



SMART GRID Bulletin

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India's First Smart Village Nanogrid



The smart village addresses 'hard' interventions such as agricultural improvement, energy sufficiency, rural industry and locally relevant livelihood, water and waste management, and improved digital connectivity, as well as 'soft' interventions, such as good governance, better public health services, sanitation, civic services, education and skill

development, along with climate change adaptation. A smart village must also move the villagers up the value chain to improve socio-economic status of the inhabitants.

The village agricultural economy, in turn, revolves around the nexus of food, water, and energy. Access to energy plays a key role in socioeconomic development of a village or a nation. However, according to IEA's report on World Energy Outlook 2011, 1.4 billion people in the world do not have access to electricity, with 400 million residing in India. The 2011 census data also show that 40% of the 'electrified' villages in India have less than 60% availability of electricity. Energy deficit and inadequate infrastructure are the root cause of this gap. The Smart Village Nanogrid™ implemented at Chhotkei village in Angul district in the state of Odisha, the first such smart microgrid implementation in India is a model that can be replicated in thousands of small villages.

The Smart Village Nanogrid™ consists of a hybrid power generation unit from locally available renewable sources (solar, wind, biomass, biogas, pico-hydro, etc.) or grid power, a distribution grid to make power available to homes, streets, and most importantly, to farms and micro-enterprises, and a complete automation system for managing the microgrid operations remotely. This brings energy-sufficiency to the

IN THIS ISSUE

- India's First Smart Village Nanogrid1
- Smart Grid Updates:
 - Policy, Regulations & Standards 4
 - Key Appointments and Transfers5
 - Technology & Projects 5
 - Pilot Projects in India7
- Smart Grid Events9
- Key Contacts9
- Third EU-India Smart Grid Workshop10
at Bornholm Denmark in
September 2016
- European Utility Week 201610
- International Conference on10
Sustainable Green Buildings and
Communities (SGBC)
- ISGF & TPDDL announce11
Certificate Program on Smart Grids
- Global Summit on Smart, Secure12
and Sustainable Cities
- Announcing ISGW 201712

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India's First Smart Village Nanogrid (Contd...)

village, and eliminates grid-dependency. Smart Microgrid concept is applicable in both electrified and un-electrified villages. The key technical intervention is the IoT/IT-enabled Smart Nanogrid™ which ensures reliable and predictable power supply through demand and supply management and citizen-centric power services. Citizens not only get quality, reliable power but can also schedule their power requirement accordingly to their convenience, view their electricity consumption and bill in real time, pay their bills and register their complain through a Mobile App that is language-independent.

Chhotkei is a small remote village inside the hilly and scenic terrain of Satkosia Tiger Reserve about 65km from its district town, Angul, and 160km from the state capital, Bhubaneswar. Approximately 600 people, in 140 households spread over 235 hectares of land lived in darkness. Lack of electricity also precluded them from the privilege of voice communication - the village has no mobile tower access. So is the state of healthcare facilities.

Even though Chhotkei is situated amidst rich natural resources, the place is deprived of the basic amenities of livelihood. Their primary livelihood is rain-fed paddy cultivation, once a year; and there is no other activity relevant to their local available resources. Lack of electricity supply makes it very difficult to set up microenterprises or have an irrigation system to cultivate during off season.



SunMoksha, a Bangalore based start-up implemented the Smart Village Nanogrid – the first such implementation in India. The village has been supplied with a 30kW Solar-power to meet the energy demands of 140 households, 20 streetlights, a temple, and three community centres. These facilities have a combined load of about 20kW. The rest 10kW has been set aside for day-time use by irrigation pumps and microenterprises such as poultry, stitching, rice-puff machines, provision stores, refrigerators, oil mill, welding machines, etc. to improve agricultural output, enable value-addition to agriculture, and generate employment.

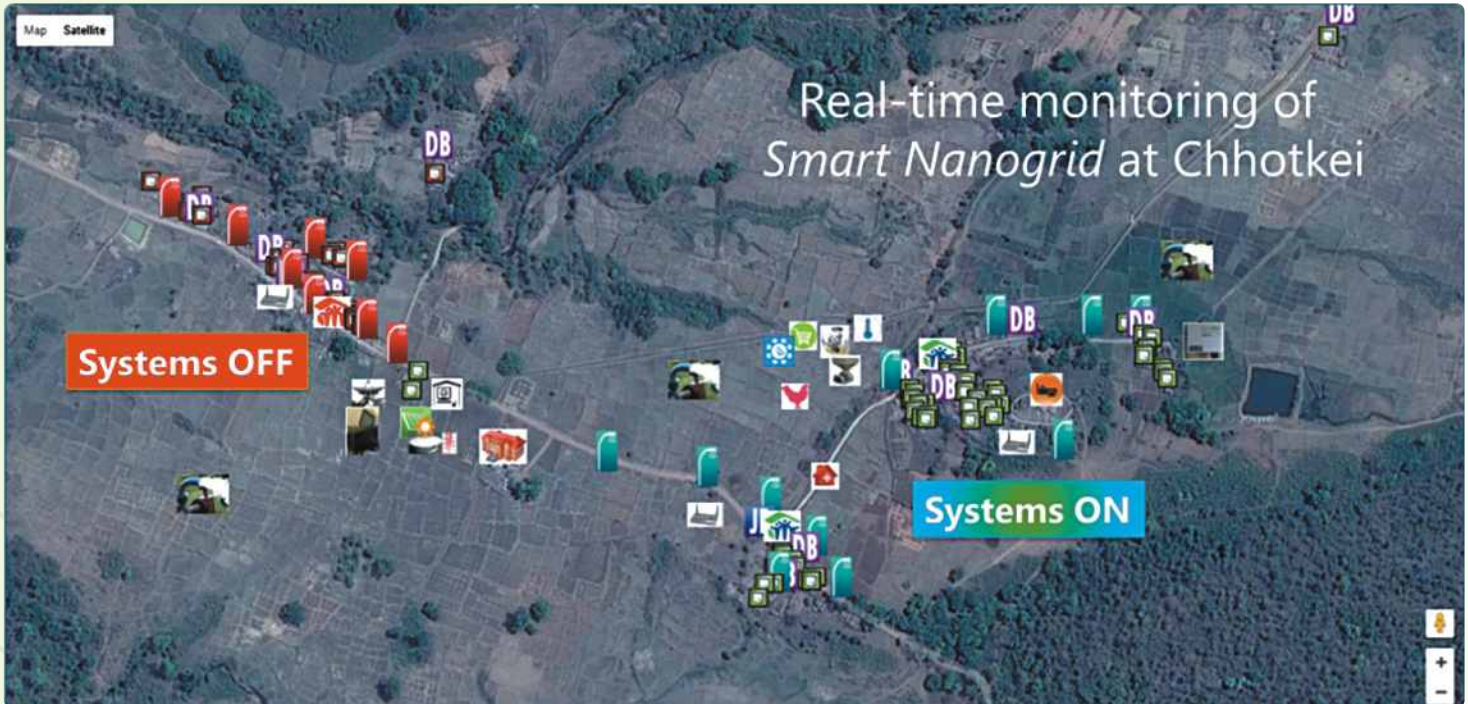
Power supplied to the Distribution Boxes, spread throughout the village, over underground electrical cables to minimize losses. The Distribution Boxes are connected to consumers through overhead wires with smart metering and control system of the Smart Nanogrid™. Underground fiber optic cables communicate to these meters and controllers from the local server.

The Smart Nanogrid™ is managed by a software tool (NanoSoft Remote™), hosted on a local server that provides metering, billing and payment (prepaid/post-paid), and alerts services and cut-off supply if unpaid. Moreover, it provides differential tariff for business, irrigation, and households. Server schedules demands of microenterprises, irrigation pumps, street lights, etc. The microenterprise load is scheduled to match the solar generation profile. The system switches off power supply, if a consumer exceeds maximum energy or power allocated. The irrigation time and amount is designed to be controlled by measuring the moisture of the soil. The system efficiently manage demand with available supply and storage capacity.

In addition to electricity, the system monitors and controls other resources such as water, waste, agriculture and environmental parameters. The system also manages customer relation, technical support, training, local value-add services to customers, and e-Governance.

Server also manages all customer information, technical support, continuous training, and local value add services to customers. The data on local server is synchronized with remote server on the cloud through a VSAT internet connection. The cloud data is available to all remote stakeholders such as sponsors, government agencies, implementers, O&M providers, and remote experts for monitoring and timely interventions, if needed. Real-time monitoring data can be viewed at www.smartnanogrid.net.

India's First Smart Village Nanogrid (Contd...)



Local customers can also get their usage information, payment status, as well as register complaints through a simple Mobile App and Energy Card with QR Code. In addition, a village micro enterprise zone (MEZ) has been created to develop micro-industries for livelihood. A community health and tele-medicine centre is being set-up to provide basic health amenities. Similarly, tele-education and village-information-kiosk facilities are planned to be set-up. Reliable power and digital connectivity also enables tele-education, tele-medicine and tele-panchayat facilities for the villagers, thereby, achieving the goals of digitally connected smart villages.

SunMoksha has successfully addressed key issues in smart microgrid implementation - monitoring and management of the grid system. This grid is managed and maintained by highly motivated local youth who have got training for project implementation, and O&M of the system post commissioning.

The Odisha Government's Renewable Energy Development Agency, OREDA, facilitated the interaction and support of the villagers in implementing and running this project.



They also interfaced with local authorities for necessary permissions and support. Recently, Ministry of New and Renewable Energy (MNRE)

conducted a workshop along with UK-DFID, to showcase this first smart village nanogrid project to national and international stakeholders with interest in such rural development. MNRE Secretary Shri Upendra Tripathy and Jt. Secretary Shri Tarun Kapur presided over the workshop and assured all support to adopt this model across states.