A Brief Summary of Good Practices and Challenges on Renewable Energy Development

IN AFGHANISTAN, INDONESIA, MADAGASCAR AND NEPAL

Prepared, presented and discussed for the Kick-off Meeting on "Knowledge Exchange on Extracting Best Practices on Renewable Energy within South-South and Triangular Cooperation Framework"
January 2021

Supported by the joint Indonesian-German project on "Strengthening Capacities for Policy Planning for the Implementation of the 2030 Agenda in Indonesia and in the Global South (SDGs SSTC)"

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A BRIEF SUMMARY OF GOOD PRACTICES AND CHALLENGES ON RENEWABLE ENERGY DEVELOPMENT IN AFGHANISTAN, INDONESIA, NEPAL AND MADAGASCAR

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Supported by the joint Indonesian-German project on Strengthening Capacities for Policy Planning for the Implementation of the 2030 Agenda in Indonesia and in the Global South (SDGs SSTC)

Developed by Indonesian Ministry of Energy and Mineral Resources and Indonesian Ministry of State Secretary within the project of Strengthening Capacities for Policy Planning for the Implementation of the 2030 Agenda in Indonesia and in the Global South (SDGs SSTC)

January 2021, Jakarta

DISCLAIMER

ACKNOWLEDGEMENTS

The Paper was commissioned by the Government of Indonesia through The Ministry of the National Development Planning/Bappenas as the Main Implementing Agency and The National Coordination Team of South-South Cooperation Indonesia which is chaired by the Ministry of Foreign Affairs. The substance of this publication and its preparation are purview of the Ministry of Energy and Mineral Resources in coordination with the Ministry of State Secretary and the Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH.

The Paper was prepared under the guidance of Zulazmi, Neni Marlina (GIZ), Agung Pribadi (MEMR) and Nanik Purwanti (MoSS).

The Government of Indonesia funded the preparation of the paper through the Ministry of Energy and Mineral Resources (MEMR) and Ministry of State Secretary, the German Federal Government (Federal Ministry for Economic Cooperation and Development) through the joint Indonesian-German project on Strengthening Capacities for Policy Planning for the Implementation of the 2030 Agenda in Indonesia and in the Global South (SDGs SSTC).

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FOREWORDS

Foremost, I would like to convey my deepest appreciation to each and every one for the coordination, partnership and effective joint working which make this “Brief Summary of Good Practices and Challenges on Renewable Energy Development in Afghanistan, Indonesia, Nepal and Madagascar” available amidst the limited exchanges due to this challenging time of Covid-19 pandemic.

Relevant with the current situation, COVID-19 has brought the generation of energy from fossil fuels to breaking point. As the lockdown measures were introduced, global energy demand dropped swiftly at levels not seen in 70 years. Renewable Energy remains important in our energy systems.

Relative to the above, Indonesia is committed to reduce our greenhouse gas (GHG) emissions. Under the 2015 Paris Agreement, we are pledged to cut our GHG emissions to 29% independently by 2030, and up to 41% with international support. Aiming to align to the global platform trough contributing to 2030 Agenda in particular Goal #7 Affordable and Clean Energy and Goal #13 Climate Action, the country has revitalized the National Energy Policy which enable Indonesia to pursue a near-100% electrification target by 2020 from the current rate of 96%. Indonesia also aims to achieve its renewable energy share in the national energy mix to 23% by 2025 and 31% by 2050.

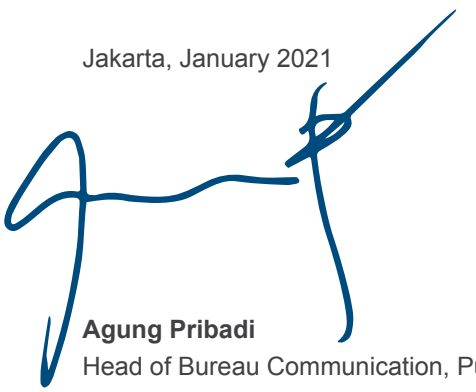
Motivated by shared interests in knowledge exchange on renewable energy for sustainable development, I am glad to learn that the Brief Summary has been developed for the spirit knowledge transfer among the stakeholders involved and envision to garner partnership within the solidarity of south-south and triangular cooperation.

I hope that this compilation of practices on renewable energy will not only serve as reference for a fruitful exchange among the Renewable Energy enthusiasts and delegates of the Kick-off Meeting on “Knowledge Exchange on Extracting Best Practices and Challenges on Renewable Energy within South-South and Triangular Cooperation Framework” but also manage to result into an impactful partnership among Indonesia, Afghanistan, Madagascar, Nepal and Germany.

Last but not least, we would like to extend our gratitude to the Government of Germany through GIZ for the effective facilitating support, cooperation and partnership during the study to have these Brief Summary and exchanges on Renewable Energy took place.

I look forward to having the continued support and partnership with each and everyone in this renewable energy initiatives and towards a more sustainable renewable energy.

Jakarta, January 2021



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I. BACKGROUND AND CONTEXT

Paris Agreement calls for global commitments in shifting towards a low carbon future in response to the risks of climate change and its impact towards vulnerable populations. To address the climate change issue, the integration of renewable energy and energy efficiency plays an important role in the achievement of sustainable development. In relation to Agenda 2030, renewable energy is aligned with **SDG #7 Affordable and Clean Energy** and **SDG#13 Climate Action.**

With the rising of global energy consumption, potentials of renewable energies have become an interest for many Southern countries including Afghanistan, Indonesia, Madagascar, and Nepal. These four countries have policies, practices and plans towards the development and promotion of renewable energy.

Having been involved in a number of global initiatives on Southern cooperation and now being an upper-middle income country (MIC), Indonesia aspires to further develop global cooperation among southern countries while enhancing the cooperation with Northern countries and bring both to the next level. In this context, the South-South and Triangular Cooperation framework fits well with the aspiration.

Indonesia proposes to host a Kick-Off Meeting which intends to bring the four countries to exchange valuable, tacit knowledge, experience, good practices and challenges on renewable energy development that the four countries have and cooperate to bring the efforts of each individual country to the next level.

The Kick-Off Meeting is initiated and hosted by the Indonesian Ministry of Energy and Mineral Resources in coordination with the Ministry of State Secretary as the shepherd institution

representing the National Coordination Team of South-South and Triangular Cooperation Indonesia (NCT of SSTC)[1] . The Kick-off Meeting has been facilitated and in partnership with Germany through a joint Indonesian-German project on “Strengthening Capacities for Policy Planning for the Implementation of the 2030 Agenda in Indonesia and in the Global South” (SDGs SSTC). The discussion and outputs resulted from the Kick-Off Meeting will contribute to “Output 2. Indonesian capacities for the engagement of SDGs in the global context through South-South and Triangular Cooperation are strengthened” of the SDGs SSTC.

The Kick-Off Meeting which was organized virtually on 20-21 January 2021 aims to:

1. To foster cooperation on renewable energy initiatives among the proposed participating countries, i.e. Afghanistan, Indonesia, Madagascar, and Nepal, along with Germany as the facilitating partner. The cooperation is developed in line with modality of triangular cooperation and in close coordination with the National Coordination Team of the South-South Cooperation (NCT of SSTC) of Indonesia.

2. To agree on the purpose, goals, objectives, outputs, and ways of working of SSTC on Renewable Energy among the participating countries, to be formulated in a Concept Note.

This “Brief Summary of Good Practices and Challenges on Renewable Energy Development in Afghanistan, Indonesia, Madagascar and Nepal” is compiled from respective countries’ own submissions, in which they themselves identify what the good practices and success and challenges on renewable energy development are and their future plans, what they would like to share with and learn from each other, and their initial thoughts on what and how the sharing & learning and cooperation could be possibly developed.

1 Government of Indonesia in 2010 has established a National Coordination Team of SSTC (NCT of SSTC) consisting of four Ministries; Ministry of Foreign Affairs, Ministry of National Development Planning, Ministry of Finance and Ministry of State Secretariat. NCT of SSTC is mandated to prepare and support the planning, implementation and evaluation of SSTC’s programs,

II. OBJECTIVE

- This document is meant as preliminary, succinct, background information for all involved stakeholders participating in the January 2021 Kick-Off Meeting.
- This Brief Summary also aims as reference for the purpose of identifying topic/programme towards the SSTC on Renewable Energy.

This document is not by any means a complete, full pictures of the renewable energy situations in these 4 countries nor does it assume that these are the areas that will be the focus of the South-South and Triangular Cooperation on Renewable Energy that is foreseen to be developed.

Further elaboration and discussions on the information provided in this document as well as other possible topics will take place during the virtual engagement of the Kick-Off Meeting, in which each country will have designated sessions to present their renewable energy situations and discuss together with all the participants

III. GOOD PRACTICES AND CHALLENGES

Despite the relatively new development of renewable energy in the four countries, good practices and lessons learned are found, that are worth sharing with and learning from each other.

Afghanistan

Afghanistan has one of the lowest per capita electricity consumption rates in the world, i.e. 100 to 186 kilowatt-hours (kWh) per person per year. This mean that the average Afghan total energy consumption is equivalent to powering a 50-watt light bulb about 51/2 hours a day. Overall, about 30-34% of the population in Afghanistan have access to electricity while only 11% of the population in the rural area has access to electricity, which is intermittent and of poor-quality voltage.

Current domestic power capacity is 519 megawatts (MW). Of this, 51% is thermal (diesel and gas) and 49% is hydropower, which is seasonal and has a capacity factor of less than 40%. The national grid of Afghanistan currently imports 80% of its power from neighbouring countries. The cost of imported energy has increased by 16 times, from $16 million per year in 2007 to nearly $270 million per year in 2019.

The international community has spent more than US$4 billion to develop the electricity sector In Afghanistan since 2002. Yet, more progress and results are expected.

The electricity sector in Afghanistan faces challenges. Weak institutional and human capacities that overlap and contradict in policies and mandates, ambiguity in the role of government ministries and international development partners, and the divergence & lack of integration between development partners' agendas and the Afghan government's needs are among the existing challenges facing the energy sector.

THE GOVERNANCE AND KEY ENTITIES IN THE ENERGY SECTOR IN AFGHANISTAN

The Government of Afghanistan has identified the rehabilitation and expansion of the country's physical infrastructure as one of its highest priorities for the reconstruction and development of Afghanistan.

In 2008 the Government of Afghanistan corporatized the national electricity service department Da Afghanistan Breshna Mossasa (DABM) into an independent state-owned utility company Da Afghanistan Brhesna Sherkat (DABS).

At the moment, the Afghanistan energy and water sector is undergoing a further restructuring. The Energy Services Regulation Authority (ESRA) has recently been established from the Ministry of Energy and Water. ESRA's details roles and responsibilities and ways of working are being formulated at this moment.

THE POLICY IN RENEWABLE ENERGY

With the installation of a new government in 2001 and assistance from the international community, Afghanistan had the opportunity to find proper means of electrification for both urban and rural settings. The Rural and Renewable Energy Policy has been the basis for the development of a number of programmes, including the rural electrification programmes.

The Renewable Energy Roadmap for Afghanistan (RER2032) was developed to realize the vision and intent of the Renewable Energy Policy for Afghanistan that sets a target of deploying 4,500 – 5,000 MW of renewable energy (RE) capacity by 2032 and envisions a transition from donor grant-funded RE projects to a fully private-sector led industry by 2032. This Roadmap is considered as a foundation for the energization of the country which seeks self-reliance in the energy sector, given the challenges with other types of energy technologies. Investment in renewable energy can happen promptly to speed up the process to power the country out of the dark.

GOOD PRACTICES IN RENEWABLE ENERGY

These are:

- **The Solar Power Plant in Kandahar and in Nangarhar** were ones of the first Public Private Partnership (PPP) in the country with the private sector taking part in the implementation, which paved the way for the private sector investment in the energy sector. In preparing and implementing this project, challenges in the contracting, technology and grid connection were faced.
- **The Herat Wind Project** is the first project of this scale implemented in this province, which produces 25MW electricity. The project involved USAID, the Government and the private sector. This project conducted re-evaluation of the grids, which then allows remote locations to be tied in the grid system. This project is ongoing and the Government is poised to make it a success and adhere to all key principles.
- **The Kajaki Hydropower Plant Project,** which is located in Helmand Province, includes the installation, building and rehabilitation of the power plant in 2 phases. It is supported by the World Bank and involves the private sector in the implementation. The financial return obtained after the completion of the first phase will be used to continue to the roll-out of the second phase of the project. The first phase of the project is considered a success as it was able to fulfil various contract obligations in order to proceed with the works.
- **The Herat Scaling Solar Project** is a 40MW utility scale project developed with support from the International Finance Corporation (IFC) and the private sector, which is an ongoing project with the first of its kind technology and contractual obligations. With the experience of this project, Afghanistan hopes to involve more private sector investment in the renewable energy sector.

- **The 15 MW Solar Rooftop Project** on public buildings is implemented in Kabul to enable reliable electricity to government institutions and to reduce gen-set fuel consumption and CO2 emission. This project involves GIZ, DABS and the private sector. Pre-feasibility studies have been completed for 40 government institutions and 9 of them are ready for implementation, while addressing the challenges in coordination among institutions and for DABS to apply Net-metering scheme. Despite its early stage of implementation, it is expected that this project will demonstrate the applicability of solar rooftop systems for government buildings and the possibility of providing reliable energy sources during office hours to maintain normal working regime.

GENDER MAINSTREAMING

Gender issues are yet to be mainstreamed in the projects elaborated above.

FUTURE PLANS

Afghanistan seeks to cover the electrification for the entire population through various means, including the offset of diesel generators with clean energy in provinces and paving the way to implement a unified tariff for universal access to energy. Afghanistan aims at providing cheap, reliable and cost-effective energy supply to rural population. With a broader renewable energy mandate, Afghanistan also aims at the strengthening the urban energy programme, through the participation of independent power producers (IPPs) and the implementation of power purchase agreements (PPAs).

In planning the above, Afghanistan sees a major challenge in the financing, despite the support from bilateral and multilateral institutions such as GIZ and the World Bank. Hence, the public utility sector aims to attract private investment in the domain of Public Private Partnership (PPAs) and other mechanisms that will support the implementation of the plans.

Indonesia

Indonesia is committed to cut the greenhouse gas emissions by 2030 to 29% independently, and up to 38% with international cooperation and support under Indonesia is committed to cut the greenhouse gas emissions by 2030 to 29% independently, and up to 38% with international cooperation and support under the 2015 Paris Agreement. Additionally, in 2014 the government revitalized its National Energy Policy that established a target to not only achieve a near-100 percent electrification by 2020 from the current rate of 96%, but also to achieve its renewable energy share in the national energy mix to 23% by 2025.

Despite having an ambitious renewable energy goal equipped with abundant potential renewable energy sources such as hydropower, geothermal, biogas & biomass, solar power and even ocean, electrification projects are still mainly driven by coal power plants. The disparity of energy access and quality are also prominent especially between Indonesia's main islands in the western part versus the rural eastern islands; and where some major islands with high gross domestic product (GDP) such as Java, Bali and Sumatera are oversupplied, the rural areas are deprived of this basic electrification needs. In addition, the lack of transparency and availability of good quality data to ensure robust planning and monitoring are even greater challenges to overcome.

[2]Recent progress in promoting off-grid renewable energy in rural areas Indonesia -- especially in the Eastern part of the country -- is applauded. Despite the challenges, efforts by the national and subnational governments along with the non-state actors and international development agencies are behind the good progress in ensuring the population in remote areas to have affordable and sustainable access to energy.

THE POLICY ON RENEWABLE ENERGY

Since 2004, Indonesia is no longer an oil exporter due to a significant decrease in oil production. In the meantime, the use of fossil fuel has increased by 60% of the final consumption. This has forced Indonesia to import oil to fulfill domestic needs. Indonesia has not adequately tapped its huge potential of renewable energy, except hydro power which already produced 4,2 GW and geothermal 0,8 GW. The use of other sources of energy such as Solar PV, wind, micro hydro, etc. is hampered by the high costs and hence its inability to compete with fossil fuel price.

2 https://wri-indonesia.org/en/our-work/topics/energy

In 2004, The Government of Indonesia issued the National Energy Policy through a Minister of Energy and Mineral Resources Regulation. The Policy is to guarantee the availability of energy to support economic stability and recovery. The use of energy -- if directed to encourage economic activities in the village -- can strengthen the local economy, which in turn will become a new economic power. The Policy also aims to increase the utilization of non-hydro renewable energy for at least 5% in 2020. In 2006, The Government of Indonesia further enhanced the National Energy Policy by the issuance of Presidential Regulation No. 5 of 2006. The Regulation states a clearly that biofuel, geothermal, and other renewable energy were targeted to reach 5% each in the energy mix by 2025. In addition, the Presidential Instruction No. 1 of 2006 adds on the utilization of biofuel in the energy mix.

The Government of Indonesia acknowledges the importance of renewable energy for domestic energy supply as well as saving the environment. In 2007, the Government issued Law no. 30/2007 on Energy that acknowledges new and renewable energy and energy conservation.

The new National Energy Policy that was issued through Government Regulation No. 79 of 2014 focuses on the realization of energy independence and national energy security to support the sustainable national development. Hence, Indonesia sets an ambitious target of new and renewable energy, which is 23% in the energy mix by 2025. Furthermore, in Paris Agreement in 2016, the Indonesian President Joko Widodo committed to reduce the emission by 29% (by Indonesian's own effort) or 41% (with international support) by 2030. Since then, the Indonesian Minister of Energy and Mineral Resources has set up various regulations and policies on the implementation of renewable energy in Indonesia with a particular emphasis on tariff in order to make renewable energy more competitive in comparison to fossil fuel.

The policy undertaken by the Government of Indonesia in developing renewable energy power plants is carried out in commercial and non-commercial aspects. Commercial aspects mean that the renewable energy power plants are developed by the independent power producers (IPP), industry or community without government grants, and either connected or not connected to the national grid operated by PT. PLN, the electricity state-owned company. In this aspect, the Minister of Energy and Mineral Resources has issued a regulation on the tariff so that this renewable energy generation can be economically feasible for IPPs. The regulations are the Minister of Energy and Mineral Resources Regulation No. 50 of 2017, and the amendment No. 53 of 2018 and No. 4 of 2020 on the Utilization of Renewable Energy Source for Electricity; Regulation of the Minister of Energy and Mineral Resources No. 49 of 2018, and the amendment No. 13 of 2019 and No. 16 of 2019 on Solar PV Rooftop.

The second aspect is non-commercial, which refers to the development of renewable energy that still requires Government intervention in terms of funding. The background of this policy is that Indonesia consists of thousands of islands which the majority are small and remote islands and it is a big challenge for the country to provide access to electricity for all people, especially for those who live in very remote and border areas. This challenge is even bigger because the cost to build transmission lines to interconnect big and small islands is very high. Meanwhile, Indonesia has so much potential for renewable energy that scatters all over the country. Renewable energy in Eastern part of Indonesia is more advantageous than fossil fuel is because the abundance of resources. In addition, renewable energy is cheaper because there is no transportation cost. It is also cleaner, which supports the Government's commitment in emission

reduction. This makes rural electrification through renewable energy is the best, fastest, and cheapest way to provide access to electricity in remote areas in Indonesia.

Grants from the national government to local governments are made available to trigger the development of small-scale solar PV and micro-hydro power plants as an attempt of rural electrification through renewable energy. These grants are made available through a mechanism that is based on local government proposals. The Indonesian Government has issued several regulations to implement this policy, i.e. the Presidential Regulation No. 47 of 2017 on Solar Lantern; MEMR Regulation No. 33 of 2017 and the Amendment no. 5 of 2018 on the Procedure For Providing Solar Lanterns For People Who Do Not Have Access to Electricity; MEMR Regulation No. 39 of 2017 and the Amendment No. 12 of 2018 on the Implementation of New and Renewable Energy Utilization Project.

Since 2011 the Government has built around 1026 units of Solar PV and Micro-hydro Power Plant in off-grid areas with a total capacity of 44,45 MW. The National Government allocates budget, conducts engineering procurement construction (EPC) tendering, does the construction up to the commercial operations date (COD). After the COD, the power plant assets are transferred to the local government that will develop the management institution which will be in charge of the operations & maintenance and to supply the electricity to the communities. As stated in the contract, the EPC company has the obligation to provide training to the local operator on the operations and maintenance of the power plant. Also, the MEMR Education and Training Center provides the required training on annual basis to make sure that the local operators' capacity meets the requirements.

GOOD PRACTICES IN INDONESIA'S RENEWABLE ENERGY

I. Bioenergy Power Plant Programme

Bioenergy as one of renewable energy sources has the potential to make a big contribution to the national energy mix through the implementation of biofuel, bioenergy power plant and biogas program.

Bioenergy Power Plant Program consists of biomass power plant, biogas power plant, municipal solid waste (MSW) power plant and crude palm oil (CPO)-based power plant. The General Plan for National Energy (Rencana Umum Energi Nasional / RUEN) has targets for annual utilization of bioenergy power plant annually as well as a target of 5.5 GW in 2025.

The key stakeholders involved in the bioenergy power plants are the Directorate General of New, Renewable Energy and Energy Conservation (DGNREEC) of the Indonesian Ministry of Energy and Mineral Resources (MEMR), the state-owned power company PT PLN (Persero), and independent power producers (IPP).

To date, the Programme has been able to develop 1896.5 MW of electricity from bioenergy power plants, which consists of 210.32 MW on-grid and 1686.18 off-grid.

The Bioenergy Power Plant Programme faces the following challenges:

- Bioenergy power plants require a substantial initial capital to build an economic of scale.
- Most of the proven technology used are still imported.

Renewable Energy Off-Grid Business Model

In order to accelerate the implementation of rural electrification, with support from development partners, the Government of Indonesia is developing a study on Renewable Energy Off-Grid Business Model. This study aims to find the applicable business models for private sector to be involved commercially in implementing rural electrification through renewable energy.

There have been many state/regional budgets and grant programs mobilized by local/national/international organization with regards to provision of energy and electricity access in rural/remote areas of Indonesia. The provision of energy in rural/remote areas cannot forever rely on the availability of the state budget or grant program, especially because of the current conditions/trends on the decreasing portion of the state budget at the central and regional levels in terms of physical construction or installation of small-scale energy infrastructure. For this reason, the approach of providing energy access for people living in rural/remote areas should change towards a market-based approach, in order to ensure the sustainability of small-scale renewable energy systems.

The Government of Indonesia (GoI) has stipulated MEMR Regulation Number 38/2016 for the Acceleration of Electrification in Under-Developed, Remote, Border, Small and Underpopulated Islands ttrough the Implementation of Small-Scale Electricity Supply Businesses. This regulation intends to encourage the development of off-grid installation by commercial or private investors. However, there are impediments to implement this regulation due to several conditions, i.e. uncertainty on the availability of subsidies, the mandatory geographic coverage of the business (it has to be for one sub-district) is too broad, the difficulty in obtaining location permit for developing the business, and the high costs and risks borne by the private sector does not commensurate with the profitability and bankability.

A new mechanism needs to be developed which will involve the private investors and the state-owned electricity company PT PLN (Persero) as the business owner in developing the off-grid installation. With the participation of PT PLN (Persero), it is expected that the implementation of the off-grid installation can be accelerated and sustainable. The same approach is also expected to be applicable in the off-grid system managed by the community, village-owned enterprise (BUMDesa), other IPPs.

- There is a lack of reliable infrastructure.
- There is a potential conflict on the utilization of raw materials for bioenergy as the same raw materials are used for food, animal feed and fertilizer.
- There is a need to update the existing data and to map the potentials for bioenergy power plants along with the development strategy.
- Feedstock availability is not sustained.
- Biomass prices are unstable.
- Cooperation with related stakeholders needs to be enhanced.
- Due to the lack of the availability of low interest funds, bioenergy business is considered high risks and therefore not attractive.
- The supporting industry is not ready, i.e. hydrogen industry, methanol industry, catalyst industry, IVO/ILO industry.
- Technology availability and innovation: It is necessary to conduct study related the use of appropriate technology and technological development that allows affordable price of bioenergy products.

The lesson learned: To support the development of Bioenergy Power Plant, the Government of Indonesia has made several strategic efforts, such as: market creation by requiring PT PLN (Persero) to purchase electricity from bioenergy power plants, simplification of the procedures and permits, regulating the renewable energy price, increase of the utilization of oil palm (waste) for electricity, and collaboration with related stakeholders to develop dedicated energy forests for ensure sustainability of feedstock supply.

II. Biodiesel Mandatory Programme

The Government has set a mandatory programme for biofuel development through MEMR Regulation No. 12 of 2015. The regulation sets the stages of minimum obligation of biodiesel blending. When it was first introduced in 2008, the blending rate was only 2.5% and it gradually increased to 15% in April 2015 and 20% in January 2016. From January 2020, the use of the blending of 30% biodiesel into diesel fuel or B30 is required.

This Programme's key stakeholders include: the Directorate General of New, Renewable Energy and Energy Conservation (DGNREEC) of the Indonesian Ministry of Energy and Mineral Resources (MEMR), PT Pertamina (Persero), PT AKR (a private company), and biodiesel producers.

This Programme has been successful in the following areas:

- In 2019, out of 9.15% of the renewable energy contribution in the total energy mix, biodiesel contributed about 30%.
- In 2019, the realization of biodiesel for domestic needs reached 6.4 million kL or increase 70% from the realization in 2018. And until 3rd quarter of 2020, the realization for the domestic needs reached 6.35 million kL.

- In 2019, Indonesia was able to save up to IDR 43 trillion foreign exchange and managed to get revenue from down-streaming palm oil industry for more than IDR 9 trillion.
- More than 800,000 workers from on farm and off-farm jobs are employed in the biodiesel sector.
- Indonesia also obtains environmental benefits by implementing biodiesel. In 2019, B20 mandatory program reduced emissions by 9.6 million tons of CO2 which equal with exhaust emissions from 34,600 small buses. The benefit is expected to increase this year with the implementation of B30.

The Programme faces the following challenges:

- Related to infrastructure, there are availability of storage tanks is limited, there is high occupancy in certain jetty locations, and lack of test lab facilities.
- Improvements of B100 specification have caused some B100s to be off-spec during the early period of B30 implementation.
- Logistical constraints are found related limited availability of large vessels with Proficiency in Security Awareness (PSA) certification and nitrogen blanketing as well as limited availability of trucks with Non-ODOL (over dimension over loading) requirements.
- The global pandemic has caused double hits to energy sector. Biofuels are faced by low oil prices and decreasing demand. A decrease in diesel fuel demand has led to decrease in the volume of biodiesel utilization. With the economy slowing down and stay-at-home orders in effect, this reduction in biodiesel demand is beyond control.
- The gap between Market Price Index of biodiesel and diesel fuel continues to increase to a new level that has never been experienced before. As the result, the need of incentives becomes much higher and this situation cannot be handled by Palm Oil Fund.[3]
- To maintain the quality of biofuel, knowledge of handling and storing is required according to the standard.

Lesson learned: To accelerate the Biodiesel Mandatory Programme, the Government of Indonesia has conducted several strategic efforts, among others:

- Improvement of Indonesian National Standard (SNI) for biodiesel;
- conduct of road test/performance test for B30;
- enhancement of the private sector's readiness to produce biodiesel;
- improvement of the proper handling and storage system method;
- preparation of the infrastructure;
- creation of incentive;
- campaign for public acceptance of biodiesel.

3 The Palm Oil Fund is built from levies on palm oil exports to finance activities that promote a sustainable palm oil industry. The fund is managed by the Palm Oil Plantation Fund Management Agency, which is under the Indonesian Ministry of Finance.

III. Biogas Development Programme

Biogas Development Program consists of domestic biogas and communal biogas. The General Plan for National Energy has annual targets for the utilization of biogas as well as a target to produce 489,8 million m3 in 2025.

The stakeholders involved in the Programme are the Directorate General of New, Renewable Energy and Energy Conservation (DGNREEC) of the Indonesian Ministry of Energy and Mineral Resources (MEMR); Hivos, a development aid organization based in The Netherlands; local governments; and Islamic boarding schools.

The Programme has been successful in the following aspects:

- The Domestic Biogas Program has reached 31 of the total 34 provinces in Indonesia.
- As of October 2020, there are 47.754 domestic biogas units which produce 75.468,7 m3 gas/day or 27,89 million m3/year.
- In 2015 – 2019, MEMR built 38 communal biogas units in Islamic boarding schools in 10 provinces (NAD, West Sumatra, Riau, Lampung, Banten, West Java, Central Java, East Java, East Kalimantan and Central Sulawesi), which process human waste into biogas to be is used as a substitute for LPG and for lighting purposes.
- The Programme is funded by the Government's main budget and Special Allocation Fund (DAK); donor organizations; and the private sector.

Challenges:

1. The cost of biogas installation is considered high, especially for rural communities.
2. A substantial amount of initial capital is required to achieve the economy of scale.
3. Initial funds to develop biogas installation are not readily available.
4. Using biogas installation is considered less practical compared to the use of LPG.
5. Grant/subsidy scheme is considered counterproductive for the community to develop semi-commercial scale biogas programme.
6. There is a need for a strong coordination among ministries/ agencies and for a better synergy among programs.
7. Most biogas programmes are yet to be better integrated with productive activities.

Lesson learned:

For a biogas programme to be successful, it requires:

- a strategic plan
- a strong coordination and cooperation with related stakeholders to attract investment and to synchronize various biogas programmes
- integration of biogas programme with productive activities
- creation of new business opportunities

- provision of training and technical guidance
- studies and strategy to accelerate biogas development

IV. Communal Solar PV Project in Muara Enggelam, East Kalimantan

Located remotely in East Kalimantan, the village of Muara Enggelam covers an area of 20 km2. There is no road access to the village, leaving only boats that travel in the big and small rivers as the only option to reach the village. For some local communities in Muara Enggelam, their houses are built on floating rafts.

In 2014 the Ministry of Energy and Mineral Resources built a mini off-grid power plant with a capacity of 30 kWp connecting 168 households and 8 public facilities (schools, village government office, health center, mosque) to electricity with an allocation of 350 W for each house and 500W for each public facility. In 2018, an additional capacity of 12.1 kWp was built and funded from the village's own funds and the village-owned company's profit, in collaboration with a private company called Gerbang Multiindo Nusantara (GMN).

The key stakeholders involved are the Ministry of Energy and Mineral Resources (MEMR); Ministry of Villages, Disadvantaged Regions and Transmigration; Ministry of Home Affairs; the village-owned company (BUMDes), and Gerbang Multiindo Nusantara (GMN).

The Project is successful in the following areas:

- The power plant management and operations are done by a village-owned entity.
- The connection fee is affordable for the local standard.
- The tariff is adjusted to the economic ability of the community, i.e. Rp.3,000 (USD 21 cent) per day. Billing is done every 10 days.
- Fraudulent customer sanction rules are formulated.
- A reward system is set up for residents who report fraudulent use of electricity.
- The power generated is used by the community for productive activities, e.g. ice cube making, fish processing, etc.
- The village has been able to set up 5 village business units related to the power plant management and operations.

Challenges:

Due to the remote location of Muara Enggelam Village, where the only transportation is by boat, the Village-owned Company (BUMDes) is challenged in conducting big maintenance, for example: replacing battery, inverter, solar module, etc. These components are not available locally and must be purchased from Jakarta, which creating high costs for maintenance.

Lessons learned:

It is very important to develop sufficient regulations on the operations and management of off-grid power plant to ensure the sustainability, especially in

keeping the community pay the electricity fee. The engagement of the community and the use of electricity for local productive activities will increase the community's awareness on the importance of the power plant and ownership of the plant.

V. Micro Hydro Power Plant in Tepal Village, Sumbawa Regency

The Micro Hydro Power Plant (MHPP) is located in Tepal Village in Sumbawa Regency, West Nusa Tenggara Province. This MHPP was built by the Ministry of Energy and Mineral Resources in 2009 (MHPP 1) with a capacity of 25 kW, and the Ministry of Cooperatives and SMEs (MHPP 2) with the capacity of 40 kW. Both plants are managed by a local multi-business cooperative called KSU Puncak Ngengas. MHPP 1 and 2 are operating 24 hours a day and provide electricity for 339 houses; 3 school; 1 mosque; 1 health center; 20 stalls; 7 productive workshops which operate, among others, drilling machine, turbine welding machine, and coffee processing machine.
Key stakeholders: MEMR, local government, and a local cooperative.

This MHPP is successful in the following areas:

- The management and operations of the power plant are done by a local cooperative.
- The tariff system is developed based on the users and usage. The fee is based on the use of the electricity. Households using electricity only for lighting and television will be charged Rp 20.000 (USD 1.40/month), while households also using other electronic equipment such as fans, cooking equipment, etc. will be charged Rp. 30.000 (USD 2.20)/month. For households using productive machines like refrigerators and food processors, electricity meters are installed so the monthly bills are adjusted by the usage.
- From the outset of the MHPP development, the local community has been involved, including in the establishment of the management institutions.
- Training was provided to the local people to run the MHPP. There were 3 individuals who were trained to become technicians and 17 as operators.
- The local operator, KSU Puncak Ngengas, has developed a good rapport with the contractor and the turbine manufacturer, who supplied the turbine for MHPP 1 and 2 and conducted the construction. In the case of a big damage, the local operator can easily contact the contractor/turbine manufacturer to obtain technical direction and support.
- The availability of electricity has enhanced productivity and generated economic benefits for the local people.

Access to Electricity's Positive Impact on Productivity

The electricity produced from the MHPP in Tepal Village is used for coffee processing, which allows the use of machine to dry and roast the coffee. In the past, the local growers sold fresh coffee beans Rp. 21.000/kg. Now they can process the coffee beans themselves, pack the end-products and sell 900% higher. The price of its premium arabica coffee is now Rp. 41.000/250 gr, ginger coffee Rp. 35.000/250 gr, local arabica coffee Rp. 27.500/250 gr, robusta coffee Rp. 20.000/250 gr, and Luwak Coffee[4] Rp. 105.000/200 gr. These coffee products that are well packaged for end-users make the distribution system easier and cheaper. The cooperative utilizes local college students who study in other islands to become sellers and distributors of Tepal Coffee.

Challenges:

One of the main challenges in operating the MHPP in Tepal is about the funding or support from local/village government. Every year, the Government of Indonesia allocate Village Fund (Dana Desa) for the development in every village in Indonesia including for energy infrastructure. Unfortunately, KSU cannot tap this funding because the business form of KSU is cooperative, while the Village Fund only allows BUMDes (xillage-owned company) that can tap the Fund. Due to this regulation, the KSU has to develop a strong coordination with the provincial government in terms of obtaining funding support for Tepal MHPP.

Lessons Learned:

- Good regulation in operating and managing the off-grid power plant is very important to ensure the sustainability of the power plant, especially to keep the community paying the electricity fee. The engagement of the community and the use of electricity for local productive activities will increase the awareness of the community on the importance of the power plant to their livelihood and hence their ownership on the power plant.
- The productive use of energy will increase the ability of the community to pay the electricity.
- It is very important for the entity which operates the power plant to have other business in addition to managing the power plant, in order to strengthen their own financial capability in case the funding support from the Government is not available.
- In terms of O&M, it's very important that the management entity to maintain contact with the contractor and technology provider in order to ease communication in case there is problem with the power plant components.
- It is very important for the existing of local service provider to decrease the O&M costs, if the component/spare part are available locally and hence there is no high cost for transportation.

4 Kopi Luwak is a coffee that consists of partially digested coffee cherries, which were eaten and defecated by the Asian palm civet (Paradoxurus hermaphroditus).

VI. Sumba School Electrification with Solar PV Smart Minigrid System

Since 2015 Hivos South East Asia (Hivos), has implemented 33 solar PV smart mini-grid systems with the total capacity nearly 65 kWp, for rural schools in Sumba Island, one of the unelectrified villages in East Nusa Tenggara (NTT) Province, Indonesia. Funding for this initiative comes from different sources, including partial support from crowdfunding and grants. In 2014 the pilot activities were implemented in 7 schools with funds from the Norwegian Agency for Development Cooperation (NORAD) and EKOenergy, an international not-for-profit ecolabel for energy (renewable electricity as well as renewable gas, heat and cold). With support from the Millennium Challenge Cooperation (MCC) and crowdfunding from the public in The Netherlands, in 2017 the scale-up took place in 28 schools. It happened that three of the schools are located in one compound. For this specific site, Hivos developed a smart grid system.

This project has been designed as a demonstration project to address lack of electricity in rural and remote schools, a situation which often contributes to the poor quality of education. It also showcases a collaborative rural electrification delivery model involving a wide range of stakeholders. This model can become an alternative approach to address energy access issues aside from the business-as-usual measures taken by the government.

Key stakeholders: MEMR, local government Office of Education; local government officials; Head of Village; Hivos; Renewable Energy Corporation (REC); Norwegian Agency for International Cooperation (NORAD); Millenial Challenge Corporation (MCC); EKOenergy; PT RESCO Sumba Terang, a private company.

Smart, Mini-grid System in Panenggo Ede, West Sumba

While the rest of the schools' solar PV systems are stand alone, in the case of Panenggo Ede in West Sumba, the school complex comprises an elementary school, a middle school, and a vocational high school. In this school compound, Hivos installed a 3x2 kWp smart system on the site. The minigrids are connected to each other through a smart grid controller with a configuration that allows sharing the excess power. The smart mini-grid installation supplies reliable electricity for the schools, teacher's living quarters, and students boarding quarters for 24 hours. This smart system has worked so well that there is no need for the schools to turn on their fossil-fuel genset.

Successful aspects:

- The power plant management and operational by local entity:
  - ∞ robust system design and compliance with international standards, hence requiring minimum maintenance.
  - ∞ establishment of Standard Operating Procedure (SOP) for O&M activities.
  - ∞ capacity building for local operators for day-to-day operations and local partner company/PT RESCO Sumba Terang for regular maintenance and basic troubleshooting.

- Periodically, the local partner company conducts a visual inspection, fills in a maintenance checklist, and assess the performance of the system.
- continuous assistance for high-level troubleshooting and warranty services.
- school's commitment to allocate O&M cost of the asset from their regular budget.

- The engagement
  - Many local stakeholders and champions were identified and engaged early on including the Head of Village, local government officials, and the district's Education Office. The involvement of the district's Education Office is important, as the O&M fee charged to schools is taken from the School Operational Assistance (BOS) Fund and hence the approval from the Education Office for the use of the Fund for O&M becomes necessary.
  - The community and the beneficiaries were actively participating and engaged in various meetings, interviews and workshops. They expressed the current livelihood challenges, how they believed electricity could help, and their aspirations when access to electricity is available.

- Productive use of energy
  - School teachers slowly adopting computer skills and the use of audio-visual equipment for teaching.
  - Specific to the vocational school, the teachers are able to use the electricity to teach the students various productive use of electricity equipments including electric mixers, rice cookers, sewing machines, as well as more advanced activities such as water pumping and processing of their farm's harvests.

Challenges faced by this project include:

- Pre project: The institutional formation in school to manage the solar PV power plant.
- O&M:
  - Lack of telecommunication coverage does not allow remote monitoring system.
  - The School Operational Assistance (BOS) Fund is received by NTT local government every 3 month, while the maintenance done by the Renewable Energy Service Company (RESCO) has to be paid on monthly basis. This is a big challenge for the RESCO to keep doing regular maintenance.
  - Commitment is made with headmaster of each school. However, in Indonesian education system, position of headmaster tend to undergo frequent work mutation. Some schools that have new headmasters have objection in payment and have accumulated one year arrears to RESCO. This situation is escalated to a forum which are attended by local government and other stakeholders, in order to find solutions.

Lessons learned:

The deployment of this pilot project including smart mini-grid systems has proven to produce significant impacts for the rural schools. Not only electricity access has supported the teaching and learning activities, it is also helpful for the security with the presence of lighting at night, adoption of computer skills for teaching purposes and utilization of new technology inputs for teaching. Increased quality in educational activities will have multiplying impacts to create jobs, raise local awareness to continue their education to a higher level, and reduce child marriage, which is one of the common issues found in Indonesian rural areas. Whenever possible, the utilization of the generated electricity can be extended for economic activities, telecommunication access, water supply, etc.

GENDER MAINSTREAMING

Indonesia has put a good thought on gender mainstreaming in rural electrification and renewable energy, and -- to some extent -- gender is already considered in some of its projects.

Rural electrification benefits women and children as security is increased with the availability of lights and power, especially in the evening. It improves the ability to conduct productive activities and the ease of doing daily activities, such as cooking, studying (especially in the evening), and opens up more access to information.

More directly, rural electrification provides more opportunity for women to be actively involved in the power plant management, operations, and maintenance. It increases gender equality in the sub-national level. For example, the Renewable Energy Service Company (RESCO) in East Nusa Tenggara has women technical officers. This is an exceptional move, considering that the majority of women in this region lives a strong patriarchal system.

In the Domestic Biogas Programme, women play an important role as both the subject and beneficiary. A gender-related training was done by Hivos in this program.

In the Communal Solar PV Project in Muara Enggelam, East Kalimantan, there is no women involvement as operator and in the power plant operations. However, the women involvement is found in the planning process, administration, and in regulation discussion at the village level.

In Sumba School Electrification Project, gender inclusion was applied since the beginning of institutional formation, in all community engagement and consultations, as well as in the O&M training. Hivos introduced Gender Action Learning for Sustainability training to teachers and parents that requires both men, women and youth to participate.

Going forward, Indonesia is keen to further mainstream gender in renewable energy policy and practice, by having systematic and practical approaches, with clear identification of outcomes and outputs, and equipped with a monitoring and evaluation (M&E) framework. In doing so, there is also a potential to collaborate with the Indonesian Ministry of Women Empowerment and Child Protection that has specific mandate on the said theme.

FUTURE PLANS

Indonesia has developed various future plans for different projects, as follows:

Bioenergy Power Plant Program

- Promote the Business and Investment Climate of Bioenergy Development, which includes drafting Presidential Regulation on Electricity Purchase Price.
- Increase the installed capacity of Bioenergy project pipeline by ensuring all parties involved to implement the Electricity Supply Business Plan (RUPTL) commitment.
- Implement Waste-to-Energy (WtE) Acceleration Project according to President's Regulation No. 35/2018.
- Encourage agro-industry with captive power to sell their electricity surplus with excess power schemes.
- Develop small-scale Biomass Power Plant in the eastern part of Indonesia and in the frontier, outermost and least developed regions (3T) extensively.

Biodiesel Mandatory Program

- Ensure the B30 Program runs as targeted.
- Develop green refineries to produce green diesel, green gasoline, and green aviation turbine fuel (avtur).
- Conduct supporting technical and economic studies.
- Develop supporting industries (methanol, catalysts, etc.).

Biogas Program

- Develop a Sustainable Biogas Roadmap.
- Encourage biogas development for domestic purposes and small, micro, and medium enterprises by utilizing domestic waste, manure or agricultural waste.
- Promote the development of commercial scale Bio-CNG for transportation, LPG substitution for industry, and power generation.

Solar PV Project for Cold Storage Facilities in Remote Areas

Ministry of Energy and Mineral Resources and Ministry of Marine Affairs and Fishery are in close cooperation to develop Solar PV projects for cold storage facilities. The idea is to integrate the supply and demand side and create a new market for renewable energy. This project intends to develop the next level of rural renewable energy, which is not just for lighting but also to increase the productivity and local economy.

As an archipelagic country, Indonesia has so much potential in fishery, and mostly the ones in small, border, and remote islands. With the unavailability of electricity in many of these islands, it is not possible to have the cold storage facilities and therefore it is hard to expand the fishery business in those areas. In some islands, there are cold storage facilities that use electricity from diesel power plants and due to unreliable of power supply from the plants, companies must provide diesel generators in case of blackout. The combined high costs of the electricity generated from diesel power plants and the costs for making available and using diesel generators have significantly increase the operational costs.

Solar PV power plants for cold storage facilities is considered as the best solution to overcome those challenges. MEMR will build the solar PV power plants and the Ministry of Marine Affairs and Fishery will build the cold storage facilities and be in charge of the operations and maintenance. This project, which is still under development will allow small fishery entities to increase their capacity and expand their business, obtain more profit, and finally increase the quality of life of the fishers and the community at large. Eventually, this improvement is expected to give a positive impact to the fishery industry in Indonesia.

One of the challenges foreseen in this project is the maintenance, especially for the ones in remotes areas, where local service providers are not available. The MEMR is in discussions with one of the national technical service providers to support and provide the maintenance needs periodically. The discussions are still ongoing among the MEMR, Ministry of Marine Affairs and Fishery, and the national service provider.

Madagascar

Madagascar's energy balance shows that about 80% of its overall energy consumption is based on biomass (mainly firewood 68%, charcoal 10% and other biomass 2%), 17% on petrol (transport), 2% on electricity (hydropower and diesel power plants) and 1% on coal.

Access to electricity remains low with about 20% of the total population having access to this form of modern energy. In the rural areas, only about 5% have access to electricity. The installed capacity of electricity production in Madagascar accounts accordingly for some 650 MW only (production in 2008 = 486 GWh). The currently utilized capacity is even lower due to inefficiency following the lack of rehabilitation of some of the large hydro power plants which provide approximately 68% of the country's electricity while the rest is produced by close to 100 diesel power plants.[5]

In terms of renewable energy, Madagascar has a great potential to be harnessed. A new Energy Policy was adopted in 2015 as part of the implementation of Sustainable Development Goals (SDGs) objectives and one of which is to increase the electricity access rate, and make it affordable to the population, through tapping the renewable energy potential of the country, thus offering a guarantee of sustainability.[6]

THE DEVELOPMENT OF RENEWABLE ENERGY SECTOR

The development of renewable energy in Madagascar began in 2009 and was primarily triggered by the increase of fossil fuel price and environmental degradation.

2 main areas for the development of renewable energy have been identified, i. e. the promotion of renewable energy and the improvement of the governance of the sector.

5 https://energypedia.info/wiki/Madagascar_Energy_Situation
6 https://www.climateinvestmentfunds.org/sites/cif_enc/files/meeting-documents/madagascar_eoi_0.pdf

Promotion of Renewable Energy

As part of the implementation of the Energy Sector Policy that was adopted in 2015, the Ministry of Energy, Water and Hydrocarbons has prioritized the promotion of renewable energy, which includes hydroelectricity and solar energy, with the objective to ensure the sustainability of operations and reduce the price of electricity, as well as to the fight against climate change.

The Energy Sector Policy which covers a period of 2015-2030 -- in line with the SDG period, will promote both on- and off-grid systems and is targeting 85% from clean energy sources. The strategy of the implementation includes electrification on a regional scale, promotion of renewable energy, development of integrated projects, and utilization of PPP financing. Meanwhile the key activities are, among others, the elaboration and updating of indicative masterplans, developing PPP, carrying out feasibility studies on energy & natural resources (ENR) projects, developing participatory approach of local authorities, and promoting gender approach.

In addition, it is expected that the wider use of renewable energy will help develop the local economy and improve the operations of basic social services. Regional master plans that cover a period of 15 years have been developed to identify locally available renewable energy sources to provide electricity to the population.

ADER has developed hydroelectric and solar projects stemming from the regional masterplans with the support of technical and financial partners, including German International Development Corporation through the PERER GIZ Program.

The involvement of different stakeholders indicates different roles that each stakeholder plays, i.e.:

- Ministry of Energy and Hydrocarbons is the licensing authority. It is responsible for granting authorizations and concessions for the operation of energy transmission, distribution and production facilities.
- Rural Electrification Agency (ADER) promotes and encourages the submission of rural electrification projects,
- Technical and financial partners (TFPs) provide technical and financial support.
- The private sector develops, implements, co-finances and operates electrification projects
- Local authorities facilitate project implementation.

Some sites developed with the GIZ :

- Hydroelectric site at Anjiajia of 80kW in the rural commune of Mahatsinjo
- Hydroelectric site at Soavina of 60kW in the rural commune of Ilaka Centre
- Hydroelectric sies in the capitals of the rural communes Saint-Augustin, Mahaboboka, Manombo Sud, Antanimieva in the region Atsimo Andrefana

The promotion of renewable energy involves the Minsitry of Energy, Water and Hydrocarbons, Rural Electrification Development Agencies (ADER), private operators, and local government authorities.

The promotion of renewable energy in Madagascar has demonstrated success in:

- The Operation of mini-hydro and solar power plants under the Public Private Partnership (PPP) system, which is able to attract more private sector's participation in the sector.
- The acceptable pricing in relation to the population's ability to pay, which has helped increase the income of the population and improve their living conditions.
- Electricity available 24 hours a day
- Participatory processes in project implementation which has made the local authorities more involved, from project planning to plant operations.

Yet, challenges are faced, such as in conducting gradual substitution of fossil energy sources to renewable energy sources and the standardization of rates by customer category.

During the implementation, key lessons that have been derived include:

- Projects must respond to the needs of the local community.
- Capacity of the private sector needs to be enhanced.
- Feasibility studies should include the provision of technical assistance to operators.
- Private operators need financial or equipment subsidies
- Technical and financial management training of the facilities is mandatory.
- Technology and skills transfer is required from the development partners (e.g. GIZ/ PERER) to ADER to the private operators, which ensures the participation of women.
- The operators' technical capacities and the farms' technical and financial management capacities are to be continuously reinforced.
- Watershed has to be protected in order to have the necessary water resources for the power plants.
- Pre-paid meter system has positive impacts on higher recovery rate and the efficiency of energy consumption.

Improvement of the Governance of the Renewable Energy Sector

The restructuring of the overall energy sector, which aims at 70% of the households to have access to electricity which comes from hydroelectricity (70%), wind power (5%), solar (5%), and thermal (15%) plants.

The governance of the renewable energy is improved by working in these main aspects:

- Redefinition and clarification of the remit of actors involved in renewable energy.
- Revision of the legal and regulatory framework, including the promulgation of electricity code and grid code.
- Creation of an energy information system that is available to the general public.
- Elaboration of regional masterplans

The activities involve the Ministry of Energy, Water and Hydrocarbons, ADER, GIZ/PERER Project, private operators, and local government authorities, with the following roles and responsibilities:

- Ministry of Energy and Hydrocarbons defines the National Energy Policy and provide the leadership and coordination in the planning of all projects in the electricity sector.
- Rural Electrification Agency (ADER) implements the policy on electrification in rural and peri-urban areas.
- GIZ/PERER is one of the pioneering technical and financial partners in the implementation of this policy.
- Private operators are in charge of co-financing and managing the infrastructures for the duration of the concession granted by the State.
- Local authorities facilitate the implementation of projects, in particular land and social aspects.

To date, Madagascar is able to identify success in improving the governance of renewable energy sector in the following areas:

- Energy information system is set up. This system serves as a national database in energy sector in Madagascar. As it is updated annually, this database provides a reference for performance indicators and direction. This database is accessible for the public who needs statistics on energy.
- Public Private Partnership Platform is set up which serves as a framework for consultation between the private sector and the government on various topics that directly affect the private sector's interests.
- Electricity sector becomes attractive for private operator.
- Indicative regional masterplans are developed and updated every two years. These documents serve as a benchmark for the local administrations to choose the best options for electrification in the said regions.

However, Madagascar feels the need to do more in governing the renewable energy sector, in order to achieve the target of 50% of the population in Madagascar will have access to electricity by 2023, which means a large-scale electrification programme is required. This translates into the need for funding. Hence, how to attract investors and project developers is the real challenge while obtaining loans from the local banks is a long and arduous process.

Another challenge is the reconciliation between the purchasing power of the population and the profitability of the project, given the condition of the majority of the population that lives in poverty.

Lessons are learned from the experience to improve the governance of the sector, such as:

- The importance of systematization of the capitalization.
- Dissemination of good practices and sharing of experience will prevent the reinvention of the wheel and enhance learning.
- The objective will only be met by creating and consolidating a number of achievements in various aspects.
- Studies and research are needed on how to optimize the available resources and define tariffs that take into account the weak purchasing power of the majority of the consumers in order to achieve 70% access rate by 2030.
- The operators are to be accompanied in the generating and sale of electricity at the level that is affordable for the consumers and maintains an acceptable level of profitability for the operators.

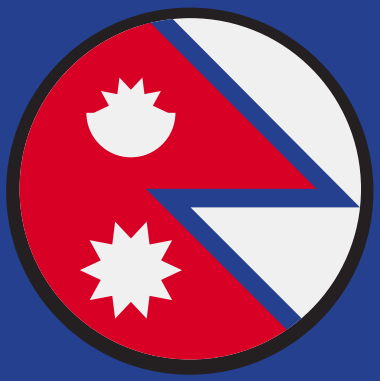
GENDER MAINSTREAMING

Madagascar has started to mainstream gender in its renewable energy promotion and activities. This includes, for example, the creation of income-generating activities in trade, such as grocery store, food store, video room, welding workshop, carpentry. Impact assessment is conducted to measure the results of gender mainstreaming. However, since the gender mainstreaming is still early in the days, there is a need to develop well-defined objectives and framework, including indicators and targets.

FUTURE PLANS

Short-term programs for the years 2020 to 2023 have been elaborated in order to achieve the objectives set by the government of Madagascar, i.e. to develop an attractive and secure rural electrification sector for public and private investors, and to sustain local development and improve living conditions for rural communities.

The target that 50% of the Malagasy population will have access to electricity at a socially acceptable price by the end of 2023 requires Madagascar to double the means of electricity production in five years, more particularly via renewable energy sources.



Nepal

Almost the totality of the electricity generated in Nepal comes from hydropower. Most of the energy supply is from biofuels and waste as 21 million people still rely on traditional biomass for cooking. In 2000, 81% of the population did not have access to electricity but with remarkable efforts from the government, only 6% remains without access today. Nepal is one of three countries with the greatest increases in electricity access from 2006 to 2016, owing to grid-connected and off-grid renewables.[7]

Three main policies and programme were developed and became the backbone of the success of electrification and the utilization of renewable energy in Nepal, i.e. Rural Energy Policy of Nepal (2006), National Rural and Renewable Energy Programme (2012) and Renewable Energy Subsidy Policy (2016).[8]

3 MAIN INITIATIVES

The following are 3 (three) successful initiatives in Nepal that are worth sharing.

I. Rural Electrification in Nepal

Background

Energy is the key to development. The per capita energy consumption reflects the development situation of a country. The per capita electricity consumption of Nepal is 260 kWh. With over 90 % of the country's total electricity generation capacity generated by hydropower plants, Nepal is heavily dependent on its hydro resources to meet its energy demand. Out of the total of 90% electrification in the country, the contribution of grid supply is 80% and off-grid supply (mainly through micro/mini hydro, solar and/or solar/wind mini-grids, and solar home systems) is 10%.

The Government of Nepal (GoN) started developing the off-grid electrification (micro hydro) sector since its 5th Five Year Plan Period (1975-80). During the 6th Five Year Plan Period (1980-85), GoN launched the "Rural Electrification Project" through Agriculture Development Bank Nepal (ADB/N) and started to provide subsidy to these micro hydro schemes. In the 7th Five Year Plan (1985-90), the government recognized the importance of Renewable Energy

7 https://www.iea.org/countries/nepal
8 https://www.iea.org/countries/nepal

Technologies (RETs) and promoted micro-hydro projects (MHPs) as a tool for developing agriculture and small-scale industries. The 8th Five Year Plan (1992-97) gave special priority to the energy sector with an emphasis on reducing the gap between urban and rural areas. The Alternative Energy Promotion Centre (AEPC) was established in 1996 as an apex body of the government for the promotion and development of renewable energy in Nepal.

The 9th (1997-2002) and 10th (2002-2007) Five Year Plans had set clear targets and put emphasis on Solar Photovoltaic (PV) for rural electrification. During this period, the government introduced Renewable Energy Subsidy Policy 2000 and promulgated the Rural Energy Policy 2006. The main objectives stated in Nepal's renewable energy subsidy policies are to; (a) improve agro-processing, reducing drudgery, (b) promote renewable energy for basic rural electrification and replace imported fossil fuels, (c) engage the private sector in the renewable energy, (d) develop the RET market, (e) increase the standard of rural electrification services, (f) support the productive use of electricity for enhancing livelihoods, (g) promote gender equality and social inclusion in the renewable energy sector, and (h) turn waste to energy. To meet the government target of increasing the access of electricity in rural areas and to embrace more renewable energy technologies the subsidy policy was revised for the fourth time in 2016. Initially, there were only a few objectives in the subsidy policy but more objectives were added as the policy was reviewed and refined embracing all the objectives mentioned above.

Due to Nepal's scattered households, decentralized energy systems such as micro hydro and solar home systems of appropriate become optimal energy solution. Considering the diversity of available resources, socioeconomic conditions and geophysical conditions, energy policy considers prioritization/hybridization of different energy options as per the varying needs, affordability and acceptability of the local people. Distributed power generation based on renewable energy sources contributes for better livelihood to remote villagers. The results show that the solar PV system is becoming economically more viable than other options apart from environment benefits.

While developing countries are not yet on the proper path to promote renewable energy, it can speed the process up by subsidizing RETs till the market for it becomes robust and economy of scale is achieved. The issue of electricity affordability is recurrent in the context of rural electrification as the target groups are usually the rural poor. But, not having access to electricity, they often have to spend much of their time and revenue for buying or collecting energy sources for their day-to-day needs. Therefore, rural households are usually willing to pay for access to electricity services.

Financing off-grid rural electrification by providing partial subsidies have improved affordability and facilitated access to electricity in remote and rural areas of Nepal. Financing of off-grid electrification needs a proper mix of subsidy, user's equity and credit. Only the formulation of policy is not enough but also social barriers such as awareness on technology and the subsidy and proper delivery channel need to be considered. In summary, electricity generation and distribution are costly; total investment depends upon various factors like technology selection, transport access, amount of energy generated and distributed, and operation and management costs.

Due to difficult geographical conditions and sparsely distributed population, especially in the mid-hill and high mountain regions, it is expensive, difficult and time-consuming to construct costly transmission and distribution lines to provide

grid electricity. The economic condition of the people living in remote rural areas is poor, so consequently they have low purchasing power so they cannot afford to consume large amounts of electricity. The off-grid electricity solutions have been suited to such situations advancing the situation of electricity access in Nepal.

II. Rural electrification through Micro/Mini Hydro and Solar PV in Nepal

Micro and Mini Hydro in Nepal is an old, proven technology, and was initiated by the Agricultural Development Bank, Nepal (ADB/N) in the 1980s and implemented by Nepal Electricity Authority (NEA) in the early 1990s. After the establishment of AEPC in 1996, promotion of micro mini hydro and solar PV home systems took momentum through different programmes and projects including Rural Energy Development Programme (REDP), Energy Sector Assistant Programme (ESAP) and National Rural and Renewable Energy programme (NRREP) supported by various development partners and implemented by AEPC together with the engagement of various partners including private sector, civil society organizations and user groups. AEPC has been developing and promoting different ranges of innovative technologies related to micro and mini hydro ranging in capacity from few kilo watts to 1 megawatt, and those related to solar PV ranging from few watts to kilowatt.

Key stakeholders involved in this rural electrification initiative are:

1. Government of Nepal (GoN) has been supporting the development of micro and mini hydro power plants since 1980, through Agriculture Development Bank Nepal (ADB/N). Since then, GoN has been supporting and promoting micro and mini hydro power plants n Nepal with technical and financial assistance.

2. Alternative Energy Promotion Centre (AEPC) was established in 1996 for the promotion and development of renewable energy technologies including micro/mini hydro and solar PV in Nepal engaging national and international partners. This is the focal agency of the GoN mandated in renewable energy and energy efficiency.

3. Rural Energy Development Programme (REDP) was the program supported mainly by UNDP and World Bank implemented from 1996 to 2011, initially under the then Ministry of Local Development and then under AEPC.

4. Energy Sector Assistance Program (ESAP) was the program supported mainly by DANIDA, NORAD, KFW and DFID, and implemented by AEPC.

    - ESAP I (1999 to 2007): The main focus areas of the program were Institutional support to AEPC, Technical support for Improved Cook Stove, Micro Hydro, Solar Energy, and Investment Support to Rural Energy including Kailali Kanchanpur Rural Electrification Project.
    - ESAP II (2007 to 2012): The components of ESAP II were Institutional strengthening of rural energy sector, Rural Energy Fund, Technical support for Biomass Energy, Solar Energy, Mini Grid Rural Electrification.

5. National Rural and Renewable Energy Program (NRREP) was the successor of ESAP II implemented from 2012 to 2017 and the main focus areas of the program were establishment of Central Renewable Energy Fund, Technical Support and Business Development of Renewable Energy and its Productive Energy Use.

6. SASEC off Grid Project is being implemented under AEPC with the support from Asian Development Bank (ADB) for the period of 2015 to 2021 under which around 10 Mini Hydro Subprojects with the cumulative capacity of 4.3 MW will be installed.

7. Private Sector Led Mini Grid Energy Access Project is being implemented by AEPC with the support from the World Bank for the period of 2019 to 2023 under which few Micro/Mini Hydro and Solar/Wind Mini Grids will be implemented with Business Model led by Private Sector.

This initiative has been successful in the following aspects:

- The Government of Nepal, with the support from various development partners has been able to promote more than 2,000 micro and mini hydro plants with the cumulative installed capacity of 33 MW electrifying around 300,000 households and Solar PV systems with the cumulative installed capacity of 35 MW electrifying around 900,000 households across the country as of now.
- Altogether around 20% of Nepal's population has got access to electricity through off-grid systems, out of which 10% is now overlapped by the expansion of national grid and other 10% still rely on off-grid systems.
- More than 300 private companies are involved in micro/mini hydro and solar energy sub-sectors in Nepal creating more than 20,000 employment opportunities in the country.
- Nepal's model of off-grid rural electrification through micro/mini hydro and solar PV implementation has also been replicated by various countries in the developing world.

The following are challenges faced by this initiative:

- Long term sustainability
- Lack of sufficient R&D
- Transition from Subsidy Model to Credit Mechanism
- Lack of Integrated Electrification Master Plan

III. Large Biogas and Waste-to-Energy Projects through Public Private Partnership in Nepal

Background

Waste management is increasingly becoming a critical issue in multiple sectors today. Rapid urbanization in many parts of the country is causing the waste volume to gradually increase, while the waste handling capacity has barely improved. On the other hand, Nepal's reliance on imported fuels for cooking and transportation leaves the country vulnerable to acute shortages and skyrocketing prices of those commodities. The "Extended Biogas Project under Scaling Up Renewable Energy Program," jointly funded by the World Bank and Government of Nepal (GoN), and executed by the Alternative Energy Promotion Centre (AEPC), specifically aims to address these pressing issues via promotion of large scale biogas systems across the country.

The biogas technology was first introduced in the country in 1955 through a pilot installation in St. Xavier's School in Godavari, Lalitpur. After that, the biogas technology was gradually adapted to suit the Nepali context and the household biogas technology based on fixed dome design, popularly known as the GGC 2047 model, was promoted across the country. The outreach of this technology consolidated under the Biogas Support Program (BSP), implemented in various phases from 1992 till 2012.

With the conclusion of BSP, the biogas program was overseen by the National Rural and Renewable Energy Program that was launched in 2012, where policy level arrangements were made for the first time for promotion of larger sized biogas plants in Nepal. Under the program, large biogas plants were categorized into institutional, commercial, community and municipal level waste to energy projects, and subsidy provisions were accordingly devised. Furthermore, considering the huge potential to promote large scale biogas plants in commercial entities and municipalities that produce large volume of waste on daily basis, the Extended Biogas Project under the Scaling Up Renewable Energy Program (SREP) was launched in 2014 as a focused program to promote large and industrial scale biogas plants in Nepal.

The Government of Nepal has been implementing biogas program through targeted policies and programs. The Renewable Energy Subsidy Policy has remained a fundamental document to channelize support to the renewable energy sector, including large scale biogas. AEPC makes preliminary assessment of the requisites and prepares comprehensive assessment of timely updates required in the policy. Accordingly, the Ministry prepares a draft of the policy updates, which gets implemented after being approved by the Council of Ministers, headed by the Prime Minister. Currently, the Renewable Energy Subsidy Policy 2016 is prevailing.

About the Programme

After successful implementation of domestic biogas program, the biogas sector in Nepal moved towards promotion of larger biogas from 2012, with the initiation of the National Rural and Renewable Energy Program (NRREP). Policy level arrangements were made for the first time under this program. The large biogas program envisaged to support sub-projects above 12.5 m3 in installed capacity. After 2017, NRREP continues as the regular program of AEPC and so do the support mechanisms developed. The entities eligible to receive support under this program have been divided into the following 4 categories, and the support mechanisms have been accordingly designed:

- Government owned/public institutions
- Commercial business entities
- Community owned plants
- Municipal scale waste-to-energy

The biogas program took a more focused approach with the implementation of Extended Biogas Project under Scaling Up Renewable Energy Program in 2014. The program primarily supports the commercial and municipal project developers through financial subsidy and technical backstopping. The program accepts investment proposals to develop large commercial/industrial/municipal scale biogas projects, that are aimed towards management of large volumes of waste and promotion of end products, i.e., biogas and

fertilizer as lucrative revenue generators. Under this program, the scale of biogas technology transformed from the built for individual use to the one that is built for commercial purpose.

The program has two major sub-components: one sub-component deals with the investment proposals submitted from the private sector developers whereas the other one supports municipal scale waste to energy projects. By the end of current project period (Aug 2021), 340 commercial biogas plants and 10 municipal scale sub-projects are envisioned to be constructed, which is in turn expected to provide headway for long term sustainable waste management in the country.

In terms of numbers, a total of 307 large biogas plants (above 12.5 m3 installed capacity) have been commissioned till date. Among them, 5 are large industrial scale sub-projects. Additionally, 12 industrial scale sub-projects are under construction, of which 5 are being built by private developers and 7 are municipal scale waste to energy projects.

Currently Nepal almost entirely depends on imports to fulfill its demands for cooking fuel (LPG) and agricultural fertilizers. The large biogas program being implemented in Nepal seeks to intervene by enabling developers to construct large waste-to-energy facilities for both self-use and sales. With this, organic waste is managed in an effective manner, while providing a domestically produced cooking fuel and organic fertilizer to the local market.

Some of the project statistics are presented in the table below:

	INSTITUTIONAL BIOGAS	COMMERCIAL BIOGAS (SREP)
No. Of Installations Till date	132	175
Daily Gas Output (m3)	850	15,386
Daily Energy Output (kWh)	1190	21540.4
Daily Fertilizer Output (Tons per day)	5.53	42
Daily Carbon Offset (tCO2e)**	0.170	12.8

The key stakeholders involved are:

- Funding Agency: Government of Nepal (GoN) and The World Bank
- Supporting Agency: Climate Investment Fund
- Implementing Agency: Alternative Energy Promotion Center
- Beneficiaries (direct): Project developers, livestock-based farmers, and municipalities.
- Beneficiaries (indirect): End consumers of biogas and fertilizer, employees of the project facility, construction materials and raw material suppliers.

The Project's success:

The organic waste management has persisted to be a challenging aspect for Nepal, especially as the pace of urbanization is steadily on the rise. The large-scale waste-to-energy systems have proven to be effective for handling large volume of waste on a daily basis. However, the larger benefits of the technology do not end with the waste management itself. Instead, the advent of this technology has transformed the perception towards waste. Now, waste is

not merely something that needs to be discarded. Rather, it is a resource that can generate revenue which can even create an impact in the national economy. The projects built under this program have demonstrated the technology's ability to serve in multiple ways, such as:

- Biogas cylinder bottling units
- Biogas-to-household direct gas distribution unit via pipeline
- Electricity generation units
- Fertilizer production units

These benefits have led to the massive acceptance of this technology across Nepal. The GoN has also lately prioritized this sector and has pledged adequate support for the sector development.

Some of the challenges being faced are as follows:

- Convincing developers of all strata across the country of the myriad of benefits.
- The technology for the industrial scale biogas systems needs to be imported and the lack of adequate service systems within the country has created some challenge to keep the system up and running if some problems are encountered.
- In situations created by the ongoing pandemic, the availability of daily waste required for the system and the assurance of the market was also challenging.
- Assuring farmers about the quality of the fertilizer produced by biogas units is also another challenge.
- As the technology is still in a nascent stage in Nepal, motivating developers to invest without subsidy seems to be daunting, which necessitates more groundwork towards streamlining the technology.

Lessons learned:

The major learning from this project has been the introduction of sophisticated technology for waste management in Nepal, which was largely practicing production and rejection of organic wastes. Although practices of re-use, re-cycle and composting were being practiced in scattered ways, the scale of the program was large enough to create awareness in a national level.

During the project construction and operation, some specific lessons learnt are as follows:

- The availability of waste on a daily basis needs to be properly ensured.
- The operation and maintenance should be viewed with equal priority, as any disruption can break the business chain, which itself is quite fragile at the moment.
- Assurance of a market for end products such as fertilizer and biogas needs to be provided in order to lure more investors into the sector.

IV. Clean cooking solutions through Domestic Biogas in Nepal

Biogas in Nepal is an old and tested solution, and was initiated by the Agricultural Development Bank, Nepal (ADB/N) in the 1970s. Biogas Support Programme implemented by SNV, supported by the Government of Netherlands in the early 1990s. In all these years the country has been promoting only one technology, fixed dome, GGC 2047, though the use of different wastes (animal dung, human excreta, and organic waste from the kitchen) has been encouraged. Currently, AEPC has been developing and promoting different ranges of innovative technologies related to biogas system focusing on the issues of clean energy, environment, health and sanitation, regional balance, gender and social inclusion, technological shift, decentralization and transformation. Along with the rural energy, increase on the urban energy access via biogas system is one of the priorities of AEPC.

This initiative involves the following key stakeholders:

1. Government of Nepal (GoN) has been supporting the development of biogas since 1975. Now the GoN provides and technical and financial support for the development and adoption of biogas.

2. Alternative Energy Promotion Centre (AEPC) was established in 1996 for the promotion and development of renewable energy technologies including biogas in Nepal. This is the focal agency of the GoN mandated in renewable energy and energy efficiency.

3. The Netherlands Development Organisation (SNV) launched the Biogas Support Programme (BSP) in 1992 in partnership with the Nepali Government and with the financial support of DGIS. BSP was implemented in multiple phases: BSP I (1992-94), BSP II (1994-97), BSP III (1997-2003) managed directly by SNV and BSP IV (2003 to 2012) managed by AEPC.

4. International Cooperation of the Netherlands (DGIS) is the historical donor for biogas promotion in Nepal. It started funding the project from the very beginning (1992) through BSP by providing technical and financial support (both for the project management and the subsidies).

5. Kreditanstalt fur Wiederaufbau of Germany (KfW) started funding the BSP from Phase III, which started in 1997 by providing finances for the subsidies and credits for biogas promotion in Nepal.

6. Biogas Sector Partnership Nepal (BSP-Nepal) was the implementing partner of AEPC for the implementation of Biogas Support Programme (BSP) Phase-IV. BSP-Nepal was established as an NGO in 2003 to take over the implementation responsibility of BSP, which formerly was managed directly by SNV. Its prime roles included providing training to users and biogas companies, ensuring quality and long-term reliability of plants, and supporting AEPC in managing the subsidies provided to the end users of biogas.

7. Nepal Biogas Promotion Association (NBPA, formerly NBPG) was established in 1994 as an association of the biogas construction companies. It works for the development and promotion of the biogas sector mainly through capacity building, advocacy and lobbying.

8. Biogas companies (BC). They are private companies qualified for installing and maintaining the biogas plants all over the country.

9. Banks and Microfinance Institutions (MFIs). They provide loan to households and biogas companies.

Project's success

- The Government of Nepal, with the public-private-partnership modality engaging various national and international partners, has supported for the installation of more than 430,000 domestic biogas plants (up to 12 cubic meters in size) across the country.
- Around 150 private companies are involved in this sector and the operation of biogas plants has created more than 10,000 employment opportunities at local levels.
- Nepal's model of dissemination of household biogas has also been replicated in various countries in Asia and Africa.
- Biogas development has substantial role in forest conservation. Direct effect can be attributed in the reduction in forest use for firewood. Some studies have indicated that about 65% reduction of firewood demand after installation of biogas plant. Some households have completely stopped collecting firewood from forest due to change from traditional cookstove to biogas.
- Biogas installation changes the livestock rearing practice. People, instead of free grazing in public land including forests, are converting to stall-feeding. As the forests in developing country, like Nepal, are affected by grazing, biogas development can reduce the grazing pressure eventually supporting forest regeneration.
- Our experiences show that the biogas development strengthens the cohesion among villagers and form a strong community. In this regard, Nepal's biogas projects are listed in Clean Development Mechanism and below mentioned achievements are gained by AEPC till date:
    - 4 Project Activities and one Programme of Activity of household biogas registered in CDM and Gold Standard.
    - Altogether 243,882 HH biogas is incorporated in carbon projects.
    - 4.19 Million units (tCO2eq) of Certified Emission Reductions (CERs) is issued from household biogas carbon projects.
    - Approximately 18 Million USD revenue is received from selling carbon credit from household biogas only.

Yet, the initiative faces the following challenges:

- Urbanization.
- Lack of sufficient R&D in this technology.
- Lack of research to ensure the quality of the slurry produce from biogas.
- Financial increment of the farmers earnings and the installation cost of domestic biogas did not grow correspondingly.

- Operators' level of commitment to sustaining technologies represent the most influential bottleneck.

GENDER MAINSTREAMING

Gender Equality and Social Inclusion (GESI) has been fully applied in all projects and program under AEPC. https://www.aepc.gov.np/gender-equality-social-inclusion

In the programme to promote clean cooking solutions through domestic biogas, the biogas system reduces the time and labor for the collection of traditional fuels for cooking. Both activities are mainly done by women and children. The workload reduction provides opportunities for women to start other activities including income generation and engagement in social activities. Experts in the health and environment sector have stressed on the need to tackle household air pollution as the death rate from it is alarming. The domestic biogas plants serve as clean cooking solution and help to reduce health impacts caused by household air pollution.

FUTURE PLANS

GoN has set the very ambitious target of achieving 100% electrification by 2022 for which grid extension has been being carried out aggressively throughout the country. At the same time, due to the difficult geographical terrain and scattered settlements in rural areas, the electrification through off-grid solutions such as micro/mini hydro, solar/wind mini grids and solar PV home systems is inevitable indeed. GoN with the support from ADB is preparing an Integrated Electrification Master Plan of Nepal.

In its 15th Five Year Plan (2019 to 2024), GoN has visibly prioritized the use and promotion of renewable energy for rural electrification in Nepal where the target of micro/mini hydro and solar/wind energy have been clearly mentioned. Nepal is committed towards achieving the SDGs including the Goal Number 7: "Ensure access to affordable, reliable, sustainable and modern energy for all".

The GoN has taken some positive steps towards streamlining the large biogas and waste-to-energy sector in Nepal:

- A special subsidy delivery mechanism has been developed which emphasizes dedicated support to the project development.
- Large biogas has specially been focused in the 15th Plan (2018/19 to 2022/23). The Government aims to support 500 large biogas projects during this period.
- The program has also been prioritized by the Ministry of Energy, Water Resources and Irrigation (MoEWRI)'s White Paper (2018).
- The Prime Minister's Office has also formed a task force for formulation of modality for cooperative owned large biogas plants.
- Looking to reduce the dependence of communities on imported cooking fuel, dedicated budget has been allocated for the development of biogas pipelines in communities.

In addition, various development partners are also looking forward to cooperate with the government to support the sector development. The Abu Dhabi Fund for Development (ADFD) has already agreed to provide USD 10 Million as a soft loan that will be re-disbursed as subsidized loan to project developers. In addition, a proposal is being readied to seek the support from Green Climate Fund (GCF) to develop municipal-scale biogas projects with fecal sludge integration as well.

The major benefits expected from the project extension relate to the increased outreach of the technology, resulting in benefits for the larger regions across Nepal. Some specific benefits are enlisted below:

- Waste management solution for connected as well as secluded residential and/or agricultural pockets.
- Increased access to locally produced biogas is expected to reduce dependency on imported Liquefied Petroleum Gas (LPG).
- The fertilizer produced after the bio-digestion is expected to become a viable alternative for chemical fertilizers. It will also lead to promotion of organic farming.
- Reduced dependence on imported commodities will also promote national economic growth.
- The creation of investment opportunities will promote entrepreneurship within the country.
- Promotion of such clean technology will support the greenhouse gas emission reduction goals.

While the waste generation is bound to increase with time, the availability of the waste resources does not seem to be challenging at the moment. However, the assurance of project financing and reassurance of market for the end-product seem to be the key motivating factors for the long-term sector development. Considering this, the government is mulling on providing additional support for the market development of biogas-based fertilizers. Donor supported programs are also under consideration to ensure financial support at subsidized rates to the interested developers.

As Nepal is an agricultural country, livestock farming is an important component of agriculture system. An estimate shows that there is feasibility of 1.1 million numbers of domestic biogas plants within the country. However, the potentiality of biogas may rise when we use other biodegradable sources like industrial waste, municipal wastes and other biomass. Besides this the following activities have been proposed for the further development of biogas technology throughout the country in general and in the rural areas in particular:

- A policy of clean development mechanism and carbon trading in international market. It will be beneficial to ensure sustainable operation of the technology and to generate resources through carbon revenue.

- Capacity development of biogas companies and local people in construction, supervision, operation, management, repair and maintenance of biogas plants.
- Wider awareness about the benefits of biogas, its adoption and usage.
- Training and orientation to biogas users on slurry management, preparation of organic fertilizer and its utilization.
- Diversification in terms of biogas technology, feedstock utilization, uses of biogas and digested slurry.

IV. IDEAS & SUGGESTIONS FOR SHARING & LEARNING

The four countries are interested to explore the opportunities for sharing and learning with each other. Some of these countries have identified the areas of interests, who from their countries will be participate, the benefits expected from the sharing and learning, and the mechanisms to conduct the sharing and learning.

AFGHANISTAN

Areas of interest:

- solar energy
- wind energy
- smart rural electrification,
- rural grids,
- smart grids,
- agricultural systems. .

Benefits

Knowledge transfer, practical skill training, networking, real-life learning.

Mechanism:

The sharing and learning are to be done through knowledge transfer and networking platform.

INDONESIA

Areas of interest:

Indonesia would like to share its experience in:

- Biofuel implementation, including formulation of regulation, road test and performance test, and incentive system.
- Waste-to- energy: formulation of regulation.

And would like to learn from others the following topics:

- Development of large-scale biogas: funding mechanism, tariffs, technical standards, community involvement, including private sector engagement in rural electrification project development, especially in terms of subsidy mechanism (if applied), and Monitoring & Evaluation.
- Renewable energy for rural areas: sustainability, support to local economy, gender equality.

Benefits

Benefits expected from the sharing and learning include:

- Exchange of experiences and information in order to increase strategic options for bioenergy development in Indonesia.
- Inputs and options to increase the quality and sustainability of existing projects.
- Government of Indonesia sets several strategic plans based on project through the most visible pathway to support bioenergy development and to achieve the target of General Plan for National Energy or RUEN.

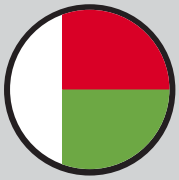
Participants

- Participants who will be involved in the Sharing and Learning Activities are from Directorate Bioenergy (MEMR) and related stakeholders.

Mechanism

- Workshops or seminars or joint working group with specific topic of RE or bioenergy.
- Some kind of forum that consists of many countries with the same interests, and sharing knowledge, experience, exchange ideas, etc.
- Online platform that is accessible for all participants to chat and upload materials for discussions.

MADAGASCAR



Areas of interest:

Madagascar would like to share its experience in hydroelectric and solar/diesel hybrid sites.

It is interested to learn about:

- The development (from planning to site operation) of low-cost power generation and distribution plants using hydropower for all the different waterfalls (low, medium, high);
- Tidal power;
- PPP: by favouring local operators in the project areas.
- Promotion and monitoring of individual solar kits
- Remote monitoring of operation centres in decentralized rural electrification

Participants

All ADER's technical management teams are interested to participate in the learning and sharing on renewable energy development, i.e. project planning and monitoring & evaluation officers, officers who develop project feasibility studies, and officers who monitor and implement the work.

Benefits

From the sharing and learning on renewable energy, ADER expects to gain:

- Update on new technologies
- Monitoring techniques with particular consideration to the Multi-Level Framework for Electrical Services.

Mechanism

It is proposed that conferences/debates and study tours to sites particularly in rural Indonesia and Nepal are to be held as a mechanism for sharing and learning.

NEPAL

Areas of interest:

Nepal would like to share the developments and achievements made by Nepal:

- in the domestic biogas technology.
- in the commercial scale of waste-to-energy technology.
- in rural electrification.

Benefits

Through this initiative, Nepal wishes to spread our experiences to other countries and learn about similar experiences from other countries that can be replicated in Nepal.

Participants

Joint Secretary of MoEWRI, Deputy Executive Director of AEPC and other relevant staff members will be participating in this initiative.

Mechanism

Similar events should be organized in the respective countries as an excursion or exposure visit where the sharing of and learning from experience can be coupled with impact showcasing in real time in the field.

The above is a summary of the renewable energy situations in Afghanistan, Indonesia, Madagascar and Nepal. It is hoped that the information will generate initial thoughts and ideas on what common situations (success, good practices, challenges, future plans, etc.) are among the involved countries within the framework of SSTC on Renewable Energy. It is also expected that possible topics and ways of collaboration could be efficiently discussed, learned from and shared with each other, prior to and during the virtual Kick-Off Meeting.

VI. RELEVANT STAKEHOLDERS

Relevant stakeholders of this initiative are from five countries: Afghanistan, Germany, Indonesia, Madagascar, and Nepal. Each country is represented by ministries and institutions which are the key stakeholders in the renewable energy sector and strategic partnership. For details of the participating ministries and institutions, see Table 1. List of Ministries and Institutions from Participating Countries[9] .

The Indonesian Ministry of Energy and Mineral Resources (MEMR) acts as the initiator and host of the activities, in coordination with Indonesian Ministry of State Secretariat which represents the National Coordination Team of Indonesia's South-South Cooperation and acts as the shepherd of the planned SSTC on RE.

COUNTRY	MINISTRIES AND INSTITUTIONS
Afghanistan	1. Da Afghanistan Breshna Sherkat 2. Energy Service Regulation Authority 3. Ministry of Rural Rehabilitation and Development
Germany	1. Strengthening Capacities for Policy Planning for the Implementation of the 2030 Agenda in Indonesia and in the Global South (SDGs SSTC), and Indonesia Energy Programme, GIZ Indonesia 2. Afghanistan Energy Sector Improvement Programme, GIZ Afghanistan 3. Renewable Energy for Rural Areas Programme, GIZ Nepal 4. Promotion of Rural Electrification through Renewable Energies (Promotion de l'Electrification par les Energies Renouvelables), GIZ Madagascar
Indonesia	1. Ministry of Energy and Mineral Resources 2. National Coordination Team of Indonesia's South-South Cooperation ∞ Ministry of State Secretariat ∞ Ministry of Foreign Affairs ∞ Ministry of National Development Planning ∞ Ministry of Finance
Madagascar	Agency for Rural Electrification Development (Agence de Développement de l'Électrification Rurale)
Nepal	1. Ministry of Energy, Water Resources and Irrigation 2. Alternative Energy Promotion Centre

9 Names of the participating ministries and institutions will be updated regularly as more relevant stakeholders are identified.

V. PHOTO GALLERY

Indonesia

President Joko Widodo inaugurated the implementation of biodiesel containing 30% palm-based fuel, or the B30 program in South Jakarta, Indonesia. The inauguration was attended by several ministers, among others, Coordinating Minister of Economic Affairs, Cabinet Secretary, Minister of Energy and Natural Resources, and Minister of State-Owned Enterprises.

Solar panels installation with up to 20 kWp capacity at An-Nuur Mosque rooftop located in Batu City, East Java, Indonesia.

Micro hydro power plant installation with 100 kW capacity at Kawinda Toi Village located in Bima Regency, West Nusa Tenggara, Indonesia

Madagascar

A hydroelectric site generating electricity with the capacity up to 60 kW at Soavina in the rural commune of Ilaka Centre, Madagascar. This site was developed with the support of technical and financial partners, including GIZ through PERER Program.

A network distribution of hydroelectric-based energy in Madagascar.

Solar panels generating power in Manombo Sud in the region Atsimo Andrefana, Madagascar. The installation of solar panel was jointly developed by international partners, including GIZ.*

Afghanistan

Solar Power Plant are installed in Kandahar City, Afghanistan. One of the firsts Public Private Partnership (PPP) collaboration in energy sector where the private sector takes part in the implementation of solar panels installation.

A group of people is inspecting the solar rooftop project located in the Training Centre of Ministry of Energy and Water of Afghanistan.

A solar rooftop project with the capacity of 20 kW is installed at the Training Centre of Ministry of Energy and Water of Afghanistan.

Nepal

A municipal waste-based biogas plant is installed the capacity of 4,200 m3 in Pokhara City, Gandaki Province, Nepal

A group of rural women carrying transmission line of micro-hydro project for distribution system located in Gorkha District, Nepal

A mini-grid solar power plant with 100 kW capacity is installed located in the Gutu Village, Surkhet District, Nepal.

A Brief Summary of Good Practices and Challenges on Renewable Energy Development

IN AFGHANISTAN, INDONESIA, MADAGASCAR AND NEPAL

Presented and discussed during the Kick off Meeting on "Knowledge Exchange on Extracting Best Practices on Renewable Energy within South-South and Triangular Cooperation Framework"

January 2021

Supported by: the joint Indonesian-German project on
STRENGTHENING CAPACITIES FOR POLICY PLANNING FOR THE IMPLEMENTATION OF THE 2030 AGENDA IN INDONESIA AND IN THE GLOBAL SOUTH (SDGs SSTC)

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