Press Kit

# Microsol, an energy solution for micro-industries at the bottom of the pyramid

*November 20, 2013, Cadarache, France*

**Press Contact**
**Schneider Electric**
**Sophie Souquet**

Tel: +33 (0)1 41 29 84 18
sophie.souquet@schneider-electric.com

**Press Contact**
**Havas Worldwide Paris**
**Emilie Gargatte**

Tel: +33 (0)1 58 47 82 09
schneider.presse@havasww.com

# I. Promoting energy access: a challenge for society and a new market to capture

## *A crucial development issue*

According to the International Energy Agency in its 2012 report, nearly 1.3 billion people still lack access to electricity: *"Ten countries – four in developing Asia and six in sub-Saharan Africa – account for two-thirds of those people without electricity. We estimate that nearly $1 trillion in cumulative investment is needed to achieve universal energy access by 2030."*[1] In its April 2010 report, the UN Advisory Group on Energy and Climate Change identified access to energy as a key factor in reducing poverty – first on the list of Millennium Development Goals (MDGs). The report also mentions that one billion more people have only intermittent access to energy. The UN has thus set goals for 2030 to both ensure universal access to modern energy services, and to reduce global energy intensity by 40%.[2]

### Meeting basic needs

Electricity helps to meet basic human needs such as medical care, cooking, lighting, access to drinking water, etc. The inability to access modern energy services is therefore a major obstacle to developing lasting social and economic activities – especially those that generate value and income. Not surprisingly, there is a strong correlation between the levels of the Human Development Index (HDI) and access to energy services. Households without access to electricity spend an average of $15 a month – up to a third of their overall budget – to buy energy.[3] As underlined by the NGO Practical Action, access to sustainable energy helps the poorest people to escape the vicious cycle of poverty. Energy access has a huge impact on farming productivity, which is especially relevant since 2.5 billion people, representing 45% of the developing world, live on what they produce. As well, emissions from poor cooking, lighting and heating methods contribute to global warming, and cause serious illnesses that result in about two million deaths every year.[4]

### 2014-2024, the Decade of Sustainable Energy for All

The United Nations declared 2012 the International Year of Sustainable Energy for All, leading to new commitments to achieve this goal. Ban Ki-moon, Secretary General of the United Nations, has made this a priority of his second term (2011-2016). On December 21, 2012, the UN also declared the decade 2014-2024 as the “Decade for Sustainable Energy for All.” The resolution calls upon member states to step up their efforts to prioritize universal access to sustainable modern energy services. As the world’s energy needs continue to grow, it also encourages governments, international and regional organizations, and other relevant stakeholders to increase their use of new and renewable energy resources.

[1] International Energy Agency, *World Energy Outlook 2012 – Executive Summary*, pp. 8-9, 2012.
[2] UN Advisory Group on Energy and Climate Change, *Energy for a Sustainable Future – Summary Report and Recommendations*, pp. 7-9, 2010.
[3] Allen Hammond, William J Kramer, Julia Tran, Rob Katz, Courtland Walker, *The Next 4 Billion: Market Size and Business Strategy at the Base of the Pyramid*, World Resources Institute – International Finance Corporation, 2007.
[4] Practical Action, *Poor People's Energy Outlook 2012,* 2012

# *What role for Schneider Electric?*

## Social Business or Bottom of the Pyramid?

In the early 2000s, two concepts helped to organize and promote the contribution of businesses in developing and emerging countries: Bottom of the Pyramid (also Base of the Pyramid or BoP)[5] and Social Business[6]. These theories advance the idea that, by opening up to the market represented by the world's poorest people, businesses – and especially multinationals – can contribute to their development by providing access to essential goods and services, all while generating profits for themselves. This approach reconciles development, growth and profit, reversing the way poverty is viewed in the capitalist economy: the poor are no longer a burden to society as in the traditional charity model, but instead represent a potential consumer market once businesses learn how to tailor their offerings to them.

## BipBop, a program for the bottom of the pyramid

Global specialist in energy management, Schneider Electric has made its corporate, social and environmental responsibility objectives an integral part of its strategy. The Group is taking a social business approach to the bottom of the pyramid (BoP) through targeted projects, which include tailoring its offerings and rethinking its relations with consumers and stakeholders.
Energy access is more than a matter of the right equipment or products: it also means working closely with local stakeholders to increase funding and improve the technical and commercial skills of energy workers. With this in mind, in 2008 Schneider Electric launched its energy access program, BipBop (for "Business, Innovation and People at the Base of the Pyramid"), to help solve the problem of energy access in emerging economies. Its aim is to start a virtuous circle that combines joint investments, energy services training and product development, through three types of interrelated actions:

- Business – contributing financially to meet the funding needs of innovative entrepreneurs in the energy sector;
- Innovation – building a tailored offering that addresses the lack of equipment;
- People – providing commercial and technical training to address the skills shortage.

With these three parallel actions, BipBop seeks to create an "infrastructure" that promotes energy access and builds economic and social momentum around energy services. Combining these pillars will ensure that every innovation makes economic sense: ultimately, they will have to be profitable to produce truly sustainable development.

[5] The "bottom of the pyramid" (BoP) concept comes from a book by economist C. K. Pralahad entitled *Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits* (2004). It shows that people living on less than $2 a day are an unexplored source of growth for businesses, which mainly target the several million people at the top of the pyramid.
[6] Muhammad Yunus, winner of the 2006 Nobel Peace Prize, introduced the concept of "social business" in his book *Creating a World Without Poverty: Social Business and the Future of Capitalism* (2009), which does not define a market segment but a specific approach. For social entrepreneurs, financial performance can go hand in hand with social contribution. Indeed, a company that operates in a capitalist system cannot make a lasting contribution if it is loss-making. The social business therefore generates no losses or dividends, and any profits are reinvested in the company itself.

# II. Developing energy access for the BoP in new economies

Innovation, a pillar of Schneider Electric's BipBop energy access program, is aimed at building an offering specifically for the people at the bottom of the pyramid in emerging economies. The technological challenge is to address and reconcile potentially wide-ranging needs so that the solutions developed are sustainable. Schneider Electric is keen to develop an integrated portfolio of products and solutions designed for BoP environments to meet the needs of its customers at both the microeconomic level (individuals and households) and the macroeconomic level (utilities, industry, etc.). The company has been adopting this new and complex approach in the energy access market since 2009 in order to develop a targeted portfolio.

## *Segmenting the energy access market to meet a wide range of needs*

From BipBop's launch, Schneider Electric sought to segment the energy access market to pinpoint the energy needs of people at the bottom of the pyramid in emerging economies.

### By geography

The three geographical segments of the energy access market in emerging economies, from left to right: hamlets and isolated dwellings, rural villages, peri-urban areas

Schneider Electric has identified three geographical segments in emerging economies, where energy access remains a major obstacle for those who live in them:

- **Hamlets and isolated dwellings**. Minimally developed off-grid areas where people live in a subsistence economy having little or no trade with other communities or stakeholders. Their primary need is for basic lighting and charging systems for personal electronic devices (mobile phones, radios, etc.).
- **Rural villages**. Off-grid areas on the fringes of major trade routes. People here are engaged in a dual economy, with a combination of subsistence activities (farming) and industrial activities (plantations, mining, etc.) that makes them part of a wider economic region. Their energy needs are individual (lighting, charging systems, etc.) as well as collective (electrification of public amenities, micro-industries, etc.).
- **Peri-urban areas**. These areas lie on the outskirts of towns and cities and are potentially connectable to the grid. They are often characterized by poor housing, widespread poverty and a lack of property rights or security. People who settle here – often migrants – mainly need energy for domestic needs (lighting, charging systems, etc.), as well as entrepreneurial activities that may develop as a side line.

### By customer type

To meet the individual and collective energy needs of these different segments, Schneider Electric focuses on a variety of end users:

- **Households**, which mainly need energy for lighting and to charge household appliances and devices (mobile phones, radios, fans, etc.). Potential Schneider Electric customers, households are found in all three segments of the energy access market targeted by the Group.
- **Governments**, which need energy for the electrification of public amenities (e.g. town halls, community and health centers, schools, etc.) and to provide more basic services for residents (e.g. drinking water, refrigeration, etc.). These Schneider Electric customers are mainly in rural villages.
- **Local micro-entrepreneurs**, who could develop their businesses locally and provide more services if they had energy access (e.g. battery hire, charging stations, etc.). Local micro-entrepreneurs are mostly found in rural villages and peri-urban areas.
- **Micro-industries**, which can boost productivity and service quality with energy access (e.g. maintaining cold chain integrity, faster drying times, etc.). These potential Schneider Electric customers are mainly located in rural villages.

## *A comprehensive, integrated portfolio for energy access*

Products and solutions are being developed to meet both individual and collective needs, from mobile lighting systems to local micro-power plants, from battery charging stations to water pumping systems. For every technological innovation, Schneider Electric focuses on making each component modular and multifunctional, offering fully integrated solutions to maximize the level of service. Since 2009 the Group has greatly expanded this portfolio of dedicated products and services.

### TS 120S, a portable lighting and electrical charging system

As a portable lighting solution that can also be used in the electric charge of a mobile phone by USB port, Mobiya TS 120S is designed to meet the basic needs of an individual lighting wherever it is. This robust technology has solar panels for charging. Launched in 2013, Mobiya TS 120S is sold mainly in Africa. Thanks to an agreement with Total, the solution will benefit of the broad distribution network of the energy group in Africa.

### In-Diya, a modular lighting and electrical charging solution

Designed for lighting and electrical home appliances charge, In-Diya targets the family unit where they live (hamlets and isolated dwellings, rural villages, peri-urban areas). In-Diya consists of several interoperable modules as needed: LED lamp, laptop battery domestic, multi-station battery charging, individual solar panel. In-Diya comes in 9 different models. Initially marketed in India since 2010, the solution has since been distributed to many countries in Africa.

### Water of the Sun, a stand-alone solar water pumping system

This pumping station aims to meet the power & water needs of rural villages. Customers targeted by this offer are mainly governments and local micro-entrepreneurs for purposes of irrigation and domestic use. The solution is fully self-contained with a power supply by solar panels and sturdy thanks to the use of an Altivar 312 by Schneider Electric. The solution is marketed in many new economies since 2011.

### Villasol and Villasmart, decentralized rural electrification solutions

Solution for rural villages, Villasol and Villasmart target governments to meet energy access needs of public buildings (clinic, school, etc..). Villasol technology is entirely based on solar energy and develops power of 3 kW per module (several modules can be assembled). VillaSmart is a solar/biomass or diesel hybrid technology that offers power between 6 and 24 kW. These solutions are marketed in new economies of Asia and Africa since 2010.

# III.Microsol: Schneider Electric's energy access solution for BoP micro-industries

A new Schneider Electric offering in the energy access market, Microsol has developed an innovative technology that simultaneously produces electricity, drinking water and heat. It's a solution that mainly benefits micro-industries in rural areas of countries with high levels of sunshine.

## *A technology breakthrough from a joint project*

The parabolic trough prototype inaugurated on November 20, 2013 at the French Alternative Energies and Atomic Energy Commission (CEA) research centre in Cadarache, France, is the first tangible result of the Microsol joint project. With a budget of about €10 million, the Microsol project was launched in January 2012 with the financial support of the French energy agency ADEME as part of its "Future Investments" program. The project combines the skills and technologies of nine public and industrial partners. As project leader, Schneider Electric selected the following partners:

- research bodies such as the CEA to help develop the technical solution, test performance and house the prototypes; as well as the Energy, Mechanics and Electromechanics Laboratory at the Paris West University, and the Energy and Theoretical and Applied Mechanics Laboratory at the University of Lorraine, to digitally model the solutions developed.
- innovative young companies such as Exosun and Sophia-Antipolis Energie Développement (SAED), to design and make solar collectors and thermal storage systems; Exoès and Stiral for their expertise in Rankine and Stirling heat engines; TMW for its water purification technology.

Two prototypes were planned at the outset of the Microsol project:

- a prototype combining SAED vacuum-tube solar collectors, a Stiral engine and a Schneider Electric power converter. Development of this prototype was abandoned after SAED's withdrawal from the project in early 2013.
- a prototype combining a solar field with a parabolic trough and Exosun thermal storage, an Exoès Rankine engine, a TMW water purification unit, and a Schneider Electric power converter and energy management system. This is the prototype currently being tested at the CEA centre in Cadarache.

The 1:1 scale prototype is remarkable for its field of parabolic mirrors that supply heat to the thermal storage tank. The heat engine coupled to a 15 kWe generator and the power converter then convert the heat from the tank into electricity. The solution can operate independently 24/7 (off grid), and offers users direct heat or electricity as well as the ability to purify or desalinate water.

After an R&D period from 2011 to mid-2013, followed by construction, the Microsol plant will be commissioned on November 20. At CEA-Cadarache, the plant will undergo testing until the end of 2014 to check performance and make final technical adjustments. Meanwhile, the partners in this prototype will install a pilot plant in an African target market to test the business model and try it out with real users. Once the pilot site has been set up, marketing can begin, capitalizing on the know-how developed and the lessons learned.

# *Helping manufacturers improve reliability and productivity*

## Microsol objectives and targets

Microsol is Schneider Electric's latest technological innovation for the energy access market, developed jointly with several young, innovative companies. Microsol is aimed at micro-industries operating in rural villages in countries with high levels of sunshine. Its purpose is to simultaneously meet three basic needs regularly expressed by these people:

- **Access to electricity** that is reliable, efficient and inexpensive;
- **Clean drinking water** that is produced economically and consistently; and
- **Heat generation** that is continuous and environmentally sound.

The solution developed is a single standard technology because these needs are common to many micro-industries in the secondary sector, where Microsol can help micro-producers in the **food**, **textile** and **paper** industries with processing their raw materials by automating some of their processes (e.g. drying, washing, pasteurization, etc.) and in the tertiary sector, where Microsol can help the **tourist** industry by providing the energy needed for many premium services: electricity for HVAC, refrigeration or security; heat for hot water, laundry or heating; water for drinking or cooking.

Located in a rural village, Microsol can also meet some or all of the production needs of local residents: water supply, electrification of communal areas, and so forth.

## Benefits of the solution

A Microsol solution produces:

- **50 MWh/year of electricity**
- **1,000 $m^3$/year of drinking water**
- **Around 800 MWh/year of thermal energy**

The solution has an expected life of at least 20 years.

For the environment, Microsol is a green solution that guarantees:

- **Zero greenhouse gas emissions**
- **Reduced deforestation and health problems** owing to the clean production of heat and electricity
- **The use of easily recyclable steel and aluminum components**

## Technical description

Microsol is based on the cogeneration principle (combined heat and power, or CHP), taking a new look at an already widespread technology: solar thermal energy. The solution focuses on designing a thermal storage system using only environmentally friendly products. It can be broken down into four successive modules:

- **1) Power generation**: composed of a 20 x 80 m field of solar collectors and a 20 $m^3$ water tank, built by Exosun and operating as a closed circuit, the module generates and stores energy in the form of hot water. A pump circulates the water through the solar field, gradually heating it to a temperature of 180 °C. The water is then stored in the tank. This type of thermal storage is safe for the environment and extremely robust.
- **2) Electricity production**: composed of an ORC[7] engine made by Exoès, this module transforms the energy generated by the first module by converting the temperature difference

[7] Organic Rankine Cycle. Through a heat exchanger, the recoverable energy is brought into contact with the organic liquid or refrigerant in the ORC turbine. The liquid is transformed into a high pressure gas, which then expands in the turbine. This high pressure gas has similar characteristics when it expands as the steam in a steam turbine. The turbine can thus drive a

into electricity. In this way it can produce up to 50 MWh/year of electricity in the right sunshine conditions.

- **3) Drinking water production**: composed of a stand-alone evaporator supplied by TMW, which has no filtration membrane or vacuum pump and uses the plant's CHP to speed up the water's natural evaporation and condensation cycle. This module can produce up to two cubic meters a day of purified drinking water from sea water or brine. Other similar modules can be added depending on the desired output.
- **4) Maintenance and supervision**: composed of a computer and a monitoring screen that can be installed locally or remotely, this module allows the operator to control the production of one or more plants simultaneously and to manage any malfunctions with ease and efficiency.

In addition to the modules of the various partners, Microsol incorporates many Schneider Electric technologies at all levels of the solution, including:

- solar tracker drive system
- solar inverter and power electronics
- automatic load shedding
- variable speed drive for water pump, programmable logic controller
- human-machine interface
- monitoring and remote control system.

## *Making technological innovation a commercial success*

### Markets, customers and financing

Schneider Electric has identified two types of customers in the market segments it targets:

- A micro-industry or consortium of micro-industries that owns, operates and maintains the solution. In this case, Schneider Electric's direct customers will be associations (cooperatives, community organizations, etc.) or NGOs.
- A service company that owns, operates and maintains the solution in order to sell energy services (electricity, water, heat, etc.) to micro-enterprises. Here, Schneider Electric's customers will be rural electric supply cooperatives (RESCO) or governments.

In each case, the initial investment for a Microsol solution will be several hundred thousand euros, so the funding model will require collaboration between various stakeholders: governments and local authorities, business and industry, banks and microcredit organizations, development aid agencies and high impact investors. To date, no standard funding model has been defined as the partners feel that local and/or national conditions will strongly influence each investment and financing decision.

### Target regions

All countries with high levels of sunshine are potential targets for marketing Microsol. However, because of its infrastructure needs, geographical location and economic models, Schneider Electric and its partners decided to focus their efforts on Africa during the seed phase. Two African regions are of particular interest:

- **East Africa** (including Kenya, Tanzania and the Great Lakes) has huge potential owing to its sunny climate, continued economic development and Schneider Electric's established presence in these areas through a vast network of local partners.
- **Central Africa** (including Nigeria, Cameroon, Central African Republic and Democratic Republic of Congo) has good potential owing to the right climate and Schneider Electric's existing presence in the region.

generator that produces electricity. After expansion of the gas in the ORC turbine, it is re-condensed to its original liquid form, whereupon the process starts again.

## Déploiement au Kenya dès 2014

After market research, the consortium chose Kenya as pilot country for the industrialization and commercialization of Microsol. Kenya meets a set of favorable conditions for the establishment and development of this solution:
- Fort sunshine;
- Stable regulatory framework;
- Good presence of priority micro-industrial sectors for MICROSOL;
- Know-how and quality of local artisans and technicians;
- Implementation of major local Schneider Electric, both commercial and technical level.

Kenya is the first economic and industrial country in East Africa with a Gross Domestic Product (GDP) of 41.8 billion U.S. dollars (USD) and a 5.1% growth in 2012. To support its development, the country faces a number of challenges: access to reliable energy sources, structuring its economy, infrastructure development, improvement of water quality. With only a 20% electrification rate, access to energy is a real sticking point for the development of the Kenyan industry: the power grid, undersized, is unreliable, resulting in blackouts like one in Nairobi on May 2013. Diesel generators and biomass facilities are heavily offset the weakness of the Kenyan network. Kenya also suffers from deforestation and lack of clean water especially because of the pollution of rivers water.

The food industry (specifically the food manufacturing industry: milk, tea, beverages, pastry) is the preferred economic sector for development of MICROSOL in Kenya. It is one of the most promising of the Kenyan economy and heavily politically supported. This leading economic sector counts for 25% of Kenyan GDP. Many projects, including parks, are designed to develop the industry. This sector is the largest consumer of combined energy (heat and electricity) per unit of sales. Many food manufacturing processes require heat: washing, drying, evaporation or distillation, pasteurization, sterilization, cooking, heating and cooling stables. The food industry has a wide variety of actors ranging from craft production to rural manufacturing plant. This diversity allows MiCROSOL to target precisely its customers.

Tourism, which represents the biggest part of the services sector in in Kenya (63% of GDP), is another area of potential development for MICROSOL. It enjoys strong growth (+13 % per year), government support and features prominently in the development plans of the country in 2030. Hotels and lodges, beyond the area of Nairobi, are often located in low-urbanized with limited access to the electricity grid areas. Attracting foreign visitors, the tourism sector has a higher investment rate than other rural economic sectors. The hospitality needs drinking water, heat and electricity: laundries, catering, space heating, water supply (bedrooms, kitchens, laundries, etc.).

## Building an export business

Schneider Electric has historically been involved in helping small and medium-sized French companies to access foreign markets. For the Group, Microsol is an opportunity to help young innovative companies like Exosun, TMW and Exoès to reach African markets in a secure environment. While these companies play a key role in Microsol’s manufacturing process, Schneider Electric can offer its global distribution and sales networks for their technologies.