Strategic Feasibility Study for Africa

Reference samples:

- Territorial: Ethiopia and Kenya
- Technique of life: no access to electricity

June 2011

SUMMARY

Strategic Feasibility Study (SFS) for Africa refers to the Road Map (RM) for Africa completed in March, 2011. RM defines Self-Powered Community (SPC) to meet rural and peri-urban areas electrification needs, and the SFS is analyzing opportunities for new renewable energy sources, systems and technologies for countries of Sub-Saharan Africa. We have had the opportunity to be in a close contact with our partners from Kenya and Ethiopia.

We are proposing SPC Program for Africa. Our proposal is in detail described in four chapters in this Strategic Feasibility Study: Market Feasibility Study, Technical Feasibility Study, Financial Feasibility Study, and Organizational Feasibility Study. The entire study is as far as the applied methodology is concerned interconnected in the first chapter which explains the context and functions from the standpoint of regional classification of SPC, defines the basic elements of the SPC and spells out requirements for creation and development of SPC using electrification, namely based on power generation from renewable sources.

In the study we present our approach to business strategy modeling, and understanding its core segments: Business Motivation Model (BMM), Business Process Model (BPM), and Business Organization Model (BOM). We adapt the BMM originally developed by Business Rules Group (BRG) in order to define four segments of the SPC Program (SPC Factory, Solar Home System (SHS), Power Utility System (PUS) and Power Plant System (PPS). To indicate the role of the Opinion and Decision making processes in business we very briefly introduced our approach to "technique of life", and the SPC methodology based on synergy of Business Modes and Financial Analysis.

Business motivation model is aimed at development a consensus among all key players. The objective of business activities is electrification of rural and peri-urban areas and cities in Africa. All four Feasibility Study chapters (Market, Technical, Financial, Organizational), and Business Modes and Financial Analyses approach are focused in this direction. This approach was assessed by two techniques recommended by the BMM: i.e. SWOT and BOCR.

This study (SFS) has the following two objectives:

- The first one is to introduced new, modern and often not very well know methods which can – if properly applied – lead to an interactive, knowledge-based support of personnel responsible for important decisions. Here we are recognizing and assuming that decisions by the African Union (AU) and its member states concerning speedy, quality, and a comprehensive electrification are such important decisions.
- The second objective is to introduce new, modern technologies for electrification of the countryside and the cities in Africa which we are ready to facilitate. Here we have Letters of Intent concerning three key technologies:
    a) Thin-film PV panels and their manufacturing in Africa
    b) Thermal turbines with an output of up to 20kW for electric power generation from waste heat also to support development of a centralized electric power distribution network (grid) members states of the AU

c) Pyrolysis units with an output of up to 250 kW for decentralized electric power generation and biogas and for disposal of a broad spectrum of waste (communal waste, waste from agricultural production, biomass in general.)

What do we offer?

1. We are ready to participate at development of the AU programming methodology and to assist the AU with development of the SPC Program for Africa. We suggest going back to our AU RG project proposal which was done for the AU this year, and develop a parallel and much broader programming activities related to the SPC Program. We are ready to start cooperation at national and/or regional levels to demonstrate the need, viability and feasibility of the SPC Program for Africa.
2. We are ready to assist national or regional governments in implementation of SPC projects using SPC Factory products (Solar Home systems, Power Utilities pilot projects). We are also ready to assist a deeper dialogs between Czech companies Naira, Ltd.; Centipede, a.s., and Arrow Line, a.s. and their public and private sector partners in Africa.
3. We are ready to be in close contact with public and/or private sectors in any AU member states with the objective of added value to electric power development and to assist our partners in Africa to be ready to start implementation of specific three pilot projects:
    a) SPC Factory pilot application (Solar Home Systems)
    b) Thermal Turbine pilot application (Power Production)
    c) Pyrolysis system (Gas and Power production and waste processing)

Who we are:

We are a multidisciplinary and international team of qualified and enthusiastic experts ready to start cooperation on development of the SPC Program and project preparation and implementation described above. In order to give such cooperation a framework the „Prague Project Portfolio Planning Platform“, (5P) was formed.

Prague has attributes of a great community for the new millennium; it is a beautiful and exemplary city for cosmopolitan co-existence, a city worthy to be introduced to the world. *Project portfolios* are something which deserves special attention. Smart *Planner* see added value in integration of subcontractor’s projects.

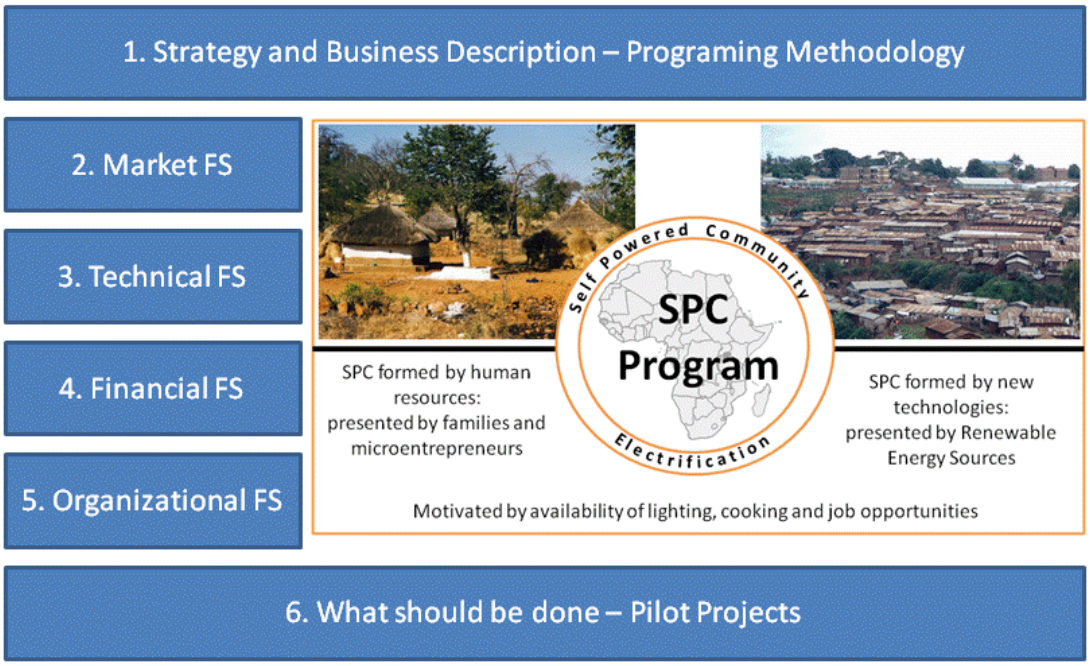
5P for Renewable Energy Sources (RES) is for those who want and are capable of getting into depth of RES investment projects through the world.

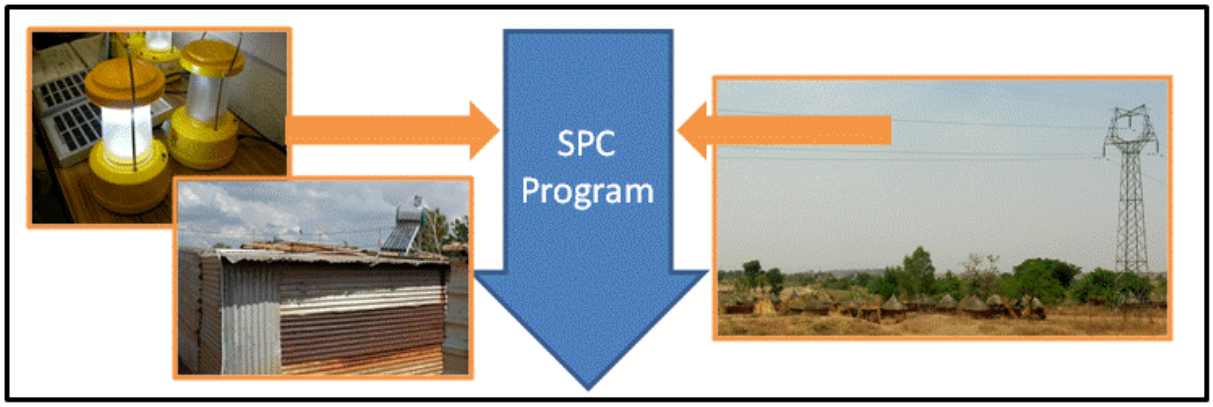
5P are bringing in innovations using synergy of the knowledge and skills necessary for development and application of technologies in production and use of electricity in today’s word.

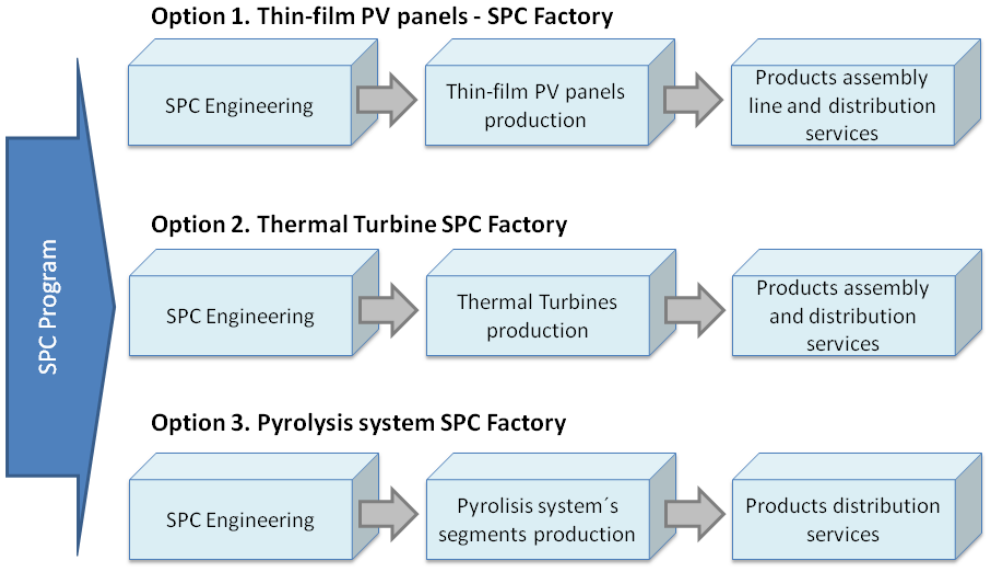
Zdenek Chalus

Head of 5P Platform

Strategic Feasibility Study structure by chapters







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Abbreviations

5P	Prague-Project-Portfolio-Planning-Platform
ACP countries	African, Caribbean and Pacific countries
AEEP	Africa-EU Energy Partnership
AFREA	Africa Renewable Energy Access Program
AREED	African Rural Energy Enterprise Development
AU	African Union
AU RG	African Union Research Grant
BMM	Business Motivation Model
BOCR	Benefit, Opportunity, Cost, Risk
BOM	Business Organization Model
BPM	Business Process Model
BRG	Business Rules Group
CGS	Credit Guarantee Scheme
COGS	Cost of Goods Sold
DFI	Development Finance Institution
DMP	Decision Making Processes
EFP	European Financing Partners
EIB	European Investment Bank
EU	European Union
FB	Final beneficiary
G	Generator
GDP	Gross domestic product
GEF	Global Environmental Facility
IFC	International Finance Corporation
OMP	Opinion Making Processes
PGS	Performance Grant Scheme
PPS	Power Plant System
PUS	Power Utility System
PV	Photovoltaic
PYS	Pyrolysis Systems
RES	Renewable Energy Sources
RM	Road Map
SBS	Syndicate Banking Scheme
SFS	Strategic Feasibility Study
SG&A	Selling, General and Administrative Costs
SHS	Solar Home System
SLED	Solar and LED Energy Access
SME	Small & Medium Enterprises
SPC	Self-Powered Community
SWOT	Strengths, Weakness, Opportunities, Threats
TG	target groups
TOE	Tonnes of Oil Equivalent
TT	Thermal Turbines
UNDP-GEF	United Nations Development Programme - Global Environmental Facility
WB	World Bank
WHO	World Health Organization

1. Strategy and Business Description

1.1 General notes

For Europeans, the electricity has been a matter of fact for generations now but not for Africans. Electricity is also a virtual export commodity. For example, in Ethiopia, which has 85 million inhabitants, approximately 80% live without electricity and those who have it have problems with power supply due to blackouts in a grid. Electricity is the cleanest form of energy, a finished product of a high-added value. But it is not always easy to synergize its technological sophistication and trade potential with business environment. The route from a fire used for cooking and making light to electricity which is distributed and sold through a reliable public power grid has not been easy as examples say of dramatic changes of Czech towns and villages over the past century illustrates. In order to understand the route which the Africans might embark on in getting electricity we have to go back to rural and peri-urban areas in Africa where the fire remains a dominant need in family life.

Technologies for lighting and cooking, now commonly used in Europe, started to change life in European villages approximately hundred years ago. But when you visit rural and peri-urban areas in today's Africa you will not see the world of our great-grandmothers and great-grandfathers back in Europe but something different, something much older and at the same time much simple. When you see a preserved medieval „black kitchen" anywhere in Europe it is something different than when you see a dinner preparation at African countryside or in an urban slum. It is not only a cultural difference but also a different „technique of life". For example, cultural differences can be seen in a preference of eating with hands while somewhere else they might need utensils (more details in Chapter 1.2).

There was no reason to do the very same things which China or India have been doing as far as mass production of basic models at the lowest cost is concerned. It was necessary to come up with something new. Therefore, after the 2010 Conference in Nairobi, we started discussions about the second generation of lights for Africa. By the second generation we mean electrification of African homes, schools, hospitals in a way which is in harmony with African „technique of life" and African cultural roots.

Our first project proposed activities focused on decentralized electrification of rural and peri-urban homes, including distribution cables, batteries, bulbs, and connections for radio, TV, mobile phone chargers and other applications while keeping in mind that the future production line's cash flow and its controls must be in compliance with payment discipline and future clients' ability to pay (e.g. "The Master Planning Process for Small and Medium Island Communities" presented at CDEnet Annual Meeting, Florence, Italy, 2009.)

Technologies have restrictive impact on technique of life of any family throughout the world. Technological development (at technical and/or organizational basis) changes technique of life (e.g. when we compare household's technical equipment for lighting, meal preparation, entertainment, etc. in Europe and Africa). It is expected that people who live in communities (in rural, peri-urban, cities), mostly poor but the rich as well, will accept any new technologies

(e.g. reliable delivery of drinking water , quality station lavatories, accessible mobile phone recharging services, etc.) if they are available and understood by them.

Key functions related to families living in African communities are: meal preparation, health, education, and jobs. Mostly new technologies must be transferred to African countries, regions, and communities and into family lives in order to increase quantity and quality of all of these four functions. New technologies bring to African market new products and technique of life will improve quality and quantity (as size of a market with growing population will grow).

New telecommunication industry has impact on anybody who lives and/or works in Africa (e.g. mobile phones, computers, and internet) and this impact grows rapidly. On other hand, there is lack of electricity, poor quality of the existing central power grids build at the national levels, while a huge natural energy potential in RES - namely sun energy – is available but not used.

Both qualitative and quantitative changes can't come true without electrification. To meet the needs of households and of industrial development in Africa by power grid systems like those existing in Europe is impractical for upcoming years and a new decentralized electrification system for Africa has to be developed. Therefore, we are proposing the Self-Powered Community Program (SPC Program).

1.2 SPC Program

SPC Program is designed to add value to African rural, peri-urban areas and cities by transfer of know-how and technology for a massive decentralized electrification that will enhance life and create jobs in communities on the basis of Self-Powered Community principles and renewable energy sources.

SPC Program proposes to assist African electrification needs in the bottom up direction. Team of the SPC Program is analyzing target groups (TGs) from "as is" to "to be" situations (dynamic view of TGs needs and constraints), and is ready to present all findings in recommendations as how to assist – step by step – with changes along the way (more detail see in the Road Map "Self-Powered Communities for Africa", April 2011).

Results of the SPC Program will be used in opinion making processes (building consensus at community level), and decision making processes (regulations at governmental levels) concerning electrification that will improve lives and create jobs for a significant part of the population.

SPC Program reflects two fundamental aspects:

- First is the human aspect; e.g. acceptance of any Renewable Energy Sources (RES) by TGs, and/or sustainability of new products, e.g. decentralized electrification of buildings (huts, public buildings, entrepreneur's premises).
- Second is technological aspect, e.g. RES business process (financing, tendering, monitoring, settlement), and/or quality of product delivered to TGs (technical and financial controls, audits).

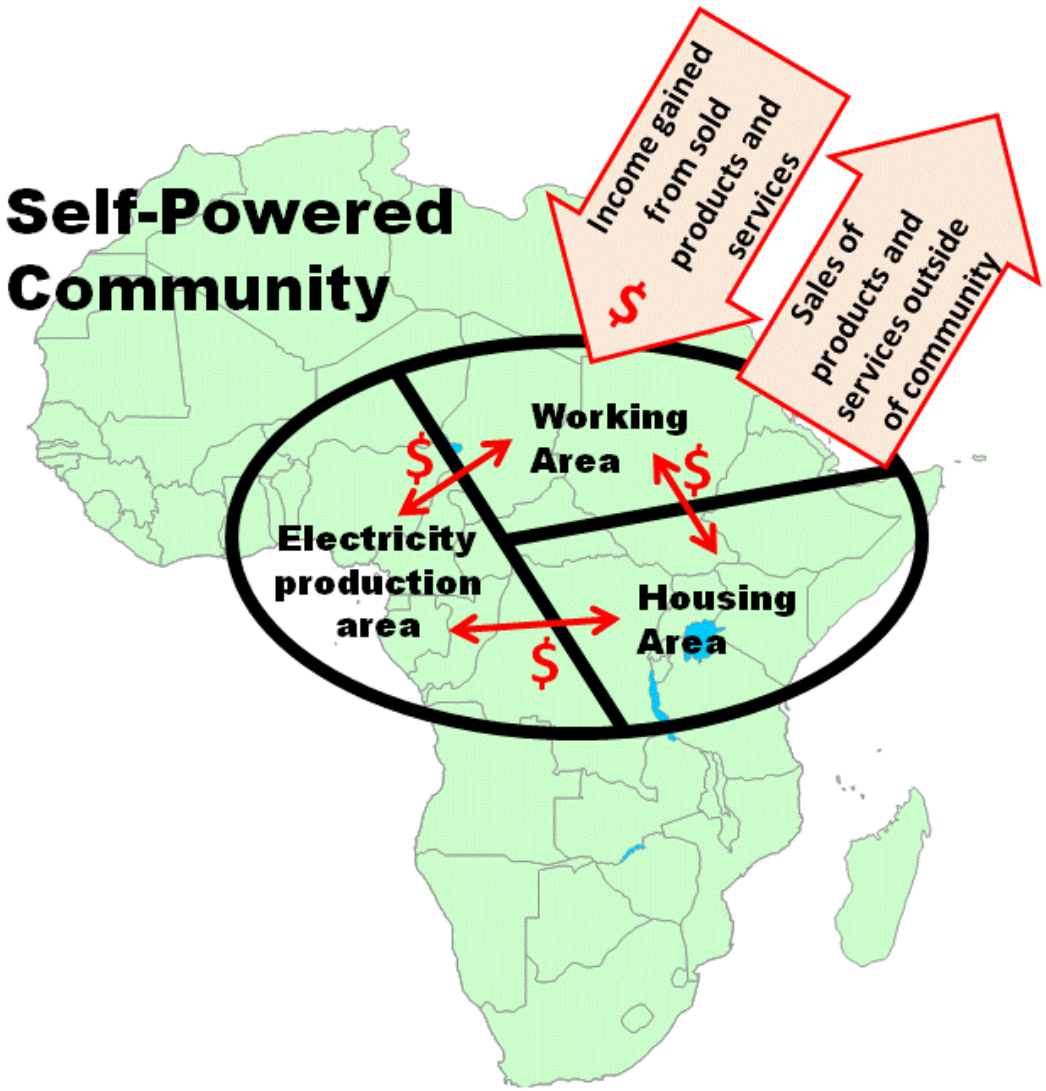
SPC Program proposal is relevant to the AU's and EU's common strategy of energy development and to the global strategy to build energy sector on the basis of renewable energy sources.

1.2.1 SPC Program: rural and peri-urban areas

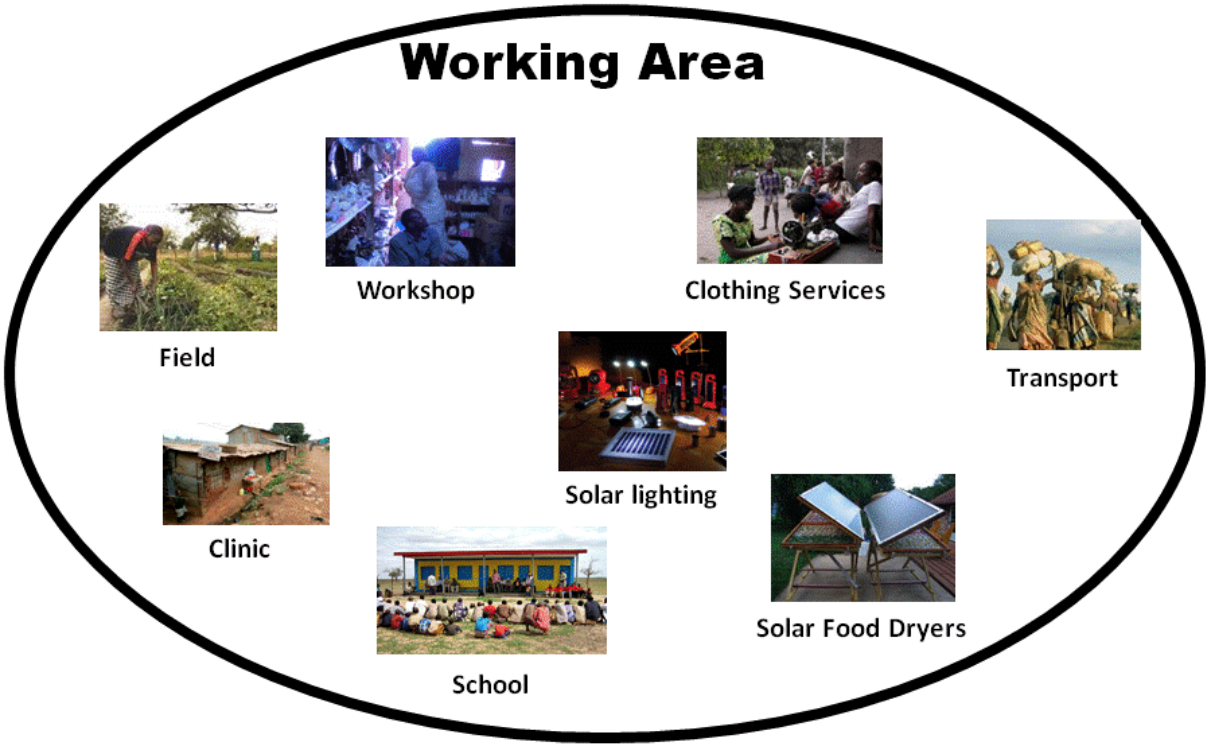
Self-Powered Community is a community that is electrified and electricity value is understood and accepted as a commodity with monetary value that can help increase standard of living in the areas with renewable energy source which are represented by natural sources such as the Sun, biomass, wind, water, etc., and renewable energy implementation systems; i.e. integration of both the fossil and the green energy into one energy infrastructure. Deployment and the improvement of such methodology will effectively contribute to Africa's poverty reduction strategies, economic growth, and social development efforts.

Self-Powered Communities is the way to address decentralized electrification of rural and peri-urban areas in Africa. The role of the Self-Powered Communities is to be a competitive, sustainable, and development-encouraging environment in contemporary lives of Africans in the regions, communities, and families.

Self-Powered Community is also a way to educate people in understanding value of electricity, i.e. that electricity is a commodity with monetary value, and that Renewable Energy Sources and Systems are the core of rural and peri- urban communities.

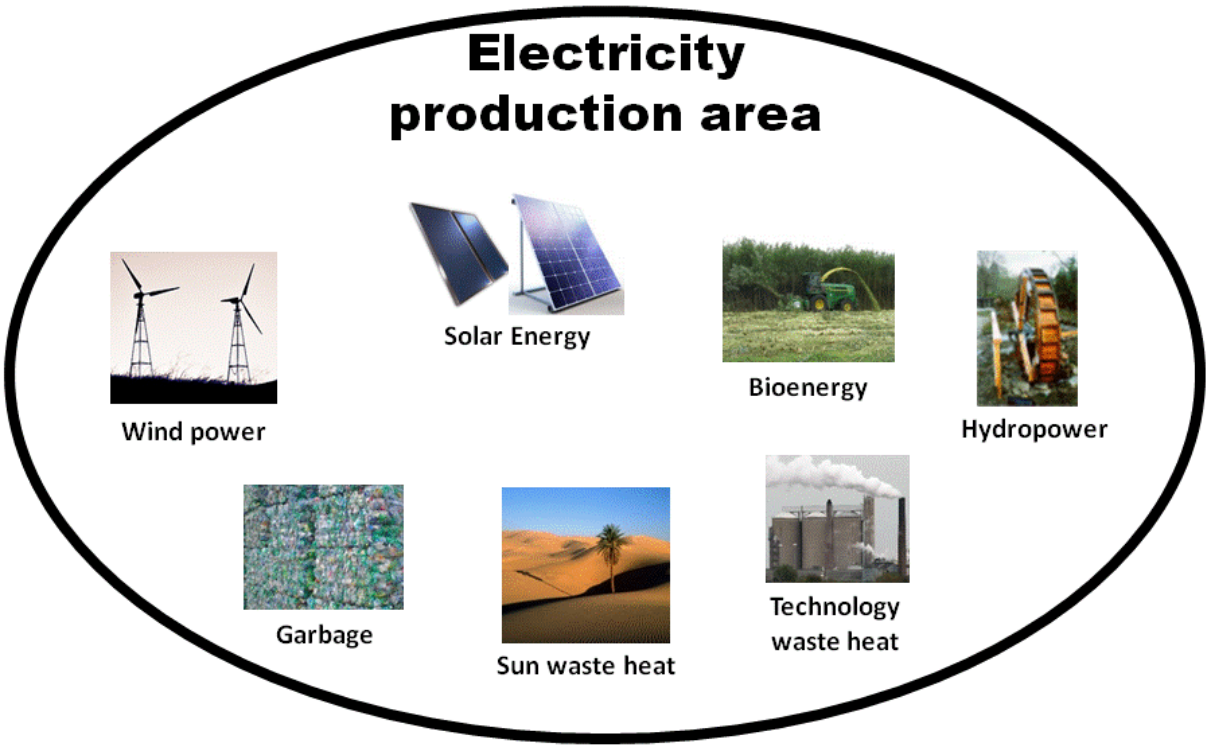


Self-Powered Community model includes three functioning areas – Working Area, Housing Area and Electricity production area. Each of these areas has its own unique functionality and components that together create one sustainable economical and social unit that can self sustain all their energy needs using Renewable Energy Sources.



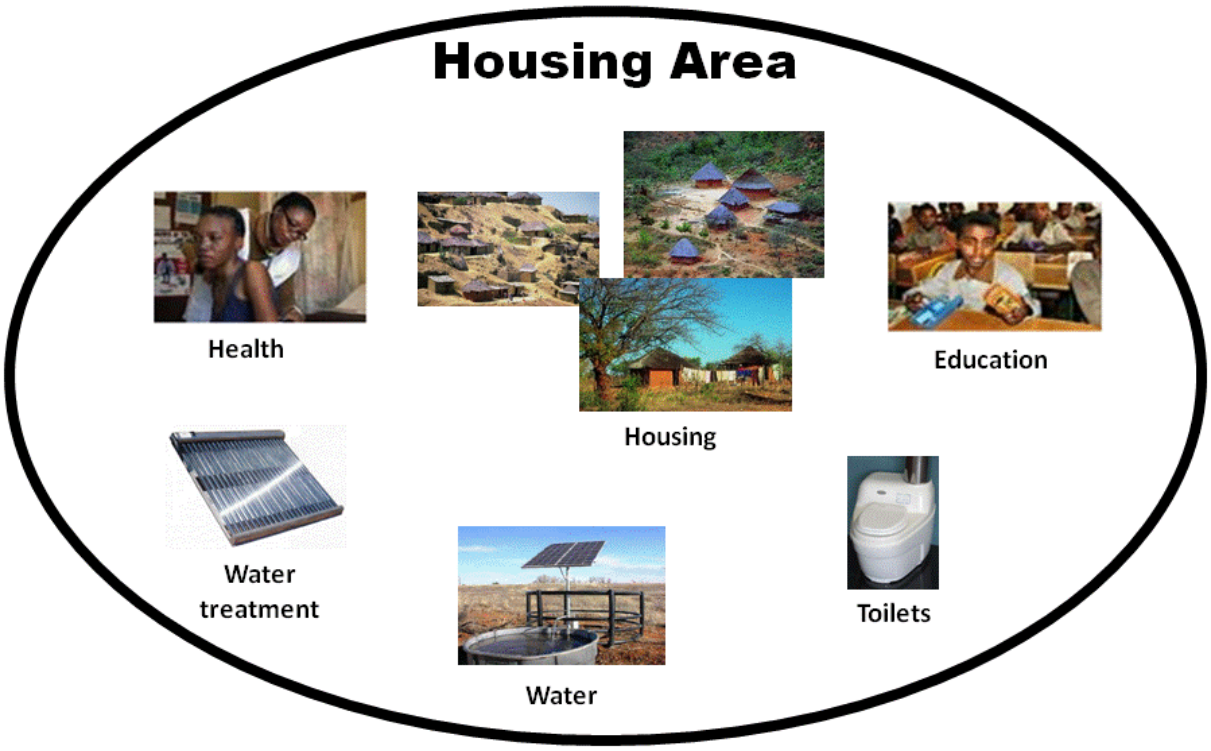
Working area	
 Field	Area of land enclosed or otherwise marked and used for agricultural purposes such as: • Cultivating crops • Usage as a paddock or, generally, an enclosure of livestock • Land left to lie fallow or as arable land Fields are the source of livelihood. Agriculture products are used for local consumption as well as for their sale outside of a community.
 Workshop	A workshop is a room or building which provides both the area and tools (or machinery) that may be required for manufacturing or repair of manufactured goods. Produced products are used to sell inside as well as outside of a community. Workshop's services are mainly provided and sold inside of a community.
 Transport	Transportation is the movement of people and goods from one location to another. Main type of transportation in Africa is humans carrying goods over dirt tracks. Transport enables community to sell their products to the outside world and earn money (to bring money into its own community's cash flow).

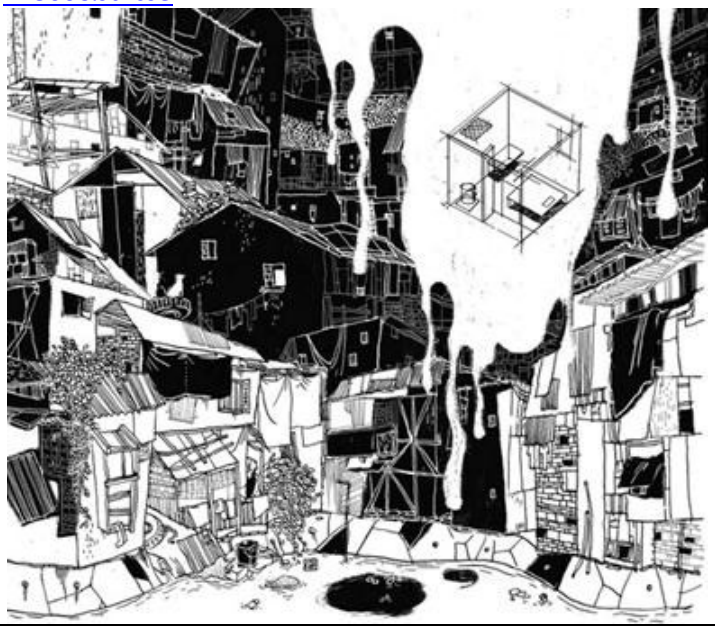
 Clothing Services	Closing Services provide services to customer in selling clothing, making new clothing, tailor-made clothing, and clothing repair. The primary purpose of clothing is functionality. It can serve as protection from the elements. Clothes also enhance safety by providing a barrier between the skin and the environment. Further, clothes provide a hygienic barrier, keeping toxins away from the body and limiting the transmission of germs. Clothing performs a range of social and cultural functions, such as individual, occupational and sexual differentiation, and social status. A uniform, for example, may identify civil authority figures, such as police and military personnel, or it may identify team, group or political affiliations.
 Clinic	A clinic (or outpatient clinic or ambulatory care clinic) is a health care facility that is primarily devoted to the care of outpatients. Clinics can be privately operated or publicly managed and funded, and typically cover primary health care needs of population in local communities, in contrast to larger hospitals which offer specialized treatments and admit inpatients for overnight stay. Clinics are often associated with general medical practice, run by one or several general practitioners or practice managers. The function of clinics will differ from country to country. For instance, a local general practice will provide primary health care, whereas a specialist clinic may provide subsidized specialized health care.
 School	A school is an institution designed for the teaching of students (or "pupils") under the supervision of teachers. Most countries have systems of formal education, which is commonly compulsory. In these systems, students progress through a series of schools. The names for these schools vary by country, but generally include primary school for young children and secondary school for teenagers who have completed primary education.
 Solar lighting	Solar lighting under Lighting Africa program. Lighting Africa, a joint IFC and World Bank program, seeks to accelerate the development of commercial off-grid lighting markets in Sub-Saharan Africa as part of the World Bank Group's wider efforts to improve access to energy. Lighting Africa is helping mobilize the private sector to build sustainable markets to provide 2.5 million people with safe, affordable, and modern off-grid lighting by 2012. The longer-term goal is to eliminate market barriers for the private sector to reach 250 million people in Africa without electricity or those using fuel-based lighting, by 2030. Improved lighting provides significant socio-economic, health and environmental benefits such as new income generating opportunities for small businesses. Lighting Africa is a key element of the global Solar and LED Energy Access (SLED) program, an initiative of the Clean Energy Ministerial.
 Solar Food Dryers	Drying is a method of food preservation that works by removing water from the food, which inhibits the growth of microorganisms and hinders food decay. Water is usually removed by evaporation (air drying, sun drying, smoking or wind drying). Drying effectively prevents bacteria from surviving in the food. Solar Food Dryer is a natural method of food drying with a high efficiency.

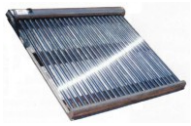


Electricity production area	
 Solar Energy	Solar energy is renewable energy made available from radiant light and heat from the sun that has been harnessed by humans. Solar energy in Self-Powered Community consists of photovoltaic panels and/or solar thermal panels. They are almost always the core part of a Self-Powered Community's Electricity production area.
 Bioenergy	Bioenergy is renewable energy made available from materials derived from biological sources. They include biomass, the biological material used as a biofuel. Bioenergy is energy extracted from the biomass, as the biomass is the fuel and the bioenergy is the energy contained in the fuel. Bioenergy in Self-Powered Community has various uses, for example for electricity generation from biomass, for cooking, etc.
 Wind power	Wind power is a conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity, windmills used for mechanical power, wind pumps for water pumping or drainage, or sails to propel ships. Wind power is optional part of Self-Powered Community's Electricity production area.
 Hydropower	Kinetic energy of water can be harnessed and used. Since water is about 800-times denser than air, even a slow flowing stream of water, or moderate sea swell, can yield considerable amounts of energy. There are many forms of water energy: • Hydroelectric energy is a term usually reserved for large-scale hydroelectric dams. • Micro hydro systems are hydroelectric power installations that typically produce up to 100 kW of power. They are often used in water rich areas as a remote-area power supply. • Run-of-the-river hydroelectricity systems derive kinetic energy from rivers and oceans without using a dam.

Hydropower	• Ocean energy describes all the technologies to harness energy from the ocean and the sea. This includes marine current power, ocean thermal energy conversion, and tidal power. Hydropower in Self-Powered Community's Electricity production area depends on suitable environment.
 Sun waste heat	Sun waste heat refers to heat from sun. Energy from waste heat: Equipment is being developed allowing for use of energy from a low temperature waste heat which is stored in water or the air and subsequently used for production of electricity. Usage of sun waste heat in Self-Powered Community's Electricity production area depend on environmental conditions.
 Technology waste heat	Technology waste heat refers to heat produced by machines, electrical equipment and industrial processes for which no useful application is found. Energy is often produced by a heat engine, running on a source of high-temperature heat. Usage of sun waste heat in Self-Powered Community's Electricity production area depend on environmental conditions.
 Garbage	Garbage is unwanted or useless materials. Some components of garbage have economical value and can be recycled once correctly recovered, such as plastics. Plastics from sorted garbage is used as an input into Pyrolysis system. Pyrolysis system can be used as a complementary source of electric power. Can be quickly activated and its production should be led directly into grid.



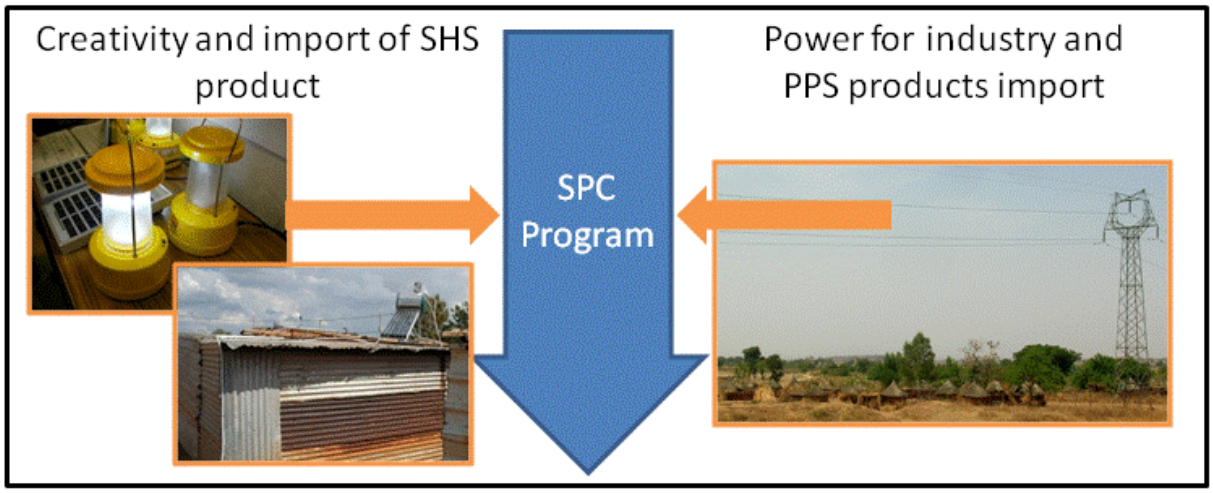
Housing Area	
 Health	Health is the general condition of a person's mind, body and spirit, usually meaning to being free from illness, injury or pain (as in "good health" or "healthy"). The World Health Organization (WHO) defined health in its broader sense in 1946 as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". A healthy community is a necessary for distribution of electric power, production and sale of products, precondition for ensuring the workforce needed for production and both within and outside of the Self-Powered Community.
 Education	Education is a process of learning. Education is an essential precondition for a community to accept the electricity, to sustain it and to be competitive in respect to other communities. Education of children has a motivational dimension for development of a community; improvement in qualifications of the adult population is a requirement for Self-Powered Community to operate successfully. In order to support skills development of occupational skills of adults we propose a separate program, for example, „Job Opportunities".
 Housing	Housing is a living space of households. The Harvard Business Review's Web site writes about their idea for "The $300 House" to address housing needs in poor areas of developing countries. The summer of 2010 competition called for design of a prototype for "The $300 House" (their original sketch was of a one-room prefabricated shed, equipped with solar panels, water filters and a tablet computer). A group of Dartmouth students involved in the project where hoping to get a better grasp of this task. They had imagined a ready-made constituency of slum-dwellers eager to buy a cheap house that should be better than the shacks they'd built themselves. But the students found that the reality here is far more complex than their business plan suggested. It turned out that target population and its lifestyle and micro-businesses would be adversely affected and no need for one-purpose $300 House actually exists. The lesson is that housing solution should fit actual needs. See New York Times: "Hands Off Our Houses" http://www.nytimes.com/2011/06/01/opinion/01srivastava.html?scp=1&sq=%24300&st=cse 

 Toilets	A toilet is a plumbing fixture primarily intended for the disposal of human excrements: urine and fecal matter. There are two basic types of toilets: the dry toilet and the wet (flush) toilet. The dry toilet needs no plumbing for water input or evacuation, but it is often coupled with a ventilation system. Practice of using toilets leads to increase in personal hygiene and ultimately to better health in community.
 Water	Water is, of course, the basic, vitally important precondition for a sustainable development of a Self-Powered Community. Water for community usage (for drinking, irrigation, etc.) can be accessed by PV Pump. PV Pump for drinking water must include water treatment.
 Water treatment	Water treatment describes processes used to make water safe and acceptable for a desired end-use. These can include use as drinking water, industrial processes, medical and many other uses. The goal of all water treatment processes is to remove contaminants in the water, or reduce the concentration of such contaminants so the water becomes suitable for its desired end-use. Water treatment is a key element to improve community's health.

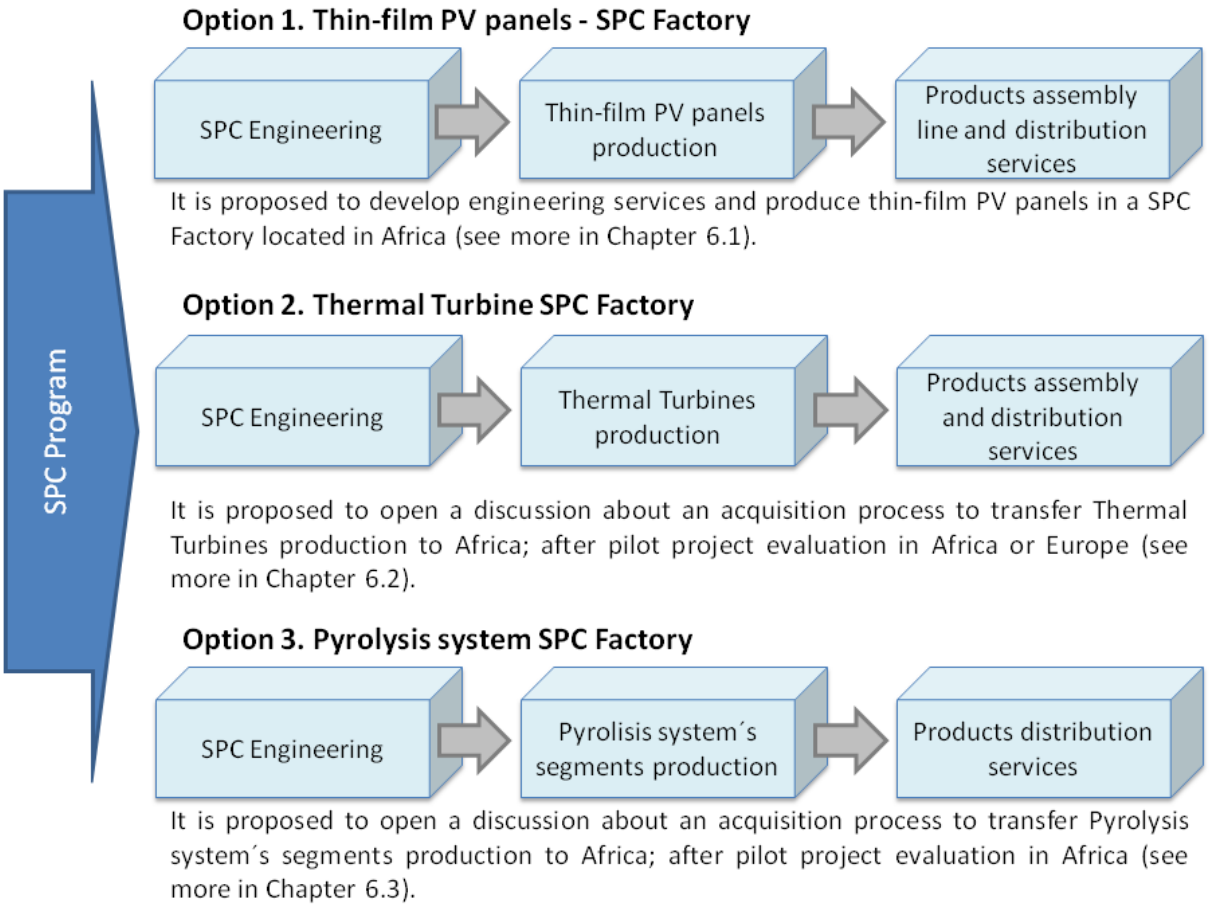
1.2.2 SPC Program: decentralized electrification

Two strategies are now implemented as far as electrification of Africa is concerned. The first one is a reaction to projects implemented within humanitarian and development assistance. Development assistance is focused of availability of light to all segments of population. An example is the WB and the IFC program "Lighting Africa" presented at the 2nd International Business Conference and Trade Fair in Nairobi in 2010. The second strategy relates to mineral raw materials in Africa and the potential for their mining and processing (e.g. coal, metals and precious metals etc.) What is missing in Africa is linkage of both strategies into one comprehensive solution to electrification.

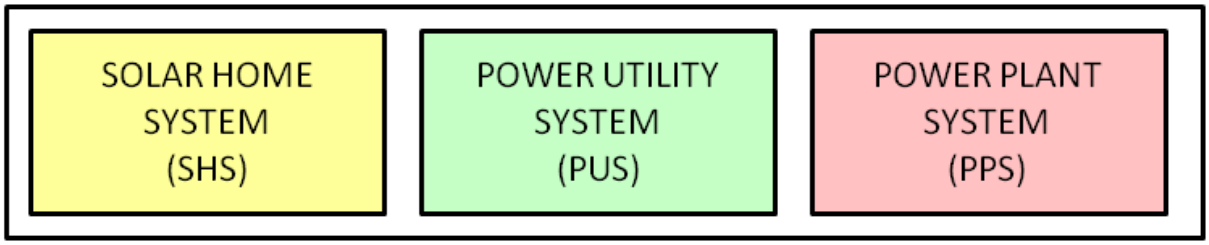
The diagram describing problems due to missing coordination among the current energy policies of individual member states of African Union:



Proposed SPC Program should be oriented on the following options:



Proposed SPC Program will be based on the following key products:



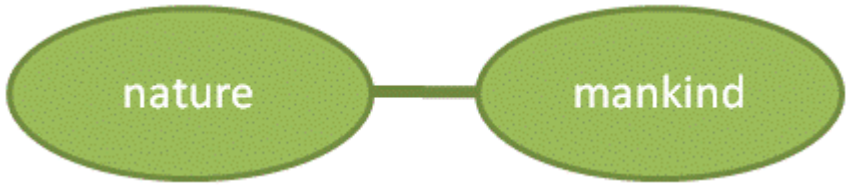
SOLAR HOME SYSTEM (SHS)	Solar-home-systems (SHS) provide power to millions of homes in Asia, Africa and Latin America. A solar-home-system uses a PV module to provide power for lights and small appliances. The system also needs a rechargeable battery, so that power is still available at night and on cloudy days. SHS bring huge benefits to homes in developing countries which aren't connected to the mains electricity grid. They replace smoky, unsafe kerosene lamps with brighter light, allowing work, study and social activities after dark. They also power radios and mobile chargers, enabling families to be in contact with the wider world.

POWER UTILITY SYSTEM (PUS)	Power utility is a company that engages in the generation, transmission, and distribution for sale, generally in a regulated market. The public utility system (electric industry) is a major provider of power in most countries. It is indispensable to factories, commercial establishments, homes, and even most recreational facilities. Lack of electricity causes not only inconveniences, but also economic loss due to reduced industrial production, public services etc. Power utility system is owned by investors or/and publicly by cooperatives, and nationalized entities. They may be engaged in all or only some aspects of the industry. Power utilities are regulated by local and national authorities. Utility's service territories are typically geographically distinct from one another. Each territory is composed of different types of consumers, usually broadly described as commercial, residential or industrial. Electricity consumers are divided into classes of service or sectors (residential, commercial, industrial, and other) based on the type of service they receive.
POWER PLANT SYSTEM (PPS)	As our world struggles with the competing demands of waste disposal, energy production and environmental protection for a limiting space and growing population, sustainable ways of waste production control and processes to transform waste into value added materials and fuel for power generation is being highly adapted for human hygiene, renewable and alternative energy sources and profitable livelihood. SFS is not interesting in performance of the overall system of power plant systems in Africa or in some AU countries. We are focusing exactly on system of two high-tech technologies to be implemented in Africa. There is no space in this study to penetrate into any component design or in a complex power plant system (e.g. power plant thermodynamic cycles, cooling system design or fossil power plants, cogeneration). Power plant system (PPS) in this study means an approach how to integrate thermal turbine (TT) and pyrolysis systems (PYS) into existing and fast growing power plant system in Africa (e.g. each country, and/or each region with a character of a power island units, and with an opportunity to be later integrated in a national/regional central power grid system).

1.2 Business strategy

Our business strategy was presented in presentation "Master Planning process for Small and Medium Island Communities" at the CDEnet Annual Meeting, Florence, Italy, 2009. We made the following compromise: We split responsibility of "navigators", i.e. a team of experts recommending an optimal route in balancing realistic needs and country-specific solutions with ever changing developments in global energy sector into two poles of the basic polarity ties for three approaches to the SPC methodology:

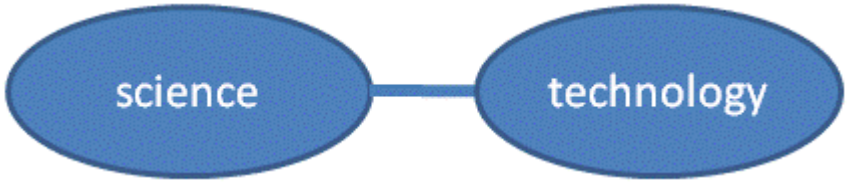
Philosophical approach



One pole represents nature and next one represents mankind; nothing more.

Examples of sub-polarities: Good - Evil, New - Old

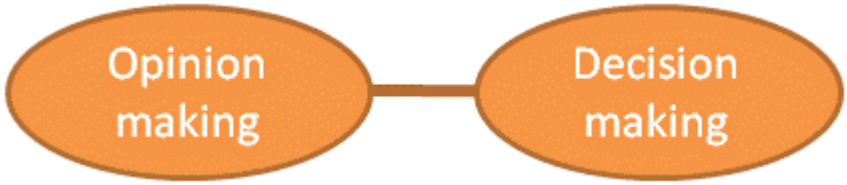
Technology approach



One pole represents science and next one represents technology; nothing more.

Examples of sub-polarities: Quantity - Quality, Cause - Effect

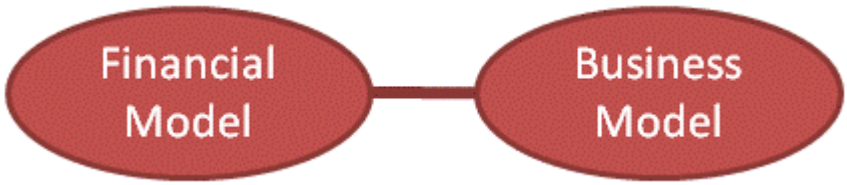
Business approach



One pole represents results of Decision Making Processes (DMP) and the next one represents results of Opinion Making Processes (OMP); nothing more.

Examples of sub-polarities: Chaos - Order, Randomness - Regularity

SPC Methodology



Business Model: see more in Chapter 1.3
Financial Model: see more in Chapter 4.1

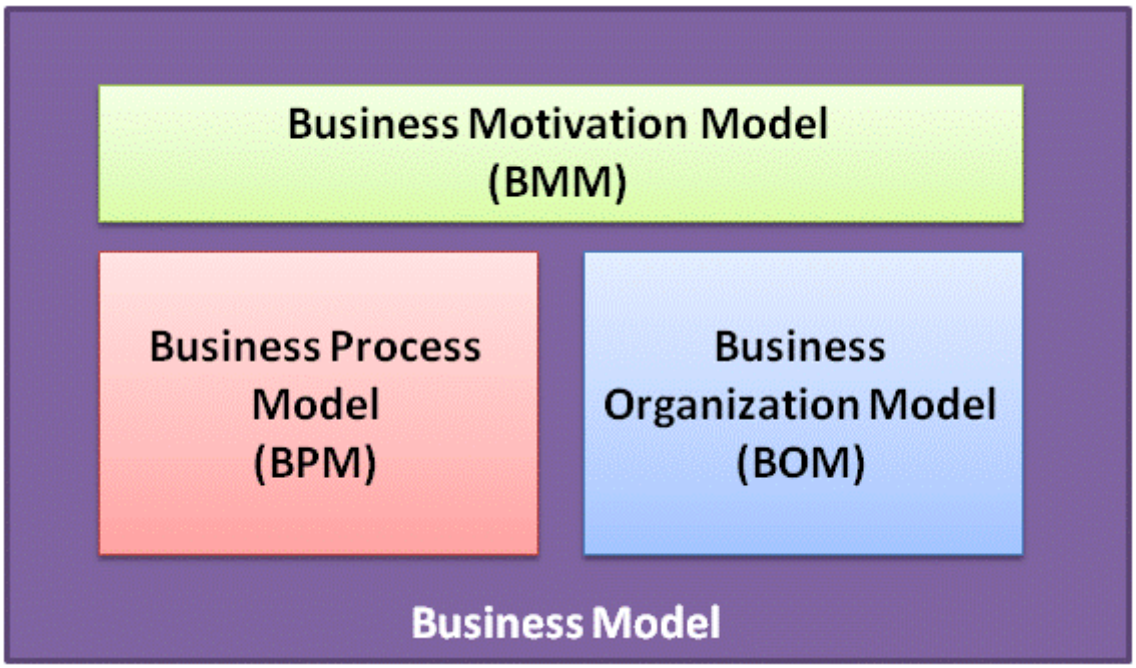
Simply said: our navigators have to keep balance between authoritative and democratic making processes.

Business strategy is based on the “Technique of life” know-how developed at the beginning of the last century and it has been preserved and refined by alumni of the Czech Institute of Technology in Prague for almost four generations.

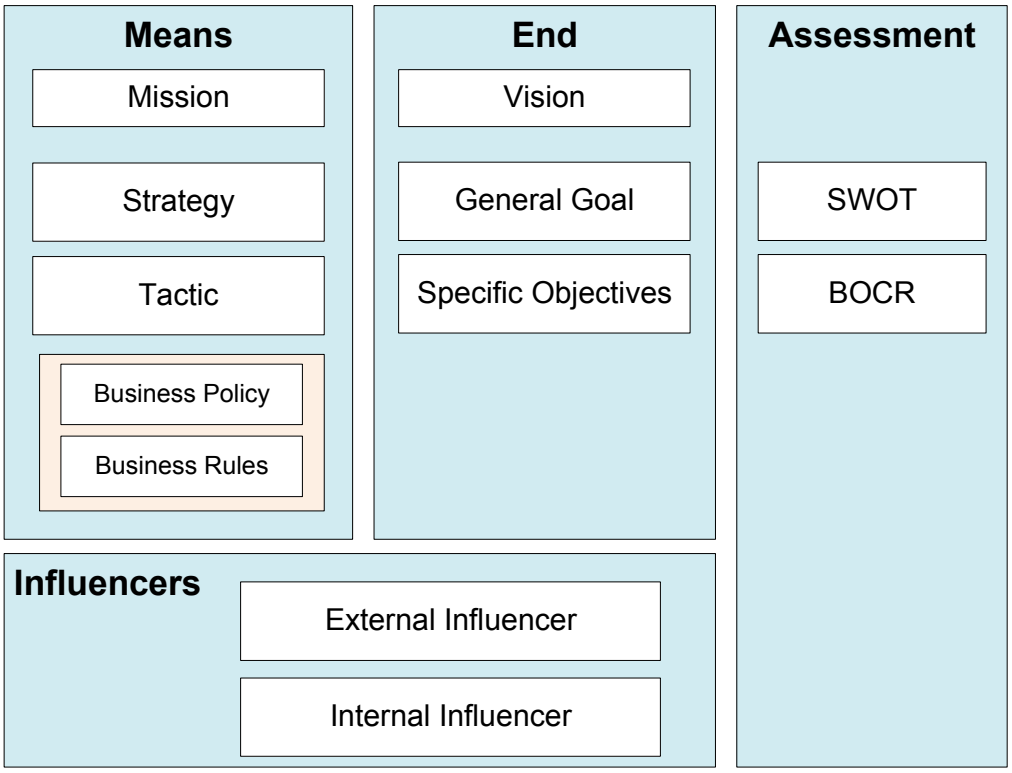
1.3. Business model

Business Model simulates any business activity by splitting it into three separate parts: business motivation, business processes, and organization environment.

Business Motivation model was originally developed by the Business Rules Group (BRG). In order to respond to the objectives of the SPC Program development we adapt this model for some specific issues, and this methodology helped us to describe the multifunctional SPC Program under one layout.



BMM structure schema is presented below:



We used BMM structure to perform any following activities within the SPC program (SPC Factory, Solar Home system, Power Utility system, and Power Plant system) under one layout:

1.3.1 SPC Factory's BMM

SPC Factory				
	Organization:	VISION		MISSION
	Business Processes:	Desired Results		Course of Action
		General Goal	*Specific Objectives*	*Strategy* / *Tactic*
		Business Policy		Business Rules
	Influencers	External		Internal
	Assessment:	SWOT		BOCR

VISION:	Existence of a new domestic industry, which supports the production and delivery of electricity generated from renewable sources and local waste
MISSION:	To build the first SPC Factory, to test its functions, efficiency, and competitiveness, to prepare dissemination of electrification results to other countries and regions
General Goal:	To break through the current practices of electricity production in Africa (i.e. to reduce dependency on imports, strengthen reliability of electricity distributing grid, speed-up process of electrification)
Specific Objectives:	To capture synergy effects of newly created industry (strengthen political stability with sufficient availability of food, jobs, education, and healthcare for the population)
Strategy:	Adoption of SPC program into Africa's development policies by the African Union (AU) and the European Union (EU) and into policies of other transnational interest groups
Tactic:	To use results and experience with pilot applications in Africa
Business Policy:	Analysis and modernization of legislative framework of the newly developed energy sector in specific countries in cooperation of governments and the African Commission
Business Rules:	SPC Factory's responsibility: Generate and publicize guidelines used for its own business activities then develop generally applicable quality standards
Influencers (external):	Changes in political leadership, local war conflicts, loss of credit with financial sector, purchase of second-tier technologies, high cost of its maintenance and disposal
Influencers (internal):	Energy sector in Sub-Saharan Africa is at a very early stage of its development – this is a both a challenge and opportunity

1.3.2 Solar Home System's BMM

SOLAR HOME SYSTEM (SHS)				
	Organization:	VISION		MISSION
	Business Processes:	Desired Results		Course of Action
		General Goal	*Specific Objectives*	*Strategy* / *Tactic*
		Business Policy		Business Rules
	Influencers	External		Internal
	Assessment:	SWOT		BOCR

VISION:	Electricity is permanent part of life of African households
MISSION:	Direct the SPC Factory wholesale and retail networks to benefit sustainable sales and operation of SHS for African households
General Goal:	Improve quality of housing of African family (reduce the use of kerosene lamps, use of charcoal), create new jobs and open access to education
Specific Objectives:	Motivate families to build and sustain SHS and in that context support creativity of people in rural and peri-urban areas

Strategy:	At the AU open international competition for SHS in rural and peri-urban areas (quality of the competition will be ensured by the outcomes of the pilot application of the SPC Factory)
Tactic:	To test business potential of wholesale and retail networks based on the local population which should provide services to this new industry
Business Policy:	To test business potential of wholesale and retail networks based on the local population which should provide services to this new industry
Business Rules:	Set forth technical requirements and administrative procedures for building SHS (e.g. guidelines for development of countrywide statistics and zoning in the countryside)
Influencers (external):	Deterioration of family links and introduction of a lifestyle "everyone for himself"(they appear in urban and sub-urban slums families with many children)
Influencers (internal):	Transfer of best practices among families and entrepreneurs from various cultures and ethnic groups; electrification supports speeding of use of mobile phones, radio, TV, and internet

1.3.3 Power Utility System's BMM

POWER UTILITY SYSTEM (PUS)					
	Organization:	VISION		MISSION	
	Business Processes:	Desired Results		Course of Action	
		General Goal	*Specific Objectives*	*Strategy*	*Tactic*
		Business Policy		Business Rules	
	Influencers	External		Internal	
	Assessment:	SWOT		BOCR	

VISION:	Communities acquire skills and the state provides conditions for the production of electricity from renewable sources and wastes especially for its own needs
MISSION:	With a help from SPC Factory Engineering select communities, build and operate pilot utility project matching the conditions in rural areas
General Goal:	Implement the policy of utilizing renewable sources of energy and use of waste from agriculture in rural areas
Specific Objectives:	Motivate communities to build and sustain PUS and in that context support creativity of people in rural areas
Strategy:	The AU to support building pilot power utilities in selected countries; outcomes of the pilot applications will determine the strategy for building utilities in Africa
Tactic:	Involve local intellectual resources (universities and research institutions) in research of readiness of communities to use local sources for generating electricity
Business Policy:	Involvement of community leaders in decision making processes concerning construction of electric utilities and assessment of impacts of PUS on communal life
Business Rules:	Generating guidelines for implementation of energy policies in a community and creation of environment for micro-entrepreneurs in electric power` generation, distribution, and utilization
Influencers (external):	Lack of interest of community leaders in new technologies, adversarial relationships among families in a community, lack of interest in micro-entrepreneurships using electric power
Influencers (internal):	Jobs, food, education of children and health of families can be achieved by the communities when they will embrace the purpose of PUS and learn to generate electricity from sources they already have

1.3.4 Power Plant System's BMM

POWER PLANT SYSTEM (PPS)	**Organization:**	VISION		MISSION	
	Business Processes:	Desired Results		Course of Action	
		General Goal	*Specific Objectives*	*Strategy*	*Tactic*
		Business Policy		Business Rules	
	Influencers	External		Internal	
	Assessment:	SWOT		BOCR	

VISION:	Existence of small and medium-sized power plants that sell electricity produced from domestic waste and renewable
MISSION:	Motivate African power energy sector to generate electricity from local waste and renewable sources of energy
General Goal:	Support power energy sector in Africa on the route of using local waste and use of renewable sources for electric power generation
Specific Objectives:	Motivate cities to cooperate with power-generating utilities in building and sustaining PPS (e.g. use of waste to generate electricity)
Strategy:	AU cooperation with power energy sector; the AU to put into the economic and national energy policies regulation of new technologies for renewable sources
Tactic:	Open room for international business competition with assistance of international financial institutions and certification laboratories (monitor quality of inputs)
Business Policy:	Involvement of local governments in decision making processes concerning construction of power energy sector units and assessment of impacts of PUS on sustainability of social peace and living environment
Business Rules:	Adopt legislation concerning quickly growing energy sector and in coordinated manner set forth pricing schedule of electricity in island systems and in the central system
Influencers (external):	Lack of interest on a part of power energy sector concerning people in their surrounding and their PPS, power outages, not well managed regulation of central network, high electricity rates, impacts of accumulation of high margins in prices
Influencers (internal):	The energy sector in the world is highly developed; Africa can achieve that level from bottom up, from households to communities and up.

2. Market Feasibility Study

***Benefit** – this part of the strategic Feasibility Study, the „Self-Powered Communities," is concentrating on benefits that adds value to business owner of SPC Factory and to output of any client of the SPC Factory, including Solar Home System (SHS) solution, Power Utility System (PUS) solution, and Power Plant System (PPS) solution.*

The purpose of this market feasibility study is to describe framework for Self-Powered Community Program from market point of view. Its framework will take into account human issue (e.g. acceptance of any Renewable Energy Sources by TGs, and/or sustainability of new products, e.g. decentralized electrification of buildings such as huts, public facilities etc.) and technology issue (e.g. RES business process such as financing, tendering, monitoring, settlement, and/or quality of product delivered to TGs from viewpoint of technical and financial controls, audits) as well as three program options: 1. Thin-film PV panels SPC Factory, 2. Thermal Turbine SPC Factory and 3. Pyrolysis system SPC Factory (for more see chapter 1.2).

In Africa, in general, there are problems with on-grid connections. This problem has two dimensions:

- 1st is the ability of a household to be connected to a grid
  - To have accessibility to a grid - huge distances and waste land
  - To be able to pay for a connection to a grid
- 2nd is the instability of a grid connection which is the result of
  - Not enough power sources
  - High energy demand

With rapidly growing demand for electric power, power supply shortages, blackouts and brownouts, and to the limit-stretched grid, power outages for businesses and homes alike are daily occurrence across much of Africa, and they can last for hours.

Market for this SFS is in Renewable Energy Sources (RES) solutions, especially solar energy, Thermal Turbines, and Pyrolysis.

Trends in RES utilization in Africa. These are mainly projects financed from funds and grants.

Type of RES	Usage	Trends for decentralized energy	Relevance towards SFS
Solar Energy	Electricity	Solar Home Systems, Torches and Solar Lamps	X
Solar Energy	Thermal	Thermal usage for heating, disinfection and solar water heating	X
Wind Energy	Electricity	Utilization of wind natural energy.	
Water	Electricity	Utilization of watercourse natural energy.	
Biomass	wood coal substitution	Manufactured pellets usage for cooking.	
Thermal Turbines	Electricity	Utilization of low-potential heat for electricity generation.	X
Pyrolysis	Electricity	Pyrolysis unit usage for the gas generation and consequently for the electricity generation.	X
Combination of various RES	Electricity	Daylong coverage of the electricity consumption.	
In combination with diesel generator	Electricity	Daylong coverage of the electricity consumption.	

Our area of interest is Africa, where we selected two states as example – Ethiopia and Kenya. We had partners in both states.

This chapter was written on the base of combination between internet research and questionnaire. Questionnaire was prepared by us and sent our partners in Ethiopia and Kenya. Especially our partner in Kenya, company **Adopt a Light** sends us fulfilled questionnaire together with supporting materials (see Annex B.). We used also publicly available materials from Lighting Africa and World Bank.

2.1. External and Internal market analysis and characteristics

External and internal market analyses in this chapter represents a snapshot of data and information that are available from different sources (see Annex B. Bibliography) and this chapter presents a market situation in Sub Sahara Africa on a set of statistical characteristic of Ethiopia and Kenya.

2.1.1 Energy production and use

In Ethiopia and Kenya produced energy is not enough to cover energy consumption (difference is -2,1 million metric tons of oil equivalent for Ethiopia and -2,9 million metric tons of oil equivalent for Kenya). And energy consumption is growing (3,5% for Ethiopia and 2,8% for Kenya). If the current electricity consumption per capita will not grow up (even if it is highly probable it will grow up) in the year 2015, electricity consumption will be 4,04 billion kilowatt hours in Ethiopia and 7,192 billion kilowatt hours in Kenya. That is 0,24 billion kilowatt hours in Ethiopia and 0,092 billion kilowatt hours in Kenya above current electricity production. These capacity should be added during the following 4 years. From this numbers it is evident that there is a need for energy and need for electricity and it's high.

	Ethiopia	**Kenya**
Difference between Energy production and Energy consumption	-2,1 million metric tons of oil equivalent	-2,9 million metric tons of oil equivalent
average annual % growth	3,5%	2,8%
Alternative and nuclear energy production (noncarbohydrate energy, includes hydropower and nuclear, geothermal, and solar power, etc.)	9,0% of total energy use (that is 2,853 million metric tons of oil equivalent)	7,0% of total energy use (that is 1,26 million metric tons of oil equivalent)
Electricity production	3,8 billion kilowatt hours	7,1 billion kilowatt hours
Electricity consumption per capita kWh (2008)	42 kWh	155 kWh
population (2011) in millions	85,9	41,4
population (2015) in millions	96,2	46,4
Expected electricity consumption in 2015	4,04 billion kilowatt hours	7,192 billion kilowatt hours

2.1.2. Renewable Energy Sources in Ethiopia and Kenya

Renewable energy sources by each country.

	Ethiopia	Kenya
Solar Energy	The Ethiopian solar market is still at an early development stage with an estimated installed capacity of 5 MWp. Growth during the 1990s was under 5 % but has reached 15-20 % during the last few years, primarily driven by the telecom market that constitutes 70 % of installed capacity. Five or six companies supply 90 % of the market and some lack a specialist focus on solar PV. The market potential is estimated at 52 MW, the majority within the solar home systems (SHS) market and continued expansion in telecom sector. SHS has the greatest annual growth rate of 20 % with few suppliers and driven by the extension of low-cost housing and real estate developments.	Solar energy is the largest single energy commodity available in Kenya. It has been estimated that on average Kenya receives 4-6 kW/m≤/day.1 This translates to approximately 1.54 billion Tonnes of Oil Equivalent (TOE). Kenya boasts a solar market that is one of the most mature and well-established in Africa. At over 1.2 MW in sales per year, the PV market offers opportunities in solar home systems, institutional systems and government procurement. Growth has been constant at over 10 % per year over the past ten years, and the potential off-grid market is estimated to be over 40 MW.
Other renewable energy sources	Currently electricity from Hydro power is most dominantly in the country even the service is not sufficiently cover the country's requirements. 82-85% of the country population is living in the rural are without electricity. The rural community using wooden trees for the daily cooking consumption. Currently the country is suffering of deforestations. Due to the fast deforestation of the country's forests, one way of the fastest solution to deploy other source energy for the domestic using like solar.	Most of the electricity currently produced is hydro with a significant and growing contribution from geothermal. The other three major sources are biomass (a number of sugar firms are installing cogeneration plants using cane wastes), wind (already 2 wind firms developed) and sea wave energy. Kenya's potential for hydro is quite limited and with the spiraling petroleum prices, interest in renewable energy is increasing. There has been reports of coal discoveries in Kenya which if successfully exploited might create a potential for establishment of coal power plants. There has been talk of setting up a nuclear power plant but this option would appear to be dream given Kenya's limitations.

2.1.3. Support for RES

There are many initiatives public as well as private to support growing RES market. We selected a few well known.

Supported sector	Supporting program/institution/grant	
Solar lights	Lighting Africa	Lighting Africa, a joint IFC and World Bank program, is helping develop commercial off-grid lighting markets in Sub-Saharan Africa as part of the World Bank Group's wider efforts to improve access to energy. Lighting Africa is mobilizing the private sector to build sustainable markets to provide safe, affordable, and modern off-grid lighting to 2.5 million people in Africa by 2012 and to 250 million people by 2030.
Biomass Energy Initiative, Electrification Initiative, Solar PV Toolkit, Gender & Energy, Energy & Climate Change SWAP-Investment & Policy prospectus	Africa Renewable Energy Access (AFREA) Program	The Africa Renewable Energy Access Program (AFREA) is supported by the Netherlands' $28.75 million contribution to the ESMAP Clean Energy Investment Framework Multi-Donor Trust Fund. AFREA objective: Meet energy needs and widen access to energy services in an environmentally responsible way (Pillar 1 of CEIF). AFREA provides essential support to AFTEG strategic agenda to promote increased access to modern energy in Sub Saharan Africa and is fully aligned with the overall strategic agenda.
Access to sustainable and modern energy services by poor people living in the African, Caribbean and Pacific countries (ACP) rural and peri-urban areas	ACP-EU Energy Facility	The Energy Facility is a co-financing instrument established in 2005 in order to support projects on increasing access to sustainable and affordable energy services for the poor living in rural and peri-urban areas in African, Caribbean and Pacific (ACP) countries.
To develop new sustainable energy enterprises that use clean, efficient, and renewable energy technologies	African Rural Energy Enterprise Development (AREED)	AREED provides early-stage funding and enterprise development services to entrepreneurs, helping build successful businesses that supply clean energy technologies and services to rural and peri-urban African customers. AREED services include training and hands-on business development assistance. For the enterprises that show the best commercial potential, AREED also provides early-stage investment and assistance to secure additional finance.
Energy access, Energy security, Renewable energy and energy efficiency	Africa-EU Energy Partnership (AEEP)	Within the framework of the AEEP, an "Africa-EU Renewable Energy Cooperation Programme" will be launched. Based on Africa's and Europe's shared interest in accelerated use of renewable energy resources and in reducing dependency on fossil fuels, the program will mobilize human, technology and financial resources to spur innovation in Africa. The program will help build a signify cant new area for industrial trade and business cooperation between Africa and Europe.

2.1.4. Population in Ethiopia and Kenya

Population in Rural and Urban households bellow national poverty line is estimated to grow in the following years. In the year 2015 it is expected to be 96,2 millions people in Ethiopia and 46,4 millions people in Kenya.

		Ethiopia	Kenya	Sub-Saharan Africa	World
Year 2011	**population (2011) in millions**	**85,9**	**41,4**	868,1	6870,0
	population bellow national powerty line	38,9%	45,9%		
	in rural areas	39,3%	49,1%		
	in urban areas	35,1%	33,7%		
	Number of approximately persons per HH	4,17	4,42		
	Number of poor Rural households (2011)	**8 095 612**	**4 598 959**		
	Number of poor Urban households (2011)	**7 230 432**	**3 156 516**		
Year 2015	**population (2015) in millions**	**96,2**	**46,4**	969,5	7241,9
	population bellow national powerty line	38,9%	45,9%		
	in rural areas	39,3%	49,1%		
	in urban areas	35,1%	33,7%		
	Number of approximately persons per HH	4,17	4,42		
	Number of poor Rural households (2015)	**9 066 331**	**5 154 389**		
	Number of poor Urban households (2015)	**8 097 410**	**3 537 738**		

2.2 RES Manufacturers and distributors

There are many manufacturers and distributors in the RES market. The source for this chapter was http://energy.sourceguides.com and our partner's information. On this sample we would like to demonstrate readiness of Ethiopia and Kenya to start SPC Program.

2.2.1 Estimation of RES Manufacturers and distributors

We identified only 14 RES businesses in Kenya and only 5 RES businesses in Ethiopia that seems to us that is not adequate to the aim of the SPC Program. This is the reason why we recommend motivation campaign and education system (see chapter 5.3. Education).

	Number of RES businesses
World	8941
Sub-Saharan Africa	274
Ethiopia	5
Kenya	14

2.2.2 List of RES Manufacturers and distributors in Ethiopia and Kenya

List of RES manufactures and distributors in Ethiopia and Kenya is demonstration of growing capacity of both countries to be ready reacts on need of SPC Program especially from its sustainability.

Company	***Country***
Shanghai Roy Solar Co., Ltd. ***Business type:*** manufacturer, exporter, system design, system installation ***Product types:*** solar street lights, solar electric power systems, DC To AC Power Inverters, solar electric charge controllers (PV charge controllers), battery, photovoltaic modules (solar PV panels, PV modules), solar pumping system, wind turbine. Web Site: http://www.roysolar.com International Company	Ethiopia Kenya
Yandalux ***Business type:*** retail sales, wholesale supplier, distributor, electric utility ***Product types:*** photovoltaic systems residential, solar traffic lighting systems, water pumps, solar water pumping system components, batteries deep cycle, photovoltaic modules. ***Service types:*** consulting, installation, engineering, project development services Web Site: http://www.yandalux.com International Company	Ethiopia Kenya
ToughStuff *ToughStuff makes very affordable solar powered products for lighting, charging phones and playing radios.* ***Business type:*** manufacturer, retail sales ***Product types:*** photovoltaic modules thin film. ***Service types:*** engineering Web Site: http://www.toughstuffonline.com Local company	Kenya
Botto Solar Ltd ***Business type:*** manufacturer, retail sales, wholesale supplier, importer ***Product types:*** biomass energy boilers, biomass energy furnaces, biomass energy systems. ***Service types:*** consulting, design, installation, engineering, project development services, research services, contractor services, maintenance and repair services Local company	Kenya
Craftskills East Africa Limited ***Business type:*** manufacturer, retail sales ***Product types:*** Wind Power Turbines. Wind Power water pumps. Batteries. DC and AC LED Lights. Solar Panels Inverters. . ***Service types:*** Energy Local company	Kenya
Dreampower Ricciardi SRL Ltd ***Business type:*** manufacturer, distributor ***Product types:*** solar lighting systems, solar traffic lighting systems, solar water pumping systems, solar street lighting, LED light bulbs, LED lighting, Rular Electrification. ***Service types:*** consulting, design, installation, engineering Local company	Kenya
Kevin Power Solutions Ltd. ***Business type:*** manufacturer, exporter ***Product types:*** backup power systems, DC to AC power Inverters sine wave, Batteries Deep Cycle, SMF Batteries, Solar Water Heating Systems, Solar Lighting Systems, Online UPS, Automatic Lift Backup System, IGBT Based Home UPS, CFL Lights, Cyber H-UPS, Sine Wave Inverter, Sine Wave UPS, DSP Sine Wave H-UPS, DSP Sine Wave Inverter, DSP Sine Wave Online UPS, DSP Sine Wave Static UPS. International company	Kenya

Company	***Country***
KIJITO WINDPOWER LTD ***Business type:*** manufacturer ***Product types:*** wood burning stoves and furnaces, biomass energy systems, composting systems, energy efficient homes and buildings, hydro energy system components (small), solar cooking systems, Biogas plant, waste water, incineration, energy efficiency. ***Service types:*** Renewable Energy Engineering Local company	Kenya
Water Africa Services Limited ***Business type:*** whole sale supplier, exporter, importer and services ***Product types:*** Water hand pumps, submersible pumps, Water drilling rigs Rotary/DTH, Water testing kits for field and laboratories, water treatment chemicals, R. O Systems, Irrigation pumps, Geo- Membrane products, GRP Panel tanks and Pipes, Deisel Engines and pumps, Generator sets, Solar and Wind power Generators etc. ***Service types:*** Bore hole drilling servies, supply of complete equipments and spares serviesInstallation and services, Training of our products Local company	Kenya
GEM Engineering ***Business type:*** manufacturer, exporter, importer ***Product types:*** water pumping windmills, Dry & wet coffee pulping & washing machines, concrete mixer manufacturing. ***Service types:*** design, installation, engineering, maintenance and repair services Local company	Ethiopia
Kevin Power Solutions Ltd. ***Business type:*** manufacturer, exporter ***Product types:*** backup power systems, DC to AC power Inverters sine wave, Batteries Deep Cycle, SMF Batteries, Solar Water Heating Systems, Solar Lighting Systems, Online UPS, Automatic Lift Backup System, IGBT Based Home UPS, CFL Lights, Cyber H-UPS, Sine Wave Inverter, Sine Wave UPS, DSP Sine Wave H-UPS, DSP Sine Wave Inverter, DSP Sine Wave Online UPS, DSP Sine Wave Static UPS. International company	Ethiopia
Tehadiso Ethiopia ***Business type:*** manufacturer, retail sales ***Product types:*** solar water heating systems, solar cooking systems, photovoltaic systems. Local company	Ethiopia
Chloride Exide Ltd ***Business type:*** distributor ***Product types:*** Chloride Exide is the sole distributor of Chloride Exide brand batteries which are manufactured locally by Associated Battery Manufacturers EA ltd. Established in Kenya. Sister companies in Tanzania and Uganda. Chloride Exide is one of the most reliable solar solutions-provider in the region, with the commitment to bring cost effective, solar power solutions for residential, commercial and industrial applications in Kenya and in East Africa as a whole. Our well-known brands of solar modules can be categorized into amorphous panels from Free Energy Europe and crystalline panels which would include Suntech, BP Solar France and Photon. The panels range in wattage from 14 watts to 170 Watts, 12 Volt based. The 135 Watts to the 170 Watts are also available as 24 Volt based.	Kenya

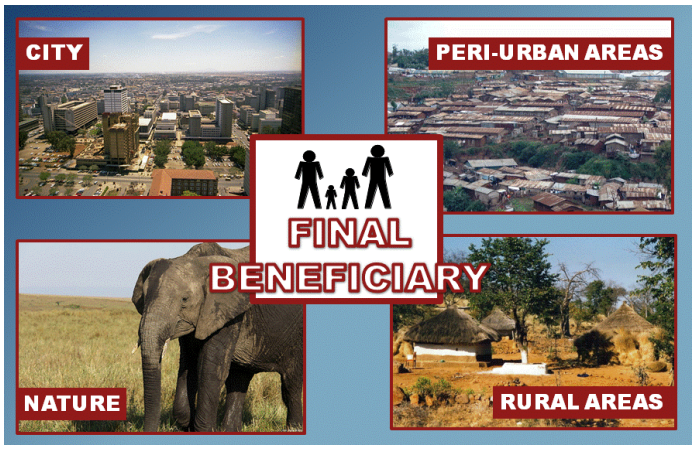
Company	***Country***
Go Solar Systems Ltd ***Product types:*** Solar Modules Solar modules provide some of the highest power density available in the market. They range from 12 Watts to 160 Watts and yield higher current output by 10-17% at operating battery voltage. Ideal for battery charging applications and in stand-alone systems such as rural electrification, lighting, telecommunications, water pumping etc. Supplied and installed in Africa for over 20 years our solar modules have withstood the test of time in some of the toughest working conditions providing much needed free electricity to schools, hospitals, aid project, settlements and missions. Technical Specifications - Solar Panels: 15/20 Watts , 50/60 Watts , 75/80 Watts, 120/125 Watts, 130 Watts, 150 Watts, 160 Watts	Kenya
SOLLATEK ***Business type:*** Manufacturer and distributor ***Product types:*** power management and solar products company, Solar Home Systems, Solar Panels, Solar Lights, Charge Controllers, D-light Solar Lanterns and Phone Chargers International Company	Kenya
Kenya Solar Kenya Solar is one of Kenya's premier solutions provider of solar and Renewable Energy products. Kenya Solar have the backing of strong international Renewable Energy companies.	Kenya

2.3. Market presumptions

The SFS is addressing the most of 85% of Africans which are no connection to power grid with almost no experiences with electric power. This SFS is addressing final beneficiaries group from two viewpoints:

1. Priorities based on final beneficiaries needs

2. Priorities based on final beneficiary's social environment



Target groups (TGs) are local, national and international public and private organizations with motivation to participate on Self Powered Community Program. Participation should be based on partnership principles and business rules and it can be in the form of direct involvement, financial contribution etc.

The target group concerns those who will be directly, positively affected by the project by its activities and its results."
(as defined in http://ec.europa.eu/dgs/education_culture/valorisation/glossary_en.htm)

Final beneficiaries (FBs) are communities in rural and peri-urban areas, households (serving their needs in meal preparation, education, health care, job opportunities), micro-entrepreneurs (interested in business success and sustainable and growing income for themselves and their communities), local and international public and private organizations interested in electricity power production (for own consumption and/or for selling).
(as defined in http://ec.europa.eu/dgs/education_culture/valorisation/glossary_en.htm)

Participatory process ensuring involvement of TGs and FBs in the SPC Program will be initiated by their involvement in development of the Business Motivation Model (BMM) and by their participation in maintaining the BMM in actual stages for duration of the SPC Program.

2.3.1 National Energy Policies

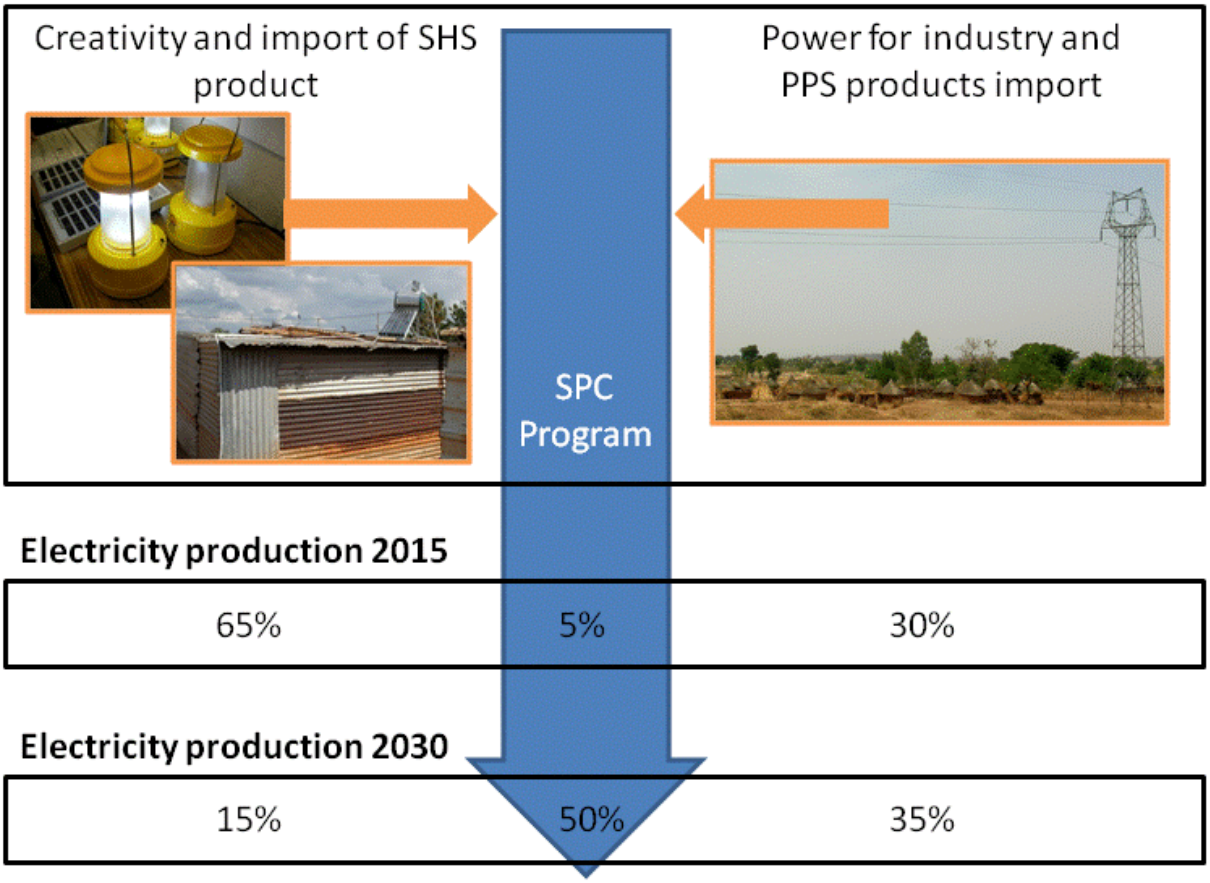
National energy policies are aimed to target group and to final beneficiaries. We were interested in energy polices of Ethiopia and Kenya:

- Energy Policy of Ethiopia, Addis Ababa, November 2006
- Integrated assessment of the Energy Policy of Kenya, August 2006

We are ready to add value to this policy papers on a lower level:

- **National Energy Strategy - Energy Master Plan for coming years to 2015 and to 2030**

Despite of the fact that we have not documents like this we would like to put under discussion a weight of the SPC Program in a common national energy policy.



2.4. Absorption capacity and SWOT assessment

Absorption capacity means the ability of the public sector (at local, regional, national governmental levels) or the private sector (local, regional, national or international firms) to receive aid (from national and/or multinational financial institutions) and use it effectively for building Self-Powered Communities (SPC) in Africa.

For example, any African country may receive enough money to enable all its households to have their own in-house electrification but due to a lack of dealers, technicians, and services or a poor administrative system, it is impossible to spend this money in given time period. Work must first be done to have pilot application, get proper access to electrification know-how, train and motivate dealers and technicians, build network of services based on local production, and so improve efficiency of the SPC system.

SWOT analyses is developed for a case of the SPC Factory readiness to produce thin-film PV panels (compare with other options described in chapter 1.2.2)

2.4.1 SPC Factory's SWOT

<table>
<tr><td rowspan="3">SPC Factory</td><td colspan="2">ASSESSMENT – SWOT</td></tr>
<tr><td>Strengths (S)</td><td>Weakness (W)</td></tr>
<tr><td>Opportunities (O)</td><td>Threats (T)</td></tr>
<tr><td>Strengths:</td><td colspan="2">• The proposed SPC program opens new opportunities for transfer of know-how and technology for electrification of African cities and rural and peri-urban areas</td></tr>
</table>

	• Everywhere around the world, electrification supported economic growth of a country or a region which adopted generation and use of electricity. A substantial but so far unmet demand for renewable sources exist and so does an extreme demand for starting to address issue of waste (especially communal waste, plastic waste, used tires) • SPC Factory represents an opportunity to manufacture RES Products, do virtual engineering for turnkey projects, have facilities for assembly, distribution and shipments to SHS, PUS and for PPS segments in Africa • The SPC Factory proposal has the following strengths: o Manufacturing of thin-film panel PV technologies (competitive prices, diffused light, job creation) o Engineering services build on expert cooperation of engineering organizations in Africa and Europe o Marketing services and turnkey deliveries for SHS, PUS, and PPS
Weakness:	• SPC program generates doubts about its implementation as it is disproportionally complex and thus can become hard to understand by the end beneficiaries (people in rural and peri-urban areas) • Electrification is divided among three main players: households investing into building their own SHS; communities investing into shared ownership of facilities; electric power utilities (in public or private hands) investing in growing electric power generating capacities. Linking the objectives of the above-mentioned three players can in the end sound counter-productive (their antagonistic interests can come up to the surface) • SPC Factory as an introduction of advanced technology and demanding organizational processes into environment which doesn't have the required experience with similar operations • SPC Factory proposal has the following weaknesses: o Still very low numbers of RES power plants in Africa opens a room for products which are in competition with SPC Factory (i.e. its PV panels, engineering and marketing services) o Shortage of qualified personnel to work at SPC Factory and having no experience with virtual teams created to work on specific projects o Undercapitalization of households and communities
Opportunities:	• Africa is a continent with a great capacity of solar radiation and great potential for using renewable sources of energy. Electrification of households, introduction of electricity into educational system, healthcare, transportation, and other services is also an essential precondition for fundamental changes in economic sector of every country. Building of the first SPC Factory in Africa is an opportunity for implementation of SPC program for 80 to 95% of the population. • SPC program is an opportunity for families to appreciate importance of electricity in a range of applications and an impulse to productive entrepreneurship especially in increased production of foodstuff including a potential for growth of already established exports • SPC Factory is also an opportunity to get away with some myths about insufficient readiness of Africa as far as the ability to absorb new technologies to meet demand for electricity including rural and per-urban areas is concerned. • The SPC Factory proposal brings the following opportunities: o Strengthening of electricity generation from solar energy and implementation of new technologies based on renewable resources - Thermal Turbines (TT) and Pyrolysis Systems (PYS) o Development of international cooperation in building renewable sources of

	energy for island systems as well as for the central electricity distribution grid under the jurisdiction if individual countries and utility companies ○ Improved professionalism in wholesale and retail services in electric power distribution to small users (families and communities) in rural and peri-urban areas and development of these services to support growth in numbers of micro-entrepreneurs which represent the foundation of future industries to be developed in members states of the AU
Threats:	• Africa is extremely dependent on imports and it is characterized by very weak domestic industrial base. Related to it is a treat of failure of even well-prepared programs namely due to delays (due to, for example, a significant underestimation of cultural diversity or the need for longer time required for implementation of such fundamental entry into political and economic spheres of the current generation) • Africa suffers from growth of imports of goods of lower quality and large volume of waste is piling up on its territory. Few statistics of this problem are being kept. • SPC program will not get a uniform framework and effective coordination might not be created on the way to common goals of individual households or communities (duplicate or counterproductive activities might appear) • SPC Factory as a brand without tradition might have problems with offers from similar (competing) energy programs (use of renewable sources of energy) • Concerning the SPC Factory proposal the following potential risks exist: ○ Production in decentralized generation capacities will be chaotic and problem with waste get deeper, expected positive synergy doesn't arrive (cash flows within the population will only reflect its energy use). ○ Development of international cooperation will be limited only to imports of products of lower quality, namely for rural and peri-urban areas. ○ Development of enterprising and urbanization of housing might untouched by current state of knowledge and procedures concerning creation of a company, its management, control, auditing, and financial engineering.

2.4.2 Solar Home System's SWOT

SOLAR HOME SYSTEM (SHS)	ASSESSMENT – SWOT	
	Strengths (S)	Weakness (W)
	Opportunities (O)	Threats (T)

Strengths:	• In-house electrification will bring households higher quality of life • Portable units for lighting, mobile phone charging, and other uses will become strong aspect of development of micro-entrepreneurship and will allow creation of new small enterprises with local reach
Weakness:	• Existence of SHS will be jeopardized when at the time of their construction effective technical mini-infrastructure is not built (see SPC Factory) • Newly created mini-enterprises and above all small enterprises can have too high expectations related to electrification and such expectations might not be timely addressed thus they might become weak link in further development
Opportunities:	• In-house electrification will bring new opportunities: to women in caring for their families, to men in gaining jobs and to children in studying for school. Acquisition of a radio, TV and getting use of mobile telephones (and internet) will shift family's activities to a new level of quality necessary for economic

	growth and stability • Portable units for lighting, mobile phone charging, and other uses are opportunity for entrepreneurship and thus creation of the necessary cash flow to families and communities to be used not only for paying for electricity but also for the cost related to improvement in lives of families and their communities
Threats:	• SHS costs might grow disproportionally and might get out of control if any regulatory and financial obligations might not be covered from revenues generated by business activities. This might lead to loss of motivation among households and communities to join in other SPC programs • An excessive share of speculation or swindles on the side of micro-entrepreneurs and small businessmen who might have unrealistically high expectations of profits might undermine expansion of electrification

2.4.3 Power Utility System's SWOT

POWER UTILITY SYSTEM (PUS)	ASSESSMENT – SWOT	
	Strengths (S)	Weakness (W)
	Opportunities (O)	Threats (T)
Strengths:	• Electrification of schools, clinics, medical centers and hospitals, public administration buildings, police and/or fire stations, churches, street lights and other communal structures will increase quality of life in rural and peri-urban areas • Power utilities serving the needs of rural and per-urban areas are the next step in a growth of entrepreneurship in African communities. Creation of utility companies will need to be a result of a consensus of people in a community. Power utility companies are opportunity for a full-scale development of local energy sector based on use of renewable sources of energy (sun, wind, hydropower, thermal energy) and new technologies for SPC such as thermal turbines (TT) and Pyrolysis System (PYS).	
Weakness:	• Communities in rural and peri-urban areas will have problem to establish, operate, and expand (or maintain) their electric power utilities when at the same time the necessary knowledge and technical mini-infrastructure is not built (see SPC Factory). • Building of power utilities for rural and peri-urban areas will call for in advance prepared detailed research of specific conditions for their construction and sustainability. • A weak point might be underestimation or inconsistent application of marketing on behalf of power utilities and not a sufficient weight being given to have a consensus in a community in negotiating with influential groups which are ruling over such community. The weakest link in implementation of power utilities might be a wrong approach by the founders in gaining community's motivation to cooperate of SPC program.	
Opportunities:	• Electrification of various communal facilities is built on energy obtained from renewable resources. The priority among them is solar energy and PV power plants (e.g. water pumping). At the same time it's necessary to help people in countryside so that they are able to utilize the potential of water streams, wind, geothermal energy, and biomass.	

	• Power Utilities: Power utilities in rural and peri-urban areas will take on various forms – from the most simple ones (e.g. a small center for charging mobile phones to a small hydro electric power plant for a local enterprise) to complex ones (e.g. electric power supply for local schools, hospitals, administrative building of a local government, a church, etc. using PV power plant in combination with Thermal Turbine and a potential to sell excess electricity into the grid). • Power utilities having a co-operative form of ownership are part of options of possible building up of energy sector in Africa as it will help involvement of majority of population into SPC Program as well as to support initiation and expansion of motivation to appreciate electrification and assist its development.
Threats:	• Electrification of facilities (schools, hospitals, office buildings, etc.) in Africa is underway and with a wide range of structural solutions of buildings (in countryside clay structures tend to dominate) and a colorful variety of architectural forms (from typical, circular huts to ad hoc forms of buildings where no particular architectural style is apparent). Cities are very quickly marked with construction of modern high-rises. • High cost of establishing and operating power utilities in poor areas with very low potential of securing the required human resources to operate them or with significant undercapitalization of communities, frequently with insignificant cash flows might be serious obstacle to successful power utility operation. Therefore, any such threats must be analyzed and proposed power utility should reflect them. • In this stage of SPC program preparations we recognize a clear cut in assessment of threats concerning power utility success in Africa: It will either succeed or not succeed in setting them up and sustain them.

2.4.4 Power Plant System's SWOT

POWER PLANT SYSTEM (PPS)	ASSESSMENT – SWOT	
	Strenght (S)	Weakness (W)
	Opportunities (O)	Threats (T)

Strengths:	• All countries in Africa are located in a region with optimal use of solar energy. This is undoubtedly a strong advantage of the continent which represents a challenge to every country to devote their attention to using solar energy. This study suggests that countries approach the issue in coordinated, goal-oriented manner and that they introduce electrification to their population in everyday life setting. • Solar power plants are already proven asset and their supplementation with systems of storing of solar energy and electric power generation in time when there is no sunshine is of interest to countries in Africa. • A strong aspect of the proposed solutions is integration of multiple functions into one relatively simple system which itself operates in environment with inputs which are not overly demanding on workforce qualification. The fuel are sorted out waste (e.g. used tires or rice husks from after harvest) which don't need to be produced (when compared to fuel rods for nuclear power plants) nor imported from afar (see import of oil or coal for power plant). Implementation of Thermo Turbine and Pyrolysis System technologies in Africa represents a great challenge and opportunity.

	• Fossil and nuclear power plants will find their role in a context of their current potential mainly close to large cities especially where growing influx of population represents serious problems which wouldn't be possible to address without sufficient capacities in electric power generation (e.g. public transportation, water treatment plants, security, etc.)
Weakness:	• A weak aspect might be political diversity and it might be difficult to find common denominator for various religions. SPC program offers electrification to everyone to benefit everyone. It is possible that phenomena of electrification and quick changes in lifestyle (light, mobile phones, internet) in the end will have positive impact. • Building solar power plants is a systemic task and great opportunity for building central distribution grid step-by-step and on basis of renewable sources of energy. A weak point of such approach might be – paradoxically – an apparent simplicity of technology applications. On other hand, problems with organization of labor and with quickly changing laws (impact of political changes) might appear. • The same might also apply to building other RES technologies (e.g. TT, PYS). But the construction will not take place in rural or peri-urban areas but in cities where it is possible to find the necessary expert capabilities and government-run utility companies will certainly find the way how to influence the legislative body. Nonetheless, the problem of "after the builders leave, the building collapses" might appear. It is problem of sustainability of values. • Fossil and nuclear power plants in Africa have the same and persisting problems. In Sahara Desert it is possible to generate so much electricity from solar energy that it would suffice to meet demand of the entire world. But it is unrealistic fiction as it is not possible to deliver such generated electricity to end users.
Opportunities:	• PPS are sources of "big energy" implemented in decentralized manner (with units having the capacity between 20 to 250kW) in a purposeful, effective, and economical location throughout an entire country and complementing the function of the central power grid. • Building solar power plants is a way of application of direct support of the central power grid with photovoltaic systems (in combination of heat accumulation and electric power generation by thermal turbines with the basic output of a unit at about 20KW). • In a context of this study, RES power plants represent application of direct support of central power grid with solar photovoltaic and thermal systems, TT and Pyrolysis systems (with the basic output of a unit at about 250kW) • Pyrolysis system is turning waste (municipal or agricultural) into gas which is either burned directly in a co-generation unit or the gas is sold in small containers to families and used for meal preparation (cooking). • Building of power plants based on fossil fuels is not in any way restricted by this study as it is and will be up to electric power utility bin each country how it will deal with limits and sanctions which are forcing utilities to reduce production of CO_2.
Threats:	• Room for small and decentralized electric power plants (without significant restriction as far as selection of a location is concerned) exist in countries where development of central power distribution grid is at the early stage and they are not exposed to threats as far as feasibility and sustainability in that context. • Certain threats might exist to power plants with capacity in multiples of 20 KW (in pilot stage of electrification) as this way might not be the main or a stable solution in a long-term view due to the fact that a research of other technologies

is underway

- Pilot applications and their evaluation are very important for any RES power plants. Potential threat for the proposed types of electric power generation (or gas production) might be a constant and timely supply of material to keep PYS units running.
- An issue of PPS implementation might be performance of contracts with end users as they might affect cash flow of a given power plant.
- Dramatic building of fossil or nuclear power plants will not represent a competitive threat to the proposed power plants at the time when CO_2 limits are being applied.

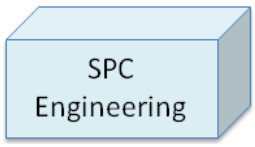
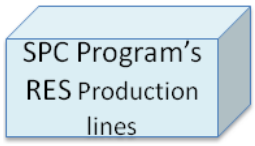
3. Technical Feasibility Study

Opportunity *– this part of the strategic FS „Self-Powered Communities" is concentrating on opportunities of knowhow and technology knowledge transfer in favor of SPC Factory and to any clients of the SPC Factory acting in solutions: Solar Home System (SHS), Power Utility System (PUS) and Power Plant System (PPS).*

3.1. SPC Factory product and services

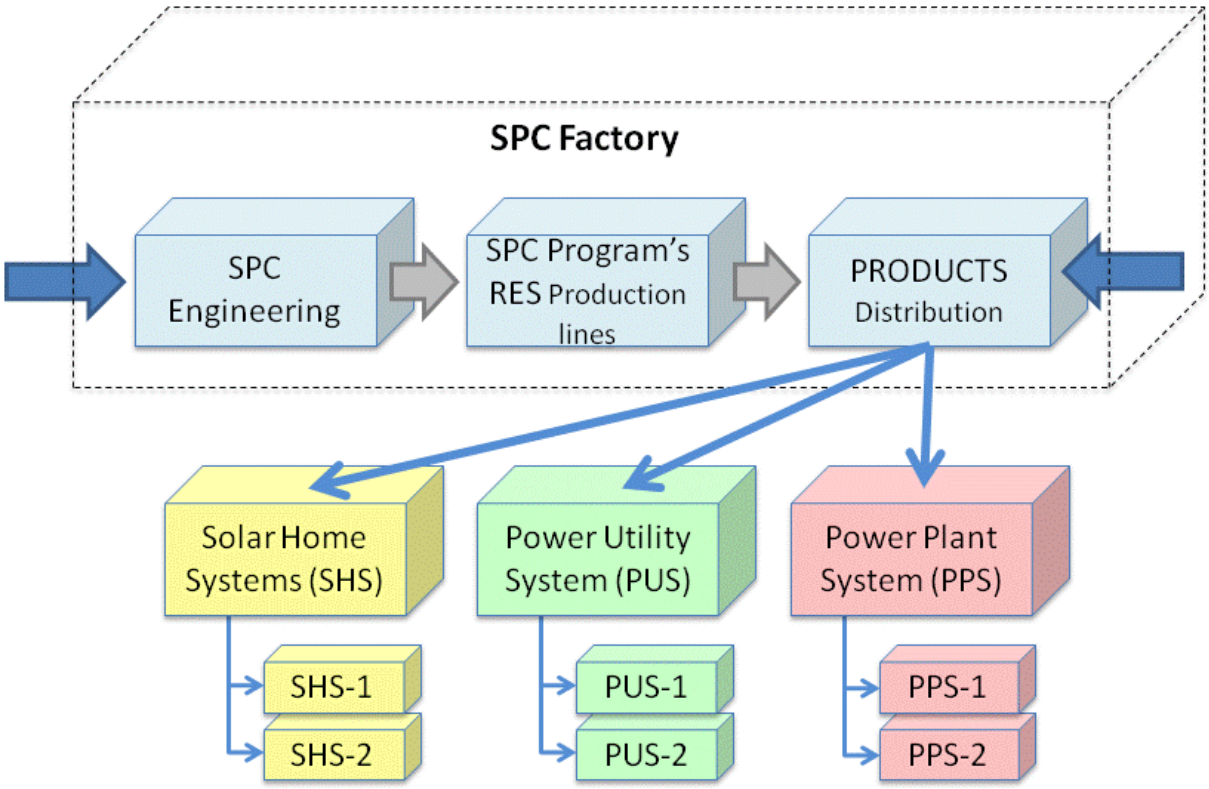
SPC Factory is a solution of a strong assistance to African countries based on virtual engineering, production facility, and distribution (selling) performance.
What does the virtual engineering means? It is performance of a interdisciplinary and international team working out of „stone building" on ad hoc long lasting and complex programs and projects.

3.1.1 SPC Factory production and services

	SPC Engineering is a discipline, art, skill and profession of acquiring and applying scientific, mathematical, economic, social, and practical knowledge, in order to design and build structures, machines, devices, systems, materials and processes for SPC Program.
	SPC Program's Production – is the use of machines, tools and labor to produce goods for use or sale. The term may refer to a range of human activity, from handicraft to high tech, but is most commonly applied to industrial production – For SPC Program (SHS, PUS, PPS) products.
	Products Distribution, whole sales and retails systems and maintenance services - distribution (selling) performance is an organization technology disseminated in Africa to local companies to perform selling and maintenance of local products.

SPC Program´s RES production line in this study means three options:
1. Acquisition and production of Thin-film PV panels in Africa
2. Acquisition and production of Thermal Turbines in Africa after pilot application is finished and test program for Africa is evaluated
3. Acquisition and production of certain components of the Pyrolysis system after pilot application is finished and test program for Africa is evaluated

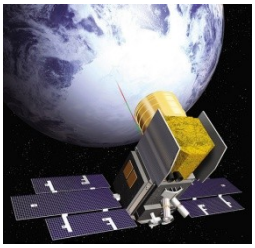
The option one is recommended for the first SPC Factory construction in Africa. Thermal Turbines and Pyrolysis systems should be tested in pilot applications before options two and three are taken into account. (more see chapter 5.3).



3.1.2 SPC Factory maintenance and services

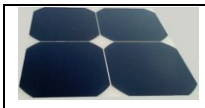
Monitoring, control in site and other revision should be performed on three levels:

Self Powered Community SPC Program Electrification	Stationary and mobile centers (proposed to the AU RG) are being supposed to be later on used as stationary centers (monitoring network). SPC Community program proposed in AU RG 1st call involves partners from two west-Africa countries (Guinea, Nigeria) and two east-Africa countries (Ethiopia, Kenya) and Czech Republic. Project proposed outputs are stationary and mobile SPC Centers.
	Decentralized electrification system has to be regularly maintain and will need regular or/and ad-hoc on-site inspections. In rural African areas there does not exist adequate motorways (demands for fast transportation). Planes for regular and ad hoc monitoring and regular revision on site (small planes should be used – there is an example of the Czech-made plane, the Sport Cruiser, equipped for these purposes)

 	Regular monitoring of all energy facilities of the SPC Program should be monitored by a satellite. TT and PYS as a high-tech technologies are equipped with electronic monitoring system. Because expected installations are in thousands, units need to be monitored via satellite.

3.1.3 SPC Factory and PV panels

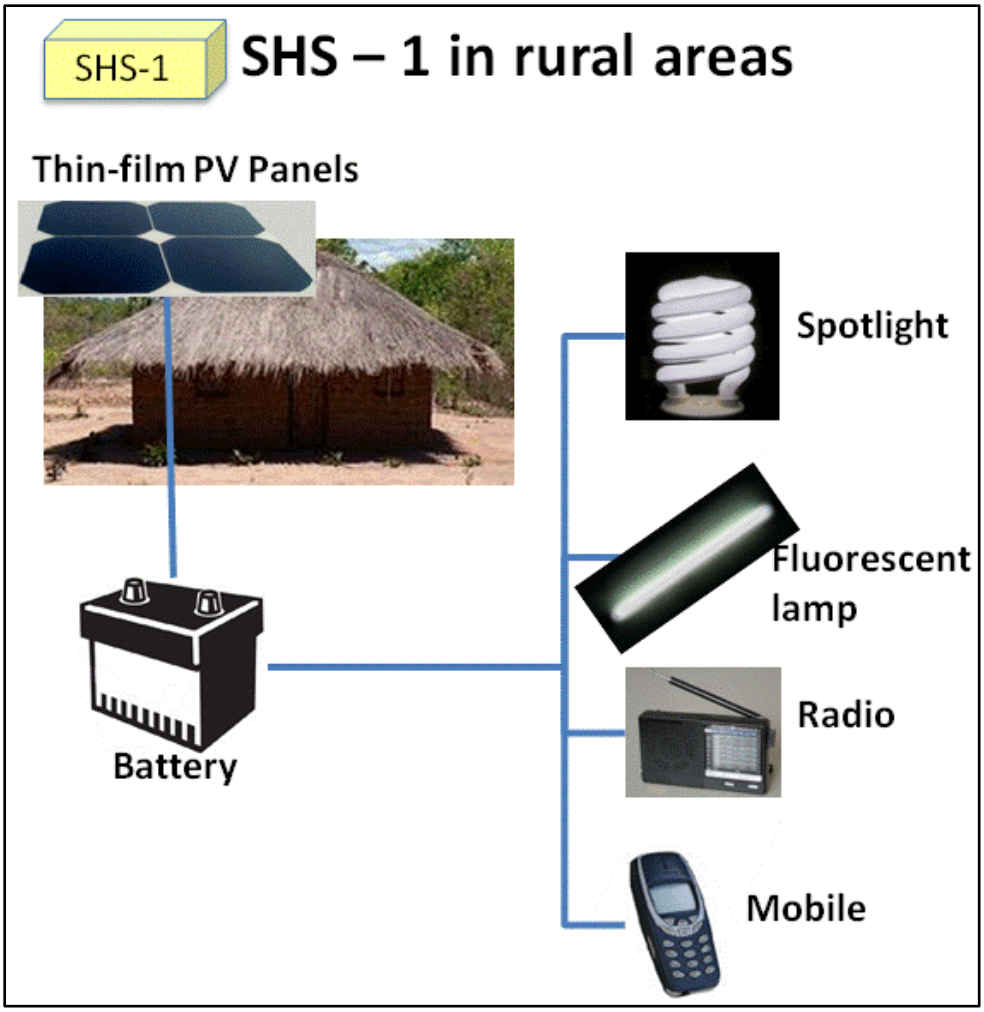
In case of SPC Program thin-film PV panel production line is proposed. Other PV Panel types would be imported.

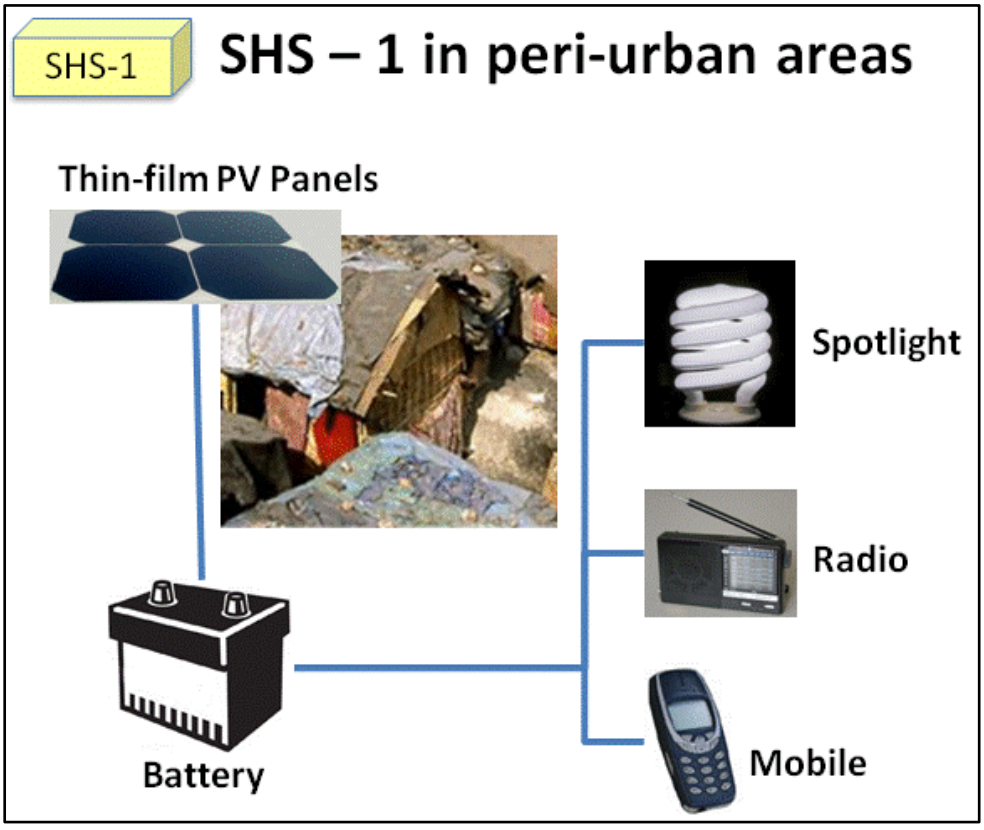
 Thin-film PV panels	PV Panels to be installed on rooftops, house-top etc. *(These panels are manufactured by thin-film PV panels production line in SPC Factory)*
 Standalone Thin-film or others PV panel	PV panels and Hybrid panels installed on separate construction. *(Standalone Thin-film PV panels are manufactured by thin-film PV panels production line in SPC Factory; other PV panels are imported)*
 Thermal Panels	Solar Thermal Panels.

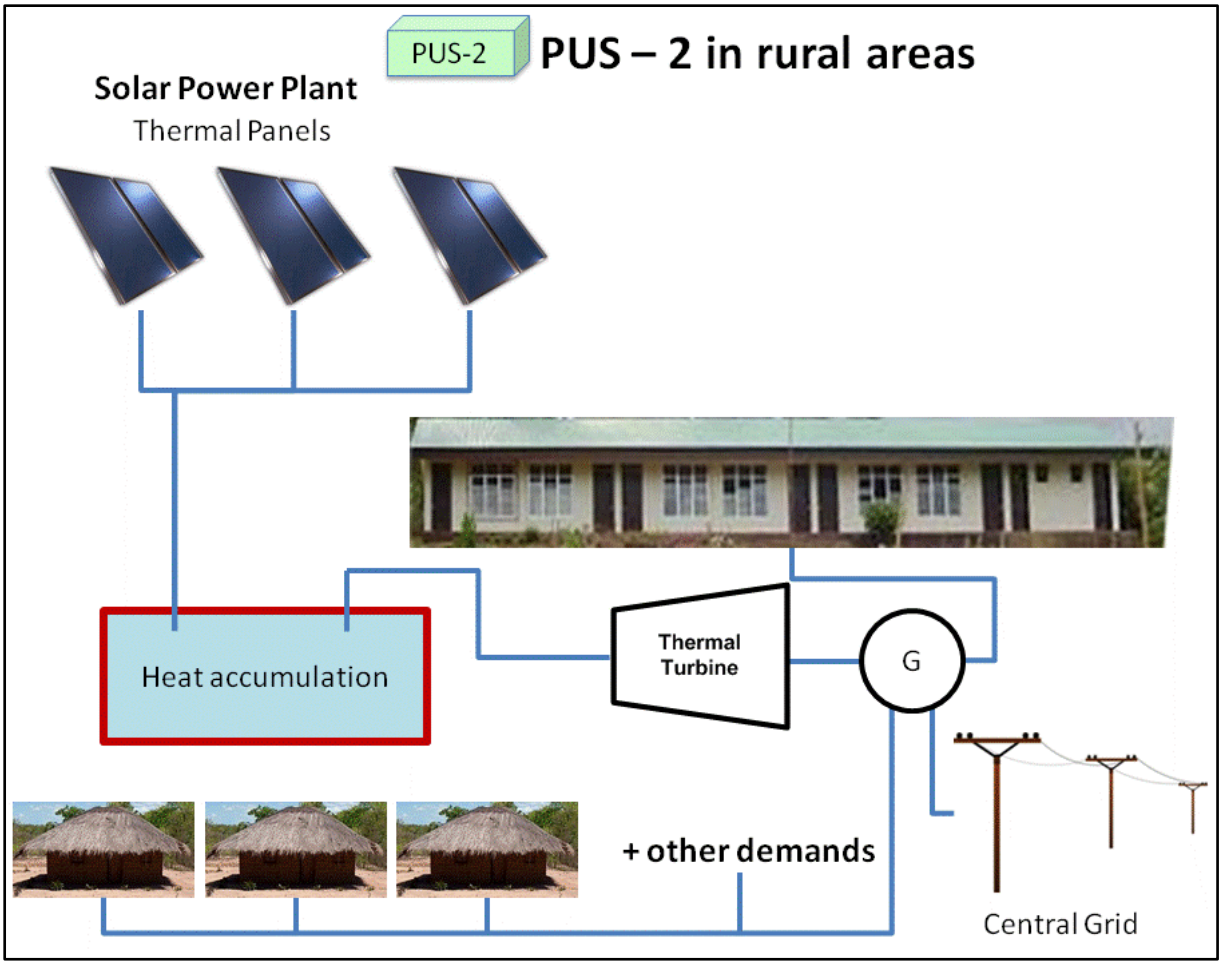
3.2 SPC Factory Products and Technologies

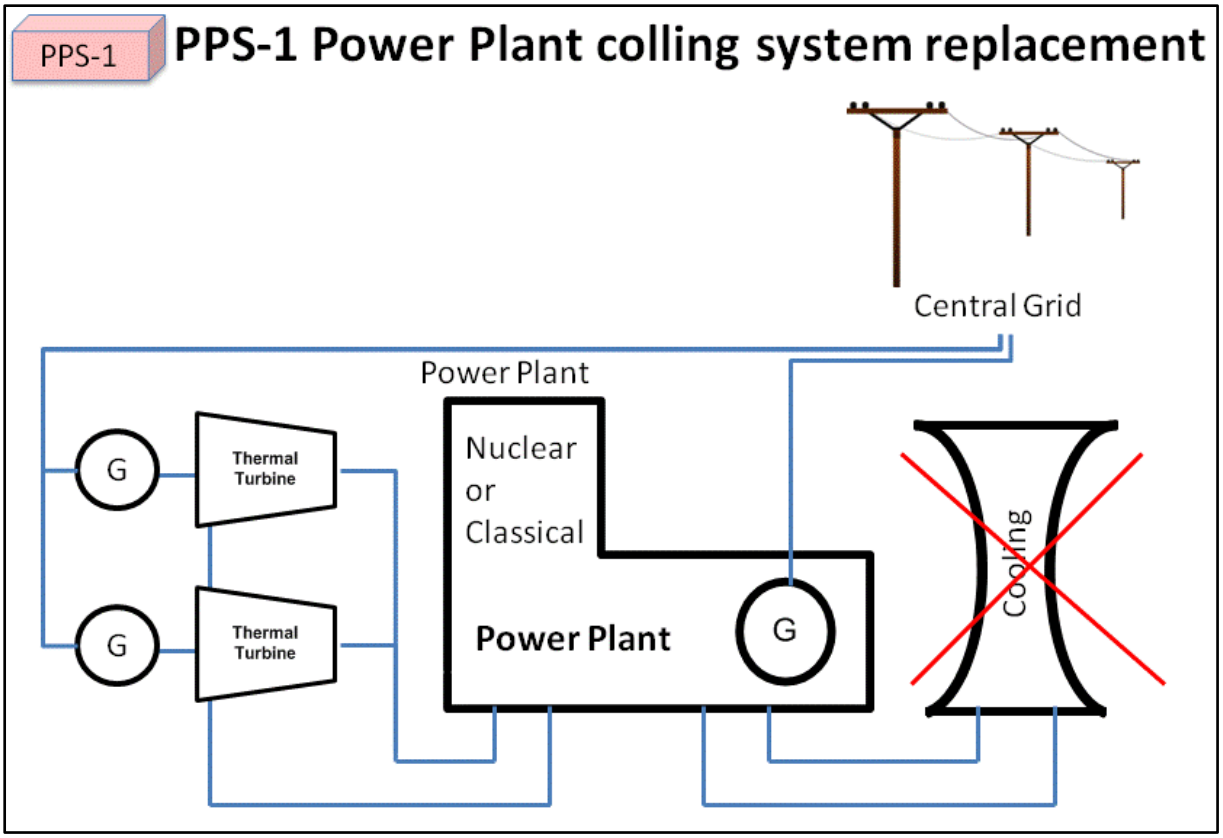
Factory products and technologies presented in this chapter follows defined structure of the SPC Factory products, and three blocks of technical schemes are presented:

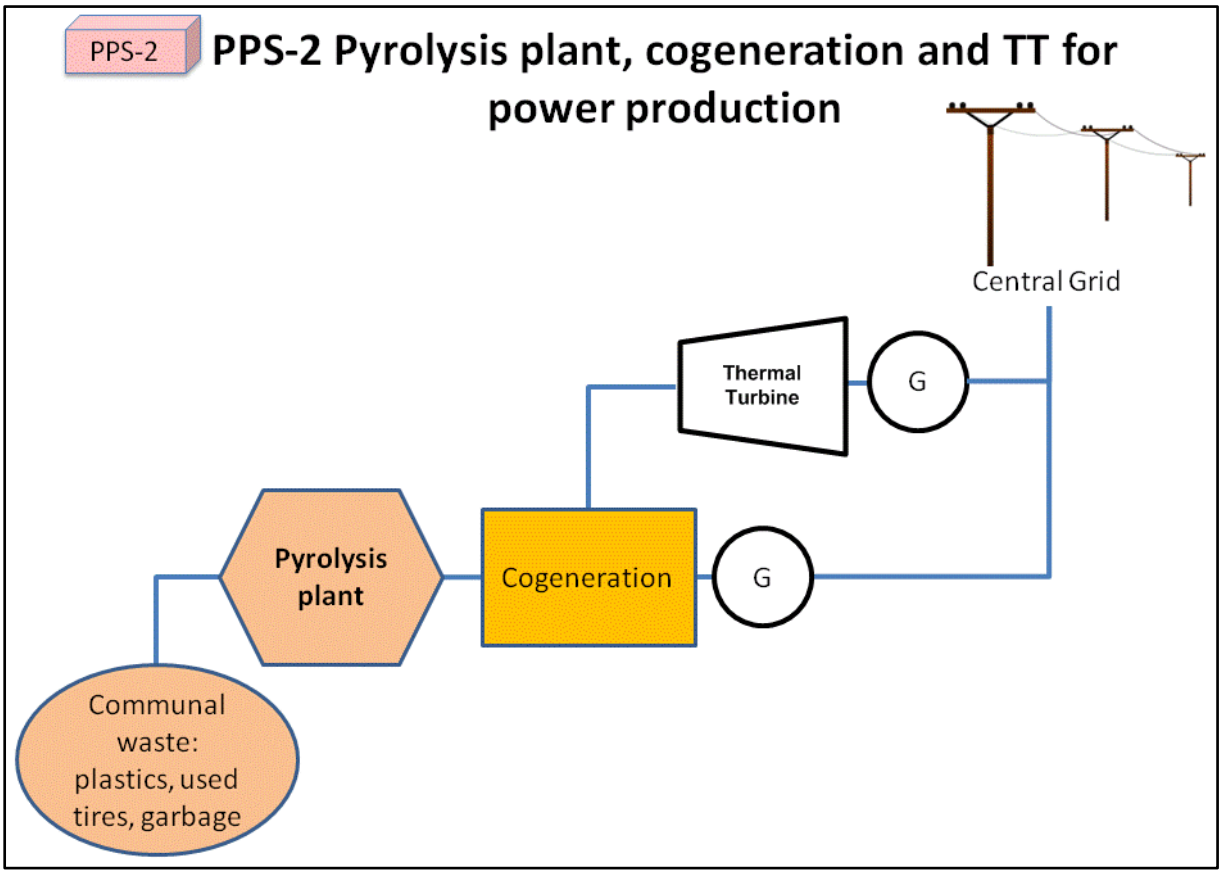
- Solar home systems for rural and peri-urban areas. Both two schemes present a single solution for huts (slum units). SFS supposes to perform both options: single application for a hut/family, and shared application for more huts/families (e.g. one hut owner can serve others by charging batteries, by distributing lights, or charged the radio).
- Power utility system for rural areas is presented by an option for schools, medical centres, and administration buildings. The scheme presents a more sophisticated solution for a school and neighbouring huts (living area) with thermal sun panels, heat accumulator and thermal turbine. There is a possibility to increase incomes of community budget by selling a portion of power to a central grid.
- Power plant system implemented under responsibility (ownership) of a National Energy Corporation. Two new proposed high tech technologies are performed:
    - A new thermal turbine (TT) technology is proposed. Waste heat is not let out into atmosphere as an energy lost but it is used for additional power production (e.g. a power plant with a capacity 10 MW can be very simply rebuild in an power plant with a capacity up to 14 MW)
    - A new pyrolysis system (PYS) technology is proposed. Waste (garbage, plastics products, used tires) is transformed into gas and electricity, and the PYS technology is equipped to transform biomass into gas and electricity (e.g. biomass as a waste or biomass as energy inputs gained from fast growing plants and woods)







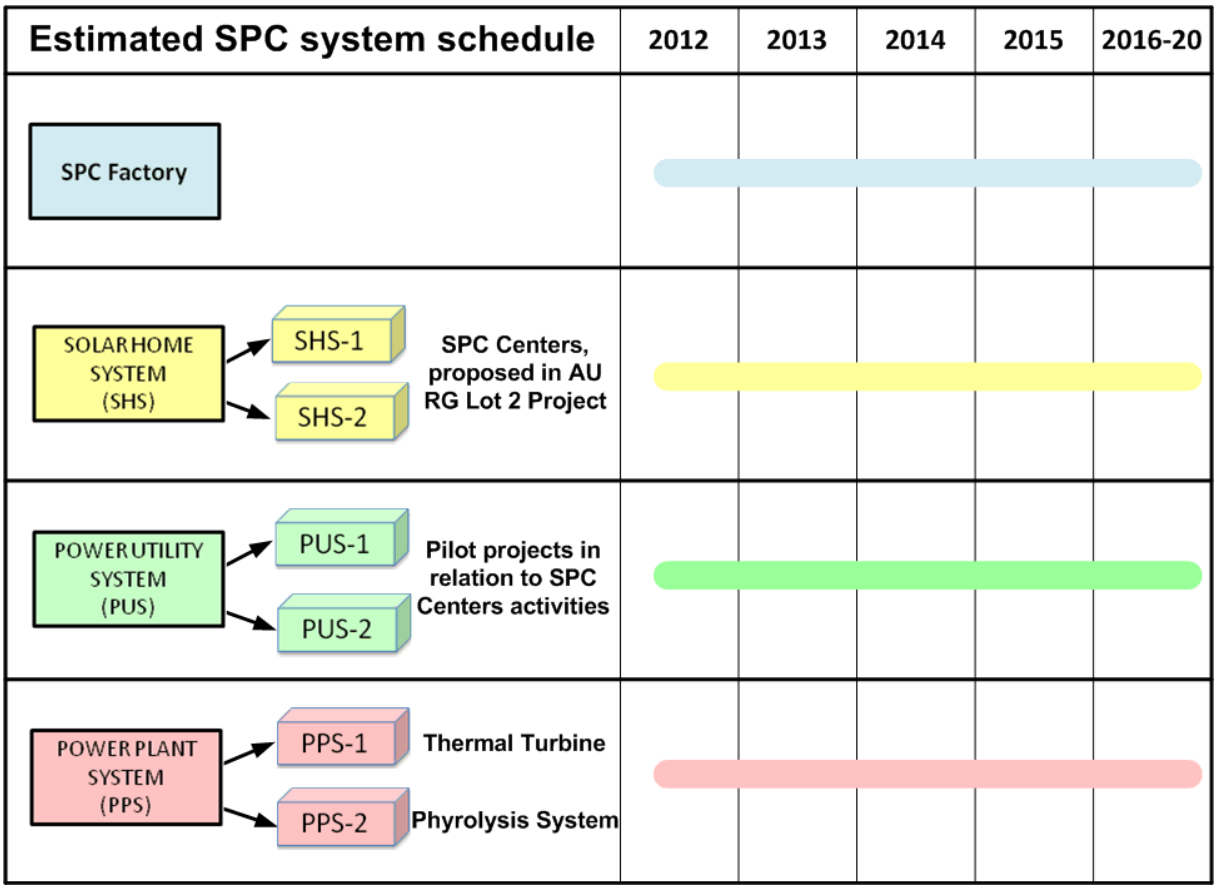




3.3 SPC system schedule feasibility and operational impact

The time schedule diagram is currently very general; it means that a lot of input information is to be added.

The aim of the Strategic Feasibility Study is to demonstrate feasibility to prepare a SPC project following a bona-fide, professionally prepared request and expression of interest from any client from Africa (e.g. the African Commission, member states, regional governments, the private sector).



4. Financial Feasibility Study

***Cost** – this part of the strategic FS „Self-Powered Communities" is concentrating on costs identification and impact on a life cycle process of SPC Factory and any investment activities on behalf of the SPC Factory for solutions: Solar Home System (SHS), Power Utility System (PUS) and Power Plant System (PPS).*

4.1. Financial models

Our business strategy and SPC methodology performance was defined in chapter 1.2. We experienced that mixing two expert's knowledge and skills into one result is a challenge. Financial modeling is a opposite pole to the Business model (see chapter 1.2).

Financial modeling is the task of building a virtual conception (a model) of an opinion and decision making situation on strategic and tactic levels. Financial modeling assists business program/projects portfolio and so business activities are inspired and regulated by monetary rules.

An integrated financial model of a business processes and organization normally contains 3 to 5 years of historical data (income statement and balance sheet information of the key players). This financial model is used to assess Business Motivation initiatives by the knowledge that key players on the strategic and tactic levels had to have:

- "Time is money" (today's value of money is better than tomorrow)
- "Cash is the King" (the most cash is generating the better the business).

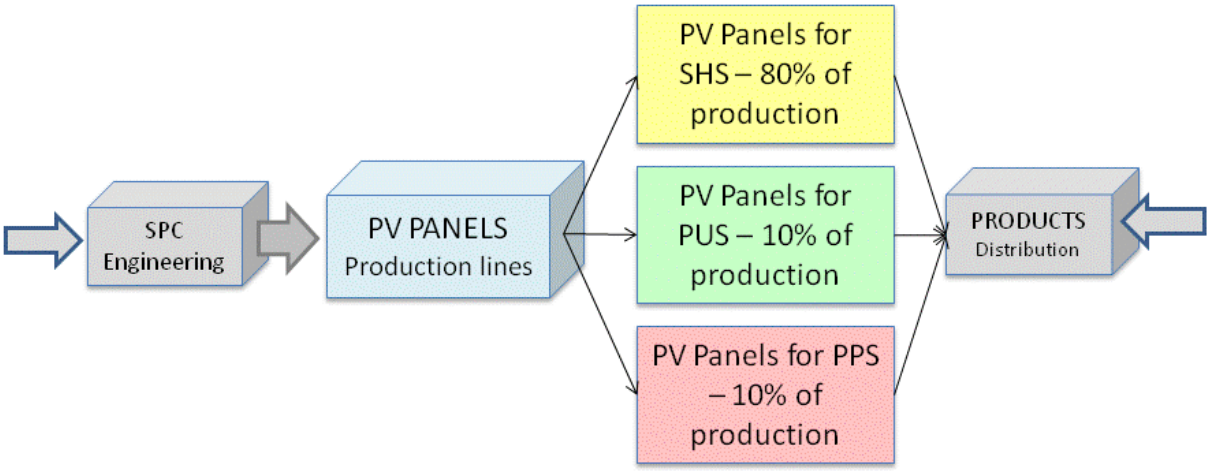
Assessment recommended by BMM (see chapter 1.3) is called "Benefit, Opportunity, Cost, Risk" and is generally equipped by information and figures that helps opinion makers to better understand and assists decision makers to do qualified decisions. BOCR assessment structure presented in this chapter is a demonstration snap of any assessment of proper business planning and financial modeling.

4.2. SPC Factory financial model

4.2.1. Introduction

The presented financial model is a simplified model of the SPC Factory producing PV panels (Engineering and Assembly costs being excluded). The model assumes production of three distinct products - SHS, PUS, and PPS. The overall production capacity structure is divided between the products in the following way: SHS - 80%, PUS - 10%, PPS - 10%. Annual production capacity of SPC Factory is 10 MWp, investment expense calculated at USD 10 millions.

PV Panels Production lines outputs production



The purpose of a financial model is to demonstrate financial health of the project. The model does not take into account specific location and legislative or market conditions related to the particular country, or a region.

4.2.2 Financial Model Assumptions

The financial model is based on a series of underlying assumptions, which are derived from generally known PV industry parameters and analytical research. As part of the research the revenue and cost structure of four leading world PV producers (First Solar, Suntech, Q Cells, Sunpower) have been analyzed, using their annual report data.

Key model assumptions are as follows:

Price per Watt / Cost per Watt – Average price and cost per watt have been stated in line with the overall industry price trends. These are generally impacted by steep decline in average price per watt of installed capacity ($1.8 in 2010, down from $3.89 in 2008 and 2.4 in 2009) and also gradual decline in average cost per watt ($0.87 and $0.77 in 2009 and 2010 respectively for First Solar). These figures are relevant for mono/polycrystalline PV panels and thin-film PV panel's price per key worlds producers. Based on these facts following four Price/Cost Scenarios have been used in the model.

Price/Cost Scenario	Price per Watt (PW)	Cost per Watt (CW)	# of Units Sold
1	$2.0	$1.0	166 000
2	$1.8	$0.8	165 400
3	$1.4	$0.7	164 200
4	$1.0	$0.5	163 000

Growth/Cost Structure Cases – Three Growth/Cost Structure Cases have been analyzed using different assumptions as per the annual average decline in PW and the average COGS (Cost of Goods Sold) and SG&A (Selling, General and Administrative Costs) costs structure. In case of COGS the realistic scenario is derived from selected Price/Cost Scenarios as defined above, while in pessimistic and optimistic scenarios reflect COGS portion increase or decrease by 15%.

The cases are thus defined as follows:

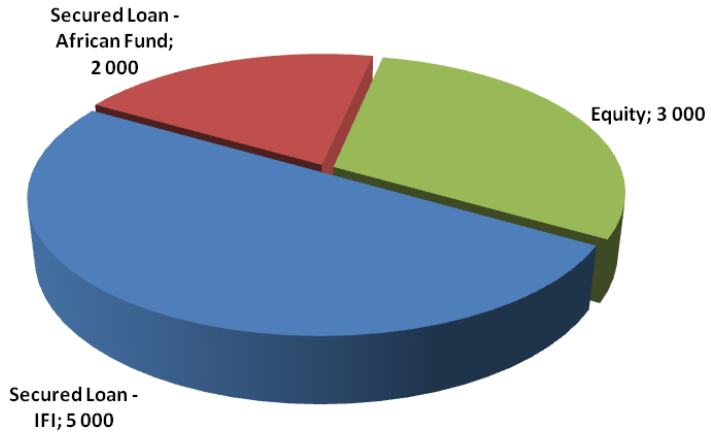
Growth/Cost Structure Case	Annual PW Decline	COGS as % of revenues	SG&A as % of revenues
Pessimistic	7%	Realistic + 15%	20%
Realistic	5%	Price/Cost Scenario	15%
Optimistic	2%	Realistic - 15%	10%

Sources of Funds – Financing of the investments expenses is expected to be done through three main sources: investor's equity, secured debt from IFI, secured debt from the African Fund. Revolving working capital will also be used to finance CW requirements.

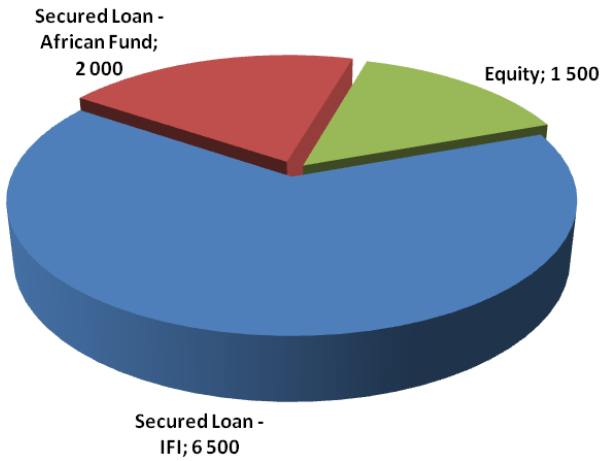
Three different scenarios are used for sources of funds:

Sources of Funds Scenario	Equity	IFI Loan	African Fund Loan
V1	$3m	$5m	$2m
V2	$1.5m	$6.5m	$2m
V3	$0.5m	$6.5m	$3m

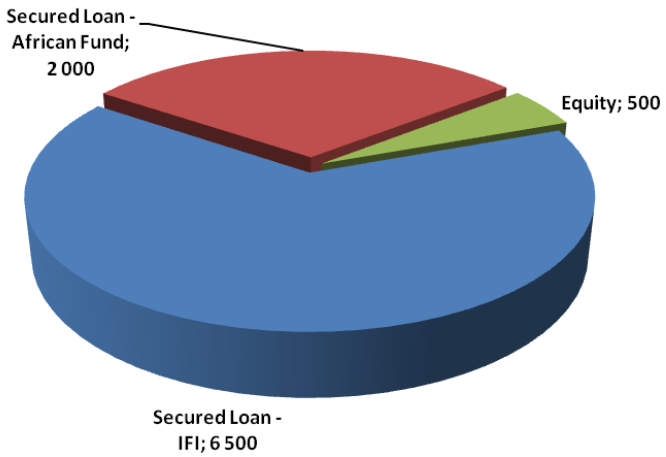
V1



V2



V3



4.2.3 Results

The following table shows results of 12 scenarios as modeled by the financial model. As can be seen from the table, 10 out of 12 scenarios show positive Net Present Value of the investment and IRR exceeding the discount rate (9%). Maximum payback periods does not exceeding 7.5 years, which complies with the expected life of the assets. Average payback period for all 12 scenarios is 4 years.

These results indicate good financial health of the project for PV panel production line. Nevertheless, more thorough financial modeling should be used once the final location of the project is selected and all regional aspects are taken into consideration.

Price/Cost Scenario	Financial Model Results	Growth/Cost Structure Case		
		Pessimistic	*Realistic*	*Optimistic*
1	*NPV (thousand USD)*	238	13 489	29 381
	IRR (%)	9,55%	33,87%	55,18%
	Payback (yrs)	6,40	2,79	1,64
2	*NPV (thousand USD)*	2 691	14 710	29 332
	IRR (%)	15,08%	36,43%	55,98%
	Payback (yrs)	5,25	2,67	1,65
3	*NPV (thousand USD)*	-396	8 852	19 977
	IRR (%)	7,99%	27,33%	44,25%
	Payback (yrs)	7,06	3,53	2,18
4	*NPV (thousand USD)*	-819	5 761	13 708
	IRR (%)	6,73%	22,16%	35,82%
	Payback (yrs)	7,58	4,30	2,80

4.3. Thermal Turbine Financial model

4.3.1 Introduction

The presented financial model is a simplified model of a thermal turbine producing electricity with 20 kW output capacity. Investment expense of the turbine is calculated at $120K, additional investment expense is $36K.

The purpose of the financial model is to provide a theoretical demonstration of the project financial health. The model does not take into account a specific location, and legislative or market conditions related to a particular country, or a region.

4.3.2 Financial Model Assumptions

The financial model is based on a series of underlying assumptions, which are derived from generally known PV industry parameters and analytical research. Key model assumptions are as follows:

Price per kWh – average price per kWh has been stated at $0.20 per kWh.

Cost of heat per kWh – price per kWh is calculated either at zero or $0.03 per kWh and represents price of the heat which is an input for the turbine.

Number of installed units – three scenarios are analyzed comprising of 1, 100 and 1000 installed units. Volume discount of 0%, 10% and 20% respectively are applied to investment expense are applied.

4.3.3 Results

The following table shows results of six scenarios as modeled by the financial model. As can be seen from the table, all scenarios show positive Net Present Value of the investment and IRR exceeding the discount rate (9%). Maximum payback periods does not exceed 6.4 years, which complies with the expected life of the assets.

These results indicate good financial health of the project for PV panels production line. Nevertheless, more thorough financial modeling should be used once the final location of the project is selected and all regional aspects are taken into consideration.

Installed Units	**Financial Model Results**	**Cost of heat (per kWh)**	
		none	$0.03 per kWh
1	*NPV (thousand USD)*	41	21
	IRR (%)	17,07%	13,23%
	Payback (yrs)	5,78	6,44
100	*NPV (thousand USD)*	4 967	3 003
	IRR (%)	19,87%	15,66%
	Payback (yrs)	5,37	6,01
1000	*NPV (thousand USD)*	58 704	39 059
	IRR (%)	23,37%	18,65%
	Payback (yrs)	4,93	5,54

4.4. BOCR assessment

The core principle of BMM is explained in the chapter 1.3. This structure is used for the SPC Program (composed from SPC Factory and its three core products: SHS, PUS, PPS). SWOT analyses were performed in chapter 2.4. This chapter opens space for another assessment technique.
Benefits (B), opportunities (O), costs(C) and risks (R) are a different view on the SPC Program feasibility and viability. We are looking for the best analytical tools for opinion and decision making processes assistance.

We are trying to define business rules for any stakeholders (from a company to the final beneficiary) to be navigated and regulated in the SPC Program. The aim is to control program and to have

an influence on business behavior during the all program's life cycles. This business rules approach is a combination of existing and new techniques and technologies in order to identify the knowledge required to run a business, to document this knowledge, to reason it, to make it operational in a consistent way, to systematically adapt it to ever changing market forces and to automate this knowledge as far as possible.

To apply multiple criteria decision-making process for African businesses can be taken up as an overrated approach, and we know it. Nevertheless we chose to use this approach to build a common language and terminology for productive dialogs not only about technology aspect but about organizational aspect as well.

This is a follow up of an assessment methodology of the BMM (more details see in chapter 1.3)

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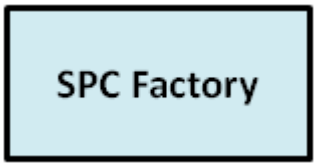
<tr><td rowspan="2"> 
</td><td>BENEFITS</td><td>OPPORTUNITIES</td></tr>
<tr><td>COSTS</td><td>RISKS</td></tr>
<tr><td>BENEFITS:</td><td colspan="2">• SPC Program:
Framework of understanding necessary for application of electrification in technologically uniform environment of the rural and urban areas. Within such framework the following will take place:
○ Achieving awareness of electricity in majority of population
○ Making mobile phones and internet accessible
○ Motivation of communities to take advantage of their own renewable sources, generate electricity and positively influence employment rates
○ Building of central power distribution grid – which is at early stage of development – will follow standards (conditions for evaluation of effectiveness of investments made will improve)
• SPC Factory:
Is a technologically fixed point placed in specific country which promotes electrification and it becomes a focal point for:
○ Transfer of engineering skills throughout Africa
○ Development of standards for manufacturing, distribution, disposal of PV power plants and for building turnkey power plants, e.g. according to BOT (Build- Operate-Transfer) standard
○ Standards for application of renewable sources of energy as a part of development of the basic energy sectors in individual countries
• Activities of a shared center for development and control of rural electrification strategies
• SPC Activities:
Direct and clear benefit to:
○ Rural households and agricultural production
○ Communities and their support of building "big energy" system
○ National Energy Policy</td></tr>
<tr><td>OPPORTUNITIES:</td><td colspan="2">• SPC Program:
Africa is a continent with a huge capacity of solar radiation and great possibilities for using renewable sources of energy. This is true for the entire continent. Nonetheless, in the SPC program we are focused on Sub-Saharan Africa and the study works with examples of two countries in East</td></tr>
</table>

	Africa: Ethiopia a Kenya. Among the main opportunities are the following: ○ Electrification of households (light, meal preparation, family life) ○ Introduction of electricity in educational process (at home, at school, at work) ○ Introduction of electricity in healthcare (healthcare centers, hospitals) ○ Introduction of electricity in transportation and domestic industry (new job opportunities) ○ Electricity as an impulse for productive activities and enterprising ○ Increase in food production including potential for exports growth. • SPC Factory: SPC Factory proposal brings the following opportunities: ○ The expansion of electricity generation from proposed RES - Engineering services for energy sector (BOT technique) - Introduction of new technologies in renewable sources - Thin-film PV panels produced in Africa - Storing of energy and Thermal Turbines (TT) - Utilizing of waste and Pyrolysis Systems (PYS) ○ Modernization of wholesale and retail networks in power distribution • The first SPC Factory in Africa (pilot application) will generate opportunities for building SPC Factories in other countries and regions • SPC Activities: Clear and repeated opportunities for promotion: ○ Democratization of society (primarily due to impact of mobile phones and internet) ○ Natural creativity (new opportunity for enterprising) ○ Motivation to those who are starting (spontaneous, positive attitude toward electricity)
COSTS:	• SPC Program: SPC costs will not exceed the volume of budgets already routinely allocated to energy programs in Europe or energy programs in individual countries financed by the World Bank. SPC Program will include the following: ○ AU Program budgeting e.g. for Sub-Sahara African countries; cost management and control roles ○ National level budgeting, cost management and control rules ○ Tenders, monitoring, evaluation and auditing methodology ○ Financial assessment of projects and cost´s benchmarking rules ○ The most important cost items in the SCP Program should be defined: - Program's sources and needs for prioritization at both the AU and the national levels - Human resources motivation and skills training assistance - Transfer and implementation viable technologies and skills - International co-operation with financial institutions - Monitoring, benchmarking, and evaluation - Internal control management and internal auditing • SPC Factory: Total cost is estimated to be above EUR 15 million. The total cost is composed of the following three parts: ○ Engineering and R&D services ○ Technology production line (Thin-film PV, TT, PYS) ○ Assembly line and sales

	• SPC Activities Costs:
	  ○ Marketing costs
	  ○ Public Relation costs
	  ○ Other costs

RISKS:	• SPC Program:
	The risks of programming at the AU level have their specifics: for example, transferability of experience with EU Structural Interventions is not possible without understanding of differences between European and African set of conditions, in this case specifics of Sub-Saharan Africa. Despite that, some general rules are transferable:
	  ○ Public and private sectors must be build on one common pillar – it is the enterprise model
	  ○ Every enterprise needs its own policy, strategy, tactics and rules of operation (none of these aspects can be overemphasized)
	  ○ Every enterprise needs its own business rules
	  ○ Not following business rules generates bureaucracy
	  ○ Bureaucracy planning kills any business creativities
	  ○ Risks diversification and sharing are two important assumptions as how to protect sustainability of SPC program.
	  ○ The most critical risk´s are:
	  - Lack of consensus and understanding of Program´s value
	  - Human capacity doesn't catch up with tempo of implementation of technologies
	  - Low quality of decision making processes and erroneous decisions
	  - No adequate risks analyses of SPC Program´s projects
	  - Non-uniform methodology and chop templates distribution
	• SPC Factory:
	Risk analysis and risk management should follow step by step all SPC Factory life cycle operations :
	  ○ Planning and construction risks
	  ○ Engineering and R&D costs and risks
	  ○ Operational risks
	• SPC Activities risks:
	  ○ Market´s risks
	  ○ Opinion and decision making impacts risks
	  ○ Other risks

SOLAR HOME SYSTEM (SHS)	**BENEFITS**	**OPPORTUNITIES**
	COSTS	**RISKS**

BENEFITS:	▪ People have the opportunity to have in their own home the electricity and gas whole day for:
	  ○ Lighting and cooking
	  ○ For education, entertainment, and communication (mobile phones, internet)
	  ○ Work and their own earned income (small workshops and retail	

	services) - Workshops in their own homes - In separate workshops in private ownership - In enterprising with electric power (charging of appliances, batteries and other services)
OPPORTUNITIES:	• In-house electrification will bring new opportunities: o To women in care for families o To men earning money for families o To children their education and better future • In-house appliances (mobile phones, radio, TV, and internet will transfer households into new quality level necessary for economic growth and political stability (bottom-up approach) • Electrification will have positive impact on household cash flow generation and its sustainability
COSTS:	▪ The costs are calculated on the basis set-forth by the Lighting Africa Programme. The rule is to keep price relation of a product and purchasing power of end users in balance. Calculations per Case Studies 1 and 2 consider financial interventions (subsidies, soft micro-loans) which are to offset price differences especially on the side of distribution and sales of the products. ▪ Calculations of costs are estimates as the objective is to present in the study more of a complexity of a solution as a whole rather than narrowly viewed specific applications.
RISKS:	▪ In the SHS case the risks are in particular linked to applications in the following circumstances: o In-house electrification - Loss of interest by country dwellers in electrification of their homes - Failure of service support - Other influences which lead to rising prices of sold products o Portable units for lighting, mobile phone charging, and other purposes - Awareness of low quality of transmission equipment; in general, it can be also caused by competitors) - Other influences (e.g. stealing, deliberate damage to transmission equipment)

POWER UTILITY SYSTEM (PUS)	**BENEFITS**	**OPPORTUNITIES**
	COSTS	**RISKS**
BENEFITS:	▪ Communities have an opportunity to have on their land electric power available to their citizens all day for: o Lighting and protection of communal property (street lighting, squares, markets, etc.) o For pumping of water and/or water treatment facilities o For drying food o For jobs and their own earnings (small workshops and services) - In communal workshops	

	- In workshops at one's home o Electric power deliveries to schools, healthcare facilities, administrative organizations, police, fire stations, etc. o Electric power delivery for agricultural production: - Poultry and eggs production - Raising pigs and cattle - Growing agricultural plants and harvest processing (drying of fruit and produce, collection and use of waste biomass, growing fast growing timber, etc.) ▪ Power utilities strengthen in Africa not very well known form of ownership – the co-operative ownership. The study presents this form as one of the possible ways for building energy sector in Africa with the objective to get involvement of majority of population in SPC Program.
OPPORTUNITIES:	• Electrification is phenomena tested in developed countries and it offers households and entrepreneurs the following opportunities: o Bring into family life order derived from natural laws (application of mathematics, physics, electricity, and mechanics) o Decentralized electrification built on renewable sources of energy represents bottom-up approach (from households to governmental structure) and it is an opportunity for country government to effectively support implementation of the nation's energy policy o Utilize potential of energy in water streams, wind, geothermal energy, biomass locally by: - Micro-entrepreneurs - Co-operatives - Companies and corporations • There are more reasons for rural and peri-urban areas to see power utilities as an opportunity: o It is the way to support entrepreneurship – starting with the simplest one (e.g. a small center for charging mobile phones or a small hydropower plant for a local enterprise) all the way to a complex ones (e.g. electric power for local school, hospital, administrative office, or a church) o It is the way for deployment of the most modern technologies in Africa (e.g. Thermal Turbines , Pyrolysis systems)
COSTS:	▪ The costs related to building of power utilities in in Sub-Saharan countries and of the projects which will be prepared and operated by them will possible to calculate only when results of research in these matters are available. ▪ We expect benefits coming out from implementation of the research project which the 5P Platform initiated in East and West Africa. In May, 2001, a project including Guinea, Nigeria, Kenya, Ethiopia, and the Czech Republic was submitted in response to a call by the AU Research Grant. Its objective is to analyze feasibility of SPC in Sub-Sahara Africa and to examine central and mobile centers for supporting of electrification of rural and peri-urban areas.
RISKS:	▪ In the PUS case the risks are above all identified from studying documentation for rural and per-urban areas in Ethiopia and Kenya: o Electrification of buildings - Selection of a community with a strong interest to participate in SPC project

- Insufficient interest in a community in participation in a project especially as it concerns with sustainability under operation which is their independent responsibility
- Power utilities
  - Unknown results of a survey of feasibility of power utilities in Africa – such survey was not yet conducted in countries of interest, i.e. Ethiopia and Kenya

POWER PLANT SYSTEM (PPS)	**BENEFITS**	**OPPORTUNITIES**
	COSTS	**RISKS**

BENEFITS:

- Countries have an opportunity to strengthen its energy sector from bottom up via coordinated development and shared protection of their national economic interests
  - Power generation is not dependent only on central sources; technological options exist for application of sources with smaller outputs and buying electricity from small-scale producer (with capacity up to 20kW)
  - Heat storage/accumulation and deployment of thermal turbines open the possibility of being able to respond to power outages in central distribution grid and to scheduled coverage of peak demand for electricity
  - Planning and building of the grid will allow for the opportunity to monitor the demand for electricity (i.e. not the other way around, when the demand stagnates because the speed of building the central grid is marked by time delays)
  - Energy sector of a country can become a permanent asset making growth of GDP of a country or a region possible
  - The "big" energy sector will have a positive and long-term effect on quality of environment:
    - Share of renewable sources of energy will grow
    - Volume of waste in cities and rural areas will decrease

OPPORTUNITIES:

- Building and development of central distribution grids in individual countries is top priority. PPS is an opportunity for speeding up development of "big" energy sector. PPS expects construction of decentralized capacities with output from 20 to 250kW efficiently and economically located throughout the territory of an entire country.
- Building solar power plants is the way of direct support of central distribution grid with photovoltaic power generation (in possible combination with heat storage/accumulation and power generation by thermal pumps (with base unit output at 20kW).
- In a context of this study, hybrid power plants mean support of central distribution grid with photovoltaic electric power which feeds into Pyrolysis unit (unit output of 250kW), which gasifies waste (municipal or from agricultural production) and the gas is either burn in co-generation unit or sold in small containers used for household use (cooking).
- Building of power plants based of fossil fuels is not in any way restricted

	by this proposal. It is and will remain to be up to power utility company in each country how it will deal with limits and sanctions forcing utilities to reduce production of CO_2.
COSTS:	▪ The criteria for building energy sector in Africa are the need to meet demand for electricity. The study offers strengthening of building the energy sector from bottom to top using a coordinated development and protection of economic interest of individual countries. ▪ The proposed procedure supports diversification of sources of energy. National energy policies are not limited by it; development of energy sector via renewable sources represents extension of a concept based on traditional fossil and nuclear power plants. Selection of energy sources and their relative weighting should be done following the criteria which go beyond the scope of this study.
RISKS:	▪ In PPS case the risks might be – above all - linked to building of power plants using new technologies: o Solar power plants - In Africa, building of PV power plants is still in very early stage - Storage/accumulation of energy is being requested but no experience in this regard exist (we consider thermal turbines' characteristics for Africa to be a challenge) o RES power plant - Any technologically complicated equipment puts increased demands on elimination of risks affecting sustainability of operation

5. Organizational Feasibility Study

***Risk** – this part of the strategic Feasibility Study „Self-Powered Communities" is concentrating on risks of the life cycle of SPC Factory and any risks of any investment activities on behalf of the SPC Factory for solutions: Solar Home System (SHS), Power Utility System (PUS) and Power Plant System (PPS) from the viewpoint of lack of business environment (legal instability, skills absence, corruption).*

5.1. As is Strategic Feasibility Study base

Since 2008, our team was formed. So far we worked on the SPC Road Map and on the SPC Strategic Feasibility Study and it is gradually formulated to be linked to development of environment suitable of multidisciplinary international cooperation. Starting with 2011, our work on SPC Program focuses on 5P Platform involving experts from various countries as they have been investing their knowledge and skills into Africa-oriented project development.

5.1.1 Initiator and engine of the SPC dissemination

The initiator and the engine behind the SPC Program is the 5P Platform, a team of people with years of experience in electric energy sector. In a context of the above-described projects the goal of our work is to take another step in electrification of rural huts and urban slums, schools, healthcare centers, and other structures in developing Africa. In order to give such cooperation an effective framework we created the „Prague Project Portfolio Planning Platform", (5P). In other words: a platform for those who want and are capable of preparing and delivering infrastructure projects abroad.

Prague has attributes of a great community for the new millennium; it is a beautiful and exemplary city for cosmopolitan co-existence, a city worthy to be introduced to the word. Project portfolios are something which deserves special attention. To be a managing contractor doesn't represent only financial and capital benefits but it is – above all – an opportunity for integration of projects of subcontractors, for being knowledgeable about the market and being ready, at the right place and the right time. We supplement the Business Platform for Foreign Development Cooperation which aims to initiate investment opportunities abroad. Objective of our Platform is to support promising projects with expertise and guide them so that they achieve their competitive position.

We recognize value of the Sun, the Earth, especially water, air, soil which are around us and we are working on renewable sources of energy, those which the nature offers in a real time. We are interested in growing plants (not the fossil ones, such as coal, oil, or natural gas), solar energy, and in importance of plants – not only for energy sector. We follow the possibilities of integration of our opportunities into thoughtful business undertakings. We are bringing in innovations using synergy of the knowledge and skills necessary for development and application of technologies in production and use of electricity in rural and peri-urban areas of today's word, specifically for the population which is currently placed at the Bottom of Economic Pyramid, i.e. for a group of more than four billion people who live on less than $2 per day (from book "The Fortune at the Bottom of the Pyramid" by C.K. Prahalad).

From this perspective, activities of the „Prague Project Portfolio Planning Platform" represent a new, innovative approach. Our approach to cooperation with Africa is also our impulse to the private sector in discussions around the Green Book prepared by the European Commission. We are a European platform, a platform for development of the above-mentioned cooperation between Europe and Africa. We are working to support effective communication between politicians and

entrepreneurs, development of the "language" of private and public investments, standards in documentation such as RoadMaps, feasibility studies, and business plans. We are aware of the fact that at this time the main players in business development in Africa are China and India. But as even European politicians are realizing that Africa represents economic foundation for Europe we believe that we too will have a room for presenting and implementing our business proposals.

We know that we can't do it all alone. Therefore, we are a platform, a tool for everyone who wants to speak the language of doing business in Africa. We are starting in Kenya and Ethiopia where we have a support from the Czech government. In May 2011 we submitted our project "Self-Power Community research for Africa" and had an opportunity to contact other partners from Guinea and Nigeria. At the end we selected clearly defined segment of the market: electrification of rural areas, peri-urban areas and cities and for this type of business we seek additional partners.

5.1.2 EU and AU contributions

EU: The European Commission asked public and private sector of all members' states to participate in discussion of a Green Book process "EU development policy in support of inclusive growth and sustainable development". There was Czech private sector contribution participating in the EU team which was working on the Green Book:

> Our competitors, for example from China and India, have – on global markets at the BOP levels – a natural advantage. Thanks to its poor these high-population giants orient themselves in the poor part of the word with more skills than we, in Europe. While it is also true that Europe has its own poor, it is not sufficient for understanding of extreme poverty in the BOP. In that context, "inclusion as an instrument for fighting the poverty", as it is being used in the Green Book, is for us not easily grasped.
>
> Concerning a debate on poverty we offer a view on poverty through the eyes who not only offer to fight it and to reduce it but who are also in situation when they simply cannot afford not to address it. More and more often we read and see that business at the BOP levels does exist, in India and in Africa alike. An excellent source of information in this sense is, for example, the World Bank and the IFC program „Lighting Africa".
>
> Seeking solutions addressing the basic needs of life, i.e. „food, education, health, and gainful employment" presents at BOP levels its own demands for specific services and skills in starting up and supporting small and medium enterprises, all this on a top of transfer of know-how via tangible products and mastery of business operations.
>
> In other words: It is not only a question what and how to sell a specific product but also with whom to trade and do business on a long-term basis. In that context we also offer to include applications of the tools in education in support of development of new sets of skills, for example, in the area of „enterprise architecture and financial engineering" in the BOP countries.

AU: The African Commission with the support from the Secretariat of the Africa, Caribbean and Pacific (AC) Groups of States and European Commission launched the first African Union Research Grants call proposals for 2011. There is brief information about a project "Self-Powered Community Research in Africa"; the SPC project was submitted on time (on May 3, 2011).

> SPC Project proposal was developed for two countries in West (Guinea, Nigeria) and two countries in East Africa (Kenya, Ethiopia) and one country in Europe (the Czech Republic). The project is based on bottom up approach with the aim to open an opportunity to start all specific project operations at the local and regional levels. Participants in the SPC Project are very well familiar and knowledgeable concerning pre-project situation in each country. The Czech SPC

Project team has the know-how in research of the knowledge economy and market competitiveness in RES sector. Their join effort will add synergy to project results.

Project team will use all relevant inputs to be fully involved in Africa-specific problems at all levels (local, regional and national), and to have proper information in order to avoid duplication of effort. Lighting, meal preparation, and jobs creations will be analyzed as an integrated package of needs and constrains typical for African communities.

Identification of any positive synergy effects and their practical impact on communities will be subject of research activities; teams of every country involved will exchange these findings and proposals and will cooperate in development of solutions and transfer identified synergy in a way of a sustainable positive impact on households and micro entrepreneurs and the real life in communities (in rural and peri-urban areas).

SPC Project has the following four segments:

- First two focus on data and information collection from selected communities. These two aspects will be performed and measured by identification of: a) community absorption capacity to accept and sustain electrification processes; b) national, regional and local institutional capacity (administrative skills) to assist communities in their development effort
- The third segments will integrate all findings and transform them into SPC Project results (input data evaluation models will be created and internal and external project communication will be assisted, and core outputs will be developed). This segment will be crucial for management and control off all activities in SPC Project.
- The forth segment is called “test in a real life”, and it is based on a pilot application in specific communities. Outputs from pilot tests and outputs from questionnaires (first two segments) will come back at the third segment (feedback).

SPC project team is ready to bring in innovations using synergy of the knowledge and skills necessary for development and application of technologies in production and use of electricity in rural and peri-urban areas of today´s word, specifically for the population in Africa.

5.2 Business Rules

Any business plan and business implementation will not have effective and economical impact and will not be efficient enough without adequate Business Rules. The most important is to break down business processes and their organization structure and financial and capital base with a step by step understanding of prioritizations of business functions.

We identified two the most critical organizational functions of the SPC Program implementation:

1. Financing mechanism and better understanding to any situation in the business organization; cash flow control in financing and changes in capitalization during the all program/project life cycle.
2. Products sales system (wholesale and retail) for the SPC Program: Product sale process and organization building encourage all key business players to be motivated and to positively participate during the entire program/project life cycle.

5.2.1. Financing Mechanism

Three financing schemes are discussed: first two for SHS and PUS applications – those directly managed and controlled at household and/or self-government levels and the third one for SPC Factory needs and PPS managed and controlled at state or corporate levels (e.g. owned by national/central electric power corporations).

SPC System	Scheme - A	Scheme - B	Scheme - C
Solar Home System (SHS)	PGS	CGS	-
Power Utility System (PUS)	PGS	CGS	
Power Plant System (PPS)	-	-	SBS

A - Performance Grant Scheme (PGS)
B - Credit Guarantee Scheme (CGS)
C – Syndicate Banking Scheme (SBS)

A - Performance Grant scheme

A Performance Grant Scheme (PGS) is usually put in place and administered through a special account at the Central Bank of a member state of the AU. Such member state provides performance-based grants to those suppliers (dealers, installers, etc.) who actually sell, install, and provide consumers with (one year) warranties for their systems in the specific target districts. These suppliers are pre-qualified using transparent, international (and national) technical standards.

This performance-based scheme is intended to incentivize suppliers to move their operations into rural areas by reducing the risk through the performance-based grant/subsidy for doing business and extending sales and installation into deep rural areas. This reduces risks and transaction costs to dealers/suppliers and tests commercial value of installers in each specific target districts (rural, peri-urban areas and cities). It is recommended to have one hundred percent under control (e.g. internal financial control, and auditing).

PGS represents physical verification of the SHS installation in each household; quality of any operation and warranty of any systems must be transparent in any target rural areas. Once those systems are verified, a certificate of verified installation must be issued to the supplier who can then present it to an agent acting on behalf of the Central Bank for payment of the relevant subsidy. Suppliers could just as easily use these certificates as a security with any entity financing their consumer or supplier credit. A number of financial institutions already view these certificates as a “cash guarantees”.

The grant will be an absolute amount for the entire system, as opposed to some percentage of the total value of the system. Were it is set up as a subsidy toward the cost of the whole system, it might give a negative incentive of encouraging dealers to sell and/or value systems at higher price. Therefore it will be geared toward the following two objectives:

1. **SHS** – Household electrification and portable units for lighting, charging and other purposes: smaller houses electrification receive a higher subsidy relative to the total cost of the system than larger, more expensive systems (e.g. SHS equipped by a TV and/or an air-conditioning unit). This assures some form of more equitable access for relatively poorer consumers.

   The World Bank experience in many countries demonstrates that if grants are not more or less similar, then a higher per unit or per watt peak subsidy could result in the perverse economic effect of wealthier consumers buying a number of smaller systems (each with a relatively higher grant than the larger systems receive). This can be overcome in number of ways, but most efficient one is making the subsidy differential relatively uniform for all sizes of the system.

2. **PUS** – Building electrification and Power Utilities: new and retrofitted buildings (schools, clinics, administration buildings etc.) can get 100% subsidy (it is a general practice now), and the same approach is recommended for the first implementation of Power Utilities pilot projects. This is a way how to ensure that in the social services area, all people, no matter how poor, will benefit

from the project through increased access to modern technologies enabled by electricity. Number of buildings might be limited because the most important priority has to be electric power made available from bottom up. The priority is to get the largest number of poor inhabitants benefiting from available electric power.

B. Credit Guarantee Scheme

A Credit Guarantee Scheme (CGS) is usually put in place and administered through a special account at the Central Bank of a given AU member state. The CGS presents a set of pre-qualification criteria that are open and transparent, and that require any applicant who is seeking credit guarantees to undertake a high level of due diligence also including suppliers and consumers they intend to provide credit to.

Applicant has to develop a request in a standardized template business proposal format and define strategies for financing of the proposed business. This approach has a potential to develop a robust wholesaling and retailing system for SHS business, and drop the costs to consumers fairly dramatically (access to rural electricity from solar PV systems will be increased, and working commercial model and example for other rural electrification will exist).

The UNDP-GEF (Global Environmental Facility) project and Central Bank of Lesotho (2006 - 2010) are proper examples: companies seeking to insure risk of non-payment on credits extended to their customers at the time when they try to obtain credit guarantees. Commercial marketing and business plan establish 'line of credit' specifically for consumer/supplier financing (to those with limited – 75% - recourse guarantees on their lines of credit. The aim of this level of guarantees is to ensure that both sides (CGS and the consumer) should bear some, but not all the risk. This limited recourse coverage is standard throughout the world.

1-2. **Solar Home System (SHS) and Power Utility system (PUS)**: there is a strong foundation of good practices throughout the world (e.g. World Bank and GEF activities)

- World Bank supports rural electrification by pilot projects whose main objective is to test various institutional delivery mechanisms for energy services in rural areas. The World Bank is also providing seed money for testing of these institutional models in a form of capital subsidies to consumers.
- Global Environmental Facility (GEF) is focused on removal of barriers and project risks (in activities such as training and capacity building, promotion, technical assistance in renewable energy technologies, feasibility studies, setting and enforcing quality standards, monitoring, and establishment of sustainable delivery infrastructure).

Syndicate Banking Scheme (SBS)

A banking syndicate is a group of investors, often a set of investment banks, who have come together in order to function as an underwriting group for a specific project. Typically, a banking syndicate is not a permanent entity, although the banks involved may maintain a casual communication for the purpose of being part of future financial opportunities to collaborate on financing projects.

There is a specific case arranged by the Development Finance Institution (DFI) and European Investment Bank (EIB). As of 2009, the total of 15 European DFIs made investments worth €18.5 billion with additional €4.6 billion committed to future investments. The primary contribution of DFI to international development comes in providing finance to those segments of the private

sectors in developing countries that are underserved, thereby increasing employment opportunities, income, tax revenue, product availability and so on.

Companies in DFI portfolio help to elevate skill levels and facilitate transfer of technology and knowledge. All these factors contribute to strengthening of local conditions and reducing aid dependency. Access to finance is not simple. Only five countries in Africa are rated as investment grade (Botswana, Libya, Morocco, South Africa, and Tunisia). This means that 49 out of 54 African countries are either rated as non-investment grade/or are not rated at all. For instance, in Sub-Saharan Africa only 5-25% of households have a formal relationship with a financial institution. Interest rates in Africa average 8%, with some countries having the average at 25%, compared to a global average of about 5%.

Micro-businesses are increasingly served by microfinance institutions but SMEs are frequently too large to qualify for microfinance and microfinance loan sizes are too small to meet SME capital needs. At the same time, SMEs are often considered by commercial banks and financial institutions to be risky and costly to serve. They rely instead on access to finance from informal sources such as family members and money lenders, who can charge high interest rates. Financial services are necessary for entrepreneurship, job creation, and economic growth and, ultimately, return on investment. For these reasons, DFIs not only provide financing and capital, but, when necessary, also support financial institution-building in cooperation with stakeholders in public and private sectors.

A case study as an example of PPS investment: In 2003. Twelve European DFIs and EIB created a joint venture with the goal of strengthening co-operation between European financial institutions to implement project outside of the EU. This structure is called European Financing Partners (EFP), and it operates with very limited operational costs. The EFP portfolio today operates projects in thirteen African and Caribbean countries. A broad range of sectors are served, the main ones being industry, financial intermediaries, communications, agribusiness and electric power, with investments also made in the transport, healthcare, and hotel sectors. Due to its impressive track record the EFP was replenished with €230 million in May 2009, of which €100 million was provided by the EIB and €130 million by the European DFI members (European DFI and EFP).

5.2.2 Product´s sales models

Experience of companies have illustrates how difficult it is to develop, manage and control wholesale and retail network in order to have effective sales operation. The most important is to identify the appropriate distribution and selling model for the specific market (country or region) dynamics.

This SFS is analyzing three independent systems:

- Solar Home System (SHS) for household electrification and for portable units for lighting, charging and other purposes
- Power Utility System (PUS) for electrification of buildings (mostly for public service e.g. schools, medical centers, administration buildings, police stations etc.)
- Power Plant System (PPS) for Thermal Turbine and Pyrolysis Systems application mostly for national electric power companies

All these systems are different in technology but from point of view of distribution there are some common features: there is a model for package of goods and one package is called „unit of equipment“. One unit of equipment value is USD 150 000. What does it means:

- SHS: One unit of equipment is composed of 375 items in a value USD 400 per item
- PUS: It is not specified (it does not make sense to do it for a couple of pilot application)

- PPS: If one unit of equipment is delivered as one item with a value of USD 150 000 per unit, either imported or made directly in Africa

This helps in analyzing the five distribution models recommended by the World Bank:

1. Distributor/ Dealer Network
2. Own Distribution/Direct to Consumer
3. Institutional Partnership
4. Franchise
5. Rental/ Leasing System

Definitions:

1. Distributor/ Dealer Network: a company sells its products through existing networks of generalist or specialist distributors in the rural/peri-urban market. This model represents a traditional private sector supply chain of consumer durables and usually engages a distribution hierarchy of at least two levels (distributor and dealer/retailer). The company's product is typically retailed in a basket of other related consumer durables.
2. Own Distribution/Direct to Consumer: a company maintains a proprietary distribution channel in which the products move from manufacturer to in-house storage facilities to a salaried/contacted sales force, which exclusively delivers company's products directly to the customer.
3. Institutional Partnership: a company partners with a relevant institution (local, national, international) to market the product to that institution's customer base or membership network. This could also include government schemes.
4. Franchise: a company offers franchising packages (including features, such as income opportunities, training, marketing support, financing) to micro-entrepreneurs who wish to be formalized retailers of exclusive company products.
5. Rental/ Leasing System: a company contracts or franchises to micro-entrepreneurs who set up a business unit. Principle of this model is explained with an example of a solar lanterns charging kiosk functioning (the micro-entrepreneurs either rent products out to consumers on an hourly/daily basis or sell the lanterns without a power source and offer a fixed fee for charging. Charging can be provided via on-grid power or alternative power generation - solar, diesel, etc).

Recommendation for product sales models:

The appropriate distribution model is highly dependent on the business characteristic, products offered, and market dynamics. The text below suggests a usage of different distribution models for different business characteristics (SHS, PUS, PPS):

Model recommended for SHS system: Own Distribution/Direct to Consumer (2)

Business characteristics	**Distribution Model**
• Existing SPC Factory with existing sales/marketing channels • Sufficient infrastructure to maintain affordable distribution/marketing	Own-distribution / Direct-to-customer model Suitable product range: Packaged products (not for single item sale); Suitable market dynamics: High or low density area; low-middle income brackets

Model recommended for PUS system: Institutional Partnerships (3)

Business characteristics	Distribution Model
• Existing SPC Factory with existing sales/marketing channels or infrastructure • Active public government bodies and private sector	Institutional Partnership Rental / Charging Station Model Suitable product range: Single or multi-product offering Suitable market dynamics: High density, peri-urban areas; low-middle income brackets

Model recommended for PPS system: Franchise Model Institutional Partnerships (4)

Business characteristics	Distribution Model
• Well-developed business channels throughout public and private sectors	Franchise Model Suitable product range: High tech products Suitable market dynamics: franchisee knowhow

5.3 Education

Education and training are much needed in communities in Africa. At the same time when negotiations concerning implementation of the above-mentioned projects are taking place it is necessary to start educational and training programs. We suggest using the following structure:

Business performance:

- Enterprise Architect - Enterprise Architect's role is to create and assist entrepreneurship framework of Self-Powered Communities in rural and peri-urban areas (in transition in developing countries).
  Enterprise Architect will integrate Housing and Services, Renewable Energy Enterprises, Micro and Small Enterprises into one sustainable economical and social unit. She/he has to develop community master plan and assist entrepreneurs in community how to develop business plan and rules, and how to demonstrate a feasibility of the solutions suggested.
- Financial Engineer - Financial Engineer's role is to demonstrate financial feasibility of Self-Powered Community in rural and peri-urban areas (in developing countries).

Financial Engineering methodology has to distinguish between financial operations "on the Wall Street" and in any rural and/or peri-urban community. Financial Engineer has to develop a financial plan and to prove its feasibility to banks, EU funds, and to other financial institutions. His/her demonstrate its ability to bring money to the community and to educate a community in management of a positive cash flow and financial sustainability, controls and audit.

Implementation:

- Engineering staff – its role is to transfer the most advanced renewable energy technology to African localities for all three Self-Powered Community Program segments: 1.Solar home system (SHS) development for rural and peri-urban areas, 2. Public utilities program research and pilot testing for future

dissemination, 3. Power plant system (PPS) assistance to cities and to national energy corporations in Africa

- Construction staff - its role is to perform construction services to the most advanced renewable energy technology in African localities for all three Self-Powered Community´s Program segments and to assist cities and national energy corporations to have a qualified staff, and to build new power generating units and new power grid connections
- Maintenance staff - its role is to perform maintenance services to the technologies and all three SPC segments mentioned above and to assist national energy corporations to have a qualified staff and to maintain operability of all energy units and new power grid constructed under the SPC Program.

Community´s motivation:

- Decision maker groups – education should be focused on understanding of the SPC Program and its added value. There will be difference among ruling groups in each specific area: rural, peri-urban, and in cities. The key and common theme for this education is electrification and consensus building among all public and private oriented groups in specific area in order to be ready to negotiate financing and sustainability of their electrification plans
- Public oriented groups - education should be concentrated on understanding of added value to their homes, schools, medical centers, and hospitals gained by SPC Program. Education should motivate people living in affected areas to participate in implementation and maintenance of SPC project.
- Private oriented groups - education should explain added value of electrification to new micro-entrepreneurs, and to any other entrepreneurs who expressed interest in being involved in the SPC Program.

6. What should be done

The world total population in 2011 is to stand at 7 billion and it will grow, mostly in Africa. The population of Africa has grown to more than 770 million in 2005. We have found some predictions suggesting 2.6-fold increase to 2 billion, by 2050 (including large migration from China, India and other countries).

Today, 3.3 billion people (more than half of the world's population) live in cities. In developing countries, 60 million people move into cities every year. This rate of movement is predicted to continue for the next 30 years.

Over the next 15 to 20 years, many cities in Africa and Asia will double in size. Most of these migrants will be living in slums in peri-urban areas (in run-down areas of a city characterized by substandard housing and squalor and lacking in security). The rest will live in rural areas.

It was the task of the SPC Road Map to analyze the general issues. Strategic feasibility study is oriented on technology aspects, business feasibility, project´s viability and sustainability in a very specific social environment.

What we are offering?

6.1 Assistance to AU programming methodology

We are ready to participate in development of the AU programming methodology; we are ready to assist the AU with development of SPC Program for Africa. We suggest referring to our AU RG project proposal done for the AU this year, and develop a parallel and much broader programming activities related to the SPC Program.

6.2 Assistance to national or regional governments

We are ready to assist national or regional governments in bringing the SPC Program projects into suitable locations in the AU member states; that includes any of the SPC Factory product (Solar home systems implementation, Power Utilities pilot projects implementation, and close cooperation with the national electric power companies or with big cities town halls to implement Thermal Turbine or Pyrolysis projects).

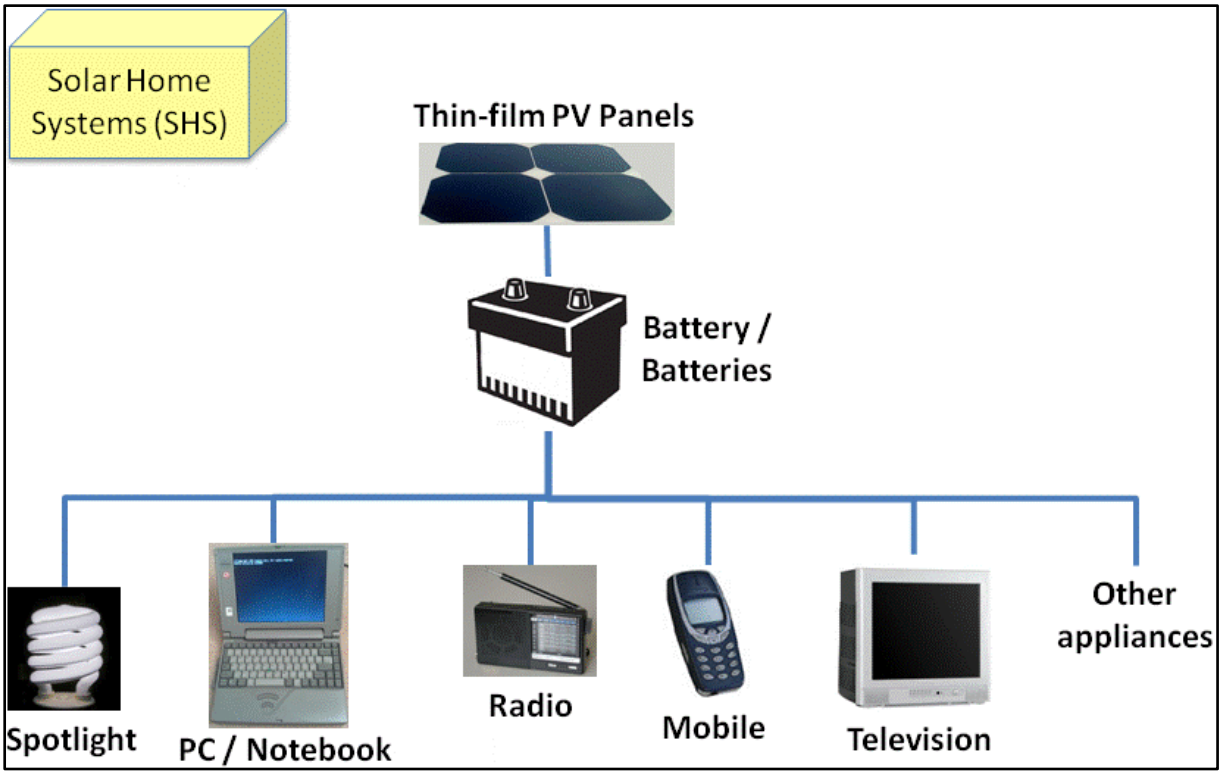
We are ready to participate on any AU Program aimed to RES investment and energy saving projects, and assist this project by our activities focused on user cases development: for families (children, mothers, and fathers), for schools, medical centers, etc.

6.2.1 Solar Home Systems

SHS is an alternative way of how to come to Africa with an effective and fast solution. The most advantage program in this field is the WB/IFC program "Lighting Africa" and other programs with concentration on household electrification, and new housing development for poor people (e.g. "The $300 House" program).

There are two ways for SHS implementation described in this sub-chapter. One is oriented on family needs, and second on micro-entrepreneur's role in community.

SHS for family needs:



Solar Home Systems will be produced in several variants. These variants will be calculated and optimized for specific usage.

For example:

SHS-1 Variant A: Basic Standard (one panel for 3 spotlights, mobil, and recharging for approximately 4 hours in night)

Electric appliance	*no. pieces*	*purpose*	*Power per unit [W]*	*Power [W]*
Spotlightings	3	one for children's to learn and do their homework, one for handiwork and one for cooking	10	30
radio power supply	1	to lisen to the radio	15	15
mobile charging	1	To charge mobile phone	35	35
batery recharging	1	To save electricity for night usage	20	20
			Overall Power	100

SHS-2 Variant B: High standard (Six panels for 5 spotlights, radio, fridge, TV, mobile, notebook and recharging for approximately 6 hours in night)

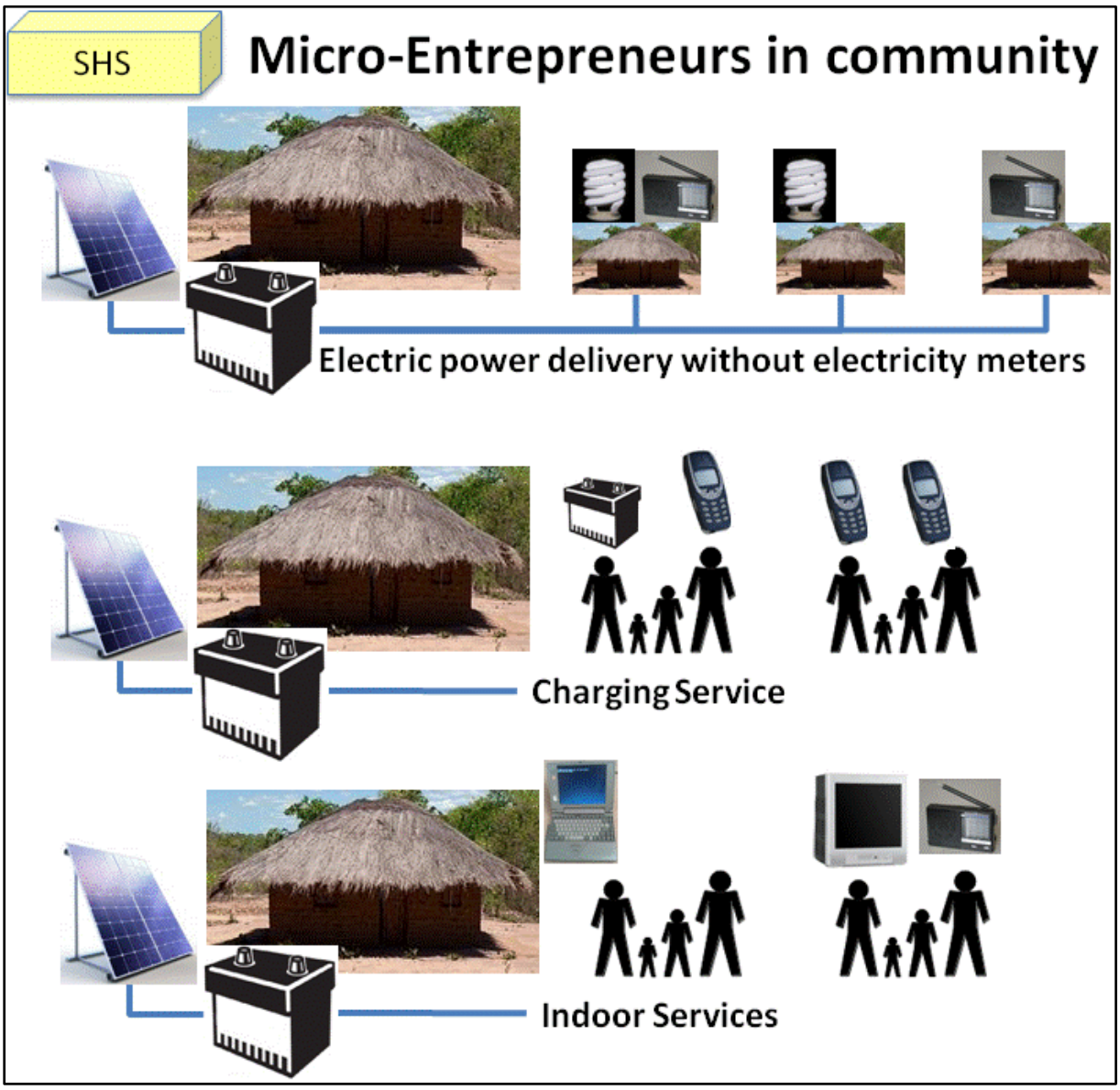
Electric appliance	*no. pieces*	*purpose*	*Power per unit [W]*	*Power [W]*
spotlightings	5	one for children's to learn and do their homework, one for handiwork and one for cooking	10	50
radio power supply	1	to lisen to the radio	15	15
mobile charging	1	To charge mobile phone	35	35
batery recharging	1	To save electricity for night usage	120	120
television power supply	1	to watch television	150	150
fridge power supply	1	to preserve food	150	150
notebook power supply	1	to power notebook	80	80
			Overall Power	600

Variants will be prepared and once prepared, distributors will receive SHS Variant's table to help customer in decision what to buy.

Solar Home Systems (SHS)	Thin-film PV Panels	Battery / Batteries	Price	Size	Wp	Spotlight	Radio	Mobile	Television	Other appliances
SHS-1 Variant A	1 (100 W)	20 W	75 USD (1.5 USD/Wp)	1.2 x 0.6 m	50 Wp	3 (1 spotlight max.10 W)	1 (max.15 W)	1 (max.35 W)		
SHS-1 Variant B	6 (600 W)	120 W	450 USD (1.5 USD/Wp)	2.4 x 1.8 m	300 Wp	5 (1 spotlight max.10 W)	1 (max.15 W)	1 (max.35 W)	1 (max.150 W)	Fridge (max.150 W) Notebook (max. 80W)

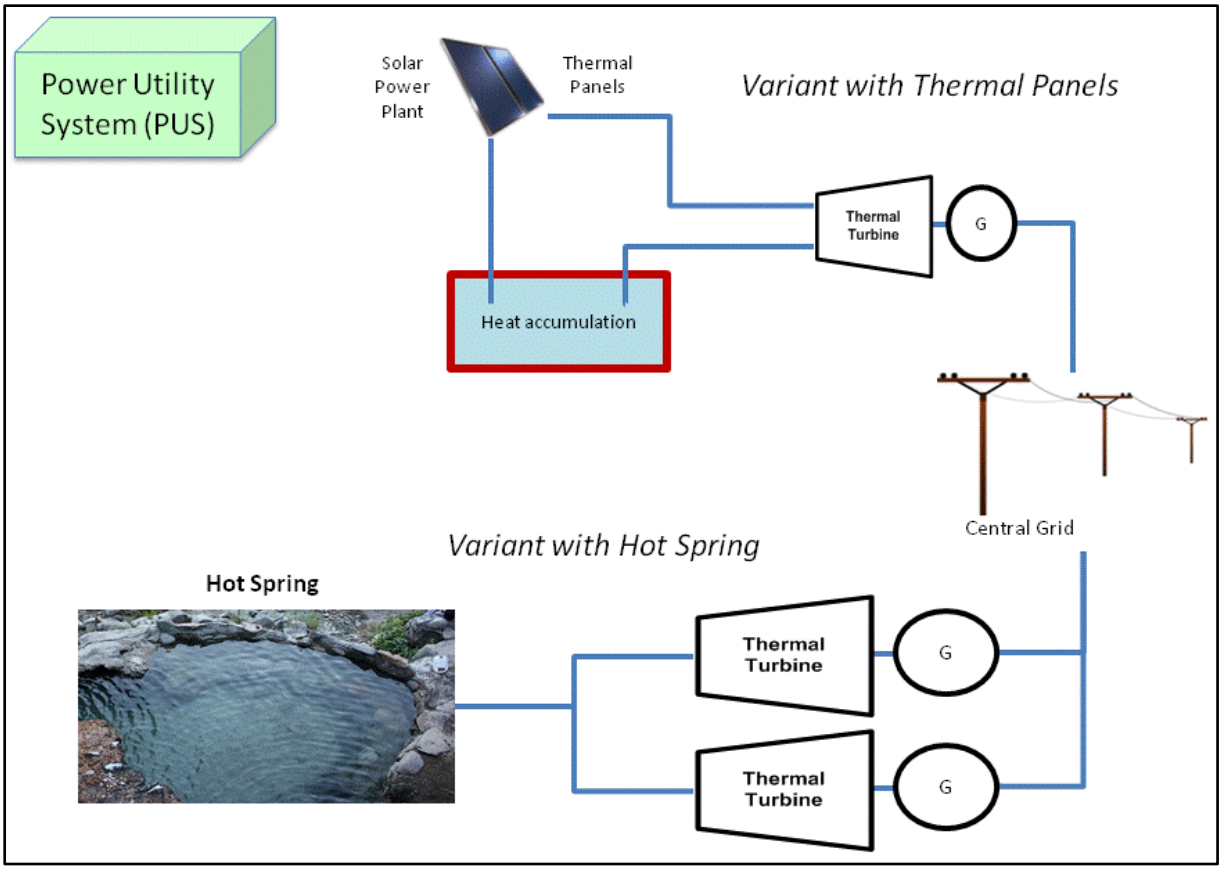
Contemporaneity coefficient is 0,5. (Contemporaneity coefficient is defined as the ratio between maximum theoretical demand and real demand.

SHS and micro-entrepreneur's role in community:

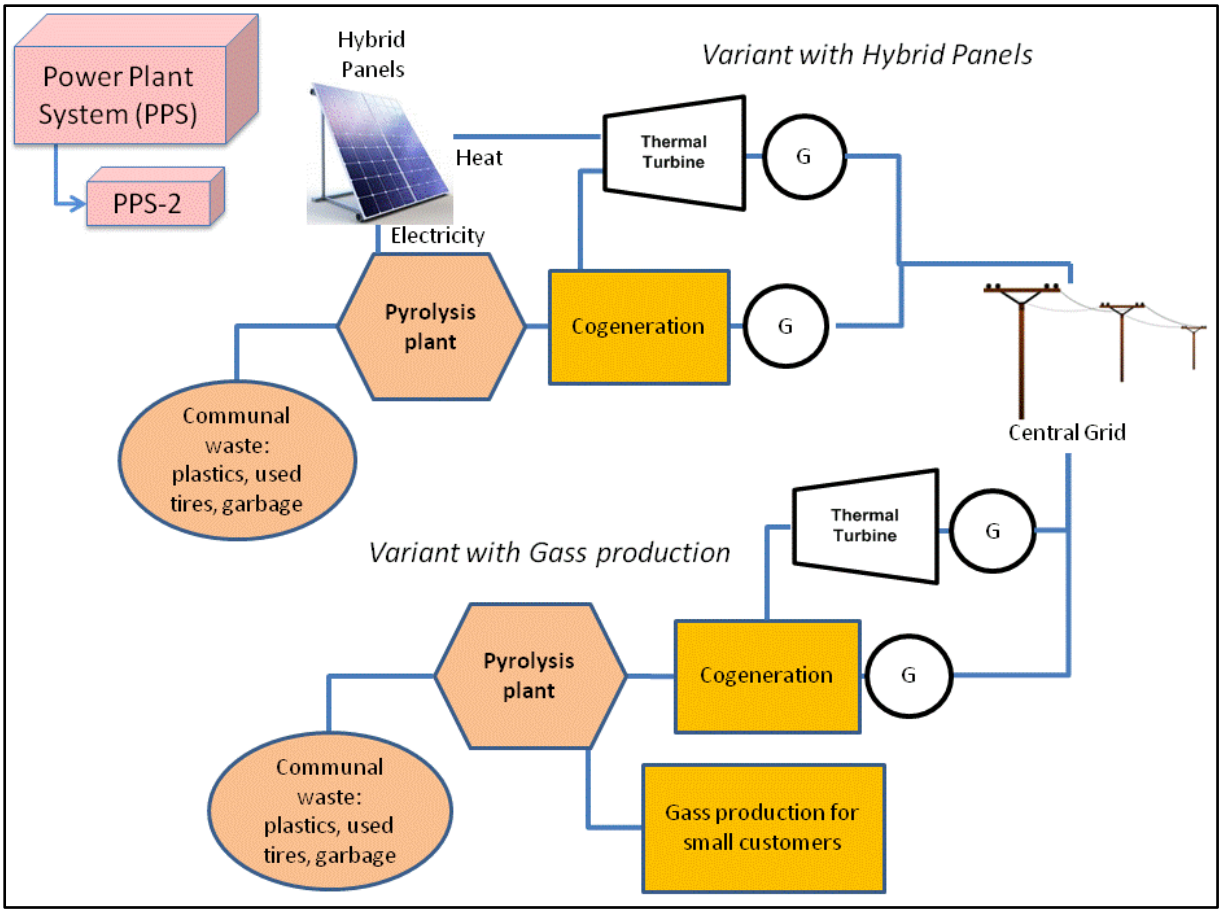


6.2.2 Power Utility system – Thermal Turbine and Pyrolysis system modification

PUS is an alternative for Africa to seek the most proper way to motivate people from municipalities; we are referring to a motivation process coming from "bottom up." We are also referring to pilot projects in a sense of developing and implementing best organizational structure for dissemination SPC technologies.



Power Utilities are great opportunity for "bottom up" electrification, i.e. from local communities toward the centralized distribution networks. Opportunities for testing exist in Africa implemented projects of Energy Utilities. An example are our findings made during preparation of proposal submitted to the AU under the project of "Renewable and Sustainable Energy for Self Powered Communities in Rural and Peri-Urban areas in Africa (SPC Project)" in May, 2011.



Power Utility system – Thermal Turbine (TT): we are ready to open pre-investment negotiation on the TTs application for a specific client, and start cooperating on inputs data development to define a specific business case on a strategic feasibility study level.

Power Utility system – Pyrolysis system (PYS): we are ready to open pre-investment negotiation on the PYSs application for a specific client, and start cooperating on inputs data development to define a specific business case on a strategic feasibility study level.

6.3 Assistance to private sector

We are ready to be in close contact with private sectors in any member states of the AU and to add value to development of electrification.

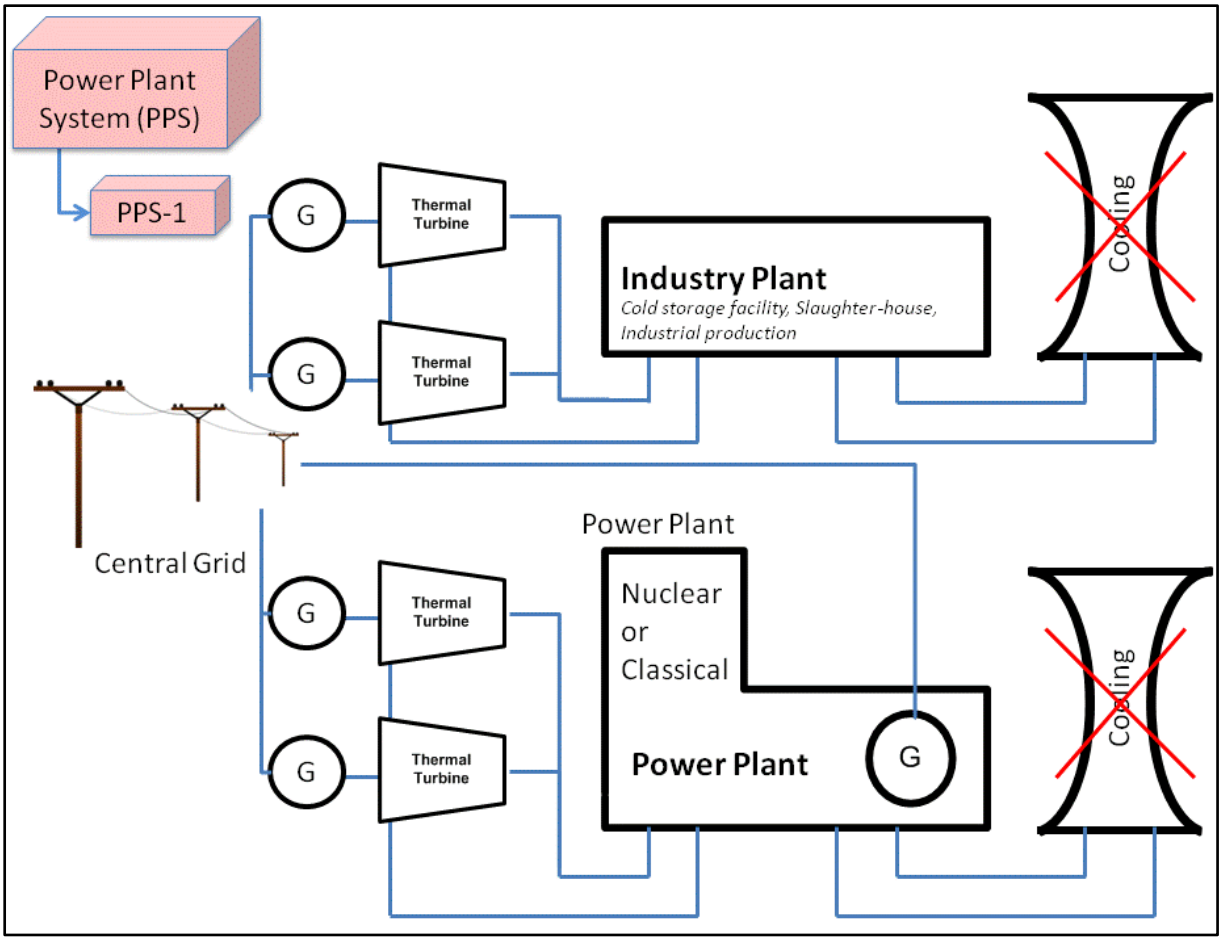
PPS is an alternative fully oriented on the most modern technologies and on professional bodies fully involved in energy business in Africa. In this case a "top down" approach following respective national energy policies and with development programs applies.

We are proposing two technologies:

- Power Plant System (PPS) – Thermal Turbine modification
- Power Plant System (PPS) – Pyrolysis system modification

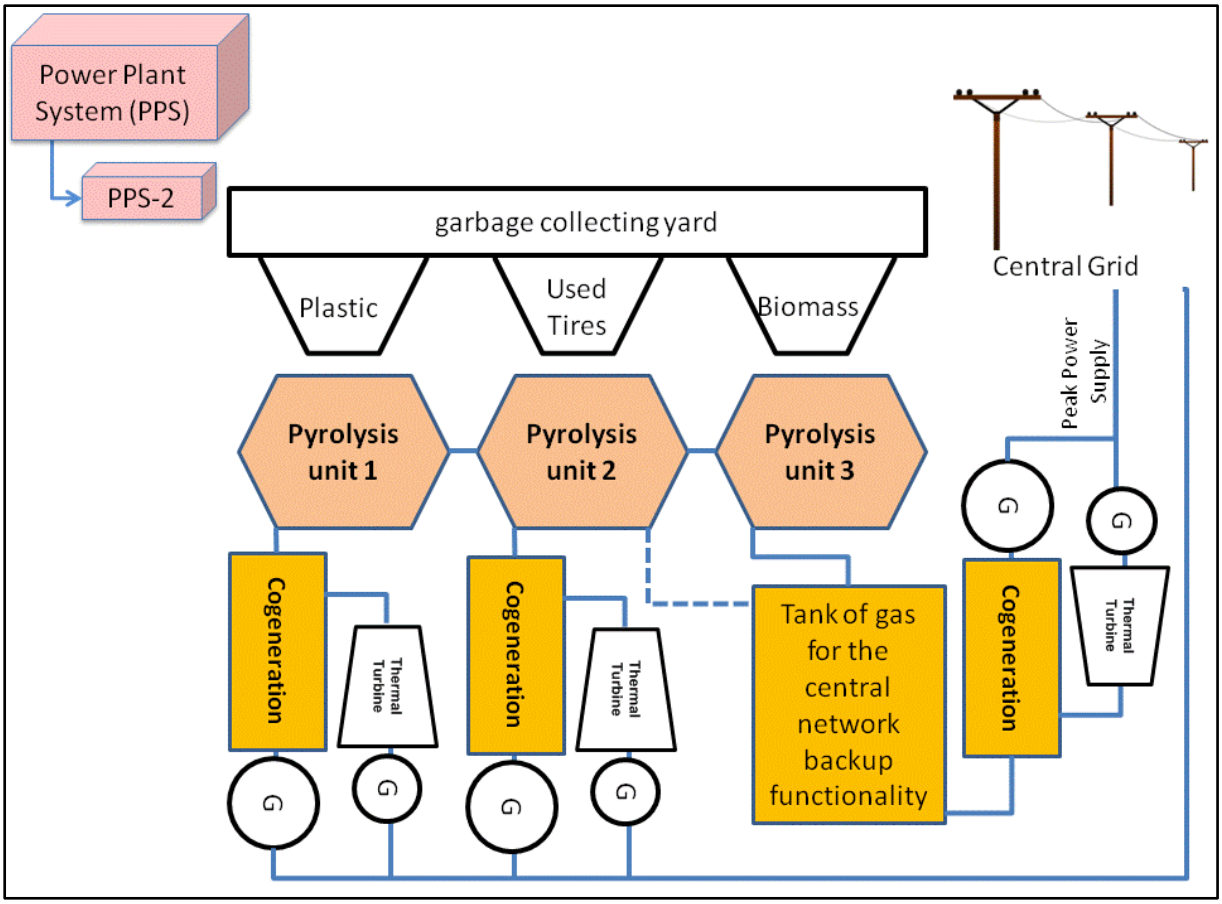
6.3.1 Power Plant System (PPS) – Thermal Turbine modification

Thermal Turbine system technology development (industrial design) is being ready to open pre-investment negotiation with potential clients from private/semi public sectors (power or industrial plants owners, and with other producers of thermal heat waste).



6.3.2 Power Plant System (PPS) – Pyrolysis system modification

Pyrolysis system technology development (industrial design) is being ready to open pre-investment negotiation with potential clients from private/semi public sectors resenting both technology producers (PYS segments manufacturers), and waste collecting (selected garbage, plastic waste, used tires etc.) private/semi public sector´s companies.

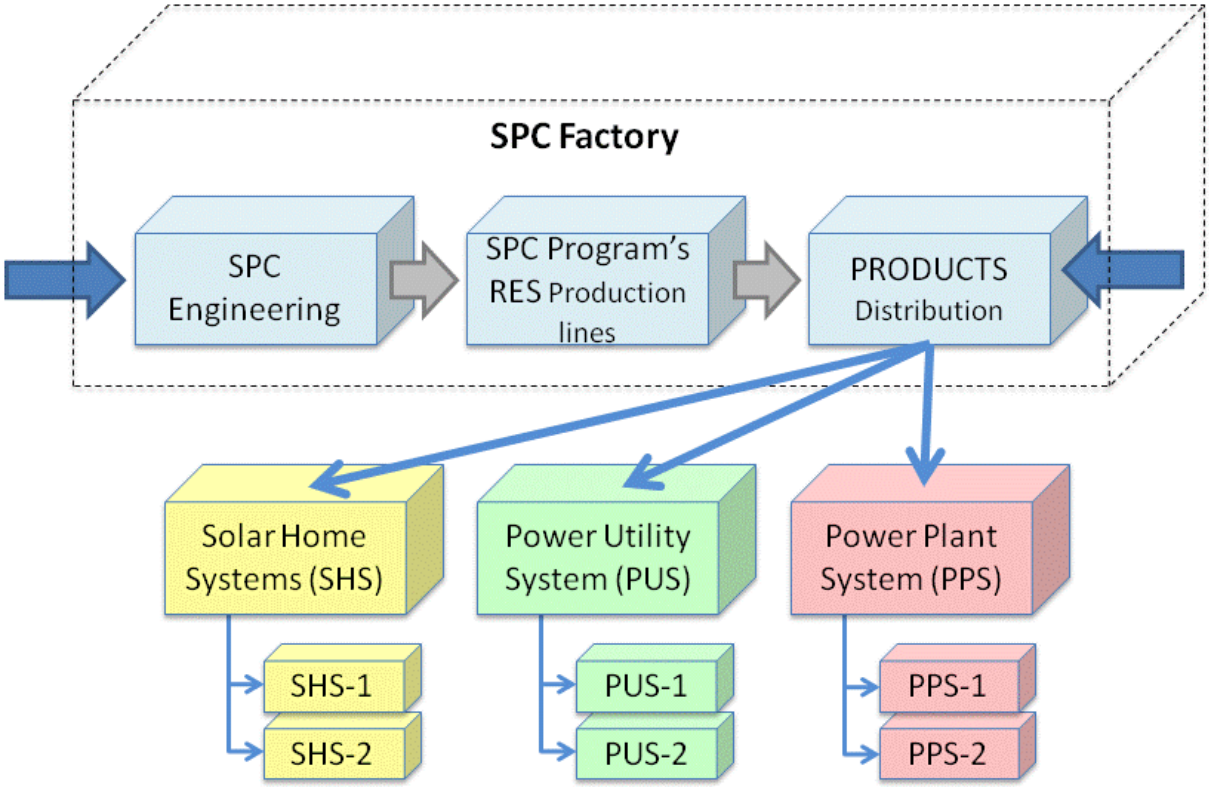


6.4 The biggest readiness to start up technological pilot projects

On behalf of previous discussion with representative bodies of new ecologies presented in the SFS there are presented four proposals of pilot project that can be deeply discussed:

- SPC Factory; thin –film PV panels production line in Africa
- Thermal Turbine implemented into hot springs for electric power generation
- Thermal Turbine implemented into electric power generation process of a power plants
- Pyrolysis units implementation in connection with waste gasification of residuals from rice post harvest processes

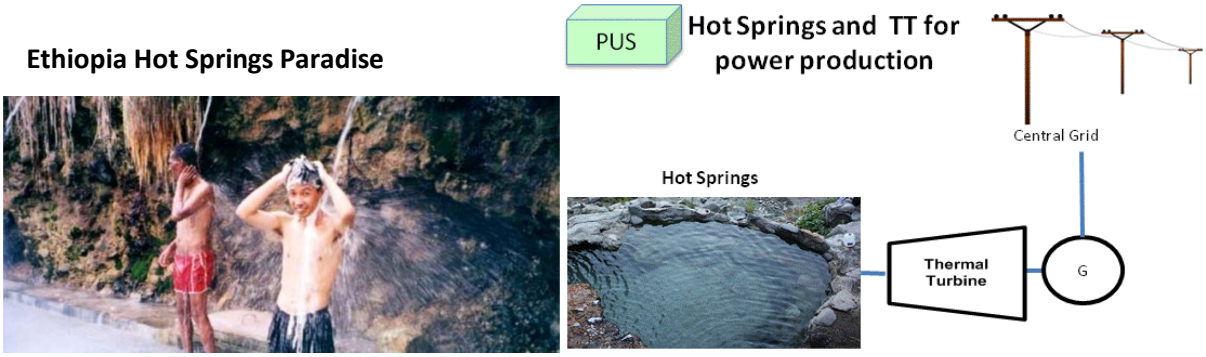
6.4.1 Thin-film PV panels production line in Africa



Pilot project implementation should be discussed on a governmental level. African governments should be addressed. We are ready to open a dialog with public and private decision maker's bodies, with international financial institutions and with local banks.

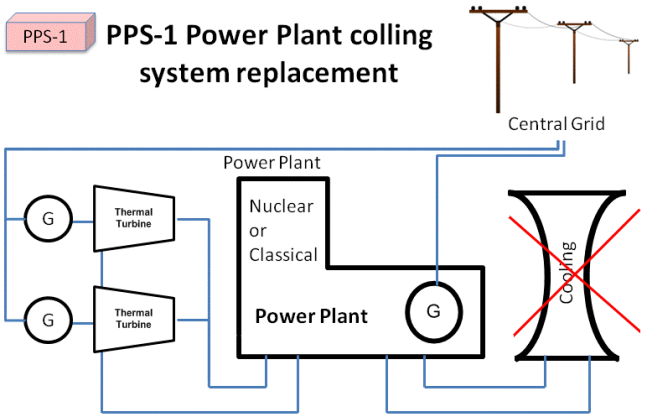
SPC Factory pilot project should be openly discussed with target groups to motivate them to participate in this project and to interest final beneficiary.

6.4.2 Thermal Turbine implemented into hot springs for electric power generation



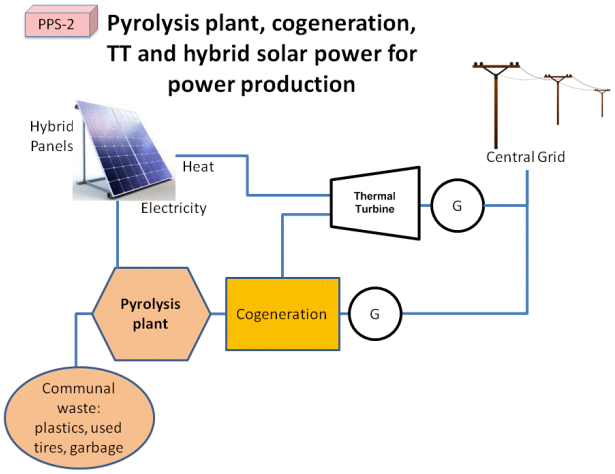
Pilot project implementation should be discussed on a town hall's level of responsibility (e.g. Addis Ababa's hot springs). We are ready to open a dialog with such owner to look for the best way of a pilot project implementation (e.g. consensus on technology, risks elimination by performing a research project, financial structure, and project life cycle's ownership structure development).

6.4.3 Thermal Turbine implemented into electric power generation process of a power plants



Pilot project implementation should be discussed on a power plant owner's level of responsibility. We are ready to open a dialog with such owner to look for the best way of a pilot project implementation (e.g. consensus on technology, risks elimination by performing a research project, financial structure, and project life cycle's ownership structure development).

6.4.4 Pyrolysis units implementation in connection with waste gasification of residuals from rice post harvest processes



Pilot project implementation should be discussed on a central or local governmental level. African governments should be addressed. We are interesting in a pilot project with very simple "waste" inputs (it would be complicated to start with garbage or any other waste collection in a city and/or peri-urban areas).

On the picture above we can see "hills" of residuals from rice post harvest processes in Nigeria. We are ready to open a dialog with local government, and open pre-project activities.

6.5. Conclusion

We are ready to cooperate on:

1. Development of SPC Program methodology with AU and EU and other interested parties
2. Feasibility study for a specific SPC Program Project for national/regional governments
3. Pilot Project development

For further information, please contact us at email address office@5profres.eu

ANNEX A: Technology background – Letters of Intents

RM defines Self-Powered Community for rural and per-urban areas electrification needs, and SFS is analyzing opportunities of new renewable energy sources, systems and technologies for Sub Sahara Africans states.

Both RM and SFS are based on know how coming from Europe. All the most important new renewable energy technologies involved in both studies are documented by Letters of intent authorizing 5P Platform to negotiate with the AU and its member states and regional governments as well as with private parties to look for the best ways how to start implementation of the SPC program and its individual segments.

The following letters of intent are:

A.1 Naira Industry Ltd.

A.2 Centipede a.s.

A.3 Arrow Line a.s.

A.1 Naira Industry Ltd.

N A I R A
Industries

Prague Project Portfolio Planning Platform
Mr. Zdeněk Chalus, Ph.D.
Parizska 17
110 00 Prague 1
Czech Republic

chalus@seznam.cz

Cc: To whom it may concern

February 14, 2011

L E T T E R O F I N T E N T

Re: Effective photovoltaic energy utilization in the Ethiopia/African Union countries

Dear Mr. Chaluš,

Based on our previous communication we would like to offer smart photovoltaic (PV) technology of utilization environmentally harmless resource of electric energy at low costs and competitive efficiency to the country of Ethiopia/African Union countries.

Herewith, we present our serious intention to find a local business partner and to offer to the government of Ethiopia/African Union countries building and integration of small manufacturing plants for thin-film PV panels and smart industrial applications.

As such we are prepared to cooperate in developing of comprehensive strategy, to deliver solution and realization for the energy coverage tailored to the needs of your country. Naturally we are also fully dedicated to provide further long term assistance to required extent.

The framework of the cooperation scope we are prepared to discuss:

- Building up of distributed thin-film PV modules manufacturing premises (in cooperation with local business partners)
- Assistance in PV energy utilization system continuous improvement
- Knowledge sharing in the area PV research and development with selected local universities

You decide whether to spend EUR 10 million of your money on one annual supply of panels or to invest it into your own production facility with the same output.

We offer:

- Licensing PV production lines based on our proprietary technology to local production premises
- Cooperation with local engineering companies who realize constructions of the power plants
- Consulting and advisory services concerning our technology
- Training local engineers and local less-qualified labors

NAIRA Industries, a.s. ▪ Žitná 2, 120 00 Praha 2, Czech Republic ▪ +420 225 372 030 ▪ info@naira-industries.eu ▪ www.naira-industries.eu

Key benefits for the country of Ethiopia/African Union countries:

- To build up local production based on offered technology means dramatically lower costs for the local PV panel product user and no negative environmental impact at the same time.
- The raw materials and photovoltaic modules do not contain toxic or hazardous agents and uses local sources of raw materials
- The technology of PV modules manufacturing conform to the highest environmental standards
- The manufacturing process can employ less-qualified labor therefore it helps to reduce unemployment – build up local production centre generates new jobs (approx. 90 jobs per production line)
- The PV panels are specially designed for "Sun-belt countries" and efficiency of the energy production is stable and not reduced even in high temperatures or diffuse light

Offered photovoltaic technology is based on silicon thin-film layers (amorphous and/or proto-crystalline). It is one of the most innovative technologies for production of economical effective and environmental friendly solar cells.

- It is not raw materials intensive (production raw materials are low cost and easily accessible), overall environmentally harmless and uses local sources of raw materials (glass, technical gases),
- It is free of dangerous or toxin environmental contaminators (such as cadmium for example),
- It generates electric energy at low costs
- and with outstanding efficiency.

Moreover, low initial investment is required for the construction of manufacturing plants. Initial investment costs of single production line with annual capacity 7 MW is about 10-11 mil. EUR (13-15 mil. USD). Production capacity can be easily upgraded to 10+ MW/year in the future.

We can send you a technical specification with cash-flow details upon your request.

	Annual Capacity	New Jobs
Single line	7 MW (10+MW in next 4 years)	approx. 90
Dual line	14 MW (20+ MW in next 4 years)	approx. 160
Delivery time	technology delivery:	10 – 12 months
	initial on-site installation:	2 – 4 months
	tuning, training of employees, semi-production:	3 – 4 months

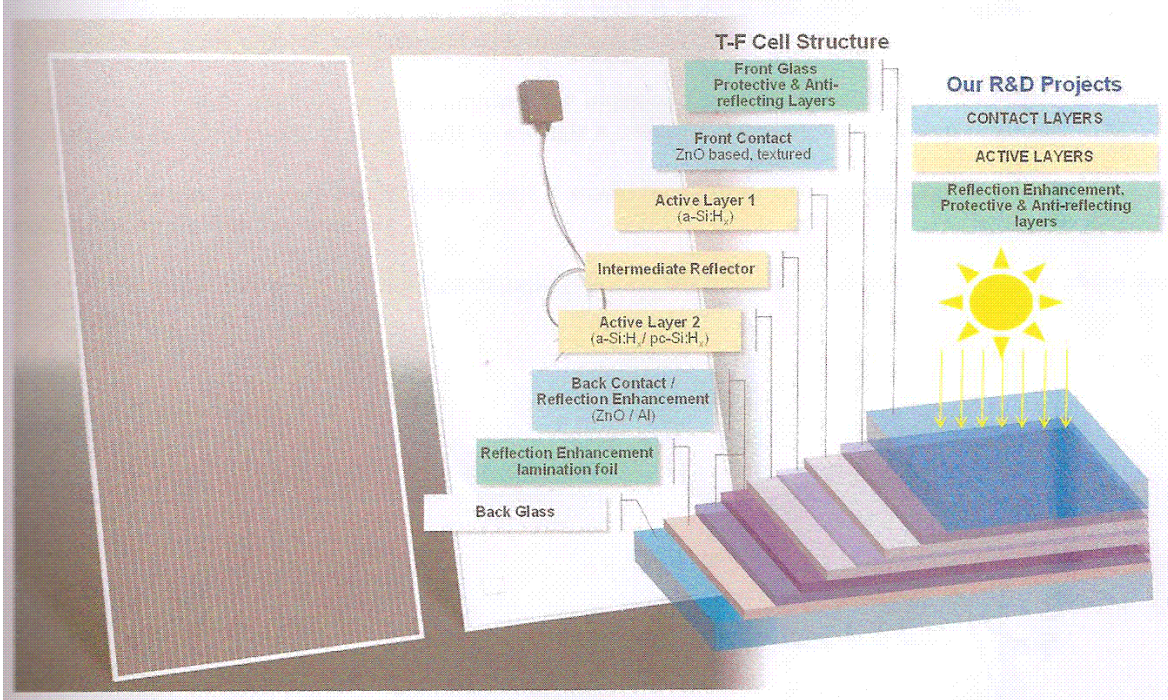
Technology key benefits summary:

- True environmentally friendly solar cell/panel production technologies
- The production process does not require the use of robotics or automated production lines and generates new jobs
- Production process uses local raw materials (glass, technical gases)
- There is no need for a sophisticated assembly process and less-qualified labor can be therefore employed.

- The production process is designed to be modular and can be easily replaced or upgraded.
- Manufacturing costs USD 0.7 / W_p today and expected less than USD 0.5 / W_p in four years

Product key benefits summary:

- Thin-film silicon-based PV cells with the current efficiency about 7% today (expected 10% in four years)
- PV cells and panels which:
  - do not contain any environmentally harmful substances;
  - has stable energy production even in high temperature environment and diffuse light;
  - have a low demand for raw materials – the raw materials used in the manufacturing of the cells/panels are, and will continue to be, abundant and widely available;
  - can be easily recycled – after the end of the panel's service life (approximately 25-30 years), the panel can be easily melted down and purified and used as a raw material for the production of new panels or other products.



Picture: our PV panel structure

To be able to maintain top quality and continuous improvement of our technologies we operate our own R&D subsidiary and cooperate with notable Czech scientists, experts in the area of photovoltaic technologies. Likewise, we also possess an strategic partnership in the area of research and development of photovoltaic thin-film technologies with major Czech Universities as Charles University, Czech Technical University, The University of West Bohemia and Academy of Sciences of the Czech Republic, well known leaders at this field of academic science in Europe.

Last year NAIRA Industries prepared a project of establishing a Czech Center of Excellence in the area of photovoltaic technologies in cooperation with this respected university.

As for production process, it does not require special inputs not even generates significant waste. Unlike the crystalline technologies offered production lines do not require robotic operational/assembly centers, it means there could be employed local workforce in the plants and lot of new job opportunities could be generated there. Moreover, our specific technology and our approach do not place specific demand of distribution system infrastructure not even huge high costs power plants.

Concluding all this, it could be assumed as an ideal solution for countries and regions where current electrification and power plants are insufficient, power costs are too high to supply energy to each household, where use of traditional electric energy resources is limited or where the demand for energy must be satisfied fast and easy at reasonable costs and of non-traditional/alternative resources.

As to the above and with regards to the global goals of your country National Energy Policy, which places emphasis on non-traditional/alternative electric energy resources utilization, we strongly believe our company could effectively contribute to the power supply problem solution of the Ethiopia/African Union countries.

We strongly believe our cooperation could result in an excellent contribution to the country of Ethiopia/African Union countries energy program as well as a good start of long term partnership on more levels such as public utilities, research and education and common business as well.

Therefore we kindly ask you to communicate our intention internally as well as to local parties it may concern and possibly check an opportunity to escalate it towards appropriate government representatives.

If there are needed any more details at this stage it would be a pleasure to answer your questions or provide necessary clarification any time.

Also, as intended during our previous communication, we are prepared to discuss our offer as above into more details.

Yours faithfully,

Suzana Lieblova
Chairman of the Board

Rostislav Frys
Member of the Board

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5P - Prague Project Portfolio Planning Platform; VAT number: CZ41830539

Mr. Zdenek Chalus, Ph.D.

Parizska 17, Prague 1, 110 00

Czech Republic

Chalus@5pforres.eu

Cc: To whom it may concern

May 15, 2011

LETTER OF INTENT

Re: Effective utilization of Thermal Turbines in member states of the African Union

Dear Mr. Chalus:

Based on our previous communication we would like to offer effective utilization of Thermal Turbine technology of environmentally harmless resources of electric power at a low cost and competitive efficiency to the member states of the African Union.

Herewith, we present our serious intention to find a local business partner and to offer the governments of countries of the African Union import and implementation of Thermal Turbine technology.

As such we are prepared to cooperate in developing a comprehensive strategy, deliver solution and implementation of electrification projects to the needs of specific countries. We are also prepared to make a commitment for an additional long-term assistance to the extent required.

The scope of our cooperation we are prepared to discuss includes the following:

- RES Investment Strategy for Africa (Thermal Turbine technology)
- Import and implementation of Thermal Turbine technology (in cooperation with local partner)
- Knowledge sharing in application of Thermal Turbine technology

The key benefits for member states of the AU:

- Use of a low-potential (waste) heat for generation electric power
    - The source of low-potential heat is solar energy
    - The source of waste heat are operations requiring cooling (such as power plants, refrigeration units, large enterprises, etc.)
- The technologies of Thermal Turbine complies with the highest environmental standards

- The implementation and maintenance of Thermal Turbine technology require hired staff, thus helping to reduce unemployment
- Thermal Turbine represents a new technology which can benefit member states of the AU in electrification of their countries and development of energy sector
- Direct deployment of Thermal Turbines in systems of power generating capacities of the central electric power distribution grid anywhere in Africa (e.g. grids owned by national electric power utilities)

Principles of Thermal Turbine technology:

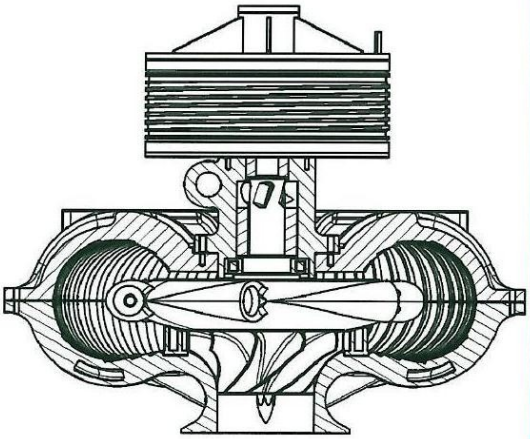
Background:

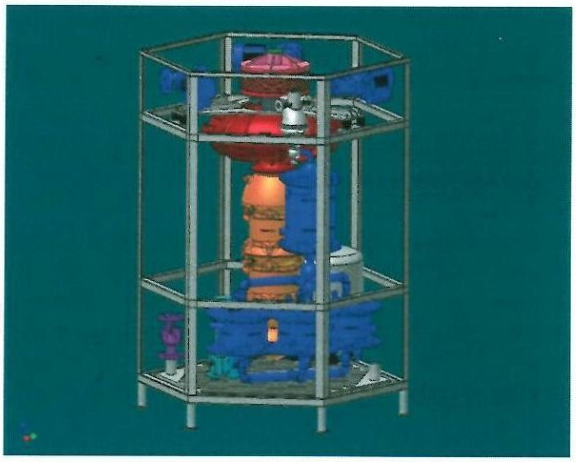
- Czech companies have over 50 years of tradition in development, manufacturing, and operation of Thermal Turbines in power generation industry
- Development of a prototype of Thermal Turbine with the capacity of 20 kWe has been completed

Application:

- Electric power generation
- Water heating (for heating or cooling of buildings)

Simplified illustration of the principle, operation and technical solution of Thermal Turbine





Thermal Turbine performs conversion of the accumulated heat (reaching 90°C) into electric power and it has an output of up to 20kW per single unit. If there might be demand for higher power output two or more Thermal Turbines can be combined into one system. Thermal Turbine has a shape of a 2 meter high hexagon which is 1.2 meter wide and weights 500 kg.

The price of the first Thermal Turbine delivered and installed is USD 120,000 and it significantly (up to 20 or 25%) drops with ordering of additional units. Time required for manufacturing and delivery of Thermal Turbines (say a set of 10 or more units) is about 3 to 4 months and we are able to accept orders for pilot projects initiatives in Africa starting with October, 2011.

The basic schema of Thermal Turbine (TT) application in power generation sector:

- TT – Solar Power Plant with Thermal Panel and Heat accumulator
- TT – Solar Power Plant with Hybrid Panel and Heat accumulator
- TT – Hot spring

- TT – Power Plant colling system replacement
- TT – Industry Plant colling system replacement

Technical data:

- Thermal Turbine is a Compaq unit with high reliability
- Thermal Turbine has a clearly defined service schedule throughout its entire life cycle
- Handling, maintenance, or transfer of Thermal Turbines don't require any special measures

Warranties (applicable to EU countries):

- Sustainable and constant electric power output
    - Drop in the power output to 90% of the original output not earlier than after 10 years of operation
    - Drop in the power output to 80% of original output not earlier than after 25 years of operation
- Three years warranty on the equipment as well as installation of units
- Overall life expectancy of 25 years when service schedule has been followed

It will be necessary to set forth warranties for AU countries as detailed survey and research of specific conditions for application of this technology in individual member states of the AU are identified and advantage of having an experience with pilot operation on the continent becomes available.

In a nutshell, it can be concluded that the Thermal Turbine technology is an ideal solution for countries and regions where current electrification and power plants are insufficient, electric power rates for households and other smaller users of electricity are too high, or where an option for using traditional electric power sources is limited. The same also applied to situations where demand for energy must be satisfied quickly, easily, and at reasonable cost.

Therefore, we kindly ask you to communicate our offer internally as well as to local parties in member states of the AU, investigate potential opportunities for application of Thermal Turbine technology and communicate our capabilities to governmental agencies in AU member states. We believe that TT system is an innovation with high-tech capacity to speed up National Power Network building in any AU countries.

Be assured that we are ready to provide you or parties you might work with any additional or detailed information as they might be needed and to answer any question you or they might have.

Yours faithfully,

Mgr. Iveta Nováková
Chairman of direction
CENTIPEDE, a.s.

A.3 Arrow Line a.s.

Arrow Line, a.s.

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Prague Project Portfolio Planning Platform

Mr. Zdenek Chalus, Ph.D.

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Czech Republic

Chalus@5pforres.eu

Cc: To Whom It May Concern/ Letter of Intent

April 15, 2011

Dear Mr. Chalus,

In a follow up to our discussion we would like to offer our pyrolisis system utilizing renewable sources of energy to generate electricity to your potential partners and clients in member states of the African Union.

We envision potential cooperation in the following areas:

- Investments into Renewable Energy Sources (RES) namely in pyrolisis technology fitting the specific needs of the AU member states
- Import and installation of Pyrolisis system in cooperation with local partners within the AU
- Sharing of know-how with local partners in planning, installation, and operational stages

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Zapsána v Obchodním rejstříku u Krajského soudu v Ostravě, oddíl B vložka 2175

Specifically, we offer:

- Demonstration of our pyrolisis system and its operation in the Czech Republic
- Consulting and cooperation with local engineering companies which are involved in designing and installation of any contemporary technologies for RES using power plants as well as training of personnel installing, operating, or maintaining this equipment.

Benefits of this technology include:

- Use of waste for generating electric power (e.g. plastic waste, used tires, sorted out communal waste, biomass)
- Pyrolisis system technology complies with the highest environmental standards
- The system might be deployed directly, independently of central power grid or to support it
- By using waste this technology also helps address other environmental issues
- The system is not depended on outsider sources of electric power, therefore can be installed anywhere
- Higher potential than when burning biomass
- Twice higher efficiency when compared to burning communal waste
- Operation of pyrolisis system encourages and motivates development of waste collection yards and processing of waste in areas where it is currently thought that issue of waste management in large urban areas and their sub-urbs is not possible.

Principles of operation of PYS system

Application:

- Electric power generation
- Procession of municipal waste
- Processing of biomass
    - Waste (for example, from harvest of rice, sugar cane, etc.)
    - Fast growing timber
- Possible combination with thermal turbines taking advantage of co-generation

Developed unit sofa pyrolisis system have power generating capacity of 250 kWe and can be used for power generation as well as for disposal and use of waste.

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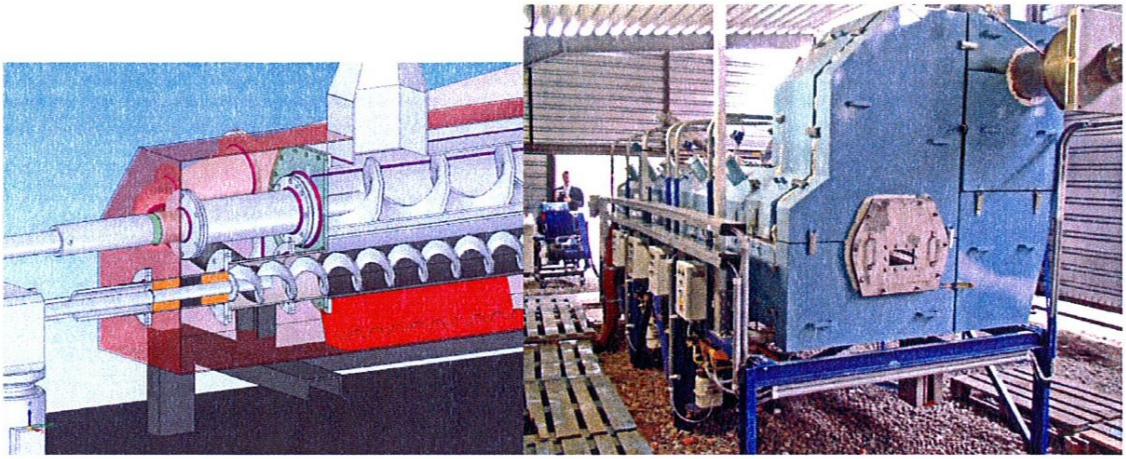

Thermal break-up of waste (gasification) with absence of oxygen and with the output of 250kW of electric power generation per single unit. More units can be combined in one system.

Dimension of a unit: 3 x 2 x 3 meters. Weight: 250 kg. Price per unit: USD 1 400 000 with volume discount of about 20%. Delivery time about 12 months starting with orders placed in October 2012. The time necessary for administrative, regulatory compliance, and logistical preparations of the pyrolisis system installation in peri-urban areas will require more than one year and must be completed at the time off placing an order.

Possible combinations of pyrolisis units:

- PYS – Pyrolysis plant, cogeneration and TT for power production
- PYS – Pyrolysis plant, cogeneration, TT and hybrid solar power for power production
- PYS – Pyrolysis plant, cogeneration, TT for power production and gass production for small customers
- PYS – Pyrolysis plant, cogeneration and TT for power production with gass production for the central network backup functionality
- PYS – Pyrolysis units, cogeneration and TT for power production with gass production for the central network backup functionality

Pyrolisis unit is a compact, highly reliable system with life cycle expectancy of 25 years. The guaranteed performance is no less than 90% of the original output. Specific manufacturer's warranties (now 2 years for the system and its installation in the EU countries) might be modified for

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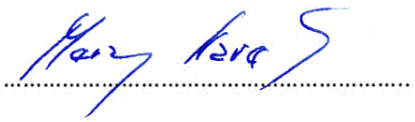
the AU member states based on research of country-specific conditions and requirements in individual states.

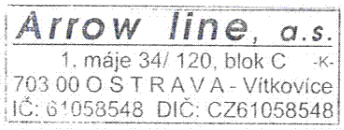
We will be very happy to provide you, your partners and/or governmental agencies in Africa with any additional information as you will represent our technology and services to them.

With best regards,



Karel Merany

předseda představenstva, ředitel



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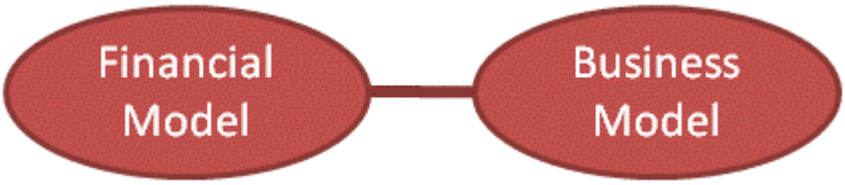
ANNEX C: Financial Models Calculations

Financial models calculations is the task of building a virtual conception (a model) of an opinion and decision making situation on strategic and tactic levels. Financial modeling assists business program/projects portfolio and so business activities are inspired and regulated by monetary rules.

SPC Methodology (see Chapter 1.2)



Business Model: see more in Chapter 1.3
Financial Model: see more in Chapter 4.1

Financial calculations demonstrate our readiness to apply SPC Methodology to any program/project case mentioned in this SFS.

Sample project's financial models are prepared and will be sent by request
(email: office@5PforRES.eu). Financial models are as follows:

- SPC Factory Financial Model
- Thermal Turbine Financial Model