Living Laboratory at NIST
About NIST

National Institute of Science and Technology (NIST) is a premier engineering college located at the Palur Hills in the rural heartland of Odisha. The institute was established in 1996 with the mission to “create engineering minds capable of mastering the global challenges of tomorrow’s technology”. True to its mission, the Institute scored 4th rank in the Eastern Region and 31st in All India in the 2012 Dataquest survey. The institute boats a leadership in research oriented curriculum and academic environment in the region, and was awarded the “Best Technical Institute in R & D Activities” in the State of Orissa in 2013. The Eastern region’s first TIFAC CORE 3G/4G Centre is hosted here in partnership with government of India’s Department of Science and Technology and a consortium of private industries. It runs joint research projects with international institutes in Japan and Taiwan. NIST is also very active in renewable energy with a hybrid solar-wind system and an active renewable energy club in place for the past few years. It is developing a Living Laboratory under the guidance of SunMoksha to address research and development needs in rural energy solutions. The institute has established itself as a fast growing centre of excellence both in academia and research.

Living RE Laboratory

The institute has established curriculum and ecosystem for renewable energy over the past five years, with the interest from faculty in mechanical, electrical, electronics and power engineering. These facilities and activities have been developed and implemented beyond the curriculum of the degree program, so as to prepare and enable students, staff and faculty to conduct research in Rural Energy and develop applications. More recently, the institute is working with a renewable energy company, SunMoksha, Bangalore, developing solutions for rural electrification through renewable energy, where the faculty, staff and students are working hand-in-hand with the company to develop and test solutions. It has resulted in deep engagement of the institute stakeholders in renewable energy. In this process, a “Living Renewable Energy Laboratory” is being created at the institute – a first in India. The only other living laboratory in the world exists at the campus of the ISCTE Business School in Portugal.

“Living RE Laboratory” is a concept where real-life working solutions of renewable energy are implemented on the campus, rather than laboratory prototypes. Students learn with the real system, and conduct research on the real systems. At “living laboratory,” the state-of-the-art renewable energy technologies are always available to provide hands-on, real-life training to professionals, teachers, and trainers on regular basis. The energy systems are constantly updated and upgraded to reflect the state of the art in the sector. The overall objectives is to provide a test-bed and development centre for technologies, products and applications across the renewable energy verticals, where industries, institutions, incubators,
technologists, entrepreneurs, investors and enthusiasts can work together in an integrated environment. 

At NIST, a replication of a rural electric micro-grid with hybrid renewable energy sources has been established. It consists of a Solar-Wind Hybrid system, operational since 2011. A 3-story building is connected to this micro-grid with on/off control for each floor. The power source for this can be switched between renewable and grid. A remote monitoring, control and management system has been developed and deployed to monitor the power generation and consumption in real time and switch from one source to another. Each of the monitoring point can be switched on and off remotely. The remote monitoring and control of the hybrid system is operational since July 2013. Very soon, a third source of energy will be fed into this grid generated from a biomass gasifier. The biomass gasifier has been imported from a state-of-the-art All Power Laboratory in Berkeley, USA and is being installed and commissioned. The biomass gasifier is being connected to a power generating unit and is expected to be online by end of January. Integration of this gasifier with local engines and power generating systems is being done at NIST by industry partner SunMoksha. Once commissioned, it will be connected to the same micro-grid that the solar-wind
hybrid is connected. To our knowledge, this will be the first ever micro-grid with power generation from three renewable energy sources.

In addition to the micro-grid, the institute is setting up several other renewable solutions. A 1-tonne-per-day biogas system is under construction at the institute that will run on the kitchen organic wastes from the hostels and canteen on campus. The biogas generated will partially replace the LPG for hostel cooking. A dual use of this biogas will be to use it as the 4th renewable energy generation source in the RE micro-grid creating the first ever quad-gen system in India. The goal is to create a penta-gen system with pico-hydro forming the fifth resource.

A solar thermal steam cooking system is being procured from Arun Solar to get a steam cooking system for 500x2 meals a day to supplement the cooking requirements at the boys hostel. Based on the performance of this system, two more systems will be purchased to make cooking as self-sufficient as possible, with solar thermal and biogas being the first and second priority sources for cooking, and LPG supplementing the requirement.

The institute is working with SunMoksha, in a unique manner - the faculty, staff and students are integral part of the team - faculty is conducting research and development work for some of the unanswered questions on the micro-grid system. The solutions are being first implemented and tested within its “Living Laboratory”, before field deployment.

Odisha Renewable Energy Development Agency (OREDA) is playing a lead role in the development of the Living Laboratory. Institute received a five lakhs grant from OREDA to conduct research for enhancement of capture efficiency of solar energy by optical fibre and ZnTe quantum dot hybrids. OREDA is also processing an order to install the remote monitoring and management system as an exhibit at Biju Pattanaik Renewable Energy Park in Bhubaneswar. It has also allocated two villages to be electrified under this micro-grid model.
Research and Testing RE Laboratory

A Renewable Energy Lab has been set-up to compliment the curriculum with hands on laboratory training. The lab has acquired equipment to provide training in solar and wind solutions. The following equipment has been set-up in this lab which is beyond the syllabus.

RE Club

Renewable Energy Club has been active for the past seven years. It was established in 2006 in collaboration with OREDA (Odisha Renewable Energy Development Agency). Annual renewable energy contest are being held for the past seven years - new concept conceived, designed, and tested. Design modifications for commercialization for some of these prototypes are in progress. The student and faculty at the Renewable Energy Club are taking activities for rural development under the guidance of mentors from industry partner SunMoksha. They are involved in not only developing some of the solutions for the village applications, but also actively engaging in the village. Last summer, they visited several villages in the areas around NIST to understand the social, economic and technical issues facing the villagers, and its relevance to (un)availability of electricity in the villages.
OREDA-Sponsored Project on
Enhancement of Capture Efficiency of Solar Energy by Optical Fiber Zn Te Quantum Dot Hybrid

Project Budget Allocations:
The project entitled, “Enhancement of Capture Efficiency of Solar Energy by Optical Fiber ZnTe Quantum Dot Hybrid,” was approved by OREDA, DST, Govt. of Odisha in the month of March 2013 vide L.No. 902/OREDA PD 05/10 Dated 12/03/2013 for a period of one year. Rs 5lakh was sanctioned, where the estimated budget applied in this project was 10, 88,000.00.

Investigators:
Dr. S.K. Tripathy, Principal Investigator
Dr. S.N. Sahu, Co Principal Investigator
Dr. A.K. Das, Co Principal Investigator

Single Plastic Fiber (b) Illuminated single Plastic Fiber with Light Source

Six Optical Fibers to form a cable (b) An arrangement for holding lens and Light source along with the cable to test the capture efficiency of fiber cable
Snapshots from Center of Excellence Renewable Energy NIST