

**Financial analysis of energy transition: The Shift from Coal-fired boilers to Heat Pumps in Vietnam**

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**Executive Summary** (100-200 words):

In pursuit of Net Zero Target in 2050, the Government of Vietnam (GoV) and international organizations are exploring support programs for energy transition not only in energy sector but across all economic sector. One of today’s concerns is the switching from coal boilers to heat pumps in industries, which can reduce carbon emission and decrease cost in the long run. This paper analyzes some options for the support programs to promote the adoption of heat pumps over coal-fired boilers, and offers policy recommendations for the GoV.

Finplan is adopted to construct a model for the comparative study. The result shows that heat pumps offer substantial long-term savings and environmental benefits, their high initial costs present a significant barrier for many companies. Without financial support, transitioning to heat pumps is not economically viable. The analysis highlights that financial support mechanisms, such as investment grants and green credit loans, are crucial for making heat pumps a feasible option. Under a baseline scenario with a 0.05% investment grant and a green credit loan covering 60% of the initial investment at an 8% interest rate, the adoption of heat pumps becomes attractive to companies. The project remains more favorable than coal-fired boilers unless financial costs significantly rise, such as the discount rate increasing to 8% and loan interest rates to 10%.

Furthermore, the study identifies a minimum support requirement: a green credit loan with a 5-year term at an interest rate of 10.2% per year, covering 60% of the initial investment. This support level is essential to ensure the financial feasibility of adopting heat pump technology in Vietnam's industrial sector.

**1. Introduction**

In pursuit of Net Zero Target in 2050, the Government of Vietnam (GoV) and international organizations are exploring support programs for energy transition not only in energy sector but across all economic sectors ([Government of Vietnam, 2021](#_ENREF_2)). This study aims to assess the financial viability of transitioning from coal-fired boilers to heat pumps in textile and Food & Beverage (F&B) in Vietnam. The scope includes an analysis of the costs, benefits, and required financial incentives to encourage this transition.

This study aims at determining the financial support needed for industries to prefer heat pumps over coal-fired boilers. This includes analysing the impact of various financial support scenarios on the Net Present Value (NPV), Internal Rate of Return (IRR) and other financial indicators of heat pump projects compared to coal-fired boilers. The specific research questions are as follows.

1. Is a baseline support (which is being discussed by GoV), including a grant of 0.05% and a loan from green credit sources at a preferential interest rate (of 8% per year) that covers 60% of the initial investment for a heat pump, attractive enough compared to a coal-fired boiler?
2. What is the minimum support needed for companies to prefer heat pumps over coal-fired boilers?
3. How might changes in interest rates and discount rates affect the feasibility of choosing heat pumps over coal-fired boillers?

**2. Methodology**

The analysis uses FINPLAN to compare the costs and benefits of heat pumps versus coal-fired boilers over a 20-year period. The model calculates the NPV, IRR and other financial indicators for different scenarios, considering variables such as investment costs, operating costs, maintenance costs and coal prices.

Data was sourced from industry reports, government publications, and case studies on energy transition projects in Vietnam. Key inputs include investment costs, operating costs, fuel costs, inflation rates, discount rates, and loan terms as follows:

* Plant production (heat) is 5 Million GJ/year
* The project life is assumed to be 20 years[[1]](#footnote-1), with the construction period from 2025-2026.
* Investment is 48.5371 Million USD; O&M costs is 30,360 Mil VND/year; and fuel cost (electricity) is 286,624.5 Mil VND/year
* The discount rate is set at 6.5%, reflecting the typical rate used in Vietnam for financial analysis ([PwC, 2023](#_ENREF_4)).
* Inflation rates are assumed to be 2% for USD and 4.5% for VND.
* A green credit loan is designed to cover 60% of the initial investment at an interest rate of 8% per year for 10 years.

Most importantly, the heat generated is not sold but utilized directly in textile or food & beverage production. Therefore, there is no revenue from selling heat. The primary benefit of adopting a heat pump is that the company avoids the cost of having a coal-fired boiler. So the revenue is converted from investment, operation and maintenance costs (O&M), and fuel expenses (such as coal) associated with coal-fired boilers of equivalent production capacity.

Accordingly, 5 scenarios were analyzed:

1. Very High Support: A 5% investment grant combined with a green credit loan at an annual interest rate of 2.5%, with a loan term of 10 years.
2. High Support: A 1% investment grant combined with a green credit loan at an annual interest rate of 5.5%, with a loan term of 10 years.
3. Baseline Support: A 0.05% investment grant combined with a green credit loan at an annual interest rate of 8%, with a loan term of 10 years.
4. Low Support: No investment grant, a green credit loan at an annual interest rate of 10.2%, with a loan term of 5 years.
5. No Support: No grant and no green credit loan.

**3. Results**

The baseline scenario, which includes a 0.05% grant and a green credit loan at 8% interest, yielded an NPV of 17,514.02 million VND and an IRR of 6.87%, making it an attractive option for companies to adopt heat pumps over coal-fired boilers.

**Table 1**. Some indicative results from scenario analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Scenarios** | **Key Assumptions** | **NPV (Mil VND)** | **IRR (%)** |
| 1 | Very high support | Grant: 5%; Green credit  (Interest rate: 2.5%; Year loan: 10) | 236,221.56 | 10.47 |
| 2 | High support | Grant: 1%; Green credit  (Interest rate: 5.5%; Year loan: 10) | 108,842.99 | 8.50 |
| 3 | Baseline | Grant: 0.05%; Green credit  (Interest rate: 8%; Year loan: 10) | 17,514.02 | 6.87 |
| 4 | Low support | No grant; Green credit  (Interest rate: **10.20352%**; Year loan: 5) | 0.0 | 6.50 |
| 5 | No support | No grant,  No loan from green credit | -138,855.19 | 1.96 |

In the high support scenario, which includes a 5% grant and a 2.5% interest loan, the NPV increased significantly to 236,221.56 million VND, accompanied by an IRR of 10.47%. Conversely, in the no support scenario, the NPV turned negative, amounting to -138,855.19 million VND, with an IRR of just 1.96%. *This indicates that without financial incentives, the transition is not financially viable.*



**Figure 1.** The Minimum Support Needed is lower than the baseline scenario

Another key finding is derived through balancing in FINPLAN model is the interest rate of 10.20352 for the minimum support of only a green credit loan with a 5-year term, covering 60% of the initial investment. This is the minimum support that can still make the adoption of heat pump favorable to coal-fired boiler (**Figure 3**).

Moreover, in order to check the feasibility of the project under uncertainty, a sensitivity analysis was conducted as follows (**Table 2**).

**Table 2.** Parameters and variations in sensitivity analysis

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Parameters changed** | **Range of value variations** | **Notes and Rationale** |
| 1 | Coal price | From -1.0% to 1.0% | In model: Reflected in AVC of coal boilder (Standard change in addition to inflation) |
| 2 | Discount rate | From 2% to 8% | As it is often controversal over what discount rate to choose for financial analysis in Vietnam ([ADB, 2023](#_ENREF_1); [PwC, 2023](#_ENREF_4); [SBV, 2024](#_ENREF_5)) |
|  | **AND** Interest rate | From 2% to 10% | The on-going discussion between GoV, donors and banks |

Sensitivity analysis of NPV and IRR showed that the heat pump project remains beneficial unless the discount rate increases to 8% and the interest rate to 10% (see **Figure 2** and **Figure 3**).



**Figure 2.** Results of NPV sensitivity analysis



**Figure 3.** Results of IRR sensitivity analysis

**4. Discussion and policy implication** (300-700 words):

The adoption of heat pumps over traditional coal-fired boilers in industrial settings presents a promising opportunity for companies to enhance their environmental and financial performance. However, the transition to this more sustainable technology is contingent upon adequate financial support, which plays a critical role in influencing corporate decisions. The analysis of the financial models shows that while the initial costs of implementing heat pump technology are substantial, strategic financial support can significantly tilt the balance in favour of heat pumps.

The baseline financial support model, which includes a grant of 0.05% and a green credit loan with a 10-year term at an interest rate of 8% per year, is particularly attractive. This package covers 60% of the initial investment, making the heat pump project financially viable. Under these conditions, the project remains beneficial even in the event of a modest decrease in coal prices by -0.25% (in addition to inflation). This indicates that the project is relatively robust against fluctuations in coal prices, which historically have been a key factor in determining the viability of alternative energy projects.

Further analysis reveals that the financial attractiveness of a heat pump project compared to a coal-fired boiler remains strong unless there is a significant increase in financial costs. Specifically, the project remains more favorable unless the discount rate rises to 8% and the interest rate on loans increases to 10%. This threshold indicates the sensitivity of the project's financial viability to changes in borrowing costs and discount rates, which are essential considerations for companies assessing long-term investments in energy infrastructure.

Despite the encouraging results under the baseline support scenario, it is essential to recognize that a minimum level of financial support is necessary for the project to remain viable. The analysis suggests that the minimum support required would be a green credit loan with a 5-year term at an interest rate of 10.2% per year, covering 60% of the initial investment. This minimum threshold represents the lowest level of financial assistance needed to ensure the project’s financial feasibility.

One critical aspect that has not been fully explored in this analysis is the impact of carbon taxes or carbon credits on the overall financial attractiveness of heat pump projects. Incorporating carbon credits as a benefit could potentially enhance the appeal of heat pumps even further. Carbon credits represent a financial incentive for companies to reduce their carbon footprint, and their inclusion in the analysis could reveal additional financial advantages of heat pumps over coal-fired boilers. This is a vital area for further research, as the global push towards reducing carbon emissions continues to gain momentum. In summary, while heat pumps represent a promising alternative to coal-fired boilers, their adoption is highly dependent on the availability and structure of financial support. The baseline support model analyzed provides a solid foundation for the financial viability of such projects.

**5. Conclusion** (100-200 words)

The transition from coal-fired boilers to heat pumps in Vietnam is financially viable with the right level of financial support. Heat pumps offer significant environmental and operational benefits but require substantial upfront investment. The baseline support scenario demonstrates that even minimal financial incentives can make this transition attractive to companies.

The government should introduce financial support mechanisms. These could include baseline support, such as grants covering 0.05% of investment costs and green credit loans with an 8% interest rate for 60% of investment over a 10-year term. Alternatively, at a minimum, the government could offer green credit loans with a 10.2% interest rate for 60% of investment over a 5-year term to encourage the adoption of heat pumps in the industrial sector. In addition, to fully realize the potential of heat pumps, it is crucial to consider the role of carbon taxes and credits, which could further tip the scales in favor of this more sustainable technology.

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1. as refered to the typical life span of heat pump in some Asian countries ([Hasanbeigi & Zuberi, 2022](#_ENREF_3)) [↑](#footnote-ref-1)