NUMBER 27 SPRING 2011

SAFT INTERNATIONAL

INNOVATION PAGE **4**

Saft Batteries equip new Siemens hybrid trams

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Confidence for 2011 and beyond

In 2010 I am pleased to say that most of Saft's activities returned to growth after a more difficult 2009. This is an encouraging sign that our customers' markets are now recovering well and we anticipate a much stronger year in 2011.

This is also the year when Saft brings on stream significant additional manufacturing capacity in the United States, in Jacksonville and also for Johnson Controls-Saft in Michigan. We are also doubling our production capacity in India and expanding in China to meet our customers' needs in those countries.

As we continue to expand and invest in lithium-ion manufacturing, the additional volumes created by our two new investments will also bring cost reduction benefits linked to these increased volumes, which will offer advantages to customers looking to select this new generation of technology.

I am confident about 2011 and beyond. Saft has an excellent portfolio of products and technologies which will continue to be developed and supported. In addition the new Li-ion capacity being installed in our Jacksonville plant will enable us to better serve the applications of the future.

John Searle
Chairman of the Management Board
Saft Groupe SA

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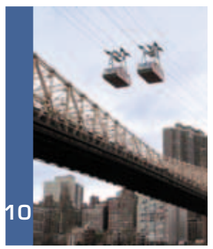

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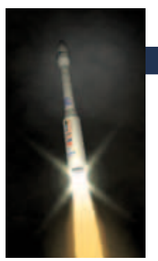

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SAFT NEWS

Saft opens a new subsidiary in Brazil

Saft's is continuing its expansion into developing markets by opening a new subsidiary in Brazil at the end of 2010. **Saft do Brasil will support the introduction of our leading-edge battery technology to customers in one of the world's fastest-growing economies.**

Saft do Brasil, Barueri, São Paulo

Saft's new subsidiary, its 19th throughout the world, will provide sales and technical support for customers in the rail, telecom networks, utilities, renewable energy and oil and gas sectors. Saft do Brasil, based in the country's largest city São Paulo, is headed by General Manager Guido Petit.

A high-growth economy

"Brazil has a particularly vibrant economy that is expected to be the fifth largest in the world by 2016, so the opening of Saft do Brasil is ideally timed to help increase our penetration within this growing market and also continues our expansion into yet another high-growth emerging economy," says Saft CEO John Searle. "One of the brakes on Brazil's development so far, compared with the other BRIC countries, has been the lack of modern transport and energy infrastructure, and these are now receiving major investment. Industrial batteries play a vital role in these sectors and particularly in hot and humid climates, so this is a great opportunity for an advanced-technology company like Saft."

A main focus for Saft do Brasil, under the management of Guido Petit, will be the promotion of advanced nickel-based rechargeable battery technology that offers important advantages for industrial customers in Brazil in terms of reliability, performance and TCO (total cost of ownership). The São Paulo team will also promote the introduction of Saft's state-of-the-art Li-ion battery technology for a range of professional and industrial applications.

Getting closer to our customers

Until now, Saft's business in South America was distributor-based and managed by Saft Baterias in Madrid, where Guido Petit was South America Sales Manager "We will now manage this business locally, still using the same distributors. This new subsidiary will allow Saft get closer to our customers and learn more about the market," says the new General Manager.

For Saft, two of the highest-potential segments are telecoms and railways. "Brazil is a huge telecom market and we have high-technology solutions to offer. Saft has already made a significant breakthrough by gaining certification for its specialist telecoms batteries from Brazil's telecoms regulator ANATEL," explains Guido Petit. "Railways are strategic for us too, and this country has lots of projects in the pipeline, including a high-speed rail link between Rio and São Paulo. In addition, Brazil will be hosting the football World Cup in 2014 and then summer Olympics in 2016. That means even more infrastructure investment, and that in turn means batteries." In other words, Saft has a bright future in Brazil, the country that is expected to drive South American development.

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ANATEL certification

All companies wishing to supply Brazil's telecoms market have to submit each product for testings and then be able to certify this range of products in ANATEL. Saft obtained certification for Tel.X in June 2010 and for Sunica+ in November 2010. Both products were approved at their first trial, and so the first alkaline battery certified in Brazil is made by Saft!

"Testing is quite lengthy (9-12 months) and complex: we look at nominal capacity, rate capacity, operation in floating, charge and discharge cycling, charge retention, performance at high temperatures, etc. The performance of Saft's batteries was excellent in all the tests, and they met all ANATEL's requirements," says Maria de Fatima Rosolem, a world-renowned battery researcher who works for Brazil's CPqD R&D center and manages the laboratory that does ANATEL testing. "We are particularly happy that Saft has entered the Brazilian market because the country is expanding its telecom infrastructure and good batteries are essential for the reliable operation of sites like back bone stations, UPS, data centres, photovoltaic systems, etc. , especially as many sites in Brazil involve very high temperatures."

INNOVATION

Ni-MH traction energy for Sitras HES system on Siemens tram

Siemens has now successfully demonstrated its powerful Sitras HES (hybrid energy storage) system, incorporating a Saft Ni-MH traction battery, aboard a tram in service in Portugal.

The Sitras HES enables the new-generation Siemens Mobility tram to operate without an overhead contact line (OCL) for distances up to 2,500 metres. Thanks to regenerative braking.

Protecting urban landscapes

The first of these innovative trams has completed more than two years of successful passenger service trials in Portugal with Siemens Mobility customer MTS (Metro Transportes do Sul, S.A.), Starting at the end of 2008, it has been operating services between Almada and Seixal in the south of Lisbon.

Trams equipped with Sitras HES can operate autonomously, i.e. without external power from an OCL, over long sections of track. The concept is ideally suited for areas where the impact on the local landscape must be minimised, such as in historic city centres.

MES and DLC

The Sitras HES comprises two energy-storing components: the Sitras mobile energy storage (MES) unit based on a double-layer capacitor (DLC) together with chokes, control unit, converter, etc.; and the Saft traction battery system. DLCs are characterised by high efficiency and a high power transfer capability based on high currents. They have a cycling-number up to one million. The two components work together to provide a very efficient energy storage system.

Saft's Ni-MH traction battery system was primarily chosen by Siemens Mobility because they were already commercially available and could be used without a long development period. Naturally, they also met Siemens stringent specifications in terms of weight, size, reliability and high energy performance.

Regenerative braking

When the tram is running the energy storage units are charged via regenerative braking. The vehicle can then use this stored energy to travel over distances of up to 2,500 metres on sections of track where no OCL is available. This distance represents a very significant increase in autonomous operation compared with the typical 500-m capability of a tram relying on battery or DLC power only, without regenerative braking. The high-energy Ni-MH battery also improves the reliability of the tram service as it allows continued operation when the OCL is temporarily unavailable, such as in the case of failure or planned maintenance.

The Sitras HES system is designed for roof-mounting on the tram and is electrically connected to the vehicle feed-in point by means of a DC/DC-chopper. This new autonomous connection concept enables the energy storage system to be either integrated into new trams or retro-fitted into existing vehicles.

Sitras HES: integrated battery unit

The Sitras HES battery unit was adapted by Saft from its range of fully-integrated battery systems developed to meet the needs of the new generation of tramways. It is based on Saft's NHP Ni-MH cells designed specifically for high-power applications to offer excellent power storage in a compact maintenance-free package. To ensure maximum reliability and safety, each battery system incorporates an active cooling device and battery management control (BMC). The unit is supplied to Siemens Mobility as a 'plug and play' package in a custom-built tray complete with power and communications connections.

The exact battery system voltage and capacity for future systems can vary according to the specific application. A typical specification would be 44 cell blocks of NHP10-340 cells connected in series, providing a nominal 528 V and capable of storing 18 kWh of energy and sustaining a peak power of 105 kW. The total battery weight is 826 kg.

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Sustainable development tram

Under optimum operating conditions, tramways using the Sitras HES system can operate without overhead contact lines where necessary and save up to 30 % in energy while reducing emissions by up to 80 tonnes of CO_2 per year and tram.

INNOVATION

High-energy Li-ion for Latin American Tetrapol network's outdoor BTS cabinets

When Cassidian was asked to extend the Tetrapol communications network in Latin America, **it selected new-generation outdoor cabinets from b+w Electronic Systems equipped with Saft Intensium 3 battery systems.**

Saft is now supplying its Intensium 3 high-performance, maintenance-free rechargeable Li-ion batteries for a telecom BTS (Base Transceiver Station) power back-up application.

b+w Electronic Systems, the German systems integrator, chose Saft's high-energy Intensium 3 rack-mount Li-ion battery system when developing a new passively-cooled outdoor cabinet that delivers increased reliability and substantial power savings in the most demanding operational conditions.

Cassidian is currently deploying the b+w outdoor cabinets in a project to expand the Tetrapol digital radio communication network used by security forces in Latin America.

Top performance in tough conditions

"We developed these new outdoor cabinets to meet the needs of our customer, Cassidian, that sees more energy-efficient, passively-cooled cabinets as the future for BTS installations," says Dirk Weniger, Business Unit Manager for Telecom Products at b+w Electronic Systems. "The high temperatures inside the cabinet, combined with daily cycling, are a real challenge for battery life, especially in Latin America where temperatures can reach +50°C," he adds. "We found Saft's batteries to be capable of delivering long service life in these conditions, with the added benefit of high energy density and zero maintenance, so they are vital to the success of the project."

Innovative design with passive cooling

The latest b+w outdoor cabinet includes several key innovations: the use of a solar panel to supply additional power, thus reducing the site's overall consumption; Li-ion batteries that allow higher operating temperatures combined with high cycling capability; sophisticated adaptive power management; and passive cooling that eliminates the need for air conditioning or heat exchangers. The result: a cabinet that requires up to 85% less power than a conventional design.

The BTS cabinet incorporates a rectifier to convert the AC power from the mains supply to the DC power required for the operation of the base station and other embedded equipment. Should the AC supply be interrupted, the 48 V battery provides back-up power to maintain continuity of operation for up to 24 hours – sufficient to allow bridging to an alternative supply or for controlled shutdown.

Customer satisfaction

Saft is currently making volume shipments as Cassidian rolls out the new outdoor cabinets through Latin America. "The network is now three-quarters deployed. The part that is already installed is fully operational and our customers are very satisfied with the performance of the BTS cabinets," says Cassidian's project manager Volker Hagenkoetter.

This project is the first time b+w Electronic Systems has used Li-ion batteries in its telecom cabinets. "We are very happy with their performance. Li-ion technology has a big future in this type of application," concludes Dirk Weniger.

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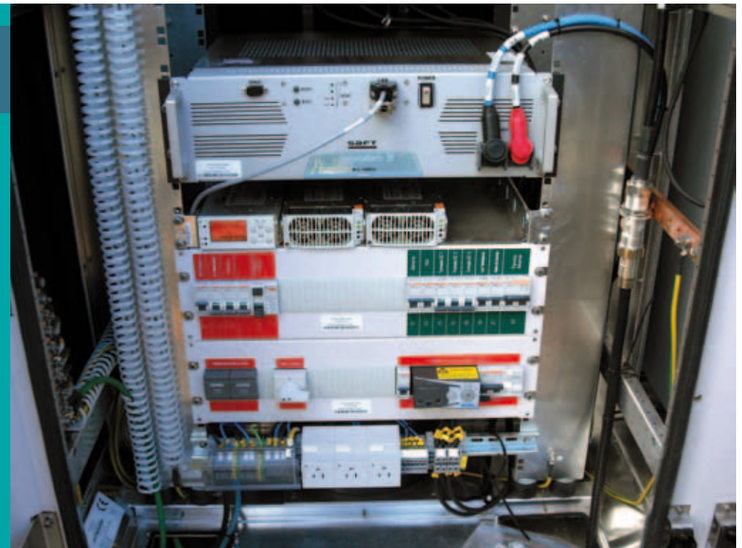
Intensium 3 Li-ion battery system

Saft's compact battery system is designed specifically to provide power back-up for remote or outside telecom plant. It is maintenance-free and offers fast recharging and high energy efficiency as well as a long service life at high temperatures – 10 years at a constant +40°C (in this application the normal internal cabinet temperature will range from +30°C to +45°C, with peaks of +50°C). 48 V Intensium 3 battery systems have a typical capacity of 45 Ah and provide 2,300 Wh energy in a 19" plug-in module that weighs 24 kg.



Technology and service

b+w Electronic Systems chose Saft because of its technology. This was a fast-track project and they needed a battery that was already proven so they could finalise the product they were supplying to Cassidian. "Saft was the only company that had a satisfactory battery ready. Not only that, but their engineers came to our Oberhausen plant to help with the final stages of development, to ensure that the battery parameters were exactly right for the system. And together we were able to make some improvements to the battery management software," adds Dirk Weniger.

EVOLVING PLANET

New lease of life for historic NY cable car, with MSX back-up

Saft's nickel-based MSX batteries are playing a perfect role for the on-board needs of the new cable cars on the world-famous Roosevelt Island Aerial Tramway in New York. MSX offer advantages required in such applications: high performance, reliability, low weight and small size.

The Aerial Tramway, which carries New Yorkers across the East River between Manhattan and residential Roosevelt Island, has just reopened following a major upgrade project aimed at improving service and ensuring passenger safety and comfort. For at least 30 years.

As part of the modernization, two Saft MSX batteries have been installed on each of the two new cabins. Saft developed the MSX series nickel-based rechargeable batteries to deliver safe and reliable back-up for safety-critical onboard systems in the rail industry. On the aerial tramway, MSX batteries will be the sole source of power for communication and internal lighting, as well as the door opening and locking systems, WIFI communications and ventilation.

A major upgrade

The order for the MSX batteries was placed by SEMER, the POMA Group company which was the main contractor for the modernization project. SEMER specializes in the engineering and production of electrical equipment and industrial automated systems. The firm has handled the Montmartre funicular railway in Paris as well as projects such as the Vin Pearl cable car in Vietnam, the Tienmenshan cable car in China and Zurich's People Mover.

During $25-million renovation from March to November 2010, virtually everything on the aerial tramway system was replaced except the bases of the three towers that support the cables. The tower tops were modified to accommodate a wider cable gauge and the single-haul system was changed to a dual-haul system that enables the two cabins to travel independently of each other.

"The correct choice of onboard battery was crucial"

"The key aims of the Aerial Tramway renovation project were to increase the reliability of the service for passengers, maximize safety and improve energy efficiency. Making the correct choice of onboard battery was crucial in achieving these aims", says SEMER project leader Stéphane Alléon. "Saft's MSX battery enabled us to meet all our design requirements in terms of performance and high cycling capability as well as offering a very significant reduction in weight and installation footprint."

High-cycling application

The cabins and their MSX batteries are in service from 06.00 am to 02.00 am, during which time each cabin makes 185 round trips over a 945-metre journey between Manhattan Station and Roosevelt Island at a speed of 16 mph (26 kph) and a height of 76 metres above the East River. So this demanding application requires the batteries to handle hundreds of charge/discharge cycles over a 20-hour shift.

The 24 V, 100 Ah batteries discharge during the 170-second single journey to power the electrical systems. They then connect automatically to a docking station at the loading quay to recharge. The recharging time available varies from 120 to 420 seconds, according to the frequency of service, which itself depends on passenger numbers and the time of day. In addition to normal service, the batteries are required to provide emergency back-up for up to three hours should a cabin be halted between the two stops.

A further challenge is the extreme temperatures encountered in New York City, ranging from -5°C to +30°C.

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The MSX series

MSX batteries were the ideal solution for SEMER as they were developed specifically to deliver high power and high cycling performance over a very wide range of temperatures, from -20°C to +40°C. The MSX design also incorporates an integral centralized water-filling system, helping to meet the operator's requirement for minimal maintenance. Each cable-car battery comprises 18 MSX 100 cells.

Roosevelt Island Aerial Tramway

The Roosevelt Island Aerial Tramway opened in 1976, alongside the Queensboro Bridge. Until 2004, it was the only commuter cable car in North America. The tramway is a well-known New York landmark, featuring in films such as Spiderman, and every year it carries over 2 million New Yorkers. Until the aerial tramway was built, people commuting from the low to middle-income housing projects on Roosevelt Island had to take a conventional tram half way across the Queensboro Bridge (which goes on to Queens) and then take a lift down to their island home.

TECHNOLOGIES

Saft makes an impact with Evolion, a new Li-ion telecom battery

Saft has confirmed its leadership in Li-ion technology by launching its new Evolion battery for telecom applications. Evolion proved very popular at OSP EXPO in San Antonio in late 2010 and then at the GSMA in Barcelona in February 2011.

Saft's new dedicated telecom solution offers exciting possibilities for compact, safe and reliable back-up power systems for telecom installations. Visitors to both trade fairs were able to meet Saft's experts and discover how Evolion can deliver maximum performance despite the limited space available in telecom cabinets while also ensuring optimum TCO (Total Cost of Ownership).

Dual expertise: telecoms and Li-ion technology

Saft has extensive practical experience of the telecom industry as a key supplier of battery systems for a wide variety of network back-up applications including fixed wireline, cable and cellular. We also have a top track record as a supplier of Li-ion battery systems for demanding applications such as motor vehicles and satellites.

Saft has leveraged this dual expertise in development of the Evolion concept that offers a unique combination of float-charging capability and high cycling performance for telecom network installations. Key features of Li-ion technology for telecom batteries include: high-energy storage in a compact, weight-saving package; high efficiency; long calendar and cycle life – even when operating in extreme temperatures – zero maintenance requirements; and reduced environmental footprint.

Evolion technology will be of particular interest for three types of telecom installations: outdoor on-grid sites, off-grid sites and DPCO (Distributed Power for Central Office).

High energy for outdoor on-grid sites

Outdoor on-grid sites such as Base Transceiver Stations (BTS), Wireline Outside Plant (WOP) and Optical Node Units (ONU) require a battery system for back-up in the event of an interruption to their commercial power supply. Evolion has a particular advantage in locations where space is at a premium, as its high volumic energy means that it requires only half the space needed by a conventional VRLA battery. Another important plus for remote plant is that Evolion's zero-maintenance design coupled with intelligent remote supervision eliminates the need for routine site visits.

High cycling and long life for off-grid sites

In off-grid telecom sites the main power source is normally a generator set, a PV (photovoltaic) system, a wind turbine or some combination of these. The role of the battery is efficient energy storage. The main benefit of Evolion here is its high cycling capability and long life, especially in high temperatures. As well as ensuring an extended battery life, Li-ion technology also offers easy battery management.

A safeguard for DPCO facilities

Saft's lightweight Li-ion technology enables equipment specifiers to address the challenges of maximum floor loading requirements in Central Offices. This makes it feasible to install the battery racks in the same room as the telecom equipment, even on raised floors. Long calendar life and compact design means that co-location of Li-ion batteries with active equipment in the DPCO translates into significantly lower TCO, while reliably protecting the transmission, processing and storage of critical data.

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"A competitive solution"

"Evolion is a light and compact high-energy solution developed for a telecom market that wants to transfer more data faster via smaller cabinets – and often in developing countries where mains power may be unstable," says Saft's Telecom Product and Marketing Manager Anne-Marie Billard. "Our new Jacksonville plant, which is concentrating on production of Li-ion batteries, will allow Saft to offer Evolion as a competitive solution."

MARKETS

Saft batteries for Africa's first high-speed urban rail link

When South Africa's new Gautrain, served by Bombardier Electrostar EMU trainsets, went into service just in time for the Football World Cup in 2010, Saft batteries were on board.

The R25.4-billion Gautrain project, the biggest public-private partnership in Africa, involves a new 80-km rail network with N-S and E-W routes to serve a densely populated area in Gauteng Province. When completed it will provide a safe and reliable service to both commuters and airport travellers in the Johannesburg, Erkhuleni, Tshwane and Midrand areas.

The new transport network is intended to reduce road congestion, drive economic development (Gautrain is expected to create close to 100,000 direct and indirect jobs) and play a role in social regeneration.

MRX specialized rail batteries

Saft MATRICS MRX batteries are the ideal choice for this type of rapid transit application as they have been purpose-designed to deliver maximum performance, reliability and low TCO (Total Cost of Ownership). They provide the low maintenance and long service life benefits of sintered/PBE technology within a slim, light-weight block battery package that shows a major size and volume advantage compared with conventional batteries. The MATRICS MRX design is extremely reliable, has a linear predictable ageing characteristic, and does not fail to open circuit at end of life, even in extreme temperatures ranging from -30° to +70°C. This phenomenon, also known as 'sudden death' can affect some conventional batteries.

A two-phase project

The first phase of the network – a 20-km link between Sandton and O.R. Tambo International Airport – opened in June 2010 with 5 Electrostar 4-car EMU (electrical multiple unit) trainsets supplied by Bombardier Transportation, a member of the Bombela Concession Company, and derived from a British design. The remaining 60 km of the network, together with the remaining 19 trainsets, is scheduled to be operational by June 2011, completing the Johannesburg to Pretoria route. The high-speed Gautrain (top speed:160 kph or 100 mph) will link the two major cities (and stops in between), covering the 50 kilometres (30 miles) in just 40 minutes.

Bombardier Transportation in the United Kingdom has manufactured a total of 24 4-car Gautrain trainsets – 5 for the airport link and 19 for the second phase. The first 3 trainsets were completed by Bombardier at its Derby (UK) facility and the remainder have been assembled locally in South Africa from kits supplied from Britain. Bombardier Transportation is a member of the Bombela Concession Company, which will operate and maintain the trains until 2026.

Reliable back-up power

The Saft battery systems provide on-board back-up power to support emergency lighting, air conditioning, door operation and communication systems for the EMUs in the event of an interruption to the main power supply. Two 110 V battery systems, each comprising 74 MATRICS MRX80 cells, with a nominal capacity of 80 Ah, are installed below the floor of each trainset.

Saft has supplied a total of 48 Gautrain battery systems to Bombardier Transportation as turnkey, installation-ready, packages, assembled in rafts complete with control equipment and interfaces to communicate with the train systems. The Project Engineer reports that the Saft Ni-Cd Batteries have performed well and reliably on the 5 EMU trainsets in operational service since mid-2010.

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A roaring success

The Gautrain has been extremely successful. "When the service opened, ridership was several times projected levels. Usage has now stabilised but we are still above predictions, and numbers are set to increase again when the second phase of the project is launched in mid-2011," says Errol Braithwaite, Marketing and Communications Executive at Bombela Concession Company. "The local authorities are happy with the system and surrounding communities have really welcomed the Gautrain and integrated it into their lives."

EVOLVING PLANET

Li-ion storage for California power utility's distributed PV pilot project

Silent Power's residential energy storage device incorporates 9kWh of Saft's advanced Li-ion battery technology, Synerion E.

Saft's advanced Li-ion battery technology is providing storage for a renewable-energy pilot in Sacramento to assess the performance of highly distributed energy storage with photovoltaic (PV) power in urban areas.

The pilot project has been set up by the Sacramento Municipal Utility District (SMUD), with support from the U.S. Department of Energy (DOE), at the Anatolia III Community, a high-penetration PV zone within SMUD's service territory.

In 2010, SMUD was awarded $4.3 million from the DOE to conduct a two-year pilot project to examine the relative value of distributed PV coupled with different types of energy storage in 15 homes and three sites on SMUD's distribution system within the community. The project will provide data on the PV system and energy storage capability and determine how well the storage systems perform during periods of peak demand. SMUD's aim is to assess the technical and economic feasibility of using distributed storage to enable higher penetration of PV within its service territory.

Li-ion battery systems

The role of the pilot project's battery systems is to provide efficient energy storage so solar power can be time-shifted to support SMUD's "super-peak" from 4 p.m. to 7 p.m., particularly when PV output drops off after 5 p.m. Li-ion is the only technology that fully meets the project's demanding requirements: 20-year battery life in a wide range of environmental conditions.

Saft's high-energy Li-ion battery technology has been integrated into both a 5 kW residential renewable energy storage device, made by Silent Power, and a 30 kW "Community Energy Storage" device made by PowerHub Systems. Both storage solutions will be used to store excess energy generated by a home-owner's solar power installation. Composed of compact maintenance-free modules, the battery solutions provide 9 kWh and 30 kWh, respectively, in a robust industrial design.

The modular battery designs offer a number of features that are important to SMUD's pilot program, including excellent cycling capability, a long calendar life and an intelligent self-diagnostic platform. They also offer high energy density, millisecond-level response time and the versatility to address multiple applications and value streams. And Saft's Li-ion technology provides precise information on the battery's state-of-charge (SOC), which is a vital function in a dynamically operating energy storage system.

SolarSmart Homes

The $5.9 million PV pilot project is leveraging SMUD's SolarSmart Homes programme, which is a key feature of the Anatolia III Community. This program partners with housing developers to provide energy-efficient homes equipped with rooftop PV systems. Other partners in the pilot project are SunPower, GridPoint, the National Renewable Energy Laboratory (NREL), Navigant Consulting, Silent Power and PowerHub Systems.

SMUD, the sixth-largest public utility in the country, is a community-owned power utility serving 592,000 customers and a total population of about 1.4 million. The utility's energy-efficiency and renewable-energy programs are recognized nationally for their leadership and innovation.

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Urban distributed PV with storage

"We are excited about the potential of this type of system to be deployed on a large scale in urban zones like SMUD's service territory,"

says Blake Frye, Saft's VP Energy Storage Sales for North America. "Saft is committed to supporting renewable energy programs to conserve energy, protect the environment and provide reliable and affordable power to all kinds of communities."

INNOVATION

Photovoltaic energy for French trains, backed by Li-ion storage batteries

Saft recently delivered a customised battery system for an innovative low-consumption concept train with solar-powered interior lighting. **This is the first time a Li-ion battery has been installed in rolling stock. The demonstrator is now in service in the Loire estuary in western France.**

The Rayon Vert (Green Flash) Regional Express is a concept train jointly developed by French Railways (SNCF) and the Pays de la Loire region. The project provides a working demonstration of state-of-the-art technology that can increase the energy efficiency of an EMU (Electric Multiple Unit) train by making greater use of renewable (photovoltaic, or PV) energy while also reducing its overall environmental impact. The PV demonstrator has been installed in one carriage of the EMU.

The key innovation is solar-powered interior lighting. In a conventional EMU, the lighting is powered directly from the overhead catenary, via the pantographs, while an on-board battery is kept on float charge to provide backup power in case of a loss of external power. With the Rayon Vert concept, the interior lights (low energy consumption LEDs) are powered by an 18-sq.m array of semi-flexible PV panels mounted on the carriage roof. The PV array operates in conjunction with a Li-ion energy storage battery and the system is completely separate from the train's main electrical system. This battery ensures a continuous supply of electricity for the lighting, not just when clouds mask the sun but even right through the night.

A green train

The project is part of the Pays de la Loire region's drive to experiment and implement energy-saving technologies in many areas, including schools, regional administration offices and transport. The aim of this project in particular was to adapt PV technology to the constraints of railways operations. The SNCF was already exploring green technologies and was happy to take up the challenge, converting one carriage of a 3-carriage EMU at its Technicentre in Nantes.

Soon after the partnership agreement was signed in February 2010 the Region decided to put the train on show at the International Railway Fair (Innotrans) in Berlin in September 2010. SNCF asked Saft to develop an energy storage solution, suitable for installation in a box on the carriage roof, that would meet the stringent specifications of the project regarding battery performance, weight, size, calendar life and cycling capability.

Fast-track project

"The time-frame was really short, but both the SNCF and Saft proved very responsive," says Gilles Bontemps, Vice President of the Regional Council in charge of Transport. "Our Rayon Vert carriage was one of the stars of Innotrans, generating a lot of interest with railway players, PV specialists and the general public too."

Saft's Intensium Flex modular Li-ion system for specialised renewable energy applications was the ideal starting point, thanks to its exceptional energy density (up to 120 Wh/litre and 98 Wh/kg). Saft's Li-ion development team in Bordeaux carried out a fast-track project to adapt the Intensium Flex modules to meet the specific needs of the project. The result is a 72 V/ 6kWh battery system based on three Intensium Flex modules and an integrated battery management module mounted in 4 x 19" racks. This extremely compact package weights just 62 kg yet is capable of powering the interior lights for 12 hours.

Looking to the future

Since early 2011 the Rayon Vert is being evaluated over a period of eight months in commercial service (and on public display…) on lines between Nantes, Angers, Le Mans and Saint-Nazaire.

"The train has already proved very popular. People are very interested and enthusiastic, about both the ecological side and the cost-saving aspects. We are proud of the project and the image spin-off for our Region and the SNCF has been very positive. If the eight-month technical evaluation is successful too, I'm sure we'll be seeing more of these innovative 'green' trains on the tracks", smiles Gilles Bontemps.

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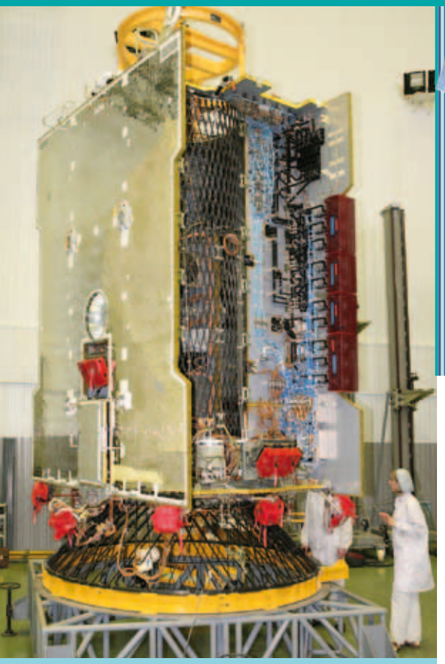
- Panel surface: 23 sq.m
- Panel energy efficiency: 21.8%
- Cell supplier: Sunpower
- Max. power output: 3126W
- Usable energy about: 8 kWh/day
- Daily energy savings estimated at 17 kWh

PARTNERSHIP

2010 - Year of Russia, Year of France

2010 was the Year of France in Russia and the Year of Russia in France, with numerous events – political, economic, business, cultural – organised to mark the occasion and strengthen institutional ties. And Saft was there.



ISS-Reshetnev telecom satellite in integration process

During the year-long programme, highlighting long-standing and very fruitful Franco-Russian relations, Saft cemented new business in four segments: space, aviation, railways and telecoms.

The big event of the year was the International Economic Forum in Saint Petersburg, which is traditionally the premiere event for Russian and foreign companies and investors to conclude major partnerships. This year France was feted. The Forum was attended by President Nicolas Sarkozy and five government ministers, accompanied a strong delegation of businessmen (including Saft's Head of Defence & Space, Philippe Jehanno) who took the opportunity to engage in discussions – and sign agreements – with their Russian partners.

Space

At the Forum Nikolai Testoedov, Chief Designer and Director General of the Siberian satellite manufacturer ISS-Reshetnev, and Philippe Jehanno signed a framework contract for the supply of advanced Li-ion batteries. By adopting Li-ion technology ISS-Reshetnev aims to considerably improve the performance of its spacecraft, in particular by increasing the capacity of its satellite platforms without increasing weight. The 3-year contract will also allow the company to optimize the value of its production.

During the year Saft also concluded sales contracts with other leading satellite players involving batteries to power telecom satellites and EOS survey satellites.

"We have a very good and long-standing relationship of confidence with our Russian partners. We all have good personal links with our counterparts and communication channels are kept open all the time", says Defence and Space Key Account Manager, David Masgrangeas.

Aviation

During the year Saft finalised and delivered new ultra-low maintenance (ULM) nickel-based batteries for the Sukhoi SSJ-100 regional jet. This new technology was certified by the Russian authorities in December 2010. The batteries can be used either to start the APU or to provide back-up power for emergency requirements. The Sukhoi SSJ-100, the only Russian-built aircraft to have this technology, has completed flight testing and is due to enter service with Aeroflot and other airlines in the first quarter of 2011.

Looking ahead, Saft is offering a similar ULM battery system for the future MS-21, a potential rival for the single-aisle Airbus A320 and Boeing 737 aircraft. The MS-21 is being designed by the Yakovlev design bureau and built by Irkut.

"We have been supplying the Russian market for nearly 20 years, with specialised batteries meeting the stringent requirements of that country's highly-reputed aviation industry. Saft and its partners have now taken a new technological direction, starting with our advanced ULM battery systems. This first step should be followed by the introduction of Li-ion technology once the product that we are currently developing for the Airbus A350 has been certified," says Aviation International Sales & Marketing Director Bernard Weber.

Telecoms & Railways

During 2010 Saft delivered high-power engine-starting batteries for 198 shunting locomotives operated by Russian Railways (RZhD), thus pursuing our long-standing relationship with this truly major world operator (world's 2nd-largest network, 1.1bn passengers and 1.1bn tonnes of freight annually, 685,000 locos & rolling stock).

This brings to almost 700 the number of Russian locomotives that have been equipped with Saft batteries in the past 5 years, our customer greatly appreciating their reliability, long life and good performance in extreme temperatures.

In 2010 Saft's 12-year presence as a supplier of replacement starting batteries was complemented by our entry into Russia's new-vehicle market: the new Desiro train intended for use during the 2014 Winter Olympics in Sochi will be equipped with Saft batteries from our Bordeaux plant. Saft's long-standing relationship with RZhD, local presence and familiarity with the certification process were key assets in this success.

"Both railways and telecom operators are becoming much more conscious of product reliability, battery size and weight, and maintenance costs. This is precisely where Saft's batteries can bring benefits to these operators and open up new opportunities for us," says Milan Sima, Sales Director for Eastern Europe.

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La France et la Russie partagent une longue histoire d'amitié. L'année croisée France Russie a marqué une étape supplémentaire dans cette relation très particulière. Son succès a donné une nouvelle impulsion à notre coopération dans tous les domaines. Je me réjouis de voir que les entreprises françaises comme Saft ont su tirer parti d'une économie russe très dynamique pour accroître leur présence et lancer de nouveaux projets de coopération avec le soutien déterminé des autorités des deux pays.

M. Jean de Gliniasty, Ambassadeur de France en Russie

"France and Russia have a long history of friendship. Our "Year of Russia-Year of France" initiative, designed to cement this very special friendship even further, was a great success and gave new momentum to our cooperation in all areas. I was delighted to see that French companies such as Saft have been able to benefit from Russia's very dynamic economy by strengthening their presence and concluding new partnerships. Both Paris and Moscow are determined to encourage this cooperation.

Jean de Gliniasty, French Ambassador to Russia

French and Russia cooperation discussions at Krasnoyarsk between Officials and Industry representatives

A bright future

"2010, the 'twin countries' year for France and the Russian Federation was an excellent stimulus for our relationship with our Russian partners. I am confident that this cooperation will grow even closer and become more fruitful in coming years. Saft aims to be a leading player in batteries and power-supply systems in the fast-growing Russian market and all the company's business segments will be working together to identify potential partnerships in state and Federal modernisation projects."

John Searle, Saft CEO

RZhD diesel loco type ChME3 equipped with Saft starting batteries

EVOLVING PLANET

Customer E-Mobility Forum

Saft and Siemens France recently organised a very successful E-Mobility Forum for industry players in Paris, prior to the grand final of the Andros Trophy ice-racing event.

On Saturday 5 March 2011, Saft, Siemens and Electricité de France held an E-Mobility Forum at the Stade de France, where 250 of their customers were invited to exchange ideas on technological solutions, applications and future market expectations in the areas of energy storage and transmission, smart grid and electric transport (electric motors, battery system, recharging infrastructure, electricity supply, etc.).

At the Forum, attended by France's Minister for the Economy and Industry Eric Besson, Saft and Siemens presented their current e-mobility solutions (vans, ferryboats, buses, trams, tram-trains, city-cars, roadsters, trucks…), with the emphasis on two e-car projects carried out together in partnership with French automotive specialist Exagon Motors: the Andros racer (a real crowd-pleaser later in the day) and the Furtive GT 4-seater sports car, unveiled at the 2010 Paris Motor Show.

John Searle (centre) Saft CEO, with Siemens François Gerin (left)

Thrills and spills

The E-Mobility Forum was held in tandem with the grand final of the Andros Electric Trophy, an event for electric racing cars and run on ice tracks, and the first of its kind in the world. The Electric Trophy, now in its second year, comprises a series of races in French ski resorts and a grand final, held in Paris. The cars are identical vehicles designed and built by Exagon Motors, equipped with electric motors made by Siemens and powered by Li-ion batteries specially developed by Saft. 55,000 race fans watched the final, which was won by Christophe Ferrier, while the overall championship was won by Nicolas Prost, son of the Formula One veteran. The Stade de France crowd also cheered the first public track appearance of Exagon's futuristic Furtive GT Electric sports car.

A great day

"The Andros Trophy is a wonderful project we started about two years ago - together with Saft, EDF and Exagon Engineering - which are all fantastic," says Vincent Jauneau, Director Industry Automation and Drive Technologies at Siemens France. "We could test our 90-kilowatt motors under extreme conditions: ice, water, and rain. After two years, we can see we were 100% successful because the motors function perfectly. It is a great day. We are slowly coming to realize that the e-cars can actually out-perform combustion engine cars. So we are very happy with the results."

Siemens is actively promoting e-cars with an eye on the future. "Some of our own employees are already driving e-cars. It is still a very modest number, but it is a test run to see how they work best, and how they are charged best… so later users won't have any problems in driving these automobiles," adds Siemens France, Deputy Director General, François Gerin.

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The Furtive GT is equipped with a 50 KWh Li-ion battery, 2 new Siemens motors of 125 kW each and special Michelin tyres for energy efficiency and road-holding: cutting-edge technology packed into a high-end e-car with the longest range ever offered to the market.

TECHNOLOGIES

Lithium technology in space - partnership for success

Lithium-based batteries, involving a range of electrochemical systems, are now accepted as a mature technology for space applications, largely thanks to cutting-edge R&D such as the joint programmes undertaken by Saft and France's CNES.

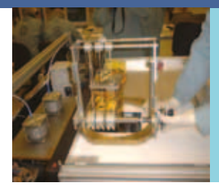
Saft is a leading player in lithium - and especially Li-ion - batteries for space applications, largely thanks to long-standing cooperation with the Centre National d'Études Spatiales (CNES), the French government space agency which is a leading member of the European Space Agency consortium and active in both the industrial and commercial fields.

The CNES is involved in all areas of space activity: launchers, satellites and space exploration (including probes and lunar rovers). The Centre carries out projects for both government agencies and the individual defence forces and also has cooperation programmes with space agencies in a number of other countries (the United States, Japan, Germany, the United Kingdom, Italy, Ukraine, Russia, Vietnam…).

Saft's cooperation with CNES, which began 40 years ago, has involved fundamental research, developmental research (R&D) and actual space-flight experience for battery evaluation, with major emphasis on developing and fine-tuning Li-ion technology for specific purposes. Joint projects are usually co-financed by both partners with either CNES or Saft suggesting research themes. This close relationship allows a strategic approach to technology development, prioritising confidentiality in the exchange of information and data.

"Both Saft and CNES feel that the best vector to develop the technology of the future is close cooperation at the fundamental research stage, well upstream of the actual application. Saft is a good R&D partner, bringing into the 'marriage' proven technological expertise and a range of products that can be upgraded, taken to the limits to satisfy the very demanding requirements of space missions. Saft is a leader in Li-ion battery systems, and space is one of the areas where this technology's key advantages - performance to weight/size ratio - are most significant."

Marc Pircher, CNES Director



Battery integration in the Rosetta space probe.

Success stories

Among the success stories written by the Saft-CNES partnership are:

Vega
Launcher - Li-ion battery system. ESA's small Vega launcher is designed to carry polar and LEO satellites weighing 300-2,000 kg. The programme started in 1998 and the first Vega is due to lift off in 2011. Li-ion batteries will be used for avionics, guidance and EVC.

Rosetta
Space science probe - primary lithium battery system. Rosetta is a combination orbiter and small lander that took off in 2004 to carry out a detailed study of the comet Churyumov-Gerasimenko, which the craft will reach after a 10-year transit.

PROBA 2
EO technology demonstrator - Li-ion battery system. PROBA 2, launched in 2009, is the second of ESA's low-cost satellites used to validate new spacecraft technology alongside scientific experiments. PROBA 2 (PRroject for On-Board Autonomy) carried and tested 17 technological innovations, including a new type of Saft Li-ion battery.

ATV Jules Verne
Space-station system - primary lithium batteries. Saft supplied specialised primary lithium batteries as part of the battery set supporting vital functions on the ATV (Automated Transfer Vehicle) space freighter "Jules Verne", the first European spacecraft to dock with the International Space Station. A second ATV, "Johannes Kepler", also with Saft batteries, docked with the ISS in February 2011.

Looking to the future

There are still a number of chapters of this cooperation success story still to be written. Saft is currently involved in research on the advanced battery technologies that will be needed by space missions launched during the next two of three decades.

New VES16 space battery
Development work on this miniaturisation of Saft's Li-ion VES series started some years ago under CNES contracts and the cells should be on the market by 2012-2013. These will be small cells with simple architecture, designed to reduce the cost of battery assembly and management.

Technology for the future 250 Wh/kg space battery
This is a jointly-funded fundamental research programme looking even further ahead, to 2020-2030, to develop Li-ion space batteries that are even smaller and lighter with enhanced performance. They are designed to meet the needs of telecom satellites handling ever-faster broadcasting data flow.

Hybrid concept batteries
Saft is working with CNES to design and fine-tune the world's first hybrid lithium battery system, intended for a new generation of launcher upper stages. The concept puts both power (Li-ion cells) and energy (primary lithium) in one battery system for the launcher's final stage, to enable the spacecraft to carry out a longer mission with better optimisation.

Long-range preparation for LiCFx technology
Saft and CNES are discussing cooperation on improving the next generation of primary lithium batteries to power the avionics in thermally-autonomous spacecraft. These batteries must be able to withstand the very low temperatures experienced during the transit phase of long-distance space exploration – conditions of -20°C to -40°C for periods of 6 months to 2 years. This should also benefit future Mars-exploration missions. For launchers, the main advantage will be the mass gain taking into account the higher energy density. A contract for LiCFx prototype development is expected to be signed in mid-2011.

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VES range of rechargeable Li-ion batteries

Saft's Space VES range of rechargeable Li-ion cells has been designed specifically to meet the on-board power needs of commercial, civil and military satellites. VES cells made their first space flight in 2004 and have established a significant flight heritage on GEO, MEO and LEO satellites. Saft and CNES began working together on VES technology in 2000 with the Stentor demonstrator (VES 140). The VES range (VES 100, VES 140 and VES 180 cells) have been used on 56 space flights accounting for 110 million cells.hours and 729 KWh in orbit.

Hybrid lithium battery model

"Optimizing the ideal lithium battery for launcher applications is a tough nut to crack and usually leads to a compromise between power and energy in order to fit the various mission profiles.
Though an R&T programme, Saft and CNES are working jointly on an hybrid solution that combines the advantages of both primary lithium and Li-ion. After developing an empiric model of this hybrid concept, based on real cell test discharge curves from their database, Saft developed software that simulates the electrical behaviour of a hybrid battery for a given launcher discharge profile. For instance, the tool draws voltage, current and depth of discharge curves, gives statistics of the battery discharge at different levels (battery, pack or cell level), calculates the mass gain in comparison to standard batteries, etc. For CNES launcher engineers, this software is a powerful design optimization tool, helping us size batteries according to a specific mission profile."

Julien Corbin Engineer,
CNES Launcher Directorate

PARTNERSHIP

ABB chooses Li-ion storage technology for its new smart-grid system

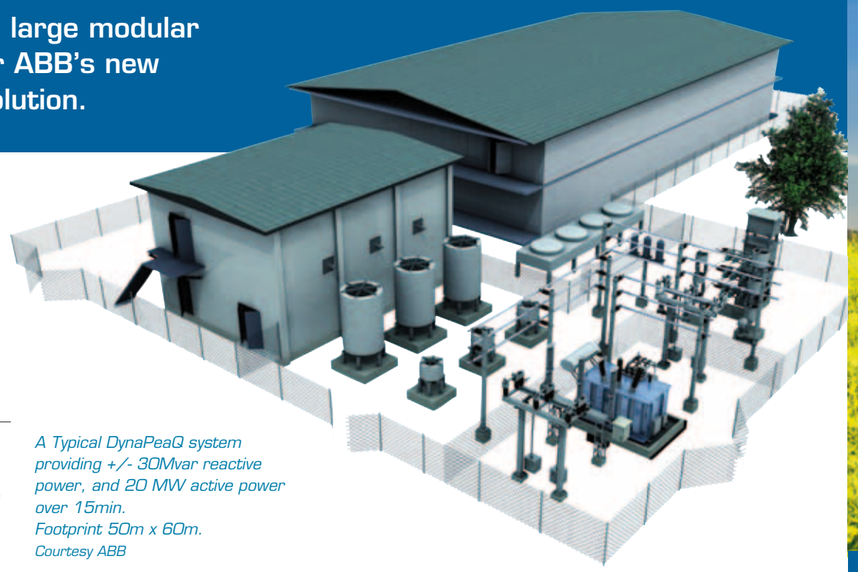
Saft is now developing a large modular Li-ion battery system for ABB's new DynaPeaQ smart-grid solution.

Saft Li-ion technology is providing the energy storage component that lies at the heart of the DynaPeaQ grid interface electronics concept, a key element in the development of smarter grids able to handle significantly increased levels of renewable generation.

Enhancing grid stability

By combining energy storage with ABB's well-established SVC Light technology, DynaPeaQ will alleviate many of the concerns related to the addition of wind and solar energy generation to existing grids by helping to level out intermittent production and to support demand response.

Combining an energy-storage system with fast-acting grid interface electronics enables dynamic control of active as well as reactive power in a power system, independently of each other. Through the control of the reactive power, grid voltage is controlled with high dynamic response while the active power element not only provides primary frequency control, but also enables a number of new services to be added including black start capability and peak load support.



A Typical DynaPeaQ system providing +/- 30Mvar reactive power, and 20 MW active power over 15min.
Footprint 50m x 60m.
Courtesy ABB

From pilot to high-end application

The concept is currently being demonstrated by a pilot project on a 11 kV grid near wind farms in England, using a 600 kW storage battery based on Saft's Intensium Flex system.

Saft's modular Li-ion battery technology makes the concept's ability to store energy highly scalable. "Based on the successful development of the pilot system, ABB decided to develop a higher-capacity solution, scaleable up to 50 MW for periods typically from 5 to 60 minutes. There is a strong, renewables-driven market out there and ABB can take a leadership position, in partnership with Saft", says Energy Storage Sales Manager Anna Jonsson.

Saft is now developing a high-power Li-ion battery system for DynaPeaQ, enabling up to 50 MW discharge under several kV. "The multi-cell battery has a modular configuration so as to meet several specific requirements. Our two companies are working in close cooperation, with ABB contributing its high-power expertise," adds DynaPeaQ Product Manager Tomas Larsson.

ABB is targeting DynaPeaQ at utilities, i.e. industrial, distribution and transmission applications. It is an ideal solution for installations that require the continuous reactive power control and frequency regulation essential for grid stability, combined with short-term active power support to cover load or supply variations.

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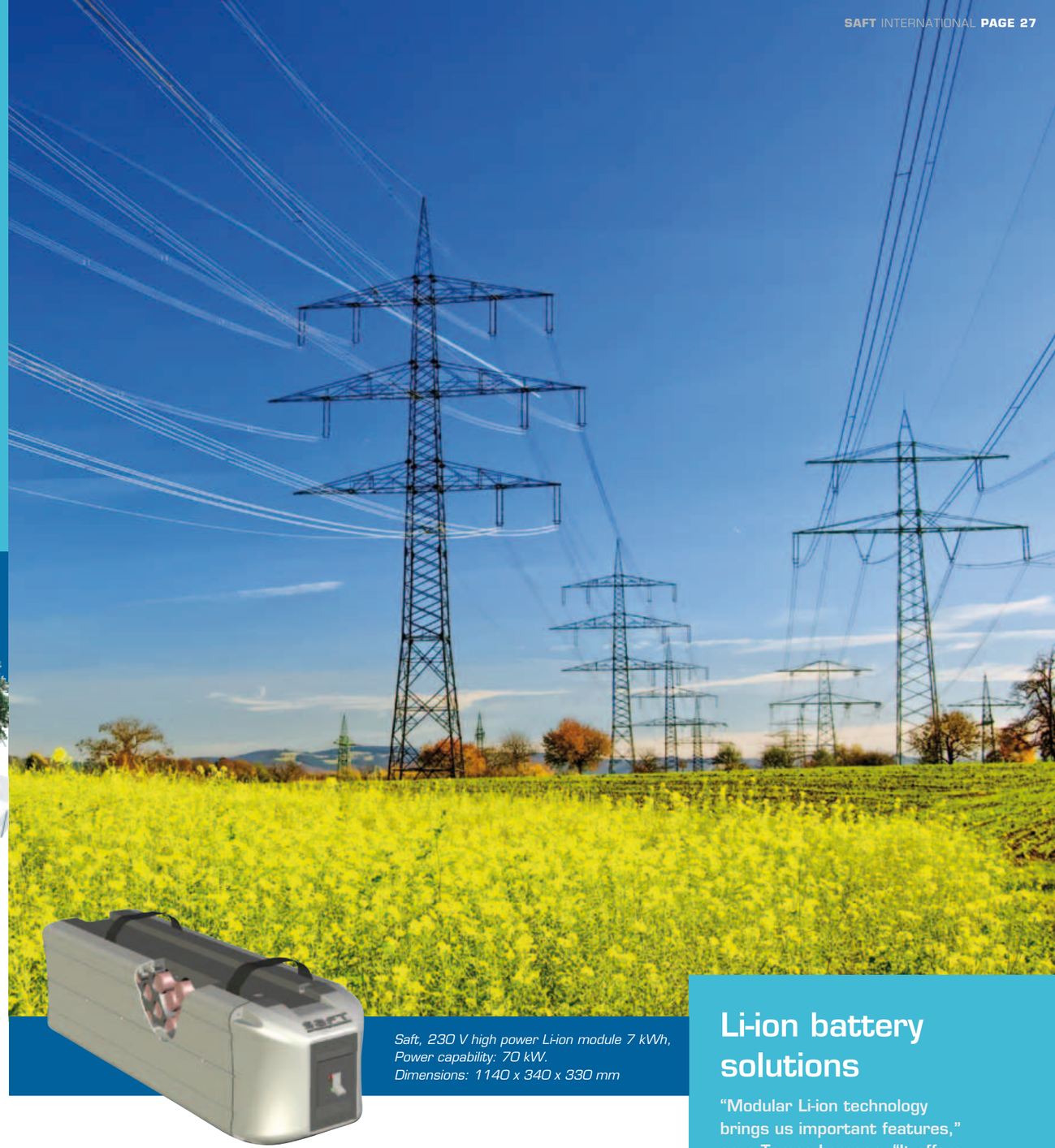


Saft, 230 V high power Li-ion module 7 kWh, Power capability: 70 kW. Dimensions: 1140 x 340 x 330 mm

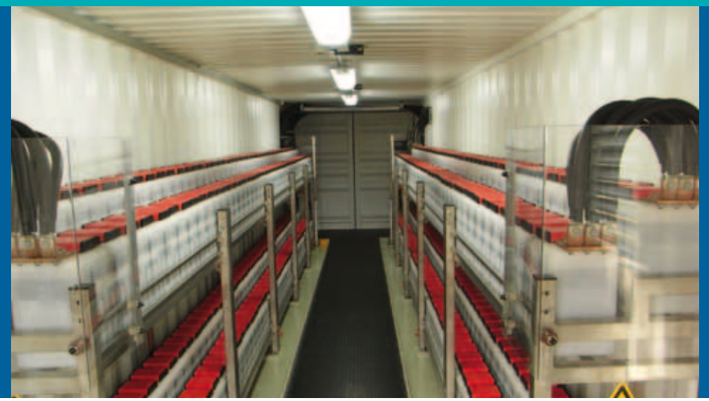
Li-ion battery solutions

"Modular Li-ion technology brings us important features," says Tomas Larsson. "It offers good cycling capability, long and predictable life and an intelligent, self-diagnostic design, high energy density, millisecond-level response time and high-power capability."

MARKETS

World's largest wind+diesel power plant relies on nickel-based battery storage

Thanks to an ENERCON wind-power system equipped with Saft storage batteries, the Caribbean island of Bonaire has now switched to eco-friendly power generation and enjoys steady power.



The world's largest hybrid wind+diesel project on the Dutch Antilles island of Bonaire now relies on a Saft 3-MW energy storage system for back-up power to ensure grid stability and continuity of supply.

The Saft energy storage system, using advanced nickel-based battery technology, stores energy from the island's independent grid and delivers it as required to ensure a totally reliable and stable power supply for the local population of 14,500 islanders and around 100,000 holiday visitors a year.

Bonaire is a small island of about 250 sq.km located 80 km north of the coast of Venezuela. Its main power plant burnt down in 2004, so until recently its power consumption of 75,000 MWh per year was met by a set of rented container (light-fuel) diesel generator systems. The new sophisticated power scheme, developed by the Dutch-German consortium EcoPower Bonaire BV on behalf of Water en Energie Bedrijf Bonaire (WEB), the state-run utility in the Dutch Antilles, has now enabled the entire island to switch to eco-friendly energy, with 12 wind turbines providing a potential 11 MW and a biodiesel power plant (5 gensets) contributing 14 MW.

Continuity of supply

Saft was called in by the German company ENERCON, a leading wind turbine and systems supplier (17,000 turbines providing 22 GW in 30-plus countries), to develop and supply the battery storage system that forms a vital element of stable stand-alone grids. ENERCON's requirements of the battery were a long lifetime, the ability to operate under high ambient temperatures, low maintenance requirements, quick reaction time and a capacity of 1 MW for 2 minutes," says ENERCON. The battery's main role is to maintain power quality and continuity of supply in critical situations, such as a sudden increase in demand or the failure of a generator, a turbine or the wind itself. The battery can deliver just over 3 MW for well over two minutes, allowing time for an additional diesel generator to be started up and brought on line.

"The power plant has gensets running all the time, but not necessarily all five", explains ENERCON."If there is a good wind they can shut down one or two gensets and save fuel. And reduce GHGs too." ENERCON supplied the turbines and the power-management system for the power station: electronics and software that monitors wind strength and energy demand. If the situation becomes critical the system automatically cuts in the batteries and starts up another genset.

Why did ENERCON turn to Saft? "We have a long and positive relationship with them. When we started wind+diesel development nearly 10 years ago, we did R&D and had a small test station at our plant. We were looking for a suitable battery for testing and asked Saft to propose a solution. We've had a good relationship ever since. They were willing to help us in our R&D phase, giving us all the data we needed, without knowing whether there was business in it for them. We liked that attitude, so we stayed with them when our R&D became business…. Saft engineers also came to Emden and helped us test the Bonaire system."

The Bonaire hybrid grid became operational in mid-2010. All components are working well and providing reliable (and greener…) power.

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Energy storage: a key role in renewables' success

"The Bonaire project is an example of the steadily increasing recognition that energy storage technology is going to play a key role in renewable energy schemes", says Xavier Delacroix, General Manager of Saft's IBG division. "Saft's advanced battery technology and growing experience in renewable energy applications mean that we are well positioned to support this type of project with reliable, efficient and cost-effective energy storage systems."

MARKETS

Fast and silent Peugeot e-motor scooter powered by Li-ion

For its new e-Vivacity, Peugeot Scooters asked Saft to develop a new-generation Li-ion battery system that would give the scooter more power and greater range. emergency lighting, professional electronics. Electric mobility is opening promising new markets, including scooters and electrically powered lifting devices. **Mission accomplished!**

By integrating two Saft Li-ion battery modules each developing 1kWh, Peugeot Scooters has provided its e-Vivacity with power of 3kW at 6,000rpm and a range of 60 km assuming a constant speed of 45 km/h. The zippy vehicle is capable of accelerations from standstill equal to those of many 125-cc models despite being a 50-cc equivalent model and it can reach the same top speed as equivalent 2-wheel vehicles with 50-cc combustion engines. But in complete silence.

Power, range, safety and environment

The battery system lodged under the scooter's foot deck comprises 2 Li-ion battery modules (6-cell modules based on the VL45E energy cell) purpose-developed for small mobility applications. The modules are equipped with an electronic battery management system developed using the international IEC 61508 risk reduction procedure, so ensuring an optimal level of safety for the battery system. At the same time the batteries combine performance with total respect for the environment: they generate no CO_2 emissions and can be fully recycled.

Long-life and user-friendly too

The scooter's batteries need no maintenance and can be fully recharged at least 1,000 times without any deterioration in their performance. They have been designed to last at least 10 years and allow the e-Vivacity to clock up about 40,000 km.

The e-Vivacity's battery system is very simple to recharge. The rider just connects a cable housed under the seat to a domestic 220V plug or an urban charge port. A full recharge takes between 5 and 8 hours depending on whether the vehicle is equipped with 1 or 2 chargers. With 2 chargers, an 80% charge can take just 3 hours. Partial charges do not affect the battery's useful life.

Close partnership

The project got under way at the end of 2009 following a request for expressions of interest from France's Energy & Environment Agency ADEME, which offered support for such a project. A Saft project team in Bordeaux worked very closely with Peugeot Scooters throughout the development and production phases. "We had regular meetings between the two project teams to discuss electronics, mechanics, interface, battery management, and Saft engineers very often went to the Peugeot plant," says team-leader Céline Auger. "This was a fast-track project so that the e-Vivacity would be the first series-production vehicle of its type on the market in Europe."

Needless to say, Peugeot Scooters was very happy with this partnership. "We didn't choose Saft, the world leader for advanced technology batteries, by chance but to give our customers the assurance of acquiring a vehicle combining performance with safety and reliability, says Peugeot Scooters CEO Pierre-Louis Colin. "Our partnership has enabled us to achieve a veritable technical and industrial breakthrough thanks to the compactness of the Li-ion batteries and a vehicle designed right from the start to integrate an electric motor".

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Li-ion: smaller and lighter

Several years ago, Peugeot launched a first-generation e-scooter called Scoot'Elec with Saft Ni-Cd batteries. It was a good product but the market was not ready. Today's consumers are much more aware of the advantages of e-mobility. The advantages of Li-ion technology were a determining factor too: the new Saft batteries take up less than half the space and weigh less than half as much as their nickel-based predecessors.

Making renewable generation predictable and grid compatible

Renewable energy is prone to significant peaks and troughs in output. Saft energy storage systems smooth intermittent generation, reduce ramp rates and firm capacity. They make solar and wind power a predictable component in the grid's electricity mix.

www.saftbatteries.com

saft