ASSESSMENT MODELS FOR FEASIBILITY STUDY OF EXTRA ELECTRICITY FACILITIES INVESTMENT PROJECT

Matsaid Budi Reksono[1)*], Abdul Rahman Rahim[2)]

[1),2)] Management, Faculty of Economics, Universitas Terbuka, Indonesia

*Corresponding author: 530087913@ecampus.ut.ac.id

Abstract

Numerous recent researches have revisited the issue of the potential conflicting feasibility method of competing investment projects. This paper provides an example of assessment models that can be built and used for feasibility analysis of electricity investment projects. An overview of feasibility assessment methods by quantitative method approach is presented, consist of general assessment model, return on investment methods, and a new sensitivity analysis used to estimate strategic and financing requirements of electricity investment projects. The conclusion found that Internal Rate of Return (IRR), Net Present Value (NPV), and Payback Period (PBP) combining with Return on Investment (ROI) and Sensitivity Analysis (SA) to analyze the project should be used to assess feasibility model study of extra electricity facilities investment projects. These findings contribute to the literature on feasibility study model by practical template and a case study. This research approach contributes to a better understanding of the value and utility of feasibility analysis in assessing an additional electricity investment project.

Keywords: Labor, capital, cooperative, optimal

Introduction

The economic success of an extra electricity facilities project, as part of the electricity and power project, is largely determined by its investment return. This is a critical factor in the electricity project's business model. From the perspective of electric or construction companies, it is essential to develop a sound investment return analysis model to enhance investment effectiveness and efficiency. According to Zhang *et al*. (2023), in the new power system, the investment and construction of power projects frequently reflect the conflicts of interest among multiple stakeholders, such as electric companies, the government, and social investors. The investment and return, cooperation, and competition of various stakeholders are critical issues in the construction of new power systems and its accessories.

The electricity project in an oil company and also in other industrial sectors is one of the challenges in terms of efficiency and effectiveness. The government, throughout Ministry of Energy and Mineral Resources (ESDM) Republic of Indonesia, emphasizes the use of electricity from National Electricity Company (PLN) for the electricity needs of oil companies in Indonesia. Furthermore, with additional electricity from various power plants, currently the power supply for the entire electricity system in Indonesia is in sufficient condition. These conditions make Indonesia ready to support the growth of investment. Therefore, the Ministry of Energy and Mineral Resources (ESDM) continues to support the National Electricity Company (PLN) in meeting industrial and business electricity needs.

The extra electricity facility project is part of the engineering and construction project to complete the electricity connection project for various electricity customers. In general, this extra electrical facilities project includes the provision of all infrastructure and equipment needed for electricity connection as well as operation and maintenance services for these facilities. The area of extra or additional facility in electricity project covers various alternatives substation, transmission and distribution line and other accessories, including power quality services. Power quality services are normally required by industries in ensuring quality of power that is received from electricity line is met with industry's requirement, reliable and cost effective. In this case, power quality could ensure minimum impact to industrial facilities and reducing voltage dip, sag, and downtime. It means the project of additional electricity facilities will reduce the operational expenditure of the industries.

This extra electricity facility project, as part of engineering projects, can be approached by feasibility study concept. According to Orsmond & Cohn (2015), the main objectives of feasibility studies focus on each project shall confirm on (a) evaluation of recruitment capability and resulting sample characteristics, (b) evaluation and refinement of data collection procedures and outcome measures, (c) evaluation of the acceptability and suitability of the intervention and study procedures, (d) evaluation of the resources and ability to manage and implement the study and intervention, and (e) preliminary evaluation of participant responses to intervention. Further, Hazen & Magni, (2021) stated in the feasibility study and analysis of engineering projects and more generally, industrial projects, the study of relative measures of worth such as rates of return or profitability indices and the relations they bear to absolute measures of worth such as internal rate of return (IRR), net present value (NPV), payback period (PBP), Return on Investment (ROI) and other measurement tools, in general, to investment decision-making has been a much-debated subject long since the past few decades.

According to Gruber and Bouchaud (2020), the essence of feasibility study which related to a financial appraisal is the identification of all expenditures and revenues over the lifetime of the project, with a view to assessing the ability of a project to achieve financial sustainability and a satisfactory rate of return. The appraisal is usually done at constant market prices and in a cash flow statement format. It is the difference of all revenues and expenditures at the time at which they are incurred. In recent years, substantial contributions on relative measures of worth have appeared in the literature. The most popular relative measure of worth, the well-known Internal Rate of Return (IRR) and Payback Period (PBP), had long been known to have undesirable properties. In particular, while consistent with NPV for project accept/reject decisions when project cash flows were conventional (all outflows precede all inflows or all inflows precede all outflows), it could be inconsistent with NPV for non-conventional cash flows. Related to this, Brealy *et al.* (2020) stated that the standard method of using IRR and PBP to rank multiple projects, by considering acceptability of successive incremental cash flows, might not be consistent with NPV if some incremental cash flows were not conventional. Finally, there is the possibility, for non-conventional cash flows, of multiple internal rates, conflicting with each other and with NPV; and the possibility of no real-valued internal rate at all (Hazen & Magni, 2021).

The research uses two methods as assessment models in feasibility study of the project in sequence. Firstly, the reserach uses three financial indicators of internal rate of return (IRR), net present value (NPV), and payback period (PP) to measure the profitability of the development of electricity project. Secondly, the research aims to investigate the sensitivity of variables related to initial investment, revenue level, and added cost or operational expenditure. Currently, there is a lack of similar research or references, thus, the results of this research can be used as a future reference on electricity projects.

Warren & Seal (2018) provides insight that Net Present Value (NPV) is the traditional method when looking at any investments and also when deciding how to lobby for change. In this case, NPV showed the outcomes when analyzing different technologies or changes in the energy market framework. Further, Bedana *et al.*(2022) and Titman *et al.* (2018) states that Net Present Value (NPV) shall deal with present value (cash inflows) and presenta value (cash outflows). NPV decision shall follow the rule which an investment is acceptable if positive net present value and rejected if its NPV is negative. The below equation widely used by different authors where they considered the initial investment cost I_0 negative.

$$NPV = \left[\sum_{t=1}^{n} \frac{CF_t}{(1+t)^t} \right] - I_0$$

In Eq. above, *CFt* represents cash flow in year t, *I* represent discount rate, *n* represents total years, and I_0 represents initial investment cost. The acceptance of a project largely depends on NPV value, and positive NPV value will lead to the adoption of the project from the economic and financial points of view. A private investor will not accept a project which yields a negative NPV value. However, from an economic point of view, several factors would be considered to have a rational decision regarding the adoption.

Titman *et al*. (2018) confirmed that the decision criterion of NPV method is if the NPV is greater than zero, the project will add value and should be accepted, but if the NPV is negative, the project should be rejected. If the project's NPV is exactly zero (which is highly unlikely), the project will neither create nor destroy value. Govender *et al.* (2019) states also that if a net present value of zero and greater is achieved the investment will be deemed viable, if the NPV is less than zero the investment will not be viable and be rejected. It is important to note that the NPV of a project is just one factor to consider when making a decision about whether or not to accept the project. Other factors that may be considered include the risk of the project, the company's financial situation, and the strategic fit of the project with the company's goals.

The Internal Rate of Return (IRR) is the discount (*interest*) rate that makes the net present values of a cash flow equal to zero. The IRR doesn't depend on market interest rate and depnd on the project's cashflow. At the same time, a single discount rate which summarizes the merits of a project. If the NPV of a project is zero at a selected discount rate, that rate is, by definition, the IRR. The IRR is then an algebraic equivalent. The IRR allows the judgment of the future performance of the investment to benchmark required rate of return. In general, the higher the IRR, the more desirable it is too undertake the project (Agostini et al., 2016; Govender et al., 2019; Patrick & French, 2016). The IRR of an investment proposal can be defined as follows:

$$NPV \;\; = o = \left[\sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} \right] - \;\; I_o$$

In Eq. above, IRR is the internal rate of return, CFt represents the cash followed at year t, and I_0 represents the initial investment cost. The private investor will adopt the project if the IRR is higher than the opportunity cost of capital. IRR decision criterion will accept the project if the IRR is greater than the required rate of return or discount rate used to calculate the net present value of the project, and reject it otherwise (Bedana et al., 2022; Titman et al., 2018). In paralel, Govender *et al.* (2019) explains in detail that if the internal rate of return (IRR) achieved is higher than the discount rate, the investment will be viable and should be accepted, based on the IRR decision rule. If lower than the discount rate is achieved, the investment would be considered not viable.

The payback period (PBP), defined as the number of years required to recover the funds invested in a project from its operating cash flows. The payback period can be determined by adding up the predicted cash flow in subsequent years until the total cost equaled the initial outlay (Agostini et al., 2016; Bedana et al., 2022). According to Titman *et al.* (2018) and Govender *et al.* (2019), the decision criterion for payback period method is accept a project if the payback period is less than a prespecified maximum number of years to be economically viable. The PBP value can be expressed through the following equation:

$$\text{PBP} = \frac{Investment\ Value}{Net\ Cash\ Flow}\ x\ 1\ year$$

In power and electricity projects, according to Zhang *et al.* (2023) the investor with the largest proportion of investment usually plays a dominant role in the management of power & electricity projects. The construction of electricity projects requires a large amount of funds, including land, power equipment and other expenditures. In addition to capital, investment also includes human resources, existing infrastructure and other non-capital components. In overall, Titman *et al.* (2018) explained that return on investment (ROI) measures the overall effectiveness of management in generating profits with its available assets. Return on investment (ROI) ratio means the product of the net profit margin and total asset turnover ratios or average return over a specified period divided by the investment given as a percentage.

The sensitivity analysis (SA) illustrates the variation of the value or result of a model in response to changes in some of its key variables, keeping the value of the other variables constant. The sensitivity analysis is carried out considering one variable at a time and always assuming that there is independence between the different variables that influence or determine the value in the model (Gaytán Cortés, 2022; Putriastuti et al., 2021; Thabane et al., 2013). Sensitivity analysis (SA) was the common method in order to find out the uncertainties in any assessments, the impact of specific parameters of any numerical analysis and the consequences of certain assumptions. The methodology is widely used to measure the impact of specific parameters and the consequences of certain assumptions. The simple sensitivity analysis is used in this study, to know the change of financial assesment results such as IRR, NPV, PBP and ROI due to any change on the specific assumptions or parameters (Jareemit et al., 2022; Pranadi et al., 2019).

Research Method

The objective of the proposed methodology in this research is to provide the required steps to evaluate the feasibility of the project. This research is a quantitative method approach and uses a case study approach on additional or extra electricity facilities project in one of electricity's company in Indonesia to explore and analyze the projects that were surveyed in depth. This method allows the project to examine the details and context of project calculations and also understand their similarities and differences. The additional electricity facility is planned to be executed within 10 years project duration with commencement of construction in 2024.

Four financial assessments models are presented in this research by using variables of IRR, NPV and PBP and finalizing the ROI calculation as part of statistical approach. Analysis of sensitivity is conducted as part of project analysis to determine the magnitude of change (sensitivity) on each of the selected variables in this extra electricity facility project.

Results and Discussions

The following Table 1 presents the detail of investment and operational expenditures budget for additional electricity project with 10 years total project duration. The 9,2% value of capital cost showed the weighted average cost of capital (WACC) composition of this project by 1,2% loan and 8% equity composition. The initial investment consists of detail of engineering development, materials i.e RUPS 2,5 MVA, genset, capacitor bank 4 MVA, panel 20 kV, panel 6,6 kV, interface panel, power transformer OLTC, cable 20 kV and 6,6 kV, electrical device accessories, building & structure, and installation & commissioning with total amount of Rp 62.318.700.000. In terms of added cost or operational expenditure consist of operational & maintenance, marketing, administration and miscellaneous expenditures with total amount per year of Rp 1.145.900.00, Rp 115.000.000, Rp 45.000.000, and Rp 850.000.000, respectively. The salvage value is estimated to be about 5% from initial investment with total amount of Rp 3.115.935.000. This value showed the residual value of an asset at the end of its useful life assumption, after all depreciation has been fully expensed. The revenue growth and inflation rate value are determined about 2% and 5%, respectively, by following the company policy.

Table 1. Budgeting of additional electricity project

Items	Amount	Unit
Added Income		
Cost of capital	9,2	%
Initial investment	62.318.700	x1000 Rp/year
Salvage value	5,0	%
Revenue value	16.999.050	x1000 Rp/year
Revenue growth	2,0	%
Inflation rate	5,0	%
Added Cost		
Operation & Maintenance	1.145.900	x1000 Rp/year
Marketing	115.000	x1000 Rp/year
Administration	45.000	x1000 Rp/year
Miscellaneous Expenditures	850.000	x1000 Rp/year
Other		
Project Duration	10	year

The cash-flows of additional electricity project and their component values such as revenue, added cost, earnings before interest, taxes, depreciation, and amortization (EBITDA, net cash flows and accumulated cashflows are presented in Table 2, respectively. Line 1 presents the revenue value using 2% revenue growth per year starting from Rp 16.999.050.000. The following line 2 added cost with total amount of Rp 2.155.900.000 covers all operation & maintenance, marketing, administration and miscellaneous expenditures by using 5% inflation rate. EBITDA is a statistic used to assess the operation performance of the company, which is a proxy for the revenue generated and total added cost per year. The EBITDA value is also calculated by considering the 5% inflation rate. The last line presents the net cash flow by calculating total value of intial investment, EBITDA and salvage value, while accumulated cashflow showed the total value of cash flows each year during project duration.

Table 2. Estimation of revenue added cost and net cashflow with inflation and growth rate of additional electricity project

Components	Investment	Value (x 1000 Rp)									
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Revenue		**16,999,050**	**17,339,031**	**17,685,812**	**18,039,528**	**18,400,318**	**18,768,325**	**19,143,691**	**19,526,565**	**19,917,096**	**20,315,438**
Operation & Maintenance		1,145,900	1,203,195	1,263,355	1,326,522	1,392,849	1,462,491	1,535,616	1,612,396	1,693,016	1,777,667
Marketing		115,000	120,750	126,788	133,127	139,783	146,772	154,111	161,817	169,907	178,403
Administration		45,000	47,250	49,613	52,093	54,698	57,433	60,304	63,320	66,485	69,810
Miscellaneous Expenditures		850,000	892,500	937,125	983,981	1,033,180	1,084,839	1,139,081	1,196,035	1,255,837	1,318,629
Total Added Cost		**2,155,900**	**2,263,695**	**2,376,880**	**2,495,724**	**2,620,510**	**2,751,535**	**2,889,112**	**3,033,568**	**3,185,246**	**3,344,509**
Initial Investment	(62,318,700)										
EBITDA		14,843,150	15,075,336	15,308,932	15,543,804	15,779,808	16,016,789	16,254,579	16,492,997	16,731,850	16,970,930
Salvage Value											3,115,935
Net Cashflow	(62,318,700)	14,843,150	15,075,336	15,308,932	15,543,804	15,779,808	16,016,789	16,254,579	16,492,997	16,731,850	20,086,865
Accumulated Cashflow	(62,318,700)	(47,475,550)	(32,400,214)	(17,091,282)	(1,547,478)	14,232,330	30,249,120	46,503,699	62,996,696	79,728,546	99,815,411

This research treated the base calculation for company's decision-making as the first assumption for the research analysis. Table 3 below presents the IRR, NPV, PBP and ROI of this research. The result showed that the average IRR for electricity is 21.55 %, which is also higher than the cost of capital or discount rate. The findings align with the research conducted by Bedana *et al.* (2022) and Pranadi *et al.* (2019) who found that IRR for their projects are is 48% and 10,69%, respectively. By considering the IRR criterion, this project is feasible to be continued to the next process. This research result confirmed that the NPV value for electricity project provided notable positive signs result as a general trend with total amoun of Rp 27.310.630.000. This positive signs of NPV result is similar with Bedana *et al.* (2022) with USD 1629,11 and Pranadi *et al.* (2019) with NP value about Rp105.819.738.042. Based on the definition of NPV, if the value is positive (more than zero), the business should be continued in the future. This current research provided the PBP value which as the period when accumulated annual discounted value of net revenues or benefits becomes equal to the initial investment into the project, is 5 years. It means in the 10th year the initial investment or capital cost will be recovered with 9.2% capital cost in 5 years. By considering the PBP criterion, it can be confirmed that this project is concluded as feasible project. The ROI found 35,50% in this project. This project provided positive or additional benefits of about 35,50% from initial investment to the company on end of the project execution.

Table 3. IRR, NPV, PBP and ROI of additional electricity project

Feasibility Parameter	Value	Criterion	Status
IRR (%)	21,55	> Cost of capital	Feasible
NPV (x1000 Rp)	27.310.630	> 0 (positive)	Feasible
PBP (year)	5	< 10 years	Feasible
ROI (%)	35,50	%	Feasible

The sensitivity analysis with three level value 80%, 100%, and 120% is provided on Table 4. This sensitivity analysis scenario was performed into three variables: (1) initial investment; (2) revenue value; and (3) added cost or operational expenditures. This research focused on analyzing those variables sensitivity on IRR and PBP to provide better guidance on electricity project development’s value and associated risks. While the effect of variable’s sensitivity on NPV will provide the level of future cash flows of the related project throughout its life cycle.

The company expected that the decrease in initial investment would generate higher or optimum IRR, NPV, and PBP, vice versa. Table 4 line 1, line 2 and line 7 presents the impacts of initial investment changes on IRR, NPV and PBP within three level percentage. The result found that the initial investment variable is one of the most fluctuate value variables with the changes. However, the desired IRR, NPV and PBP rank can only be achieved by a comprehensive approach that takes all factors into account. It means impossible to achieve the desired value on IRR, NPV and PDB by changing the initial investment only. This research provided a similar result to Jareemit *et al.* (2022) that the initial investment significantly contributed to the changes in the overall electricity project. This project result presents the value on IRR changes from 16.5% to 28.7% when initial investment changes from 120% to 80% or a decrease 40%. The NPV level changes from Rp26.591.787.000 to Rp51.519.267.000, while the PBP range within 4 – 5 years. However, all parameters showed above the discount rate or cost of capital of 9,2%.

Table 4 line 4 provides the impacts of targeted revenue values changes to IRR, NPV and PBP. The targeted revenue will determine how much revenue would be generated by the extra electricity facility project. However, the revenue itself should still guarantee the competitiveness between competitors in this similar project. Based on this research, the result found that the revenue value is one of the most sensitive variables with the changes. The research result found that the targeted revenue value should be put above 20% from initial calculation to exceed the discount rate of 9.2% and reach a higher IRR, positive NPV and the best PBP with value 28%, Rp47,965,034 and 4 years, respectively. Meanwhile, the expected IRR, NPV and PBP could only be achieved when the targeted revenue is at a higher value. This means that although the increases in revenue value could assist company in the extra electricity facility project to reach the optimum IRR, NPV and PBP, it will provide a lower the competitiveness as it is significantly higher than the market price of the similar projects. Thus, another economic variable should be adjusted along with the company revenue value to be able to achieve the optimum IRR, NPV and PBP while maintaining market price competitiveness.

Table 3.

Scenario	IRR (%)	NPV (x1000 Rp)	Pay back Period (Years)	Sensitivity on Initial Investment (%)	Sensitivity on Revenue Value (%)	Sensitivity on Added Cost (%)
1	16.5	14,846,890	5	120	100	100
2	28.7	39,774,370	4	80	100	100
3	28.1	47,965,034	4	100	120	100
4	14.5	6,656,226	6	100	80	100
5	20.6	24,381,442	5	100	100	120

6	22.5	30,239,817	4	100	100	80
7	21.6	27,310,630	5	100	100	100

Table 4 line 6 shows the significant impacts of added costs or operational expenditure changes to IRR, NPV and PBP. This research found that operational expenditure needs to be reduced from Rp2.155.900.000 to Rp1.724.720.000 or 20% decreases from the initial value to exceed the 9,2% cost of capital or discount rate. Moreover, in this level, the project achieved the desired IRR 22,5%, NPV Rp30.239.817.000, and PBP in 4 years. Thus, the operational expenditure variable is proven to be more realistic to be adjusted to achieve an IRR, NPV and PBP value for this project. This project result on sensitivity analysis aligns with the research conducted by Putriastuti *et al.* (2021).

This research has some shortcomings. One limitation in this research is that it lacks the support of accurate and comprehensive data from company and also real-world companies' data as comparison. In fact, the cost of capital and revenue value data is company-specific, which is determined and calculated by the company considering numerous factors. The information gathered from company is normally insufficient and sometimes not comprehensive enough in generating an accurate estimation to be used for the IRR, NPV, PBP and ROI calculation, let alone the sensitivity analysis of IRR, NPV, and PBP methods.

Future research could be conducted by collaborating with companies and gathering more precise and comprehensive or thorough data. At the same time, the next research could also consider the optimum both interest and growth rate assumption. With more historical data, the next research can better analyze how sensitivity of interest rate and growth rate changes have affected the IRR, NPV and PBP of investment projects. Meanwhile, a more complex model could be created that takes into account a wider range of variables. This could help us to understand the impact of each factor on the IRR, NPV and PBP and finally on investment decisions.

Conclusions

This research is intended to provide insights into an important aspect of the new project of additional electricity facilities project with reference to its financial appraisal point of view. Various terms of the financial appraisal as tools for feasibility of the project are discussed, using real-world examples; the IRR, NPV, and PBP as the criteria for the go ahead for the project; by considering the ROI value and sensitivity analysis of its project variables.

The results of this research found that all financial assessment models, including the IRR, NPV, PBP and ROI methods support the project to continue at the implementation stage. The results of the sensitivity analysis also provide an additional view that this project is greatly influenced by changes in initial investment, desired revenue, and the level of added cost or operational expenditures issued by the company.

References

Agostini, A., Battini, F., Padella, M., Giuntoli, J., Baxter, D., Marelli, L., & Amaducci, S. (2016). Economics of GHG emissions mitigation via biogas production from Sorghum, maize and dairy farm manure digestion in the Po valley. *Biomass and Bioenergy*, *89*, 58–66. https://doi.org/10.1016/j.biombioe.2016.02.022

Bedana, D., Kamruzzaman, M., Rana, M. J., Mustafi, B. A. A., & Talukder, R. K. (2022). Financial and functionality analysis of a biogas plant in Bangladesh. *Heliyon*, *8*(9), e10727. https://doi.org/10.1016/j.heliyon.2022.e10727

Brealy, R. A., Myers, S. C., & Allen, F. (2020). *Principles of Corporate Finance* (13th ed.). McGraw-Hill Education.

Gaytán Cortés, J. (2022). Sensitivity Analysis and Financial Decisions. *Mercados y Negocios*, *47*, 107–118. https://doi.org/10.32870/myn.vi47.7683

Govender, I., Thopil, G. A., & Inglesi-Lotz, R. (2019). Financial and economic appraisal of a biogas to electricity project. *Journal of Cleaner Production*, *214*, 154–165. https://doi.org/10.1016/j.jclepro.2018.12.290

Hazen, G., & Magni, C. A. (2021). Average internal rate of return for risky projects. *The Engineering Economist*, *66*(2), 90–120. https://doi.org/10.1080/0013791X.2021.1894284

Jareemit, D., Suwanchaisakul, A., & Limmeechokchai, B. (2022). Assessment of key financial supports for promoting zero energy office buildings investment in Thailand using sensitivity analysis. *Energy Reports*, *8*, 1144–1153. https://doi.org/10.1016/j.egyr.2022.07.086

Orsmond, G. I., & Cohn, E. S. (2015). The Distinctive Features of a Feasibility Study. *OTJR: Occupation, Participation and Health*, *35*(3), 169–177. https://doi.org/10.1177/1539449215578649

Patrick, M., & French, N. (2016). The internal rate of return (IRR): projections, benchmarks and pitfalls. *Journal of Property Investment & Finance*, *34*(6), 664–669. https://doi.org/10.1108/JPIF-07-2016-0059

Pranadi, A. D., Haramaini, Q., Setiawan, A., Setiawan, E. A., & Ali, C. (2019). Sensitivity Analysis of Financial Parameters in Varying PV Penetrations in the Optimum Location of a Feeder. *Energy Procedia*, *156*, 95–99. https://doi.org/10.1016/j.egypro.2018.11.101

Putriastuti, M. A. C., Yusgiantoro, F. C., Haryanto, & Margenta, I. D. R. (2021). A feasibility study of flare gas utilization through a small-scale LNG development in South Sumatra, Indonesia. *IOP Conference Series: Earth and Environmental Science*, *753*(1), 012029. https://doi.org/10.1088/1755-1315/753/1/012029

Thabane, L., Mbuagbaw, L., Zhang, S., Samaan, Z., Marcucci, M., Ye, C., Thabane, M., Giangregorio, L., Dennis, B., Kosa, D., Debono, V. B., Dillenburg, R., Fruci, V., Bawor, M., Lee, J., Wells, G., & Goldsmith, C. H. (2013). A tutorial on sensitivity analyses in clinical trials: what, why, when and how. *BMC Medical Research Methodology*, *13*(1), 92. https://doi.org/10.1186/1471-2288-13-92

Titman, S., Keown, A. J., & Martin, J. D. (2018). *Financial Management: Principles and Applications* (13th ed.). Pearson Education.

Warren, L., & Seal, W. (2018). Using investment appraisal models in strategic negotiation: The cultural political economy of electricity generation. *Accounting, Organizations and Society*, *70*, 16–32. https://doi.org/10.1016/j.aos.2018.04.001

Zhang, J., Wu, C., Wang, G., Du, J., & Yang, Y. (2023). Research on investment-return model of new power system considering financial pressure. *Energy Reports*, *9*, 540–546. https://doi.org/10.1016/j.egyr.2023.04.346