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POWERING UP HOMES AND COMMUNITIES

in Karen and Mon States

Acknowledgement
KESAN and the Research Team would like to thank Mr Witoon Permpongsacharoen, Director of The Mekong Energy and Ecology Network (MEE Net), Mr Andrew Pascale, Ms Chom Sangarasri Greacen and Mr Chris Greacen, founders of Palang Thai, for their contributions to the process of finalising the English version of the brochure.

Note to NGOs and CSOs

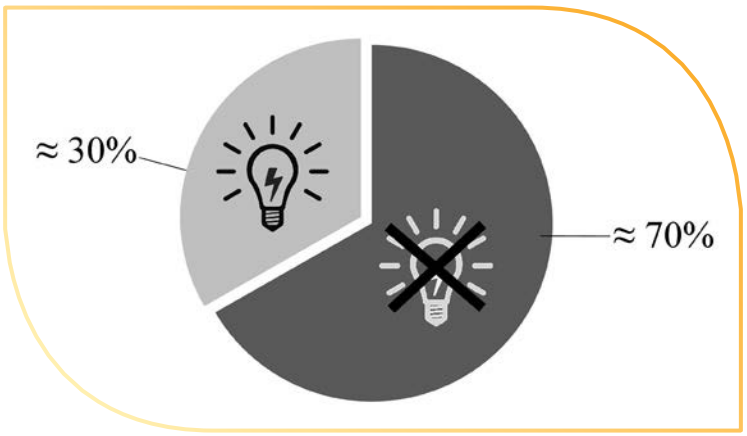
This brochure is intended to serve as resource for NGOs and CSO representatives in your work to raise awareness among communities in Karen and Mon States about the current energy situation in Myanmar, and the effects the government's proposed plans have on the land, health and human rights of the communities. Information in this brochure will hopefully provide communities with knowledge and awareness of the different existing options to access electricity and should be considered a complement to larger campaigns against harmful development projects, such as mega hydropower dams, special economic zones, and gas- and coal fired power plants. The brochure gives a brief overview of alternative energy forms. It is not intended to provide the reader with a detailed description of how these alternative energy forms function or how they can be installed

The questions in the end of this brochure can serve as guidance when initiating a discussion with communities about their electricity situation. First of all it is important to establish whether or not the community have access to electricity or not. That question will lead in to what sort of electricity currently is available in the local area, which will open up a chance to discuss the differences between electricity coming from the national grid system and a locally distributed energy system. A community energy audit should be conducted to explore how much of communities income today is spent on energy and what energy they use. Follow up with an energy-needs survey looking at how much energy is necessary to provide sufficient electricity for the community, and a natural resources survey exploring where there is potential for developing renewable energy in the community or nearby locations to create a locally distributed energy system.

Do you have electric power at home?

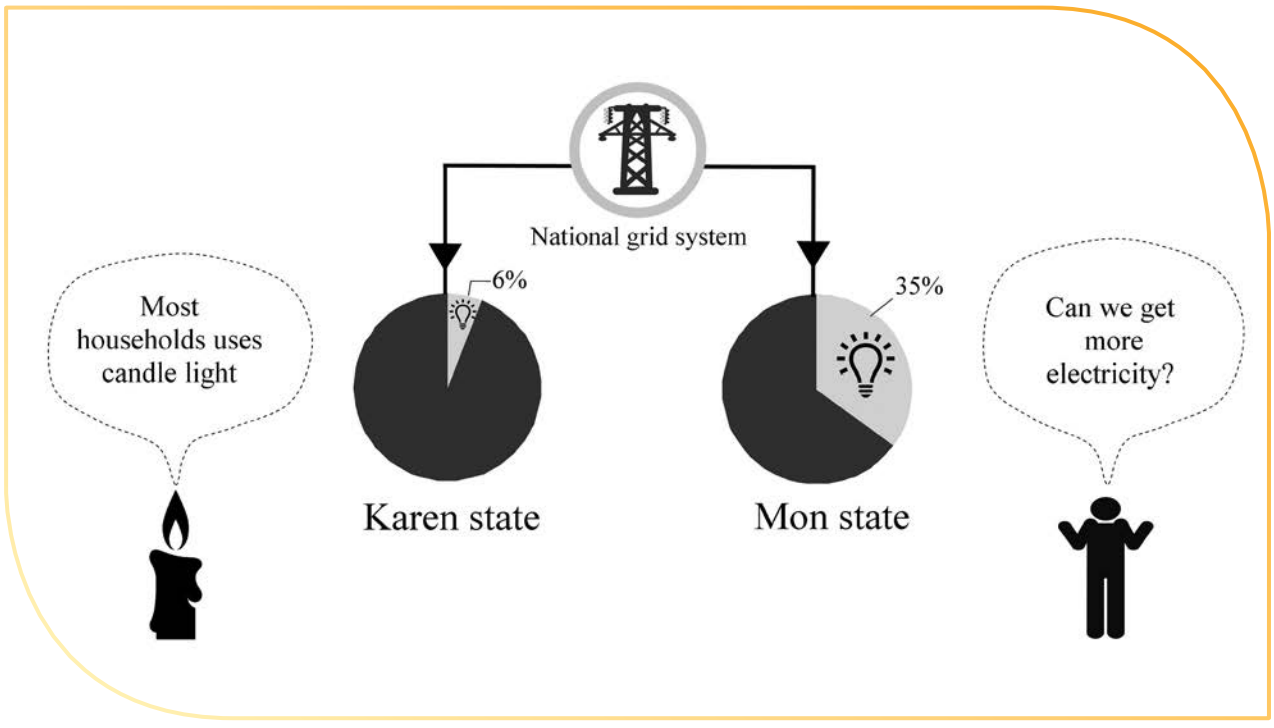
Electricity can come either from the centralised national grid system that is connected by transmission lines and supplied by the government, or it can come from a local electricity-generating system, that may or may not be connected to national transmission lines.

If you do have centrally provided electricity at home, you are one of the lucky few, because only about one third of the households in Myanmar have access to centrally provided electricity.[i] This is one of the lowest rates of electricity supply in all of ASEAN. As people are well aware, even when electricity is available, it is very unreliable. During dry season blackouts lasting several hours are very common since two thirds of all electricity comes from hydropower and there is limited amount of water. An increased demand of electricity among people, combined with old and worn out transmission lines add to the problem.[ii]



Only 1/3 of households in Myanmar can access electricity through the national grid system.

Most people in Myanmar who have centrally provided electricity in their homes live in the bigger cities, like Rangoon, Nay Pyi Daw or Mandalay. However, in the rural areas of the country, access to centrally provided electricity is extremely limited. In December 2013, it was estimated that only 6% of households in Karen State, and 35% of household in Mon State were connected to the national grid,[iii] and the Myanmar Census in 2014 found that most households in Karen and Mon State depend on candles for their main source of lighting.[iv] Yet, many rural households actually have access to electric power through local solutions, such as private diesel, solar and hydro powered electricity systems.[v]



Households in Mon and Karen States that have access to electricity through the national grid system

If you do have electricity, where do you get it from?

Do you get electricity from **(I) connecting to the national grid** or do you have access to **(II) locally generated electricity?**

(I) Connecting to the national grid

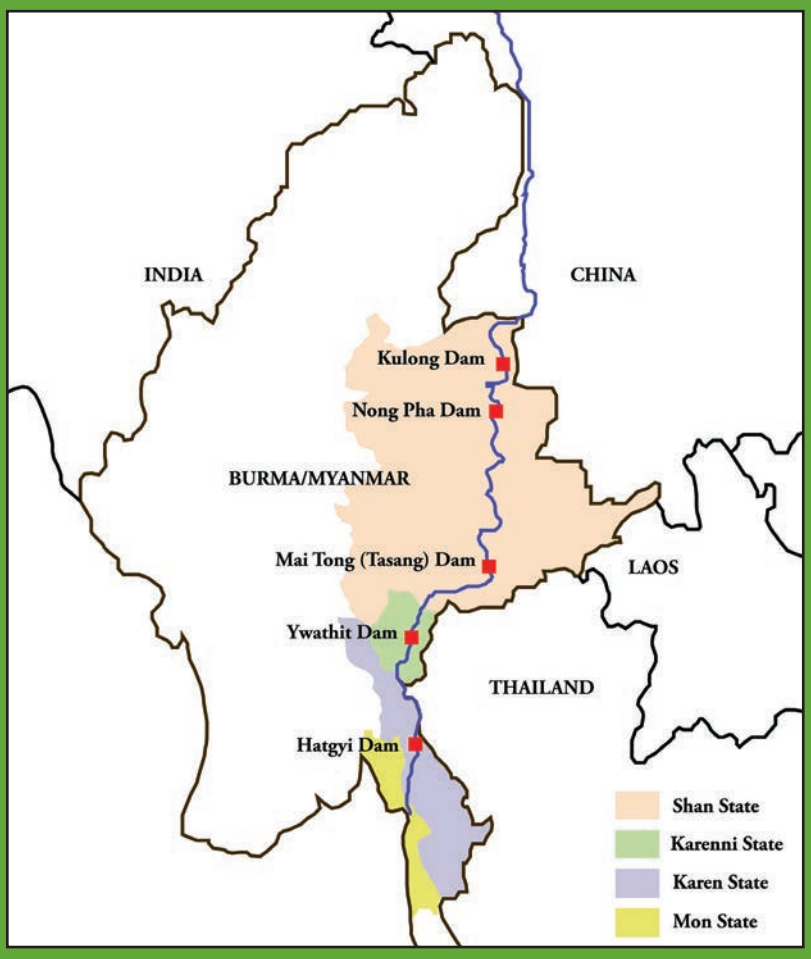
Most of the electricity used in Myanmar comes from the centralised national grid system.[vi] The electricity is generated from large-scale energy projects, such as hydropower dams and gas- or coal fired power plants, which is then transferred through long transmission lines to urban households, shops and factories.[vii]

The government of General Thein Sein said it wanted every household in Myanmar to have electricity by 2030. In order to supply electricity to the two thirds of households lacking it, the government developed plans to build more mega hydropower dams, coal fired power plants and other electricity producing projects. Together with existing power plants, these projects could generate around 46,000 MW by 2030. 46,000 MW represents a huge amount of electricity, much more than actually needed. Under the government's plan only 26,000 MW are intended for use in Myanmar, which is still considered to be about 10,000 MW more than the estimated demand in 2030.[viii] The rest will be exported to neighbouring countries, leaving the people of Myanmar - especially people from the rural and ethnic areas most impacted by large energy projects - with even less benefit from the use of their natural resources.[ix] Much confusion still surrounds goverment plans, but one thing is certain though - the consequences of the electricity projects will affect communities living in and around the project areas.

Hydropower on the Thanlwin River

As part of the government's plan five dams are to be constructed on the part of the Thanlwin River that runs through Myanmar's ethnic Shan, Karenni, Karen and Mon states. Most of the electricity generated in these dams will be exported to neighbouring countries, while communities living in and around the dam construction site will or already have been forced to leave their land.

Other severe consequences of hydropower dams are for example flooding of large areas of forest, cultivated land and cultural sites, which causes loss of livelihood and destruction of wildlife. Not only the flood zone and dam construction areas are affected. Research shows that large hydropower dams affect the whole ecosystem of rivers, especially the numbers and kinds of fish. When fish populations decrease very large numbers of people downstream who rely on the river to provide food for their families suffer.[x] Two examples of planned hydropower dams on the Thanlwin River and their severe impacts are showcased below.



[Photo credit: KESAN]

[Photo: KESAN]

Local community members gather near the Hat Gyi dam site to commemorate the International Day of Action for Rivers and Against Dams, 2015, organized by Karen River Watch.

Hat Gyi Dam project

In Karen State, inside HteeThadaw Hta village track in Dwelo Township in Mutraw District, the government may allow construction of the Hat Gyi dam. Besides causing irreparable damage to fish life in the river, the dam if constructed, will flood areas inhabited by at least 41 indigenous communities forcing them to relocate, and killing countless wild animals and trees.[xi] Most of the electricity generated will not go to the Karen people, but will benefit users outside the state, and outside of Myanmar. Those who remain on their land in the Hat Gyi area will likely see the huge transmission lines carrying the electricity produced, but will not be able to access or afford the electricity. The few communities in Hpa-An and Mawlamyine that currently are connected to the national grid will not escape the impacts of the dam if construction is approved. The fluctuation of the water level caused by the dam will have consequences on for example their ability to grow their crops, to cultivate the river bank, to fish for food, and to access the seasonal islands, which will be flooded if the dam is constructed.

Mai Tong (Mon Tong) Dam project

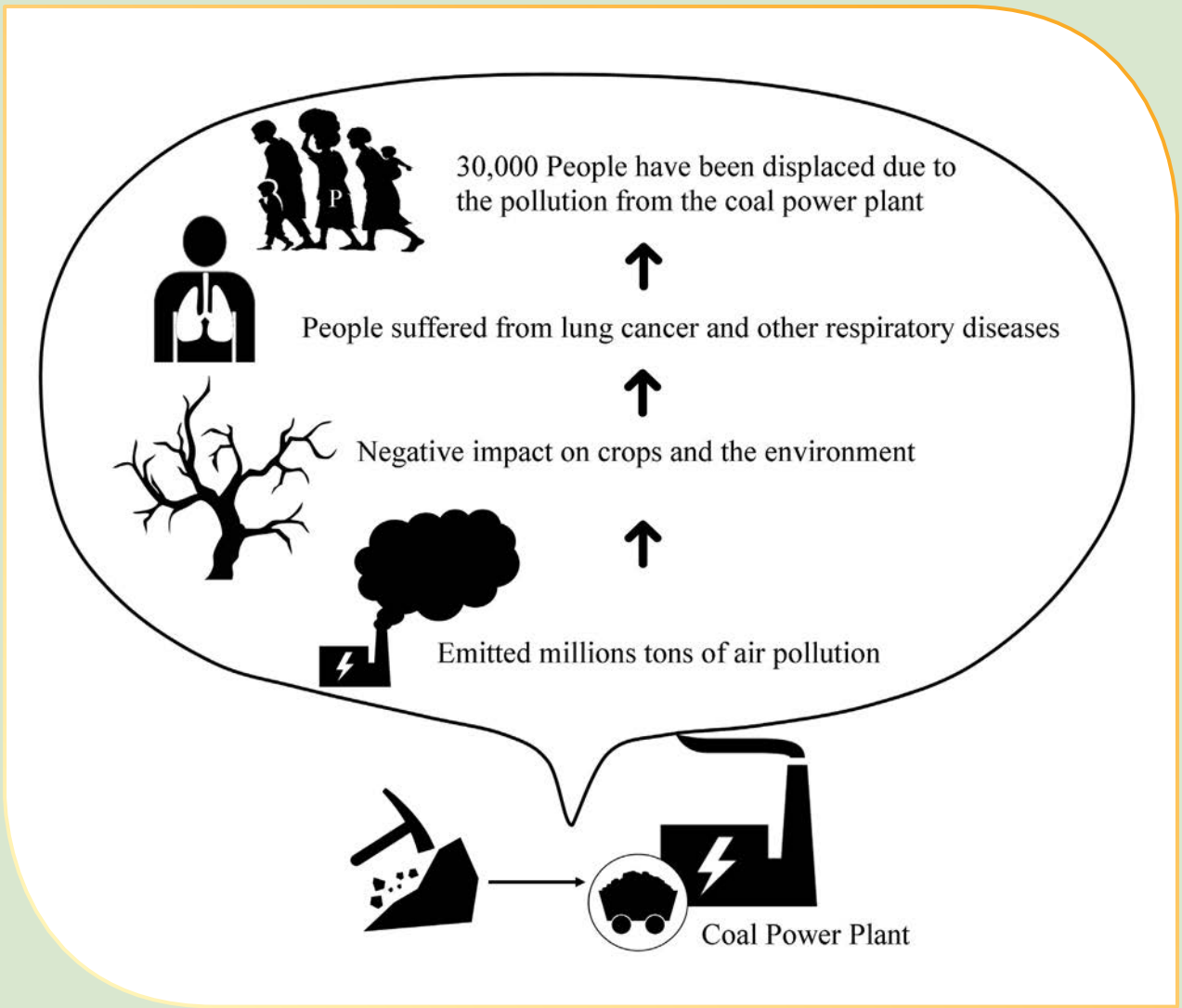
The Mai Tong Dam (formerly the Tangsang dam) is located in southern Shan State. If it is built, this planned dam will become the biggest hydropower dam in all of Southeast Asia, and according to news articles,[xii] almost all of the generated electricity from the dam will be exported to Thailand. Meanwhile, there is on-going conflict in the area and around the construction site, leaving communities that have not already been displaced (300,000 people since 1990's) vulnerable. The dam will flood an enormous area, including the township Kunhing (One Thousand Islands) on the Pang River, a tributary to Salween River river, destroying its renowned and unique ecology, and the livelihood of communities living along the river.[xiii] This again shows that large dams in Myanmar exploits and destroys natural resources in ethnic states, leaving the local communities suffering the consequences.

Save the Salween Network and community members gather to commemorate the International Day of Action for Rivers and Against Dams in Wasala village Mai Tong Township, Shan State near the Mong Tong dam site, 2016.

[* This list is not exhaustive]

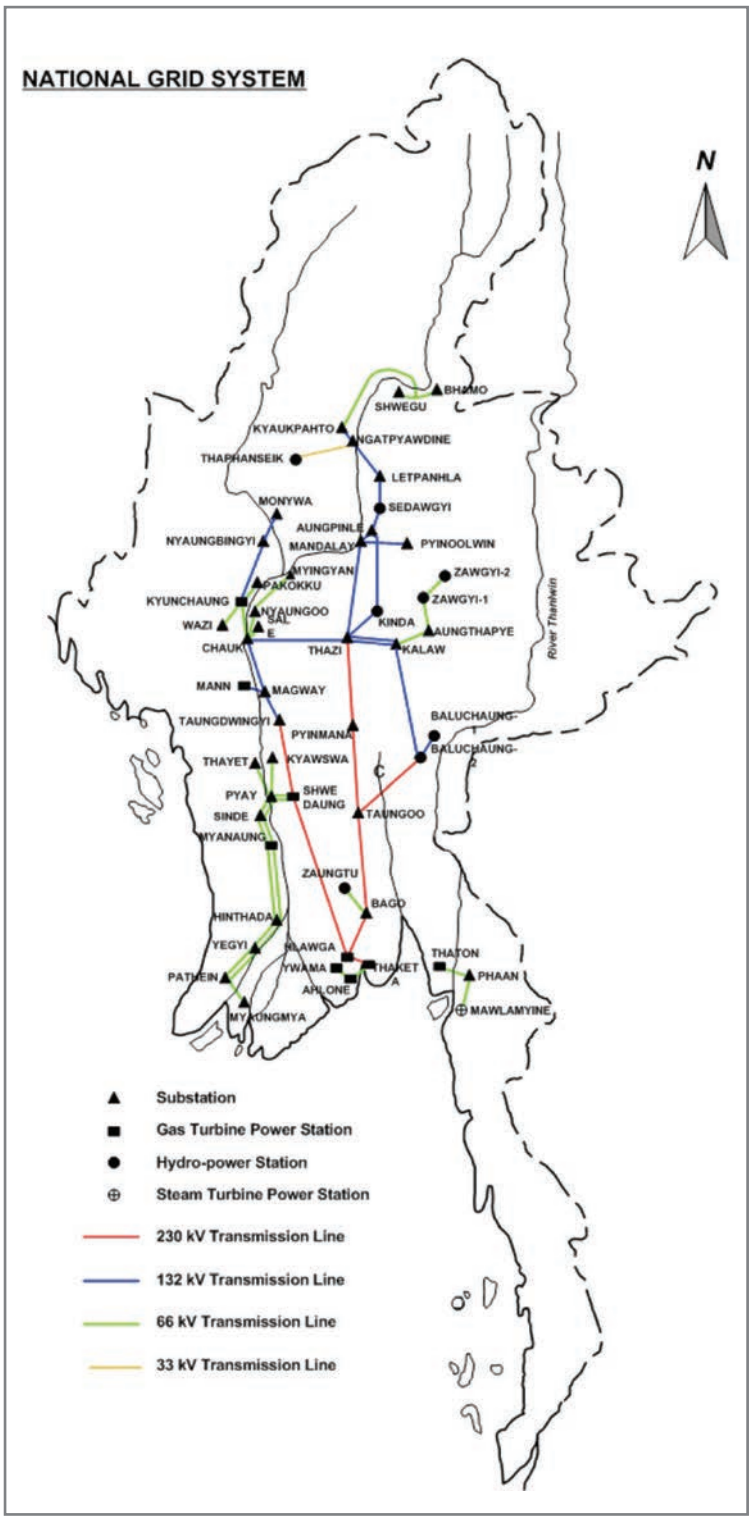
Coal Fired Power Plants:

As an example of what the many coal-fired power plants the Myanmar government has planned to build will bring, take a look at the Mae Moh open pit lignite mine and power plant in northern Thailand's Lampang Province that has operated since the early 1970's. In the 1990s the plant emitted millions of tons of bad smelling smoke and pollution every year, causing severe impacts on people's health, crops and the environment. Affected communities sued the government's Electricity Generation Authority of Thailand (EGAT) that operates the power plant.[xiv] In 2015, the court acknowledged that more than 130 persons suffered from lung cancer and other respiratory diseases as a consequence of the power plant pollution. But communities claim that hundreds have lost their lives due to the operation of the power plant, and another 30,000 people is said to have been displaced. The Thai Supreme Administrative Court ruled that EGAT has to pay compensation to the communities, relocate affected persons to a safe distance from the mine and to rehabilitate the environment surrounding the open pit mine.[xv]



Effects of the Mae Moh Coal Power Plant, Thailand

Myanmar Power Generation System (2013)



Source: WWF (2016) Alternative Vision for Myanmar's Power Sector.

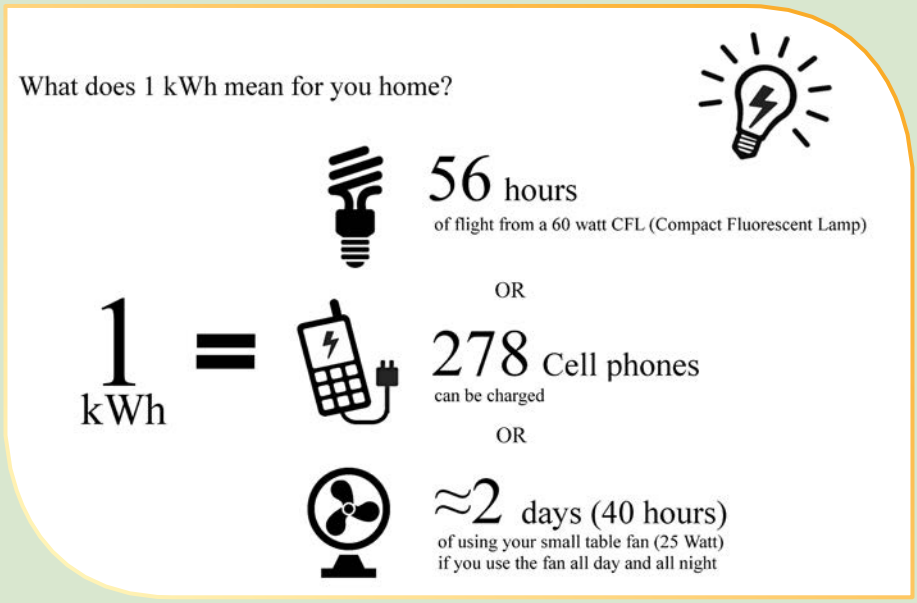
National grid - limited reach

It is interesting but not surprising that ethnic states use a tiny amount of electricity compared with the rest of the country since the transmission lines of the national grid simply do not even reach some of the state's capital cities, much less rural areas (as shown in the map to the left). Even under planned expansions, people living in many of the rural areas of Karen and Mon states have yet to be practically included in World Bank supported plans to reach all the people in Myanmar with electricity by 2030.[xvi] It is unlikely that the addition of more mega projects to Myanmar's poorly maintained, inefficient, unreliable and underdeveloped national grid system, will result in people living in the rural areas gaining access to electricity sufficient to meet their needs within the next 15 years. Large energy projects will simply exploit the natural resources in ethnic areas, while causing much destruction and loss of livelihood in Karen, Shan, Kayah, Kachin and Mon states.[xvii] What is needed immediately in rural and ethnic areas are locally led projects, such as replacing candles with electric lighting, improving cooking solutions, and implementing appropriate energy systems that support local livelihoods.

Alternatives to large hydropower dams and gas- and coal fired power plants exist to meet such needs. Electricity can come from within your village and community. Electricity that is generated locally and community-based is closer to the people who use it - moving the control of the electricity also closer to you. One can argue that this is a more democratic solution than a national grid system, which is controlled by the central government. The option of having locally produced electricity may also represent a cheaper choice since there is no need to invest in expensive transmission lines to transport the electricity from its source to its consumers.

How do we measure electricity usage?

Before discussing alternative energy forms it could be good to know that when talking about electric energy consumption and costs for it, the term kilowatt hour - kWh - is used. One kilowatt hour is the amount of energy equivalent to one kilowatt (kW) being used for one hour.



1 MW (megawatt) = 1000 kW (kilowatt) = 1000,000 W (watts)


[Photo: KESAN]

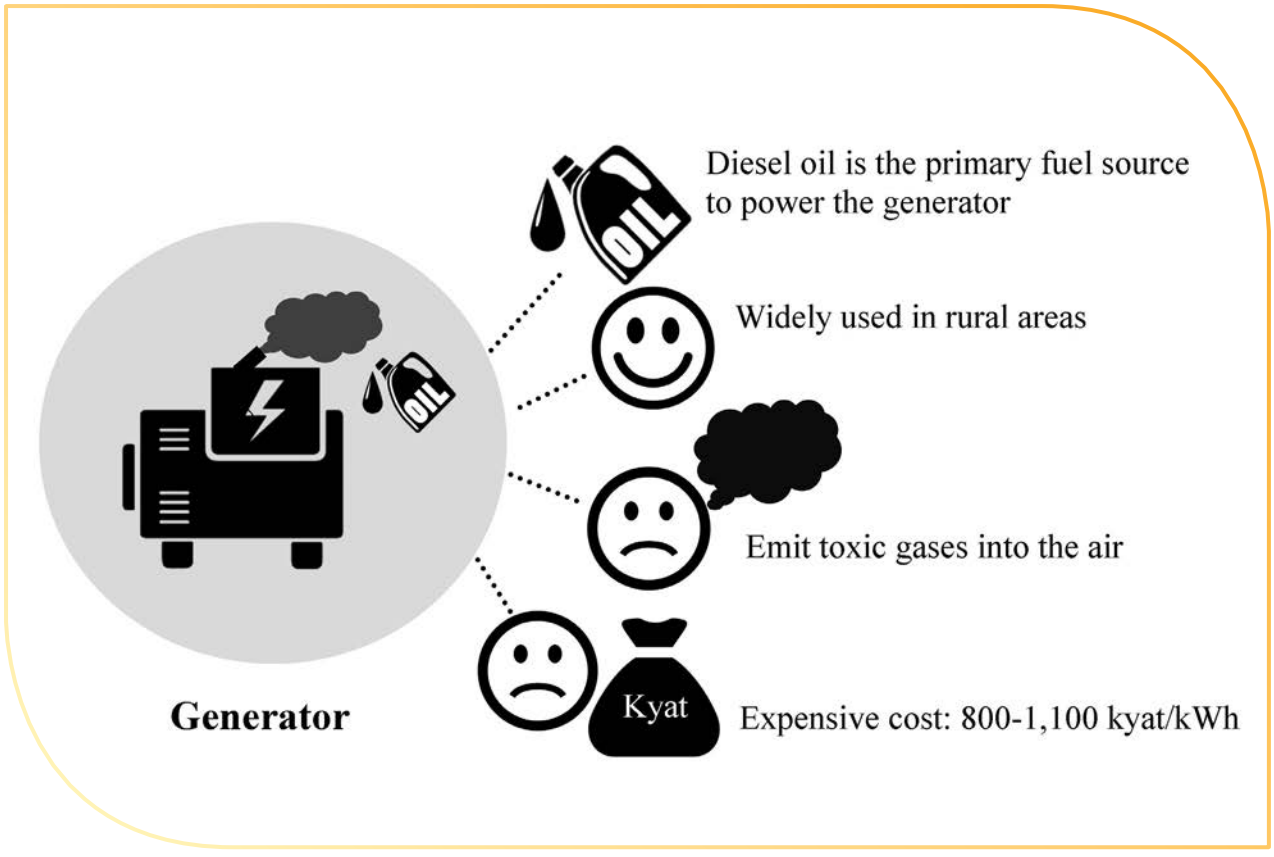
A micro-hydro power system in Kwelaypya Village in Beelay Township, Doo Tha Htoo District in Karen State (see p. 10) provides electricity to a school dormitory so that students can read at night.

(II) Locally generated electricity

How can electricity be generated in your village? Local decentralised electricity systems can consist of solar panel systems, mini-hydro power stations, biomass power plants, wind turbine stations and/or generators. Many villages in Myanmar already use these solutions today.

Generators are one of the most common sources of electricity for people living in rural areas. Diesel run generators are popular because they are easy to use and do not need much maintenance. Well-maintained and supported generator powered systems are more reliable than the national grid and do not suffer from frequent blackouts. However, diesel generators have negative aspects. Diesel generators rely on the steady availability of affordable diesel fuel (which is not a certainty in Myanmar as was seen by the sudden and large increase in 2007 fuel prices that sparked the Saffron revolution[xviii]), and are an expensive electricity source with prices ranging between 800 to over 1100 kyat/kWh.[xix] Generators also emit toxic gases into the air when used, which are particularly harmful to human health and local environment.

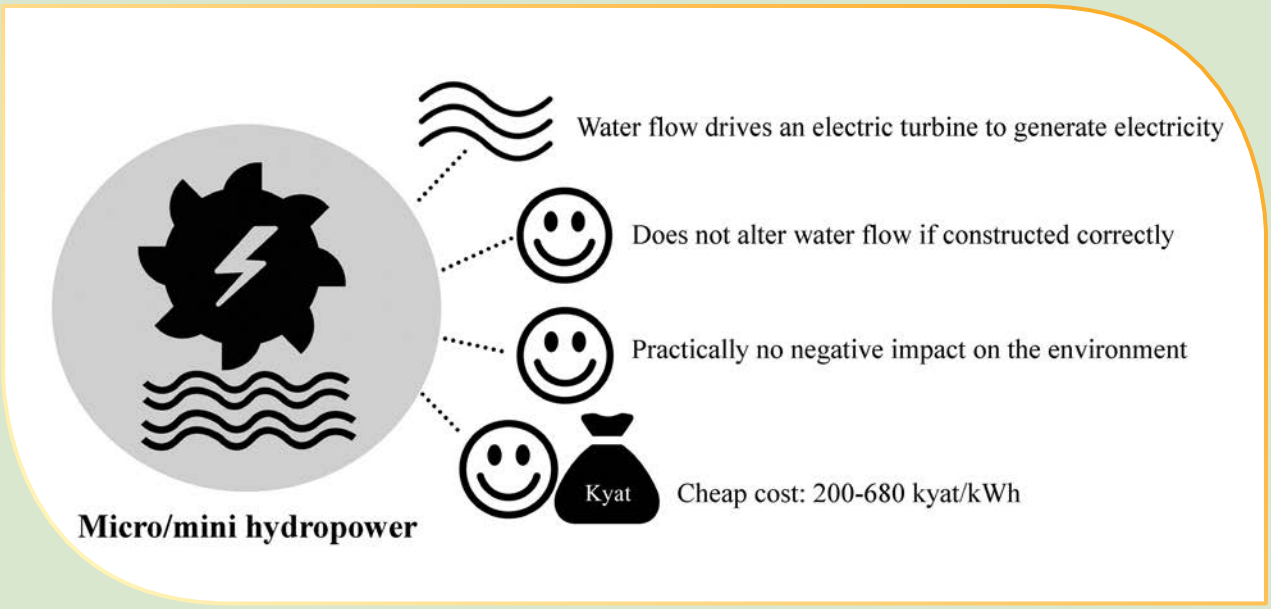
Since it is a costly and toxic way of getting electricity, it is useful to explore the other options available today that are relatively cheap and environmentally friendly. So, what are the options for renewable energy?



Community members in Kwelaypya Village in Beelay Township, Doo Tha Htoo District in Karen State are building a micro-hydro power system.

Renewable energy power

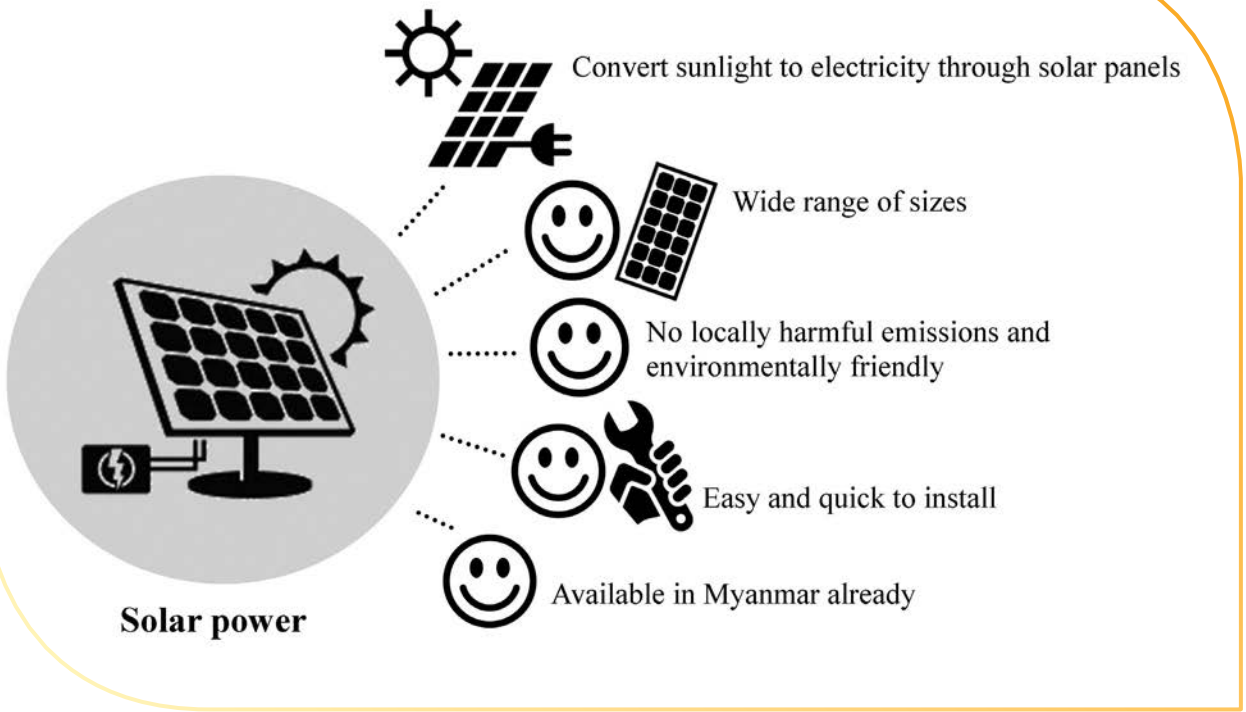
Micro- or mini hydropower is easy to run and can, depending on the available river or stream produce enough electricity to power hundreds or even thousands of homes.[xx] Micro- or mini hydropower uses the natural flow of the river to drive a turbine connected to a generator that produces electricity without having to store water in a dam. It is an efficient energy source with practically no negative impact on the environment since it does not alter the water flow if constructed correctly. It is furthermore a cost effective source of energy. While a diesel run generator will cost around 800 to over 1100 kyats/kWh, a micro hydropower will generate electricity to an average cost ranging from 200 to 860 kyat/kWh.[xxi] One example of a micro-hydro power system in Karen state is located in Doothehtoo district, and it provides electricity that supports the local school.



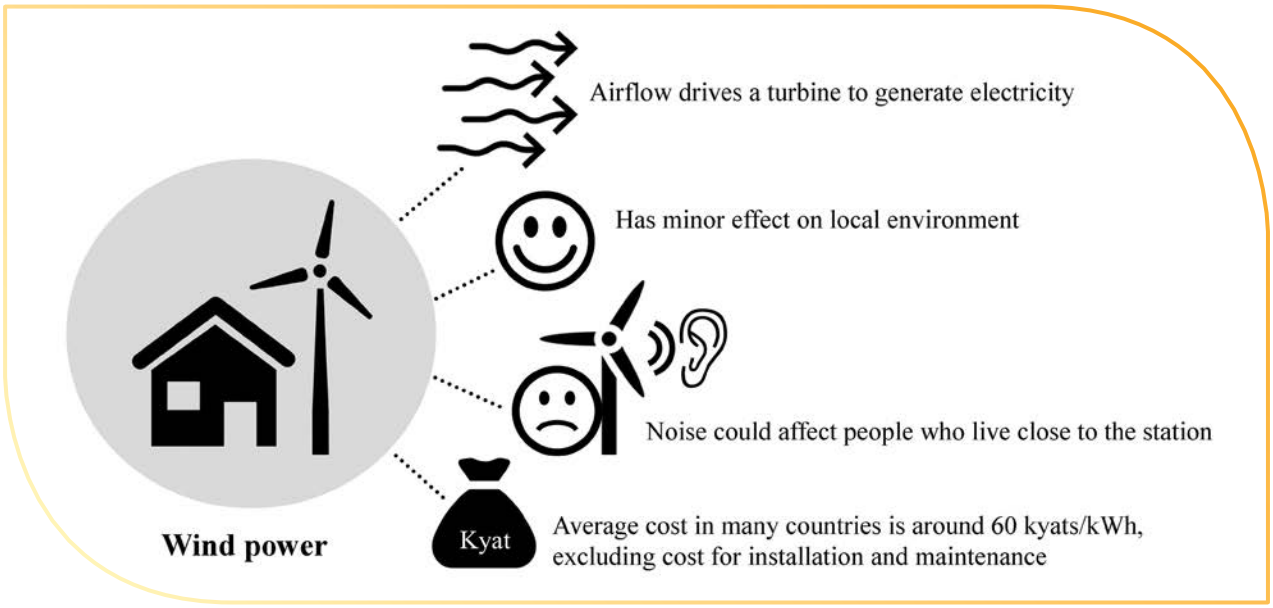
Solar power converts energy from the sun into electricity by using photovoltaic cells in solar panels. When sunbeams hit the solar panel, the material inside absorbs the energy in the form of electrons' movement. A flow of electrons creates electricity, which is then transferred from the panel through wires, adaptors and batteries to the user's electricity using equipment. Compared to coal and hydropower plants, solar panels are relatively quick and easy to install and are an efficient source of energy, which can be used to light houses, charge small appliances, and provide other useful energy services. It is a locally environmentally friendly source of energy with no harmful emissions linked to the actual electricity generation. Government provided, NGO subsidized, and privately purchased solar power systems covering a wide range of sizes and applications can be found across Myanmar today.[xxii] As with other local power systems, affordability depends on provider and time period considered, but solar power systems are dropping in price. [xxiii]

In eastern Karen state, the Kaw Lah Hay School has installed four solar panels on its roof which now provides power not only to the school facilities but also the dormitories, and staff offices.[xxiv]

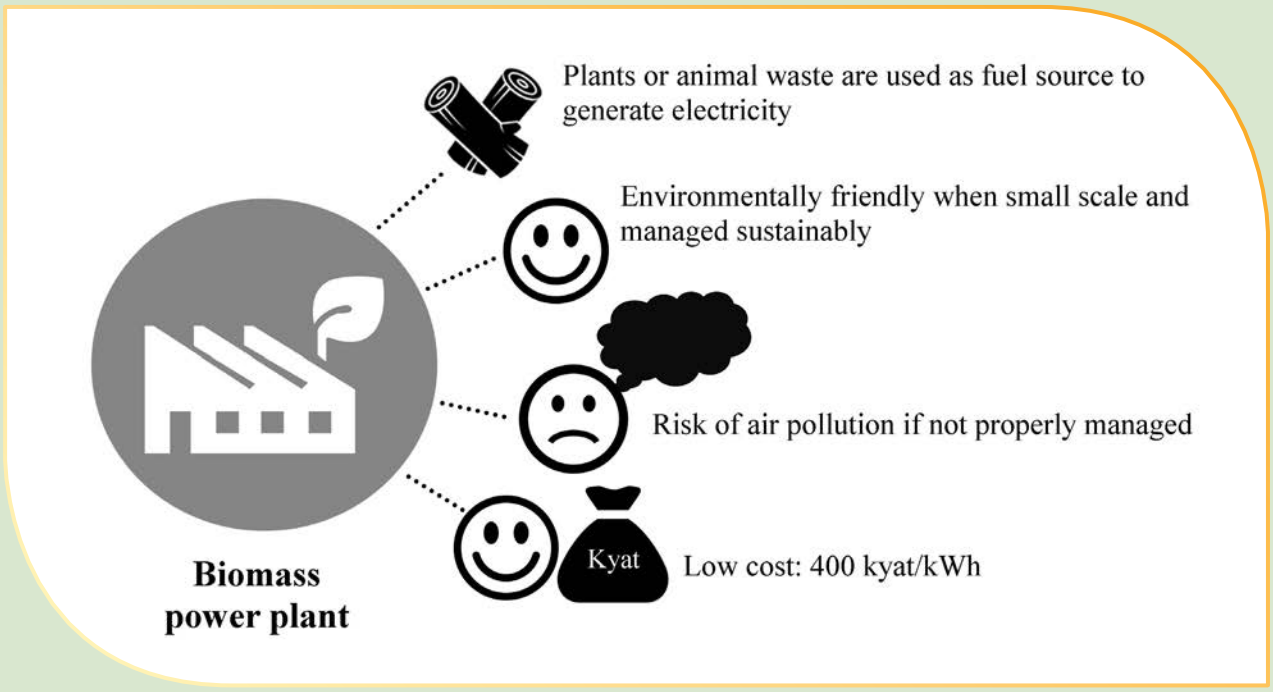
Maintainance of solar panels in Karen State.



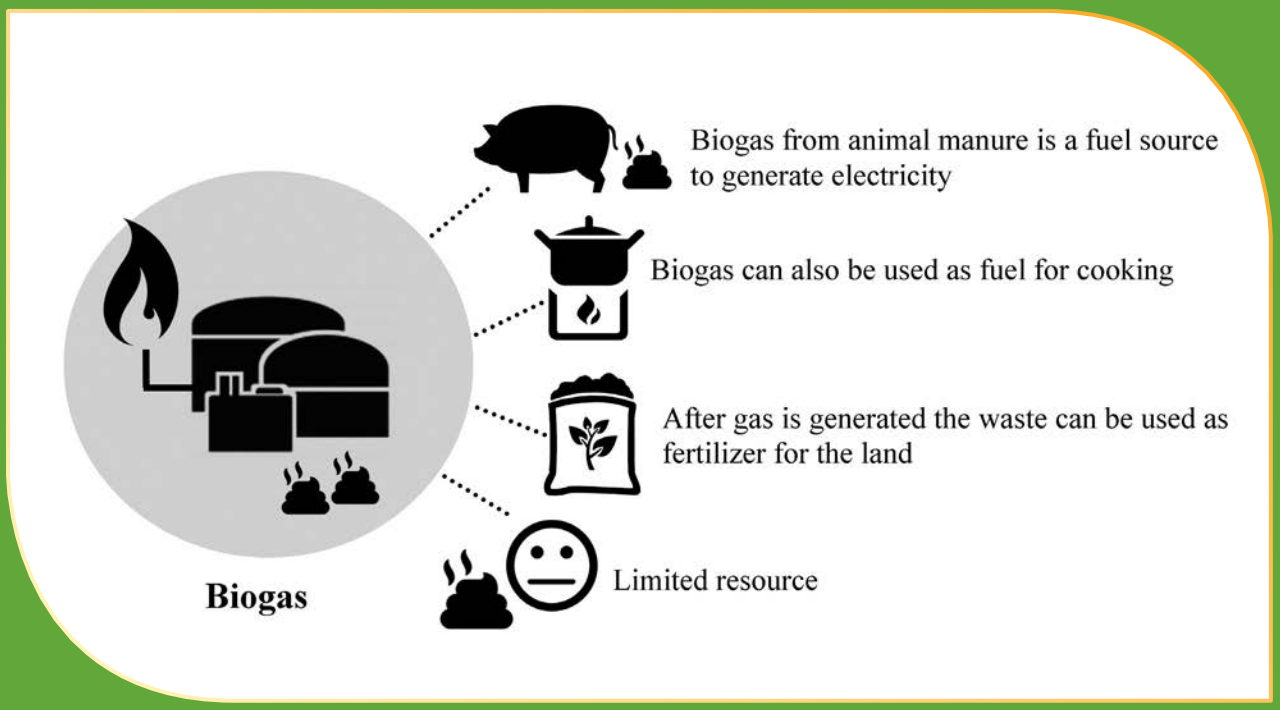
Wind power is as the name suggests, electricity produced by airflow. The turbines in the wind power station rotate when the airflow hits them and the wind-powered generator transfers the energy into electricity. The effect the small-scale wind power has on the environment is minor. Noise is one of the few side effects of wind power if one lives very close to the station. The cost of wind power-generated electricity in many countries lies around the equivalent to 60 kyats/kWh. It is cheap but one also has to include the cost for installing and maintaining it.[xxv] Although no known examples of community scale wind are operating in Karen or Mon states, exploration of wind resources in some parts of Southeast Myanmar is currently on-going.[xxvi]



Biomass power plant can, if run in small scale and sustainably, be a viable environmental friendly option for electricity. A biomass power plant burns plant waste or animal waste to heat water. The steam from the heated water drives a turbine, which in turn powers a generator that creates electricity. It is important when talking about biomass power plants to acknowledge that they can, if not run in an environmentally

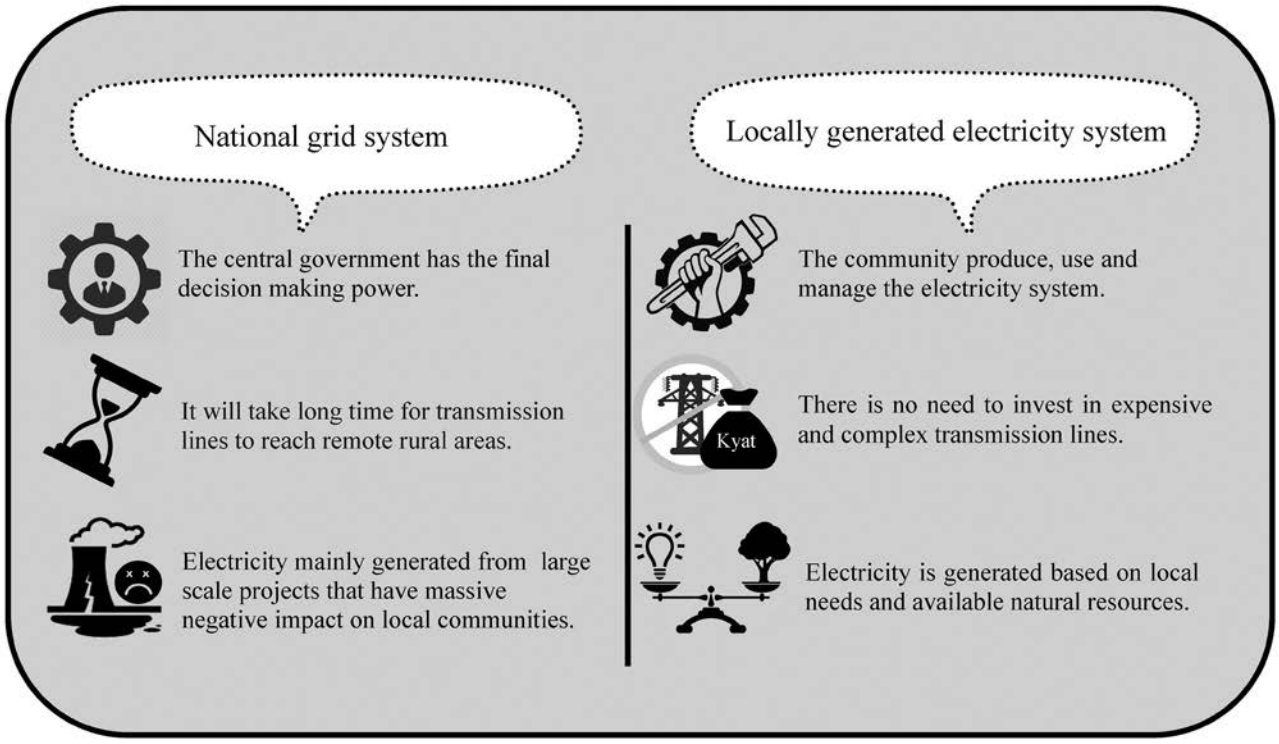


friendly way, emit air pollution and toxic gases, which contribute to global warming. This can be avoided by for example ensuring that what is used as waste is sufficiently dried before it is put in the burner. It is especially important in biomass-generated power to focus on maintaining a balance in nature between what you take from it and what you give back. By for example properly managing the forest where wood is taken from, one can ensure that the forest will not be depleted, and by returning the ashes of the burnt wood to the forest the land will be fertilised. Fallowing the land to let it recover is a common method used in Karen farming and should be used in biomass-generated electricity. The cost for electricity generated from biomass gasification mini-grids is around 400 kyat/kWh.[xxvii]



Community-based biogas-powered electrical generators[xxviii] are up and running in Myanmar today, producing enough electricity to last a total 4 hours a day in 172 villages.[xxix] Biogas energy is based on the same organic matter as biomass, for example plant waste or manure from poultry, swine, cattle and buffalo. A simplified explanation of biogas power is that the organic matter is stored in digesters (tanks) that contain bacteria. The bacteria eat the organic waste and create methane in the process. The methane gas in itself can serve as fuel for cooking or heating, but can also be transferred into electricity through a gas engine. After the waste has been used it can be returned to the land as fertiliser for the soil.[xxx]

There is good potential for increasing the number of biogas-powered generators in Myanmar as many people's livelihoods are based on farming. The problem to overcome is the difficulty in collecting the organic waste and in particular the manure since so many farmers keep their livestock uncaged.[xxxi]



How to store energy?

One issue that arises in all of the listed renewable energy forms above is how to store the energy or electricity. Since the extent of each natural energy form varies depending on season, there is a need to store and save electricity those times excess electricity is generated. Usually, electricity is stored in batteries from which people then can access electricity. However, such batteries are still quite expensive even though batteries now have been improved to last longer. There are other ways of storing energy though, by for example pumping water up into a high-levelled tank for use when electricity is most needed. Such creative solutions are key if batteries are a too costly option.

Furthermore, these alternatives might not individually suffice to provide your community with enough electricity. Common solar home systems found in Myanmar are for example great for providing electricity to light your house and small appliances, but do not provide enough electricity to have a refrigerator or large electrical appliances or tools.[xxxii]

So what do you do then?

Women and Energy

When energy and electricity is scarce in a household or community, women and girls are particularly affected. Without access to electricity women and girls, in general, spend more time per day gathering fuel to use in the home, for example fuel that is used to cook food with or to heat the home with during winter. This limits their possibility and time to go to school and get education or to get a job. Women's health is also affected, in particular when wood-burning stoves are used inside the house (for cooking or heating purposes), since these stoves emit toxic smoke that can cause respiratory diseases.

Since women suffer severe consequences of lack of energy or electricity at home, and since many women hold in-depth knowledge about the existence and management of the natural resources available in the community and surrounding areas, it is extremely important that women are included and have an equal say in community discussions and decision-making processes regarding energy solutions.[xxxiii]

Solution: Hybrid renewable energy systems

A hybrid renewable energy system sounds more complicated than what it really is. It simply means that the different alternative energy forms described in the text above are combined to meet the electricity demand of a community or village. The sun does not shine during nighttime; water levels in the stream might run low during dry season; and the extent of wind might fluctuate from season to season. But if two or more of these energy sources are combined to complement each other, the electricity generated may well suffice.

Start by looking at your village. What types of natural resources are available to you? Do you have a river or a stream running past your village? Do you get sunlight most days, and is your village placed in such a way that it gets windy often? What already existing local resources can you, in a non-harmful way, capture by investing in micro-hydro, wind- and solar power, or biomass/biogas plants?

But most importantly, start by examining what the electricity need is in your village. What do community members want to use electricity for? Is it to light up the house, support local livelihoods, charge batteries and cell phones, to heat or cool the house, watch TV, listen to the radio or store food in refrigerators? After carrying out this type of survey and establishing the number of households your community consist of, it will be easier to estimate how much electricity the entire community need and what the best options are for you when it comes to generating electricity.

Successful hybrid systems like the one described can be found already today in Myanmar. One example is located in Cahungthar village, which has a hybrid system consisting of combined power from solar, wind, diesel and battery, generating 220 kWh supporting 100 households.[xxxiv] Although, some of the hybrid systems operating in Myanmar are in need of touch up and can be improved by using more modern equipment, which will make them more efficient in generating electricity. The positive thing is that the technical skills necessary to construct or maintain hybrid renewable energy systems already exist in Myanmar as many development partners have supported these types of projects.[xxxv]

(Photo: Armin Kübelbeck, CC-BY-SA, Wikimedia Commons)
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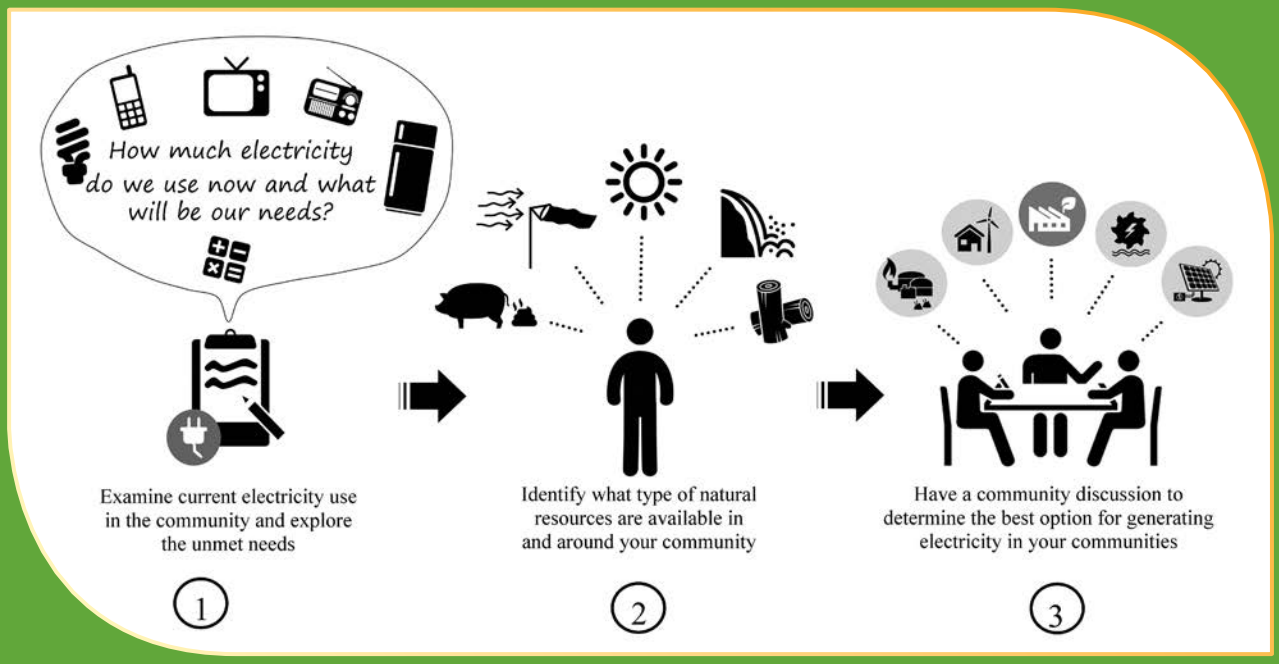
Wind power and solar panels

Steps to take when moving forward



EXAMPLE OF SURVEY QUESTIONS

These questions are listed to assist the community facilitators in discussions with community members on renewable energy solutions. This is not intended to be an exhaustive list, but should only serve as inspiration.

Energy audit survey questions

- What is the average number of members in each household?
- What is the total average monthly income of each household?
- What are your priorities for spending your annual income? (e.g. food, education, energy, clothes, health care, entertainment)
- Is electricity available in your community?
- What is the main source of electricity in your community?
- On average, how many hours a day is electricity available?

Energy needs assessment

- Which fuel type do you use for cooking in your home? (e.g. firewood, charcoal, electricity, gas)
- When you choose a fuel, what is most important to you? (e.g. fuel price, convenience to use, lowsmoke level)
- Which fuel type do you use for lighting?
- How many hours do you normally use lighting daily?
- If you have electricity, which and how many appliances do you have (e.g. lights, phone, rice thresher, computer, fan)? Which other appliances would be important to you?
- Does the community need lighting for the community school, temple, clinic or any other community facility? How many hours of light is needed?

Potential energy resources mapping

- List the energy resources that are available to your community and that you use every day (e.g. water stream, wind, wood, animal manure, sunlight, petrol, electricity) and pick the five most important ones for the community.
- How has your community used these resources previously; how are you using them today, and how do you think you will use the energy resources in the future? Has the amount of energy resources changed during the years?
- How many hours of sunlight do the village and its surrounding area get in a day during the most and the least sunny parts of the year?
- Which place in the community is most frequently windy?
- Are there any water streams with high waterhead located in the area that has potential for micro-hydro power?

How to regulate?

One important thing to remember is that the national government has legislated that if a proposed electricity project has more generating capacity than 30 MW, it needs to be regulated from central government. However, if the generating capacity of the planned project (e.g. micro-hydro or solar power) is lower than 30 MW the local authority are granted control.[xxxvi] If the local authorities develop a policy allowing for it, these local energy projects (below 30 MW), can be operated by the community itself through cooperatives, by individual companies that are set up by one or more community members, or by any other system suitable. This could spur the local economy to grow, as there will be a need for labour during the construction of the mini-grid but also in the maintenance and sales of the electricity. Policies, both at national and local level, supporting and allowing for renewable locally distributed energy systems, should therefore be developed.

Sharing resources in a community requires of course that rules and regulations are in place to ensure that the distribution amongst and between the households are fair and equal and that payment for the electricity is made. As there are no set laws or regulations in general for mini-grids, the community itself needs to decide upon such rules, preferably through a participatory process where all community members can voice their opinion. One new interesting and cheaper method of payment for rural electricity is "pay as you go", which allows consumers to pay their electricity bill using their cell phones or pre-paid cards to transfer money. Such methods and strategies can and should be explored in the community discussions.[xxxvii]

If you, within the community, can provide sufficient electricity for every household in your village, you will not depend upon the national grid system. You will be able to have more control over your power through the decentralised system. When or if the national grid system is developed enough to reach Karen and Mon state, it will be possible to connect to it if that is the wish of the community. If the community electricity system generates enough electricity you might even be able to sell potential excess electricity back to the national electricity grid. As the village grows bigger with more and more households, the community's mini-grid can adapt and expand to meet the increased demand.

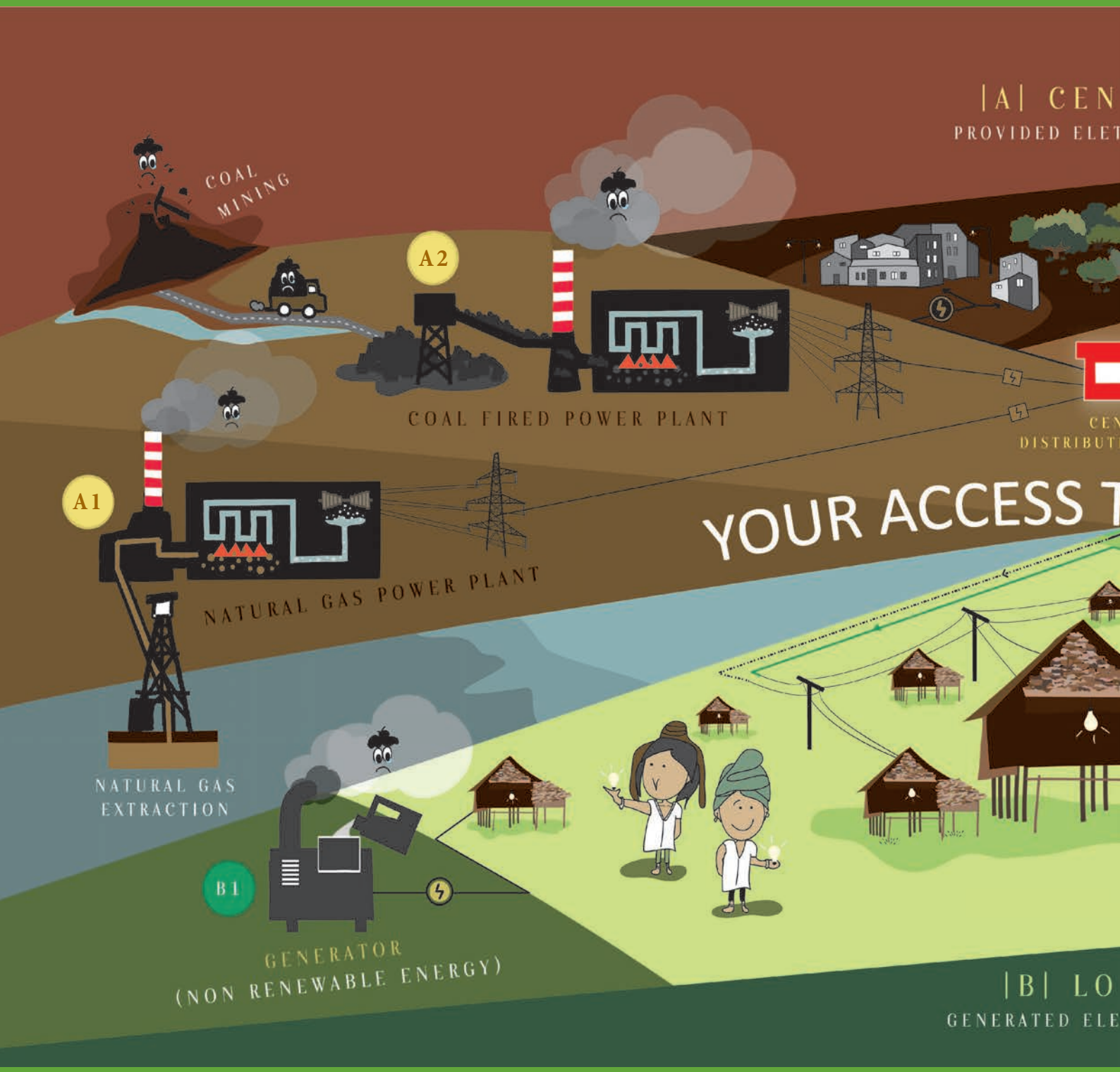
> **"The power will be in your hands."**

Use electricity efficiently!

It is important to remember to also use energy in an efficient way so that the same amount or less electricity can provide more service to you. For example by using a LED-bulb less electricity is needed while the bulb will last longer than standard bulbs. Using appliances wisely, for example switching them off when you don't need them and using recycled materials instead of buying new, are two other examples of reducing energy demand. [xxxviii]

How to get more information

If you need more information on the different alternative energy forms and hybrid systems, or how to get in touch with organisations or companies providing technical support on renewable energy to communities, please contact Karen Environmental and Social and Action Network (KESAN) at email:**info@kesan.asia** and we can help you.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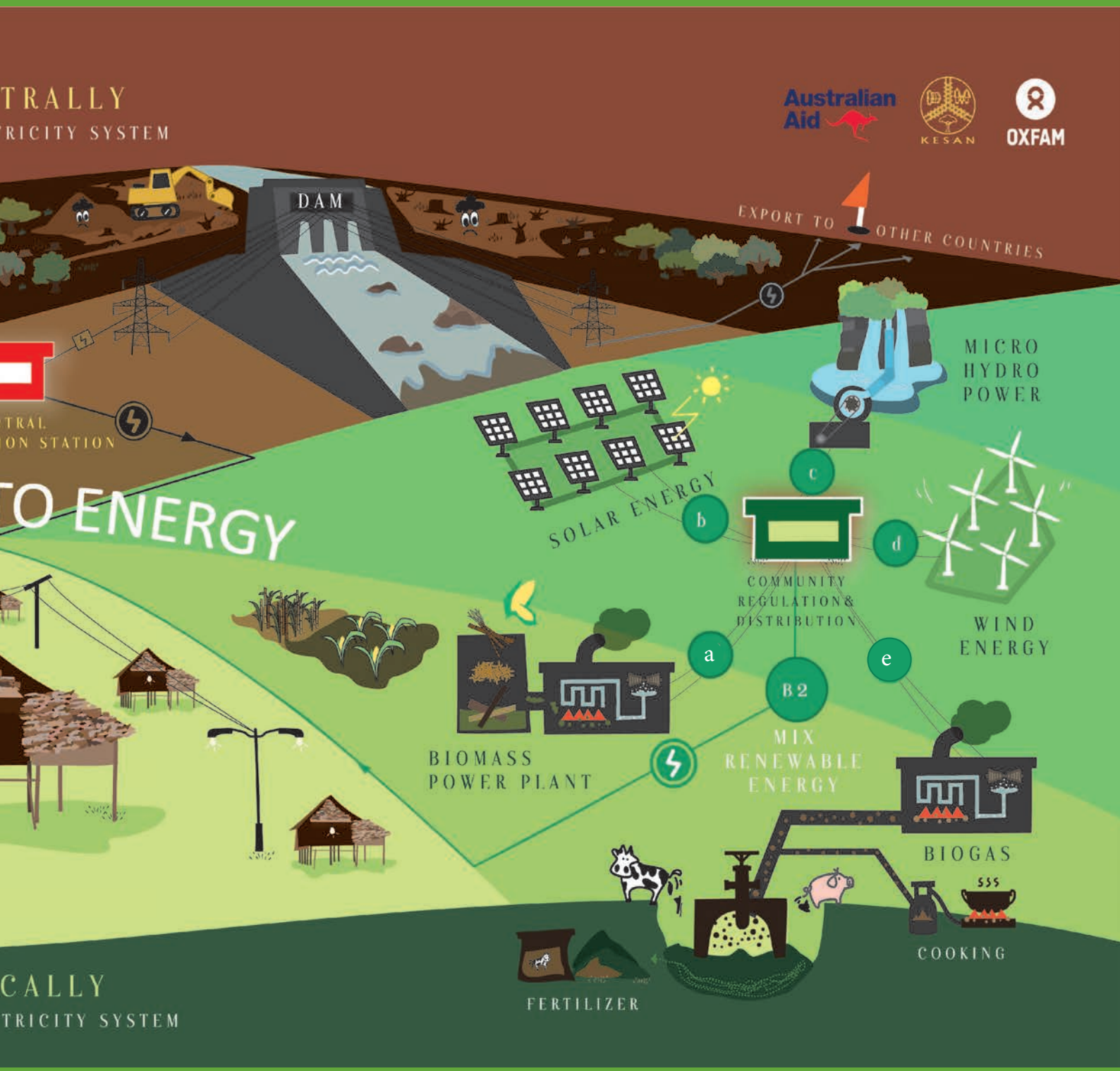
TRALLY
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a
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B2
MIX RENEWABLE ENERGY
BIOMASS POWER PLANT
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Year/MW	For export	For Myanmar
2013-2016	-	3729
2017-2021	8,203	10,907
2022-2026	7,611	7,611
2027-2031	3,848	3,847
SubTotal	19,662	26,094
Total	45,756 MW (43% for export)	

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KESAN is a community-based, non-governmental, non-profit organisation that works to improve livelihood security and to gain respect for indigenous people's knowledge and rights in Karen State of Burma.

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