World Agroforestry Centre

Exploring the potential of bioenergy in Indonesia for multiple benefits

Synthesis of the International Workshop on Developing Science- and Evidence-based Policy and Practice of Bioenergy in Indonesia within the Context of Sustainable Development, Bogor, 14 February 2017

Photo: World Agroforestry Centre/Robert Finlayson

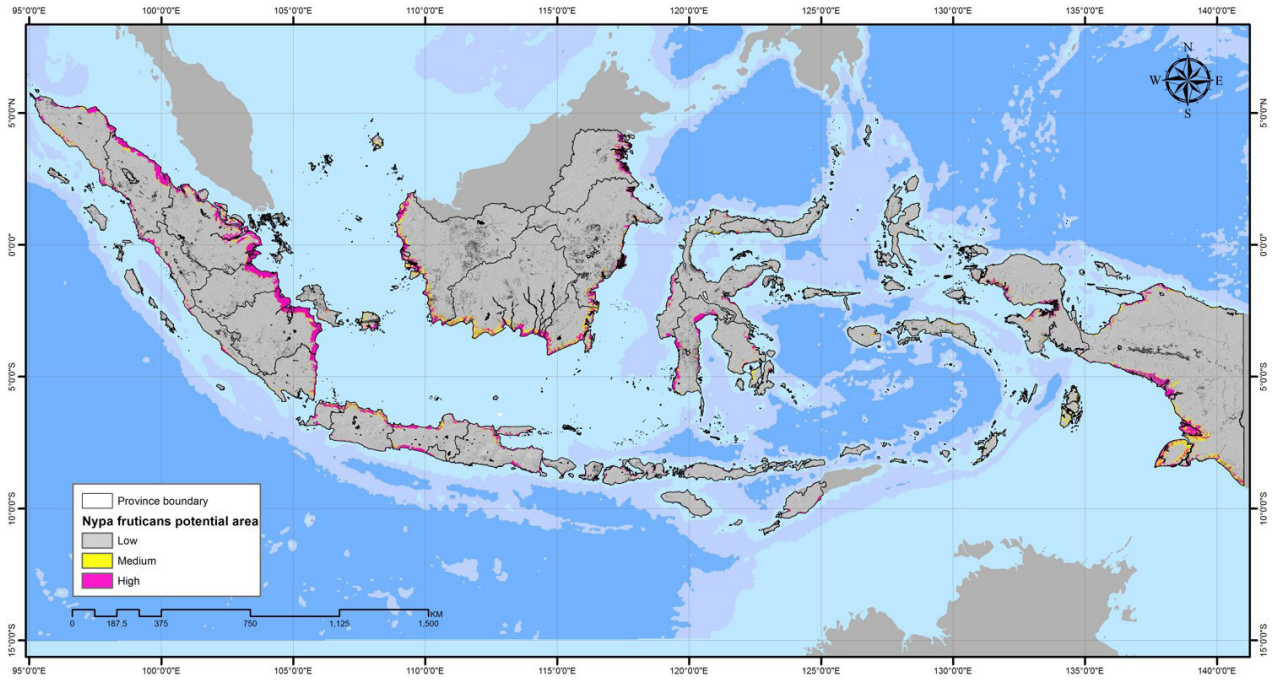
Introduction

Indonesia has committed to provide energy to all its population through the National Energy Policy (*Kebijakan Energi Nasional*). The policy highlights the importance of diversification, environmental sustainability, and enhanced deployment of domestic energy resources. Diversified energy supply should include oil, coal, gas, and new-and-renewable energy (NRE). The contribution of NRE to the nation's energy supply is mandated to reach 23% by 2025. Indonesia has also made commitments internationally to align energy provision with sustainability, as stated by the President of Indonesia at the Twenty-first Conference of Parties to the United Nations Framework Convention on Climate Change in 2015, along with a commitment to further reduce net greenhouse-gas emissions.

Bioenergy is an important renewable energy alternative. It is defined as energy produced from plant biomass and plant-derived residues and waste (Souza et al 2015). Modern bioenergy carriers include liquid biofuels—such as bioethanol and biodiesel—as well as solid biofuels, biogas and bioelectricity (http://www.ebtke.esdm.go.id/). Bioenergy sources include forests, crops, livestock and urban and industrial waste. The use of biomass resources requires integration with multiple activities in rural and urban areas.

Table 1. Main points and policy implications

Main points	Policy implications
• Bioenergy research has made progress in Indonesia although the knowledge is scattered and not easily accessible. A major challenge lies in achieving wider deployment.	• Boundary organizations can help with collating research results and making them accessible to policy makers and practitioners. Government and the private sector could build on the research by initiating larger-scale tests of the findings, including any pilot studies, to speed the achievement of economies of scale
• Enabling conditions need to be addressed, including policy, regulation and financing.	• Government policies and regulations should be responsive to the need for bioenergy uptake and pricing, bearing in mind local and provincial contexts.
• Bioenergy development and uptake should be put in context. It could range in scale from off-takes by major power or fuel companies to small-scale energy solutions in remote areas.	• The development sector, government and non-governmental bodies should together map contexts, especially, energy needs and feedstock, and create enablers at local levels for energy sufficiency.
• Bioenergy provisioning should be seen as one component in multi-functional land use or waste recycling systems and create synergies with other environmental and development agendas.	• Bioenergy should be taken into account in planning and development pathways. A multi-sectoral approach should be made through the planning processes with multiple partnerships.



Potential distribution of *Nypa fruticans* in Indonesia. Source: World Agroforestry Centre

The International Workshop on Developing Science- and Evidence-based Policy and Practice of Bioenergy in Indonesia within the Context of Sustainable Development was held to contribute to achievement of the target of 35 GW of electricity production for all of Indonesia and to explore ways to enhance collaboration for bioenergy development. The workshop aimed to increase awareness of the state of bioenergy research and development; identify gaps, bottlenecks and challenges in developing bioenergy value-chains and uptake; and provide input and recommendations for creating enabling conditions to address the challenges.

This policy brief has been developed based on four major points from the workshop and the role that policy can have in addressing the challenges and promoting bioenergy (Table 1).

1. Bioenergy research in Indonesia has made good progress but wider application remains to be achieved

The state of bioenergy research, technologies and development in Indonesia shows good progress in testing an innovative variety of energy sources and in cross-sectoral collaboration in developing such initiatives. Effort has been put into multiple aspects of bioenergy development: from technological perspectives through to exploration of business models for small- and medium-sized enterprises. Collaboration on biomass energy has made progress across government, for example, through the Timber Plantation for Energy scheme (Hutan Tanaman Energi/HTE) established together by the Ministry of Energy and Mineral Resources and the Ministry of Environment and Forestry. Other examples at smaller scale include research and piloting work with nipa palm (*Nypa fruticans*) for bioethanol and with bamboo for electricity generation.

The larger-scale use of bioenergy for fuel and power generation has shown varied progress. Amongst the pilot work across Indonesia, issues surrounding off-take by the state-owned enterprise have been quoted as the main challenges. These include distance and provision of infrastructure between sites of power generation and the main electricity grid as well as price for bioenergy electricity, which typically needs to be higher than the price paid by the state-owned enterprise. Uncertainty of feedstock availability and fluctuating prices are also factors hampering use of biomass for larger-scale electricity production.

Biodiesel from oil palm is part of the national fuel supply and is also exported to Europe. The achievement of a mixture of 20% methyl ester from palm oil in Indonesia's biodiesel (B20 Program) is one of the highest in the world. Abundant feedstock and established infrastructure form a substantial part of the success factor. Volatility occurs from competition with fossil fuel. Decreases in global oil prices are major challenges for producers.

2. Enabling conditions need to be addressed, including policy, regulation and financing

Biomass and biofuel production and uptake face various challenges to achieve wider scale, not the least of which is the link between guaranteed availability of feedstock and increased risk of land conversion.

The second is the initially high investment in the production chain. Third, despite some progress with the B20 biodiesel, lack of engagement by major industry off-takers, such as PLN for electricity and Pertamina for

fuel, is still quoted as a major challenge. The underlying reason is competition from the lower price of fossil fuel. Other sources of biodiesel have never taken off from pilot stages for the same reason. The failure of jatropha (*Jatropha curcas*) biodiesel in 2005–2007 was mainly owing to the absence of supporting factors for implementation.

Concomitant with the above, a specific challenge for small-scale producers is a general lack of access to the biodiesel production chain.

To address these challenges, key enabling conditions need to be identified. One such is 'incentives', which broadly covers provision by the government of subsidies, infrastructure and low tax. Another aspect of incentives is provision of mutual benefits to the various people who interact in the production, provision and use of bioenergy. Mutual benefits, such as rewards for ecosystem services or through public-people-private partnerships and other interactions between government, the private sector and communities, can serve as indirect incentives.

3. Bioenergy development should be put in context

Challenges have been identified and need to be addressed, in context. In areas remote from the main population areas, energy supply and electrification rates are both low. Challenges faced by the major off-takers, such as PLN and Pertamina, should not stop provision to areas where need and production can be harmonized via a different strategy.

The geographic focus for bioenergy development should take into account competitiveness with fuel and power generated from fossil fuels. For example, with low fossil-fuel prices, bioenergy cannot compete on an island like Java, which has a high population and relatively good infrastructure. Yet in areas where electricity price per kilowatt-hour is very expensive and the fossil-fuel price very high, which is typically the case in the outer islands, bioenergy is more likely to be competitive.

Bamboo is a very common plant in rural communities. It features fast growth and regrowth and has good properties for bioenergy production. Photo: World Agroforestry Centre/Riyandoko

Priority areas for development of bioenergy should be based on local needs (for example, level of electrification in the area) and resource availability, including suitability of trees, crops and wastes as feedstock. Consideration of the context should also include analysis of existing enabling conditions, such as any instruments that have been locally developed. Work plans of forest management units, community-based forest management schemes or restoration programs are all possible sources of information.

4. Bioenergy should be aligned with other environmental and development agendas

Other environmental and development agendas can provide a ground for synergies with bioenergy development so that bioenergy can add value as a bi-product or co-benefit.

For example, restoration of degraded or marginal land could provide income, fuel and energy for communities by selecting species that are suitable as bioenergy feedstock that can be sustainably harvested. Specific examples include bamboo for stabilization of sloping land and river banks and for biomass power generation; nipa palm and 'nyamplung' (*Calophyllum inophyllum*) for coastal protection or restoration and for bioethanol and biodiesel production, respectively; and various tree species for agroforestry for local livelihoods and food security as well as for production of energy from biomass. These kinds of integrated systems also reduce pressure on arable land and native forests.

Schemes under the Social Forestry Program, such as Hutan Kemasyarakatan (community forest) or Hutan Tanaman Rakyat (community timber plantation), have the potential to be sources of biomass. Included in any such synergistic scheme should be the development of business models for small- and medium-sized enterprises (SMEs) and local capacity building.

Across Asia, around 300 million tonnes of rice straw are burned as waste every year. Using this as a bioenergy resource could provide clean, renewable energy in rural areas. Fermenting it to make clean biogas fuel is one example. Biogas is a versatile fuel that can be used as clean cooking gas, or for electricity production, or even for transport fuel. Photo: World Agroforestry Centre/Robert Finlayson

Group photo during International Bioenergy Workshop. Photo: World Agroforestry Centre/Riky Mulya Hilmansyah

There is large potential for the use of rice straw as feedstock for biogas. No additional investments are required to produce feedstock, no additional land is required and there is no competition with food crops. The synergy involves waste utilisation and, hence, multi-functionality within a landscape.

Bioenergy development, especially with oil palm, should be guided by sustainable land-use practices and governance to ensure alignment with environmental and social safeguards, including enhancing local livelihoods and compliance with low carbon-emission, 'green' growth policies.

Conclusions and ways forward

Bioenergy has a huge potential for development in Indonesia. It is linked to forestry, agriculture and urban waste management. In order to realize existing potential, enabling conditions (for example, policies and regulations for incentives, price guarantees and subsidies) need to be created along with their associated governance structures at different levels. Research findings have to be taken from experimental scale to pilots and wider implementation. Research and development organizations need to engage with the private sector and other practitioners to develop innovations and business models at appropriate scales and in most suitable contexts (for example, particular geographical areas that are economically and socially attractive for bioenergy development). Finally, development of bioenergy should be planned in the context of sustainability, including green-growth planning, climate-change mitigation and adaptation, and achievement of the Sustainable Development Goals. Bioenergy development in Indonesia can make a strong contribution to the Bonn Challenge, a global effort to restore 350 million hectares by 2030, and the nationally determined contributions committed under the United Nations Framework Convention on Climate Change for reduction of greenhouse-gas emissions.

Reference

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