IDEAS THAT IMPACT
Where technology and social innovation bridge the gap
Livelihood and Agriculture
Deepavali, the festival of lights, is celebrated across India with joyous celebrations. A multitude of earthen lamps and electric illuminations light up homes as friends and families come together to rejoice.

In 2009, when Siddharth R Mayur rang his grandmother, who lives in his ancestral village to exchange greetings, he came to realise that she was celebrating the festival of lights without any electricity. She was sitting in absolute darkness.

This troubled him deeply. As a grandson living far away, he felt utterly helpless.. Troubled deeply by this, he began to question the larger picture and was confronted with a rather disheartening reality- The majority of the Indian population living in the rural areas faced an unreliable power supply that left them struggling with repeated blackouts. He believed that people deserved a 24/7 clean, green, reliable, and affordable power solution.

His search for a research and development partner to achieve his vision took him and his founding associate, Amarnath Chakradeo, to Fraunhofer Institute for Ceramic Technologies and Systems in Dresden, Germany (Fraunhofer IKTS) -one of the world’s leading applied research institutes for fuel cells.

They acquired the commercialization and production rights of the technology created by Fraunhofer and together they set up H2e Power Systems Pvt. Ltd. in 2013. Amarnath Chakradeo designed the core structure and approach of BJUrja as a solar and fuel cell hybrid system.

BJUrja
SOFC- Solar PV portable co-generated power system

The heart of this Fuel Cell Power Pack System (FCPPS) is a 250kw Solid Oxide Fuel Cell that is trailer mounted along with solar PV panels, and a storage system. This is supported with a specially

Lighting up the lives of all

BJUrja is h2e’s initiative to ‘Be the Change’ for the small farmers. A system that has the potential to bring about the First Green Energy revolution in the farm sector”.

Siddharth R Mayur, Founder & CEO, h2e Power Systems Pvt Ltd
designed set up of 3 LPG cylinders with a GSM interphase. A common power bus connects them all to provide a seamless and no-frills power supply to the end user. An android based user interface is being developed for the entire system and its monitoring, including the LPG cylinders. The system will have a pre-installed solar pump for irrigation purposes. This energy independence enables the discerning farmer to tow BJUrja with a tractor (or a cattle cart) to any desired point of application.

A Smart Energy Management System (SEMS) that maximises efficiency manages BJUrja’s entire architecture. The SEMS is a single microcontroller based control system for the entire unit. During the non-availability of Solar PV or battery discharge, the SEMS will switch on the fuel cell system and maintain adequate power output.

BJUrja is designed to operate as a load following system for its lifetime. LPG cylinders will be monitoring pressure sensors and the cloud based predictive maintenance features will inform the team of remote diagnosis thus avoiding any damage or system failure. When the cylinders are below 20% capacity the load cells trigger a signal, which is relayed to the farmer via an SMS. The farmer can then request for a refill/ replacement of the cylinders.

BJUrja combines multiple clean energy technologies on a single platform. The farmer can choose conventional fuels like Natural Gas/LPG or even alternative cleaner fuels like Biogas, Hydrogen or Bio-CNG with options for Diesel and Bio-Diesel in future.

All bio-fuel or waste to energy projects can benefit through state and central government capital subsidies, and with other benefits such as special buy-back rate by state utilities. h2e is in talks with Ministry of New and Renewable Energy (MNRE) and government officials as they plan to work closely with NABARD.

**Primary applications and tasks**

- The farmer can run the water pumps and drip irrigation system on a plug and play basis. The system with the current configuration can be used to irrigate around 6 acres of farmland with Jain irrigation supported Drip irrigation system through a 2 hp or a 4 hp pump.
- Farmers can add capacity and run their harvesters and rotavators on the farm. Thus converting their farms into factories.
- The farmer can have multiple BJUrja units to set up his own storage facility wherein he will be able to increase the shelf life of his produce and serve the market when needed.
- He can carry the system home and power his house and use it for running critical devices.
- Dairy industries have a large requirement of electrical energy for operation of machineries along with thermal energy for processes such as pasteurisation. A larger capacity SOFC technology (industrial scale, e.g. 5kW to 100kW) can be installed and coupled with larger capacity solar PV arrays and/or wind modules for applications in dairy industry.
- Most dairy plants generate a large amount of biodegradable waste. Coupled with the sludge from ETPs, this waste has good calorific value and can be used to generate biogas that can be used in BJUrja’s system for power generation.
- Shops, groceries, micro-dairies and those requiring refrigeration solutions can undertake handling of perishable goods with a long-term business plan.
- It is scalable from its current 250W fuel cell and 600W solar form to a higher 500W – 1 kW fuel cell and corresponding solar configuration.
Long term goals

H2e Power Systems is planning:

• To incorporate automation and take the solution to a mobile platform.
• To use IoT solutions to go beyond energy production and help the farmer with multiple tasks.
• To be a part of Government of India’s solar pump initiatives.
• To install BJUrja systems in farms run by agricultural colleges in collaboration with department of Agriculture.
• Looking to work with NABARD with support from MNRE and Maharashtra government in the initial stages.
• To replace the 700,000 diesel pumps those are bought every year (as per MNRE estimates).
• To provide energy independence to farmers and small business owners.
• To propose bigger configuration with 2X250W SOFC system that can be integrated with 1kW systems in the future.

Beneficiaries speak

“BJUrja is a step forward in empowering the agriculture sector, especially the farmer, by empowering him with energy. It is an energy solution on wheels, which will give the farmer the independence to power his farm and also use the power in his home. He can also rent the system to create additional income source.

We at Jain Irrigation are supportive of this idea and are looking forward to anchor this product by integrating BJUrja with our drip systems”.

Ashok B Jain, Chairman, Jain Irrigation Systems Ltd

MILESTONES

2013 - H2e Power Systems Pvt. Ltd founded

Development of SOFC and National Fuel Cell Supply Chain, 2013-Present

2015 - First organisation in India to develop a micro-CHP SOFC system and manufacture fuel cells

2015 - Operational SOFC prototype ready in Pune

2015 - Working directly on renewable fuels such as BIO-CNG, Biogas and Hydrogen

2016 - Successful first field trials and product validation at Jain Irrigation

A multi-fuel reformer has been developed than works on gaseous fuels The new reformer will work on liquid fuels as well - Development underway