VB Ceramic Furnaces OPC Private Limited (VBCC)

0.5 kW SOFC / SOEC Platform

Investor Introduction & Vision Document

Powering the Future with Solid Oxide Technology

The world is entering a new era of clean energy. Governments, industries, and households are actively searching for reliable alternatives to fossil fuels that can provide uninterrupted electricity with lower emissions and higher efficiency. While solar and wind energy are growing rapidly, they remain intermittent and require large battery storage systems. Solid Oxide Fuel Cell (SOFC) technology provides a unique solution by generating electricity continuously as long as fuel is available.

VB Ceramic Furnaces OPC Private Limited (VBCC) is proud to introduce its **0.5 kW Solid Oxide Fuel Cell (SOFC) / Solid Oxide Electrolysis Cell (SOEC) platform**, developed as the foundation for a complete family of distributed energy systems ranging from household power generators to industrial 100 kW power plants.

Our vision is not merely to manufacture fuel cells but to build India's next generation distributed energy ecosystem capable of producing electricity, heat, hydrogen, and synthetic fuels from multiple energy sources.

Introduction to SOFC

A Solid Oxide Fuel Cell (SOFC) is a high-temperature electrochemical device that converts chemical energy directly into electrical energy without combustion.

Unlike diesel generators or gas engines, SOFC systems produce electricity through an electrochemical reaction rather than burning fuel. Since there is no combustion process, the system delivers:

• Higher electrical efficiency

• Lower emissions

• Silent operation

• Reduced maintenance

• Long operating life

• Excellent reliability

The fuel cell continuously generates electricity whenever fuel is supplied, making it suitable for 24×7 operation.

Unlike batteries, an SOFC does not store energy—it produces energy continuously.

Multi-Fuel Capability – A Major Advantage

One of the biggest strengths of SOFC technology is its ability to operate using multiple fuels.

These include:

• Hydrogen

• Natural Gas

• Biomethane

• Biogas

• Methane

• Ammonia

• Methanol

• Renewable e-fuels

This flexibility allows SOFC systems to utilize existing natural gas infrastructure while gradually transitioning toward a hydrogen economy.

Biogas generated from:

• Agricultural waste

• Dairy farms

• Municipal waste

• Sewage treatment plants

• Food processing industries

can directly power SOFC systems to generate clean electricity at the point of production.

Why SOFC is Superior

Compared with conventional power generation systems, SOFC offers several important advantages.

Extremely High Efficiency

Electrical efficiencies of **50–60%** are routinely achieved, and when combined with waste heat recovery (Combined Heat and Power – CHP), total system efficiencies can exceed **90%**.

No Combustion

Electricity is generated electrochemically, resulting in:

• Very low NOx

• Very low SOx

• Low particulate emissions

• Reduced CO_2 emissions per kWh

Continuous Operation

Unlike solar panels, SOFC systems generate electricity day and night.

Unlike batteries, they do not require charging cycles.

Modular Design

Systems can be designed as:

• 0.5 kW

• 1 kW

• 5 kW

• 10 kW

• 25 kW

• 50 kW

• 100 kW

• MW-scale installations

Household Power Generation

VBCC envisions compact household SOFC systems capable of replacing or supplementing conventional electricity supply.

Typical applications include:

• Independent homes

• Apartment complexes

• Farm houses

• Villas

• Rural electrification

• Remote villages

• Telecom towers

• Hospitals

• Commercial buildings

Such systems can operate using:

• LPG-derived fuel

• Natural gas

• Biogas

• Hydrogen

A household SOFC provides:

• Continuous electricity

• Hot water

• Space heating (where applicable)

• Backup power

without the noise, vibration, or pollution associated with diesel generators.

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100 kW Distributed Power Plants

VBCC's future roadmap includes modular **100 kW SOFC power plants** designed for:

• Industries

• Hotels

• Hospitals

• Universities

• Data centres

• Industrial parks

• Defence establishments

• Smart cities

Multiple 100 kW modules can be integrated into MW-scale installations, enabling decentralized power generation with exceptional reliability.

Hydrogen Economy

Hydrogen is increasingly recognized as the fuel of the future.

SOFC technology plays a critical role in this transition because it can efficiently utilize hydrogen while also operating on existing fuels during the transition period.

The complementary **SOEC (Solid Oxide Electrolysis Cell)** technology enables hydrogen production using electricity and steam.

This creates a closed clean-energy ecosystem where renewable electricity can be converted into hydrogen for long-term storage and later reconverted into electricity through SOFC systems.

Hydrogen thus becomes both an energy carrier and a strategic industrial feedstock.

SOEC – Producing Hydrogen and Syngas

SOEC is essentially the reverse operation of an SOFC.

Instead of producing electricity, it uses electricity to split steam into hydrogen and oxygen.

A unique capability of SOEC is **co-electrolysis**, where steam and captured carbon dioxide are simultaneously converted into:

• Hydrogen

• Carbon monoxide

Together these gases form **syngas**, the building block for numerous industrial chemicals and fuels.

Syngas can subsequently be used to produce:

• Methanol

• Dimethyl Ether (DME)

• Synthetic methane

• Sustainable aviation fuels

• Chemical feedstocks

• Polymer intermediates

This makes SOEC an important technology for industrial decarbonization.

Hydrogen as a Value-Added Product

Within an integrated energy system, hydrogen becomes an additional revenue stream.

Depending on system configuration, hydrogen may be:

• Produced using renewable electricity

• Stored for future electricity generation

• Supplied to industries

• Used in mobility applications

• Utilized for ammonia production

• Converted into synthetic fuels

Thus, hydrogen is not merely a fuel—it becomes a strategic by-product supporting a future hydrogen economy.

Global Scenario

Worldwide deployment of SOFC technology is accelerating.

United States

Commercial SOFC systems are operating in:

• Data centres

• Hospitals

• Logistics hubs

• Technology campuses

• Retail facilities

These installations operate on natural gas, biogas, and hydrogen blends while providing reliable 24×7 distributed power.

Multi-megawatt projects demonstrate that SOFC technology has reached commercial maturity and bankability.

South Korea

South Korea is among the global leaders in SOFC deployment.

Commercial installations include:

• 19.8 MW SOFC power plant

• 8.1 MW utility-scale installation

These systems supply electricity to tens of thousands of households using existing city gas infrastructure.

Government support continues to expand SOFC deployment across the country.

Europe

European countries are investing heavily in:

• Hydrogen infrastructure

• Industrial decarbonization

• Green fuels

• Fuel-cell-based distributed generation

Gulf Region

Countries such as Saudi Arabia, the United Arab Emirates, and Oman are investing billions of dollars in:

• Green hydrogen

• Green ammonia

• Solar-powered electrolysis

• Industrial decarbonization

SOEC technology is expected to become a key component of these future industrial ecosystems.

Opportunity for India

India generates enormous quantities of:

• Agricultural residues

• Dairy waste

• Municipal waste

• Sewage sludge

• Organic biomass

These resources can be converted into biogas and biomethane, which in turn can fuel SOFC systems for decentralized electricity generation.

Potential applications include:

• Village microgrids

• Smart cities

• Dairy farms

• Food processing units

• Waste-to-energy projects

• Industrial campuses

• Defence installations

India's growing emphasis on clean energy, hydrogen, and domestic manufacturing makes SOFC technology particularly relevant for long-term energy security.

Why VBCC?

VB Ceramic Furnaces OPC Private Limited possesses unique strengths that differentiate it from conventional fuel-cell developers.

Expertise in High-Temperature Engineering

SOFC systems operate between approximately **650°C and 850°C**, demanding advanced expertise in:

• High-temperature materials

• Ceramic engineering

• Furnace design

• Thermal insulation

• Heating systems

• Process control

These areas represent VBCC's core competencies developed over decades of experience in high-temperature ceramic equipment.

Proven Engineering Capability

VBCC has successfully designed and manufactured:

• High-temperature furnaces

• Vacuum furnaces

• Tube furnaces

• Industrial kilns

• Advanced ceramic processing systems

• High-temperature testing equipment

This engineering background provides a strong platform for SOFC and SOEC system development.

Indigenous Development

Our 0.5 kW SOFC platform demonstrates VBCC's commitment to indigenous technology development under the "Make in India" vision, reducing dependence on imported systems while creating opportunities for local manufacturing.

Scalable Product Strategy

VBCC's roadmap includes:

• 0.5 kW residential prototype

• 1–5 kW domestic systems

• 10–25 kW commercial units

• 50–100 kW industrial modules

• Future MW-scale integrated power plants

This modular strategy enables gradual commercialization while addressing multiple market segments.

Investment Opportunity

VBCC is now entering the next phase of commercialization.

Investment will accelerate:

• Product engineering

• Long-duration validation

• Stack optimization

• Manufacturing scale-up

• Certification

• Field deployments

• International partnerships

• Global market expansion

The objective is to establish VBCC as one of India's leading manufacturers of advanced SOFC and SOEC systems.

Vision 2030

VBCC envisions a future where every home, industry, hospital, village, and commercial building can generate clean electricity from locally available fuels while contributing to the hydrogen economy.

Our long-term goal is to develop an integrated energy platform capable of producing:

• Electricity

• Hydrogen

• Heat

• Synthetic fuels

• Industrial syngas

through highly efficient solid oxide technologies.

We believe SOFC and SOEC will become foundational technologies in the global transition toward sustainable, decentralized, and resilient energy systems. With its expertise in advanced ceramics, high-temperature engineering, and indigenous innovation, VBCC is well positioned to play a significant role in this transformation.

We invite visionary investors, strategic partners, industries, and government organizations to join VBCC in building India's next generation of clean energy technologies and shaping a sustainable future for the world.

by

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