



Workshop Cash Flow Model Photovoltaic Tunisia

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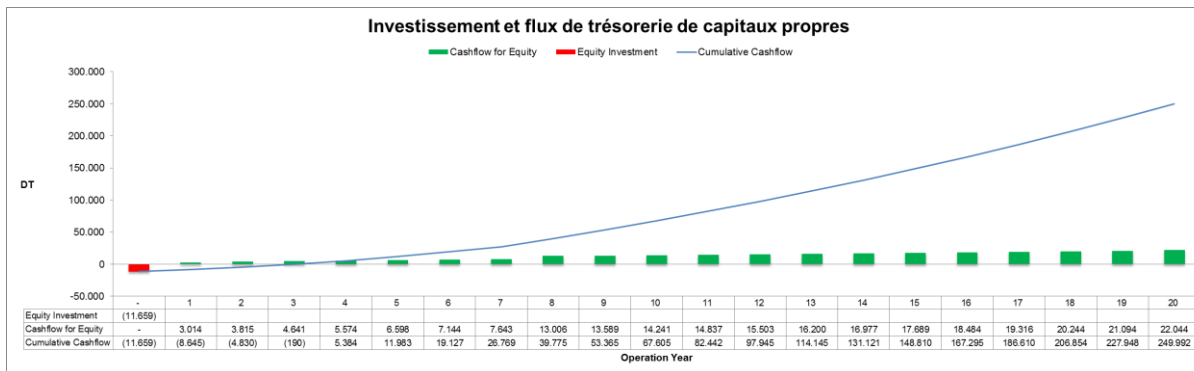
Agenda

- **Introduction**
- **Model Structure**
- **Inputs**
- **Construction and Operations**
 - Practice
- **Funding and Equity**
 - Practice
- **Cash Flow Waterfall**
- **Sensitivity Analysis**
 - Practice

Introduction to the capabilities of the excel cash flow modelling tool.

- **What can you do with the tool?**

- It enables users to calculate PV projects in all relevant market segments for PV in Tunisia
- The charted results give an overview on the cash flow's of the project
- Financial parameters are indicating the profitability of the investments and its risks
- Users can test the sensitivity of a project to changes in the framework conditions (electricity prices, system prices etc.)
- The tool can be used to validate calculations and models for projects received from others . If results are different, the tool helps to investigate the reasons for differences (e.g. different assumptions)

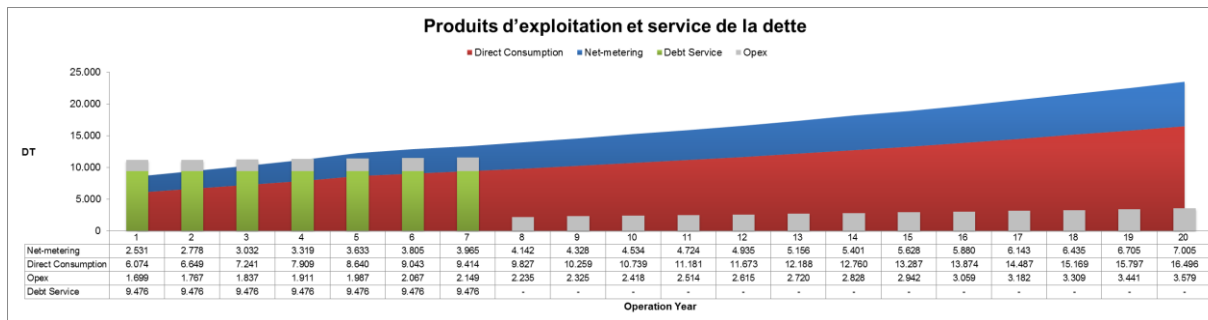


| Results | | |
|-------------------|--------|--------|
| Net-Present-Value | DT | 41.589 |
| Project IRR | % | 8,56% |
| Equity IRR | % | 11,83% |
| Amortization | Years | 9,06 |
| LCOE | DT/kWh | 0,12 |
| Min DSCR | x | 0,73 x |
| Min LLCR | x | 0,96 x |

Reasons for using a cash flow modelling tool for project assessment.

- **Why should you use the tool?**

- To optimize projects with regards to system size, debt sizing and tenor, equity IRR
- To understand the mechanics of the project and its business model and thus be aware of the involved risks (scenario analysis)
- Discover attractive market segments and add real numbers to the discussion with clients, banks and project developers
- Benefit from the higher transparency regarding the methods and calculations compared to the black-box calculations of common technical planning tools
- For an initial assessment of project sites without a detailed technical planning

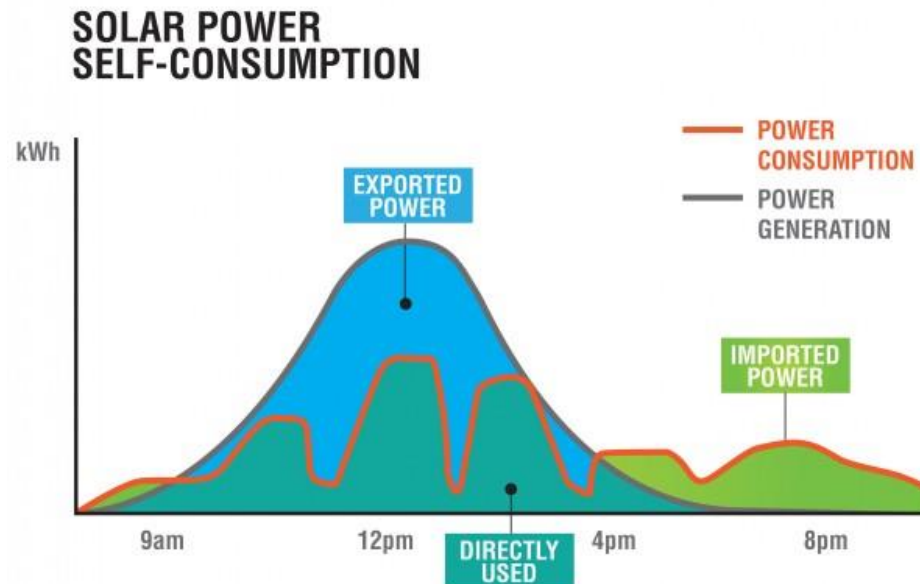


| Investment | | |
|---|-------|--------|
| Durée du projet | Years | 20 |
| Subventions | DT | 9.600 |
| Ratio d'endettement | % | 70% |
| Durée de crédit | Years | 7 |
| Taux d'intérêt | % | 5,94% |
| Taux d'actualisation des flux de trés % | | 8% |
| Min DSCR | x | 0,73 x |
| Min LLCR | x | 0,96 x |

Quick introduction to key background knowledge.

- **PV Business Models**

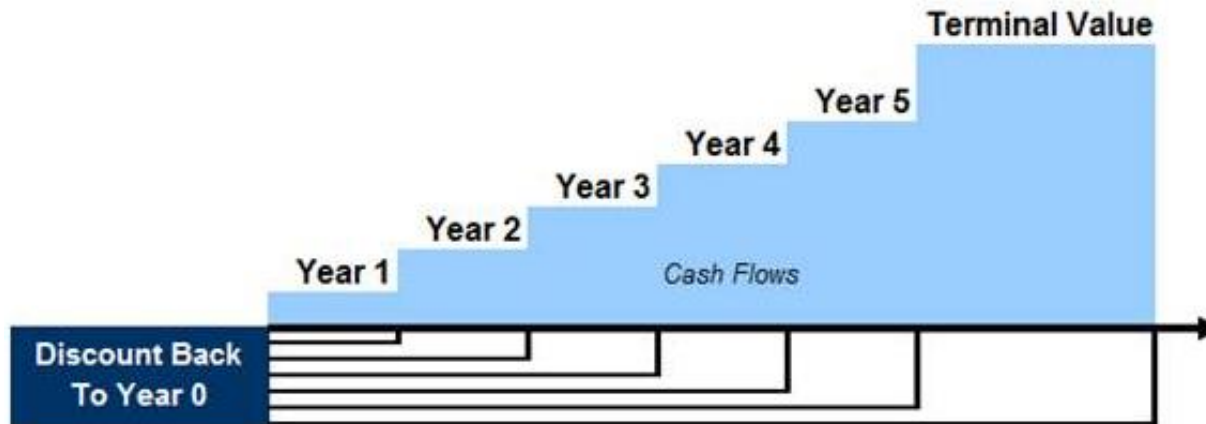
- The economics of PV projects are based on **direct consumption of the PV electricity and net-metering credits** for excess PV electricity.
- Due to the **electricity tariff structure** for “Basse Tension” projects, savings also occur for the **residual grid electricity**.
- The **savings are considered as calculative cash flows** for the discounted cash flows analysis (DCF) and the levelized cost of electricity calculation (LCOE).



Quick introduction to key background knowledge.

- **Discounted Cash Flow Analysis**

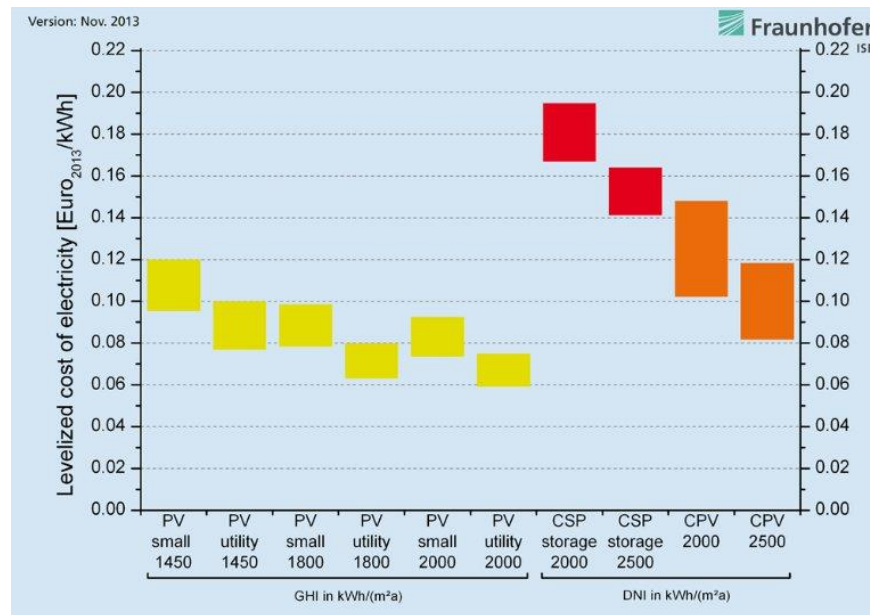
- DCF analysis is a method of valuing a project using the concepts of the **time value of money**.
- All future cash flows are estimated and discounted to give their present values (PVs) - the sum of all future cash flows is the Net-Present-Value (NPV), which is taken as the value or price of the cash flow's in question.



Quick introduction to key background knowledge.

- **Levelized Cost of Energy**

- LCOE is the **price at which electricity must be generated** from a specific source **to break even over the lifetime of the project.**
- It includes all the costs over the project lifetime: **initial investment, operations and maintenance, cost of fuel, cost of capital.**



Cash flow available for equity, CFADS is the most significant line in the cash flow waterfall.

- A project's cash flow is summarized using a **cash flow waterfall**, which shows the **priority of each cash inflow and outflow**.
- CFADS – **Cash flow available for debt service** is calculated in the cash flow waterfall by netting out:
 - Revenues, operating expenditure (OpEx), capital expenditure (CapEx), debt and equity funding, tax and working capital adjustments.
- CFADS is the most significant line in the cash flow waterfall because it **drives all debt repayment calculations and ratios**, including:
 - Debt Service Coverage Ratio (DSCR) measures how many times the project can repay debt service in each period
 - Loan Life Coverage Ratio (LLCR) measures how many times the discounted cash flow's can repay the loan balance within the tenor
 - Project Life Coverage Ratio (PLCR) is similar to LLCR but looks at the project lifetime instead

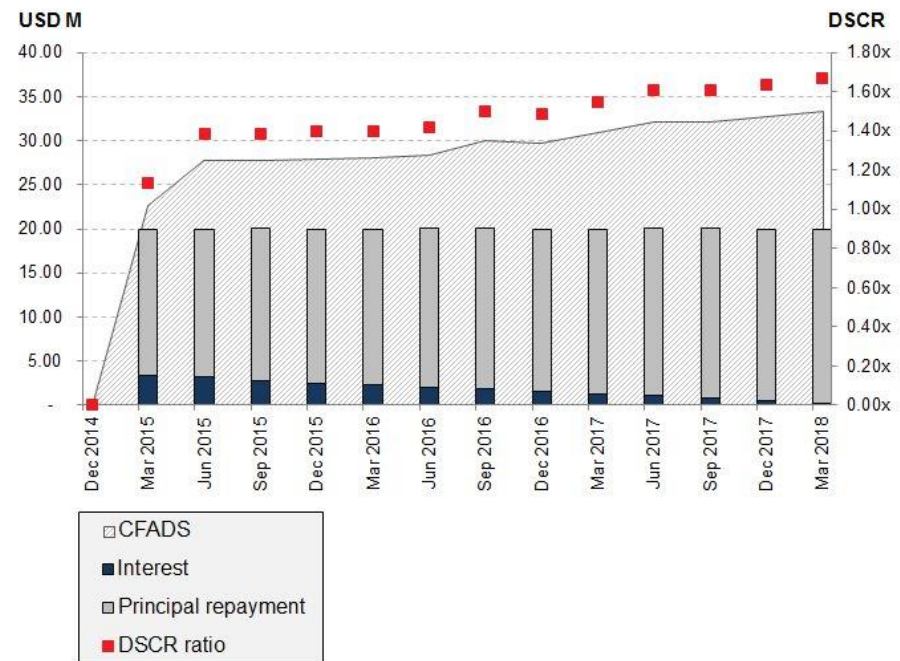
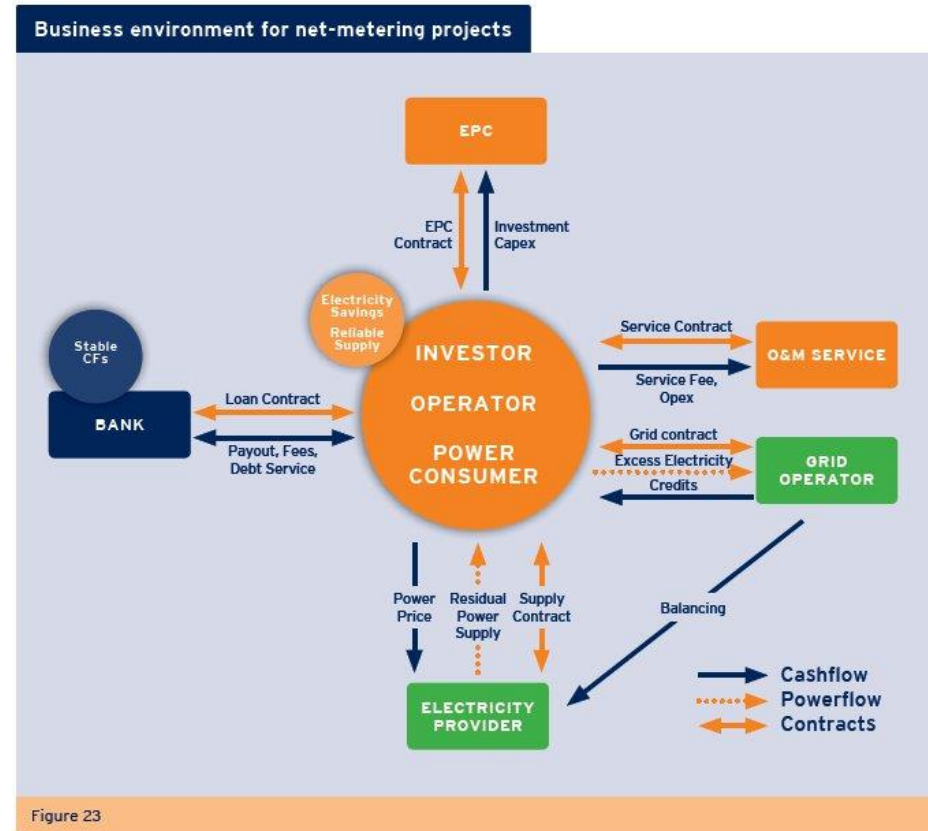


IMAGE 2: CHART ILLUSTRATING THE RELATIONSHIP BETWEEN CFADS AND DSCR IN A PROJECT FINANCE TRANSACTION

The tool uses the project finance approach which aims at having positive net cash flow in each period of operation.

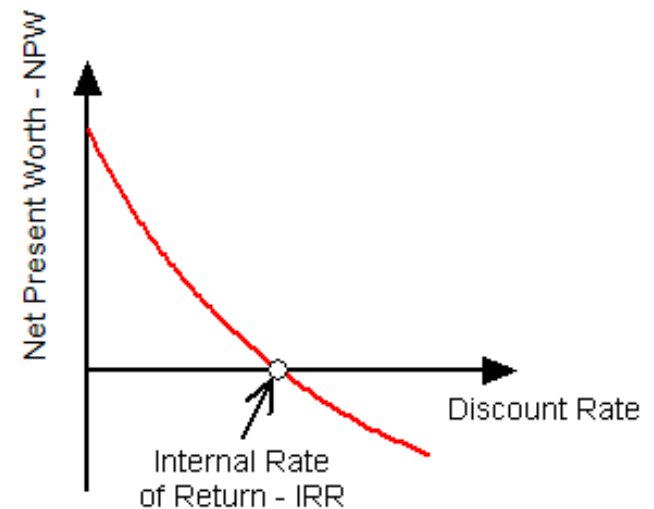
- **Project Finance vs Balance Sheet Financing**

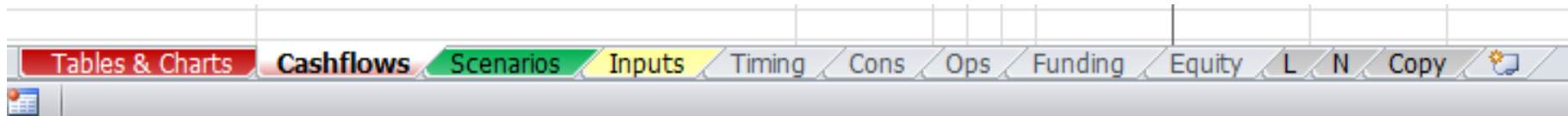
- **Project finance** is the long-term **financing** of infrastructure and industrial **projects** based upon the projected cash flows of the **project** rather than the balance sheets of its sponsors.
 - This includes a non-recourse or limited recourse where the lender can only use the project itself as a collateral in the event of a borrower default.



The tool uses the modified IRR calculations with different IRR's for the reinvestment of the returns.

- **Standard IRR** assumes that returns are reinvested at the same discount rate, although in the real world projects with the same IRR are not easily available.
 - **Project IRR** – cash flows related to financing (principal, interest) are not considered
 - **Equity IRR** – debt drawdowns, principal and interest payments are deducted from the cash flows, the remainder belongs to equity shareholders resulting in the return on equity
 - **Modified IRR** – re-investments of cash flows at the same IRR is usually not possible because access to similar PV projects is limited for investors, thus the modified IRR method applies custom returns to re-invested cash flows during operations





The model consequently separates the different project phases and model elements in different sheets for a transparent structure.

- **Overview on Excel sheets**

- **Tables & Charts** – Contains results for the Base Case
- **Cash Flows** – Details the cash flow waterfall
- **Scenarios** – Contains the scenario analysis and charts with results
- **Inputs** – Contains all base case inputs of the model, some of them are changed dynamically via the Scenario sheet
- **Timing** – Contains dates and indexes that are being used throughout the workbook
- **Cons** – details the spend profile and debt and equity uses during construction phase
- **Ops** – details generation, savings, revenues and operating costs
- **Funding** – details debt account, repayments terms and debt ratios
- **Equity** – details equity account, dividends and investment performance indicators

The Input sheet contains all input parameter for the model, some base case assumptions may be changed via the scenario sheet.

- Inputs in **yellow** cells can be changed by the user
- Cells with **green** color integrate scenarios into the input sheet and the model
- The model has yearly operations and monthly construction
- **Input Categories**
 - **Timing** with start and end date for construction and operation phase
 - **Construction** with system prices, cost categories and subsidy definition
 - **Operation** setting the assumption for net PV generation
 - **Electricity Savings** defining the input for the calculative revenues through electricity savings and net-metering
 - **OpEx, Operational Expenses** including fixed, variable costs and ongoing CapEx*
 - **Funding** with assumptions for debt/equity sizing, fees and repayment terms and equity
 - **Equity** with equity amount, dividends and WACC**
 - **Macroeconomics** with base rate and cost escalation

Please change the following items in the input sheet and check and explain what is happening in the Cons, Ops and Tables & Charts sheet.

- Adjust *project duration* from 20 to 25 years
- Change the applied *system cost* by changing the *system prices and subsidies*
- Increase *degradation* to 3% per year
- Change *electricity prices* by adding a *new category* above the 500 kWh limit
- Change the *cost escalation* for the *electricity prices* in the first 5 years to 5%

Please change the following items in the input sheet and check and explain what is happening with profitability, savings and the LCOE.

- **Adjust *project duration* from 20 to 25 years**
 - Decreases LCOE and increases NPV
- **Change the applied *system cost* by changing the system prices and subsidies**
 - Direct effect on profitability and LCOE
- **Increase *degradation* to 3% per year**
 - It reduces revenues from savings every year
- **Change *electricity prices* by adding a *new category* above the 500 kWh limit with a higher price**
 - Increases direct savings and thus profitability but has no effect on indirect savings
- **Change the *cost escalation* for the *electricity prices* in the first 5 years to 5%**
 - Has a strong effect on profitability also due to the further cost escalation in subsequent years (no effect on LCOE)

The Construction sheet models the spending and funding sources during the construction phase.

- **Spend Profile and Costs as negative cash flow pre-operation phase**
 - Contingency may be included for a potential cost overrun during construction
 - Land acquisition costs may be included
 - Cash flows always occur at the end of the period
- **Funding Uses**
 - Senior Debt and Equity drawdowns
 - Equity drawdown first and then debt
 - In the event of a shortfall additional equity and debt with the same gearing is being used
- **Interest and financing fees during construction**
 - Up front fee paid at financial close
 - Commitment fee paid on the undrawn amount of the loan
 - Interest consisting of a margin depending on the risks of the project and the base rate

The Ops sheet models the generation, revenues and costs during the operation phase.

- **Generation**
 - Degradation included via index from timing sheet
 - 20 to 25 years of operation are common for PV projects
 - Efficiency allows to add losses in addition to the performance factor (e.g. grid losses for net-metering)
- **Revenues (Basse Tension)**
 - Direct Savings due to reduced grid consumption
 - Basse Tension: Indirect Savings due to lower tariff for remaining grid consumption
 - Moyenne Tension: Savings due to net-metering credits including grid fees
- **Operation Costs**
 - Fixed costs like regular operation and maintenance
 - Variable costs like land lease that is based on generation
 - Costs are escalated with inflation rate
- **Ongoing CapEx**
 - E.g. inverter replacement after 10 years of operation

The funding sheet models the debt account and calculates the debt ratios.

- **Debt Account**
 - Debt account is used to calculate principal and interest during operation periods
 - Selected repayment method is annuity repayment
 - Based on repayment terms with tenor and optional grace period
- **Annuity Repayment**
 - Repaying a fixed amount periodically (principal plus interest)
 - Principal portion increases over time, interest payments decrease
 - Better fit of debt service with increased savings in later operation periods
- **Interest Margin**
 - Margin is charged on top of the base rate
 - May change depending on project risks and/or credit rating of the borrower
 - May decrease over time because risks decrease within the first years of operation
- **Tenor and Grace Period**
 - Total length of the loan
 - Tenor may comprise of grace period and repayment period (interest still needs to be paid during grace period)
 - Debt may be re-financed during tenor

The debt ratios are the key indicators for the riskiness of the project from a banks perspective.

- **DSCR (Debt Service Coverage Ratio)**
 - Measures how many times the project can repay debt service in each period
 - Calculated by **CFADS / Debt Service** in a certain period
 - Principal and interest included in debt service
 - A ratio of 2.00x means that there was twice as much cash flow's to repay principal and interest in the period
 - Typical limit for banks for feed-in tariff projects is a minimum DSCR of 1.20x in any period
- **LLCR (Loan Life Coverage Ratio)**
 - Measures how many times the discounted cash flow's can repay the loan balance within the tenor
 - Calculated by the remaining **Discounted CFADS / Debt Service** during loan life
 - LLCR of 2.00x means that the discounted cash flow's can repay the current loan balance twice within the **remaining loan life**
- **PLCR (Project Life Coverage Ratio)**
 - Measures how many times the discounted cash flow's can repay the loan balance within the project lifetime
 - Calculated by the remaining **Discounted CFADS / Debt Service** during project life
 - PLCR of 2.00x means that the remaining discounted cash flow's can repay the current loan balance twice within the **remaining project life time**

The Equity sheet models the dividends and returns and calculates performance indicators for the investor (IRR, Amortization, NPV).

- **Dividends**

- Periodic payments to equity shareholders
- Projects based non-recourse project finance usually have a debt reserve account, e.g. PPA projects
- Net-metering projects will be financed on recourse basis with a dividend payout ratio of 100% and equity injections in case of shortfalls

- **Equity Ratios**

- Based on returns to all equity stakeholders of the project
- Equity IRR (modified)
 - Based on all equity investments / injections and the cash flow available for equity throughout the projects lifetime
 - Re-investment of cash flow's yield the target IRR of the investor and not the equity IRR of the project, because it is being assumed that the investor has limited access to similar PV projects
- Net-Present-Value
 - Current value of all future cash flow's discounted with the interest of a risk-adequate alternative investment
- Amortization
 - Time period after which payback of initial and additional equity is achieved

Please change the following items in the input sheet and check and explain what is happening to the financial performance indicators.

- Change the *debt tenor* to 12 years and explain what is happening with the DSCR
- Change the *grace period* to 1 year and explain what is happening with the LLCR
- Change the *solar yield* and explain what is happening with the amortization
- Change the *discount rate* and explain what is happening with the Net-present-value (NPV)

Please change the following items in the input sheet and check and explain what is happening to the financial performance indicators.

- **Change the *debt tenor* to 12 years and explain what is happening with the DSCR**
 - A longer debt tenor results in a lower debt service in each period and thus a higher DSCR and less risk
- **Change the *grace period* to 1 year and explain what is happening with the LLCR**
 - A grace period results in a shorter loan life which decreases the LLCR
- **Change the *solar yield* and explain what is happening with the amortization**
 - The higher the yield the shorter the amortization
- **Change the *discount rate* and explain what is happening with the Net-present-value (NPV)**
 - Increased discount rate results in decreased NPV and vice versa

The cash flow waterfall is a representation of the cash flow statement rearranged to show the priority of each cash inflow and outflow.

- **Cash Flow Waterfall is preferred by banks in project finance transactions to assess security and liquidity. The main categories are:**
 - Operating revenues and other income
 - Operating expenses and capital expenses
 - Funding
 - Tax
 - Debt Service: principal repayments and interests paid (not payable)
 - Dividends
 - Net movement in cash balance
- **CFADS is the most important line for a banking transaction model as it drives debt repayment calculations**
 - Operating Cash Flows
 - Cash Flow Available for Debt Service (CFADS)
 - Cash Flow before Funding
 - Cash Flow Available for Debt Reserve Account
 - Cash Flow Available for Equity
 - Net Cash Flow

Scenario analysis is critical to assess the impact of changing assumptions on a projects profitability and bankability.

The Scenarios are applied dynamically by altering the base case assumptions without changing them manually.

- **To evaluate the project on an upside/downside case (answers what if)**
 - Up/Down of plant performance
 - Up/Down of electricity price escalation
 - Up/Down investment subsidy
 - Up/Down monthly consumption
- **The results for each scenario are listed in a data table and plotted in a chart**
 - Equity IRR (modified) and Project IRR
 - Amortization
 - Debt Service Coverage Ratio (DSCR) and Loan Life Coverage Ratio (LLCR)
 - Levelized Cost of Electricity (LCOE)

Please get comfortable with the scenario sheet and try to change the base case selection and the different scenario assumptions.

- **Change the base case for a selected sensitivity and check how that effects the charts for the other sensitivities**
- **Explain why the IRR and amortization remains constant when increasing the *specific yield*? How is that linked with the sensitivity for monthly consumption?**
- **Explain why the IRR for higher debt amounts decreases after a certain amount**

Please get comfortable with the scenario sheet and try to change the base case selection and the different scenario assumptions.

- **Change the base case for a selected sensitivity and check how that effects the charts for the other sensitivities**
 - Other sensitivities may change because they now use a different base case
- **Explain why the IRR and amortization remains constant when increasing the *specific yield*? How is that linked with the sensitivity for monthly consumption?**
 - If PV generation and consumption are not balanced over a year, a credit for excess electricity cannot be used
- **Explain why the IRR for higher debt amounts decreases after a certain amount**
 - More debt is used then needed which results in higher interest rate payments and thus decreases the Equity IRR



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