

Project finance to develop solar projects: a case study of Hassi R'mel solar-gas power plant

تعزير مشاريع الطاقة الشمسية من خلال طريقة تمويل المشاريع: دراسة حالة محطة الطاقة

الشمسية-الغازية بحاسي الرمل

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Abstract:

This paper highlights the role of the 'Project Finance' paradigm in fostering renewable projects. This funding method focuses on the project's long-term profitability because funders will get their repayments from the project's cash flows. We illustrate how this method effectively mitigates the high risks and substantial funding requirements for solar projects. Our analysis of the Hassi R'mel solar gas station, a pioneering renewable solar project built under the project finance model, shows its efficacy. The plant, operational since 2011, continues to generate significant cash flows from electricity sales until 2036 and meet all its financial commitments. We believe this success should catalyse more renewable projects in Algeria.

Keywords: Project Finance (PF); solar plants; cash flows; Power Purchase Agreement; off-taker.

JELClassification Codes : G3, Q4, Q42

ملخص:

تسلط هذه الورقة الضوء على دور النموذج المسمى "تمويل المشروع" في تطوير مشاريع الطاقة الشمسية، نعتقد أن تمويل المشاريع، بتركيزه على مداخل المشروع على المدى الطويل و ربحيته ، يناسب كثيرا محطات الطاقة الشمسية إذ يمكن من تخفيف المخاطر وتحصيل التمويلات الضخمة التي تتطلبها ؛ كما تعرض هذه الورقة نموذجا ناجحا هو محطة حاسي رمل لتوليد الكهرباء بالطاقة الشمسية والغاز وهي أول مشروع للطاقات المتجددة استفاد من هذا النمط التمويلي في الجزائر ، بينت دراستنا ان

هذه المحطة تحقق تدفقات نقدية كبيرة وتفي بكل التزاماتها المالية، نرى كذلك بأن هذا النشاط من شأنه أن يحفز مشاريع أخرى للطاقة المتجددة

كلمات مفتاحية: تمويل المشروع؛ محطات الطاقة الشمسية؛ التدفقات النقدية؛ عقد شراء الطاقة؛ المشتري؛

تصنيفات JEL: G3, Q4, Q42

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1. INTRODUCTION

With climate change becoming a significant concern, countries are taking a stand and enhancing laws requiring the transition to renewable energy sources. However, renewable projects, including solar power, are known to be costly, especially during their construction, and to become profitable after years of running; hence, contracting loans and raising the necessary equity to build such projects is a quintessential issue, if not the paramount one. This study delves into project finance features and shows how such a technique could efficiently address this problem, specifically focusing on its implementation in Algeria's Hassi R'mel solar-gas power plant. By shedding light on the financial framework and performance of the project, our goal is to clarify the capacity of project finance to support the advancement of solar projects and mitigate their risks.

2. Project finance: A crucial pillar for heavy-investment projects

Intricate projects such as water desalination stations, solar power plants, or refineries are notorious for their high construction costs and lack of revenues until fully operational. One main obstacle these projects face is obtaining significant construction funding and finding an adequate way to reimburse funders. This is where the Project Finance method comes in, which will be thoroughly explained in the following paragraphs.

2.1 Project Finance: Definition, Genesis, and Evolution

- Definitions:

- Basic definition

Under the project finance method, rather than funding the company, seeking a loan for its project, and requesting guarantees, the funders—creditors and investors—will fund the project if it can demonstrate its long-term profitability with the debt repayment and interest rate, or ROE, coming from project revenues during its operation life. To project finance the construction of an infrastructure, the funding formula is generally around 70% - 80% of the capital secured from loans and 20% to 30% from equity.

-The Basel Committee's definition

Basel II rules, which centre on credit risks for lenders, define Project Finance -from the creditors' perspective in rules N 30.9 and 30.10- as a funding method where:

- The operational project's sales revenues source the credit reimbursement.
- The sales revenues generally come from long-term sales contracts.
- The infrastructure built is collateral.
- The borrower is a special company formed solely to develop the project.
- The special-purpose company and the lenders agree on a contract interest rate to be paid from the long-term revenues. (Bank for International Settlements, 2022, p. 2)

- Genesis and Evolution of Project Finance

Project Finance had its roots nine centuries ago. The British king then secured funding for some mines through a bank loan, which was repaid from the mines-produced ore. (Kesinger J. W and Martin J. D, 1988, p. 70) and (Esty B. C. and CHRISTOV I. L., 2004, p. 470).

Since then, Project Finance has been recognised and used, but its rise was especially noticeable during the 1970s and 1980s when it became the privileged funding method for large infrastructure projects. At the macro

level, less developed nations leveraged their banks to fund complex investments through the project finance paradigm, often with the backing of international financing organisations.

2.2. Features of Project Finance

Project finance is best understood when compared to corporate finance, a traditional alternative funding method for large projects.

- In corporate finance, the borrower is the company that owns the project, an actual entity with its specific activities. However, in project finance, the borrower is a special-purpose company created solely for the project.
- In corporate finance, the borrowing company repays the debt using its revenues. However, the debt repayment in Project Finance is sourced from the project's revenues.
- In corporate finance, lenders give the borrower credit based on solvability. In contrast, in project finance, lenders' main criterion for deciding whether to give credit is the project's projected long-term revenues.
- In corporate finance, collaterals (such as real estate properties and cash assets...) are requested, whereas Project Finance uses the project as the only collateral. (Gatti, 2023, p. 4)

3. Solar plants' bankability and Project Finance

The following paragraphs highlight the core project finance features that make it the most suitable funding method for these specific projects. Lastly, it will address the legal and contractual structures commonly used in project finance.

3.1 Enhancing solar projects' bankability with Project Finance

The term 'bankability' refers to the likelihood of a large project getting the necessary funding from banks, investors, or other financial institutions. Solar projects' bankability poses a significant challenge because of the

substantial funding and new technologies they use. Project Finance, however, builds on convincing potential lenders and shareholders that the project's future cash flows will be sufficient to pay dividends and service debt after covering all the project costs. A pivotal document in this process is the Solar Power Purchase Agreement (SPPA), signed between the project company and a reliable client referred to as the off-taker who commits to buy the electricity produced over the useful life of the project on a take-or-pay basis, meaning that the off-taker must make payments even if they decide not to buy the electricity. (Corporation, 2015, p. 75)

3.2 Structural Framework of Project Finance

The primary stakeholders involved in solar projects financed under Project Finance are:

The developer or Initiator is the company responsible for originating the project concept, developing it, and obtaining funding from investors and lenders. To receive financing, the developer must furnish the lenders with thorough project documentation, including the power purchase agreement and technical documents. This will allow potential lenders to evaluate the investment risks. (Corporation, 2015, p. 159)

The funders, consisting of lenders and shareholders, contribute financial resources for the construction phase. Lenders, typically banks or financial institutions, offer money to borrowers in return for interest payments.

Investors, also known as shareholders, contribute funds in exchange for dividends defined by the return on equity (ROE) and their ownership percentage of the capital.

The project owner, a special-purpose business, is a legally established temporary corporation formed by a joint venture of investors. Its sole goal is to manage the project and oversee the cash flow receipts, debt, and dividend payments.

The buyer of the electricity generated, known as the off-taker, initiates the project. It is typically a power company that shows interest in purchasing the electricity produced by the solar plant and agrees to put solar panels on its property. Afterwards, the off-taker and the Project firm enter into a long-term purchase agreement to buy the electricity generated at a

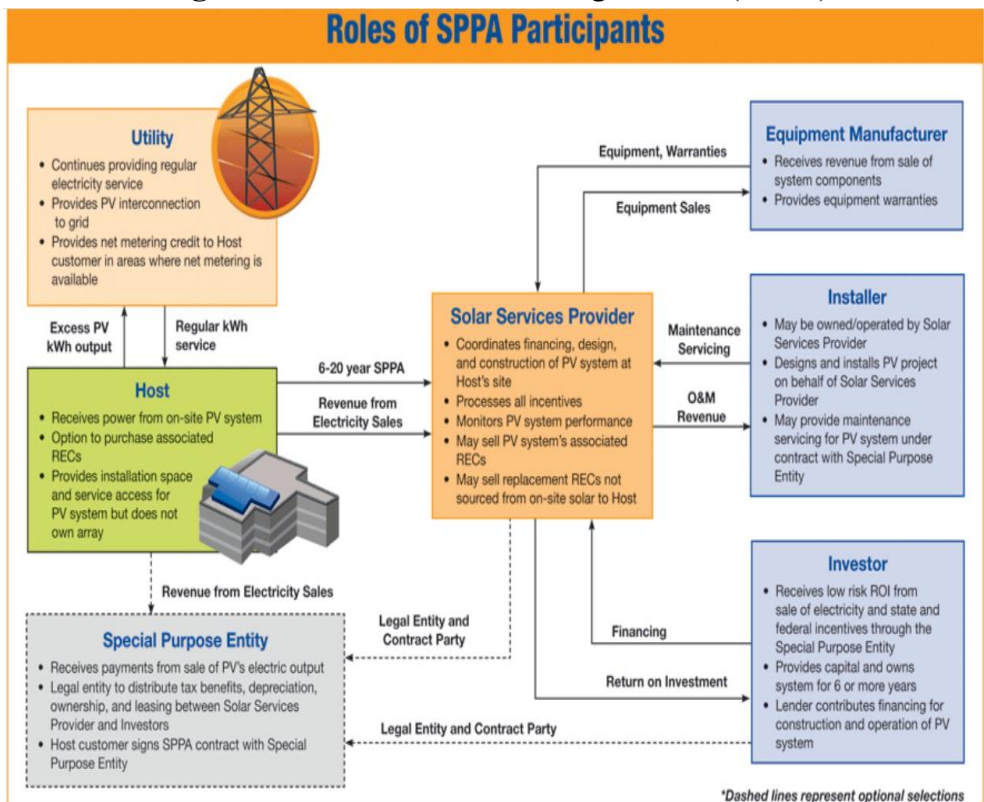
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price equal to or lower than the usual retail rate the consumer pays to their utility supplier. Furthermore, in the project finance model, the financial well-being of the off-takers plays a crucial role in determining whether lenders and investors choose to finance the project. This is because the repayment of the funds relies on the off-taker's energy purchases. (What Is a Solar Power Purchase, 2024) and (M., 2023).

3.3. the Solar Power Purchase Agreement and other contracts

Fig. 1 shows the Solar Power Purchase Agreement (SPPA) and the other related agreements:

Fig 1: Solar Power Purchase Agreement (SPPA)



Source: United States Environmental Protection Agency, 2024

- **The Solar Power Purchase Agreement (SPPA)**

The backbone of the Project Finance method is the Solar Power Purchase Agreement, in which the customer, the power company, commits to purchasing all generated electricity at a predetermined price during the solar power plant's running life, typically spanning 20–30 years. The prior sections explain that under Project Finance, the cash flows generated by electricity sales make all payments due to equity and loan providers. The project company must sign an SPPA with a reliable company to assure those funding providers that the sales revenues will cover all operational costs, repay them, pay interest to lenders, and pay dividends to shareholders. (Grooby C. , Pierce J. , Faber M. , Broome G., 2010, p. 2). It is worth mentioning that financial modelling is critical; the model has to prove that the cash flows suffice to pay off the debt, interest, and dividends after covering expenditures over the project's operating life.

- **The other related contracts**

They are the Engineering Procurement and Construction Contract (EPC), the Operation and Maintenance Contract (O&M), the supply contract, the loan agreement, the shareholder agreement, the concession agreement, and the interconnection agreement. The section dealing with the Hassi R'mel solar power plant's contractual package will focus on these agreements.

4 Case study: analysing Hassi R'mel solar-gas plant constructed under Project Finance

Around 2000, Algeria introduced the Project Finance method. Its primary and common application was desalination projects, with 11 projects funded through this method from 2002 to 2009. In 2011, the renewable energy sector introduced project finance to construct the Hassi R'mel hybrid solar-gas power station. To shed light on project finance for solar plants, this part will focus on the first solar-gas station built in Algeria; we will show how its

funding was secured from loans and investors' equity as the project developer came to find the best financial model to repay debt and dividends from electricity-produced sales revenues annually.

4.1 Overview of the Hassi R'mel solar-gas power plant

The Hassi R'mel hybrid solar-gas power plant, which produces up to 140 MW of clean electricity for the 2011-2036 timeframe, effectively launched the 2011 Algerian renewable energy plan. It is Algeria's first solar energy project, the first power plant with this technology in the Mediterranean, and the second worldwide. The plant is located north of Hassi R'mel (Cofides, 2011).

This project was carried out by the project company Solar Power Plant 1 (SPP1), a joint venture established under Algerian law in 2006 between Sonatrach subsidiary New Energy Algeria (Neal) and the Spanish Abener Energia. These two shareholders provided 20% of the financing, and the 80% remaining was secured via a loan granted by a group of state-owned banks made up of Banque Extérieure d'Algérie (BEA), Crédit Populaire d'Algérie (CPA), and Banque Nationale d'Algérie (BNA).

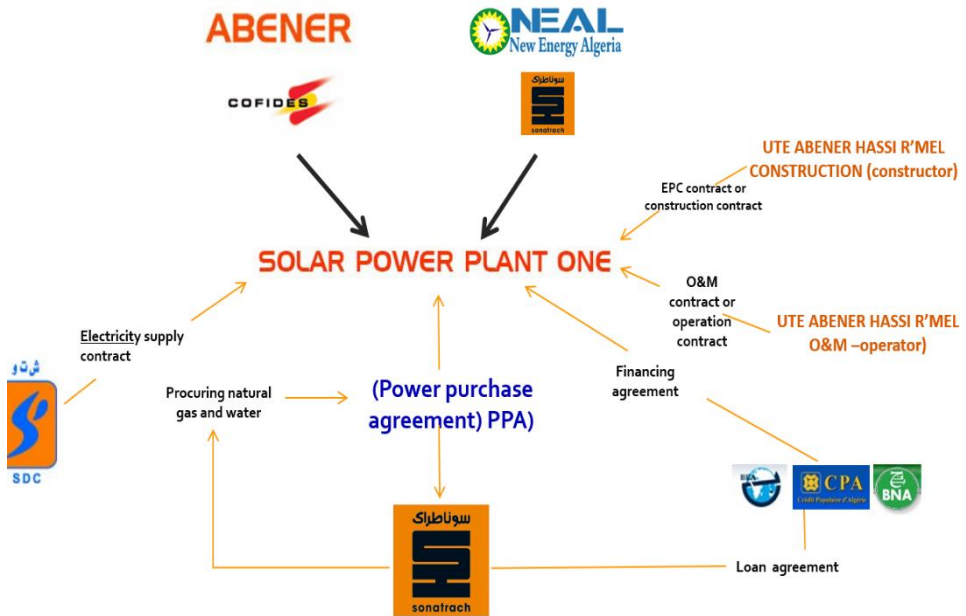
Core Project completion phases. project development lifecycle

June 2005: Launch of the call for investors,
January 17, 2006: Opening of bids, Technical phase,
June 2, 2006: Opening of bids, Commercial phase,
July 26, 2006: Signing of the NEAL - ABENER shareholders' agreement
July 30, 2006: Creation of the project company, Solar Power Plant One (SPP1) between Neal and Abener,
December 16, 2006, and February 13, 2007: Signing of the contractual package,
October 2007: The 252-million-euro bank loan file closed,
November 12, 2007: Release of the first disbursement (T0 of the construction contract);
May 14, 2011: Provisional acceptance,
May 15, 2011: commissioning of the power plant,
From 2011 to 2036, the project company SPP1 runs the power plant, produces electricity and pays off the debt, dividends to investors, operational expenditures, and taxes from the electricity sales.

4.2 contractual package of the solar gas power plant Hassi R'mel

Figure 2 illustrates the financial structure of the hybrid power plant of Hassi R'mel.

Fig 2: Contractual package of Hassi R'mel plant



Source: Documents of Neal company

The Hassi R'mel solar-gas power plant was constructed using the Build-Own-Operate model, whereby the Algerian government commissioned New Energy Algeria Company (Neal) to develop the infrastructure. The project has been funded through the project finance paradigm. The project developer, Neal, raised funds through equity and lenders. Furthermore, it selected the Spanish company Abener Energía as a shareholder, constructor, and operator. Neal developed a financial model to guarantee that the revenue from selling electricity over 25 years would adequately cover operational expenses

(OPEX) and loan payments and yield a return on equity. Neal was required to approximate the expected cash inflows and outflows for the next 25 years. Neal also had to determine the adequate return on equity (ROE) and interest rates that lenders and shareholders would find acceptable. Neal entered a Solar Power Purchase Agreement (SPPA) with Sonatrach -the long-term customer-. Sonatrach is Algeria's largest firm, which has enhanced the funders' confidence.

The key other participants are:

Solar Power Plant One (SPP1) is the project company created in 2005 from a joint venture between the Spanish company Abener and the Algerian company Neal. It holds the Hassi R'mel hybrid station, receives cash flows, and makes all the due payments. SPP1's sole purpose is to carry out the project. However, it will cease to exist when the facility shuts down in 2036. -Abener and Neal are the shareholders. As the shareholders' agreement outlines, Abener has a controlling stake of 66% in SPP1 capital, and Neal owns 34%.

- Sonelgaz is the service provider, signed an agreement to supply electricity to SPP1.

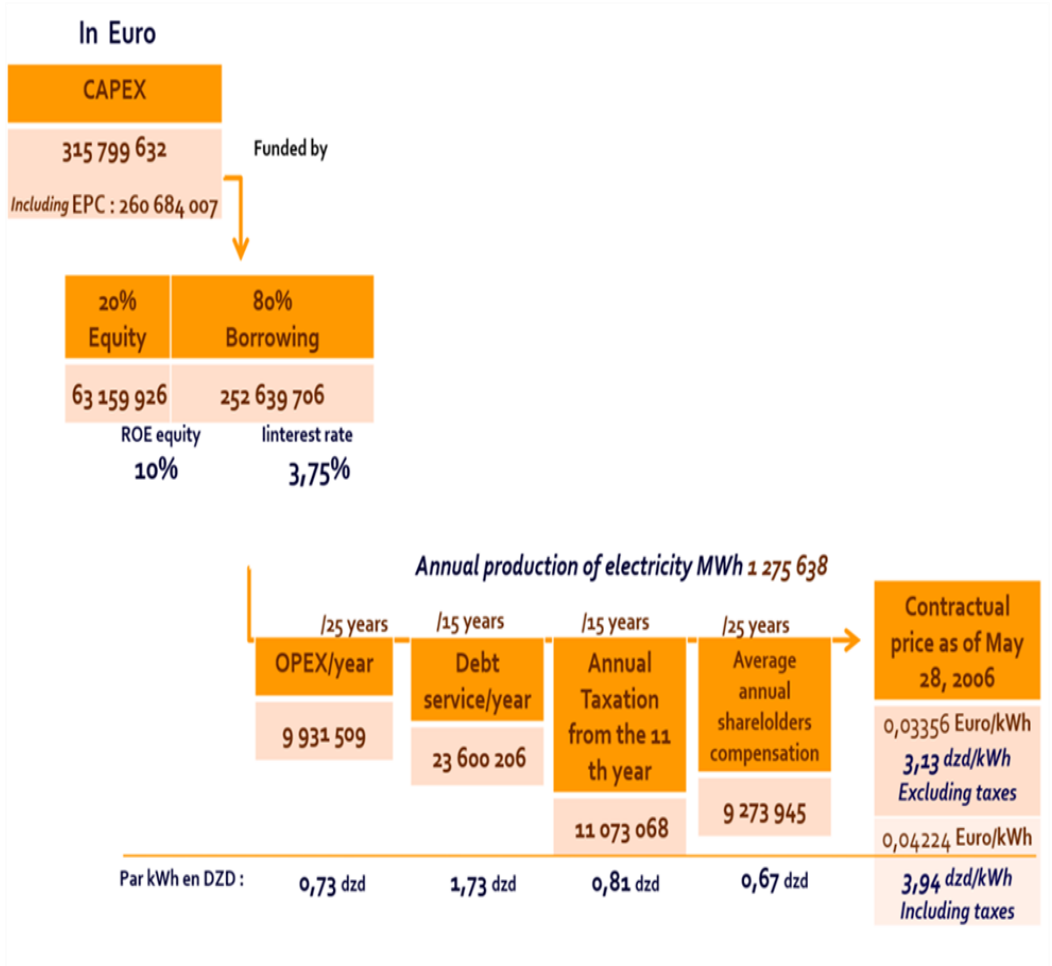
Abener is the constructor responsible for the power plant's construction under the Engineering, Procurement, and Construction Agreement (EPC).

Abener is also the operator responsible for the operation and maintenance of the power plant under the Operations and Maintenance contract (O&M).

4.3 Financial package, cash flows, dividends, and reimbursements

Figure 3 below illustrates the project's financial structure using the project finance method and the BOO model:

Fig 3: The financial package of the solar gas power plant Hassi R'mel



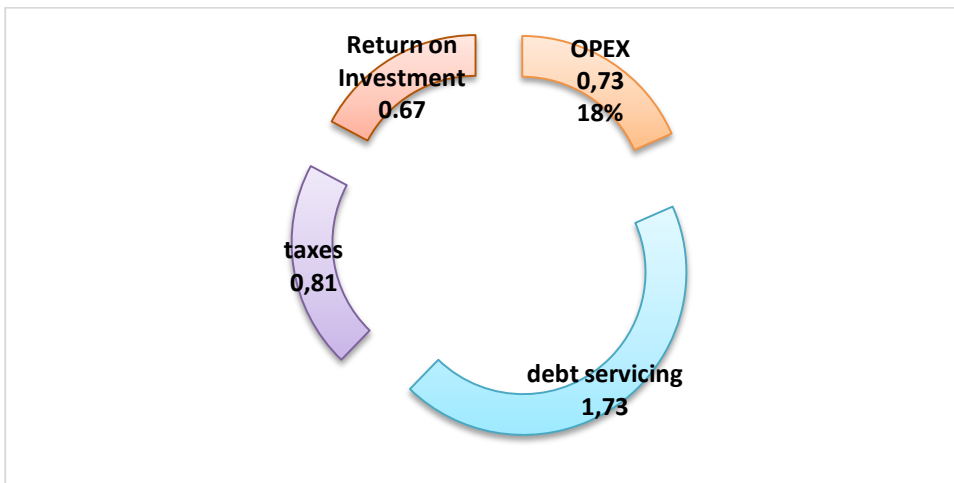
Source: Neal documents

Fig. 3 demonstrates that the shareholders (Abener and Neal) procured 80% of the total 315799632 euros of capital expenditure required for the power plant construction, and the remaining 20% was obtained from loans. In addition, the ongoing operating costs (Opex) during the plant's useful life were 9931509 euros per year, funded from the electricity-produced sales revenues.

The unitary electricity price (or base tariff) in the Power Purchase

Agreement (PPA) consists of fixed and variable components. The fixed part covers the fixed operating costs, debt service payments, taxes, and return on equity. Regarding the PPA's 'take or pay' nature, Sonatrach, the customer, must continue paying for the fixed component, even if it requires no electrical power. However, the variable part covers the variable operating costs and is only payable when Sonatrach buys electricity. SPP1 must invoice and pay for the electricity produced in Algerian dinars. Therefore, it must convert foreign currency's fixed and variable components into Algerian currency using the prevailing exchange rate on the monthly invoice date.

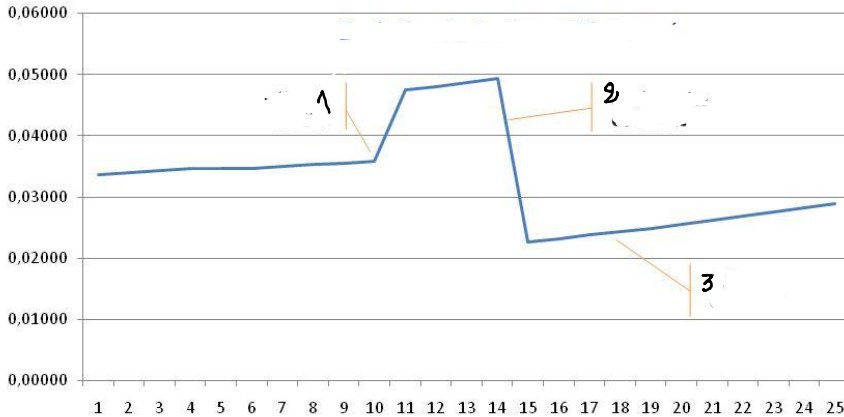
Fig. 4: How is determined the contract tariff



Source: Documents of Neal Company

The contract tariff is determined at a level that includes debt servicing, ROE and tax payment, and Opex covering. It must be revised to consider changes; the revised tariff is called the indexed tariff.

Fig. 5: The evolution of the contract tariff compared to the indexed tariff



Source: Documents of Neal Company

In Fig. 5, which shows the evolution of the indexed tariff compared to the contract tariff, the three following phases mark a significant change.

Phase 1: Tax payment start date

The solar project benefited from tax exoneration until the 10th year of operation; starting from that date, the index price for electricity will include the tax amount of 0.81 DZD, which means the indexed tariff will increase compared to the base tariff.

Phase 2: End date of debt servicing

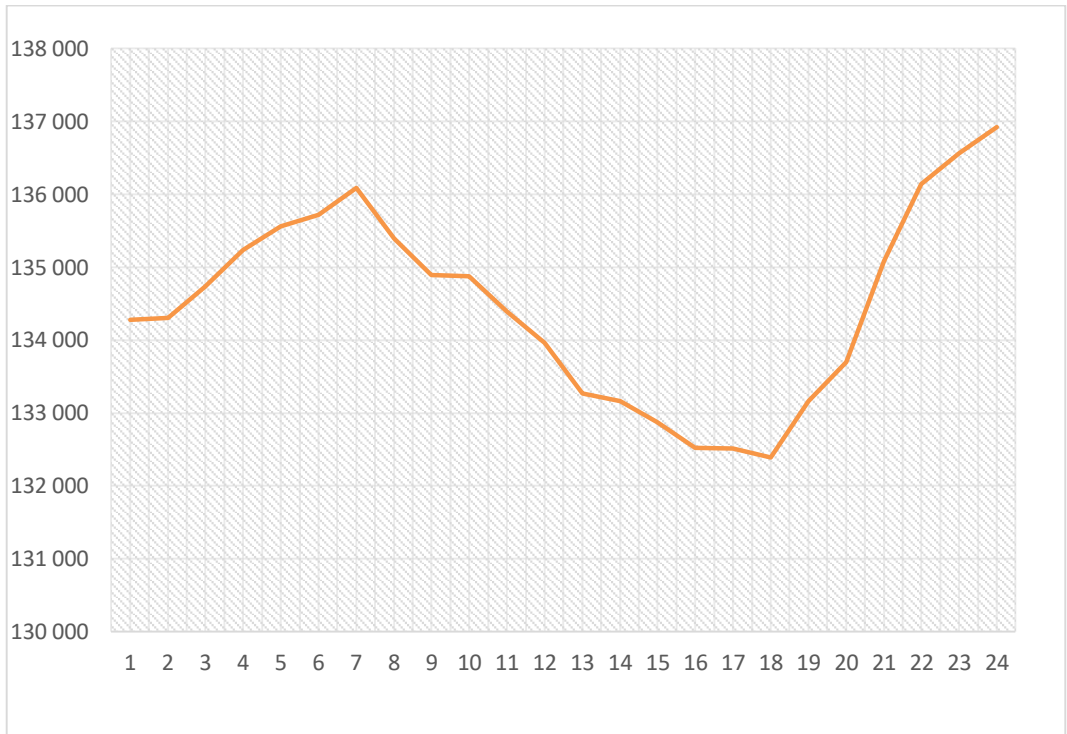
According to the signed loan agreement between SPP1 and the banks, the loan is payable in 15 years. Therefore, at the end of year 15 of the solar power plant's operation, i.e., 2026, the indexed price for electricity will not include a debt servicing component, resulting in an increase in price compared to the base tariff.

Phase 3: The inflationary effect

Considering the impact of inflation, we expect the index to rise starting in the 20th year.

- **The Hassi R'mel power plant production**

Fig. 6: The Hassi R'mel production during the 2011-2036 period



Source: Neal Documents

The Algerian hybrid power plant is expected to reach up to 136,000 kWh of electricity; for instance, its revenues for 2023 were \$7 billion in sales.

5 Conclusion

This paper aimed to elucidate the fundamental importance of the Project Finance paradigm in promoting solar energy infrastructure. Project finance addresses such projects' inherent risks and high capital requirements by establishing specific contractual and financial arrangements that enhance the project's bankability and profitability. Our research reveals that Algeria primarily uses this technique for water desalination stations, with only one solar project, the Hassi R'mel solar-gas power plant. A joint venture between Algerian shareholder Neal and Spanish shareholder Abener, which provided 80% of the required funding and the remaining 20% through a loan from a group of Algerian banks, funded this project; we thoroughly analysed the construction and cash flows of this project showing how well it works. We anticipate its success will lead to more renewable transitions, resulting in a better, more sustainable future.

6 . Bibliography

- Bank for International Settlements. (2022). *Basel committee on Banking Supervision: CER calculation of RWA for credit risk*.
- Corporation, I. F. (2015). *Les centrales photovoltaïques commerciales*.
- Esty B. C. and CHRISTOV I. L. (2004, April). An overview of project finance, 2001 update. *Harvard Business School*(9), 202-105.
- Gatti, S. (2023). *Project finance in theory and practice*. USA: Academic Press.
- Grooby C., Pierce J., Faber M., Broome G. (2010). *Project finance primer for renewable energy and clean tech projects*. WSGR.
- Kesinger J. W and Martin J. D. (1988). Project finance: raising money the old-fashioned way. *Journal of Applied Corporate Finance*, 69-81.
- (2015). *Les centrales photovoltaïques commerciales*. International Finance Corporation. International Finance Corporation.
- M., B. (2023, January 11). *Key Players In Project Finance*. Récupéré sur <https://medium.com/@matthew.bernath/key-players-in-project-finance-e86ad295dfba>
- S, G. (2023). *Project finance in theory and practice*. USA: Academic Press.
- What Is a Solar Power Purchase*. (2024, January 3). Retrieved from United States Environmental Protection Agency: <https://www.epa.gov/green-power-markets/solar-power-purchase-agreements>