

CHEM, Hydrogen Fuel Cell

# Let There be Light: Changing Rural Livelihoods

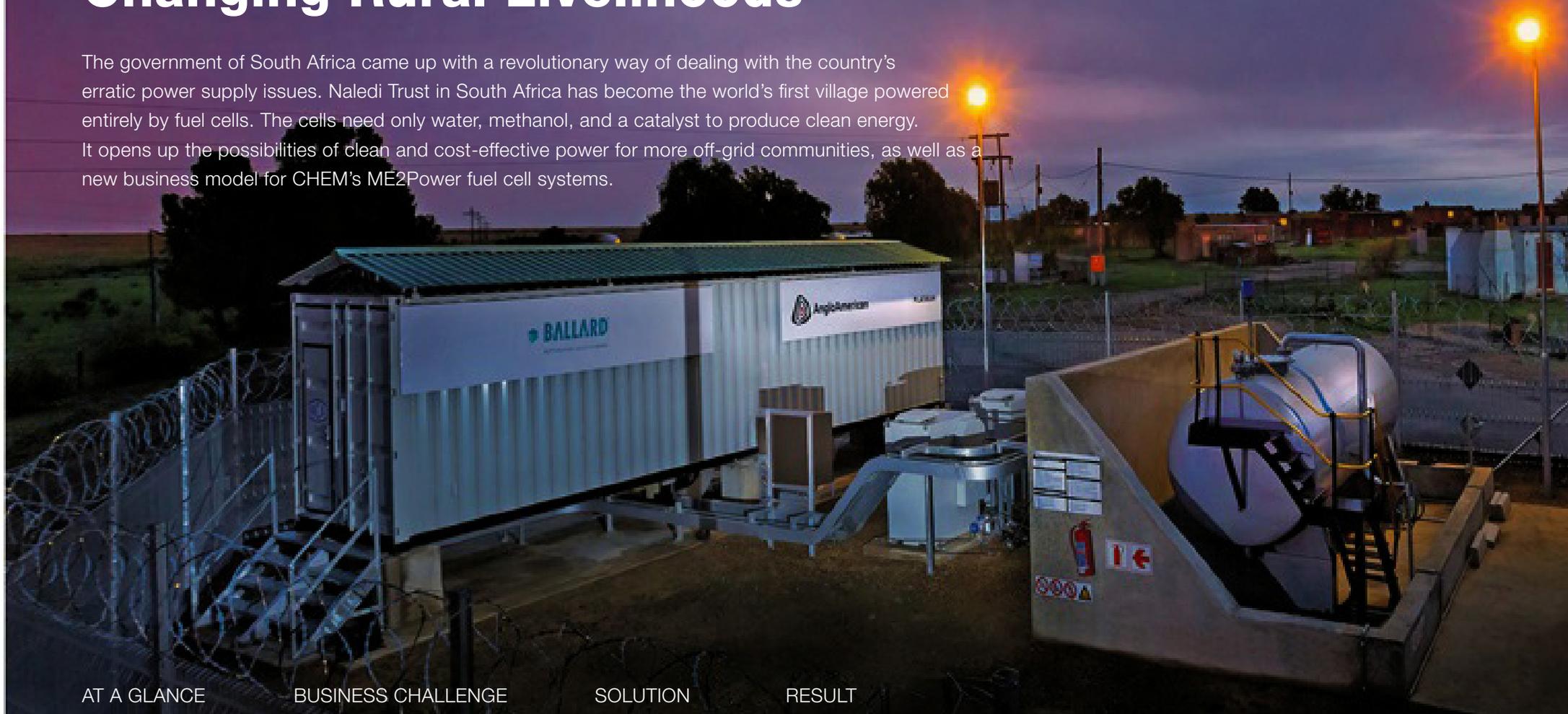
The government of South Africa came up with a revolutionary way of dealing with the country's erratic power supply issues. Naledi Trust in South Africa has become the world's first village powered entirely by fuel cells. The cells need only water, methanol, and a catalyst to produce clean energy. It opens up the possibilities of clean and cost-effective power for more off-grid communities, as well as a new business model for CHEM's ME2Power fuel cell systems.

AT A GLANCE

BUSINESS CHALLENGE

SOLUTION

RESULT



# Fuel Cell System Helps Channel Electricity to Rural Community

Like many developing countries, South Africa faces an acute power shortage. The lack of reliable access to electricity is an impediment on economic growth, investment, and development.

Originally designed as a backup power system for telecommunication stations at remote places, the ME2Power fuel cell transforms its role into the main power generator for small communities. Chung-Hsin Electric & Machinery Mfg. Corp's (CHEM) fuel cell mini-grid system uses platinum as a catalyst and is fueled by methanol. It generates mostly water as a by-product.

This approach has now become an alternative sustainable energy solution for more off-grid communities after completing a two-year pilot run in Naledi Trust community in South Africa. "The government of South Africa is considering to roll out similar plans in rural areas where the cost of electrification via an expansion of the national power grid is too costly or technically prohibited," said Amy Liao, Director of CHEM's Hydrogen Department.

**"Access to reliable, low cost, and clean electricity is vital. The Naledi Trust project can make a tremendous difference in the lives of hundreds of rural communities."**

**Amy Liao**

Director of Hydrogen Department, CHEM



## Chung-Hsin Electric & Machinery Mfg. Corp

**Founded in:** 1956

**Headquarters:** New Taipei, Taiwan

**Industry:** Energy, Manufacturing

**Number of Employees:** 2,000

**Website:** [www.chem.com.tw](http://www.chem.com.tw)

## Results

- Transforming a traditional machine-selling model to Machine-as-a-Service and increasing sales revenue
- Enabling live monitoring of the system through reliable cellular communications
- Saving 50% manpower cost on maintenance

# Improving Remote Maintenance Cost and Metrics

CHEM's 5kW ME2 fuel cell system is integrated into a complete hybrid off-grid energy solution. It includes a battery bank and inverter operating within a microgrid. A mixture of water and liquid methanol is piped through to these fuel cells where an electrochemical process converts it into hydrogen gas, which is used to generate electricity.

"The theft of the solar PV panels is a common phenomenon in South Africa," said Liao. "The government of South Africa was eager to find an alternative solution to the problem." Weighing 295 kg, the ME2Power system makes itself a hard target.

The system provides a total of 15 kW of generated electric power and generates a peak power of 70 kW with the support of batteries. It is sufficient to power the 34 households in the Naledi Trust community. Monthly delivery of liquid methanol fuel to an external storage tank enables uninterrupted primary power to these homes.

"It takes a lot of manpower to conduct inspections and manage the logistics of fuel delivery," said Liao. "As all systems are located at remote places, it was a challenge for us to improve our maintenance metrics without a network."

## Challenges

- High and recurring operational expenditure for maintaining equipment at remote areas
- Wired network is unavailable for data transmission
- Harsh environments in rough rural terrains



# 3G Helps Gain Real-Time Insight from Equipment Anywhere

To solve this problem, CHEM integrated Moxa's cellular remote I/O into the fuel cell system. The cellular I/O features dynamic IP access that provides reliable 3G cellular connectivity. CHEM's fuel cell system is currently the only one that offers a remote monitoring function.

"Deploying IIoT technology, CHEM's fuel cell systems distributed at scattered locations can be fully monitored via a mobile phone. Control sites can check the conditions of systems, including power consumption, voltage, power supply time, methanol level, and unit sensors anytime."

In addition to collecting data from sensors at remote sites, Moxa's patented Click&Go Plus IF-THEN-ELSE control logic allows CHEM to configure SMS alarms to deliver real-time notifications for handling issues as soon as they arise. "This report-by-exception approach requires far less bandwidth than traditional polling methods," said Joseph Chang, Special Assistant of the Chairman Office, CHEM.

## Moxa Solutions

- Remote I/O with a built-in cellular function collects and transmits data status through 3G communication
- Click&Go Plus™ control logic for event alert setting for optimized bandwidth utilization

**"We can gain quick response time and reduce machine downtime using the advantage of real-time monitoring."**

**Joseph Chang**

Special Assistant of the Chairman Office, CHEM



## The IIoT Gives Rise to Machine-as-a-Service

In addition to saving time and cost on inspections, CHEM can organize the logistics of fuel delivery and on-site troubleshooting more efficiently. Data from field sites are collected and transmitted to the SCADA-based control and monitoring center located in Taiwan. “We are able to work more efficiently with our local service provider. When the SCADA system receives an abnormal status report, we can immediately inform the local service providers via SMS to dispatch maintenance personnel for instant on-site troubleshooting,” explained Chang.

A fuel cell system costs much higher comparing to a diesel-powered generator. Customers facing budget restrictions will not consider purchasing the fuel cell system. “The IIoT is transforming our business model. We are transitioning from selling a product to offering Machine-as-a-Service. Rather than relying on a one-time sale, we are charging customers based on machine use and service,” explained Liao.

“This business transformation helps us to generate a new revenue stream in aftermarket services by strengthening our core business in parts, repair, and maintenance. By analyzing the collected data, we can help customers improve the efficiency and stability of their operations, and provide predictive maintenance services,” she said.

IIoT technology is also helping our customers to measure their energy usage and manage their budget. The consumers can pay accordingly to the actual power generated and consumed.

“We will continue to enhance our remote monitoring and control system to improve our service quality for our customers,” Liao said. As a member of Moxa’s Solution Partner Alliance program, CHEM is working closely with Moxa to integrate GPS into their next generation fuel cell system.



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**Amy Liao**

Director of Hydrogen Department, CHEM