

FIAMM Worldwide Energy Storage

Privately held and in business for over 70 years, the FIAMM Group has factories and offices all over the world. FIAMM is the supplier to the world's leading manufacturers, despite remaining deeply linked to its Italian roots. FIAMM ENERGY STORAGE SOLUTIONS builds both traditional storage systems and ones employing the new FIAMM lead-free sodium nickel SoNick batteries. It is present in sixty countries, with about seventy percent of its sales overseas.

"SoNick" nickel sodium technology has demonstrated success with over 150M miles in the EV market, deployment as stationary backup and in data centers with some of the largest telecommunication companies and most recently in the energy storage markets with global deployments for on grid, off grid and micro grid installations.

S&C Electric Company Introduction

S&C Electric Company (S&C) is pleased to provide information for the supply of and commissioning of integrated PureWave® Storage Management System (SMS) for the Living Pilot. S&C's Power Quality Products group represents the most experienced team providing MW size inverter based products and services available worldwide. Beginning in the early 1990s, S&C identified power electronics as a growing need for the worldwide electrical industry. The first power electronic based multi-MW High Voltage UPS was installed in 1996. Then the first inverter based DSTATCOM was installed in 1997 by employees of what is now the S&C's Power Quality Products. In 2006, the first S&C SMS Energy Storage System went into service. From those first systems, S&C has continued to grow and improve its power electronic offerings to address a wide variety of industry real and reactive power requirements.

- For the utilities industry – S&C has provided inverter based products and services that serve the utility industry starting in 1996. Since then S&C has grown our products for utility substations to include both PureWave® DSTATCOM Distributed Static Compensators and PureWave® Storage Management Systems equipment and services.
- For the renewables industry – S&C has provided numerous power electronic products and services that serve the renewable energy sector starting in 2001. S&C has grown our services in both substation and collector system design, construction and equipment installation, including design and installation of Dynamic VAR compensation and Energy Storage Systems.
- Power Electronics Project Experience – S&C has medium voltage PureWave® UPS Systems, PureWave® DSTATCOMs, PureWave® Storage Management Systems and PureWave® Community Energy Storage serving a variety of critical utility and end user process applications.
- S&C is a proven, profitable supplier to the Electrical Utility Sector who has demonstrated our long term and conservative engineering approach for more than 100 years. Utility sector business accounts for over 80% of S&C's annual turnover.

SoNick Battery Applications

The SoNick applications cover a wide range of use from kilowatt-hours to several megawatt-hours with a 2 h to several hours of discharge time. The following applications are indicated as 'proven' in several SoNick battery installations.

- **Load Leveling**
- **Power Quality**
- **Renewable Resource Optimization**
- **Energy storage markets on-grid, off-grid, micro grid**
- **Utility Grid**
- **Ancillary Services**
- **Telecom Backup Power**
- **Black Start**

Benefits of the FIAMM Energy Storage System:

- FIAMM Energy Storage System "SoNick" technology has demonstrated long-term safety and reliability with over 10 years of field deployment.
- Over 100MW installed globally.
- Over 150M miles deployed on EV
- System designed for zero maintenance.
- Systems come with 2-year warranty.
- Energy modules are designed to continue to operate with multiple cell failures.
- Energy modules are field replaceable with no impact on system performance.
- System DOES not need to shut down to replace energy modules (increased uptime, systems remains in operation should field technician be required)
- Systems designed to be maintenance free. (Lower Opex)
- Systems operates in temperatures between -40c – 60c. (Operating flexibility)
- No additional A/C or generation needed to maintain battery operations (lower Capex)
- Battery can be stored up to 20 years with no loss of performance.
- Energy modules have zero impact on the environment. (100% recyclable)
- System can be monitored remotely. Small footprint required, higher energy density

Technology Overview:

ZEBRA "SoNick" battery technology and its brand originally created for public local transportation fleets and logistic services by a Swiss company MES-DEA, has been solely owned by FIAMM Group since February 2010. The technology has been renamed as SoNick and is now equipped with advanced control system to better-fit system requirements of energy storage applications.

Safety

By comparison with other electrochemical batteries (PbA, Li-ion, NaS), SoNick batteries offer important advantages, such as high specific energy and energy density, independence of external temperature, no hydrogen emission. With respect to other high temperature batteries such as NaS, SoNick features improved robustness and safety. There are four major safety features in all SoNick batteries.

- 1) Safety by Chemistry
- 2) Safety by Cell Design
- 3) Safety by battery design
- 4) Safety by electronic control

Performance

SoNick battery is a high-energy battery with medium-power capability suitable for a wide range of applications with energy storage capacities from a few kilowatt-hours to several megawatt-hour installations. Energy density of integrated battery module less BMS is 100Wh/kg or 120Wh/l. The battery may be discharged within 2 hours giving highest constant power. Due to the ceramic electrolyte the battery has no electrochemical self-discharge. Dependent on operation conditions, the thermal loss is balanced by the internal electrical loss that is converted to heat so that the overall efficiency is in the range of 80-95%.

Proposed offering for Pilot Program-These are commercial NOW.



FIAMM Spring 1

S&C PureWave SMS

Solution 1: 2-container 1.5MW scalable solution.

- Spring 1-1.5MW contained in a standard 20 foot shipping container
- S&C 1MW PureWave SMS is housed in a single 20 foot ISO container
- Containers can be easily deployed with minimum EPC, set back or easement requirements.
- Assets can be repurposed for multiple locations
- Spring 1 can provide multiple services from single asset, ancillary, time shift, load shift etc.
- Standard 10 year life with ability to extend to 20, 30.

Solution 2: Scalable Energy Storage Systems

- FIAMM Energy Storage System-Scalable cabinet solution scalable from KW to MWs.
- Capacity on demand. Paired with S&C PCS with additional capacity this solution allows SCE to reduce future capital investment with a pay as you grow solution.
- Scalable cabinet solution containing 4 batteries (100kw each) allowing SCE to add capacity in 100kW increments.
- Cabinets can be deployed as needed for indoor or outdoor use.
- Small footprint, flexible, maintenance fee scalable design.



Energy Storage Solutions

Fiamm Group