externalities using this model.

If you are using an existing financial model for the assessment, you can skip Step 2 and proceed to Step 3.

Step 2: What financial data is available?

If a project finance model must be built, we would request a range of financial information from the asset owner. We can plug any holes in data with assumptions as needed, but that could have an impact on the accuracy of the results. All assumptions need to go into the "Input" worksheet. In line with Corality SMART best practices, all hard-coded numbers should have a yellow background (see Table 1).

Table 1. "Input" worksheet

	A	B	C	D	E	F	G	H	I
1	**Assumptions**								
2	SAVi Academy								
3									
4									
5			Timing						
6			**Start**						
7			Model Start Date	Date	31-Dec-15				
8									
9			**Construction**						
10			Start	Date	01-Jan-16				
11			Duration	Qtr(s)	8 Qtr(s)				
12			End	Date	31-Dec-17				
13									
14			**Operations**						
15			Start	Date	01-Jan-18				
16			Duration	Yr(s)	10 Yr(s)				
17			End	Date	31-Dec-27				
18									
19			Construction						
20			**Categories**						
21			**Development Costs**				Total	Cons Qtr 1	Cons Qtr 2
22			Turbine Construction	GBP M	60.00		100.00%	12.50%	12.50%
23			EPC Management	GBP M	5.00		100.00%	12.50%	12.50%
24			Civil Works	GBP M	10.00		100.00%	25.00%	25.00%
25			Electrical	GBP M	4.00		100.00%		
26			Wind Monitoring	GBP M	3.00		100.00%	70.00%	
27			Spare	GBP M	-		0.00%		
28			Spare	GBP M	-		0.00%		

Legend | Names | Inputs | Scenario table | CFW | Con | Ops | Debt | Equity | Timing | Copy

As this is a simplified model, only the most essential data points are listed here. To develop a full project finance model that includes depreciation, taxation, and options for debt sculpting, among others, the list of data required would be much longer.

Table 2. Main data points from the hypothetical onshore wind farm financial model

Name	Explanation
Construction time	The construction phase is expressed in number of quarters. The start of construction will also determine the model's starting date. The model is currently set up to use quarterly intervals. For projects with an operating lifetime of 40+ years, using yearly intervals is recommended.
Operations time	The operations phase is expressed in number of years. Construction and operation phases can overlap if the generation capacity is gradually being increased.
Development costs	Development costs are also known as capital expenditures. The table on the right in Table 1 determines how the costs are spread out across the construction phase. This data can be used to inform decisions on tapping additional financing.
Contingency	Contingency factors in potential cost overruns during construction.
Generation	This data point represents the amount of energy generated every year. "Overall efficiency" should be adjustable to better reflect the technology used and the local conditions.
Price	Prices indicate the expected nominal electricity prices. Base, low, and high price levels are included to make assessing different price scenarios easier.
Operational expenditure	Operational expenditure is the fixed and variable costs of operating the project. SAVi externalities expressed as EUR/MWh are also included under the variable operating costs. In the wind farm financial model, the grey cell indicates that the value comes from an off-sheet source, which is the "Scenario Table" in this case.

Name	Explanation
Senior debt	This section covers all the debt-related financial information. This information includes the size of debt financing used (debt limit), the interest rate premium on top of the risk-free rate (margin), various financing fees, debt tenor, and the initial time period when interest payments are waived (grace period).
Equity	Equity-related information includes the amount of initial equity financing and any additional increase needed during construction. Also, the user can define the percentage of profits that can be paid out as dividends as well as the equity cost of capital (discount rate).
Macroeconomic data	Macroeconomic data includes the base interest rate (i.e., the central bank rate) for the currency used in the model. If any currency conversions are required, the relevant exchange rate can also be specified here. Finally, the expected inflation rate is also included here.

Step 3: What scenarios should be modelled?

The next step is to determine what externalities and scenarios need to be included in the project finance model. This is decided as a result of consultations with the asset owner and with other relevant stakeholders. We use a scenario table (see Table 3) to set up the scenarios identified.

Table 3. Scenario table worksheet

Scenario Table

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Scenario manager

Case selector — Selection — 1

		Applied	1	2	3	4	5	6
Name		Base	Base	Labour income	Social cost of carbon	All externalities	Temperature increase	Carbon tax
Generation flex	x*(1+y%)	-	-	-	-	-	(10.00%)	-
Price	Selection	Base	Base	Base	Base	Base	Base	Base
Price flex	x*(1+y%)	-	-	-	-	-	-	-
Debt size	GBP M	45	45	45	45	45	45	45
Initial equity	GBP M	20	20	20	20	20	20	20
SAVi externalities	GBP / MWh	-	-	(0.70)	0.50	(0.20)	-	0.30

Scenario data table

	Case	Equity IRR	Equity NPV	Project IRR	Project NPV	Min. DSCR	Ave. DSCR	Min. LLCR
	Base	27.72%	28.99	20.29%	19.25	2.34x	2.69x	2.53x
1	Base	27.72%	28.99	20.29%	19.25	2.34x	2.69x	2.53x
2	Labour income	28.19%	30.16	20.59%	20.42	2.37x	2.72x	2.56x
3	Social cost of carbon	27.38%	28.15	20.07%	18.41	2.32x	2.66x	2.51x
4	All externalities	27.85%	29.32	20.38%	19.59	2.34x	2.70x	2.54x
5	Temperature increas	22.95%	17.56	17.22%	7.82	2.06x	2.37x	2.23x
6	Carbon tax	27.51%	28.49	20.16%	18.75	2.32x	2.67x	2.52x

Note: IRR = internal rate of return; NPV = net present value; DSCR = debt service coverage ratio; LLCR = loan life coverage ratio.

The purpose of the scenario table is to demonstrate how key financial indicators change when externalities, calculated by the system dynamics model, are integrated. We usually calculate the net present value and the internal rate of return, both at the level of the equity and of the project. If relevant for the assessment, other indicators can also be included, such as the debt service coverage ratio and the loan life coverage ratios.

Each column of the table represents a different scenario. Each scenario can include a single or a set of different externalities. The rows in the table determine to what extent key project assumptions would change under each scenario. Most externalities are reflected as a positive or negative change in variable operating costs. However, more complex scenarios, such as climate change, might adjust several model assumptions at the same time. Depending on the project type, these changes can include the amount of electricity generated, capital expenditures, and maintenance costs, for example.

The scenario manager shown in Table 4 modifies the relevant assumptions in the "Inputs" worksheet. These are the cells with off-sheet references having a grey background. The case selector determines the set of assumptions that are loaded into the scenario manager. The number in the selection box corresponds to the number of the scenario in the scenario table.

Table 4. Scenario manager

Scenario manager		
Case selector	Selection	1
		Applied
Name		Base
Generation flex	x*(1+y%)	-
Price	Selection	Base
Price flex	x*(1+y%)	-
Debt size	GBP M	45
Initial equity	GBP M	20
SAVi externalities	GBP / MWh	-

We use the "Data Table" Excel functionality to calculate all the key financial indicators for each scenario at once (Table 5).

Table 5. Data table

Scenario data table

	Case	Equity IRR	Equity NPV	Project IRR	Project NPV	Min. DSCR	Ave. DSCR	Min. LLCR
	Base	27.72%	28.99	20.29%	19.25	2.34x	2.69x	2.53x
1	Base	27.72%	28.99	20.29%	19.25	2.34x	2.69x	2.53x
2	Labour income	28.19%	30.16	20.59%	20.42	2.37x	2.72x	2.56x
3	Social cost of carbon	27.38%	28.15	20.07%	18.41	2.32x	2.66x	2.51x
4	All externalities	27.85%	29.32	20.38%	19.59	2.34x	2.70x	2.54x
5	Temperature increas	22.95%	17.56	17.22%	7.82	2.06x	2.37x	2.23x
6	Carbon tax	27.51%	28.49	20.16%	18.75	2.32x	2.67x	2.52x

The data table provides a quick overview of the financial impact of environmental, social, and economic externalities. For example, the social cost of carbon, being a negative externality, decreases the financial performance of the project when integrated as a cost: the project internal rate of return (Project IRR) changes from 20.29% to 20.07%. Please note that the values used here for the different externalities are not from an actual SAVi assessment on a wind farm but were just made up for this example.

When to use a different approach to integrate externalities

As mentioned earlier, the approach discussed above is only one way to integrate externalities in project finance modelling. For the purposes of a typical SAVi application, this approach has proven sufficient and easy to understand for stakeholders. However, it is important to note that, by treating externalities as a variable operating cost change, the asset owner has to be comfortable with the assumption that these externalities are modelled as an actual cash flow.

For governments, this is normally not an issue, as they are by nature expected to apply "systemic perspectives" when making decisions on infrastructure. On the other hand, for investors, whose mandate is to generate a financial return for their clients, using this approach would only make sense for externalities that could potentially have a cash flow impact. A carbon tax would be a good example. If carbon taxation were implemented, it would indeed be reflected as an operating cost change. However, integrating the positive economic contribution of the project this way, for example, would be hard to justify. In this case, the integration of externalities in the cash flow statement would be more appropriate. This approach would avoid changing the taxable income, alongside other key modelling components, and keep externalities "outside the model," while still allowing the calculation of a sustainable internal rate of return. All this is to highlight that these factors need to be carefully considered when using the methodology discussed in this example. However, a detailed explanation of these alternative ways to integrate externalities is beyond the scope of this tutorial.