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The Impact of Fiscal Incentives on the Feasibility of Solar Photovoltaic and Wind Electricity Generation Projects: The Case of Indonesia

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ABSTRACT

In most developing countries, renewable energy still cannot compete with fossil-based electricity generation costs. Compared to various measures to support renewable energy deployment, fiscal instruments can be considered the most promising tool in emerging economies. Fiscal instrument effectiveness in renewable energy development in developing countries is still underemphasized in the literature. Using the case of Indonesia, this study aims to simulate how different fiscal incentives can affect the economic price of renewable energy by employing six types of fiscal incentive scenarios, namely tax reduction including the tax holiday, tax allowance, value-added tax reduction and subsidy policy consisting of the cost of debt subsidy (soft loan), exemption of land acquisition costs, and project development facility. Using a typical financial model for 66 projects of solar photovoltaic and wind technology provided in Indonesia's ten years national electricity plan, the findings generate two major outcomes. First, compared to other incentive policies, tax holiday and tax allowance are the most significant policies that would reduce the electricity price of renewables in Indonesia. Second, solar photovoltaic is relatively more sensitive in response to fiscal intervention compared to wind technology. The findings would be of high value to support specific strategies toward energy transition in developing countries.

KEYWORDS

Solar photovoltaic, wind, fiscal inventive, financial feasibility, Indonesia.

INTRODUCTION

Reducing the cost of renewable energy (RE), particularly wind and solar, remains a challenge in developing countries. Most developing countries are struggling to lower the financing cost of renewables, which affects its competitiveness against fossil fuels [1]. Despite the financing cost, these countries are also hampered by the structural issue of high investment cost [1]. The overall net effect is a clear loss in competitiveness for renewable energy deployment in developing countries. There is a long-running bidirectional causality between

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renewable energy consumption and carbon emissions, which explains the notable influence of developing countries over global carbon emissions and the need to focus on the issues that surround this [2].

Indonesia is one such developing country grappling with such renewable development challenges. Although endowed with vast renewable energy potential, the country is still highly dependent on fossil fuels for its electricity. Producing around 58% of domestic electricity, the coal-fired power plant dominates the electricity energy mix in the country [3]. To achieve Indonesia's NDC (Nationally Determined Contribution) target, which takes the energy system as the second-largest contribution, the government has to go to the extra mile to achieve the target of 23% renewable energy share in the primary energy supply by 2025 (Government Regulation 79/2014). Currently, renewables only contribute 12.2% of the installed capacity mix in 2019 and it has been stagnant since 2011 [4]. When it comes to wind and solar energy, the adoption of both exhibits a stagnancy as well. By 2017, the combination of solar and wind electricity capacity is maintained under 0.1GW [5]. Slow deployment of wind and solar in Indonesia is referred to some inefficiencies of renewable energy regulations [6].

Harsher regulations of carbon-based technologies, which may encompass tax incentives and other policies akin to them, have been enacted in light of the extensive deployment of renewable energy [7]. One example of this is the fiscal incentive, which aims to lessen costs associated with investment and plant operation [8]. The policies are contributing substantially to driving the advance of renewable technologies by attracting the investment that leads to the advancement of technology penetration, resulting in a competitive cost and stimulating sustained development in the sector. Fiscal incentive policies are instituted by the government at specific levels of intervention to enhance the competitiveness of renewable energy technology costs. They may manifest as income tax facilities, import duties and value-added tax (VAT) facilities, or subsidies. It should be noted that a policy's efficiency has a negative correlation with its level of intervention [9]. Cost efficiency is considered an essential assessment of the incentive policy. The efficiency of the incentive policy hinges on its capacity to attract more investment in renewable energy by improving its cost competitiveness in the short term and accelerating its deployment in the long term.

Previous studies have highlighted the impacts of fiscal policies to enhance RE deployment by utilizing several approaches, such as econometric analysis [10], cross-sectional time-series [11], and Input-Output (I-O) analysis [12]. Existing studies are primarily focused on developed countries. For instance, focusing on the European Union, an empirical study was conducted to measure the fiscal policy's effectiveness on renewable energy deployment in a particular region [13]. Over the district level, state fiscal incentives were observed to yield a notable positive effect on the development of wind energy in the western region of the United States [12]. The previous finding on fiscal policy impact so far has not been homogenous across countries. The magnitude of fiscal instruments' effectiveness in developing countries such as Indonesia is still underemphasized in the literature. This paper aims to fill this gap and contribute new perspectives on the effect of fiscal policy by using Indonesia as a case study. Utilizing a financial model, this study presents a magnitude impact analysis of certain types of fiscal policy in the country.

Therefore, by employing six types of fiscal incentive scenarios (covering tax holiday, tax allowance, value-added tax reduction) and subsidy policy consisting of cost of debt subsidy (soft loan), exemption of land acquisition costs, and project development facility, the study simulates the effect of particular interventions on the economic price of renewable energy power plants. This study makes significant contributions in several ways. First, the study contributes to the literature by providing an efficient policy in promoting the deployment of RE, especially wind and solar technology in a developing country such as Indonesia. In developing countries, renewable development is complicated by the need to improve electricity access for living improvement as well as maintaining tariff affordability. Second, it employs a financial model designation in analysing data regarding particular existing fiscal policies in

Indonesia. Compared to other utilized measures, the impact of existing and the potential fiscal incentive can be estimated comprehensively. Third, policymakers could understand the kind of fiscal incentives that have effectiveness in increasing investment for renewable energy projects.

The structure of the paper is as follows: Section 2 describes the prior research of incentive policies and their implication, section 3 presents the methods, section 4 discusses the results and brings the main findings into context.

LITERATURE REVIEW

In a new era of energy investment, wind and solar electricity generation have become prominent for renewable energy investors [14]. This is partly because the last decade has seen a marked decrease in electricity costs from renewables, particularly wind and solar energy. There was an 82% decline in the global weighted-average levelized cost of electricity (LCOE) of solar photovoltaics, reaching USD 0.068/kilowatt-hour (kWh), with onshore wind and offshore wind amounting to USD 0.115/kWh (fell 39%) and USD 0.053/kWh (fell 29%), respectively [15]. Both technologies are increasingly out-competed compared to the estimated cost of new fossil fuel-fired projects, which may vary from USD 0.05/kWh to USD 0.177/kWh.

As costs continued to fall, the deployment of wind and solar is still ongoing and dominating the total renewables installations. Worldwide, the installed capacity of solar photovoltaic (PV) is expected to experience a 68% rise from the present to 2025, with the total investment reaching USD 192 billion per year [1]. Meanwhile, there will be an increase of greater than 300% in the global cumulative installed capacity of wind power in 2025, from the remaining period up to 2050 (USD 211 billion/year) [16]. The massive deployment of solar and wind investment cannot be disconnected by investment climate improvement, including technology advancement, up-gradation of electricity generation intermittent management, and high commitment from policy effort. These measures significantly take the lead to costs fall of solar and wind investment.

In years gone by, renewable technology is attributed to the increase in electricity production costs as a consequence of the less-competitiveness of renewable energy systems (RES) technology in most electricity systems [17]. This is no longer the case. Even before taking into account the external costs of coal-fired generation, breakthroughs in solar and wind power have enabled them to rival the capacity of coal generators in providing affordable energy [18]. Furthermore, it was revealed that a number of new solar and wind installations could now compete with the operating costs of coal-fired power stations [19].

Several substantial factors can create a positive environment and leverage renewable energy deployment, such as financial, legislative, political, and fiscal incentives [20]. Financial support is needed due to high initial cost and potential risks related to technology and resource uncertainties. This incentive can be a public sector fund provided through grants or loans [21]. Legislative support to the RE project is related to the importance of clear and legal frameworks for improving investor interest. An example of this support is the Feed-in Tariff (FiT), which supplies renewable generators with a fixed amount of income earned by their projects [22]. In addition, the expansion of renewable energy resources may be promoted through long-standing, nation-wide political backing, which may include national energy policies [23]. Each type of support is necessary for addressing the specific aspects of many RE deployment obstacles.

To overcome these financial barriers, fiscal support is necessary for deploying the renewable project. Particular forms of support could improve renewable energy competitiveness, particularly by addressing the proportion of initial costs from the total plant cost [24]. The intervention is not only essential in nurturing early-stage of RE technology but also can reduce overall RE cost structure [25]. Furthermore, fiscal policies can improve the financial appeal of renewable power projects, in turn enticing independent power productions to consider investing in them. A number of policies, including fiscal incentives, could be employed in the renewable energy market to remedy its shortcomings, according to a dataset from the OECD panel [26].

Under a holistic view, fiscal incentives assume the form of several types of schemes, including tax incentives, subsidies, attractive loans, and a mix of other different strategies (see Table 1). The means of government intervention within the market could be classified into two approaches: price-driven and quantity-driven. The price-driven approach does not impose quantity targets, but rather concerns itself with maintaining electric power generators by way of a financial subsidy per kilowatt (kW) of capacity installed or a payment per kWh of energy produced [27]. In comparison, the quantity-driven approach is contingent on the government, specifically regarding what it desires to be the level of generation or market penetration of electricity from different RES [27]. Market penetration is promoted through this approach, under which the regulators determine the desired quota or goal, as well as the time frame, while allowing competition between generators to dictate prices.

Subsequently, the policies are grouped in more detail based on government specific purposes: investment-incentive and generation-incentive. The investment-incentives aims to enhance the deployment of renewable energy investment. To encourage investment, the implemented policies have to support the financing of independent power producers through investment subsidies, soft loans or tax credits, which can bring down the financial risk and encourage climate investment in the renewable energy sector [27]. Moreover, reformation of fossil fuel subsidies is also important to ensure competitiveness in the energy sector [28]. Incentives, in contrast, place a greater emphasis on expanding renewable energy generation, with their prices being borne by consumers and largely offered as a fixed payment or as a premium per unit of energy generated. Feed-in tariff, feed-in premium, and public biddings are examples of this kind of policy.

Having the advantages, fiscal incentives have been implemented by a certain region/country to support renewable energy deployment. In addition to penalizing the use of fossil fuels due to externalities and recycled it to RE project, several European countries have been delivering tax exemptions, such as for individual investors of wind energy in Germany and reduction of tax on biofuel in France [20]. This particular approach has also implemented in some emerging countries. In China, the government has been delivering support by providing various fiscal incentives. This includes VAT exemption for power installations that utilize municipal solid waste incineration, tax exemption for three years' worth of income for various types of renewable energy (wind, solar, hydro, and geothermal power projects), and it is also possible to finance the import duty and VAT of vital components and raw materials used by local businesses to build wind turbines [29]. As mandated by the Electricity Act of 2003, India has delivered fiscal incentives including tax holidays, 100% depreciation in year 1; concessional import duties, and sales tax exemption [30]. In Brazil, specific tax incentives has been regulated to reduce the cost at phases of construction and operation of renewable energy for electric generation [31]. In the South-East Asian region, some country including Malaysia, Indonesia, Philippines, and Thailand has been implemented several types of fiscal incentives [24]. As of today, the Government of Indonesia (GoI) has actively intervened the renewable energy market through incentive policy aiming to improve market competitiveness. This takes the form of income tax incentives, income tax holidays, import duties exemptions, monetary contributions to green investments, and soft loans to projects. However, the financial strain imposed by these incentive policies has caused them to face stagnation.

Table 1. Comparison between theory and experiment

Schemes	Price-driven		Quantity-driven	
	Investment incentive	**Generation-incentive**	**Investment incentive**	**Generation-incentive**

Tax exemption	Tax carbon emission			
	Tax allowance			
	Tax holiday			
Subsidy	Reformation of fossil subsidy			
	Capital subsidy			
	Rebate			
Attractive loan	Soft loan			
	Partial loan guarantees			
Other schemes	Grant	Feed-in Tariff		Tendering system for long-term contract
		Feed-in Premium	Tendering system for investment grant	Renewable portfolio standard
	Financial Guarantee	Rate-based incentive		Tradable green certificate system
				Quota

The role of fiscal incentives in improving project cost of solar and wind

As is common with other renewable energy technologies, wind and solar are capital intensive. The cost component of both technologies is dominated by the upfront capital cost predominantly referred to as capital expenditure [32], particularly the cost of the turbine itself [33]. Despite the fact that between 2010 and 2019 there was an 82% and 39% drop in the global weighted-average LCOE of utility-scale wind and PV plants, respectively, it nevertheless remains true that the share of different cost components is specific to the country and the project in question. This is particularly true for wind and solar power, where such components involve the country's cost structures, site requirements, and the competitiveness of the local wind and solar industry. Some countries exhibit significant improvement in terms of reducing the cost of renewables. China and India are two countries which have lower capital costs for all generation technology than the global benchmark.

Even though some improvements have been demonstrated in the capital cost of wind and solar projects in other countries, they remain uncompetitive in Indonesia [34]. For instance, in India, China, and Europe, solar PV enjoys a capital cost of below 1000 USD/kW, whereas in Indonesia, it can vary from 700 to 1200 USD/kW [15]. The overall capital cost is ultimately influenced by a variety of factors associated with each capital cost component. As mentioned above, the total investment cost is dominated by expenditures in equipment. In contrast the local content requirements have resulted in the prohibitive prices of solar PV modules, regarded as one of the most expensive pieces of equipment in Indonesian solar projects compared to their non-solar counterparts. It is also worth noting that a lack of sufficient critical infrastructure affects these steep capital costs. Compared to solar PV equivalents, for instance, wind power has an inherently greater reliance on critical infrastructure to be able to transport rotor blades and tower segments. Therefore, the costs of installation and logistics for these components may increase if the turbine is built in an underdeveloped region. Moreover, Indonesia's bureaucratic system, whose process involves the procurement of permits and land access, as well as the entire management of grid access, may exacerbate pre-development costs because these costs also depend on a country's regulatory environment.

Learning from other advanced countries, the decline of project costs with the increased deployment of wind and solar cannot be separated from fiscal policies. On the one hand, new markets have become accessible due to the fiscal instruments now present in some countries, which will in turn usher in a new wave of expansion in solar and wind power that will aid in offsetting costs through the learning effect [16]. Moreover, fiscal policy might also impact the cost component, which may promote further deployment of renewables in the future.

The LCOE of the renewable power plant could be reduced by turning to the international market to ensure lower prices for renewable equipment. Subsequently, some countries grant exemption from import duty in the case of equipment in the power sector. Such an incentive facility would decrease the LCOE at a rate that is 2-5% lower compared to one that involves the adoption of import duties and taxation [34]. Moreover, some countries have introduced a viability gap fund (VGF), intended to bolster an installation's financial viability and appeal to investors through direct assistance. Through capital grant scheme, the VGF would reduce LCOE by 15.7% under the assumption of 20% capital grant injection [34]. Another well-known fiscal instrument is a soft loan, which sets a loan below the market rate of interest, wherein it will cause a notable decrease on the current rate of solar LCOE to the range of 3.5-8 cents USD/kWh [34].

Against this backdrop, this study fills the gap in the existing literature by simulating several types of fiscal policies toward the deployment of renewable energy which is partially installed in remote areas. To do so, this research was conducted in Indonesia, an archipelagic country in which deployment of wind and PV development is still in the initial stage. This particular study is noteworthy for the deployment of renewables, particularly small-medium capacity projects for supporting local energy security.

METHODS

This study proposed descriptive research approach, in which examining how distinct fiscal policy instruments interfere the viability of a particular RE project. This study generally employed multi-approach assessment using simple financial feasibility and cost-benefit analysis. The financial structure of RE projects was modelled to elicit the price by holding the project's net present value (NPV) at a constant level 0 as the least criteria for feasibility. The results were further deployed into cost-benefit analysis to examine the lowest required price for a project to be viable. Fiscal incentive schemes (tax reliefs and subsidies) were incorporated to determine how the policies affect the electricity price. We also performed sensitivity analysis to evaluate the price's response if the policy variables alter by a certain degree.

Data collection

In general, this study aims to simulate the effect of several government interventions through fiscal policy on electricity price generated from the renewable energy power plant. The simulations only focused on solar PV and wind energy as the subject of analysis considering the growing global investment of the two technologies and the Indonesian target to deploy larger scale of solar and wind energy in the next coming years. As the object of observation, this study examined 66 solar PV and wind power plants projects across Indonesia which are listed in the 2019-2028 Electricity Supply Business Plan (RUPTL). All the projects have already signed the Purchasing Power Agreement (PPA) with PLN and are in the pre-construction phase. All projects are assumed to be built in 2020 with the project lifetime of 25 years for solar PV and 30 years of a wind power plant. The standardization of the starting year in 2020 aims to ensure the same cost and price level for all projects, and therefore they are easier to compare. The sample distribution is presented in Table 2.

Table 2. Sample Distribution

RE Technology	Total Project	Capacity (MW)	Total Capacity (MW)	Distribution according to island				
				Sumatra	Java	Kalimantan	Sulawesi	Eastern Indonesia
Solar PV	36	0.25 – 100	581	50%	3%	3%	10%	33%
Wind	30	3.8 – 150	1448	21%	53%	5%	5%	16%
Total	66	0.25 -150	2029	26%	38%	6%	6%	24%

Notes: Eastern Indonesia includes Bali, Nusa Tenggara, Maluku, Papua, and West Papua

Assumptions and data for the cost breakdown were collected from various sources, including review of the extant literature and primary input from RE project developers. We used sample of five RE projects, consisting of two wind and three solar power plants, to define the financial and technical assumptions. A series of in-depth interviews, focus group discussion (FGD) and mini-surveys were conducted directed towards national and international scale RE developers to obtain required information for the cost breakdown. Using the collected data, data interpolation was performed to determine various assumptions used for the financial model. Policy review was also undertaken to evaluate the existing fiscal policy in the RE sector.

Cost breakdown

The main method used in this study is financial model simulation, which further needs the cost breakdown of the project's overall expenditure. As has been mentioned previously that the projects evaluated in this study are in the pre-construction phase, the costs components indicated in here are predominantly based on the project's feasibility study, but some of the cost components are benchmarking to the current operating power plants with several adjustments (e.g., exchange rate and inflation).

As an overview, the cost components of RE power plant project are composed of three main expenses, namely (1) Capital Expenditure (CAPEX) which includes Engineering, Procurement, and Construction (EPC) costs and non-EPC costs; (2) Operating Expenditure (OPEX); and (3) Financing Cost (cost of fund). Value-added tax (VAT) adds up to the overall CAPEX as it is mandatory by the government and typical in each country. As a result, the presence of the VAT component raises the average cost of electricity generated. Furthermore, along with revenue, these cost components determine the price level of electricity.

In general, the regulatory and geographic aspect influence both revenue and the cost of power plants. As regulated in the Indonesian Ministry of Industry Regulation No. 5/2017, solar PV projects are obligated to meet the local content requirement (*Tingkat Komponen Dalam Negeri/TKDN)* which required the power plant projects to use at least 40% locally produced of solar module. According to IESR [4], this will lead to significant increase of solar module as the price difference is quite high, around 27% to 88% between local and imported modules. Meanwhile, the geographic factor is represented as the regional adjustment factor, which will affect certain costs that differ geographically, such as the cost of civil works and land acquiring cost.

Table 3. Summary of General Parameters

Parameters	
Cost of equity	14.98%
Cost of debt	7.00%

Debt to Equity Ratio	70:30
Tax rate	25%
Weighted Average Cost of Capital (WACC) & Discount Rate	8.17%
Inflation rate	3.50%
Exchange rate	Rp14,000 per USD
OPEX escalation	40% higher than inflation
Regional Adjustment Factor	
Sumatera	1.2
Java	1
Kalimantan	1.3
Bali & Nusa Tenggara	1.5
Sulawesi	1.4
Maluku & Papua	1.6

The characteristics of each technology, combined with regulatory and geographical factors, create additional factors affecting the cost components of RE. These features have also been considered in developing the cost structure. For instance, the biogas and biomass power plant require major overhaul after thousands of working hours or after around eight years. Meanwhile, solar PV power plants experience a certain degradation rate which causes decreasing electricity produced annually. Moreover, the inverter of solar PV in general needs to be replaced every ten years.

The proportion of each cost component—investment cost (CAPEX) and OPEX—is also different for each RE. In general, the proportion of CAPEX of solar PV and wind power plant is higher compared to its OPEX, which only account for approximately 1% to 2% of CAPEX cost per annum. Meanwhile, the proportion of OPEX to its CAPEX for biogas and biomass is higher than previous power plants. The OPEX is assumed to increase by 4.9% annually, after adjusted to inflation rate. Understanding this will provide insight into estimating the period of cash disbursement and choice of source of financing along the project's lifetime.

Financial model simulation

The simulation project feasibility through financial model was conducted by employing the Discounted Cash Flow valuation method. This approach will generate the NPV which is fundamentally the result of comparison between cost of initial investment with the present value of potential revenue over the project lifetime. Furthermore, the Internal Rate of Return (IRR) is another commonly utilized indicator to evaluate a project. This is defined as the rate at which NPV equals zero, which means the entire revenue allocated to cover project cost. This study will set the NPV equal to zero, with intuition to make the project developers left without any margin, but the project is still feasible to be executed.

The calculation process started with calculating the investment cost (CAPEX) and operating & maintenance cost (OPEX) over the project lifetime. Then, followed by constructing the income statements and cash flow statement, precede estimating the NPV and IRR. In the case of NPV equals to zero the IRR will be in the same level of the discount rate.

Table 4. Fiscal Policy Interventions

Types of Intervention	Name of Intervention	Mechanism
Tax Reduction	Tax Holiday (Based on the Minister of Finance	Reduction on the organizational income tax: • Investment Rp 100-500 billion: 50% for 5 years, plus 25% for 2 years.

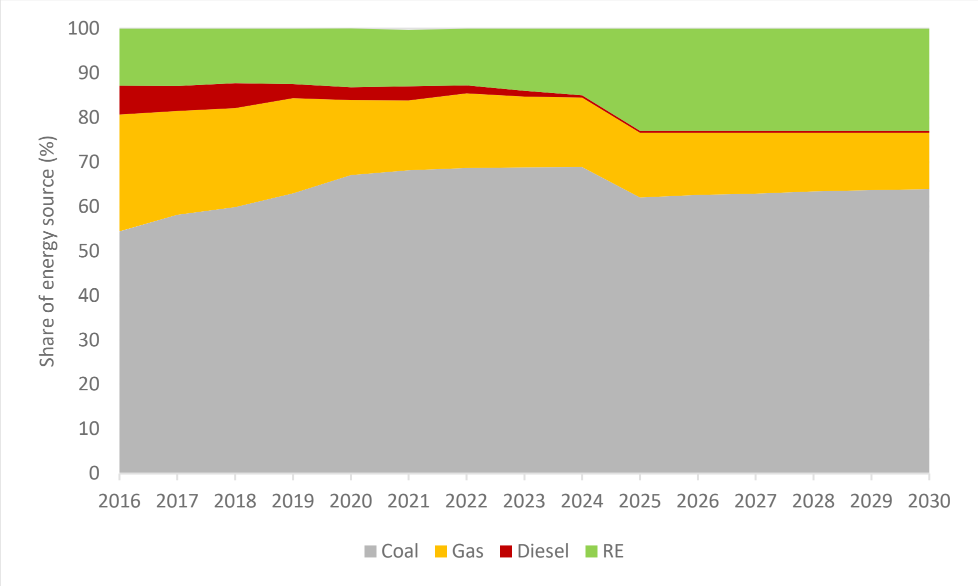
	Regulation No. 150/PMK 010/2018)	• Investment Rp 500 billion – 1 trillion: 100% for 5 years, plus 50% for 2 years. • Investment Rp 1-5 trillion: 100% for 7 years, plus 50% for 2 years.
	Tax Allowance (Based on the Minister of Finance Regulation No. 89/PMK 010/2015)	Scheme: • Reduction on 30% of net income in 6 years, spread equally (5% each year). • Accelerated depreciation, all assets are depreciated in 10 years using straight-line approach. • Loss compensation for a project with more than 5 years and less than 11 years negative profit.
	Reduction on VAT	Reduction on VAT to several levels: 5% and 0%
Subsidy	Cost of Debt Subsidy	Reduction on the cost of fund to several levels: 4% and 3%. Evaluation if an increase to 12%.
	FS Fee Reduction	Reduction on FS fee expense in several levels: 25%, 50%, 75%, and 100%.
	Land Acquisition Cost Reduction	Reduction on land acquisition cost.

The next step of the simulation was to induce fiscal policy interventions in the financial model and evaluate the new price given the government interventions. The interventions are categorized in two groups: tax reductions and subsidies. The tax intervention comprises of the tax holiday, tax allowance, and reduction in value-added tax, whereas the cost of debt subsidy (soft loan), exemption of land acquisition cost, and project development facility (only focuses on feasibility study (FS) expense deduction) compose the subsidy regulation. Furthermore, the list of fiscal interventions can be found in Table 4.

RESULT AND DISCUSSION

For decades, Indonesia's electric power industry has been managed solely by Perusahaan Listrik Negara (PLN), a state-owned monopoly, which has various business units that carry out functions involve generation, transmission, and distribution. However, to meet the skyrocketing electricity demand since the 1980s, the government had taken action to deregulate the power market structure and introduce competition in the power sector [35]. The 1985 electricity law signified the start of the structural reform that contributed to the opening up of the electricity market to private investors, but it had little impact on administrative governance structures [36]. Indonesia began allowing Independent Power Plants (IPPs) to take part in the electricity industry in 1992, notably in the power generation business units.

In 2020, the government stipulated a mandate to PLN to expedite the provision of electricity across the country and aim for a 100% electrification rate through the construction of power plant projects using renewable energy, coal, and gas. The programs include Fast Track Program (FTP) I, FTP II, and 35 GW Program. In response to the mandate, private investors were invited to leverage their involvement in Indonesia's power industry by participating in the construction of power plants, including the related transmission lines, and for PLN to purchase the electricity and therewith, in a limited permit, supply end users. In the future trajectory, the role of the private sector is expected to be more salient as IPP-owned power plants are projected to outgrow PLN's power generators—more than 75% of private ownership in the 35 GW program. Furthermore, the deployment of renewable energy projects increases the demand for private investments significantly [37].



*note: 2021-2030 are projected numbers, under optimal scenario

Figure 1. Electricity Energy Mix, 2016-2030

Following the government's climate commitment to cut 29% of carbon emissions (approximately 834 million tons of CO_2) compared to the baseline by 2030, the electricity sector is targeted to achieve 23% of renewable energy share by 2025. Figure 1 depicts how electricity energy mix change over the last six years and projection for future trajectory. For decades, coal-based electricity has dominated national's power industry, occupying a lion's share of just above 66% in 2020 and are projected to rise until 2024 up to 68%. Meanwhile, diesel power plant is pushed down to the minimum level. Nonetheless, despite the country's effort to achieve the climate pledge, contribution of renewable energy generation did not exhibit any significant improvement during the past couple of years. In 2020, RE only contributed 13.2% and is forecasted to have a paltry incremental before expected to achieve 23% in 2025. The slow deployment of renewable energy power plants in Indonesia is influenced by several convoluted conditions such as an unfavorable pricing scheme, uncertain regulation and the business climate [38].

Utilizing a financial model, the impact of existing and potential fiscal incentives on the feasibility of solar and wind projects in Indonesia was estimated. By doing so, 66 solar PV and wind power plants projects across Indonesia which are listed in the 2019-2028 Electricity Supply Business Plan are examined.

Tax reduction

The tax reduction policy consists of tax allowance, tax holiday, and VAT reduction. Each intervention derives a different level of price change. Tax allowance resulting in higher level of price change followed by tax holiday and VAT reduction. However, the price elasticity is different in each type of technology for each policy intervention. According to [32], the price distribution of solar PV is huge compared to wind due to the wide capacity gap in solar PV projects (see Table 2), but the tax allowance as an intervention has consistently reduced price of both renewable energy sources.

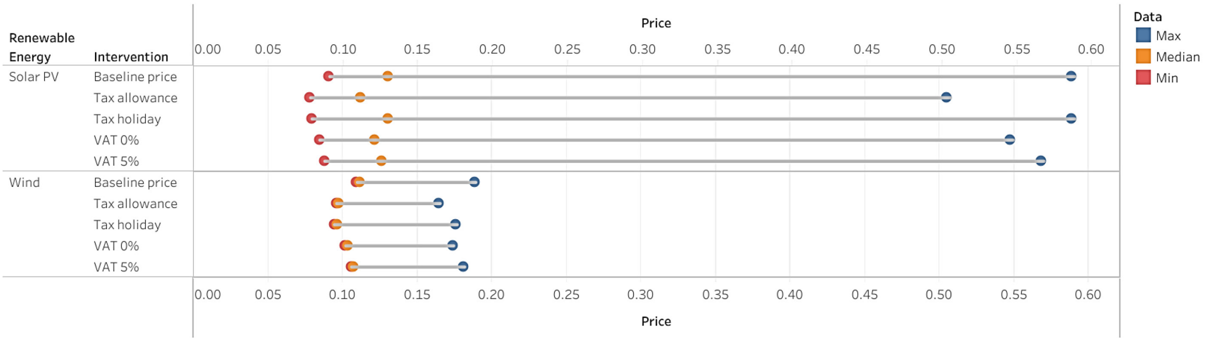


Figure 2. Price Distribution of Solar PV and Wind Projects as a result of Tax Reduction Policies

Tax allowance. This typical policy has been implemented since 2015 through the Regulation of Minister of Finance No. 89 Year 2015, which regulates reduction on the net income for tax calculation as well as a set of asset depreciation and loss compensation setting for several key sectors in Indonesia, including renewable energy. This arrangement enables a project to be eligible for income tax exemption in the early stage of project operationalization. Based on the simulation result, with the application of tax allowance in RE power plant project, the electricity price drops on average 12.63% for wind and is even greater for solar PV at 14.3%. This price change is the highest compared to other fiscal policy intervention which is observed in this study. Furthermore, referring to information received from the Fiscal Policy Agency, tax allowance is the most applied facility by RE power plant developers due to ease of application and less complicated requirements.

Tax holiday. The tax holiday is a particularly new facility to the energy sector which was introduced in 2018 through the Regulation of Financial Minister No. 150 year 2018. The facility offers an income tax reduction for a project with specific requirements, notably in the amount of initial investment. This facility is less favorable because not all projects are qualified to be rewarded the incentive, and thus it has a low rate of applicants. Simulating a tax holiday in the financial model, the outputs present a declining price rate on average of 11.9% and 8.8% for wind and solar PV, respectively. Similarly, a study conducted by the Fiscal Policy Agency in 2018 indicated there is a 2.11% increase of project IRR using the tax holiday facility.

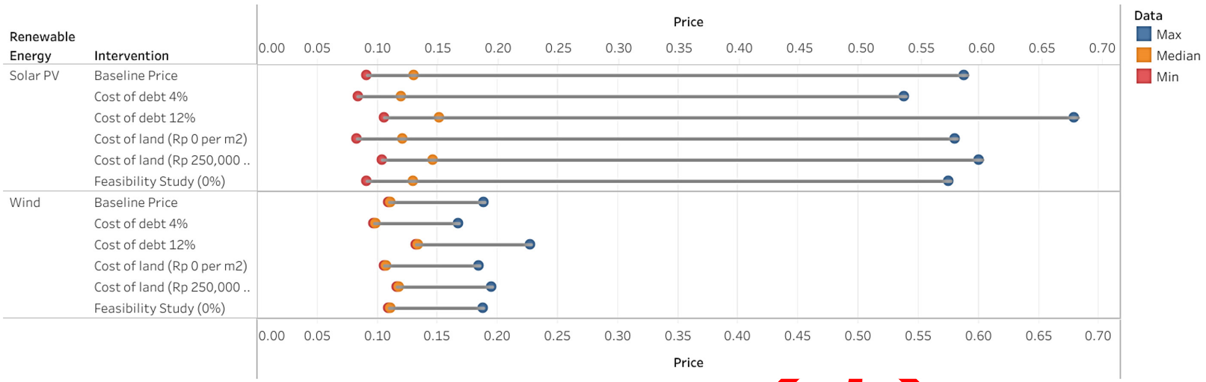
The price reduction for Solar PV in the tax holiday scheme is significantly lower than price reduction resulted from tax allowance. This is because of the minimum initial investment requirement causing many solar PV projects being not eligible to apply for the tax holiday, given their small scales project and lower investment, whereas small scale projects essentially have the potential to escalate the electricity rate, particularly in remote areas. Hence the facility is fundamentally needed to increase project feasibility.

VAT Reduction. The government has set a 10% value-added tax for imported components and civil works. Although this value makes up only a small portion of CAPEX, for small scales project this might be very considerable if it can be eliminated. Reduction of 50 % VAT shrinks electricity prices on average 3.6% for both solar PV and wind energy, while fully exempted VAT drops the price to on average 7.2% relative to the basic price with no facility applied. Fiscal Policy Agency found that delivering import facility to RE power plant project allows IRR to rise to 3.62% for solar PV power plants.

Subsidy

The subsidy schemes simulated in this study—the cost of debt, cost of land, and fee for undertaking the feasibility study—have different impacts on the prices of solar and wind power plants. On average, solar prices are more sensitive to subsidies, except for the cost of debt, compared to wind prices. According to Figure 3, the price distribution of solar PV and wind significantly varies for each subsidy intervention, but the cost of debt rising from baseline (7%) to 12% caused the highest increase in median prices compare to other interventions.

Figure 3. Price Distribution of Solar PV and Wind Projects as a result of Subsidy Intervention



<u>Cost of Debt.</u> The reduction in the cost of debt from 7% to 4%—referring to the interest rate of the international loan for developing countries—could, on average, reduce wind power plant prices by 11.34 % and solar prices by 8.63%. However, when this cost increases from 7% to 12%—referring to domestic loan interest rate—on average, it can increase wind prices by 20.38% and solar prices by 15.56%. This shows that an increase in the cost of debt has a more price-sensitive impact, thus expanding access for developers to get funding at low cost is crucial.

The limited capacity of public funding to support massive renewable energy deployments in Indonesia is a strong reason to encourage private sector investment to take part [38]. Capacity or scale is noteworthy because private international finance is not suitable for funding small capacity projects [39], such as solar power plants in remote areas. However, it is critical to understand as well that the high cost of borrowing is also caused by the efficiency and competitiveness of the renewable energy market and domestic market maturity level [15], even policy instability, particularly in the long-term horizon [40].

<u>Cost of Land.</u> Considerable land requirements are one of the challenges in developing these types of RE because the existing scheme in Indonesia forces the developer to acquire land instead of leasing. Land prices also vary widely in each region, such as the densely populated island of Java which is the center of the Indonesian economy, can be many times more expensive than the eastern region of Indonesia. The impact of an increase in land prices from IDR 100,000 per m^2 to IDR 250,000 per m^2 on average could increase the price of solar plants higher than wind, reaching 11.87% and 5.67%, respectively, due to the higher land requirements per megawatt (MW) of solar power plant compared to wind. Apart from land access [6], the project location will also depend on the location of potential wind and solar irradiance, which makes the location can be anywhere, including in forest areas, as in the initial stage of the Sidrap project which had problems related to land acquisition [41]. Notable alternative schemes to meet land requirements are by collaborating with local governments through public-private partnership (PPP) scheme, engage with corporations whose access to sufficient land holdings, or accumulate land from local communities [39]. In addition, the government should understand the urgency of fixing issues related to the land procurement process, such as unregistered land and overlapping permits that have the potential to cause conflicts, even project cancellations, such as what happened in the wind plant project in Yogyakarta [6].

Fee for feasibility study. Developers face a dilemma when undertaking a feasibility study. FS needs to be performed before the developer participates in a tender by the government, which makes this cost becomes sunk cost when the project does not pass the tender and reaches the power purchase agreement. FS is also a requirement in PPA, one of which is used as the basis for determining the point to install the metering system. As one of the most commonly offered project development facilities by governments or international financial institutions, the simulation results show that eliminating FS costs in the electricity generation cost structure has slightly impact, 1.32% and 0.19% for solar and wind plants, respectively. Although it does not give a substantial impact to the price, however, a good feasibility study document through a series of project development facility is potentially improving project's credibility, hence it will help the project to be more bankable. The availability of de-risking instruments can aid in reducing financing costs, as was the case in India [6].

Simulating six types of fiscal incentive scenarios using a financial models of solar PV and wind in Indonesia, the findings generate two major outcomes. It is found that tax holidays and tax allowance significantly would lower electricity price compared to subsidy incentives, holding other types of incentives are adjusted in a certain level as assumed in this study. Then, the solar PV project is relatively more sensitive in response to fiscal intervention compared to wind technology. For instance, with the same level change in land acquisition cost, solar PV has two times higher change in price than wind power plants. One of the reasons is due to the fact that the majority of solar PV power plants are built on a small scale, so they are highly elastic in terms of cost alteration. The particular result indicates the effect of the fiscal intervention on the electricity price generated from renewable energy power plants varies depending on the type of incentive. Different features of the project, such as the project's scale and location, contribute to the variation of the examined electricity price.

This finding is consistent with those of other studies that investigate fiscal incentives in another region. Imposing a 50% value-added tax for solar power plant developers could boost solar power plant investment in China [42]. In addition to tender and feed-in tariff policy, tax incentive has also increased capacity deployment of renewable energy in the EU and US [10]. The intervention effect on the return of renewable energy investment. The particular effect is necessary since to support renewable energy deployment through private finance mobilization, an effective policy should address risk and return dimensions [26]. It leverages renewable energy competitiveness by addressing initial costs proportion [24]. Having such significance, tax incentives are associated with uncertainty, since it is related to government budget availability as well as fiscal decision change [11]. Therefore, the intervention is essential in nurturing the early-stage of renewable development, such as in Indonesia [25].

CONCLUSION

To date, fossil fuels are still dominant at more than half of the current Indonesian energy mix. The creation of an enabling environment for renewable energy investment is expected to boost RE deployment as well. This can be start by supporting the elements of RE competitiveness, such as enacted the favorable policy for RE, and overcame the financial and market barriers. Utilizing the state fiscal incentives is believed can close the gap of electricity generation cost between renewable energy and fossil fuel. Therefore, this study focuses on simulating the effect of several Indonesian government interventions through six different fiscal incentive scenarios on electricity prices generated from the renewable energy power plant.

This study found two major findings. The tax reduction policy—specifically the tax holidays and tax allowance—generates significant lower electricity price compared to subsidy incentives. In terms of renewable energy technology, the solar PV has higher sensitivity to fiscal intervention compared to wind. The varied scale and different location contribute to the variation of generated electricity price. The combination of various fiscal policies might potentially induce the private investment required to achieve the 23% of RE proportion target by 2025. However, in the long term, it is necessary to create a pathway for lessening government intervention and creating market-based mechanisms in the Indonesian RE market. Nevertheless, the fiscal intervention is essential to promote investment and reduce the perceived risk of investor in the initial stage of Indonesian renewable energy development.

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