Journal of Renewable Energy and Sustainable Development (RESD) Volume 5, Issue 2, December 2019 - ISSN 2356-8569
http://dx.doi.org/10.21622/RESD.2019.05.2.080

Natural Gas Pre-feasibility Study for Future LNG Importing Terminal Project in MOROCCO

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***Abstract* -** In recent years, energy debates are increasingly focused on the transition of more ecological energy sources, therefore, Morocco is projecting to invest in its first Liquified Natural Gas (LNG) importing and storage capacity by 2030. This article comes to establish a pre-feasibility study for the future importation terminal and the objective is to develop a scientific approach to investigate the financial viability of such a project. The main challenge poses on the data estimation methodology and the relevance of the assumptions. Besides, the level of uncertainty depends on the stability of the LNG international market.

The profitability of an investment is generally the most important criterion for the decision-making. Even if the combined ecological and industrial benefits of natural gas can sometimes provide enough motivation to invest, a long-term profitability study must be systematically pursued to evaluate the economic impact of such an investment decision.

After highlighting the multiple benefits of natural gas, the first step is setting up the financial model to be adopted, which is in this case the net present value (NPV) and the Discounted Payback. Therefore, operating and financial assumptions are made based on the benchmark with other similar projects. The pre-feasibility study will help to measure the LNG terminal capacity to generate revenue.

***Keywords* -** CAPEX, Cash Flow, Discounted Payback, GNL, Net Present Value, OPEX, Pre-Feasibility, Profitability..

I. INTRODUCTION

Global warming is a phenomenon known and recognized by scientists such as climate change and its adverse effects on the environment [1]. The history of energy between massive pollutions, nuclear disasters, energy resources scarcity and global environmental issues indicates the limitation of the current energy system and calls for a gradual shift towards a sustainable energy mix.

The global energetic context makes LNG an attractive alternative for electric and industrial generating units that currently run on other polluting, more expensive, and less suitable fuels. As a result, Morocco has set itself the goal of building an LNG import and storage terminal at Jorf Lasfar by 2030. In tune with developing a terminal site location and an optimum routing alternative for pipelines [2], this article comes as a follow up to conduct a pre-feasibility study for the future LNG importation terminal.

The reorientation of energy to LNG is a considerable step towards this objective. It is a source of clean energy that translates a strong commitment to:

- Replace the use of coal and harmful fuels in electricity production.
- Prepare a favorable economy that can be combined with renewable sources, particularly solar.
- Contribute to the development of energy efficiency.

Some countries, particularly Morocco, do not dispose of natural gas in their soil. In this case, their commitment is illustrated by an investment decision on LNG importing terminal. In the current economic environment, this decision is a decisive step that guides the national strategy.

II. CHOICE OF NATURAL GAS

The development of natural gas is driven not only by its availability as a resource, but also by its preference by consumers. Indeed, natural gas has several advantages and combines reliability, availability, cleanliness and safety as compared to nuclear energy.

A. *Ecological Benefits*

Compared to other fossil fuels, natural gas is considered by excellence the cleanest source of energy; its emissions of sulfur dioxide (SO2), carbon dioxide (CO2) and nitrous oxide are low compared to coal or oil [3]. In fact, a recent Greenpeace study, published in August 2019 and based on data from NASA [4], warns Morocco against the risks of air pollution due to the use of coal.

Fig .1 Nasa capture of SO2 hot spot, showcasing Morocco, 2019 [4]

The environmental qualities of natural gas largely justify the growth of its demand. With its high hydrogen content, its combustion is considered perfect and does not produce heavy unburnt.

B. *Industrial Benefits*

Natural gas continues to attract electric power plants and industrials because of its simple hydrocarbon composition (mainly methane) [5] whose use offers several advantages:

- Pure and perfect combustion: immediate and total flammability.
- Quality and precision of the flame: possibility of reaching very high combustion temperatures.
- Cleanliness: no emission of heavy polluting particles.
- Low maintenance: natural gas is not corrosive, it does not damage pipelines.
- Safety: restricted range of flammability.

C. *Economic Benefits*

The discovery and exploitation of natural gas is relatively newer than many other types of energy, hence its technology is naturally subject to several research development and technical progress. The entire chain of LNG, from exploration and drilling to end use, continues to gain efficiency and effectiveness.

The Moroccan global context makes LNG an attractive alternative for sectors currently running on other fossil fuels [6]. The LNG price competitiveness and the increasing number of stakeholders are only pulling its operating costs down, making it more and more attractive.

III. FINANCIAL AND PROFITABILITY CRITERIA

The investment decision is one of the strategic and irreversible decisions that engage resources in the long term. To evaluate the profitability of an investment and decide whether it should be retained, several methods can be used such as the Net Present Value (NPV) and the Payback method. These indicators rely on the estimated cash flows generated in a future environment.

The application of these financial techniques to evaluate the profitability of an investment is limited by the difficulty of modeling an economic reality of a distant and random market into a financial equation. Admittedly, the financial model of NPV is the most appropriate approach to decision making.

A. *Net Present Value*

In order to know if a given project is financially acceptable, the decision criterion considered is the NPV. Like any investment, the construction of an LNG terminal requires an investment period, an operating period, and a projected profitability that corresponds to the cash flows generated during the operating period. Thus, it is essential to estimate the following elements:

- Capital required for investment: The amount of funds necessary to conduct the project.
- The lifetime of the project: The operational period of the project or its useful life.
- The discount rate: The anticipated return of profit for a project which presents a similar risk, also called the cost of the invested capital.

- The annual cash flows: The remaining profit after revaluating the project's revenues and expenses.

The NPV is the difference between the investment and the annual project discounted cash flows. The discount rate corresponds to the required minimum rate of profit. A positive NPV indicates that the project is profitable, which means that the cash flows generated make it possible to reimburse the initial investments and generate added value

$$NPV = -I_0 + \sum_{i=1}^{n} \frac{CFi}{(1+t)^i} \qquad (1)$$

With:
- i: a year in the project lifetime.
- I0: initial investment.
- CFi: cash flow generated during the operating year i.
- n: project lifetime.
- t: discount rate.

The discount rate is the cost of capital given its composition and the risk of the investment, assuming a discount rate of 9% [7].

B. Discounted Payback

To deepen the analysis, the evolution of the project payback is calculated according to the annual cash flow performed.

The payback is the time needed to recover the amount of the investment. This criterion allows to focus on projects quickly amortized, it is defined as the time required to recover the initial investment through cash inflows. This duration corresponds to the value of n for NPV = 0.

IV. MODEL DESCRIPTION AND ASSUMPTIONS

The investment required to carry out an industrial project of such a large size occupies an important place in the strategic launch decision. The profitability of an investment is completely determined when these two elements are known or at least can be accurately estimated: The amount of the investment also called Capital Expenditures (CAPEX) and the Operating Expenses (OPEX).

A. CAPEX Inventory

Several factors can influence the cost of building a terminal, feedback has shown that one of the most important factors is the quality of site environment, which can require some additional investments to limit and contain potential risks [8]. On the other hand, LNG storage tanks are generally the most expensive element of a storage terminal. They are also very often the most critical element because of the large surface area they claim, their visual impact that is often deemed unacceptable by the surrounding residents, and their potential risks if poorly managed.

1. LNG Storage Tanks

An LNG storage tank is particular and different from a hydrocarbon storage tank and has several challenges due to the specifications of the stored product, such as:

- The storage tank is intended to contain both vapor and liquid phases of natural gas.
- The storage tank must be insulated to minimize heat ingress.

The overall storage capacity of the site must meet the projected LNG consumption needs assessed by the Ministry of Energy as follows [9]:

Table 1 FIRST YEAR ANNUAL VOLUME OF IMPORTED NATURAL GAS [9].

	Year 1 (volume in k m3)
Volume gas to Power	3 500 000
Volume gas to Industry	1 500 000
Total Volume	5 000 000

According to the High Commission for Planning and considering an average growth of electricity consumption of 6% and an economic growth of 3% [10], the 20-year site import forecasts are as follows:

Table 2 LNG IMPORTING VOLUMES PROJECTIONS.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Electricity growth %		5%	5%	5%	5%	5%	5%	5%	5%	5%
Volume gas to power (k m3)	3 500 000	3 675 000	3 858 750	4 051 688	4 254 272	4 466 985	4 690 335	4 924 851	5 171 094	5 429 649
Economic market growth %		3%	3%	3%	3%	3%	3%	3%	3%	3%
Volume gas to industry (k m3)	1 500 000	1 545 000	1 591 350	1 639 091	1 688 263	1 738 911	1 791 078	1 844 811	1 900 155	1 957 160
TOTAL Volume (k m3)	5 000 000	5 220 000	5 450 100	5 690 778	5 942 535	6 205 897	6 481 413	6 769 662	7 071 249	7 386 809

	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Electricity growth %	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Volume gas to power (k m3)	5 701 131	5 986 188	6 285 497	6 599 772	6 929 761	7 276 249	7 640 061	8 022 064	8 423 167	8 844 326
Economic market growth %	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Volume gas to industry (k m3)	2 015 875	2 076 351	2 138 641	2 202 801	2 268 885	2 336 951	2 407 060	2 479 271	2 553 650	2 630 259
TOTAL Volume (k m3)	7 717 006	8 062 539	8 424 138	8 802 573	9 198 645	9 613 200	10 047 121	10 501 336	10 976 817	11 474 585

Table 3 SUPPLY FREQUENCY PER YEAR.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Liquid GNL volume (km3)	8 333	8 700	9 084	9 485	9 904	10 343	10 802	11 283	11 785	12 311
Supply frenquency per year	23	24	25	26	28	29	30	31	33	34

	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Liquid GNL volume (km3)	12 862	13 438	14 040	14 671	15 331	16 022	16 745	17 502	18 295	19 124
Supply frenquency per year	36	37	39	41	43	45	47	49	51	53

The sizing of the storage must allow the reception of the projected volumes and shall also guarantee flexibility in the case of a significant increase of the volumes. Natural gas is imported in the liquid phase and occupies 1/600 of its volume [11]. Thus, storage must be correctly sized to meet current and future forecast needs.

Given the many advantages of having multiple storage tanks, the breakdown of the storage would be as follows:

Table 4 BREAKDOWN OF THE TOTAL STORAGE CAPACITY.

Tank Diameter (m)	80
Tank height (m)	12
One Tank Capacity (m3)	60 288
Global Capacity - 6 tanks (m3)	361 728

With useful capacity of the importation terminal estimated at 360 000 m³, the supply frequency starts first with 2 importations per month and reaches on the 20th year 4 importations per month. Thus, the possibility of extending the storage remains possible. This storage capacity allows a good flexibility in cargos importation, two or three storage tanks can be used as principal linking distribution sources with the regasification process and the natural gas pipelines.

Using an average density of LNG of 445 kg / m³ and assuming $274/ton as the average world costs [12] for storage tanks, the CAPEX is:

http://dx.doi.org/10.21622/RESD.2019.05.2.080

Table 5 STORAGE CAPEX ESTIMATION.

Capacity in m3	Density in kg / m³	Capacity in ton	Average cost $/t	CAPEX in $
360 000	445	808 989	274	221 662 921

2. LNG Storage Tanks

The cost of the pipeline, on the other hand, can weigh heavily in the project investment amount. Its

cost depends on several parameters of which are mainly the type, the diameter and the length of the pipeline, the cost of the steel, the nature of the environment and the ground quality of its crossing. Assuming that the location of the importation terminal is in Jorf Lasfar and given the optimum pipeline routing, distance is calculated in the article “Study of site location and pipeline routing for future natural gas importing terminal project in Morocco” [2]. The shortest distance from Jorf Lasfar linking all consumption points including the furthest power station is 490 km.

Given that the investment reference announced for 5660 km of the Nigeria - Morocco pipeline project is estimated at 20 to 50 billion dollars [13] and considering the same pipeline characteristics for 490 km portion of the proposed routing, the pipeline investment can be roughly estimated at 1,8 to 4,5 billion dollars.

In order to estimate pipeline cost more accurately, several methods exist. The first is to launch a consultation procedure through a business consultation file; this approach makes it possible to acquire prices closest to the reality of the local market. Nevertheless, this approach is time consuming and is only applied at advanced stages of the project. On the other hand, a scientific formula developed by experts in this field can lead to a reliable estimation of the costs. It is a method developed by Menon, E._Shashi [14]:

Eq (2) pipeline $material\ cost$ ($)

$$= 0{,}02463\times(D-T)\times L\times T\times(cpt)$$

With:
L: Length of the pipe, km
D: Outside diameter of the pipe, mm
T: Thickness of the pipe wall
Cpt: Pipe cost, $ / ton

Considering the American petroleum standard (API Spec 5L, ISO 3183), based on the united metallurgical company and the pipeline safety trust, the type of steel commonly used in natural gas pipeline construction, [15], the corresponding characteristic is:

L = 490 km
D = 40 ‘’
T = 9,5 mm - 236 Kg/ml
Cpt = 800 $ / ton

Applying the formula, the estimated Capex for pipeline is:

$Pipe\ material\ cost$ ($)

$$=0{,}02463\times(D-T)\times L\times T\times(cpt)$$
$$= 2\ 211\ 352\ 728\ \$$$

Many other aspects must be added to the pipeline investment such as:

Pipeline external coating and wrapping [14] are estimated at 5$ per foot, therefore:

Pipe coating and wrapping cost = 50 × 0,3048 × 490 000 = 7 467 600 $

Compressor Station Costs [14]: as the gas travels in the pipeline from high pressure areas to low pressure areas, it would be necessity to provide compressor stations which increase the internal pressure at regular intervals along the pipeline. Using an installed cost of 2 000$ per compressor station and given that there must a compressor station every 20 km, the:

Compressor Station Costs = 2000 × 25 = 50 000 $

SCADA and Telecommunication Systems [14], which correspond to the necessary automation and remote monitoring of the pipeline. SCADA system costs include facilities for monitoring, operating and remote control of the pipeline from a central control center. They are estimated as a percentage of the total project cost from 2% to 5%.

Environmental and Permitting [14]: due to stricter environmental and regulatory requirements, this category includes elements such as environmental impact reports, environmental studies of sensitive areas such as industrial sites and habitat areas. Authorization costs would include pipeline construction permits such as crossings of roads and railways. Costs related to the environment and authorizations can range between 10% and 15% of total project costs.

Other Project Costs [14] can cover unforeseen circumstances and design changes, including small diversions to bypass sensitive areas and modifications of facilities not originally planned at the beginning of the project. These costs can represent between 15% and 20% of the total cost of the project.

Table 6 PIPELINE COST ESTIMATION BREAKDOWN.

Pipe material	$2 211 352 728	
Coating and wrapping	$7 467 600	
	Min	Max
SCADA and Telecommunication (2% to 5% of total cost)	$60 789 598	$184 901 694
Environmental and Permitting (10% to 15% of total cost)	$303 947 990	$554 705 082
Other Project Costs (15% to 20% of total cost)	$455 921 985	$739 606 776
TOTAL Pipeline cost ($)	$3 039 479 902	$3 698 033 881

Thus, the global estimated pipeline cost is between 3 billion and 3,6 billion $.

It is important to record that the pipeline CAPEX is estimated to extend all CAPEX aspects but cannot be part of the profitability study itself. In fact, the scope of financial study is restricted in this article to the LNG importation terminal.

B. CAPEX Inventory

CAPEX estimation is a very important step as every site is specific in terms of capital cost. In general, considering the scope of the terminal alone, the storage tank represents the most important investment after the applicable maritime and process environment such as pump out and vaporizing process.

Based on the cost allocation for some similar LNG terminals conducted in a similar environment [16], the total CAPEX of the terminal is:

Table 7 CAPEX DISTRIBUTION OF THE IMPORTING TERMINAL.

	Cost Distribution	CAPEX in $
Jetty, topwork, trestle	10%	108 679 393
LNG storage	21%	221 662 921
Vaporizing, boil-off handling, pump out	39%	418 577 070
Utilities, offsites, fire and safety	19%	199 066 216
Allowance for land	3%	27 976 874
Owner's project management team	4%	43 041 344
Allowance for port and break water	5%	57 029 781
TOTAL CAPEX ($)	100%	1 076 033 599

Regasification itself represents 39% of the total cost of the project. The port equipment and LNG tanks are taking the large portion of the investments, with very large disparities related to site conditions.

Excluding the pipeline, the total CAPEX of the LNG importing terminal is estimated at 1 076 033,5 K$.

C. Operating Expenses

The specificity of the LNG market makes it difficult to estimate the operating expenses. The quantity imported depends on the national future consumption as the purchase prices and sales are very volatile. However, their trend is unpredictable and depends on several variables: currency rate, geopolitical stability, purchase contract or spot purchase, ocean freight, supplier countries, price indexation, etc.

The operation costs of an importation terminal are generally made up of the following items:

- Personnel cost and salaries: it is important to provide an organizational chart, with the estimated human resources and shifts. The wages are in general subject to variation depending on regions.
- Maintenance cost including corrective and preventive maintenance.
- Supply reception costs dedicated to LNG harbor and cargoes reception.
- Operating energy consumption.

Based on the OPEX data for some similar LNG terminals [16], the first year OPEX is estimated at 2,5% of the project CAPEX, the statistical distribution is then applied to recover the OPEX items:

Table 8 LNG TERMINAL OPEX DISTRIBUTION

	Cost Distribution	OPEX in $
Personnel salaries and/or wages	22%	6 033 833
Plant maintenance	26%	7 039 472
Marine Operations maintenance	37%	10 056 389
Energy Consumption	14%	3 771 146
TOTAL first year OPEX (2,5% of CAPEX)	100%	26 900 840

Once the CAPEX and OPEX are estimated, the profitability study can be perused.

V. PROFITABILITY OF THE LNG PROJECT

It is nearly impossible to speculate on the evolution of natural gas prices; therefore, a pricing reference is necessary to simulate the production and distribution margin. Considering the fluctuation in natural gas prices and according to the national LNG law project, Gas pricing will be regulated [9]. The prices hypothesis are based on the study on LNG prices of the Belgian market, published in 2018 [17], the Belgium market has many similarities with the Med Europe quotation market, therefore, the main hypothesis is as follows:

- Natural gas calorific power = 10,83 Kw/kg [18]
- Average import price = 14 €/MWh [17]
- Resale to power plants = 17 €/MWh [17]
- Resale price to industrial consumers = 18,9 €/MWh [17]
- Exchange rate 1 € = 1,1 $

A profitability analysis is carried out for the project considering all these factors during a 20 years lifetime. This life expectancy does not reflect the life of LNG terminal, but it is an economic life that can be used to evaluate the profitability of the project in the short/medium term. The longer the considered lifetime is, the more uncertain data are collected.

The financial calculation makes it possible to express the benefits of LNG terminal in monetary terms (profits) by comparing the revenues with the expenses while considering the monetary value of the time (by means of a discount rate).

Therefore:

The net present value (NPV) = $-I_0 + \sum_{i=1}^{n} \frac{CFi}{(1+t)^i}$

NPV = -176 563 k$ < 0

The project is financially not profitable.

Other financial indicators can be calculated to help us interpret profitability such as Profitability Index (PI) and Internal Rate of Return (IRR).

The profitability index is:

$$\frac{Future\ Cash\ Flows}{Initial\ Investment} = 1{,}29$$

The internal rate of return is the discount rate that makes the net present value (NPV) equal to zero.

$$\text{NPV} = -I_0 + \sum_{i=1}^{n} \frac{CFi}{(1+IRR)^i} = 0$$

Therefore, IRR= 7%

The discounted payback period is estimated at 12 year of operation, given a 9% discount rate.

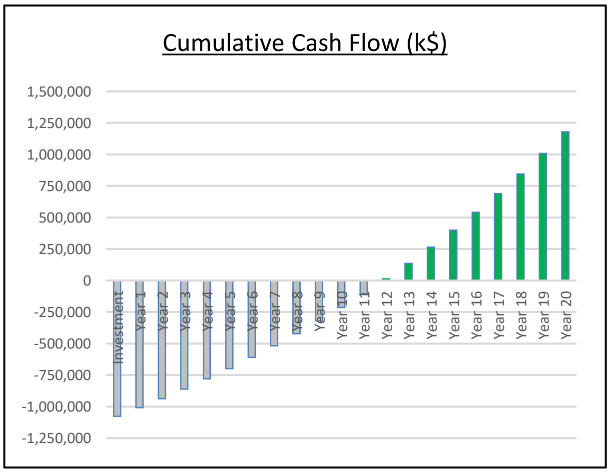

Fig .2 LNG terminal cash flow and discounted payback.

A 12-year payback means that the cash flows generated by LNG terminal is starting to recover the original investment from the 12th year of operation. It is important to point out that the cost of the distribution pipeline is not included, given the fact that the original pipeline is coming from Nigeria through many other countries, who can be participating in financing the pipeline. [2]

Table 9 LNG TERMINAL PROFITABILITY.

	Investment	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
TOTAL CAPEX (k$)	-1 076 034										
Gas to power volume (km3)		3 500 000	3 675 000	3 858 750	4 051 688	4 254 272	4 466 985	4 690 335	4 924 851	5 171 094	5 429 649
Gas to industry volume (Km3		1 500 000	1 545 000	1 591 350	1 639 091	1 688 263	1 738 911	1 791 078	1 844 811	1 900 155	1 957 160
TOTAL gas volume (Km3)		5 000 000	5 220 000	5 450 100	5 690 778	5 942 535	6 205 897	6 481 413	6 769 662	7 071 249	7 386 809
Operating and distribution margin (k$)											
Resale to power plants (k$)		315 426	331 198	347 758	365 146	383 403	402 573	422 702	443 837	466 029	489 330
Resale price to industrial consumers (k$)		151 087	155 619	160 288	165 096	170 049	175 151	180 405	185 817	191 392	197 134
TOTAL Operating income (k$)		466 513	486 817	508 045	530 242	553 452	577 724	603 107	629 654	657 421	686 464
Operating charges (k$)											
Average import price (k$)		-371 090	-387 418	-404 495	-422 358	-441 043	-460 589	-481 037	-502 431	-524 814	-548 234
OPEX k$ (2% inflation)		-26 901	-27 439	-27 988	-28 547	-29 118	-29 701	-30 295	-30 901	-31 519	-32 149
TOTAL Terminal charges (k$)		-397 991	-414 857	-432 483	-450 905	-470 161	-490 290	-511 332	-533 331	-556 333	-580 383
Net Cash Flow (k$)	-1 076 034	68 522	71 960	75 562	79 336	83 291	87 434	91 775	96 323	101 088	106 081
Cumulative Cash Flow (k$)	-1 076 034	-1 007 511	-935 551	-859 989	-780 652	-697 361	-609 927	-518 153	-421 830	-320 742	-214 661

	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
TOTAL CAPEX (k$)										
Gas to power volume (km3)	5 701 131	5 986 188	6 285 497	6 599 772	6 929 761	7 276 249	7 640 061	8 022 064	8 423 167	8 844 326
Gas to industry volume (Km3	2 015 875	2 076 351	2 138 641	2 202 801	2 268 885	2 336 951	2 407 060	2 479 271	2 553 650	2 630 259
TOTAL gas volume (Km3)	7 717 006	8 062 539	8 424 138	8 802 573	9 198 645	9 613 200	10 047 121	10 501 336	10 976 817	11 474 585
Operating and distribution margin (k$)										
Resale to power plants (k$)	513 796	539 486	566 461	594 784	624 523	655 749	688 536	722 963	759 111	797 067
Resale price to industrial consumers (k$)	203 048	209 139	215 413	221 876	228 532	235 388	242 450	249 723	257 215	264 931
TOTAL Operating income (k$)	716 844	748 626	781 874	816 659	853 055	891 137	930 986	972 686	1 016 326	1 061 998
Operating charges (k$)										
Average import price (k$)	-572 741	-598 385	-625 223	-653 309	-682 705	-713 472	-745 677	-779 388	-814 677	-851 621
OPEX k$ (2% inflation)	-32 792	-33 448	-34 117	-34 799	-35 495	-36 205	-36 929	-37 668	-38 421	-39 189
TOTAL Terminal charges (k$)	-605 533	-631 833	-659 339	-688 108	-718 200	-749 677	-782 606	-817 056	-853 098	-890 810
Net Cash Flow (k$)	111 312	116 792	122 535	128 551	134 855	141 460	148 380	155 631	163 228	171 188
Cumulative Cash Flow (k$)	-103 350	13 443	135 977	264 528	399 383	540 843	689 223	844 853	1 008 081	1 179 270

VI. CONCLUSIONS

An investment in a national LNG importing terminal is an important decision requiring a huge investment. After assimilating at first the other non-financial benefits of natural gas, a financial model description and LNG market hypothesis were considered and exposed in order to provide a reliable pre-feasibility study regarding the available data now for the Moroccan market.

At this stage of the project, accuracy of these estimates is believed to be +/-40%. The conducted financial study shows that the project is not profitable within 20 years lifetime, but has estimated payback of 12 years of operation, excluding the pipeline investment. The NPV is negative and the IRR (7%) is inferior to the discount rate (9%), which reflects that, mathematically, this project will not be profitable enough even after 20 years of operating.

These results justify the fact that the profitability of this kind of investment requires government encouragement through subsidies and tax reduction. The environmental qualities of natural gas largely justify the conduction of this project. With its high hydrogen content, gas combustion is considered perfect and does not produce heavy unburnt harmful particles for environment or health. Given the tax incentives and government conventions planned in Morocco to encourage the use of natural gas, the profitability of this investment is guaranteed on a long term.

The profitability is generally the most important criterion for the decision-maker, who can also base his judgment on other non-quantitative criteria of an economic or strategic nature, however, investment in ecological energy is a strategic decision that cannot be reduced to a calculation of mathematical expectations. Certainly, financial analysis is of paramount importance in the decision-making process, but some non-financial and non-quantifiable criteria must be taken into account.

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