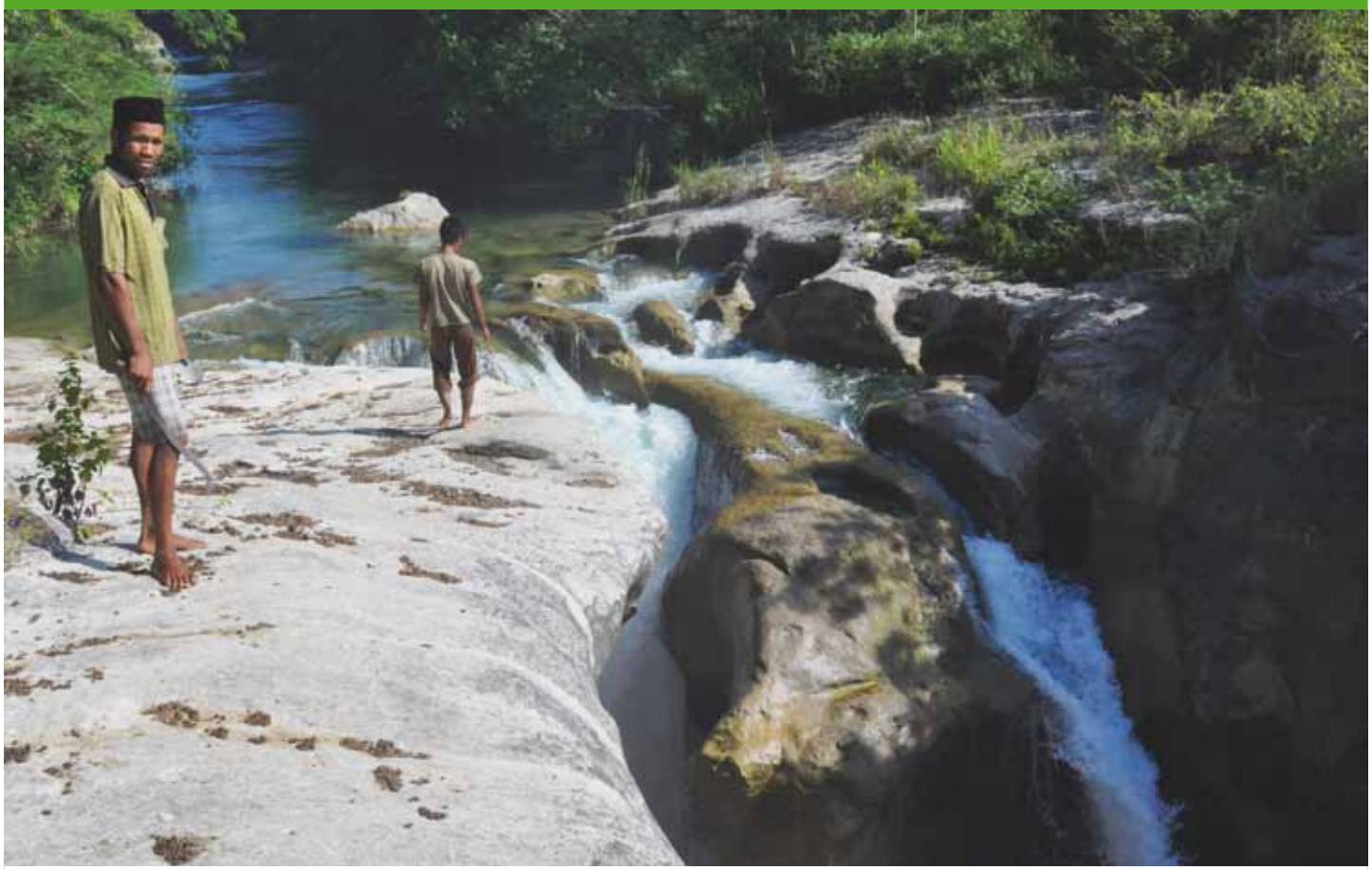

SUMBA: AN ICONIC ISLAND TO DEMONSTRATE THE POTENTIAL OF RENEWABLE ENERGY

Poverty reduction, economic development and energy access combined

With update January 2012

Hivos
people unlimited

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Foreword

Providing the population of a medium sized Indonesian island with 100 percent renewable energy. Improving the quality of life for hundreds of thousands of people in small island communities. Stimulating economic development as well as taking concrete steps towards addressing climate change. These are but a few of the intended outcomes of the Iconic Island project, developed by development organisation Hivos.

While ambitious, our research shows that the idea of the Iconic Island is neither impossible nor utopian. We are confident that this project is highly realistic and technically and economically feasible. Moreover, the preliminaries have been very well received by various stakeholders both in Indonesia and the Netherlands.

This brochure presents the Iconic Island project. It will highlight its potential and the necessary requirements to make the Iconic Island not only a reality, but a breakthrough success.

The general introduction focuses on our objectives. It will provide a background, outline our strategic approach and describe stakeholders and target groups involved. Chapter 2 will show that the Iconic Island project combines two agendas: renewable energy as a solution to address climate change as well as a means to poverty reduction. Chapter 3 elaborates on the island that was identified for the implementation of this project: Sumba, in the East Nusa Tenggara province of Indonesia. And finally, in Chapter 4 we will describe how we envision the realisation of this project. This includes the activities and necessary steps to be taken, in addition to the financing of the various components of the project.

The project is part of our overall vision. Hivos opts for clean and decentralised use of energy sources, made accessible to developing communities. We fervently believe that energy is an indispensable source of development.

At Hivos we have made our choice. Our choice is 100 per cent renewable energy and efficient energy solutions. It is an answer to poverty and it is an answer to climate change. We invite you to join us to make the Iconic Energy Island happen.

Manuela Monteiro, *Executive Director Hivos*
The Hague, November 2010

1. The Iconic Island: a general introduction

Purpose

The objective of the Iconic Island is to provide access to reliable renewable forms of energy to the population of a medium sized Indonesian island, and in doing so, ending their dependency on fossil fuels. Moreover, increased access to energy will support development and economic activities of the local population.

The project will mainly focus on the energy needs of households, public facilities, offices and small industries, and is to be carried out as a collaborative initiative between stakeholders. As a result, the project is expected to attract interest, cooperation and funding from institutions, companies, authorities and the public in Indonesia as well as abroad.

The longer term objective is to demonstrate a replicable model that addresses both climate change and poverty alleviation. This innovative approach is expected to gain broad support for the approach taken in Indonesia, The Netherlands, and elsewhere.

Background and strategy

The importance of the connection between providing renewable energy to small islands and poverty alleviation may not be immediately clear. In climate change discourse, small islands are mostly mentioned in the context of their vulnerability to rising sea levels, while their contribution to global carbon emission often goes unmentioned. The fact that many of these islands are usually entirely dependent on outside sources of energy is overlooked, and the development and the quality of life of its inhabitants suffer as a result. Renewable energy can offer solutions to this problem, as many islands have the potential for local and sustainable sources of energy.

Currently, the majority of the Indonesian Islands' population do not have access to electricity, and the few that do, often have irregular services. In addition, many rural communities, even those on the more populous larger islands, remain reliant on wood for fuel to meet other energy needs. This applies more so to the communities on the thousands of smaller islands of the Indonesian archipelago.

The electricity that is available is mostly provided by diesel generators and often limited to a few hours a day. Villages located farther away from the island's main roads are generally not connected to energy grids at all. Another problem is that in more remote places kerosene (used for cooking and lighting) and diesel fuel (used for larger and smaller generators and transportation) are not always available in sufficient quantities and as a result prices fluctuate.

While the state electricity company in Indonesia, Perusahaan Listrik Negara (PLN), is planning the establishment of coal powered generators for larger islands and main industrial hubs, it is limited in its capacity to provide low cost electricity to the smaller islands. Even though there are plans to establish small coal fired power plants in these remote places, few of them are currently operational. One issue is that attracting funding for these projects has proven to be difficult. Another is that coal supplies need to be shipped in from the island of Kalimantan, which comes with a hefty price tag.

The purpose of the Iconic Island Project is to demonstrate that all energy needs of small and medium sized islands, including the more isolated communities, can be well served by renewable sources.

As such, the project has a strong potential for becoming a model for the country and the broader Pacific region. With rising prices for fossil fuels, renewable energy sources will have significant comparative cost advantages, especially for remote islands that are by and large dependent on this form of energy. And while prices of fossil fuels fluctuate and are likely to increase in the long term, renewable energies are freely available and their operating costs easily anticipated.

In Indonesia, various renewable energy technologies have already been successfully applied and particularly micro-hydro, geothermal, and biogas and biomass are already contributing to the generation of energy. PLN has stepped up its efforts to increase the capacity of renewable energy power plants throughout the country.

For example, earlier this year PLN announced plans to build several solar power stations on five islands with a total capacity of 2.5 megawatts. Together with the private sector PLN is also developing geothermal power plants and the energy company encourages the private sector to develop and invest in biogas and micro hydro power stations. However, the various technologies are rarely combined and integrated with the objective to relieve communities or regions of their dependence on fossil fuel.

The purpose of the Iconic Island is to demonstrate that this objective is actually highly feasible. Naturally, the realisation of the project will require meticulous planning and the mobilisation of a broad group of stakeholders, including leading technology companies and well connected development organisations such as Hivos and its local partners.

Although the development of the Iconic Island is still in an early stage, elaborate scoping studies have been done on a number of 'candidate islands'. Based on these studies, Sumba stands out as an island that has a great unexploited potential for renewable energy. It also has a low income per capita and has one of the lowest electrification ratios in Indonesia. Moreover, its relative easy reach from Jakarta makes it very suitable for a show case project.

Hivos is currently actively engaging consultants to undertake in-depth research covering technical and institutional issues in preparation of a coherent strategy to realise the project.

Stakeholders and target group

The main stakeholders will be the beneficiaries on Sumba. It is anticipated that the local communities will be actively involved in the management of the smaller electricity generation installations in particular (e.g. micro hydro, biogas and solar power systems). This will most certainly require the creation of local community-owned and managed enterprises, possibly cooperatives. Specialised NGOs such as IBEKA can be involved in sub-projects (see box). Provincial and district local government agencies will need to be involved in the planning, supervision and the promotion of the Iconic Island.

At a national level the Ministry of Energy and the National Planning Board (Bappenas) were already involved during the preparatory phase. The Ministry of Energy has shown a keen interest in the Iconic Island, as it recognises the challenge of providing electricity to the thousands of smaller inhabited islands in the Indonesian archipelago. Indonesia being the third largest emitter of GHG, the government of Indonesia has identified the promotion of renewable energy sources as a major strategy for reducing Green House Gas (GHG) emissions.

Where larger systems need to be developed, cooperation will be sought with for example the government poverty alleviation programme PNPM Mandiri (which has a micro-hydro window), energy companies building and managing renewable energy installations and finance institutions (e.g. World Bank, International Finance Corporation or Asian Development Bank).
On the Dutch side, Agentschap NL is involved and the Dutch embassy in Jakarta has shown interest. With the BIRU biogas programme (see box) Hivos is already implementing one major programme in this sector in Indonesia.

As shown, stakeholders on all levels will be involved in the realisation of the Iconic Island. The primary beneficiaries of the project will be the inhabitants of the Island of Sumba, which in scoping research has shown great unexploited potential for renewable energy resources.

2. Renewable Energy: combining two agenda's

Alleviation of poverty and fighting climate change

Hivos believes that energy is a vital driving force for economic development. Access to energy significantly improves the quality of life and creates conditions for economic development. However, continuing to mainly use fossil fuels has serious consequences: the vast CO_2 emissions that go hand in hand with economic growth are considered to be a main cause of climate change.

The occurrence of natural disasters such as floods, desertification and the loss of agriculture yields seem to increase as result of climate change. Especially people in developing countries are experiencing the impact of this change. A small variation in the weather patterns may reduce yields dramatically. A report published in 2009 by the Economics of Climate Adaptation Working group predicts that climate change could cost developing countries up to 19 per cent of their GDP by 2030[1].

A rapid transition to renewable energy sources on a large scale is essential to lower CO_2 emissions at a rate fast enough to reduce its negative effects. We believe that stimulating economic growth in developing countries, while at the same time reducing CO_2 emissions, is the right approach. And we recognise that developing countries are actually in a better position to take the sustainable route, precisely because they have not yet embarked on the carbon-intensive development path.

Moreover, different energy scenarios show that the potential for clean energy sources is vast. For example, the force of the wind generates 200 times the energy needed to power global consumption and one day of sunlight is enough to supply the world with eight years of economic consumption. If the technology continues to develop at the current rate, clean energy can supply 32.5 per cent of the world's electricity in 2020.

[1] *Economics of Adaption to Climate Change (2009), Shaping climate resilient development, a framework for decision making*


Mamboro Waterfall
Lowa Waterfall
Wind Site Hambapraing
Wind Site Palakahembi
Lokomboro Hydro Power Plant
Matayangu Waterfall
Lukat Waterfall
Wind Site Lawola
WAITABULA
WAIBOKUL
WAIKABUBAK
WAINGAPU
GAPRANA
870
WANGGAMETI
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SUMBA ISLAND
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3. Sumba: why it is suitable to be the Iconic Island

Geography and economy

Sumba is located in the eastern part of The Indonesian Archipelago between Sumbawa Island to the Northwest, West Timor to the East and Australia to the far South at a distance of about 700 km. The island is part of the Nusa Tenggara Timur (NTT) province and one of the four largest islands in the province. The total land area is approximately 11,052 km^2, which is about one fourth of the size of the Netherlands. The island has a population of only 656,259 inhabitants with a density of 58.62 inhabitants per km^2 (for comparison: Java Island has a density of 968 inhabitants per km^2).

In general, Sumba Island has a dry climate compared to the rest of the Indonesian Archipelago. The island is mountainous with small pockets of flat land. The topsoil is relatively thin because of the region's rocky structure with minor vegetation cover, and therefore vulnerable to erosion. As the majority of the households use firewood for cooking, deforestation is a problem. By stimulating planting of trees the government tries to counter this.

Although land conditions provide limited support for agricultural activities, the agricultural sector dominates the economy in Sumba. Crops farmed by communities include food crops (rice, cassava, sweet potato) and cash crops (coffee, cashew nuts, coconut). In 2008, the agricultural sector accounted for around 48% of the gross domestic regional product (GDRP), whereas services account for 27%.

Sumba Island has beautiful beaches attractive for surf lovers. Trade, hotel and restaurants account for 16% of the GDRP and the remaining sectors each account for less than 4% (i.e. finance, transportation, and mining and construction sector).

The limited economic activities in the province are reflected in the low per capita income of districts in Sumba Island. In 2008 the average income per capita was only around 1.9 million IDR (153 Euro), which was far below the national average income of 8.01 million IDR (644 Euro) in the same year.

Renewable energy resource assessment

In June 2010 Hivos commissioned Winrock International to do a thorough assessment of Sumba, in order to determine its desirability as a candidate to become a 'fossil fuel independent island,' taking the available and verifiable renewable energy sources on the island into consideration. Winrock's research found that Sumba has a significant renewable energy resource potential. Hydro, solar, wind and biogas (from cattle) resources each have high potential on the island. To a limited extent these resources are already being used to meet increasing power demands on the island.

There is an existing micro hydro installation with a capacity near 1 MW and Solar Photovoltaic's (PV) are being used to provide small amounts of power to households in off grid areas ('Solar Home Systems'), either for lighting or telecommunication applications. In some areas small 10 watt wind turbines were installed but these are not operational anymore.

Although renewable energy sources were found to be present, the development of renewable energy on Sumba has lagged behind in terms of growth and capacity compared to diesel fuelled power, which is still the main source of electric power.

In the past, the high investment costs of renewable energy resources and the more complicated grid control of renewable have discouraged PLN to further investigate its potential utilisation even when PLN acknowledge renewable energy's proven technical and financial merits in isolated places like Sumba. In addition, private sector developers have shown little interest to invest in renewable energy projects, because the Power Purchase Agreements have been associated with unattractive rates of return in view of the perceived risks.

Sumba has two main grid systems, Waikabubak and Waingapu. The peak load of the Waingapu and Waikabubak systems combined amount to about 5.5 MW with a 2.5MW base load. The energy demand on this sparsely electrified island is increasing in line with regional economic development and population growth. Based on PLN information, the electricity demand in Waingapu and Waikabubak has grown with 6% and 8% per year respectively.

The current power requirements on the Island of Sumba are still relatively limited and not even 6 MW of peak load. The total kWh generated only requires a little less than 6 million litres of diesel fuel on a yearly basis. In the next 10 years, at current growth rates of around 8% per year, these figures are likely to double.

However, research on land requirements for biofuels also shows that 25 million litres of Crude Jathropa Oil (CJO) can be produced, using merely 25% of the suitable land. So even if energy loads double and fuel consumptions rise at 100%, in principle all fossil fuels for power generation can be replaced. Currently, the plantation agency has planted 10 ha of Jathropa on Sumba, which is showing good results.

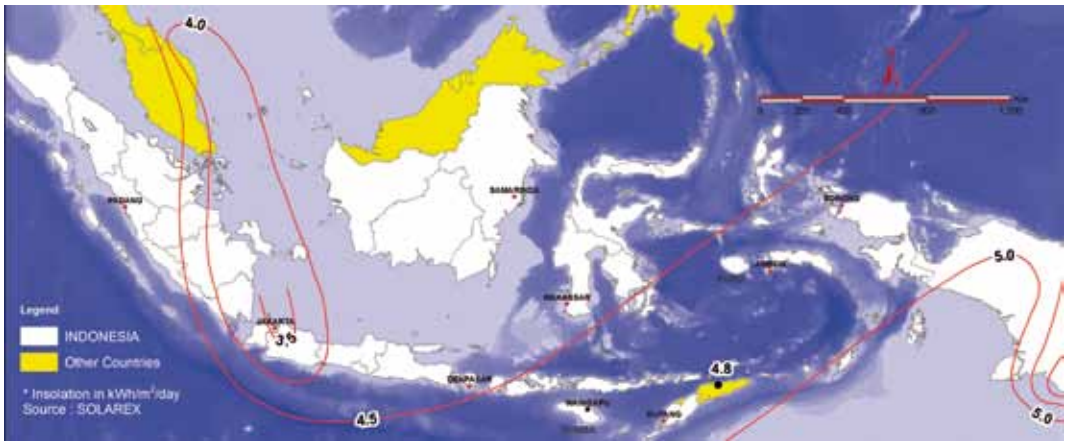
At the same time other, proven, renewable energies such as hydro, wind and solar photovoltaic (PV) are important for the start of the Iconic Island project. Winrock's study uncovered close to 4.5 MW of hydro potential at selected sites and virtually unlimited wind energy resources. Both resources can be generated at lower cost than the fuel component alone of the current diesel generated power.

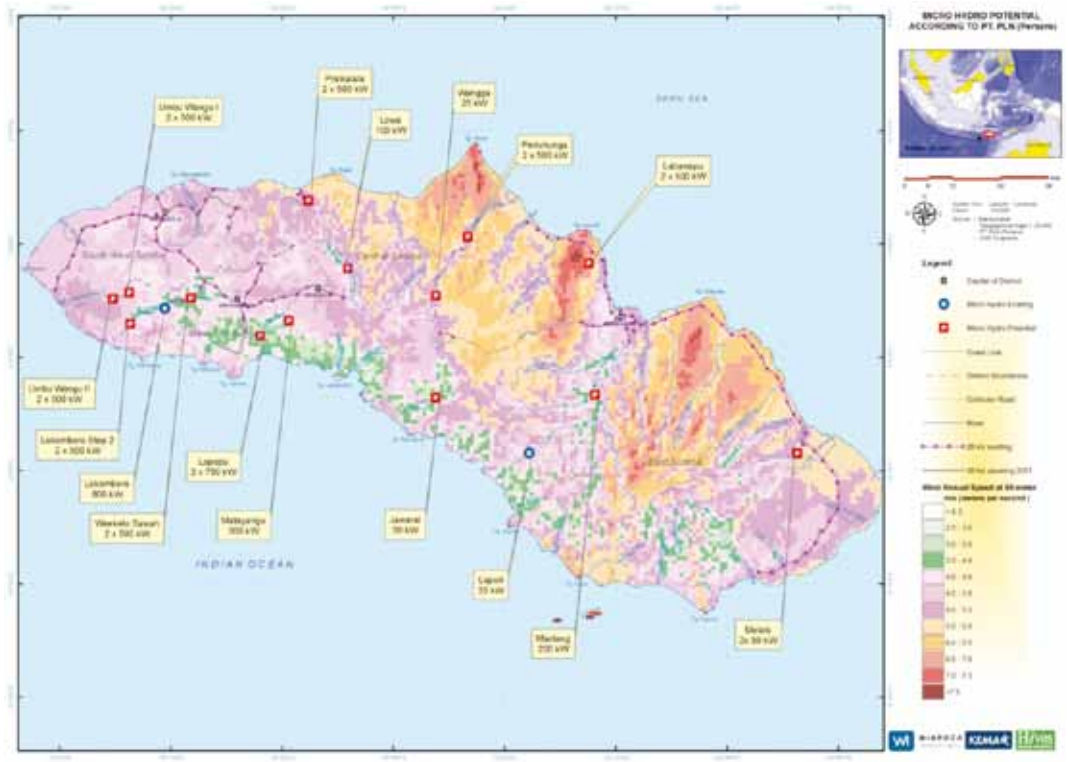
The costs at present of power production is around US$ 0.25 – US$ 0.30 per kWh and the costs for diesel fuel is about US$ 0.20 per kWh. For power production diesel is bought at standard prices and electricity is heavily subsidised, resulting in sales price about US$ 0.07. At this scale, hydro electric power is very competitive at an estimated cost of US$ 0.06 – 0.08 per kWh; and if only a small part of the subsidy of current electricity is used for renewable energy, renewable energy would be cheaper.

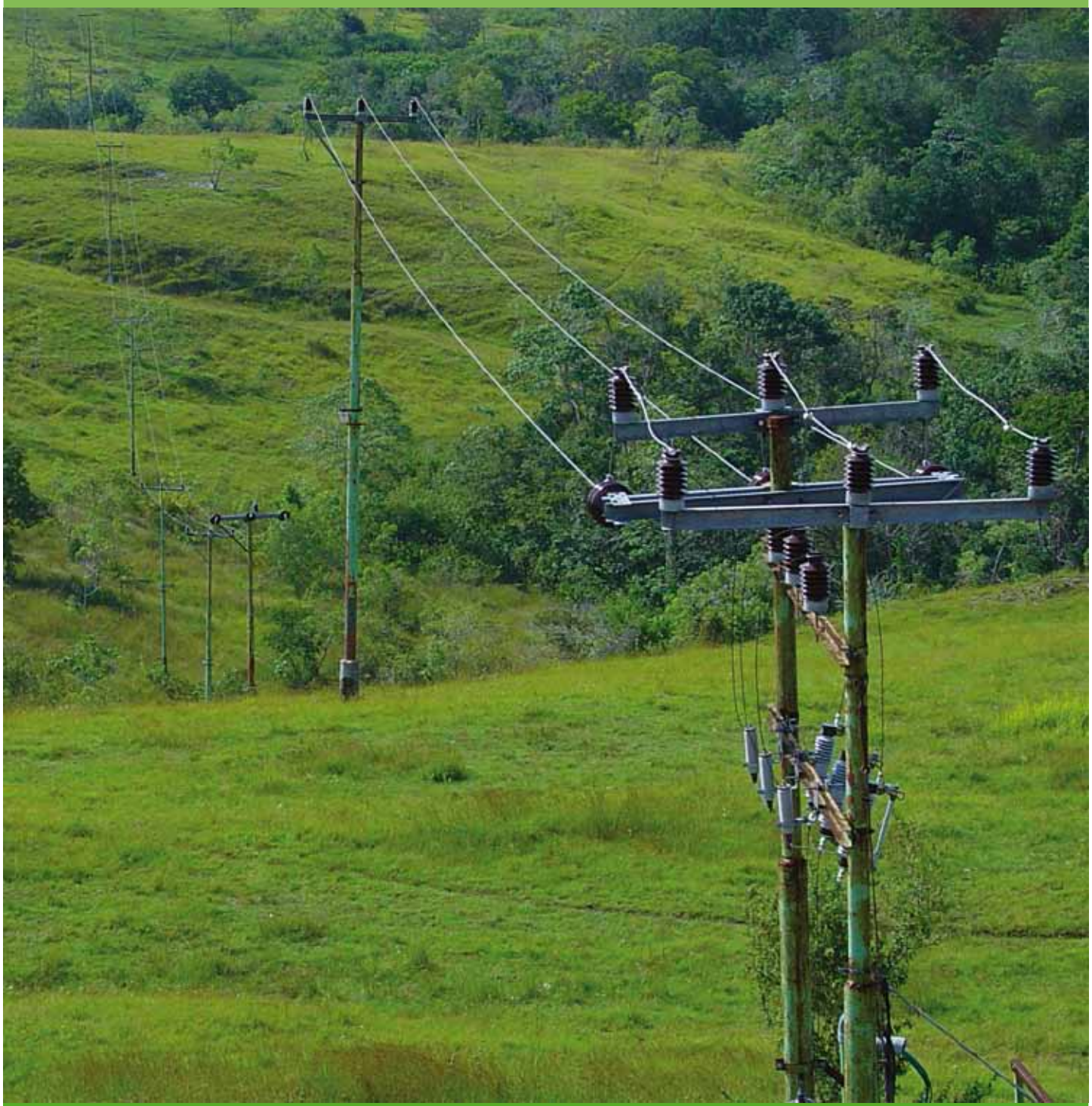
Wind energy, while somewhat less competitive, would still be much more economical than the use of high speed diesel (HSD). 'Utility scale' wind electric power can be generated at US$ 0.10 – 0.15 per kWh. A significant advantage of wind over hydro resources is that its capacity can easily be scaled up. This shows that a combination of hydro and wind energy could be ideal for Sumba. Even though solar PV has unlimited resources, it is commercially less attractive for grid connected applications; as alternatives such as wind and hydro are available there is little reason to include solar PV in grid connected applications. However, on the Island of Sumba, with its typical wide dispersed population and very low levels of electrification, solar PV does stand out as the single best option for off-grid electrification.

Solar Home Systems (SHS) are already contributing to rural electrification of Indonesia's remote areas and Sumba is not an exception. One problem observed with the government sponsored solar PV programs is that 'after sales' and maintenance services are not available to the rural recipients, which leads to the malfunctioning of systems within a short time frame. Commercial and market driven models might be more suitable to encourage more sustainability in the long run.

Overall, Sumba poses as the ideal candidate for the 'fossil fuel independent pilot island.' Important renewable energy resources, such as Hydro, solar, wind and biogas are present on the island and have high potential in terms of becoming the primary energy sources for the island.







4. Making it happen: planning and financing

The Iconic Island is a huge and ambitious project. Ideally, various financial sources will be used, such as grants, subsidies, revenues from sales and payments from users. Even though the startup costs of renewable energy are high, after 5 to 10 years it is proven to be cost efficient and even profitable.

2010 is considered to be the foundation year of the project. Hivos, as the initiator of the project, will share its ideas and ambitions, and invites others to join. Participation and agreement on the objectives of all important stakeholders, and especially the government of Indonesia, is essential. Together these stakeholders will form an initiative group which will develop the project further. Hivos will fund and coordinate this collaborative effort.

The start of the project is envisioned in 2011. The project will be developed gradually and divided into subprojects. The main subprojects will be:

1. *For area's not connected to power grids* – implementation of renewable technologies such as biogas, micro hydro and possibly SHS, small scale wind and pico hydro;

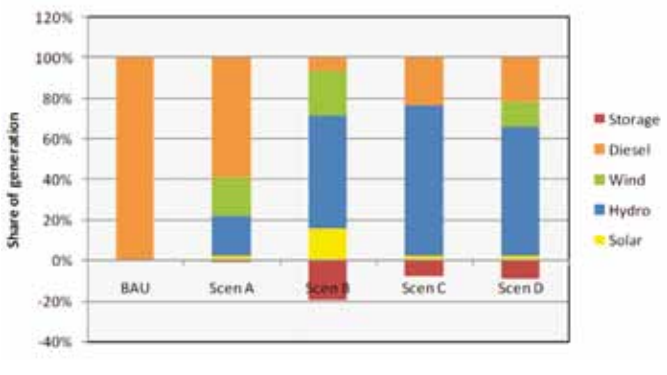
2. *In areas connected to power grids* – investment in the production of electricity from renewable energy sources especially those based on wind and micro hydro

3. *For transport and for replacement of diesel*: further develop and research the production of biofuels and waste-to-energy.

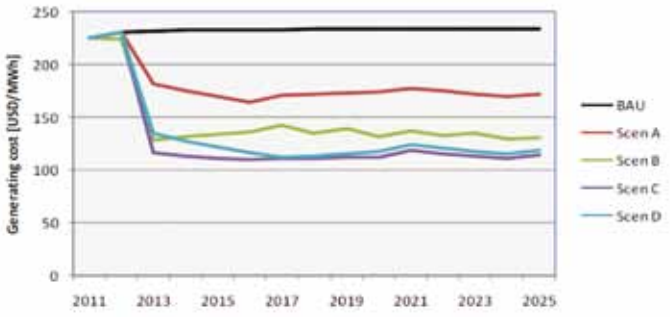
The timing of the subprojects can vary and stakeholders may differ for the respective subprojects. For instance, energy access in remote areas will mainly involve NGOs and local governments, while private sector involvement is favourable for grid base load electricity production. The first step for most subprojects is an in-depth feasibility research. Some studies are already underway (base load study for renewable power generation for grid connected areas). For subprojects of which the strategy is clear, field research and the implementation of the project can begin. For instance, best practices and lessons learned at current biogas projects undertaken by HIVOS (see box) can be used at Sumba.

The project is to be a joint undertaking. All stakeholders will play specific roles, but all will be based on a shared vision, target and principle. Hivos will be taking a coordinating role. In addition it will fund the collaboration on the Iconic Island project. This also includes attracting other parties to participate financially.

Hivos will share experiences and contribute to the funding on specific implementations such as biogas, micro hydro and the introduction of efficient stoves. Together with other stakeholders, Hivos will develop business plans to ensure the financial planning and to secure commercial and non-commercial sources of funding. Different strategies should be explored, such as grants, loans, microfinance, contributions from beneficiaries, Public Private Partnerships (PPP) for grid connected power generation, cooperation with research institutes for field trials and pilots for biofuels and waste-to-energy projects. Hivos also welcomes joint funding with other grant making institutions.



Average contribution of resources in the overall generation



Average annual cost price of electricity supply for five scenarios

5. Update January 2012

Broad support for Iconic Island Initiative

Hivos works closely with local governments, the state energy company PLN and national ministries such as the ministry of Mining and Energy (MEMR), BPPT and Bappenas. As part of the collaboration, the MEMR coordinated several meetings with the various stakeholders involved. Overall, the responses and feedback to the project have been very positive and supportive. Not only was the initiative warmly welcomed, its concept corresponds well with the existing Indonesian policy agenda to increase the use of renewable energy. The Iconic Island initiative was also welcomed as an important strategy to provide energy to people who do not have access yet. As a result, the Governor of NTT, all elected leaders – the Bupatis - of Sumba and PLN-division NTT signed an agreement on March 31 2011 in Tambolaka, Sumba. By signing the agreement leaders have explicitly expressed their commitment to achieving the objective of a 100% renewable island.

Initial results in the realisation of the Iconic Island

Alongside the Iconic Island initiative the state energy company PLN has developed the so called No Fossil Fuels (NF2) policy, which will be applied to Sumba as well. PLN will also provide a huge number of solar lighting sets for villagers that currently do not have access to the main power grid. The villagers pay a small fee to participate in the programme and in return PLN maintains and repairs the lighting sets.

Another project is the construction of a micro-hydro installation by IBEKA in Mbaku Hau. This remote village did not have access to electricity. With financial support of Hivos, villagers and IBEKA have built a micro-hydro plant and distribution lines to approximately 100 houses. A community organisation is responsible for managing the installation and collecting the fees.
In June 2011 Hivos extended its Indonesian biogas programme to Sumba providing energy for cooking and lighting. Hivos strengthens local NGOs by training masons in the construction of high-quality biogas digesters. Farmers need to keep their lifestock in sheds at least during the night in order to collect the dung to produce biogas. By the end of 2011 the first 20 biogas installations were in operation and in 2012 around 100 biogas digesters are expected to function. To expand the biogas program, external funding is needed on top of the contribution of the farmers themselves.

Feasibility studies

In light of the Iconic Island Sumba, Hivos has commissioned several feasibility studies. Dutch consultancy firm KEMA has finalised a 'least cost planning' for the production of electricity from renewable sources for the grid. The results of this research show that renewable energy sources are widely available to cover the estimated future electricity demand of Sumba. And while the investment costs are relatively high, in the long run the costs for electricity from renewable sources will be lower than the extended use of diesel generators.
Other opportunities such as biomass and biofuel use, additional locations for microhydro installations and small windturbines for irrigation are studied as well. Conclusions will be used to develop new approaches in 2012.

Business plans and funding

Based on the outcomes of the feasibility studies, further business plans and proposals for funding will be developed. Currently, the preparation of these plans is in various stages of progress. And with the best possible outcome in mind, all support and ideas are highly welcomed!

Current Hivos Renewable Energy projects in Indonesia: two examples

1. The Indonesia Domestic Biogas Programme

Having started in May 2009, Hivos' Indonesia Domestic Biogas Programme initiated its activities in cooperation with local partners in 4 provinces. The Biogas plants convert animal dung and various other organic materials into combustible methane gas know as biogas. Farmers with at least two cows can generate sufficient biogas to meet their daily basic cooking and lighting needs.

The investment cost for a quality 'fixed dome' biogas plant varies between Euro 400 to700, depending on plant size, location of construction and availability of material. These plants have a life span of at least 15 years, whilst operation is easy and maintenance inexpensive. For the user, biogas provides clean cooking energy, contributes to health improvement and reduces the time needed for biomass collection, especially for women.

The partners in the programme have constructed more than 4000 units at the end of 2011. Furthermore, the target is to build at least 8.000 units (of which 2.000 units outside Java) before the end of 2012 partially subsidised and facilitated with credit. Through its multi-sector approach, the programme mobilises the private sector, NGOs, cooperatives, MFIs and the government sector, focusing on clusters of high-density livestock areas and aiming at farmers with at least 2 or 3 stabled cows.

The programme is managed and implemented by Hivos with technical assistance from SNV – Netherlands Development Organization, in cooperation with national and local stakeholders. The programme is funded by the Embassy of the Kingdom of the Netherlands in Jakarta and was established in close cooperation with the Indonesian Ministry of Energy and Mineral Resources. The technical viability of small-scale biogas technology has repeatedly been proven in field tests and pilot projects, but mass dissemination of this technology was not been accomplished in Indonesia. With this project Hivos has made an important step to introducing a promising form of renewable energy in Indonesia.

2. IBEKA hydropower plants

Hivos' approach to working with local NGOs that have strong roots in local communities has proven very successful in the IBEKA hydropower plants project.

The Indonesian organization IBEKA built micro-hydropower plants in more than 60 villages. This includes large units that produce around 500 kilowatt and smaller ones with a capacity of merely 200 watt. While using a community development approach, IBEKA also has strong relations with the Indonesian Ministry of Energy and PLN.

The plants in the villages are owned by the community and the villagers are responsible for paying for the electricity. In addition, the villagers are responsible for maintaining the plants themselves. Once a hydropower plant is up and running properly, it immediately improves the quality of life of the people in the village. For example, women who work in the rice fields during

the day are now able to carry out other activities that need light in the evenings and children can do their homework.

IBEKA has also built a small plant in Cinta Mekar, where the inhabitants are now earning money from the generated power by selling excess energy to the electricity company. How the earned money is spent, is determined by an organisation the villagers have created specifically for this goal. As a result, some 130 children are now attending school, women are getting microcredit for small businesses and poor families are receiving free health care.

IBEKA intends to build as many small hydropower plants as possible. Through IBEKA's efforts, residents of remote villages who would otherwise never have had access to energy, now have electricity in their communities.

About Hivos

A fair, free and sustainable world – that is what Hivos, (the Humanist Institute for Development Cooperation) a Dutch NGO, stands for. In collaboration with local organisations in developing countries, Hivos strives for a world in which all citizens – both men and women – have equal access to resources and opportunities for development.

The work of Hivos focuses on structurally alleviating poverty, while emphasising civil society building and sustainable economic development. The efforts of Hivos are centred around nine themes: financial services and business development, sustainable production, human rights and democratisation, HIV/AIDS, gender, women and development, art and culture, ICT & media, advocacy and communication, and 'the knowledge programme'.

Hivos believes that joining forces and pooling resources is crucial to achieving its objectives. It supports over 800 partner organisations in more than 30 countries through financial means and institutional support as well as the exchange of knowledge and experience. In addition, Hivos collaborates with a number of organisations, companies and governments in the Netherlands and Europe, and it is part of various national and international networks. Hivos also conducts its own advocacy activities in the Netherlands, throughout Europe and worldwide.

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