



A Vision for Smart Villages

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Abstract

What are the characteristic features of a smart village? How might progression towards a smart village model improve lives in those communities?

This brief provides a vision for improving the lives of rural villagers based on the smart villages concept (a rural analogue to smart cities).

It also explores two prototypical case studies in Malaysia and Tanzania, where parts of this vision have already been realised.

1.1 The central premise is that given the appropriate enabling conditions (including access to finance, appropriate technologies, technical capacities and services, and regulatory/policy frameworks) and an integrated approach to development, rural communities can harness and develop entrepreneurial capacities to provide modern energy services. Modern energy access can act as a catalyst for development - education, health, food security, productive enterprise, clean water and sanitation, environmental sustainability and participatory democracy. This in turn supports further improvements in modern energy access, ensuring sustainable electricity supplies to meet village needs and the availability of clean and efficient appliances for cooking.

1.2 Progressively, such communities may establish the various features of smart villages outlined in this paper. Residents would consequently be able to lead healthy and fulfilling lives, achieve their development potential, earn a viable living, and be connected to the wider world. As a result, villagers would be given a real choice between life in a city or a smart village. They could capture many of the benefits of urban living while retaining valued aspects of rural life, and ensuring balanced development at the national level.

1.3 Among the key characteristics envisaged in smart villages are connections to towns and cities both through physical infrastructure and through information and communications technologies (ICT) enabled by energy access. ICT can enhance education and health services, providing access to the world's knowledge base and opportunities for distance learning, and enabling the deployment of tele-medicine initiatives. Furthermore. ICT has the potential to enable participation in governance processes at local, regional and national levels.

1.4 By producing high-value added agricultural and rural industry products for export to national and international markets as well as goods and services for local rural markets, smart villages can complement smart cities as engines of economic growth. Moreover, smart villages can become stewards for the environment, ensuring that their development is achieved sustainably in respect of impacts on local environments.

1.5 Productive enterprises and facilities with higher demands for power will need to be located in hub villages, supplied by the national grid if sufficiently close, or for the many remoter communities, by local minigrids driven by renewable energy sources, in some cases in hybrid forms with diesel generators. The more dispersed communities around the hub villages will typically use solar home based systems to provide more basic levels of electricity supply until distribution networks can be extended to them.

1.6 The following paragraphs set out an ambitious vision for smart villages, intended to stimulate discussion and to stretch aspirations. Some villages in developing countries already demonstrate some of the outlined features, though few if any yet achieve all of them. And some governments^{1.2} have initiatives to develop smart villages with characteristics broadly consistent with those outlined here.

Sectors of development

With an outline of this vision, we will now examine how it might work out so far as typical sectors of development are concerned and invite discussion. The following paragraphs outline generic features – the actual realisation of the smart villages concept will vary according to the country, region and specific context.

Education

Access to modern energy in smart villages has the potential to increase the time available for students to study by providing safe and good quality lighting in homes after dark, and by reducing the need to spend time collecting biomass for cooking. It also lowers indoor air pollution by replacing kerosene lamps and open fires with clean sources of light and heat, thereby reducing respiratory illness which is a prevalent impediment to learning as well as a cause of many premature deaths.

Furthermore, ICT-equipped schools can provide a good level of access to the internet and consequently the world's knowledge base, and end the information isolation experienced by many rural communities. Distance and adaptive learning become a new possibility, reducing the need to move to towns or cities to achieve higher levels of education. Also, ICT and internet access is a 'pull-factor' providing incentives for school attendance and for attracting and retaining good teachers.

Taken together, these various factors can enhance the ability of students to acquire the knowledge and skills necessary to achieve economic goals and improve productivity.

Health

Modern energy access can significantly improve health. It enables households to use potable water and to consume a more nutritious diet due to the reduced cost of boiling water and cooking food. And as indicated above, replacing kerosene lamps and traditional biomass cook stoves with modern technologies and cleaner fuel sources substantially reduces indoor air pollution, currently the cause of four million premature deaths every year.

ICT-enabled telemedicine initiatives such as the Swasthya Slate³ allow for mobile health diagnostic solutions, requiring relatively low levels of local medical skills and providing access to specialist health care services based in urban communities where necessary. The ability to gather epidemiological data can be much enhanced, providing the opportunity for more effective interventions, and an 'early warning' capability in respect of outbreaks of contagious diseases, such as cholera and ebola.

^{1.} In Malaysia – http://bit.ly/1MvuPXx

^{2.} In India – www.saanjhi.gov.in/

^{3.} www.swasthyaslate.org/

66 Africa needs to utilize all of its energy assets in the short term, while building the foundations for a competitive, low-carbon energy infrastructure.

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Food security

Approximately one in every seven people in the developing world is food insecure: unable to consume, or have access to sufficient food to sustain a healthy and active life. Energy provision together with ICT has the potential to help Smart villages to become more food secure as farmers take advantage of improvements in irrigation systems, weather forecasting, cold-storage infrastructure, and agronomic and market information⁴ Consequently, smart villages should be in a better position to gain from the benefits of agricultural modernisation, reduce wastage and capture more of the agricultural value chain.

Productive enterprise

Productive enterprise in rural areas generally consists of small-and-medium sized enterprises. There is great diversity⁵ as enterprises participate in primary, manufacturing, service and increasingly knowledge-based activities, and range from handicraft shops to factories, being operated informally to being organised as a formal business, and from using traditional production processes to employing cutting-edge modern technology.

In smart villages, the provision of

5. Typical examples of rural industry include: agro-processing, textiles, furniture, chemicals, electronics, machinery. modern energy can bolster rural industry by enabling the use of mechanical power, increasing the availability of a more skilled workforce through ICT-enabled education, and extending working hours through high quality lighting. Through supporting the use of ICT, mobile financial services and up-to-date market information can be accessed, enabling integration into more complex value chains and international markets through identifying and transacting directly with previously unreached customer bases.

In some cases, smart villages may host clusters of rural enterprises in strategic areas of dynamic competitive advantage. Such clusters, underpinned by modern energy access, hard and soft infrastructure, and supporting institutions can enable rural enterprises to benefit from economies of scale and agglomeration.

Environment

Smart villages can undertake a stewardship role for their local environment, aided by technologies to remotely monitor key environmental indicators, such as forest diagnostics, water quality, soil conditions and landscape changes. Pressure on deforestation can be reduced through the use of efficient cook stoves to decrease the use of traditional biomass energy sources (e.g. charcoal), which is currently a key driver of unsustainable forest use. Smart villages may host community-run recycling facilities ranging from the recycling of wastewater, to organic waste from agro-processing, to next generation facilities for the recycling of electronic-waste and energy storage and generation technologies (e.g. batteries and solar panels). Depending on geographical endowments, some smart villages may 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, and consequently to lack information on societal issues and to face difficulties in being actively involved in debates about how to address them. Through ICT, rural communities in smart villages can become more aware of their social, economic and political rights, engage in governance processes at all levels, and hold policymakers accountable.

Quality of Life

Through the provision of modern energy, smart villages potentially have a transformative impact on villagers by alleviating the drudgery that is pervasive in many lives in rural communities. For example, household appliances can save much time and effort. The availability of radio, TV and the internet enables villagers to enjoy entertainment, and public lighting can be provided at night so that people, particularly women, can enjoy social interaction without fear of danger.

^{4.} www.elimsis.org/

Case studies

The question to which we now turn concerns how these aspirations have been addressed so far and what are the outcomes.

Smart Villages Case Study 1: Terrat Village, Tanzania

Located in the Manyara region in Tanzania, the Maasai village of Terrat exhibits many of the characteristics of a smart village. The village has a thriving economy and is rapidly growing, with a current population of approximately 1,252 households. Development in the village has been driven by the Institute for Orkonerei Pastoralists Advancement (IOPA)⁶. In its present form, IOPA is a limited company with 1,084 Maasai members. Its objective is to bring about positive social, economic and cultural transformation. Currently, IOPA remains dependent on donor financing but expects to become self-sufficient by diversifying economic activity and finding new ways to enable energy access.

Modern energy access is provided by three biodiesel generators, totalling 300kW capacity. The generators run on biodiesel made from jatropha, which is processed in-house. There are plans to convert the glycerin by-product into soap for commercial sale and for the waste material from biofuel production to be used for biogas generation. The generators currently provide electricity to 189 households in the village, as well as to schools, a health centre, a church and a mosque, and a range of productive enterprises (e.g. shops, tea rooms, light manufacturing, agro-processing). Electricity from the generators also powers eight

6. <u>www.orkonerei.or.tz</u>



Light industry, such as this workshop in Terrat is supported by electrification.

boreholes providing 40,000 litres per hour of water for domestic use, livestock, and milk processing.

Electricity access has helped transform Terrat and the livelihoods of villagers. An important economic activity in Terrat is the processing of surplus milk into higher value dairy products, such as cheese, yoghurt, butter and ghee and their export to niche national and regional markets. This has turned out to be a successful economic activity with daily processing capacity being between 1,000 to 2,000 litres per day and the milk economy accounting for approximately 400 million Tanzanian shillings (USD 230,000) per year. Women play a key role in milk processing and there has been resultant progress in gender equality in Terrat.

For other businesses in Terrat, key improvements include significant cost reductions. For example, grocery shops, bars, hairdressers and tea rooms were previously powered by diesel generators. With electricity from the biodiesel generators, these businesses have reduced their daily electricity costs by up to 95% per day. This has resulted in expansion and diversification involving both capital investment (e.g. in milling and welding machines) and investing in labour (e.g. hiring more staff).

Terrat has benefited from significant improvements in education, environmental sustainability, food security, health and general quality of life outcomes. For example, households with electricity now forego using firewood for cooking and children can read at night time with bright electricity-powered lights. Furthermore, IOPA runs a library, an internet centre, a video/TV producing centre and a radio channel that is able to provide information and entertainment to an audience of approximately two million people. In summary, urban aspirations appear to be increasingly met as a result of electricity: "...because we were in the dark and now we are in the light, like other people in Arusha [a nearby city]." As a result, the youth of Terrat are less inclined to migrate to the city in search of a better life.

Smart Villages Case Study 2: Rimbunan Kaseh, Malaysia

Rimbunan Kaseh is located to the North-East of Kuala Lumpur in Lipis district, Pahang. Launched in March 2013 as a public-private partnership between IRIS Corporation Berhard and MIGHT - a partnership think tank that brings together government, industry and academia. The mission behind Rimbunan Kaseh is to integrate disparate technology to stimulate rural growth and bring the 21st century to rural villages, Rimbunan Kaseh is equipped with durable, affordable and energy-efficient homes for approximately 100 households, as well as educational, training and recreational facilities, and a highly innovative agricultural system that not only provides for many local needs, but is integrated into global agricultural value chains.

Modern energy access is provided as one of a number of public goods by the local government. IRIS, however, is currently leveraging its innovative strengths and looking at expanding the use of renewable energy sources. Rimbunan Kaseh is a rural pioneer in energy efficiency, as demonstrated by IRIS' integrated production system of agricultural crops, aquaculture and livestock production. Water is used first in aquaculture – where highly valued species of fish are reared - and is then recycled and used to irrigate crops through the AutoPot system: an energy efficient hydroponic system that relies on a smart valve that ensures that plants receive precisely the level of water and nourishment required. Resultant agricultural waste is mulched to use as poultry feed which, also serves as an input to create fish food for aquaculture.

On the ground evidence suggests that villagers have experienced significant improvements in their income and quality of life. Household income has been supplemented by up to USD 500 per month as a result of the innovative agricultural system. This is largely due to the production of high value crops, such as golden melon and jade perch fish, and the ICT-enabled integration of Rimbunan Kaseh into global value chains meaning that these products sit on, for example, Singaporean supermarket shelves. The provision of internet and educational facilities to rural households is likely to have a significant indirect impact on rural household income and to allow Rimbunan Kaseh to grow into a local hub, providing both educational and employment opportunities to nearby communities.



Rimbunan Kaseh is a rural pioneer in energy efficiency, featuring an integrated production system of agricultural crops, aquaculture and livestock production.

Conclusion

Achieving the Sustainable Development Goals and the UN target of sustainable energy for all by 2030 requires a concerted effort focused on rural areas, where approximately 70% of the world's poor live. Drawing on thinking behind, and aspirations of smart cities, the smart villages vision offers a 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 which will be sharpened and refined through the series of global workshops. What is clear, however, is that while the smart villages vision and the immense potential benefits that it can bring to rural communities may be seen as aspirational, it can be realised with the engagement and wholehearted commitment of all stakeholders.

66 Energy is the golden thread that connects economic growth, increased social equity, and an environment that allows the world to thrive. — BAN KI-MOON

Notes

Smart Villages aims to provide policy makers, donors and development agencies concerned with rural energy access with new insights on the real barriers to energy access in villages in developing countries - technological, financial and political - and how they can be overcome. We are have chosen to focusing on remote off-grid villages, where local solutions (home- or institution-based systems, and mini-grids) are both more realistic and cheaper than national grid extension. Our concern is to ensure that energy access results in development and the creation of 'smart villages' in which many of the benefits of life in modern societies are available to rural communities. www.e4sv.org | info@e4sv.org | @e4SmartVillages

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