

A Simple and Reliable Tool to Optimize Sustainable Energy Programmes: the Profitability Index Method (PIM)

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The "Profitability Index" (PI) is simply the ratio between the net present value (NPV, the sum of the discounted cash flows of a project over its lifetime, including the initial investment period) and its initial investment cost I. It is already used in industry and business as an indicator of the profitability of a project, but a recent simple and innovative analysis has shown that its advanced use gives access to a comprehensive, reliable and simple way to analyse the profitability of all kinds of investment projects, and **moreover to the definition and then to the use of optimal markets regulation and economic incentives systems designed to favour investments which are in favour of sustainable development**. Such systems may include soft loans, subsidies on initial investment and/or on operating expenses, guaranteed tariffs (rates) of marketed products and services, sales on a derivative market of environmental advantages (e. g. "green certificates" or "carbon credits"), or a combination of such incentives.

For an energy service company (ESCO) active on global dynamic markets with various technologies and applications requiring different operating periods, the profitability index method (PIM) is an adequate tool which can give a competitive advantage to assess at a very preliminary stage the profitability of a simple project, to choose on a sound basis between various options of investments and last but not least to define an investments portfolio in a context of capital rationing which is very near to the theoretically possible optimum.

1) Summary of the content of the Profitability Index Method (PIM) and of its basic tools:

1.1) Linear Model "Profitability Index (PI) versus average selling price (tariff)" allowing:

- To describe a simple project economic profitability from its costs and performance ratios and to give access to the simple and powerful related "PI - Tariff" linear graph.
- To determine directly the value of the Overall Discounted Cost (ODC, the "manufacturing cost") of a product or a service delivered from the investment and to assess its structure (variable cost part, O&M cost part, investment cost part).
- To determine the relevant selling price (the tariff) and the related profit margin to apply on this cost (the margin on cost MOC) to get a targeted profitability of the project expressed in PI value.
- To clarify the linear link between the PI of a project and its margin on cost (MOC). In the case of power production, this link allows to demonstrate the "**Free fuel cost energy sources paradox**", which should be at the basis of the definition of a sound market regulation in order to favour renewable energy sources versus fossil based ones.
- To determine from a dynamic "Markets / Technologies Matrix" the minimal weighted mean value of the profitability indexes for the investments of a company active on global expanding markets and using advanced technologies, in order to ensure a stable and strong long term development of this company.
- To establish the links between the PI and the other profitability parameters (direct pay back time, discounted pay back time, internal rate of return (IRR), benefit-cost ratio), in order to assess their minimum or maximum required values from the above rational minimum values of profitability index.
- To easily integrate the valuable inputs from advanced profitability methods such as CAPM (capital asset pricing model) or ROV (real options valuation).

1.2) Standard method to describe a complex project with variable cash-flows as a simple equivalent constant cash-flow project, this simple project being described by the above linear model with its relevant advantages described in § 1.1.

1.3) Method and graphic tool to optimise an investment portfolio in a context of capital rationing which does not allow to finance all the potential possible projects.

1.4) Simple electronic spreadsheets (on Microsoft Excel) to apply the PIM either to general projects or to standard types of projects using specific technologies and applications.

Those electronic spreadsheets are based on explicit formulas, and so sensibility studies are very easy and straightforward.

2) **Types of applications for which the method has already been validated:**

- Power production from conventional or renewable energy based power plants.
- Heat production from conventional or renewable energy based systems.
- Combined heat and power production systems using conventional and/or renewable fuels.
- Energy saving, energy efficiency, demand side management and rational use of energy projects.
- Energy production from hybrid systems.
- Simple production process delivering products or services.
- Profitability resulting in investing in a "clean and efficient process" in place of investing in a conventional one ("mutually exclusive investments" or "differential profitability"), such as for example:
 - Case of a high quality and high efficiency building (such as a passive solar building) versus a conventional one.
 - Case of an advanced innovative industrial process in place of an existing one (profitability resulting from an R&D programme).
 - Case of a "clean and efficient" industrial process in place of a conventional one (profitability of an "industrial ecology" programme).

3) **Advantages for a market regulation by prices:**

3.1) Direct and reliable design of "advanced tariffs systems" in order to develop a large scale market deployment of the technologies favourable to a "sustainable development".

3.2) Used with success to design the French wind tariff system in 2000 (up to 10 b€ of related investments up to 2010).

4) **Advantages for a market regulation by subsidies:**

4.1) Direct calculation of the subsidy on initial investment required to get a targeted value of profitability, taking into account the too low profitability level before subsidy. Direct graphic sensibility analysis diagrams.

4.2) Rational assessment of the impact of subsidies on the level and on the speed of market deployment of products and services favourable to a "sustainable development".

4.3) Rational assessment of a mix of subsidies on initial investment, and/on O&M expenses and/on variable costs in the case where the final customer (typically a family in a rural area of a developing country) has not a sufficient financial capability to purchase a decentralised energy service such as rural electrification, potable water delivering, etc.

5) **Advantages for a market regulation by taxes:**

5.1) Direct assessment of the impact of an "energy tax" or a "carbon tax" on the profitability of a simple investment project. Direct graphic sensibility analysis diagrams.

5.2) Direct assessment of the profitability increase due to the energy or the carbon taxes, in favour of the projects using "clean and efficient technologies" in place of conventional ones (increase of the "differential profitability").

5.3) Direct assessment of the impact of potential energy or carbon taxes on the level of the selling price or the profit margin of products or services from a potential investment project taking into account the acceptable profitability level for the project developer.

6) **Advantages for a market regulation by quantities** (e. g. mandatory production regulation systems with targeted levels of production or quotas to be justified by companies active on the market by providing relevant amounts of "green certificates" or "carbon credits") :

5.1) Method to assess the potential additional equivalent constant annual revenue from an hypothetical profile of the value of the relevant "green certificates" or "carbon credits".

5.2) Direct assessment of the impact of this potential additional revenue on the profitability of a project. Direct graphic sensibility analysis diagrams.

- 5.3) Assessment of the impact of the hypothesis made on the "baseline" (reference case) on the quantities of carbon credits and direct assessment of the impact of those hypothesis on the profitability of the project. .
Direct graphic sensibility analysis diagrams.

7) Advantages for a market regulation by a mix of solutions :

- 7.1) Explicit formulas to assess the increase or the decrease of profitability of a project from a mix of regulatory economic measures (soft loans, incentives, taxes, guaranteed tariffs, environmental based derivative markets...).
- 7.2) Direct sensibility studies from explicit formulas and related graphs.
- 7.3) From the relevant PI values of the project, direct calculation of the corresponding values of the other conventional profitability parameters (IRR, pay-back times, benefit/cost ratio, margin on cost or margin on selling price of the related product or the service).

8) Conclusion

The profitability index method and its associated tools can clearly contribute to the economic analysis of sustainable energy projects by providing a sound, simple and reliable view:

- For market regulators, on what are the best measures or what is the best mix of measures for the regulation of energy and environmental markets in order to give clear advantages to the technologies and to the applications which are in favour of sustainable development, so that the relevant markets can reach specific targeted levels within a specific time frame.
- For projects developers, on what is the impact of a specific set of incentives or market regulation mechanisms (soft loans, subsidies, energy or carbon based taxes, green certificates or carbon credits to be sold on an environmental derivative market...) on the selling price of the product or the service delivered by a kind of energy project, and what are at the end the profitability and the prospects for market deployment of this kind of projects.
- For energy services companies, operating under various global specific market regulation conditions, on what are the corresponding economic profitability levels of sustainable energy projects versus the costs and performance ratios of related technologies and applications (renewable energy based projects, energy efficiency projects...), and what is the best potential investment portfolio in order to maximise the economic profitability of the company in a context of capital rationing.

Of course, the preliminary results from the Profitability Index method must be completed by a financial profitability analysis before the final decision to set up a new regulation measure or before to invest in a project, but the advantages of such a comprehensive, simple and reliable preliminary analysis are evident in order to save time and money and in order to reduce the related economic risks.
