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A Roadmap for Indonesia Renewable Energy Development to Achieve the APEC Doubling Goal in 2030

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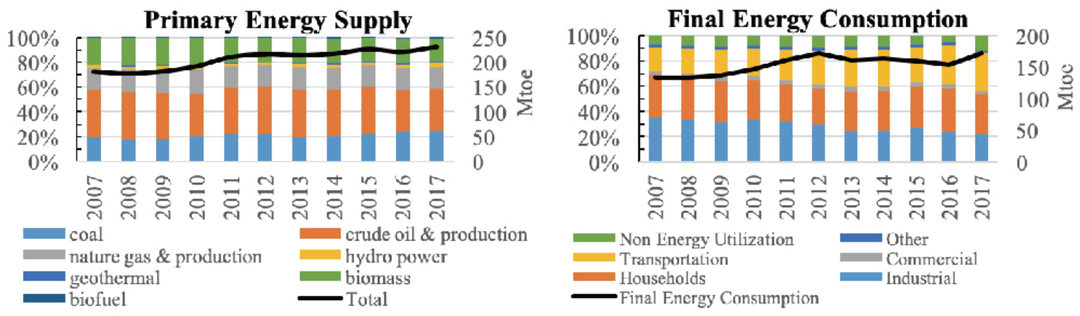
Abstract

Indonesia is among the world's fastest growing countries in terms of energy consumption, and there are abundant renewable energy resources in Indonesia, which make Indonesia an important role for reaching the APEC renewable energy doubling goal, which were set In the APEC Leaders' Meeting in 2014 and the APEC Energy Ministers' Meeting in 2015. Therefore, the research will focus on the renewable energy development and related strategies in Indonesia, and analysis challenges and provide recommendations for its future development.

1. Current Energy Status

In 2017, the total primary energy supply in Indonesia reached 231 Mtoe, which is a historical high since the recant ten years. The main sources of primary energy supply come from crude oil (34%), coal (25%), biomass (19%) and nature gas (17%). Hydro power, geothermal and biofuel account for the rest 5% of the total. The supply from coal has increased 5% since 2007, and the supply from crude oil has decreased 3% in the same period.

Indonesia is the largest energy user in the ASENA region, accounting for 41% of total final energy consumption (TFEC) in 2017 (ACE, 2017). The total final energy consumption in 2017 reached 173 Mtoe. Among the total consumption, households sector accounts for around one third of the total, the proportion of transportation sector has increased from 18% to 29% since year 2007 to 2017, and industry sector accounts for 22%, which has decrease 13% since 2007. The main energy type of consumption is fuel, which accounts for 45% of the total, and followed by electricity (17%), natural gas (13%), biofuel (10%), LPG (8%) and coal (7%).



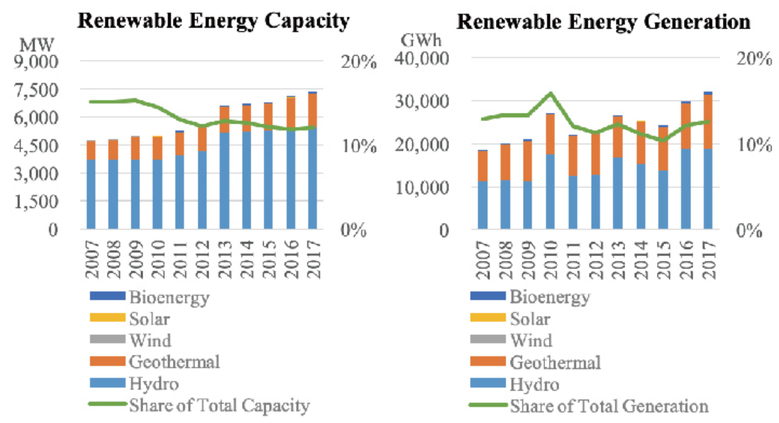
Source: MEMR, 2018

Figure 1 Primary Energy Supply a nd Final Energy Consumption

2. Renewable Energy Development

2.1 Current Status of Renewable Energy Development

According to the latest statistics from MEMR, the total on-gird generation capacity in Indonesia is 60 GW in 2017, renewable energy accounts for 7.3 GW, which is 12%; and the on-grid power generation is 254 TWh, renewable energy accounts for 32 TWh, which is also around 12%. The total renewable energy capacity has increased 57% since the year 2007; however, the share of renewable energy in total installed capacity has decreased from 15% to 12%. The reason for the decline is due to the growth of the total capacity, which has increased 97% during the decade. Figure 2 breaks down the renewable statutes in total power plant installed capacity and generation. It shows that among all types of renewable energy, hydro and geothermal are two most important renewable energies for Indonesia.



Source: MEMR, 2018

Figure 2 Renewable Energy in Total Power Plant Installed Capacity and Generation

2.2 Target for Renewable Energy

The draft National Electricity General Plan (RUNK) 2015-2034, which was issued by MEMR, presented the specific targets for various renewable energy technologies in different sectors by 2025 (Table 1). The target for renewable energy in TPES is 23%, and the target for renewable energy in power generation is 25%.

Table 1 National Targets for Indonesian Renewable Energy Development by 2025

Items	Targets for 2025	Items	Targets for 2025
Overall targets		**Power Sector Targets**	
*Renewable energy in TPE	23%	Large Hydropower	18.3 GW
Renewable energy in power generation	25%	Small Hydropower	3.0 GW
Ethanol blending		Bioenergy Power	5.5 GW
Transportation	20%		
Industry	20%	Geothermal Power	7.1 GW
Biodiesel Blending			
Transportation	30%	Solar PV	6.4 GW
Industry	30%	Wind Power	1.8 GW
Electricity	30%	Ocean Power	3.1 GW

***excluding traditional uses of bioenergy** **Source: IRENA, 2017**

2.3 Potential of Renewable Energy

The total potential for renewable power in Indonesia was estimated as 484.9 GW by the Indonesia government. However, According to the research from IRENA, the total potential was estimated as 716.4 GW (IRENA, 2017). The potential of solar PV is the one caused in such difference, there are 324.7 GW gap between government and IRENA; besides, the potential of marine and wind energy also have different measurement basis, which will be illustrated in the following section.

Table 2 shows the total potential of renewable power in Indonesia by different energy types. It can be seen that more than 70% of the renewable power potential concentrated in Sumatra, Kalimantan and Maluku & Papua. Java-Bali, where is the area that demand most energy consumption in the country, only processes about 10% of renewable power potential. Moreover, the table also presents that solar PV and hydropower are the two types with the highest potential for power generation.

Table 2 Total Potential of Renewable Power in Indonesia **Unit: GW**

Area	Solar PV	Large Hydro	Small Hydro	Bioenergy	Geothermal	Marine Energy	Wind	Total
Based on IRENA's Research								
Sumatra	137.1	15.6	5.7	15.6	12.9	8.3	1.0	196.2
Java-Bali	38.7	4.3	2.9	9.2	10.1	2.4	3.9	71.5
Kalimantan	149.0	21.6	8.1	5.1	0.2	-	0.3	184.2
Sulawesi & Nusa Tenggara	66.8	10.8	1.8	2.6	4.8	6.9	3.9	97.6
Maluku & Papua	140.9	22.8	0.8	0.2	1.5	0.4	0.3	140.9
Total	532.6	75.0	19.4	32.7	29.5	18.0 (tidal)	9.3 Onshore	716.4
Based on Indonesian Government's Research								
Total	207.9	94.5		32	29.5	61	60	484.9

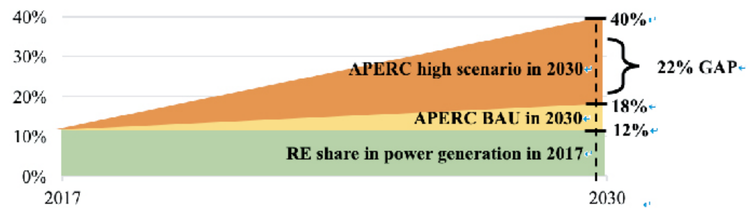
Source: IRENA, 2017; IRENA, 2016

3. Gap of Reaching the Doubling Goal

3.1 Gap Calculation Based on APERC Outlook

The Asia Pacific Energy Research Centre (APERC), which was established to conduct researches to foster understanding among APEC members of regional energy outlook, market developments and policy, published "APEC Energy Demand and Supply Outlook 6th Edition" in 2016. In this report, it calculated the gap of all APEC economies to achieve the APEC doubling goal in high scenario, which is 808 GW. For Indonesia, the BAU 2030 of renewable energy share in power generation was estimated as 18% (82 TWh).

Figure 3 presents the share of renewable energy in power generation in 2015, and the gap of share between APERC BAU 2030 and high scenario 2030. In APERC high scenario, the renewable energy share of power generation will reach 40% (187, TWh), which means there are 22% gap with BAU 2030. For installed capacity, APERC BAU 2030 predicted the capacity of renewable energy is 20 GW, and in high scenario the capacity will increase to 43 GW. Accordingly, to reach the target of APERC high scenario 2030, Indonesia needs to increase 23 GW renewable energy in power capacity.



Source: APERC, 2016; MEMR, 2018

Figure 3 Gap of RE share in Power Generation according to APREC

3.2 Utilization of Renewable Energy Potential

According to the analysis for the utilization of renewable energy potential in 2017 and in APERC High Scenario 2030, it can be seen that according to the power capacity in 2017, the current utilization of total renewable energy potential is less than 2%, and based on capacity of APERC High Scenario 2030, the utilization is 8.8% in government's potential and 6% in IRENA's potential. The total potential form government's estimate is 484.9 GW, which means in APERC High Scenario, there are still 442 GW renewable energy potential are not developed. Moreover, the total potential estimate by IRENA is 716.4 GW, therefore the remaining potential will be 6673. The huge remaining potential which were calculated above indicated that theoretically Indonesia is able to develop renewable energy to fill the gap and to achieve the APEC doubling goal.

4. Strategies and Recommendations

Indonesia has abundant and diversified potential of renewable energy, and according to the current utilization which has been illustrated above, only a small fraction has been developed. The situation indicated that there are full of opportunities for Indonesian government to promote renewable energy, and the government also set the ambitious goal. However, there are some barriers in Indonesian energy market which might impede the development of renewable energy. The research will provide some recommendations to remove the barriers or to improve the difficulties and situations which are caused by those obstacles.

Table 3 Challenge and Recommendation for Developing Renewable Energy

Challenge	Recommendation
Geographical mismatch in resource potential and energy demand	■ Consider the utilization of hybrid system and energy storage technology in the rural areas.
Difficulty in obtaining land	■ Land Ownership Investigation ■ Specific Areas for Renewable Energy Projects
Limited infrastructure in rural and remote areas	■ Evaluate the areas which possess most potential or require most energy supply, and improve the local infrastructure. ■ Provide direct grant or subsidy for developers for constructing local infrastructure
Insufficient historical data for exploration	■ Establish inter-cooperation between agencies. ■ Establish specific projects for data collection, and published relevant information to developers for project assessment.
Limited financing projects provides	■ Increase awareness at commercial banks of opportunities and clear signals on long-term support for renewable. ■ Provide loan guarantees, drilling insurance, direct grant or revolving fund to further lower the risk to investors.
Lack of coordination between stakeholders	■ Establish one stop shop services for tendering. ■ Provide capacity building for local government. ■ Establish a dialogue mechanism with relevant actors, including the investors, developer, etc.
Lack of technical experiences and human resources	■ Put more resources for R&D, formulate incentives measures to encourage technology research. ■ Cooperate with foreign companies which possess advanced technologies and abundant experiences.

5. Conclusion

Theoretically, Indonesia has sufficient resources for developing renewable energy; however, there are some major obstacles for the government to promote renewable energy. The government need to overcome the barriers through reformulating national targets, policies and regulations, through interdepartmental cooperation, and through multilateral negotiation.

Besides the effort from the local government, as a member of APEC, ASEAN and other international organizations, Indonesia could establish a long-term, beneficial and cooperation relation with other economies. Through the perspective of an international organization like APEC, it's significant to agglomerate sources from each economy, and plan a comprehensive picture which could reach the best interest for each economy.