APPLICATION NOTE

LIFE CYCLE COSTING CASE STUDIES OF RES AND EE PROJECTS

Eclareon

July 2014

ECI Publication No Cu0200

Available from www.leonardo-energy.org

Document Issue Control Sheet

Document Title:	Application Note–Life Cycle Costing case studies of RES and EE projects
Publication No:	Cu0200
Issue:	01
Release:	July 2014
Author(s):	Jules Luternauer and José Ignacio Briano
Reviewer(s):	Hans De Keulenaer

Document History

Issue	Date	Purpose
1	January 2014	Initial version
2	July 2014	Adaptation and first publication in the framework of the Good Practice Guide
3		

Disclaimer

While this publication has been prepared with care, European Copper Institute and other contributors provide no warranty with regards to the content and shall not be liable for any direct, incidental or consequential damages that may result from the use of the information or the data contained.

Copyright© European Copper Institute.

Reproduction is authorized providing the material is unabridged and the source is acknowledged.

CONTENTS

Summary **3**

Introduction **4**

Sources of Financing **4**

PV Plant Case Study **9**

PV Plant Inputs and LCC 9

Financing Assessment 11

Financing options to consider if investors can have access to equity 14

Financing options to consider if investors cannot have access to equity 15

Energy Efficiency Case Study **16**

Energy Efficiency Case Inputs and LCC 16

Financing Assessment 17

Financing options to consider if investors can have access to equity 21

Financing options to consider if investors cannot have access to equity 21

Conclusions **22**

Annex: Acronyms **24**

SUMMARY

Making sound energy investment decisions is a complex task – no matter whether it concerns a Renewable Energy System (RES) or an Energy Efficiency (EE) investment. A Life Cycle Cost (LCC) analysis combined with an assessment of the available financing options should be the obligatory path for every investment decision. Decision makers usually focus on familiar financing schemes and may fail to consider alternative means of financing which can be of significant added value to a project.

This paper is intended to be a guide in the process of evaluating a project. Such evaluation includes an assessment of its cost structure through the LCC approach (also called Total Cost of Ownership or TCO) and an assessment of financing options. It will be demonstrated and explained that the most profitable financing is not always the most appropriate one.

This report is organized as follows:

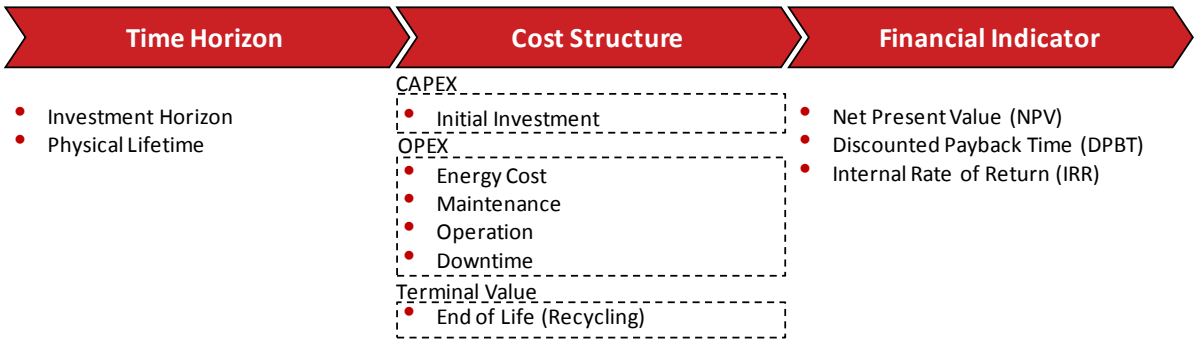
- An Introduction explaining the approach and its usefulness in assessing a project
- A detailed description of available Financing Sources
- A Case Study of a utility-scale PV Plant applying the LCC method and assessing four adapted financing options:
    - Bank Financing
    - Project Finance
    - Operational Lease/Renting
    - Capital Lease
- A Case Study of an Energy Efficiency (EE) project applying the LCC method and assessing four adapted financing options:
    - Financing/Guaranteed Savings Bank
    - Shared Savings
    - Operational Lease/Renting
    - Capital Lease

INTRODUCTION

This publication is a continuation of the Leonardo GPG LCC series which currently includes three papers: Life Cycle Costing–the Basics, Stochastic Life Cycle Costing and Economic Analysis of Wind Projects. This paper analyzes two different cases using the LCC method. The LCC method provides a unique perspective as it integrates all costs of a project during the entire lifespan of the asset. The principal focus of the study is to evaluate the impact of financing sources on key financial indicators. The two investment cases studied are a utility-scale Photovoltaic (PV) Plant under a Power Purchase Agreement (PPA) business model and an EE installation for a medium-sized hotel which combines a solar thermal installation and a lighting change. Both cases are based on real figures provided by professionals in the sector.

Since both cases have significant Operation Expenses (OPEX) compared to the entire LCC, the LCC analysis is the appropriate method to illustrate and elucidate all costs involved. Using this method, the decision maker will be able to choose between a high up-front cost project and a more economical project with higher operational expenses.

A LCC analysis follows a rigorous methodology. In the initial step, time horizons need to be defined, followed by identifying cost components in order to finally analyze financial indicators. In more detail:



Source: ECLAREON Analysis

Figure 1—Life Cycle Cost components

The investment horizon is the period being analyzed. At the end of this period, a terminal, residual value or recycling value needs to be integrated, based on the particularity of the asset. All project cost structures can be segmented into three main categories: Capital Expenditure (CAPEX), OPEX and Terminal Value (also called Residual Value) representing all of the costs of the project.

SOURCES OF FINANCING

Financing is one of the largest barriers to the development of Energy and Energy Efficiency projects. The development of these projects often requires substantial amounts of capital in order to plan and design the project, purchase and install the equipment, as well as to train or recruit staff for the operation and maintenance of the system installed. In particular, EE projects are viewed as very high risk investments by financial institutions and therefore their access to financing is limited.

There are several reasons why financing becomes a barrier to the development of these projects:

- High upfront costs compared to other conventional energy sources
- Perception of high investment and operational risks by financial institutions
- Changing regulatory frameworks and therefore regulatory uncertainty
- Lack of market information

- Lack of EE finance experience and an existing asset-based culture in financing
- The efficiency and savings are not easy to estimate and are initially invisible (compared to conventional revenues)
- There are few EE project developers active in the market

All the above issues will determine the financing affordability of these projects.

FINANCING OPTIONS

There are three basic types of financing: equity, debt and grants.

EQUITY

Equity investors provide capital in a project in return for a stake in the project. It involves the highest risk due to the fact that equity investors have the right to distributions from the project (dividends) only after every other financial and tax obligation is met. In return, the equity investor expects higher returns. On the other hand, equity involves ownership and the right to get involved in the decisions to be made regarding the project.

From the project point of view, capital can be provided in the form of pure equity or investor loans. In the case of an investor loan, the amount lent has to be repaid but with flexible repayment terms. This loan also bears interest.

DEBT

Debt financing involves taking a loan (or issuing a bond) to provide capital and requires repayment of both the amount of money borrowed and the interest charged on that amount. Lenders must be repaid before distributions can be made to shareholders and therefore they bear less risk than equity holders.

Loans can be provided by:

- Commercial banks: apply market conditions to terms of repayment period and interest rates. They are more accessible than the following debt providers
- Multilateral or development banks (EBRD, World Bank, MIGA, IDB, et cetera): offer loans at an interest rate and/or payback periods below commercial banks' average, although they do not offer financing on their own most of the time but in conjunction with other banks (banking syndicate). They can also offer guarantees to mitigate the risk of the project and facilitate other forms of financing (such as loans from commercial banks). Some of these institutions focus on a specific continent or region.
- Investment banks/Investment funds: these can be loan providers or also invest in the form of equity (called capital investors).
- Other finance corporations

Debt can be with recourse which implies that the company's assets stand behind the project and the related debt and lender have to recognize them in the event of default. This is also called on balance sheet financing. Businesses are often willing to use recourse finance only for core business activity and not for projects in auxiliary activities (EE is usually seen as an auxiliary activity by companies).

Non-recourse financing is called Project Finance. It is long-term financing based upon the projected cash flows of the project rather than the balance sheet of the project sponsors. It is secured by the project assets (considered as a collateral), including the revenue producing contracts. This model is of limited usefulness for EE projects, given that:

- EE equipment has a low collateral asset value
- On average, EE projects have a limited size that cannot justify the high expenses inherent to Project Finance

A Special Purpose Vehicle[1] (SPV) is required to ring fence the risks of the project. Establishment of a SPV implies fixed costs that can be afforded only if the project has a significant size.

SUBORDINATED DEBT

Subordinated debt, also called mezzanine debt, is a debt instrument falling between debt and equity. It can be provided by a project partner or a financial institution and is subordinated to other primary debt (senior debt) in the event of project default. In return, it commands a higher interest rate of return to reflect that risk.

OTHER DEBT INSTRUMENTS

LEASING/RENTING

There are two types of leases. When the leasing company retains ownership it is called an operating lease. When the ownership is transferred to the purchaser it is called a capital lease. In both cases, payments from the customer cover the equipment costs of the leasing company minus a slight residual value, interest and insurance costs and a return on capital.

Operating leases are not capitalized on a company's balance sheet and lease payments are treated as an expense in the P&L. Under a capital lease, a lessee is required to show the leased equipment as an asset and the present value of lease payments as debt on its balance sheet. Some capital lease programs also allow the customer to purchase the system when the lease expires.

Renting is like an operating lease except that the annual payment includes the operating and maintenance costs of the EE project.

VENDOR FINANCING

Vendor financing occurs when a financier provides a vendor with capital to enable it to sell its products without immediate payment. It is used by equipment manufacturers to help sell their products by facilitating a customer's purchase. Leasing (or renting) is the most common form of vendor financing.

BONDS

[1] A legal entity created in order to isolate the project's cash flows and risks.

Further debt instruments include bond financing. Bonds are debt securities issued by companies or governments with a fixed life time and entitle the holder to the repayment of principal plus interest in regular installments during the lifetime of the bond. Bond financing is not easy to structure. It requires that the project is rated with at least investment grade. Bonds get an investment grade by rating companies when they have a low risk of default[2]. In this regard, the construction or technological risk must be minimized or eliminated.

An example of bond financing relevant to energy efficient projects is the issuing of municipal bonds for municipal EE projects.

PERFORMANCE CONTRACTING (ESCO)

In EE projects financing can be canalized through an ESCO. An ESCO is an energy service company which helps another company to identify suitable EE projects and assists in project design, equipment selection, project implementation, testing to verify savings and O&M.

Three types of contracts can be proposed by an ESCO:

- Profit sharing: the most common form. The company repays the ESCO out of the savings achieved which are split between both parties as stipulated in the contract (no matter whether they turn to be greater or lower than expected). There is no penalty for the ESCO for not achieving the initially estimated savings.
- Guaranteed savings: the ESCO guarantees the achievement of a level of savings. If they later turn out to be lower than expected the ESCO pays the difference. If they turn out to be greater they are shared between the ESCO and the company as agreed in the contract.
- Mixed model: is a combination of the above models. The savings are split between the ESCO and the company as it has been agreed in the contract, but if the real savings are lower than expected a penalty must be paid by the ESCO. If they turn to be greater they are shared based on the agreed percentage initially.

In these types of contracts, the client does not have to invest anything. The asset is owned by the ESCO and it is paid back by the savings it generates. At the end of the contract—this usually lasts between five to seven years—the ownership of the asset moves to the client. Therefore, ESCOs intervene in two aspects of the financing structure: 1.) in limiting the upfront investment required by the client or end-user in exchange for a staggered payment for service, and 2.) in serving as financial intermediaries in obtaining bank loans. Sometimes ESCOs offer guarantees to secure loans themselves which they then use to finance projects. In this case the loan is on the balance sheet of the ESCO and the ESCO is exposed to the end-user credit risk. The main advantages of financing through the ESCOs' balance sheet include:

- Simplicity: the customer signs a contract with a service provider for the installation, maintenance and repairs of the system and makes periodic payments in return
- Flexibility: customer never takes ownership of the system and it can be transferred to another customer if the customer no longer wants to pay for the service

[2] Investment grade is equivalent to a credit rating of ≥ BBB- by S&P and Fitch or ≥ Baa3 by Moody's. Usually, Pension funds are limited to investing in investment grade bonds. Bonds which fall below the investment grade threshold are known as speculative bonds.

- Affordability: periodic payments and unexpected expenses for major components are avoided

FACTORING/FORFEITING

This is a means of transferring future receivables from one party (cessionary—ESCO) to another (the financial institution). The original creditor (the ESCO) cedes their claims and the new creditor (the financial institution) gains the right to claim future receivables from the debtor. The ESCO sells the future receivables in return for a discounted one-time payment.

GRANTS

Grants do not require repayment (non-recoverable subsidy). They are provided by governments and international organizations to promote environmental and development projects. The money is given with specific requirements or terms for use and time frame restrictions. They are often used as an incentive to make investments more attractive in new markets or projects where savings have not been tested. Governmental subsidies can also be in the form of soft loans and taxation. Soft loans are a type of loan with extended payback periods, low or zero interest rates, short term interest deferral periods and inclusion of payback grace periods. Taxation can be a powerful tool to stimulate EE by providing incentives to invest in such projects through tax exemptions, incentive regimes related to capital gains tax, property tax, VAT and accelerated or free depreciation.

GENERAL COMPONENT OF FINANCING OPTIONS

The financing decision always involves a combination of the above sources of funds. Financial institutions or loan providers and governments (in the case of grants) will always require investors to risk equity in the project as a form to show their commitment. Depending on the project risks and characteristics the percentage involved from each party may differ.

PV Plant Case Study

The first case analyzes a utility-scale PV Plant operating under a Power Purchase Agreement (PPA). A PPA is a contract between an electricity producer and an electricity consumer who signs an agreement to sell the electricity produced at a set price during a fixed period of time (usually between fifteen to twenty-five years for utility-scale PV parks). As this business model does not depend on governmental incentives it is seen as the future of the sector of utility-scale PV parks.

PV Plant Inputs and LCC

Provided by international actors of the industry, PV Plant characteristics have been set on the following assumptions:

Concept	Unit	Value
Power Capacity Installed	MWp	40
Time Horizon		
Physical Lifetime	Years	30
Investment Horizon	Years	25
Initial Investment		
Total EPC Cost	EUR/Wp	0.90
Operation & Maintenance		
Maintenance Cost	EUR/MWp	15,000
Insurance Cost	EUR/MWp	3,700
Park Management	EUR	7,500
Renting	EUR/Hectares	600
Renting Area	Hectares	80
Park Production Factors		
H.S.P	$Wh/m^2/day$	4,600
Annual Panel Deterioration	%	0.60
Downtime		
Performance Ratio	%	80
End Of Life		
Recycling Value	EUR/Wp	0.04
PPA Contract		
PPA Price per kWh[3]	EU/kWh	0.10
PPA Tenor	Years	25
Financial Data		
Income Tax Rate	%	30
Inflation	%	1.50

Table 1—PV park characteristics and PPA assumptions

Since the PPA runs for twenty-five years, the analysis has been performed on a 25 year investment horizon. Total EPC cost includes all installation costs (module, racking, inverters, cabling, construction work and EPC margin). For a utility-scale PV Plant in Europe, the total EPC cost ranges from 0.80ct€/Wp to 1.3ct€/Wp depending on the location of the installation. The notion of residual value for a PV park is complicated. On the one hand, the cost of decommissioning needs to be forecasted, but on the other hand, modules can be sold to

[3] According Solar Praxis, average PPA prices in 2011 were roughly 20ct$/kWh but prices tend to decrease.

the secondhand market (mostly in Africa). According to experts, decommission costs can be equal to raw material sales income (steel, copper, et cetera) in the best case. There are three different methods for integrating this forecasted cost in financial statements:

- It can be directly integrated in CAPEX in year one at a present value cost
- It can be provisioned each year
- It can be provisioned during the last four to five years, based on the fact that at this time, park owners will have a clear idea of what the decommissioning phase will cost

This accounting decision has to be approved by a tax consultant as it has a direct impact on income and might not be validated by tax authorities. In our example, no residual value has been added, but a recycling cost has been integrated in CAPEX based on a decommissioning price of 0.05€/Wp in 25 years.

The NPV of all LCC elements is represented below:

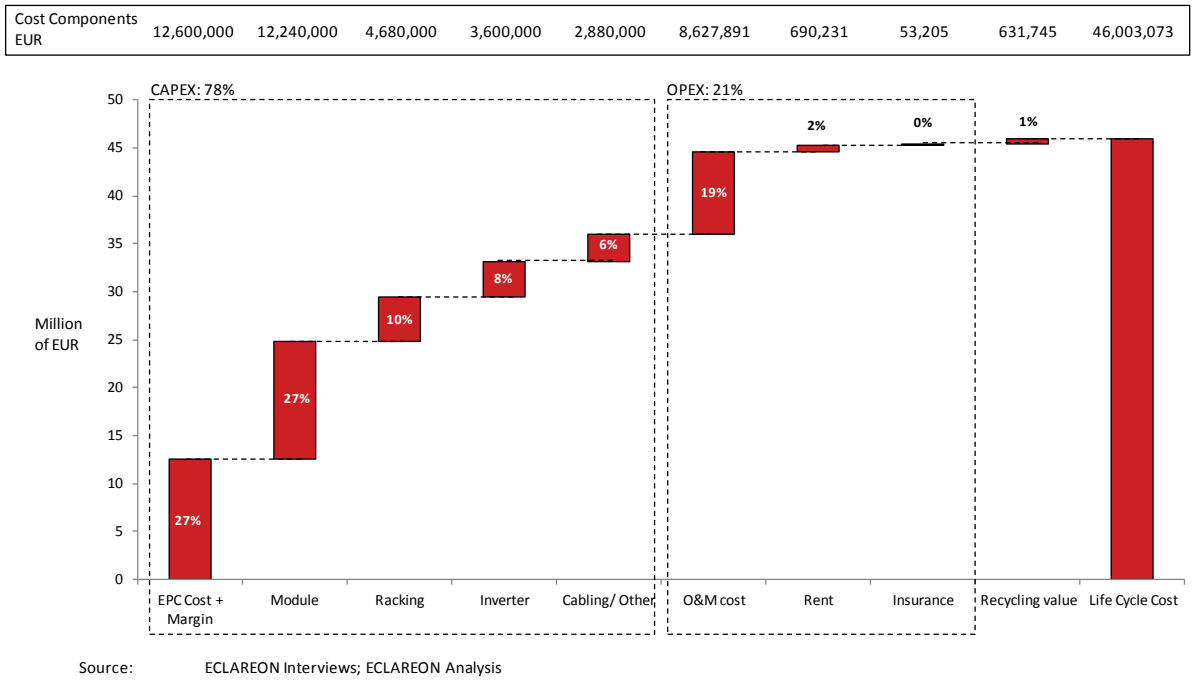


Figure 2—PV Park Life Cycle Cost

As shown in Figure 1, the CAPEX typically represents more than 75% of the LCC for a PV park. The present value of operational expenses represents 21% of the investment. However, it is relevant to note that those proportions can change depending on the technology used and on the local environment.

FINANCING ASSESSMENT

In general, choosing a financing source will depend on the investor profile, meaning the suitability of a financing source depends on the risk appetite of the investor and on the amount of equity the investor has available. In order to assess the impact of different financing sources, the following options have been considered:

- Bank Loan (Recourse)
- Project Finance
- Operational Lease/Renting
- Capital Lease

The following table sums up the assumptions used for each type of financing alternative considered:

Concept	Unit	Value
Bank Loan (Recourse Debt)		
Leverage	%	80
Tenor	Years	9
Interest only Period	Years	1
Interest Rate (Euribor + Margin)	%	5.10
Opening Fee	%	1.25
WACC[4]	%	4.76
Project Finance		
Leverage	%	70
Tenor	Years	15
Interest only Period	Years	1
Interest Rate	%	6.10
Due Diligence Cost	%	1.00
Debt Service Coverage Ratio (DSCR)	Times	1.60
WACC	%	5.84
Operational Lease/Renting		
Lease Period	Years	10+15
Interest Rate	%	6.25
Annual lease Payment	EUR	2,250,000
WACC	%	4.38
Capital Lease		
Lease Period	Years	25
Interest Rate	%	6.25
Annual Lease Payment	EUR	2,250,000
WACC	%	4.38
Other Assumptions		
Risk-Free Rate (German 20 years)	%	2.50
Risk Premium	%	7

Table 2—Characteristics of financing sources

[4] WACC = (Cost of Debt*Percentage of Debt in Capital Structure) + (Cost of Equity*Percentage of Equity in Capital Structure).

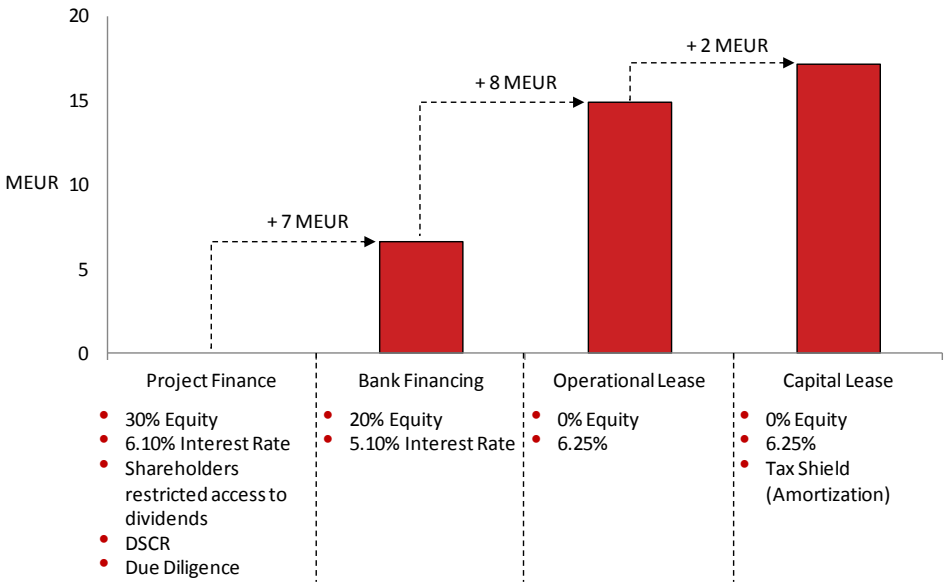
In this analysis, an operational lease is considered to be equal to renting. The Project Finance input is based on the characteristics of big infrastructure projects (data provided by a financial institution). In order to be able to compare each financing source with the others, it has been assumed that the operational lease will be re-contracted at the same price for another 15 years after the first 10 year period. The buyout option has not been applied at the end of the Capital Lease contract, given the insignificant impact on the NPV.

The Net Present Value of cash flow available for investors/shareholders can be used to compare the projects with each other. This value has been calculated as represented in the graph below:

Figure 3—NPVs comparison

As Project Finance and Bank Financing include an initial investment, it is possible to calculate the IRR and DPBT. On one hand, Bank Financing's IRR is higher than that of Project Finance due to the Debt Service Reserve Account obligation and due to its restriction on dividend distribution. On the other hand, discounted payback time is longer for Bank Financing than for Project Finance because of the French amortization method for typical loan and the Project Finance amortization following DSCR requirement and the higher leverage assumed in the former (80%) compared to the latter (70%).

The particularities of each financing option have a direct effect on its NPV. Differences in the value of the NPV are explained as follows:



Source: ECLAREON Analysis

Figure 4—Explanation of differences in NPV between different financing options

NPV levels will change substantially depending on the leverage and on interests rates assumed in each type of financing. These characteristics reflect fundamental differences in the structure of the financing, which have implications on the ownership of the asset, e.g. an operational lease implies no ownership of the asset by the contractor, but under bank financing the contractor owns the asset. The differences illustrated in Figure 4 mean that an NPV comparison needs to be completed with others types of analysis (see Figure 10).

In this event, Equity investment is the first reason for the low level of Project Finance and Bank Finance NPV. The difference between Operational Lease and Capital Lease NPVs level is the tax shield effect of the amortization of the leased asset in the case of a Capital Lease.

PPA prices can vary tremendously depending on the location of the power plant; it usually ranges from 0.05EUR/kWh to 0.25 EUR/kWh. OPEX prices are indexed on labor costs and consequently vary depending on where the project is realized. A sensitivity analysis has been performed based on PPA Prices, OPEX, interest rates and inflation:

OPEX

	-10%	Base Case	+10%
Bank Financing	+2.74%	100%	-2.74%
Operational Lease	+2.55%	100%	-2.55%
Capital Lease	+2.85%	100%	-2.85%
Project Finance	+2.34%	100%	-2.34%

PPA Price

	-10%	Base Case	+10%
Bank Financing	-23.54%	100%	+23.54%
Operational Lease	-22.11%	100%	+22.11%
Capital Lease	-24.48%	100%	+24.48%
Project Finance	-19.91%	100%	+20.16%

INTEREST RATE

	-300 bps	Base Case	+300 bps
Bank Financing	+10.42%	100%	-11.00%
Operational Lease	+83.50%	100%	-54.87%
Capital Lease	+79.92%	100%	-53.32%
Project Finance	+10.49%	100%	-16.70%

INFLATION

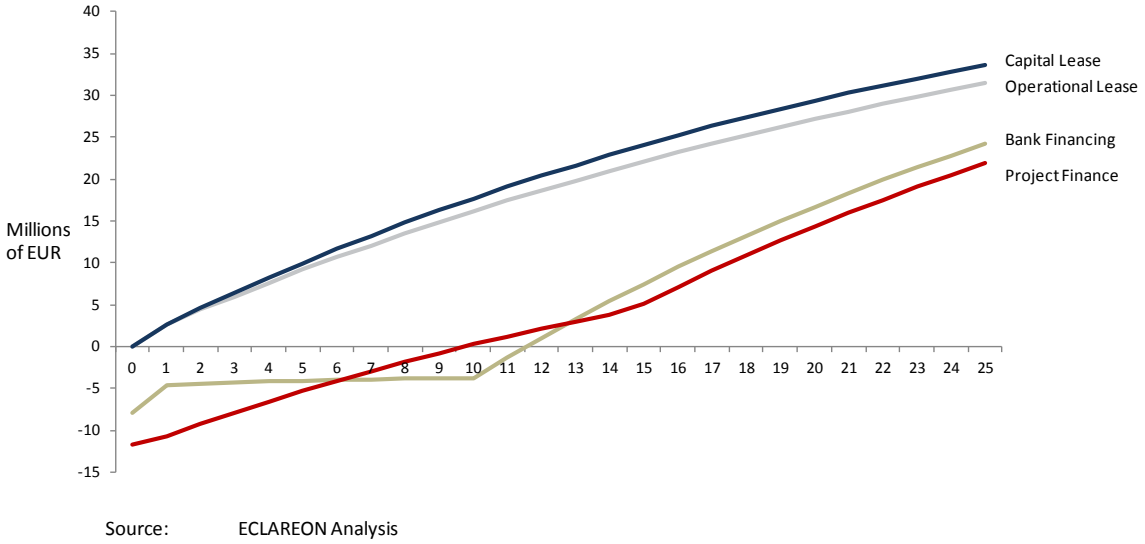
	-1%	Base Case	+1%
Bank Financing	-17.52%	100%	+20.43%
Operational Lease	-14.73%	100%	+16.73%
Capital Lease	-18.40%	100%	+21.46%
Project Finance	-15.06%	100%	+17.66%

Note: BPS = Basis Point, equal to 1/100th of 1%
Source: ECLAREON Analysis

Table 3—Sensitivity analysis of project NPVs

Interest rates have a significant impact on lease profitability given that the annual lease quote is based on it.

The evolution of projects' cash flows during the analyzed period is relevant to differentiate each financing option, as is illustrated below:



Source: ECLAREON Analysis

Figure 5—Comparison of accumulated discounted investor/shareholder cash flows of each financing option[5]

Significant impact of different financing option characteristics can be noted:

- In year zero, leverage and non-equity financing differentiation can be noted clearly
- The interest only year used for the Project Finance and the Bank Financing has a significant impact only on Bank Financing cash flow (see on the graph the first year of Bank Financing). In the case of Project Finance, the available cash flow directly feeds the Debt Service Reserve Account (DSRA)
- As soon as the debt has been paid (year 10 for bank financing and year 15 for project finance), accumulated cash flows increase sharply

When different financing is considered, it is important to integrate other factors into the assessment analysis including but not limited to the ownership of the asset, tax deduction, non-economic factors, et cetera. For example, an operational lease does not allow the contractor to sell the asset at the end of the financing agreement.

FINANCING OPTIONS TO CONSIDER IF INVESTORS CAN HAVE ACCESS TO EQUITY

Bank Financing through corporate loans and Project Finance require equity. Historically, Project Finance gave access to a better leverage, up to 90%-100%, but at present, this trend has changed due to the global financial crisis. Project Finance leverage is now usually lower than a typical corporate loan.

The main differences between these two financing sources are:

- Leverage
  - A corporate loan has higher leverage

[5] This is a purely cash flow perspective that does not include balance sheet considerations, e.g. potential sale of the asset at the end of the financing period.

- Recourse
    - No recourse possible against the project owner in a Project Finance scheme (only limited to the capital invested in the project)
- Requirements
    - Due Diligence, Minimum Debt Service Coverage Ratio over the life of the loan, and Debt Service Reserve Account are required in a Project Finance scheme
- Dividend accessibility
    - The shareholders access to dividends is restricted in a Project Finance scheme (this usually depends on meeting certain DSCR requirements)

Having the ownership of the asset can allow the project owner to make all the decisions on their own.

FINANCING OPTIONS TO CONSIDER IF INVESTORS CANNOT HAVE ACCESS TO EQUITY

The ability to have access to this type of asset without using equity can be extremely interesting; leases are often used in such situation.

As explained in the previous section, the main differences between these two financing sources regarding financial statements and ownership are:

- Impact on financial statements
    - The operational lease does not go on the balance sheet of the investor, whereas the capital lease asset shows on the balance sheet (NPV of future lease payments)
- Tax Shield
    - Capital lease interest and asset depreciation cost reduce the income tax bill, whereas in the operational lease, the lease payment is considered as an operating expense and deducted from the P&L
- Buyout option
    - At the end of a capital lease, the buyout option is proposed and should be considered since it can give asset ownership to the investor

It is essential to recognize that the most profitable financing option is not always the most suitable or viable. Indeed, for utility-scale PV parks, an investment bank loan or Project Finance scheme are generally preferred to leases. However, leases are also used. The tricky thing with the operational lease is that it is set for a short period of time, so it needs to be renegotiated with the lessor at the end of the tenor. Other metrics need to be considered when investors have to choose between different financing options, such as recourse terms, restrictions to shareholder cash flows, guarantees required as collateral, and the cost of financing and tenor.

Energy Efficiency Case Study

EE investments are only profitable on a long-term basis due to the high cost of equipment and installations. In this case, a medium-sized hotel changes a part of its lighting installation, and adds a solar thermal installation, a tubular heat exchanger and a new boiler in order to reduce its energy bill.

Energy Efficiency Case Inputs and LCC

Assumptions made and used in the financial model are included in the following table:

Concept	Unit	Value
Time Horizon		
Physical Lifetime	Years	12
Investment Horizon	Years	7
Initial investment		
Equipment and Installation	EUR	84,497
Project and Construction Management	EUR	9,371
Energy Efficiency Analysis	EUR	7,828
Operation & Maintenance		
Annual Operation	EUR	8,762
Annual Maintenance	EUR	3,528
Energy Consumption Data		
Old energy bill	EUR	173,256
Forecasted energy bill	EUR	135,464
Downtime		
Has been included in energy bill forecasting		
End of Life		
Recycling value[6]	EUR	-
Financial Data		
Income Tax Rate	%	30
Inflation	%	1.50
Energetic CPI	%	3.00

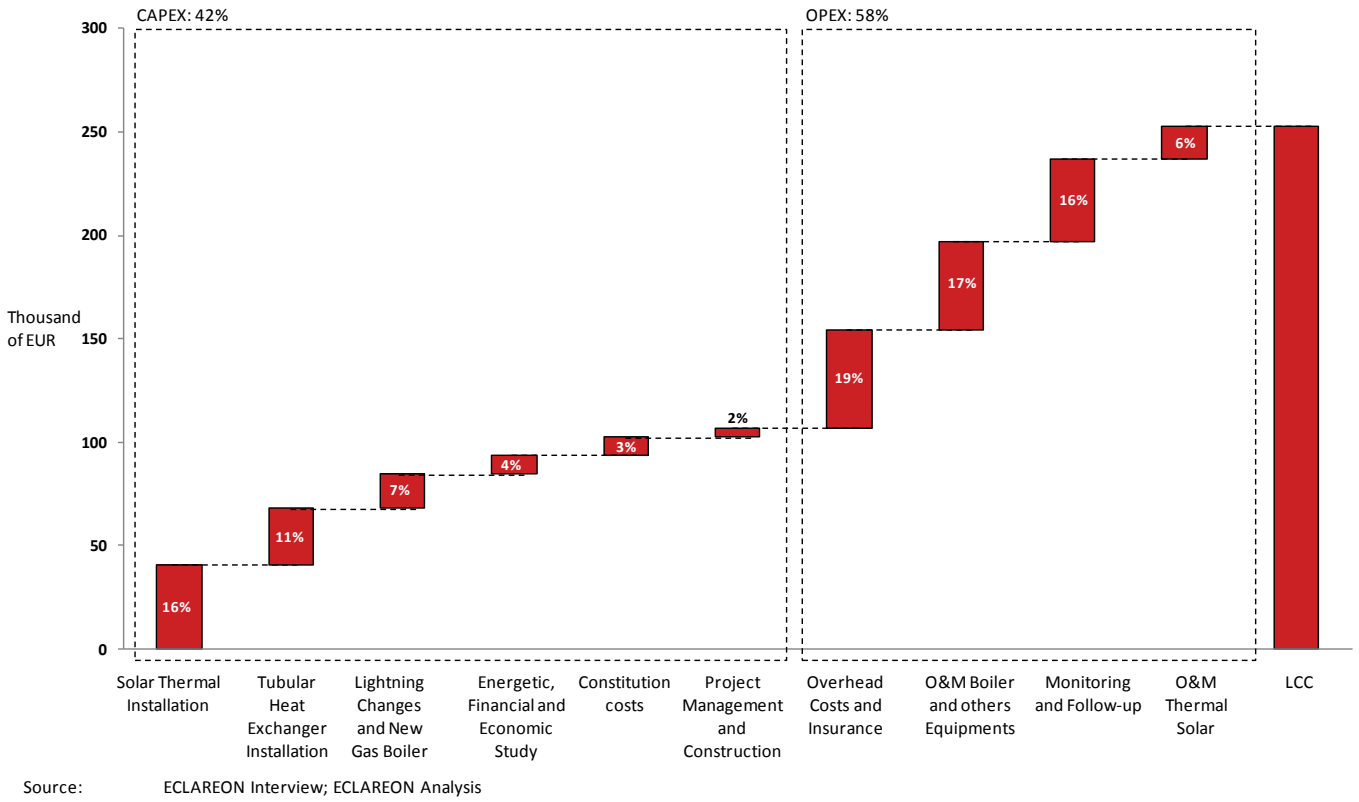
Table 4—Energy efficiency case assumptions

This type of investment has a long-term investment horizon, as LED lightning is in generally expected to last 12 years compared to traditional energy consumption devices. The Equipment and Installation category includes the solar thermal installation, the tubular heat exchanger, the lightning change and a new gas boiler. An energy CPI has been used to estimate energy cost evolution in order to calculate future savings.

The breakdown of all cost components has been illustrated in the following LCC chart:

[6] No recycling value has been considered given that there is no reason to dismantle the installation at the end of life.

Components cost (EUR)	40,772	27,181	16,544	9,448	8,576	4,023	48,063	42,464	39,770	15,996	252,836



Source: ECLAREON Interview; ECLAREON Analysis

Figure 6—Energy efficiency installation LCC

Even if the CAPEX of an EE project is significant, it can be noted that OPEX is bigger. A good O&M of the entire installation is therefore essential in order to obtain the best yield.

Financing Assessment

The main barrier to EE project is financing. That is the reason why the industry came up with three financing alternatives to incentive client decision. In this case, bank loan financing, operational lease and capital lease and shared savings financing model were considered. The financing assumptions made and integrated into the model are presented in the table below:

Concept	Unit	Value
Finance form Debt/Guaranteed Savings		
Leverage	%	80
Tenor	Years	6
Interest Rate	%	5.10
Interest only Period	Years	1
Opening fee	%	1.25
WACC	%	4.76
Operational Lease/Renting		
Lease Tenor	Years	6+6
Annual Lease Payment	%	10,170
Interest Rate	EUR	6.25
WACC	%	4.38

Concept	Unit	Value
Capital Lease		
Lease Tenor	Years	12
Annual Lease Payment	EUR	10,170
Interest Rate	%	6.25
WACC	%	4.38
Shared Savings		
% of the savings charged by the ESCO	%	83
Contract Tenor	Years	7
WACC[7]	%	5.94
Others Financial Inputs		
Risk-Free Rate (German 20 years)	%	2.50
Risk Premium	%	7

Table 5—Characteristics of financing sources

As explained in detail in the sources of financing section, there are three types of performance contracting: Shared Savings, Guaranteed Savings and the mixed model proposed by ESCOs. From a modeling point of view, the Bank Financing can be assimilated into the Guaranteed Savings and the mix model has not been modeled as it differs only if real savings are not equal to forecasted savings.

It has been assumed that the operational lease will be re-contracted at the same price after the first six years for another six year period, in order to make it comparable with other financing sources.

This type of investment is usually made through an ESCO and results are attractive. When such installation is applied to an old building with obsolete equipment, results can be extremely profitable. As explained in the previous case, since the alternative financing sources do not involve an initial investment, the only way to compare all projects is using the NPV valuation. As there are no incomes but savings in an EE project, savings have been modeled in order to perform the analysis. EE project investor/shareholder cash flow NPVs are illustrated in the following graph:

[7] This WACC has been calculated based on typical capital structure of a medium size hotel 60% debt and 40% equity

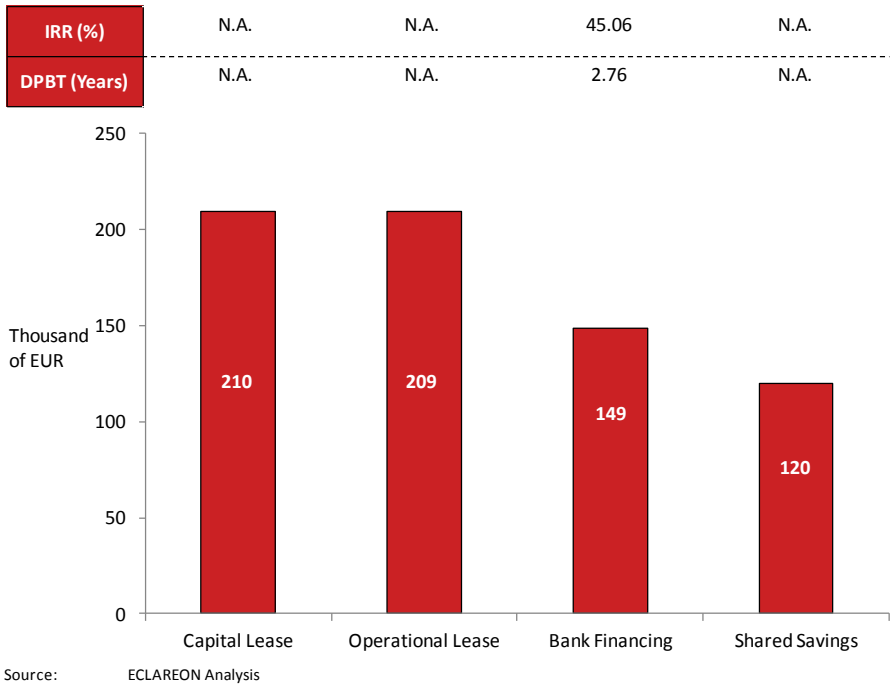


Figure 7—NPVs comparison

In this case, bank financing is the only option with an initial investment. That is why IRR and DBPT have been calculated only for this financing option. It turns out to be an extremely profitable investment given those financial indicators.

The following figure explains NPV differences:

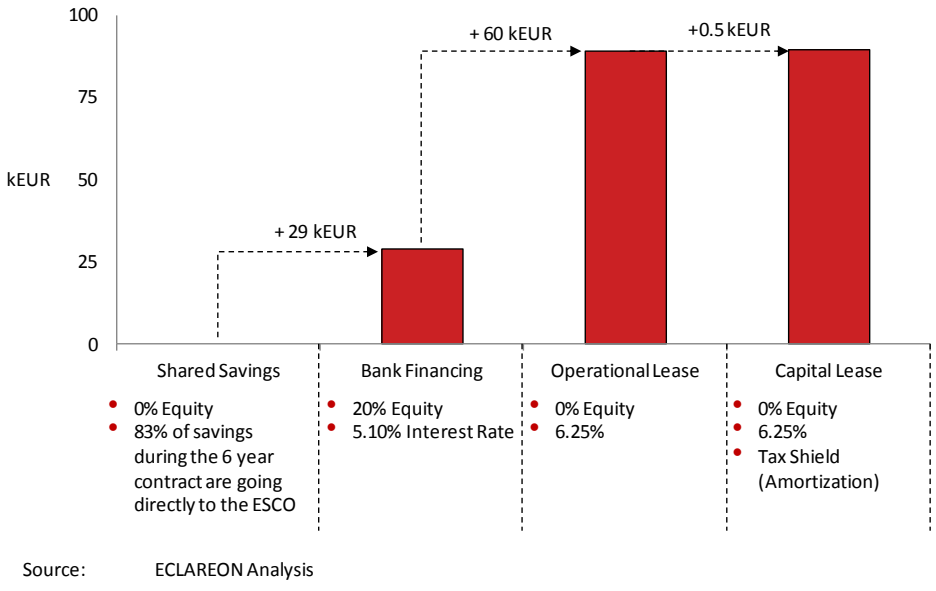


Figure 8—Explanation of differences in NPV between different financing options

Shared Savings is the safer financing option for this case since there is no commitment from the client. On the other hand, it is the financing system with the smallest profitability of all the options compared.

There are four critical factors that can have a direct effect on NPVs: OPEX, energy savings levels (if it follows estimations or not), interest rate, and inflation. A sensitivity analysis of those factors has been performed below:

OPEX

	-10%	Base Case	10%
Bank Financing	+6.08%	100%	-6.08%
Operational Lease	+4.70%	100%	-4.70%
Capital Lease	+4.95%	100%	-4.95%
Shared Savings	+2.86%	100%	-2.86%

ENERGY SAVINGS

	-10%	Base Case	10%
Bank Financing	+66.72%	100%	-66.72%
Operational Lease	+51.64%	100%	-51.64%
Capital Lease	+54.38%	100%	-54.38%
Shared Savings	+41.26%	100%	-41.26%

INTEREST RATE

	-300 bps	Base Case	+300 bps
Bank Financing	+3.02%	100%	-3.13%
Operational Lease	+27.95%	100%	-22.20%
Capital Lease	+28.43%	100%	-22.53%
Shared Savings	-	-	-

INFLATION

	-1%	Base Case	+1%
Bank Financing	+3.06%	100%	-3.27%
Operational Lease	+2.12%	100%	-2.26%
Capital Lease	+2.52%	100%	-2.69%
Shared Savings	+2.46%	100%	-2.67%

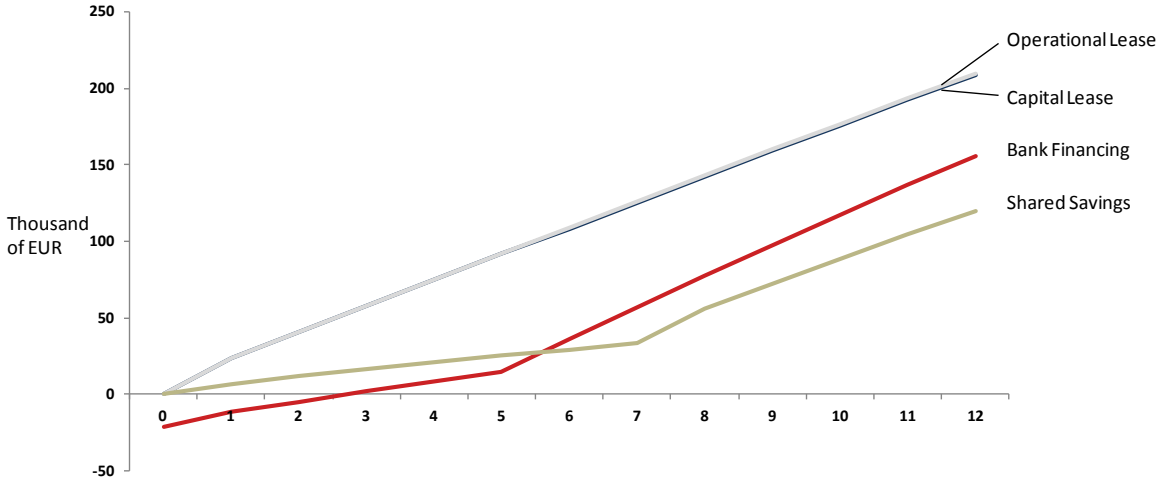
Note: BPS = Basis Point , equal to 1/100th of 1%
Source: ECLAREON Analysis

Table 6—Sensitivity analysis of project NPVs

The Energy Savings factor is the key component of an EE project's profitability. Energy savings impact on profitability can be hedged by performance contracts offered by an ESCO.

Interests rate changes do not impact the shared savings model since the only payment for the installation is directly taken by the ESCO as a part of energy savings.

Since the Bank Loan Financing option is the only one with an initial investment, cash flows can be calculated and represented as shown in the following graph:



Source: ECLAREON Analysis

Figure 9—Comparison of accumulated discounted investor/shareholder cash flows of each financing option[8]

[8] This is a purely cash flow perspective that does not include balance sheet considerations, e.g. potential sale of the asset at the end of the financing period.

Significant impact of different financing option characteristics can be noted:

- In year zero, the difference between equity investment in Bank Financing and non-equity financing can be noted
- After year 6, Bank Financing has been entirely paid and savings increase sharply
- At year 7, the performance contract ends and the EE installations are given for free to the client, which explains the steady increase of savings after this date

FINANCING OPTIONS TO CONSIDER IF INVESTORS CAN HAVE ACCESS TO EQUITY

It is worth considering an investment in EE on the company equity due to the high return and the short payback period.

For a client considering an EE project, it will always be worthwhile to lever some equity as long as equity is available with a bank loan due to the high return and the short payback period of this option. Main advantages of choosing such financing are:

- Ownership of equipment
- Short payback period and high IRR

FINANCING OPTIONS TO CONSIDER IF INVESTORS CANNOT HAVE ACCESS TO EQUITY

Energy Service Companies (ESCOs) propose principally two alternative ways for obtaining an EE installation without equity: Shared Savings and the mixed model. Leases are also a financing source that does not require an initial investment. Main advantages are:

- Accessibility
- Security, since the equipment is insured by the equipment owner (lease companies or ESCOs)

EE projects are a very specific investment, since the returns do not come in the form of income but in the form of savings. Therefore, the higher the client's saving potential, the easier the access to any kind of financing will be.

CONCLUSIONS

We have seen that each financing option is a mix of different financing sources composed in most cases by both equity and debt, but alternative financing options such as leases or performance contracting may also be attractive.

Choosing the more suitable financing is a key component of the success of a project. The main characteristics of financing that should be considered are:

- Requirement for upfront investment
- Operational risk of the project
- Equity available to the investor
- Risk aversion/risk appetite of the investor
- Legal terms of the financing
- Other contract particularities

Other factors such as the company's main activity also have to be taken into account when deciding the most suitable financing option for each project. For instance, for a hotel it might be wiser to do an EE installation through an ESCO, even if it would be less profitable, in order to stay focused on its core business.

Large infrastructure companies that cannot afford to commit equity or its balance sheet will most likely choose project finance due to its high leverage and non-recourse/off-balance sheet terms.

Given the importance of OPEX in both projects analyzed (21 % for the PV plant case and 56 % for the EE case), it is highly important to have the LCC perspective; it enables a clear understanding that in some cases it is worth increasing the upfront investment in CAPEX if future OPEX can be lowered or income increased, thereby increasing yield. For example:

- Better components can lead to less maintenance and/or better yield
- Better materials helps to increase the asset lifetime

Only the LCC approach can truly assess all costs across the asset´s lifetime. It is therefore a vital tool in investment decisions related to assets.

Financing, however, is almost as important as the project remuneration itself. Before starting a project, the investor must assess each opportunity in detail and find the most appropriate financing source by taking the above factors into account. The following summary table (Figure 10) proposes an overview of the different types of financing that can be used to finance EE or RES projects taking into consideration the main variable that influence the choice of financing, e.g. size of the project, type of project, risks, et cetera.

		MAIN ADVANTAGES	MAIN DISADVANTAGES	SIZE OF PROJECT	OPERATIONAL RISK	TARGET INVESTOR	TYPE OF PROJECTS
EQUITY	EQUITY	• Higher return • It implies ownership and decision making	• Return in the form of dividends (accounting restrictions) • Higher risks (last in event of default) • Longer payback period	• Any size	• High	• Investors with capital investment potential	• All types of projects
	INVESTOR LOAN / SUBORDINATED DEBT	• Considered as equity in balance sheet • Flexible repayment terms (usually via cash sweep) • Interest paid deducted in P&L • Complementary solution to other options	• Specific requirements from grantor • Less attractive projects or with greater risk involved	• Any size	• High	• Investors with little possibility to invest capital	• All types of projects
DEBT	BANK LOAN	• Interest paid deducted in P&L • Less risk than equity holders • Recourse to balance sheet and core activity (incl. Assets) • Flexibility for early termination	• More expensive • Lower cost measures instead of a more complex approaches with a longer payback period (e.g. project finance)	• Any size	• High & low	• Investors with capital investment potential	• All types of projects
	MULTILATERAL BANK LOAN	• Cheaper financing and more flexible terms	• Requires a project with investment grade (low technological or operational risk) • Full Due Diligence process • Not flexible • Takes longer to reach financial closing	• Large projects (> 20 MEUR Aprox.)	• High & low	• Investors with capital investment potential	• Projects in developing markets and regions (environmental, political or welfare point of view)
	PROJECT FINANCE	• Non recourse to balance sheet • Ring fenced risks in SPV • High up-front investments	• Exhaustive due diligence (banks require independent advisors) • High transaction costs • Long period of time to reach financial closing • Sensitivity analysis • More guarantees required (performance bonds, completion guarantees, completion, etc.) • Insurance • Close monitoring of the project in construction and operation period	• Large projects (> 20 MEUR Aprox.)	• Low or mitigated by risk allocation	• Investors with capital investment potential	• High investment projects (cogeneration)
	LEASING / VENDOR FINANCING	• Easy access for all types of investors • Tax advantages (operational leases payments are considered as operational expenses and therefore lower the final income tax while capital leases lower tax through depreciation	• More costs over the life of the asset (long term expense) • Stiff penalty for early termination • Maintenance costs	• Mostly small size projects (< 1 MEUR)	• Low	• Investors with little or no possibility to invest capital	• Smaller projects (ie. Lighting in households, hotels, schools, etc.)
	BONDS	• Allows greater leverage • Longer term	• Never on their own • More exhaustive due diligence • Structuring and emission costs	• > 100 MEUR	• Low or mitigated by risk allocation	• Investors with capital investment potential	• Smaller projects (ie. lighting in households, hotels, schools, etc.)
ESCO/ PERFORMANCE CONTRACTING		• One-stop shop (less involvement of owner) • Simplicity and flexibility • Affordability • ESCO assumes risk of under-performance	• Less flexible in terms of repayment period and more expensive than multilateral institutions	• Mostly small size projects (< 1 MEUR)	• Low	• Investors with little or no possibility to invest capital	• Smaller projects (ie. lighting in households, hotels, schools, etc.)
GRANT		• No repayment of the amount granted • No interest or low interest (soft loan)	• Specific requirements from grantor • Less attractive projects or with greater risk involved	• Any size	• High	• Investors with little or no possibility to invest capital	• New markets where savings have not been tested

Figure 10—Summary table

ANNEX: ACRONYMS

Acronym	Meaning
CAPEX	Capital Expenditure
CPI	Consumer Price Index
DPBT	Discounted Payback Time
DSCR	Debt Service Coverage Ratio
DSRA	Debt Service Reserve Account
EBRD	European Bank For Reconstruction And Development
EE	Energy Efficiency
EPC	Engineering, Procurement And Construction
ESCO	Energy Service Company
IDB	Inter-American Development Bank
IRR	Internal Rate Of Return
LCC	Life Cycle Cost
LED	Light Emitting Diodes
MIGA	Multilateral Investment Guarantee Agency
NPV	Net Present Value
O&M	Operation and Maintenance
OPEX	Operational Expense
PPA	Power Purchase Agreement
PV	Photovoltaic
TCO	Total Cost Of Ownership
WACC	Weighted Average Cost Of Capital