



Impact of policy instruments for solar energy development in Vietnam



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ABSTRACT

Objective – This study analyzes the development of renewable energy in ASEAN and delves into specific promotion instruments for solar energy in Vietnam. Method Cost-benefit analysis was conducted to compare economic benefits with investment and operating costs.

Methodology – Vietnam was entering a period of transformation in the field of renewable energy, especially solar energy (installed solar power capacity was 16,000 MW in 2023, intending to increase to 25,320 MW in 2030). Compared to ASEAN countries with many similarities in developing this industry, such as Indonesia (solar power capacity was 2,100 MW in 2023), Vietnam faced an excellent opportunity to surpass.

Findings – The results of the study show that government instruments had different levels of influence on various aspects, and the most influential were the FIT tariff (243.75 points) and tax exemption (49.71 points).

Novelty – Although solar energy in Vietnam is developing rapidly, it is still necessary to improve and develop reasonable allocation strategies for supporting policies and incentive mechanisms to optimize economic benefits.

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Keywords: Policy Instruments, Solar Energy, Renewable Energy, Energy Transition, Sustainable Development, Sustainability Goals, FIT.

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1. Introduction

Association of Southeast Asian Nations (ASEAN) is a group of 10 countries with many remarkable similarities, including geographical location, culture, environment, and economic development (Kurniawan et al., 2024). The countries in this region are all located in the tropical climate zone, which has excellent potential for developing electricity production from renewable energy (Handayani, 2024). Analyzing the development of renewable energy sources in the five countries with the highest renewable energy ratio in ASEAN in 2023 (Vietnam, Philippines, Thailand, Indonesia, Malaysia) not only helps to understand better the investment priority level in the policies of the countries but also creates opportunities

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for countries to learn from each other, support the construction of a sustainable development model, select and adjust investment in potential energy sources suitable to the actual situation in Vietnam (Gui et al., 2024). Solar energy was an abundant source of energy in Vietnam, and the price of solar panels was decreasing (in 2017, the average price of solar panels was about 0.085 USD/W, decreasing to 0.06 USD/W and 0.045 USD/W in 2020 and 2024, respectively), making this energy source one of the most competitive ones.

2. Literature Review

Vietnam was the leading country in ASEAN in 2023 regarding renewable energy (42.8%), thanks to the prioritized investment in hydropower (29%), solar power (9.1%), wind power (4.4%), and biomass (0.3%) (Hartarto et al., 2024). Vietnam has a dense river system, mountainous terrain favorable for hydropower (2360 large and small rivers, the total length of all rivers in Vietnam is estimated at more than 10,000 km, of which the five most significant rivers are the Mekong River - the part flowing through Vietnam is 220 km, the Red River - the part flowing through Vietnam is about 510 km, the Dong Nai River - 586 km, the Ca River - 520 km, the Ba River - 240 km), helping this energy source accounted for the largest proportion (Phuoc & Hung, 2024). The cost of developing hydropower in Vietnam was relatively low, allowing this country to take advantage of its abundant water resources (Singh et al., 2025). However, most areas with great hydropower potential had been developed. Other renewable energy sources besides hydropower were being focused on investment to diversify and balance energy (Galevskiy & Qian, 2024).

Tax incentives and financial support had been implemented to encourage investment in solar energy in Vietnam (Nguyen & Ponomarenko, 2025). The government had applied preferential tax rates for renewable energy projects, including corporate income tax exemption for the first 4 years and a 50% reduction for the next 9 years (Tien, 2024). Many domestic and foreign investment funds had invested in this sector (for example, the International Finance Corporation (IFC) has invested 100 million USD in the Trung Nam solar power project in Ninh Thuan). Loan interest rates for solar energy projects range from 5% to 6% for 5 to 15 years, (typically banks such as Vietcombank and BIDV offer preferential loan packages). Vietnam was developing large-scale solar energy projects, especially in the South, which has more sunshine than the North and Central regions. This development not only helps ensure energy security and reduce CO₂ emissions, but also contributes to creating thousands of jobs and boosting the local economy. Vietnam is on track to become one of Southeast Asia's leading renewable energy hubs (Long et al., 2024).

3. Research Methodology

Data were collected and analyzed from official sources, statistical data, government planning documents, and documents in the national regulatory system related to renewable energy sources. Cost-benefit analysis (CBA) is a systematic process for calculating and comparing the benefits and costs of a policy project, instrument or government decision (Tseng et al., 2021). It aims to provide a basis for comparing instruments, involving comparing the expected costs of each option against the total benefits received to see whether the benefits outweigh the costs and by how much (Bratskikh et al., 2024). In CBA, benefits and costs are expressed in monetary terms, and adjusted for the time value of money, so that all flows of benefits and flows of project costs over time (which tend to occur at different times) are expressed on an everyday conceptual basis of their net present values. This article includes the following sections: a) Policy instruments that had been applied to promote electricity generation from green energy sources in the five countries with the most significant proportion of electricity from renewable energy in ASEAN, including solar energy; b) Assessing the impact of policy instruments promoting solar energy development in Vietnam;

4. Results

4.1 Policy instruments had been applied to promote electricity generation from green energy sources in ASEAN

The five countries with the highest electricity supply rate from renewable energy sources in the ASEAN group are developing countries, with a significant factor influencing the development of these countries being the electricity supply for economic growth (Handayani, 2024).

The renewable energy structure in the five countries in 2023 studied is listed in Table 1.

Table 1. Electricity consumption and the proportion of electricity consumption from green energy sources in the countries with the most significant green energy in ASEAN in 2023. Source: Compiled by the authors based on (Gui et al., 2024), (Hartarto et al., 2024) and Renewable Energy Statistics 2024 (IRENA)

Country	Indonesia	Thailand	Vietnam	Malaysia	Philippines
Electricity consumption (billion kWh)	768	383.65	280	236	118
Share of renewable energy sources in the energy balance, %	18.1	19	42.8	18.11	22
Share of solar power plants in the energy balance, %	0.1	2.7	9.1	1.65	2.2
Hydroelectric, %	7	3.7	29	5.8	4.6
wind power, %	0.14	1.5	4.4	0.05	0.3
Biomass, %	5	9.8	0.3	0.02	0.9

Table 2 lists the policy instruments that five countries (Vietnam, Philippines, Thailand, Indonesia, and Malaysia) had adopted to develop renewable energy, including solar energy.

Table 2. The policy instruments that Vietnam, the Philippines, Thailand, Indonesia, and Malaysia had adopted to develop renewable energy, including solar energy, in 2023. Source: Compiled by the authors based on (Nguyen & Ponomarenko, 2025) (Hartarto et al., 2024); and (Singh et al., 2025).

Countries	Green tariffs	Direct subsidies and loans	Tax benefits	Legal regulations and standards
Vietnam	- FIT since 2017 - The Green Certificate System - Tariff for small-scale renewable energy power generation enterprises	- Bank loans from domestic and international banks and financial institutions - The GEF	- Import tax exemption - VAT exemption - Corporate income tax reduction (from 20% to 10%)	- RPS
Philippines	- FIT since 2012 - The Green Certificate System	- Subsidies from the Environmental Fund - The GEF	- Corporate income tax for companies investing in renewable energy (from 30% to 20%)	- The Renewable Energy Act in 2008

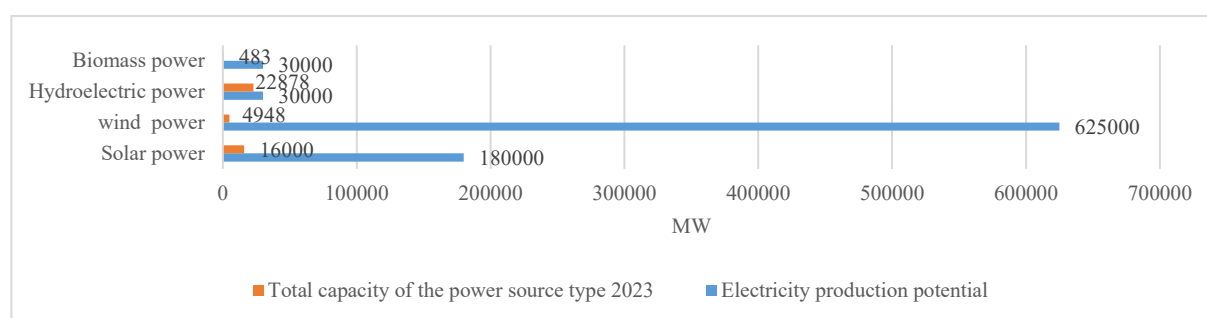
Thailand	- FIT since 2010	- Concessional loans for renewable energy projects - The GEF	- Exempted VAT (from 20% to 15%)	-
Indonesia	- FIT since 2017	- Indonesia's sovereign wealth fund - The GEF	- Corporate income tax (from 25% to 15%) - Exempting import tax on solar power technology machinery	- The Renewable Energy Law in 2014
Malaysia	- FIT since 2011 - The Green Certificate System	- The GEF	- Income tax reduced (from 24% to 10%) - Exempting import tax on solar power technology machinery	-

The development of renewable energy not only helped to reduce environmental impacts but also contributes to the sustainable economic development of countries in the ASEAN region (Galevskiy & Qian, 2024). To achieve this goal, these countries have adopted incentive policies to promote the development of renewable energy sources, including instruments such as green electricity tariffs, direct subsidies and loans, tax benefits, legal regulations and standards (Pashkevich & Danilov, 2023). In which, the total electricity output and GDP of these countries in 2023 were: Vietnam (80,560 GW and 430 billion USD), Philippines (27,346 GW and 437 billion USD), Thailand (223,000 GW and 515 billion USD), Indonesia (323,321 GW and 1371 billion USD), Malaysia (177,750 GW and 400 billion USD) (Cheah & Low, 2022).

4.2 Vietnam the impact of policy instruments promoting solar energy development in Vietnam

The potential for electricity production from renewable energy sources and the total installed capacity in Vietnam were recorded, as shown in Figure 1.

Figure 1. Potential and total electricity capacity of renewable energy sources in Vietnam 2023. Source: Compiled by the authors based on General Statistics Office of Vietnam (online accessed 01 March 2025: <https://www.gso.gov.vn/>)



According to the Ministry of Industry and Trade's 2023 report, the total number of solar power projects put into operation reached 1,300, solar energy not only met domestic energy needs but also created investment opportunities for domestic and foreign enterprises. Solar panel technology was developing rapidly, with installed projects increasing from 1,000 MW in 2017 to 16,000 MW by the end of 2023. The investment cost for solar power has decreased by about 80% (from about 3.5 USD/W to about 1 USD/W)

since 2013. Interest from people and businesses in clean energy was increasing, with more than 100,000 households installing rooftop solar power systems.

Vietnam had 16,000 MW of solar power installed (data at the end of 2023, of which 3,172 MW of capacity less than 1 MW, which was not subject to FIT price) (Oskar, 2022). Each MW could generate electricity for an average of about 1,600 hours/year (this index changes depending on annual environmental conditions), and the total solar power output calculated by FIT was 20,527,360,000 kWh. The cost of purchasing FIT electricity in 2024 for solar power was 1,522,405,760 USD, including 10,666 MW on land (FIT price was 0.072 USD/kWh), 48 MW floating (FIT price was 0.078 USD/kWh), 5,287 MW rooftop of which 40% of total capacity were from systems larger than 1 MW (FIT price was 0.085 USD/kWh). Assuming these costs were 15% of the cost of buying electricity, the estimate was 228,360,846 USD. The average electricity price in Vietnam in 2024 was 0.083 USD/kWh, and the revenue from selling electricity to people was 1,703,000,000 USD. The total cost for the FIT instrument was 47,776,624 USD. The number of rooftop solar power systems had reached about 100,000 systems under 1 MW (total rooftop power capacity was 5,287 MW in 2023, of which 60% of total capacity from systems smaller than 1 MW) had a preferential price of 0.029 USD/kWh (CR & John, 2024). Small businesses' total solar power output was estimated at 50,755,200 kWh for 1,471,900 USD, and the Small Business Tariff instrument brought profit to the state budget of 2,519,995 USD in 2024. Green certification system includes operating and management costs, there are no specific figures yet, but it is expected to reduce manufacturers' costs. Subsidies from environmental funds: the fund supports an average of about 10 million USD/year for solar energy projects (Phuoc & Hung, 2024). Bank loans: The total investment in solar energy was 1 billion USD in 2024 (Tien, 2024), the interest rate was 3%, and the annual interest cost was 30 million USD/year. Import tax exemption: assuming the total value of imported equipment for solar power was 500 million USD in 2024 (Long et al., 2024), the import tax on standard machinery and equipment was 10%, the total amount of import tax paid to the state budget will be reduced by 50 million USD/year. VAT exemption: assuming revenue from solar power projects was 2 billion USD (Phuoc & Hung, 2024), the standard VAT is 10%, and 200 million USD reduces the total VAT amount to the state budget. Reduce corporate income tax: Suppose the total corporate income tax (CIT) that solar energy businesses have to pay is 200 million USD/year in 2024 with a base rate of 20% (Nguyen & Ponomarenko, 2025). With a tax reduction of 10%, the total amount of CIT paid to the state budget decreased by 100 million USD/year in 2024. RPS (Renewable Portfolio Standards) includes operating and management costs. No specific figures are available, but it is expected to increase revenue and reputation for qualified businesses.

The instruments have costs for the government, bring economic benefits to businesses, new jobs created and impact on the amount of CO₂ emissions reduced into the environment are listed in Table 3:

Table 3. Annual government costs, economic benefits for businesses, new jobs created, and CO₂ emissions reduction compared to coal power of each instrument in Vietnam in 2024. Source: Compiled by the authors based on General Statistics Office of Vietnam (online accessed 01 March 2025: <https://www.gso.gov.vn/>) and Renewable energy and jobs: Annual Review 2024 (IRENA)

Instruments	Annual government expenditure (thousand USD)	Business economic benefits (thousand USD)	New jobs created (number of people)	Environmental impact (tons of CO ₂ reduced)
FIT (Feed-in Tariff)	47,777	1,522,406	127,207	18,317,739
Small Business Pricing	(2,520)	1,472	123	17,710
Green certification system	-	-	-	-

Subsidy from environmental fund (Vietnam Renewable Energy Fund)	10,000	10,000	836	120,321
Global Environment Facility (GEF) Grants	0	1,000	84	12,032
Bank loan	30,000	30,000	2,507	360,963
Tax exemptions and reductions	350,000	350,000	29,245	4,211,235
RPS	-	-	-	-
Total	435,257	1,914,878	16,000	23,040,000

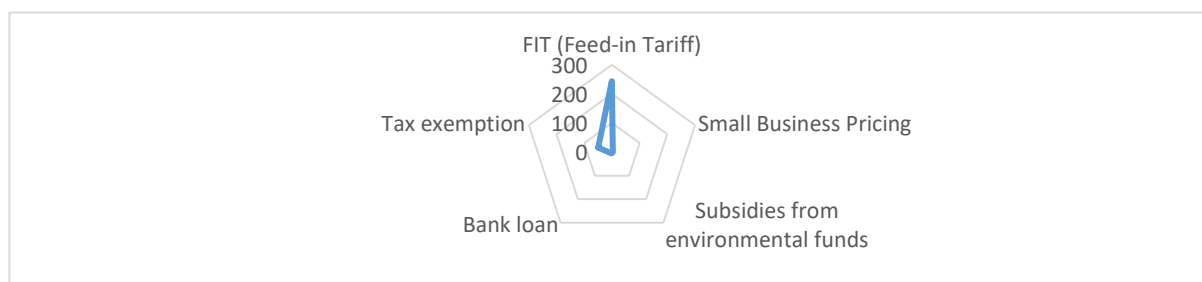
According to research by IRENA, each MW of renewable energy can create 5-15 jobs depending on the technology and scale, and each MW of solar power can reduce 1,440 tons of CO₂/year on average compared to coal power. This shows great potential in creating jobs and reducing CO₂ emissions from solar energy projects. To determine which instrument had the most impact for the same amount of cost, the effectiveness of each instrument was determined when the price was fixed, the study assumed a support budget of 10 million USD for each instrument and evaluated the benefits each instrument brings. Based on the assumptions and collected data, the calculation table of the impact of the instruments and the effectiveness index (Effectiveness Index) is shown in Table 4:

Table 4. Impact level with a cost of 10 million USD from the Vietnamese government of the simulated instruments. Source: Compiled by the authors

Instruments	Government support costs (thousand USD)	Economic benefits of the enterprise (thousand USD)	New jobs created (number of people)	Environmental impact (tons of CO ₂ reduced)	Efficiency index (score)
FIT (Feed-in Tariff)	10,000	318,651	14,613	2,104,246	243.75
Small Business Pricing	10,000	11,472	14	19,774	3.13
Subsidies from environmental funds	10,000	10,000	96	13,822	2.39
Bank loan	10,000	10,000	228	41,466	5.17
Tax exemption	10,000	10,000	3,359	483,765	49.71

This showed that the FIT policy had successfully encouraged investors to participate in the solar energy market. The tax exemption had a high-efficiency index of 49.71, showing that this instrument had supported solar power projects with high economic costs, reducing the burden of purchasing machinery and equipment, corporate income tax, and VAT. The efficiency index of 5.17 showed that bank loans had supported investors with capital to start and maintain solar power projects, a social impact of 228 jobs created with an investment of 10 million USD. Figure 2 shows the impact of policy instruments invested in Vietnam. Green certification systems, Global Environment Facility (GEF) grants, and RPS were instruments that did not have government cost data, so they were excluded from the table of assumptions.

Figure 2. The impact of the policy instruments invested in Vietnam. Source: Compiled by the authors



The Vietnamese government's support instruments have positively impacted renewable energy development. Although FIT is the most effective, other instruments, such as tax exemptions and bank loans, must also be optimized to maximize their potential. Applying incentive policies such as RPS and green certification systems could create strong incentives for renewable energy development while helping Vietnam achieve its future sustainability goals. These efforts not only helped Vietnam minimize negative impacts on the environment but also created more job opportunities, improved the quality of life for people, and contributed to the country's overall economic development.

5. Conclusion

The main instruments to promote solar power development the five countries with the highest renewable energy share in ASEAN are green tariffs (FIT, green certificate systems, tariffs for small businesses producing electricity from solar energy), direct subsidies and loans (subsidies from environmental funds, GEF, bank loans); Tax benefits (import duty exemption, VAT exemption, corporate income tax reduction); Regulatory and regulatory standards (RPS).

The cost-benefit analysis of solar energy support instruments in Vietnam, assuming the same government investment, showed that implementing effective policies could bring significant economic, social, and environmental benefits. Instruments such as FIT (243.75 points), tax exemptions (49.71 points), and bank loans (5.17 points) should be prioritized for investment development to support the sustainable development of renewable energy in the future. Small business pricing (3.13 points) and subsidies from environmental funds (2.39 points) also have relatively positive impacts and need to improve their effectiveness to optimize the capabilities of these instruments. Green certification systems and RPS are also tools that need attention and investment and have the potential to impact society and the environment positively.

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