

# Innovating sustainable energy for the rural BOP: Bricolage and intrapreneurship in ABB's mini-hydro power project in rural Ethiopia

Minna Halme, Helsinki School of Economics, Finland  
Helsinki School of Economics  
Dept. of Marketing and Management  
P.O. box 1210  
00610 Helsinki, Finland  
E-mail: minna.halme@hse.fi  
Tel. +358 40 353 8251  
Fax. +358 9 4313 8777

Sara Lindeman, Hanken School of Economics,  
Dept. of Marketing  
Arkadiankatu 22  
FI-00100 HELSINKI, Finland  
E-mail: sara.lindeman@hanken.fi  
Tel. +358 40 3521554

## Introduction

Much of the empirical BOP case research is about successful of business concepts. They may have been created through hardships, but are presented as inevitable success stories. The cases are written ex-post, and the research perspective is that of a winner concept. Paradoxically, while the formal "lessons learnt" reported in the BOP literature emphasize the shortage of resources and the difficulties of the institutional and physical environments, the post-hoc rationalization and success logic are BOP stories "painted pink"<sup>1</sup>. We claim that these pink stories distort the BOP business research. BOP business reality is red and green, black and white and all colours in between. While the pink approach is inspirational, it may also work against the goal of encouraging and giving authentic information to entrepreneurs once they hit first, second and eventually the N<sup>th</sup> obstacle on their way.

This paper has two main purposes. For one, it describes sustainable energy innovation for the rural BOP. Secondly, it is a longitudinal study of an innovation process at and for the BOP, the end result of which is not yet known. Thus there is probably less success bias than in much of the current empirical descriptions of innovation processes of enterprises operating at the BOP.

The research we report here is of ABB's intrapreneurship (entrepreneurship within existing organizations) (Antoncic and Hisrich 2001) is about an on-going process. The aim of the ABB project is to provide electrification to rural Ethiopia. A long-term plan is to extend to other African countries that have untapped water resources which make possible mini-hydro power provision that does not disturb the nature. The project is run by a business development manager of ABB. The study offers an interesting case about a BOP project, where a visionary and determined intrapreneur in a large corporation mobilizes resources in a fashion that can be termed as bricolage, making do with what is at hand (see Nelson and Baker 2005).

The larger context of the ABB project is the prevalence of energy poverty. Roughly 1.6 billion people, which is one quarter of the global population, still have no access to electricity and some

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<sup>1</sup> This is also typical of much of the general management literature.

2.4 billion people rely on traditional biomass, including wood, agricultural residues and dung, for cooking and heating. More than 99 percent of people without electricity live in developing regions, and four out of five live in rural areas of South Asia and sub-Saharan Africa (IEA 2002). Entangled in this case description are the complex dynamics and challenges linked to energy poverty.

We write this paper more like a story rather than a formal paper that starts with a literature review and proceeds through the case description to results. We follow a data-driven inductive research strategy. Both of us have thorough knowledge of the BOP literature, but we gathered the current data without assumptions on what we want to find. We did not even have a formal research question, but we were interested in studying empirically a BOP business development process whose end result is not yet known. The context is energy provision for the rural BOP, and the particular focus on an initiative for introducing sustainable and affordable yet high-quality electricity for the poor. Only in the very end of the paper we discuss the implications of the case to the BOP literature.

## **The story begins in the Addis Abeba Innovation Centre**

*“The project started, to be honest, in the lobby bar of Hilton Addis Ababa more than two years ago, I think that was 20th Jan 2006... There I met a Finnish strategy adviser, Mr. Tapio Peltonen, who at that time was working with Nokia and ETC [Ethiopian Telecom Company]. We had long discussions about developing countries, opportunities here, new approaches how to develop a country in profitable way and many other topics.”* [Development Manager Mika Turpeinen, ABB, in an e-mail correspondence on Feb. 21, 2008]

A number of developing countries struggle in a paradoxical situation with originally abundant resources but facing a number of complex and interrelated problems that result in even extreme poverty among their citizens. Ethiopia is a case in point. It is one of the poorest countries in the world, yet not due to lack of natural resources but rather due to failing governance the country has plunged into deep poverty and dependence on foreign food and development aid. Somewhat contradictory to the common imagery of drought and famine in Ethiopia, this high altitude country is in fact the source of 84% of the Nile water. Despite the huge potential, exploitation rate is only about 2% (API 2007), i.e. little of the renewable natural resource of “falling water” is electrified. This would not be as tragic a fact if not coupled with the fact that most households use wood as cooking fuel, which has led to deforestation and erosion. From the original 60 %, today only less than 2 % of the land area is covered by forest (Bishaw 2001). Deforestation has left parts of the Ethiopian population without arable land, and led to mass migration of others from unlivable areas to those which can support human livelihoods. But the pressure on the land is constantly increasing and fuel-switch alternatives to wood are desperately called for.

In this paper we focus on energy poverty and particularly rural electrification. Lack of cooking, lighting and household energy directly influences the lives of poor individuals. In the absence of electricity, people depend heavily on the usage of firewood for cooking. This coupled with a staggering population growth in Ethiopia has led to deforestation and loss of livelihoods. The problem is recognised by the Ethiopian government, which sees (rural) electrification as a priority, but still fails to provide electricity despite its promises and deforestation problems.

Although not as dramatic as lack of nutrition or shelter, the lack of electricity indirectly influences the lives of the poor in a number of ways. It means lack of light or high costs of other sources of light, such as kerosene for lamps. Ethiopians actually often refer to living without electricity as “being in the dark”. Furthermore, it means that cooking energy comes from wood, causing indoor air pollution and respiratory diseases. Basic activities such as grain grinding and fetching or pumping water in rural communities have to be conducted manually. These laborious tasks are primarily duties of women and young girls. Much of their time goes to fetching water and wood for cooking and preparing food without help of even simplest appliances that would require electricity. On top of that, people have to spend a considerable amount of their income to sources of power

(e.g. wood, kerosene, batteries for radio) that the wealthier ones get cheaper since they can fulfill their needs with the help of electricity.

Over 80 % of the nearly 80 million population of Ethiopia lives in the countryside and derives its livelihood from subsistence agriculture and livestock (REES 2006). Only around 20 % of the population has access to electricity despite that Ethiopia has economically exploitable hydropower potential of more than 30,000 megawatts. Moreover, "access to electricity" in Ethiopia does not indicate that households actually get electricity. Rather, it indicates that there is an electricity line coming to the village. The electricity lines are not connected to all dwellings and power provision is erratic.

## Data and research methodology

The bulk of data consists of interviews with the two key persons in charge of the ABB's rural electrification initiative in Ethiopia, the key stakeholders of this project as well as village chiefs, subsistence entrepreneurs and individuals in rural villages representing potential users of electricity. The key stakeholders are state and regional authorities and NGO representatives (Appendix 1). The two key persons running the initiative are business development manager Mika Turpeinen from Finnish ABB (lives in Ethiopia), and strategy advisor Tapio Peltonen. We have had regular discussions and correspondence with them since November 2007. The other interviews were conducted in Ethiopia in February and March 2009.

Our discussions with village inhabitants as well as local subsistence entrepreneurs mainly concerned their daily lives in general and energy usage and related problems and solutions in particular.

## Sustainable energy -inspired intrapreneurship within ABB

*"At that time I was also studying, more or less as a hobby, the new financing sources such as CDM and other carbon credit issues. The first idea was to create "fuel-switch" CDM project by bringing whole energy chain to replace wood fuel burning. We thought, based on wrong information from Ministry of Environment of Finland, that CDM legislation would allow such a "fuel-switch". However, the CDM legislation counts wood fuel as renewable energy, even though the wood fuel is used in very unsustainable way and forests keep disappearing. There was proposal in UNFCCC<sup>2</sup> to include "avoided deforestation" to CDM concept but that did not happen until few months ago in Bali meeting."*

The quote above is a part of Mika's letter to the director of ABB East Africa on Feb. 21, 2008, in which he explains what he is doing in Ethiopia. Mika is formally employed by ABB Finland. Due to the organizational structure there has only been a loose coordination between Mika's efforts in Ethiopia and ABB East Africa organization. We will extensively quote this particular e-mail of Mika, because it is very descriptive of the rural electrification project we focus upon here.

*"So this CDM financing was the key issue during the year 2006, I went to our HQ [headquarters] in Zürich to present these ideas to our Sustainability Affairs group in autumn and got very good feedback but very little resources... They gave me a small budget to travel to Ethiopia 1 -2 times but that was it. However, internally in ABB Finland it created more attention. For example I was nominated as contact person for group called FinFlex, that is group of 50 main industry players in Finland and the group's task was to find suitable CDM projects.*

*Still the first year, 2006, I spent my own free time, holidays and nights and even some of my own money to study things, meet with many people and develop ideas further. Mr. Peltonen [strategy*

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<sup>2</sup> United Nations Framework Convention on Climate Change

*advisor] was also spending huge efforts and helped me a lot during this and following year - even that he has his private consultant company he was doing this early stage development without even discussing about invoicing.*

*In end of 2006 I managed to get seat in Nairobi UNFCCC meeting. I was there to present one of our technology innovations. That meeting opened my eyes a lot. I found out that there are in general two types of players in climate change and energy poverty game. First ones are e.g. United Nations or World Bank having great global scale plans, lot of big numbers and huge organizations. The other ones are small companies, NGOs and individuals - having nice little solar panels or something and great devoted people working in those. What I noted was that those two speak different language, they don't meet each other. There is very rarely any holistic, scalable and strategically important development action really made. I must say that was very proud after discussing maybe an hour with one World Bank guy explaining the basic idea of this Ethiopian hydro project. He told me that "these kinds of projects we have been looking for, however I know that it is almost impossible to make it happen as there are no such players in field who think this widely". So we were in right track I concluded."*

Mika Turpeinen has worked extensively in a number of East African countries since the early 2000, and he has frequently visited Ethiopia ever since 2004. He lives in Addis Abeba since January 2008 and is married to an Ethiopian woman.

## **Making sustainable electricity a business at the BOP**

The poor often pay more for everything, in relative and absolute terms, than their wealthy counterparts (Kandachar and Halme 2008, Hammond et al. 2007). In energy business it means for example that poor settlements are often not in reach of the electric grid and are therefore resort to kerosene for lighting or diesel generators for other power needs even though the total costs are much higher. The situation is the gravest in rural areas in developing countries. Hence rural electrification schemes abound, but a vicious circle can be found in many of them as well. Electricity distribution networks in rural areas are designed using (extremely-delete?) low cost principle to make sure that maximum amount of households can be connected. However, the cheap design, low quality materials and unprofessional installation all lead to unreliable poor quality of electricity. Many households may be connected, but it is impossible to build any sort of business that relies on electricity if voltage fluctuation breaks or damages equipment or if blackouts takes days or weeks.

### ***The mini-hydro technology***

Since the first meeting in Addis Abeba Innovation Centre, i.e. the Hilton lobby bar several discussions and e-mail correspondence followed. Mini-hydro power was the idea that ABB's Mika Turpeinen and Tapio Peltonen came up with. The focus on hydro power is well justifiable as Ethiopia has an plenty of so called falling water. The choice of mini-hydro power size generator was made because of economic feasibility and environmental sustainability (for hydro power types see the footnote<sup>3</sup>). Depending on its capacity, a mini-hydro generator can generate enough electricity for lighting, cooking and various business needs for a cluster of villages, including a few thousand households.

*"Currently in many countries the national grid with huge power plants are the only option. However, the distributed generation scheme is today the hot topic in Europe, but it should be very hot topic in developing countries. The erection of transmission lines or huge power plants require very much resources and cause high financial burden as consumption and related economic development*

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<sup>3</sup> Typically four levels of hydro power are be distinguished. Pico hydro is water power up to 5 kW (Pico hydro 2009), micro hydropower schemes are those from 5kW to 100kW power capacity (Wikipedia 2009), mini hydropower is a term used for capacity up to 1 MW, but sometimes even 3 MW hydro power generators are referred to as mini hydro. Power plants with capacity bigger than this fall typically under large hydropower.

*would pay investment back only after extremely long time. Now, by bringing many independent small scale distributed systems to most needed areas, we could get faster payback for investment - especially if we let private investors to come to game. (cf. Bornstein 2004)*

In 2006 ABB Finland had, in a separate project, developed new type of hydropower concept that would greatly simplify mechanical design and reduce costs. The technology was successfully tested in Finland, however there were still lot of question marks before it could be called a "containerized power plant" that could be easily deployed to developing countries as the plan is not only about a couple of mini-hydro power plants:

However, the plan is not only about a couple of mini-hydro power plants:

*"The idea of building 20+ power plants immediately instead of playing with one or two had changed the nature of discussions [with financiers and climate change stakeholders] totally - it is easier for financiers to give money 50 MEUR distributed to 20 sites instead of put all the eggs in one basket and give 2 MEUR for that. Especially when we explain that Ethiopia is just a pilot country and the aim is to extend to other countries as well with similar 20+ chain of power plants".*

*We target to plant sizes 0.3 - 1 MW each, run-off river types i.e. no dams are needed. Naturally several plants can be installed in parallel in sites where demand is high and water flow is enough. The key there is the standardization - we will not try to optimize our power plant for any specific site - that is why we need many similar sites."*

[Mika Turpeinen in an e-mail correspondence on Feb. 21, 2008]

### **SmartGrid<sup>BOP</sup>**

While in the above quotation Mika writes about 20 mini-hydro power plants, in 2009 the goal has developed: a smart grid suitable for BOP conditions. The SmartGrid<sup>BOP</sup> concept aims at providing ecologically sustainable [e.g. hydro, solar, wind] and affordable, yet high quality energy to fulfil the needs of poor people. Here we make a distinction between smart grid technologies in general, which facilitate more flexible, safe and "intelligent" electricity distribution networks and the SmartGrid BOP concept, which aims at applying this in the BOP and focus on renewable energy sources.

While traditional electricity distribution networks are designed for centralized power generation and radial network structures, networks today include an increasing amount of small generating units, such as wind turbines, creating new challenges for network protection and control. The term SmartGrid is a general term describing various innovations made within energy value chain starting from generation through transmission and distribution all the way to end user equipment. Grid is energy market place and shall be designed to accept virtually any kind of energy sources.

The SmartGrid<sup>BOP</sup> concept aims to find solutions where understanding of BoP markets is combined to technological innovations of SmartGrid systems. It is already understood that methods and technologies used in Europe where grid reaches everybody are not optimal for African green field countries – or if we put it in other words; if networks in Europe should be rebuild now with today's technological understanding those would look very much different. That gives African countries an advantage as there is no need to repeat all development steps and mistakes made elsewhere.

Many technological and business innovations already exists that can be rather straightforwardly adapted to SmartGrid<sup>BOP</sup> concept. However, the concept is novel and untested in practice. Thus there is a need to be careful when selecting technology options, deploy new wide scale business models or start to hype around few details such as Automatic Meter Reading as is case today. A lot of research and many trials need to be made and many errors to overcome. The challenge is to understand how BoP energy markets really work and how technology can fulfil the needs there. These have to be tested in practice.

*"Now, if everything goes like in movies, in about year from now we start building first ones and within two years all 20 plants should be in operation. That is a great challenge for ABB and personally for me - but it might also be very rewarding, a real triple-bottom case, scalable globally, opening up totally new market for us."* [MT correspondence Feb 21, 2008]

## **The stakeholders and cooperation**

### ***Joint action on climate change – Allem***

As is familiar from previous BOP literature, co-operation with local stakeholders is crucial in initiating business at the BOP (Prahalad 2005; Hart 2005; Rocchi and Kusume 2008; WBCSD 2004). This also goes for the present ABB case. One of the key NGO collaborators has been a local church, or rather its development wing, which itself also has undertaken activities for small-scale rural electricity provision.

*"In 30th Jan 2007 I was invited to talk in EECMY [Ethiopian Evangelic Church Mekane Yesus] Development Commission annual meeting. I have one friend of mine working in that organisation and she knew in general what I was doing so she thought that my work might interest EECMY. I got short 10 minutes slot, which extended to almost an hour speech... The meeting started with presentation of EECMY's organization and what they do in field. I continued that by starting my speech: "...why don't you outsource your social development efforts to profit making companies..." - that caused a lot of laugh among priests and other people there. However, after explaining the idea of how non-profit organizations and companies could benefit from each other the atmosphere was most well-coming - and that has led now to Memorandum of Understanding I signed with EECMY last month" [in January 2008].* [MT correspondence Feb 21, 2008]

UNDP Ethiopia is another noteworthy collaborator. Once they learnt that Mika participated in the UNFCCC meeting in Nairobi and knows the Clean Development Mechanism<sup>4</sup> (CDM), they invited Mika to develop several CDM projects together with Ethiopian Ministry of Mines and Energy. Moreover, the plan was to make ABB's mini-hydro project the first CDM-project of Ethiopia.

While the majority BOP literature emphasizes cooperation with NGOs, in the present case federal and regional authorities play a major role: the events take place in a country where the state energy company (EEPCo) has monopoly in electricity provision. Getting the plans to even start has meant countless discussions and meeting with federal authorities such the Ministry of Mines and Energy and the National Electrification Agency as well as representatives of EEPCo, the Ethiopian Electric Power Company. Secondly, as Ethiopia is a Federal state and regional authorities hold considerable power, negotiations have also been conducted with a number of Oromian authorities, which is the region where the first mini-hydro power plants are planned to be constructed. These include the Oromian State Agency, regional office of Ministry of Mines and Energy, Co-operatives Promotion Agency Oromia among others as well as representatives of communities.

One of the challenges is the introduction of a law on feed-in tariff. While ABB would be only the technology provider and a local company would run the eventual power plants, a legal framework for Power Purchase Agreements (PPA) with national grid owner (EEPCo) is needed. While power generation was liberalized in 1990s, transmission and distribution remain with the public sector (EEPCo). The feeding tariff legislation is now in the process. According the General Manager of National Electrification Agency<sup>5</sup>, the agreements for power producers would then be 15 -20 years. However, there is no definite projection about the date of its introduction.

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<sup>4</sup> CDM allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries (UNFCCC 2009).

<sup>5</sup> Interview on Feb 27, 2009.

*“There is an initiative on the feeding tariff. It is a price to be legislated by the parliament. The idea is to give guarantee of cash flows for the duration that the bid is to be effective. That would also encourage investment... This is now still developing in the coming months. We expect this change to tap our resources, small hydro in particular, and also geothermal and also wind. This is as far as we [National Electrification Agency] can go in encouraging investment in this area. It has to be approved by the government.”* [The General Manager of National Electrification Agency, interview Feb. 27, 2009]

The above quote indicates that Ethiopian authorities are, in principle, positive towards private initiatives for distributed energy. Also local authorities appear to be cooperative and positive towards private investments. As a part of the feasibility study of the ABB mini hydro project, a research team from the Addis Abeba University had been given the task to conduct a study of energy consumption behaviour and preferences in rural towns in Ethiopia. Local authorities were also interviewed for this study. One of the researchers gave the personal assessment that the local authorities genuinely want to promote rural electrification but they are handicapped by acute lack of resource and by heavy bureaucracy. She believed that the local authorities in general are positive towards private energy initiatives. This interpretation was also confirmed by our own experience of the local authorities in Dembi Dolo, where Tilahun from the ministry of mining and energy and Abraham from the cooperatives development agency, were positive towards the ABB mini-hydro project being piloted in their region. Yet this positive stand turns into action slowly.

Mika has been actively working for getting legislation in place.

*“As a foreigner it is easy to get to almost anywhere. But it takes time. For instance I’ve been training the ministry people [Ministry of Mines and Energy] on emissions trading on UNDP’s behalf. For some reason the minister of Mines and Energy and the state minister are super interested in this emission trading project [the plan that ABB’s mini-hydro would be Ethiopia’s first CDM project]. Afterwards we talked about half a day about many things from emissions trading to how Ethiopia should be developed as a country”.* [MT, interview Feb. 26, 2009]

The eventual electricity provision was not to be run by ABB:

*“It was clear from the beginning that ABB as a company will not become equity partner of any private power utility and will have clear role as technology developer only. Therefore an operating utility, SPC (Special Purpose Company) had to be created. There were several Ethiopian individuals expressing their interest to invest in private power generation, however most of the discussions failed when real commitments were needed. Also, as private power generation is very new in Ethiopia the legislation of SPC structure was unknown and made bureaucracy very complicated. Therefore we decided we should start company registered as a consulting company. The company was opened by Jote Korssa Wakjira, an Ethiopian entrepreneur that had participated in project development since 2006. Further contracts, land acquisition and other operations were done through this consultancy company while waiting for the legal issues were cleared and an appropriate SPC could be formed”.* [MT correspondence April 26, 2009]

As we can see, ABB has found several interested and important partners in Ethiopia. Ethiopian partners – *Allem! Allem* means “there is” in Amharic, the main language of Ethiopia.

### ***Joint action on climate change with financiers? Yellem***

The opposite term *yellem*, “there is not” is a more commonly used expression in Ethiopia.

*“During 2007 we started to negotiate with various financiers. Naturally we needed financing for this development phase, to cover my costs and costs of other people I needed to join my team. We estimated that it may take around 1 - 1.5 years to develop all phases and reach state where we*

*can start the erection of first group of power plants. That financing we covered from Finnpartnership<sup>6</sup> program.” [MT correspondence Feb 21, 2008]*

While the Finnpartnership partly financed the feasibility study during spring 2008 – spring 2009, the next step for Mika and Tapio was to search financier for the power plant investments itself. The negotiations started in the spring 2008 and by the following autumn a tentative agreement with a Dutch socially responsible investment bank for financing 50 % was made. The challenge was to find the remaining 50 %.

*“There were some opportunities to get grant funding to cover other half. The idea to use grants was not in line with initial idea of making commercially sustainable business around hydropower, however for piloting phase it was foreseen that we need it to cover high risks. After extensive search of grant financiers one gave green light and the project passed the first evaluation stage”.* [MT correspondence April 26, 2009]

Another potential financier was Rural Electrification Fund (REF) from where financing for distribution network had been requested. In that stage the structure of ownership was decided so that SPC will operate generation units and cooperative formed from end-users will operate distribution network.

In August 2007 Ethiopia had launched a \$1.67 billion rural electrification program aimed at supplying power to 1,714 towns and villages in the coming 12 months throughout the country. In the press conference a representative of the national electricity company EEPKO informed that the funds for the program have been secured from its own resources and international aid agencies (API 2007). This program was promising news to people in rural areas as 99 percent of EEPKO's customers live in urban, not rural areas.

The REF was established for administering these funds. In practise, EEPKO is the only noteworthy electricity provider in Ethiopia. Other suppliers are few, supplying only a small number of people with electricity and often on a non-regular basis. The purpose of the REF was to strongly support off-grid rural electrification. Hydro-power is one of the most potential sources of electricity according to the off-grid rural electrification master plan study (REES 2006).

Ethiopian parliament wants to encourage energy from renewable sources such hydro, solar, wind and geothermal sources:

*“... the fact that the parliament is agreeing about the price [feeding tariff] is a sign that the parliament wants to encourage energy from renewable sources. Like wind or hydro or solar or geothermal”.* [The General Manager of National Electrification Agency, interview on Feb. 27, 2009]

However, despite that REF had been established for a long time only very few projects had actually been financed from there. After several meetings of Mika, Tapio and Jote with the REF managers, the funding agreement with REF is still in square one.

## **The devil is in the detail**

Tapio keeps saying that the devil is in the detail. That seems to be pretty much the principle that he and Mika follow in their project: check and double-check. Despite this approach, surprises can lure around any bend.

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<sup>6</sup> The Finnish business partnership programme providing advisory services for business activities of Finnish companies in developing countries and financial support in the planning and development phases of a project.

## ***In search of the perfect the waterfall***

According to estimates, Ethiopia holds a potential of more than 30,000 megawatts of economically exploitable hydropower. Wonderful! But where exactly is this untapped energy source situated? A seemingly innocent question that turns out to be more critical than anyone had anticipated.

Mika and Tapio want to demonstrate a modern 3x500kW power plant. That would offer a starting for their future dream, SmartGrid<sup>BOP</sup>. To that end, the criteria for selecting potential sites are many. Firstly, they need a waterfall or rapid, approximately 30 - 80m head - or higher. It should have water throughout the year - and to be in safe side a minimum dry season flow of 5 m<sup>3</sup>/s. Secondly, for the distribution and business model, the waterfall would ideally be fairly easily accessible and close to villages and small towns. The denser the population, the easier it is to distribute electricity. Thus a town or village of minimum 2000 households with basic public services such as health centre nearby. Ideally and finally, to replicate the model there ought to be minimum 20, preferable over 100 almost similar sites. To find that number, a few hundred sites should be initially evaluated in order to find those 20 something similar sites.

In early 2008 Mika and Tapio seem to have a push of luck. National Energy Agency gives them a survey of 200 waterfalls, with accurate measures of falls and GPS coordinates for the location. The devil however, paid a visit: the figures turned out to be unreliable. Either there were no waterfalls where they should be according to the survey's GPS coordinates or the waterfall's capacity is not the size the survey gives. Accurate information – *yellem!*

As no authorities can provide reliable information, Mika turns to the EECMY-DASSC partner. They have some experience and rudimentary information on waterfalls, and it is decided with the managing director that DASSC water technicians shall conduct the necessary measurements and data collection during the dry season- March to April – 2008<sup>7</sup>.

*“So at the moment I have dozens of people from EECMY field crew doing initial site surveys throughout the country. In parallel Rural Electrification Authority and especially Oromian State Energy are searching through existing studies and try to fetch data from regional offices. Next phase is to go through the results, make analysis and classification of site types and select most prominent ones for further analysis. For next phase we will train few EECMY engineers so that they are able to make professional field measurements. That is expected to be done within two months to ensure that we analyze sites during dry season.”* [MT correspondence Feb 21, 2008]

Mika trains the water technicians to do the additional measurements, and results were expected by April. All is well, Mika receives the first few site reports in March giving the impression that the operation is running smoothly, until out of the blue, in mid-April, Mika finds out that the remaining bulk of sites has not been measured. By then, the dry season was practically over meaning that the next opportunity to get minimum flow measurements comes in one year's time. Devil again!

With funding running out and pressure to show concrete results, Mika decides to hire the best possible engineers in Ethiopia that can conduct measurements of waterfalls after the dry season and then estimate minimum flow measurements. Mika trains the engineers hands on at a few sites and gives them precise instructions. The engineers set out on this quest in the summer 2008, receiving 100 USD/day – a definitive top-end compensation in the Ethiopian context. They come up with a short list of eight potential sites.

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<sup>7</sup> Be mindful that traveling within Ethiopia is surprisingly time consuming. The measurement of one waterfall can take up to 4 days, thus making it impossible for Mika to do merely by himself.

In these results, the perfect-looking waterfall is found. The Keto river in the Oromia region has it all: a 35m fall with a strong water flow, located 200m from a road, and there are densely situated villages in the surrounding area. Moreover, some of the communities are recently resettled to this area – as a consequence of the deforestation of their previous home region. Thus, they know the consequence of deforestation and are likely to be willing to cooperate in fuel switching.

### **...but in which one?**

This morning, February 28, 2009, Dembi Dolo, a town of 50.000 inhabitants in the South West Oromia region of Ethiopia, some 150 km from the Sudanese boarder – is our departure point. We are in the highlands. Rolling hills of surprisingly lush forests and neatly organized small farms of clay huts pass by the windows of our robust back-country jeep. The dust from the red soil of the dirt road whirls against our white jeep and enters the slightly opened windows during the two hours it takes to complete the 50 km distance.

Our presence never goes unnoticed, by-passers wave and smile, children run alongside the jeep shouting *ferengi* – meaning foreigner. Leaving the jeeps by the roadside, we follow the trek along the river towards the waterfalls. The sunshine is intense and the temperature around 37 degrees Celsius. Coming closer to the falls, the terrain gets very steep and keeping balance on the loose stones is challenging. Once down at the riverbed the vegetations lightens and finally we get a good view. Keto waterfall is beautiful. An impressive waterfall landing in a true oasis with small boys swimming and fishing in the sun kissed mist of the waterfalls.

Then the operations begin. Our expedition group, consisting of Mika, Tapio, Jote, two men from the local authorities and myself, is gradually growing as the boys and other by-passers silently join to observe and be part of the operation. Mika and Tapio start conducting the very basic measurements. There is an atmosphere of damped excitement, a feeling that something big is about to happen and we are all here to witness it. Not much is spoken except for occasional comments on Finnish, Oromic, English or Amharic. Besides the rumble of the waterfall and the intense atmosphere, there is mainly silence.

The measurements go on for some hours. Hundreds of pictures are taken, construction plans are discussed and every possible observation is made. Eventually, all that can be done is done and it is time to gather in our jeeps and head back to Dembi Dolo. After all the excitement and the turmoil, the jeep feels calm and consided to a private space. There is a long silence. Mika is in the front passenger seat, holding on to the sealing and gazing distantly forward. After a while he slowly turns around and breaks the silence: "It's not going to work"

Calculation in his head, Mika came to the conclusion that the waterfall power is not enough. The waterfall height is not 35m, but closer to 25m, and multiplied by the flow measurements the power was not what was expected based on the consultants reported measurements. "Everything was based on this". One year of work is falling into pieces

"How could this happen, why? Why did the engineer give inaccurate information? I repeatedly told him that no matter what – do not exaggerate the size and water flow of the sites!"

Devil or not, Mika ultimately takes the blame on himself. "I made a mistake", he says heavy with concern.

This time the devil in the detail is a crucial one. The aspired 3x500kW power plant becomes but a dream. The plan to make this intended power plant the first CDM-project of Ethiopia negotiated with UNDP Ethiopia, which would ease the financing opportunities, is destroyed. A smaller plant is no good for a pilot case.

From the financing perspective, the fixed costs of setting up of 0.2 - 2MW run-off-river plant are almost the same. Originally, the Keto site was meant to demonstrate a modern site, which would have been developed little by little toward a "smarter" network, i.e. other small power generators

(solar, wind etc.) could have been added. The electricity sales prospects from a 3x500kW plant would be sufficient to convince the financiers to fund the first plant.

It is March 2009 and the project is running out of time. The financing from ABB and Finnpartnership will end in two months time.

## Concluding discussion

Few contest that starting business in the BOP context is challenging. Nevertheless, the extent to which entrepreneurs or intrapreneurs over a long period of time juggle with finding and matching the different pieces in the puzzle, without safeguards as to what will work and what the outcome will be has been overlooked in BOP literature. As noted earlier, current BOP literature tends to describe post-hoc success stories, which – albeit perhaps unintentionally – leads to linear textbook examples on how to do it (Prahalad 2005, Prahalad and Hammond 2002). The reality might, however, look distinctively different.

The present case example gives rise to a number of topics to study further. These are of both practical and academic nature. The most pressing practical gap between the aspirations (how it should be) and reality (what is), is the *funding* of sustainable innovations, particularly CO<sup>2</sup>-free energy technologies. This particular case of rural electrification would address a pressing problem acknowledged by many stakeholders in an environmentally sustainable way. It is an initiative of a large corporation which has a sustainability policy. ABB itself also would have the resources to push this case, which would also suit its (sustainability) strategy (ABB 2008). Yet this kind of bottom-up intrapreneurial project falls in between its different parts. No country organization, no department, or other part takes the ownership of this kind of an initiative, which at least to an outside observer it appears to fit well with the corporate sustainability strategy. Without the ownership of any department, its funding is peanuts. The structure of major external financiers such as the World Bank is too slow in decision-making and does not allow them to pick up on a case like this. This case hints to that in climate change action there is lack of the middle ground efforts which could be very efficient. Our evidence for this observation remains incomplete, but we want to lift this issue to discussion since it suggests severe faults in the current system and might indicate where to channel efforts to make joint efforts on climate change more effective.

From the perspective of BOP theory development the case hints to least two themes. Firstly, successful BOP business models are portrayed as something that the top-management supports and has initiated or blessed with a strategic decision. The rhetoric is corporate rhetoric: “Cemex, Unilever, and so on started the BOP business model called...”. This is often presented as strategic purposeful action that takes place as a result of corporate level decision. However, when muddling through this case we are compelled to ask: how many BOP business models came about due to the determination and conviction of individual middle managers? How many of these determined managers act like social entrepreneurs (Mair and Marti 2006; Zahra et al. 2008) while are employees inside of large corporations? Our hypothesis is that a likely start of BOP initiatives often can be unwavering middle managers who act as intrapreneurs in their companies. In the case of BOP intrapreneurship in a corporation the process is likely to be characterized by bricolage, making do with what is at hand. This type of action is more typically recognized in small enterprises (Baker and Nelson 2005; Mair and Marti 2008). One of the implications to BOP literature is that BOP business development processes are likely to be more complex and non-linear processes than the post-hoc reporting of successful BOP cases indicates.

*“Business development in the BOP market is very challenging as can be seen from this initiative. There are surprises in every corner. How to manage unmanageable, how to be prepared for unexpected? In business development risk management is one of the cornerstones to build. In BOP business development it is more intuition and enthusiasm that mitigates risks. There is always one door to be opened, one stone to be turned, one new idea to try. However, with limited resources it also means that there is one hour less to sleep and one more headache to suffer.”*  
[MT, April 26, 2009]

Another observation is the importance of government institutions which has been played down in current BOP literature. The mainstream BOP literature focuses on MNCs and large companies as dominant actors, and NGOs as the “untypical partners” they should work with to realise BOP business models. Yet in this particular case government institutions from the state to the regional government offices were important players. Particularly in areas such as energy that are state regulated, government institutions are likely to have both enabling, gatekeeper or partnering roles. One future research task for us is to contrast energy with telecom, which also tends to be heavily state regulated but still boosts with BOP success stories – why? In addition, we intend to scrutinize themes of bricolage and intrapreneurship further. We particularly want understand how the institutions dedicated in combating climate change could better assist entrepreneurs who promote solutions for poverty alleviation and climate change mitigation simultaneously with the hope that it would become easier in the future.

As a final note, we want to point out that the story of the ABB mini-hydro case does not end by the Keto waterfall. True to the entrepreneurial spirit, this set-back has been turned into a learning experience. The project is on good way in negotiations for continued funding and the business model is continuously developed. We will continue to study this case.

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## Appendix 1

### List of interviewees

Respondent:	Organisation:	Title:	Interview date and place:
Mika Turpeinen	ABB Finland stationed in Addis Abeba Ethiopia	Business Development Manager	Interviews, discussions and email correspondance 2007-2009. Finland and Ethiopia
Tapio Peltonen	Strategy Advisors, Finland	Consultant	Interviews, discussions and email correspondance 2007-2009. Finland and Ethiopia
Jote Korssa	BOP Consulting, Ethiopia	CEO	Discussions, cultural and linguistic interpretation, assistance in interviews. 25.2- 12.3.2009 Ethiopia
Deed Jaldessa	EECMY-DASSC, Ethiopia	Managing Director	Interview in English, 5.3.2009, Addis Abeba Ethiopia
Getahun Moses	National Electric Agency, Ethiopia	General Manager	Interview in English, 26.2.2009, Addis Abeba Ethiopia
Abraham Tesfa	Cooperatives Promotion agency, Oromia Region Ethiopia	Director	Interviews and discussions in English, 28.2-3.3.2009, Dembi Dolo, Ethiopia
Tilahun Endashaw	Ministry of Mines and Energy, Oromia Region, Ethiopia	Regional manager	Interviews and discussions in English, 28.2-3.3.2009, Dembi Dolo, Ethiopia
Martha Kibru	St. Mary University, Addis Abeba, Ethiopia	Researcher	Interviews and discussions in English, 26.2.2009 and 11.3.2009, Addis Abeba, Ethiopia
Zelege Desalegn	LamLam village	Village head	Interview in Oromic with interpretation, 2.3.2009, Ethiopia.
Ahmedin Shimalesh	Giraro Tulama village	Village head	Interview in Oromic with interpretation, 2.3.2009, Ethiopia.
3 Village women	Village 21	Wives, household responsible	Interview in Oromic with interpretation, 2.3.2009, Ethiopia.
Name unrecorded	Village 21	Village cooperatives' grain mill employee	Interview in Oromic with interpretation, 2.3.2009, Ethiopia.
Several interviews	Village 21 and Dembi Dolo town	Subsistence entrepreneurs (shop keepers, barbers, laundry keeper, tailor)	Interview in Oromic with interpretation, 1.-3.3.2009, Ethiopia.

