

Energy for development – the concept

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Worldwide, 1.3 billion people remain without access to electricity and 2.7 billion are still cooking on harmful and inefficient stoves¹. Many live in remote rural village communities, and until they have access to energy services, little progress can be made to develop and improve their lives². As United Nations Secretary-General Ban Ki-moon has stated, “energy is the golden thread that connects economic growth, increased social equity, and an environment that allows the planet to thrive”³.

Improving the lives of rural communities by developing smart villages is a concept analogous to the more familiar smart cities. The vision for smart villages is that modern energy access can act as a catalyst for development – in education, health, food security, productive enterprise, clean water and sanitation, environmental sustainability and participatory democracy – which in turn supports further improvements in access to energy. Integrating energy access with other development initiatives, harnessing and developing local entrepreneurial capacities, and technological advances in the supply and use of sustainable energy are making such transformative change possible.

Overview

Smart villages capture many of the benefits of urban living while retaining valued aspects of rural life and ensuring balanced development at the national level. This enables villagers to attain healthy and fulfilling lives, achieve their development potential, earn a viable living and be connected to the wider world, giving them a real choice between the traditional route of migration to a city, or life in a smart village.

Smart villages will be connected to towns and cities through information and communication technologies (ICT) enabled by access to energy. Such technologies will enhance education and health services by providing links

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to the world's knowledge base and opportunities for distance learning, as well as supporting initiatives in m-health (mobile health, also known as telemedicine). Connectivity will also open up participation in governance processes at local, regional and national levels.

Smart villages will serve as complementary engines of economic growth to smart cities, producing goods and services for local rural markets as well as high-value-added agricultural and rural industry products for both national and international markets. And they will act as stewards for the environment as well as, in some cases, functioning as ecotourism hubs.

Key enablers of these development benefits in smart villages are sustainable electricity supplies and the availability of clean and efficient appliances for cooking. Productive enterprises and facilities with higher energy demands will tend to be located in hub villages supplied by the national grid if sufficiently close or – for the many remoter communities – by local mini-grids driven by renewable energy sources, possibly in hybrid form with diesel generators in some cases. The more dispersed communities around the hub villages will typically use pico-power and stand-alone home systems to provide more basic levels of electricity supply until distribution networks can be extended to them (see Box 1)^{4,5,6}.

Smart Villages Initiative

This initiative is evaluating how to deliver energy access to rural communities so as to make smart villages a reality. Through a three-year programme of engagement activities in Africa, Asia and Latin America, it will help to ensure that policies and development initiatives are better informed on the realities, challenges and opportunities of rural energy provision for development in key sectors. The following paragraphs elaborate on some of the characteristics of smart villages that will be explored by the initiative.

Education

Smart villages aim to increase the time available for students to study and will address prevalent factors that negatively affect the ability of students to acquire the knowledge and skills necessary to achieve economic goals and improve labour productivity. These include eliminating the need to spend time collecting traditional biomass, reducing respiratory illness caused by indoor air pollution, and ensuring that lighting is both safe and of sufficient quality.

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ICT-equipped schools will provide a good level of access to the internet and consequently the world's knowledge base, ending the information isolation experienced by many rural communities. New opportunities will be generated for distance and adaptive learning, reducing the need to move to towns or cities to achieve higher levels of education. In

Box 1 Electrification technology options for smart villages^{7,8}

Technology	Generation capacity (kW)	Energy sources	Services available	Estimated economic cost
Pico-power systems	0.001–0.01	Solar PV	Lighting, radio communication reception, two-way mobile communication	US\$ 10–100
Stand-alone home systems	0.01–1	Solar PV	Same as above plus additional lighting and communication, television, fans, limited motive and heat power	US\$ 75–1,000
Micro/mini-grids	1–1,000	Hydro, wind, solar PV, biomass, diesel, hybrid combinations	Same as above plus enhanced motive and heat power, and ability to power community-based services	Medium-large capital cost, low marginal cost to end-user
Regional grid connection	1,000–1,000,000	Fossil fuel, hydro, wind, solar PV, biomass, geothermal	Assuming high quality of connection, same as above up to a full range of electric power appliances, commercial and industrial applications	Medium-large capital cost, low marginal cost to end-user



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Small-scale solar is ideally suited to the low energy requirements of modern communication technologies.

addition, ICT and internet access also have a “pull factor”, providing incentives for school attendance and for attracting and retaining good teachers.

Health

At the most basic level, households in smart villages will be able to consume potable water and a more nutritious diet due to the reduced cost of boiling water and cooking food, and enhanced agricultural productivity arising from associated development initiatives and reduced wastage. Furthermore, modern technologies and cleaner fuel sources will replace the traditional biomass cook stoves that currently result in harmful indoor pollution.

ICT-enabled m-health initiatives such as the Swasthya Slate (www.swasthyaslate.org) will enable mobile health diagnostic solutions, requiring relatively low levels of local medical skill and providing access to specialist health-care services based in urban communities where necessary. Epidemiological data will be gathered, providing the opportunity for more effective

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interventions and early warning capability in case of outbreaks of contagious diseases such as cholera and Ebola.

Food security

Approximately one in every seven people in the developing world is food insecure, unable to consume sufficient food to sustain a healthy and active life. Energy provision together with ICT can help smart villages become more food secure as farmers take advantage of improvements in irrigation systems, weather forecasting, cold-storage infrastructure, and agronomic and market information, and become fully informed of cognate environmental issues. Consequently, smart villages will be in a better position to gain from the benefits of agricultural modernisation, reduce waste and capture more of the agricultural value chain.

Productive enterprise

Productive enterprise in rural areas generally consists of small and medium-sized enterprises such as agro-processing, textiles, furniture, chemicals, electronics and machinery. Energy access promises participation in knowledge-based activities ranging from handicraft shops to factories, operated informally or organised as a formal business, and using traditional production processes or even employing cutting-edge modern technology. Participation in primary manufacturing, however, will be limited in off-grid villages by the scale of energy required relative to that available from local sources.

Smart villages, through the provision of modern energy access, will bolster rural industry through a variety of channels, including the ability to use mechanical power, the availability of a more skilled workforce through ICT-enabled education, and extended working hours through high-quality lighting. ICT will provide access to mobile financial services and up-to-date market information to enable integration with more complex value chains, and to carve out niches in international markets through identifying and transacting directly with previously unreached customer bases.

Where appropriate, smart villages will host clusters of rural enterprises in strategic areas of dynamic competitive advantage. Clusters will be underpinned by modern energy access as well as other hard and soft infrastructure, and supporting institutions. This will allow rural

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health, water quality, soil conditions and changes to the landscape. They will also reduce pressure on deforestation through the use of efficient cook stoves to decrease the need for traditional biomass energy sources such as charcoal, a key driver of unsustainable forest use.

Smart villages will host community-run recycling facilities ranging from those equipped to recycle wastewater and organic waste from agro-processing, to next-generation facilities for the recycling of e-waste including energy-storage and generation technologies such as batteries and solar panels. Depending on geographical endowments, some smart villages will be able to operate as regional ecotourism hubs, an activity that can improve the welfare and connectivity of rural and urban communities.

Participatory democracy

Rural communities tend to be politically disenfranchised due to their relative remoteness. Consequently, they lack information on societal issues and have difficulty becoming actively involved in debates about how to address them. Smart villages, through ICT, will allow rural communities to become more aware of their social, economic and political rights, engage in governance processes at all levels and hold policy makers to account.

Quality of life

Through the provision of modern energy, smart villages will have a transformative impact on villagers by alleviating the drudgery of repetitive tasks that is pervasive in many lives in rural communities. This will save time and effort, and villagers will be able to enjoy entertainment through radio, television and the internet. Public lighting at night will mean that people, particularly women, can enjoy social interaction without fear of danger.

Conclusion

Achieving the Millennium Development Goals, the post-2015 development agenda and the United Nations target of energy access for all by 2030 requires a concerted effort focused on

enterprises to further benefit from economies of scale and agglomeration.

Environment

Smart villages will be stewards of the environment aided by technologies to monitor key environmental indicators such as forest

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rural areas, where approximately 70 per cent of the world's poor live⁹. Drawing on the success of smart cities, the smart villages vision offers an ambitious and unifying framework that is sufficiently flexible to allow for different development pathways for different rural communities, while leading to significantly improved lives for villagers and village communities, and contributing to balanced national and international growth.

There are many areas within the smart villages vision that will be sharpened and refined through a series of workshops to be held around the world under the current Smart Villages Initiative. What is clear, however, is that the smart villages vision, with the immense potential benefits that it can bring to rural communities, is not just aspirational but can be realised with the engagement and wholehearted commitment of all stakeholders, from the inventors of new energy-provision technologies to indispensable village leaders as role models.

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For more information on the Smart Villages Initiative, see www.e4sv.org.

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