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Green Energy
AHMED ISMAIL MEGAHEH ABDALLAH - Egypt

12-In-One system to achieve the millennium development goals

New eco- friendly technology for rural development and poverty, hunger eradication, specifically tailored for those define as base of the pyramid



12-In-One System to achieve the Millennium Development Goals

New eco-friendly technology for rural development and poverty eradication

Presentation

by Ahmed Ismail Megahed Abdallah

12-In-One System is an affordable, cost-effective, eco-friendly, solar powered system. It is designed to fulfil up to 12 functions: heating, sterilizing, distilling water, disinfecting, drying food, grain and wood and smoking crops. Consequently, the use of the System allows improving health, increasing food security and income generating.

Differently from the other mono-function comparable products that are weather dependent and usable for a brief period of the year, 12-In-One System is specifically tailored to the conditions of isolated rural communities and small-scale farmers, even if affected by biological and chemical water pollution. Despite its affordability and simple design, it is equipped with many technical innovations, not even available in the comparable existing solar-energy devices.

12-In-One System has many different uses. It can serve for water purification: when water is biologically or chemically contaminated, it works as a sterilizer or a distiller. During the rainy season and harvesting season it can be used as food, grain and wood dryer. In cold regions it can be used for spaces heating. It can be also used as a conventional stove when quick cooking is needed. Finally, it can be always used for heating water and for grain disinfestations and in agro processing industries.

12-In-One System performance (efficiency per unit, per day) was optimized to reduce size and cost, recycling the exhausted heat to reduce power need. The system reliability was increased by using 2 local sources of power (at night, or when solar intensity is not sufficient it can be powered by local fuel) enabling the system to achieve optimal performances in most climates and making it usable during all the year.



What problem does it solve?

The innovation, thanks to its many different functions and innovative technology, contributes to achieve directly some specific UN Millennium development goals and to provide indirect support to the further goals relating to livelihoods enhancement. In particular, the System allows solving in a direct way the problems related to: water contamination, hunger, post-harvest losses, energy scarcity.

Rural communities, especially the most isolated, are often affected by lack of access to safe and pure water. This is cause of malaria and other diseases and generates negative economic effects, reducing people's productive time and increasing poverty. According to UN data, 1.4 billion people lack of safe and reliable water, and water shortage will affect 2.3 billion people by 2025. Moreover, an estimated 50% of the hungry people in the world are small-scale subsistence farmers, mostly living in developing countries and unable to produce enough food for their basic needs. According to FAO, about 60% of the poor farmer community crops are usually lost before accessing the market, losing time, efforts and money. Regarding global warming and pollution, rural communities are often the most affected by the problem, being forced to deplete natural resources to get their needs and thus paying a high price in terms of time, labour, health, and social inequity since, in some cases, the fuel to cook a meal may cost more than the food itself. Finally, while solar energy is free, solar related technologies are not, despite the vital role that they can play in rural development, being a luxury for many rural communities.

The existing solar-energy technologies also present problems. They can play a vital role in solving environmental problems but, due to the high cost, their convenience compared to traditional energy sources is reduced, thus having a negative effect on the development and diffusion of solar systems.

Compared to the aforementioned problems, 12-In-One System presents significant advantages and offers different solutions. First, the System is based on an appropriate new technology, with simple manual control in temperature, performing its different functions by applying heat under controlled conditions. Moreover, the costs of implementation, manufacture, transport, storage and shipping have been reduced through outsourcing the system components manufacture. At the same time, in order to facilitate diffusion to isolated communities, the involvement of partners from the targeted communities is foreseen, providing them with the appropriate know-how for assembling, maintaining and installing the system, generating job opportunities.

Adopting 12-In-One System allows rural communities to increase quality, productivity and profitability of the crops, raising income and improving food security. Used as a dryer, the system can form the basis of sustainable agro processing micro enterprises to process fruits and vegetables in case of seasonal super abundance, improving family nutrition and providing employment, particularly for the women. Used for water purification, the system allows reducing health care expenditure, and helps to lower the mortality and morbidity rate of young children, due to water related diseases. Consequently, the higher household income can reduce child labour and help parents to pay children school fee. Improving health nutrition and increasing incomes, the System utilization also reduces susceptibility to HIV infection as well as other major diseases.

The System also presents a highly positive environmental impact, as it is mainly powered by solar energy. It saves energy by recycling the exhausted heat. To do that, 2 or 3 functions can be powered at the same time, using the same amount of energy. The system also allows eliminating traditional insecticide, providing two quick effective eco-friendly methods to control insect infestations, instead of the traditional fumigation which utilizes Ozone depleting substances.

12-In-One System, in practice

The system is based on a simple but innovative technology, with an easy manual control of temperature, fulfilling different functions by applying heat under controlled conditions.



The utilized technology was created to serve the farmer communities on global scale and it was based on adequate understanding of the farmers' different social-economic realities, life style, motivations and behaviours. The system is the first of its kind designed to collect, concentrate and store solar thermal energy in a controlled amount of water.

The technology is replicable at large or small scale as it is simple, easy to be learned and manufactured. The System operates without electric or electronic components; it is powered by local fuel and locally maintainable with no need to import spare parts (many parts can be manufactured from locally available materials, such as wood and others). Moreover, the System dissemination strategy foresees to get partners from the interested communities who will be responsible of advertising, maintaining and assembling the System components.

This presents many benefits, in particular allowing to low the cost of transport, storage and shipping; furthermore, each community can order only the specific components needed to solve the problem(s) it may suffer (water contamination, drying, space heating...)

The system's performance allows operating at least 12 functions, achieving different goals:

- **Solar water heater:** to heat water for household sanitary; cleaning and sterilizing farm equipment; providing control on hot water temperature and consumption with no electricity need.
- **Solar water sterilizer:** to treat biologically contaminated water.
- **Solar water distillation:** to treat chemically contaminated water.
- **Fuel powered distiller**
- **Solar food dryer:** to dry food at optimum temperature and in a shorter amount of time, avoids the development of moisture gradient across the drying bed.
- **Solar grain dryer:** (same as previous).
- **Solar thermal disinfestations of grain:** to make use of the fungicidal and insecticidal action of heat.
- **Grain cooling:** to cool the hot dried grain at room temperature.
- **Meat and fish smoker:** to be used by fisher-folk communities.
- **Fuel powered dryer:** to increase reliability during the rainy season when it is difficult to obtain the necessary quantity of warm dry air to dry food effectively.
- **Conventional biomass cook stove:** to increase social acceptance and to meet with users need we gave users of the system the ability to shift between using it as a modified and conventional cook stove, with additional advantages as easy to set balance and supports the pot firmly.
- **Modified biomass cook stove:** to maximize fuel efficiency.

Moreover, two new functions are at the moment being provided:

- **Spaces heating:** to suit and serve small isolated mountain communities.
- **Fuel wood drying:** to reduce pollution while burning, and increase the effective energy value of wood.

Results

12-In-One System (first version), despite being at the moment at the prototype stage, demonstrates to be highly competitive especially if compared with alternative solutions. Traditional methods for crop preservation are not always optimal: drying crops in the field is slow, the food loses most of nutritional and commercial value and many problems occur in the rainy season. Conventional solar dryers are weather dependent, they can't provide the sufficient drying temperature needed for the first phase of drying; without control in drying temperature, they become too hot at noon and damage the drying crop, losing value when sold.

The usage of toxic chemicals for grain disinfestations can leave residues in the food that are toxic for human health. Boiling is widely used for water purification. This method wastes energy and is not effective when water is chemically contaminated. Other methods need periodical purchasing of chemicals and are very complicated to be successfully implemented. The existing solar thermal energy devices are mono-function, expensive, out of the reach of the majority of the rural population, difficult to implement and generally don't meet user expectations, not considering the local social-economic reality and life style. These systems are not profitable in terms of payback period, due to their seasonal use (standing still for the large part of the year) and tend to force users to change their traditional habits, leading to a disparity between these technologies and what communities are willing and able to pay for.

Instead, 12-In-One System is based on the use of simple technology and locally available materials. Maintaining and assembling the product by local labour offers job opportunities, makes money circulating in the community, generates local prosperity, increases confidence and assure sustainability. It is an eco-friendly project that is possible to be implemented at a small and large scale, able to make a radical change in living conditions of the rural communities. In this sense, it can be an effective tool to help rural communities to meet the MDGs and respond to the urgent need to find better approaches to rural development and poverty reduction.

International interest

12-In-One System (first version) was awarded by the Arab Organization for Industrialization Care Program for Patents and Industrial Projects. It was awarded as the 2nd best eco-innovation of the EBN-UNDP/IDEASS International Contest. It was selected as semi-finalist of the Dell Social Innovation Award 2009; semi-finalist of the award of Schwab Foundation for Social Innovation of the Year for the Middle East and North Africa 2009; semi-finalist at Primal Prize India 2008; selected as promising practice by UN-HABITAT 2006; selected as good practice by UN-HABITAT 2008; selected by the American Academy of Sciences to get presentation in the 4th International Conference on the Environmental Science and Technology USA 2008; selected by the Arab Healthy Water Association to get presentation; nominated by the US Environmental Protection Agency (EPA) at the Ozone Layer Protection Award 2009.

In February 2010, the innovation was selected as semi-finalist at the MIT Arab Business Plan Competition, which involved 1900 applicants from 13 Arab countries. The author was invited to attend the Entrepreneur workshop in Lebanon.



Nairobi, 16 February 2009

Dear Mr Ahmed Ismail Megahed Abdallah,

On behalf of UN-HABITAT and Dubai Municipality, I would like to inform you that your initiative, "The 6-In-One system to achieve the MDGs." was selected as a Good Practice. The Technical Advisory

Moreover, contacts are at the moment underway with different International Organizations that expressed interest to fund the development and implementation of the innovation: in particular the International Renewable Energy Agency (IRENA) and the Global Energy Efficiency and Renewable Energy Fund (GEEREF).



Award from Arab Organization for Industrialization Care Program for Patents and Industrial Projects

To use 12-In-One System in other countries

In Egypt, where 12-In-One System has been first promoted and the first prototype has been patented and awarded by the Arab Organization for Industrialization Care Program for Patents and Industrial projects (AOI), contacts have been done to disseminate the innovation to the new desert villages and the 14 new desert cities where 5 million settlers will inhabit.

The expectation is to reach the emerging market where orders for export have been already got and to attract further investments from large commercial organizations. Other prototypes of the innovation still need to be realized and more field study implemented for 10 designs of the system, after raising the needed financial resources. At the moment some organizations in the USA, Germany, England, Ghana and Kenya expressed their interest to support the transfer of know-how and the dissemination of the innovation.

To find out more

Publications:

- UN HABITAT data base 2006
- UN HABITAT data base 2008
- International conference for environmental science and technology USA
- Arab Healthy Water Association international conference

Contacts

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