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Summary

Bringing Energy to the Poor
21. April 2010

Tri Mumpuni
Mika Turpeinen

How to set up inclusive energy systems
in developing regions

eine Veranstaltung von

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Summary

corporAID Multilogue Bringing Energy to the Poor

Mika Turpeinen and Tri Mumpuni share their expertise on how to set up inclusive energy services in developing regions

Energy for Development

The access to reliable and affordable energy supply is a vital requirement to initiate social and economic progress anywhere in the world. What are the obstacles preventing to supply the remaining 1.5 billion people with energy? **What are the reasons why 2.5 billion people still rely heavily on traditional biomass?** The multilogue ‚Bringing Energy to the Poor' concentrates on answering some of these questions. The invited international experts, Tri Mumpuni and Mika Turpeinen share their experience on how they are managing to set up viable, **manageable and inclusive energy systems in developing regions,** which also benefit the poor. They will explain how financial, technological and regulatory obstacles to electrify rural regions in developing countries can be overcome and how private investments can be attracted.

Challenges

Energy is the backbone of economic development and social progress anywhere in the world and this is especially true for developing and emerging regions. The International Energy Agency (2008) estimates that still about **22 percent of the world population have no access to electricity** and 85 percent of those are living in rural areas. Half of those people, who rely heavily on traditional biomass such as wood or agricultural residue to meet their energy needs, are either living in India or Sub-Saharan Africa.

Energy from the generation to the **distribution and the access to electricity** is a very complex sector due to its strong linkages with the public interest. Every decision made in the electricity sector will always have a direct impact on the public. For instance, the decision to revise electricity tariffs, will affect the **affordability of electricity** or the decision to introduce efficiency measures or new standard technology can impact positively on air pollution in the community or in the best case, reduce carbon emissions for the whole economy. However, **investments in the electricity sector are always very costly** and this is where one of the biggest challenges lies.

Nevertheless, the social, environmental and economic importance of the electricity sector is well recognized. But to ensure a reliable and affordable access to electricity, particularly for the poor, to bridge the so-called **energy divide, is a big challenge** for a lot of actors: policy makers, governments, businesses but also the development cooperation and donor agencies. Creating small-scale energy generation is one promising approach to service the poor. But the right technology alone will not bring 'power' to the people.

Energy services for the poor in Ethiopia: Mika Turpeinen

Mika Turpeinen, who used to work for the technology corporation Asea Brown Boveri ABB as a business developer, coordinated the development of the **'Distributed Energy Concept' for emerging markets.** He was also responsible for the development and market launch of a new type of **hydropower plant designed for the base-of-pyramid markets** in cooperation with the Finnish development agency, Finnfund. Now, Mika Turpeinen works as a consultant in Ethiopia engaged in various projects: smart grid models, renewable energy, low-cost-low-energy houses, information and communication technology and business incubator services.

Current trends of energy consumption Ethiopia

Mika Turpeinen starts to introduce the current energy situation in Sub-Saharan Africa by explaining the long-term energy trends. He uses **Ethiopia as an illustrative example,** comparable for the whole of the Sub-Saharan African region. He points out the population growth in Ethiopia: around 300 years ago approximately 10 million people lived in Ethiopia. Today the population has reached 80 million and the upward trend continues: According to some estimates **100 million people will be living in Ethiopia by 2015** and 250 million even by 2050. As the population increases continuously, the forest coverage decreases. While Ethiopia initially had a forest coverage between 60 and 70 percent, similar to Finland's still today, now only 2 percent of the original forest coverage remain.
The reason for that **loss of forest coverage** can be found in Ethiopia's energy mix, which consists – with 93 percent – mainly of biomass. In other words, Ethiopian people need to **supply their energy demand with traditional biomass,** in this case mainly wood, as other sources of energy are not available to them. However, the country is very poor, large in size and has quite mountainous regions, so it is difficult to supply everybody with electricity. Mika Turpeinen goes one step further and refers to the social implications, this lack of energy implies.

Social Implications

People were able to gather fuelwood from their surroundings even few decades ago – today, in many area this is not possible anymore: the demand has outgrown the supply. In other words, **today mostly girls need to spend several days gathering fuelwood.** This, on the

one side, prevents them from going to school, although Ethiopia offers free school education, and on the other side, puts them at risk for crimes, being alone and far away from their homes. At some point, it became necessary for their brothers to join them. Hence, two people spend their days trying to satisfy the basic needs, instead of investing in their future. Clearly, the **lack of energy comes at a very high cost of labour.**

Export

The **national power utility EEPCO** has strategy to bring energy to 50% of the people in coming years. In addition Ethiopia is building interconnectors to Djibouti and Sudan and there are plans also to connect Kenya. This would require huge investments and careful balancing between domestic energy needs and income available from exported energy. There is a continuous debate ongoing if EEPCO should first **electrify Ethiopia and then export the surplus**. However, it is easier said than done. The value of exports of all sectors was 1.2 billion USD in 2007. The coming energy export to Kenya only could create 0.3 billion annual income. The energy export could become the most valuable source of foreign currency and help Ethiopia to reduce her dependency of donor aid.

Traditional energy setting

Another challenge in the Ethiopian energy business is its traditional energy setting. An Ethiopian electrified household consumes around 50 W throughout the day, but in the evening the energy consumption increases drastically, even up to 3000 W in houses, where electricity is used to cook meals. This **peak of energy consumption is extremely expensive as generation and distribution capacity have to be dimensioned accordingly.** For a commercially viable business it is therefore important to get rid of that peak and utilize energy assets more efficiently. In an effort to counteract that peak, Mika Turpeinen, together with the Addis University, developed a special sort of insulated frying pan, which consumes about 100 W continuously throughout the day. This way, it is possible to balance out the energy consumption peak in the evenings.

Furthermore, Ethiopia's current **billing system puts constraints on its efficiency:** currently, somebody who reads the meter and collects the money visits every single household in the village. If nobody happens to be at home, someone is required to go to the office that sometimes is 100km away, to pay the bill. Mika Turpeinen considers a fixed tariff with certain regulations, especially for hydropower, to be a suitable option to pay for electricity in Ethiopia, while the Ethiopian government insists on having uniformed tariffs, a matching of different energy prices although the production prices vary.

Alternative Options

So what are the options? Mika Turpeinen points out that it is absolutely **necessary to provide Ethiopian people with affordable energy** and to give them alternative, more efficient energy sources other than biomass, which allows them to use their time more productively. Ethiopia is estimated to have **a huge potential of renewable energy:** the geothermal potential along the rift valley, going from Djibouti via Ethiopia and Kenya to Northern Tanzania, is about 5,000 MW and **hydropower has an unused capacity of around**

40,000 MW. The main source for hydropower is the river Nile and her tributaries. Some 84% of the waters from the Nile rain in highlands of Ethiopia. Well aware of this potential, Ethiopia's energy production now relies to 97 percent on hydropower, whereas heavy transmitting system and very big power systems are the common standard. Unknowingly, the conditions for hydropower generation are slowly being destroyed, as the people, in their need for energy, use wood and reduce the forest coverage. Thus, the rainwater cannot be absorbed; the topsoil is being flushed away, which makes it difficult to plant new trees and to feed rivers and lakes.

- **Hydropower – Large scale** Hydropower seems to provide a suitable option to improve the Ethiopian energy situation. However, differences in scale are of major importance. Large-scale hydropower plants, for instance, have experienced more difficulties than small-scale: a recent project, mainly financed by the Italian government, failed due insufficient geological studies. Another big hydropower project is planned in the South of Ethiopia, which could cause enormous damages, if not researched and implemented properly. Large-scale hydropower plants often involve large amounts of money from different parties, which brings the discussion to a very different level.

- **Hydropower – Small scale** One hydropower project, located in Dembi Dolo, a town by the river Meti in the West of Addis Ababa, has a different approach. The. Dembi Dolo village is already electrified by EEPCO but the power quality and availability remains very poor leaving town out of electricity for several days a week. The electricity is of quite significant importance for the region, as it has a hospital with a catchment area of 900,000 people, a mobile phone network, a water distribution system and a school with approximately 12,000 students. The power supplied by the national grid is not always working properly. For this reason an old hydropower system by the river will be restored to feed the hospital's and other critical demand. The water pumps will be fed through frequency converters to enable maximum utilization of the hydropower capacity. A cooperative, recognized by the Ethiopian legislation, will manage the plant, regulates the price, evaluated necessary investments and maintenance needs. The surplus profit will be managed by the community development fund.

- **Alternative options** Mika Turpeinen also talks about alternative options to supply people with energy, which he focused on during his work with ABB. The idea was to build reasonable and relevant size of power plants, which are standardised and containerised. This way, the investment and operational costs can be reduced and at some point, the power plants can be operated on a commercial basis to guarantee their maintenance. The business model aims at establishing standardised, simple, easy, robust systems, which can be easily shifted and replicated, but are still of relevant size for people to benefit.

The role of international donors

At the moment, Ethiopia's government budget depends to 60 percent on international donors, but Mika Turpeinen would like to see more sustainable development aid. The aim of development aid should be to stop the need for development aid. For instance, a

grant company handing out guarantees for investment could be a sustainable use of development aid. Also, development aid needs more space for innovation. Rather often creative and innovative ideas cannot be realised, as they do not comply with certain rules of 'development aid packages'. Development aid could also be used to initiate or create markets – it should have a commercial base, to be sustainable.

Energy services for the poor in Indonesia, a different approach: Tri Mumpuni

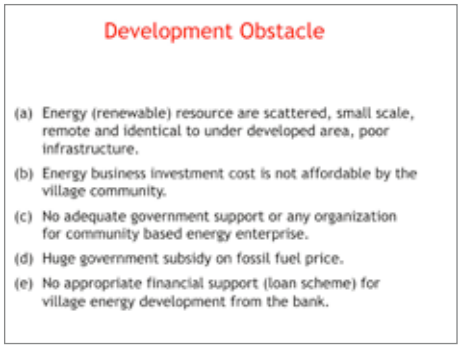
Tri Mumpuni, a social entrepreneur, works with a slightly different approach in Indonesia. With her organization, **People Centered Economic & Business Institute IBEKA,** she enables electric power supply through **micro hydropower for rural areas.** Her concept allows the communities to have equity in funding the system and to receive income from the generated revenue. The United Nations Economic Commission for Asia and the Pacific UNESCAP adopted the concept as a Public Private Partnership model in the Asia Pacific region. Tri Mumpuni was elected **Ashoka Fellow in 2006** and listed as one of the 100 most powerful women in Asia in 2007.

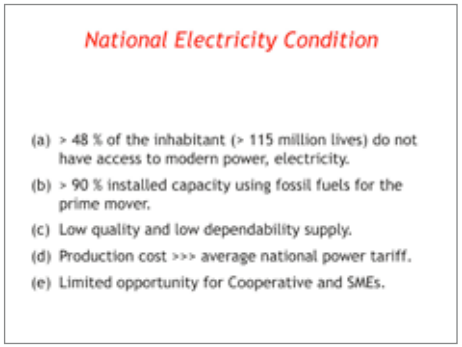
Challenges of energy supply in Indonesia

Indonesia has a rather unusual geographical setting, as it consists of around 17,000 islands, some of them face serious challenges due to global warming. Only 7,000 islands are inhabited and 20,000 MW installed capacity are not only of very low quality, but also not enough to supply all islands, especially those, which are scattered, remote and with poor infrastructure. In other words, **out of 240 million people living in Indonesia, roughly 115 million people have access to modern energy supply.** Furthermore 90 percent of the installed capacity **depends heavily on fossil fuels,** although Indonesia has abundant sources of hydropower. The hydropower potential is about 75,000 MW of which around 10 percent could be generated from mini and micro hydropower plants.

Engergy gap

Tri Mumpuni has the aim to fill the energy gap, where the government faces limitations to do so, but the poor infrastructure across the islands, **uniformed tariffs and sub-**





sidies are making it difficult and limit the opportunities for cooperatives and SMEs. Often community based projects experience competition from the state owned electricity company, PLN, as it offers lower, subsidized tariffs. This can drive community projects out of business. In 2002, Tri Mumpuni remembers the first small 'IPP – Individual Power Purchase', which enables electricity sales between community projects and the national grid. Further, **obstacles to provide all Indonesian people with electricity are:**

- the inability by communities to afford the investment costs
- inappropriate financial support (e.g. soft loans)
- fairly low purchase power
- inadequate government support for community-based enterprises

IBEKA's Approach

The Indonesian government is strongly involved in large-scale projects. Similar to Mika Turpeinen's conclusion on large-scale hydropower projects, also Indonesian **large-scale projects often do not supply what they promised.** The sustainability of these projects varies and rather often, due to the lack of community involvement and ownership, the projects fail after a few months. Tri Mumpuni with her organisation IBEKA works quite differently to the government's scheme and **puts the community development in the centre of the projects,** while the government still approaches its projects top-down.

The Set Up

IBEKA projects have been supported since the early 1990s by donor agencies from different countries like Japan but also some European countries. Tri Mumpuni quotes the media asking, why all success cases are supported by donor agencies outside the country. The Indonesian government periodically spends around 1.5 billion USD on rural electrification but is not as successful. The answer might lie in the **'proposed local enterprise program',** the community involvement being one of its key success factors. By working that way, Tri Mumpuni ensures that the **business is working beyond profit and will benefit the community** who is in need.

So far, the government has been the biggest source of financial support to IBEKA projects. Tri Mumpuni's next challenge is to look for ways to engage with the private sector also. She needs to measure the costs and identify the economic viability in order to attract banks, for instance, which could support IBEKA projects with soft loans or through a **'Rural Electricity Empowerment Fund'.**

Isolated and Connected grids

According to Tri Mumpuni, it is very important to combine the generation of electricity with the generation of income. In that sense, IBEKA projects work on two different levels: with isolated and connected grids. After enduring efforts, some projects have now **managed to sell energy to the grid,** which makes it fairly easy to generate revenue from the electricity sales. The income is being used in endowment funds to **invest in education or health care, infrastructure improvement or even some micro credits.**

Isolated grid-projects mostly involve agricultural processing units, allowing the farmers to process their products through drying and grinding, and to achieve a better value.

When Tri Mumpuni is asked how much people are willing to pay for electricity, she differentiates between the **willingness and the ability to pay.** In other words, while some might be able to pay a certain price, they might not be willing to do so. Once people are making a living, they are also able and willing to pay the appropriate price for electricity. They will recognize that electricity is a mean to their income and will actively support the maintenance – this way the system is sustainable. The IBEKA staff works with the village community as the centre of development and in that sense, the village has to come to a **common consensus regarding the electricity price.** Sometimes this involves a certain learning process, whereas the villagers have to appreciate the access to energy in comparison to other things.

Step by Step

Before starting a project **IBEKA undertakes studies on different levels** to avoid any misunderstandings or wrong expectations. IBEKA's research draws, next to intensive geological studies, extensively from the experience of the local villages to determine the fluctuation curve and hence the feasibility of a project. Sometimes, the electricity production of a project will only be 10 months and everybody involved will have to acknowledge this. Also, the social aspects and preparation will need to be considered. During this process, where the IBEKA staff often stays for several months, **training and support on managerial and technical aspects** are being shared with the community. The community also has to realize the value of electricity and accept an adequate tariff setting, often above the national setting, realizing the sustainability of their facilities. They are willing to pay a higher tariff, as they are directly involved with the projects, partly own and always maintain them.

TRI MUMPUNI

Tri Mumpuni is a social entrepreneur in Indonesia. With her organization, People Centered Economic & Business Institute (IBEKA), she enables electric power supply through micro hydropower for rural areas. Her concept allows the communities to have equity in funding the system and to receive income from the generated revenue. The United Nations Economic Commission for Asia and the Pacific (UNESCAP) adopted the concept as a Public Private Partnership model in the Asia Pacific region. Tri Mumpuni was elected as a Ashoka Fellow in 2006 and listed as one of the 100 most powerful women in Asia in 2007.

MIKA TURPEINEN

As a business developer for the technology corporation Asea Brown Boveri (ABB), Mika Turpeinen coordinated the development of the Distributed Energy concept for emerging markets. He was also responsible for the development and market launch of a new type of hydropower plant designed for the Base-of-Pyramid markets in cooperation with the Finnish development agency Finnfund. Mika Turpeinen now works as a consultant in Ethiopia engaged in various projects: smart grid models, renewable energy, low-cost-low-energy houses, ICT and business incubator services.

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