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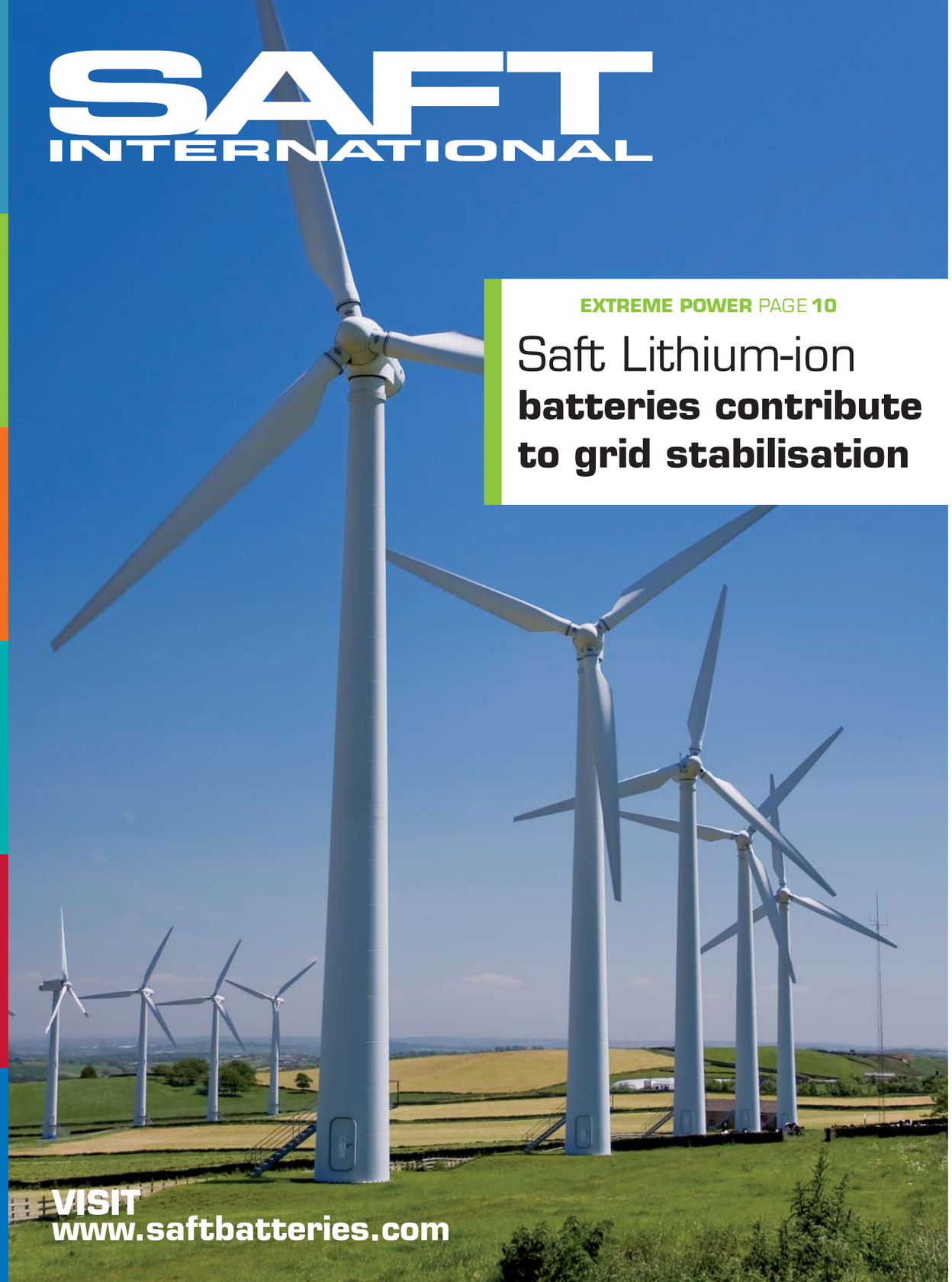
SAFT INTERNATIONAL



EXTREME POWER PAGE **10**

Saft Lithium-ion **batteries contribute to grid stabilisation**

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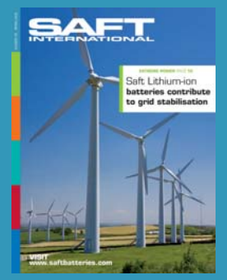
Meeting our customers' needs



Saft performed well in 2008 despite a challenging economic environment and 2009 will of course also be difficult due to the market conditions. We are taking the necessary decisions to preserve our overall efficiency by seeking operational synergies and keeping costs under tight control. One such decision is to merge the RBS and IBG divisions in order to take advantage of under-utilised assets. Our customers will not be affected by this change, as our sales and support staff will continue to serve them as usual. We remain totally focused on our customers' businesses, and our short- and medium-term projects continue to progress.

We have expanded capacity in some facilities to meet demand: production capacity for Tel.X telecom network batteries at our Valdosta, Georgia site, and primary lithium cell production as well as Li-ion satellite battery test capacity in Poitiers, France. In addition, Johnson Controls-Saft is in the process of increasing capacity for Li-ion hybrid and electric vehicle batteries in Nersac, France.

Saft remains very concentrated on addressing our customers' needs and seizing the opportunities which develop.

We have flexibility in both development and production and we strive to continually improve our competitiveness.

I am confident that the strengths of Saft will enable us to continue to develop and to accompany our customers' progress through these challenging times.

John Searle
Chairman of the Management Board
Saft Groupe

IN THIS ISSUE

Saft International – A magazine for Saft's customers and business partners. **Editor-in-chief:** Jill Ledger. **Managing Editor:** Catherine Jouatel. **Texts:** Graham Lord. **Graphic design:** D Parquet and ML Lanceau. **Photo credits** ©: iStockphotos/Brian A Jackson • J.Grison/LaCompany • iStockphotos/Stephen Strathdee • Ed Doherty • Ford • D.Cocatrix • iStockphotos/James Steidl • iStockphotos/Otmar Smit • Saft • ESA/D.Ducros 2007 • AIRBUS S.A.S. 2008 - Computer Rendering by Fixion - GWLNSD • BT Sweden • Hamburger Hochbahn • Sabik • NLB • Lange Aviation GmbH • DCNS • JSC – ISS • ECA • Cooper Safety • MineTracer Text Communicator - Photo courtesy of Venture Design Services • iStockphotos/P. Sikora/D. Hristov • Getty images/Malcolm Fife

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STRATEGY

Saft starts production of new Tel.X batteries purpose-designed for telecom networks

In January 2009 Saft started up its new $9-million production line at its US manufacturing plant in Valdosta (Georgia). **The line is dedicated to Saft's new Tel.X nickel-based product range designed specifically for telecom applications.**

The Tel.X range is designed to deliver reliable backup power for the growing number of decentralized telecom facilities supporting fixed, wireless, cable and cellular networks. Tel.X is the result of a 2-year development project led by the Valdosta team, with strong support from Saft's Bordeaux and Nersac sites.

The new manufacturing line, which has a capacity of over 16,000 48 V Tel.X batteries per year, will enable Saft to expand its customer base in a market where performance, reliability and low total cost of ownership (TCO) are crucial.

"Saft is already a significant player in this market, which has considerable growth potential", says Xavier Delacroix, General Manager of Saft's IBG division. "Our new production line shows our strong commitment to this market and we are ready to expand capacity as demand develops".

State-of-the art production tool

"Our new Tel.X assembly line – the only dedicated Ni-Cd telecom battery line in the world – is semi-automated, using state-of-the-art robotics and digital controllers", says Valdosta plant manager Peter Denoncourt. "Poka-yoke (error prevention) has been designed into the line concept, so it is nearly impossible to manufacture a non-conforming product".

Saft teamed up with an American system integrator, Automation Tool Company, to develop the semi-automated assembly line for Tel.X. "This team approach resulted in the best quality automation, customized for our product", adds Peter Denoncourt.

On 29th January 2009. Saft officials with telecom customers and Valdosta Chamber of Commerce staff

Ideal solution for network applications

Tel.X batteries are ideally suited for the majority of telecom network applications, including the hardware serving recent trends - cabinets and end terminals in fibre-optic 'triple-play' networks as well as BTS (Base Transceiver Station) and BSC (Base Station Controller) installations in wireless networks. This means equipment that is often in remote or demanding outdoor locations.

Saft's focus is on providing a high quality battery solution for applications that are subjected to extreme temperature as well as high levels of humidity. Other key Tel.X features are:

- maintenance-free under normal operating conditions, so ideal for remote sites
- compact, light and easy to install; around 15 minutes for a 48 V battery
- exceptionally long service life, over 20 years in normal temperatures and more than 14 years at +40°C
- wide range of capacities
- high volumic energy density of up to 100 Wh/L while weighing around 30% less than a conventional battery
- designed for use in standard 19" and 23" racks and cabinets, where its size makes it easy to install as a direct replacement for VRLA batteries
- compatible with all telecom rectifiers.

Ongoing field trials

Tel.X batteries are currently being tested by a number of customers around the world, and Saft technicians have been directly involved in many field trials, conducting the electrical tests on-site. The market for this type of battery has been primarily an American one, so far but is expected to rapidly expand to other zones. However, Valdosta is prepared to ship orders to customers anywhere in the world.

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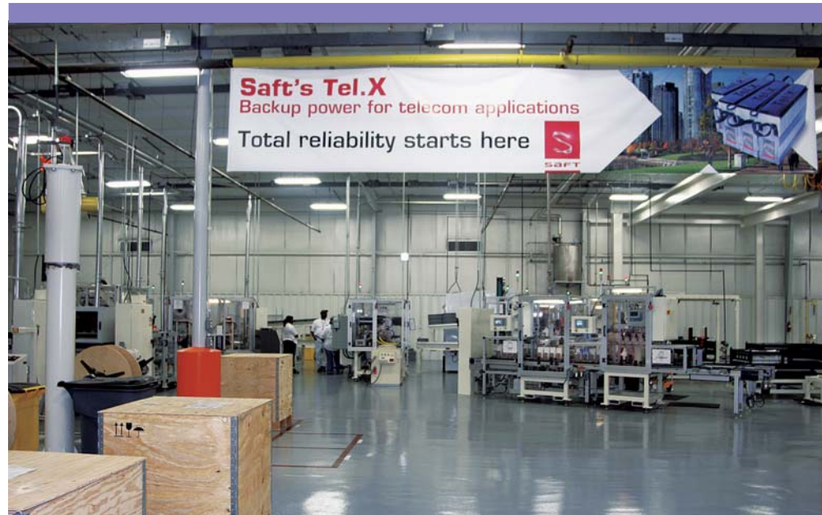


MARKETS

Johnson Controls-Saft begins manufacturing Li-ion batteries for hybrids

In 2008, Johnson Controls-Saft inaugurated its new Li-ion line at Nersac, France. The plant, which manufactures advanced Li-ion batteries for hybrid, plug-in and electric vehicles, is the first of its kind in the world. Batteries from Nersac will soon be powering the new Mercedes-Benz S-Class hybrid sedan to be launched in June 2009. **Johnson Controls-Saft is set to become the leading Western manufacturer of batteries for hybrid and electric vehicles.**

The 2,000-sq.m Nersac plant, which required investment of €15 million, has the capacity to produce up to 10,000 battery packs (350,000 cells) per year and is built to be scaleable so that production can be increased to meet growing demand from auto manufacturers. Johnson Controls-Saft is now on the way to becoming a leading world player and no.1 Western supplier in this high-growth segment.

A high-potential market, driven by environmental concerns

Saft President and CEO John Searle describes the new plant as a confident investment in the future, explaining that "The market for clean vehicles has enormous potential. In Europe, all car makers have stated their intention of developing these vehicles and Li-ion technology is now recognized as the way to go. Studies estimate sales of around 4 million hybrids by 2015 and increasing interest in PHEVs and EVs. With this state-of-the-art facility, Johnson Controls-Saft is set to become a major supplier of HEV/EV batteries".

Major contracts

Johnson Controls Vice President Alex Molinaroli outlines what the "excellent match" joint venture had already achieved in this key market: "In 2007 General Motors awarded us a development contract for batteries of the Saturn Vue Green line plug-in hybrid SUV, and in August we won the contract to supply Li-ion battery packs for a test fleet of Dodge Sprinter plug-in hybrid delivery vans. Then in January 2008 the joint venture won two new contracts for the Chinese market. Johnson Controls-Saft was selected by China's leading car maker, SAIC, to provide Li-ion batteries for its demonstration fleet of new energy vehicles. We will be also be producing Ni-MH batteries for Chery Automobile's new A5 mild hybrid, which will be available to consumers in 2010".

see page 8

Ford's Escape Hybrid Plug-in with a Li-ion battery supplied by Johnson Controls-Saft

Excellence in manufacturing

At Nersac, Johnson Controls-Saft has merged the manufacturing excellence of both mother companies. Nersac has launched a full manufacturing efficiency programme covering everything from equipment design to process improvement. For instance, Li-ion cells are very sensitive to moisture, which can impact the performance of the battery. "We have built one of the largest and most efficient dry rooms in Europe, with airlock doors for personnel and materials to prevent atmospheric moisture from entering", explains Operations Manager Thierry Bouilleau. "But that's not enough; we also have special clothes for the operators and we set strict rules to apply at each step of the processes. We are already in the second phase of process improvement, aimed at minimizing the water content in our components. Excellence in operations will be one of the critical success factors in optimizing our overall performance and meeting customers' expectations".

Johnson Controls-Saft - Comprehensive expertise

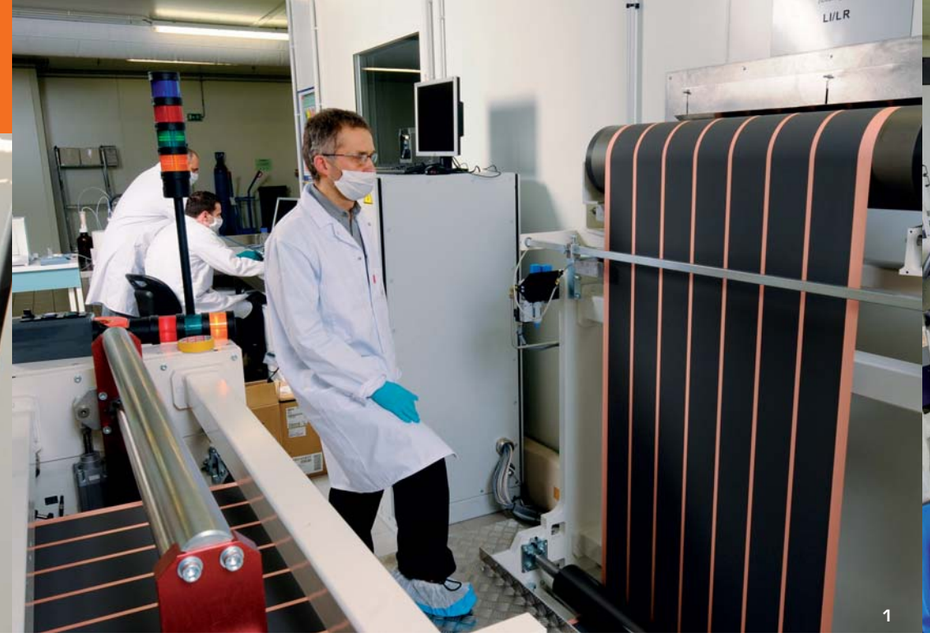
Johnson Controls-Saft is a joint venture set up in early 2006 between Johnson Controls, the world's leading supplier of automotive batteries and a company with long experience in integrated automotive systems, and Saft, an advanced energy-storage solutions provider with extensive Li-ion battery expertise.

Saft brings into the partnership its Ni-MH cylindrical-cell and Li-ion technologies and Johnson Controls contributes its systems-integration know-how, its Li-ion laboratory in the US and its extensive knowledge of the world auto industry.

The joint venture's expertise covers the full package:
- Cell chemistry and design
- Cell manufacturing
- System engineering (mechanical, electronics and SW, electrical, validation)
- Integration
- JIT assembly.

Johnson Controls-Saft has built up a global footprint so as to be more accessible to customers. In addition to the plant in Nersac, the company has R&D centres in Milwaukee (USA) and Bordeaux (France) as well as system engineering, testing and integration centres in Milwaukee, Hanover (Germany) and Shanghai (China).

MARKETS



1

2

1 • Coating line
2 • Cell assembly line

Since then the company has announced:

- a BMW production contract to supply Li-ion batteries to power the ActiveHybrid 7 Series,
- a production contract with Azure in the US representing the plant's first success in the commercial vehicle segment,
- a production contract with Ford for its first plug-in vehicle.

Johnson Controls-Saft is currently launching capacity expansion in Nersac to meet demand. 2009 has also seen a market initiative from several governments to accelerate the development of clean vehicles, which should stimulate demand.

Saft: auto-industry partner and Li-ion leader

Saft's involvement in supplying batteries to the motor industry dates back to the 1990s when the company started to produce Ni-Cd EV batteries in Bordeaux for Peugeot-Citroën (PSA) and Renault. This project was a limited success as the range of the car between recharges was too short, but this encouraged Saft in 1995 to start work on developing advanced technologies such as Ni-MH and Li-ion, again in our R&D centre in Bordeaux. Later, this work was extended to develop high-power Li-ion technology for HEVs and other applications, and this technology has become the basis of the batteries Johnson Controls-Saft are producing on this new site. Over the last 10 years, Saft has invested an estimated €120 million in developing its Li-ion technology, which is also used in our traditional activities for the space, aviation and defence markets.

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Going for 100% quality

"With hybrid and EV batteries, quality is everything", says Pascal Lafaye, Quality Manager, Automotive, who heads the joint venture's 7-man QC team. Even though Saft already has very high standards (ISO 9001), customers insisted on even greater emphasis on quality.

"It's a matter of battery lifetime", explains Pascal Lafaye. "Today's car batteries are only expected to last 3 to 4 years. But firms manufacturing hybrids want batteries that last the life of the car, meaning around ten years. To achieve this, you have to completely eliminate defects". So at the Nersac plant, Johnson Controls-Saft has already received the ISO-TS certification. "This increases the confidence of our automotive customers. We have received the green light from Daimler to launch series production of our first lithium-ion hybrid battery. We are using a new preventive tool to analyse and reduce risk. This starts with the equipment, because if you have low-quality equipment you get low-quality manufacturing. It also covers careful selection of suppliers (i.e. auditing their QC procedures too) and training line personnel to perform systematic quality controls at every stage of the manufacturing process - electrode preparation and assembly".

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Battery technologies for hybrid vehicles

Chemistry	Battery characteristics	Applications
Ni-MH HEV Ni-MH	▶ High power application ▶ 8 yr life announced ▶ Manufacturing capacity available in Japan ▶ Key component of cost - Nickel	Mild Hybrid Full Hybrid
Li-ion HEV Li-ion	▶ High power application ▶ Smaller, lighter batteries ▶ Very long life demonstrated by Saft ▶ Potentially lower cost with high volume	Mild Hybrid Full Hybrid
Li-ion EV Li-ion	▶ High energy application ▶ Range up to 30 - 200 km ▶ Zero emission in EV mode	Plug-in Hybrid and Electric Vehicle
Li-ion With Fuel cells	▶ High power application to aid acceleration ▶ Demonstrator fleets being planned	Electric Vehicle

EXTREME POWER

New high-voltage Li-ion batteries help improve stability of power grids while optimising renewable sources

Increasing use of wind and solar power is definitely a plus for our planet's environment, but feeding these variable power currents into existing distribution networks can destabilise the grids. **Saft and ABB have a solution.**

The two partners have scored a world first by developing a 5,200-volt dynamic Li-ion energy-storage solution to minimise grid disruptions in particular due to the increasing penetration of renewables.

Power transmission systems are subject to voltage and load variations, and this phenomenon is becoming more serious as increasing numbers of renewable sources (wind farms, solar PV systems…) are brought on line. This instability reduces a grid's transmission efficiency. Current technology allows utilities to stabilise voltage variations. But ABB, the world's leading specialist in AC systems to stabilise power grids, such as the company's FACTS (Flexible AC Transmission Systems) range, has launched a project to increase their scope to cover short-term load variations by adding a battery energy storage device to their system. The new system will be most useful to industries with high short-term power demands and grids with a high penetration of intermittent renewable energies.

More efficient use of renewable sources

The new solution, called DYNAPOW, combines dynamic energy storage provided by Saft's 5.2-kV battery, which will help respond to disruptions in the grid, with ABB's SVC (Static Var Compensation) Light high-frequency switching technology for dynamic voltage control. While current FACTS technology is focused primarily on stabilising grid voltage, the addition of energy storage also allows it to cover short-term supply or load variations.

"The key aim is to demonstrate the feasibility and added value of incorporating Li-ion energy storage within a FACTS system", says Per Eckemark, Head of ABB's FACTS System Group. "It could play a vital role in ensuring the stability of utility grids as the penetration of wind power increases"

Li-ion battery system

Li-ion technology brings a number of advantages to this application: excellent cycling capability; long calendar life; high energy density; very short response time; high power capability in both charge and discharge; maintenance-free design. Saft's technology also provides the system with precise information on state of charge (SOC), which is a vital function in a dynamically operating energy storage system.

The battery system comprises eight stacks of Saft's Intensium Flex, rack-mounted Li-ion modules. Each stack involved 13 modules and a control unit (BMC). Nominal voltage is 5.2 kV and the system can deliver active power of 200 kW for an hour and 600 kW for over 15 minutes. Saft is also supplying the control and management devices for the battery, as well as a CAN-based optical communication interface with ABB's MACH-2 controller that will monitor the battery continuously and optimise its operation.

Development partner

"We chose Saft for two reasons", says FACTS Group R&D Manager Peter Lundberg. "Their Li-ion batteries have the high power and high density our application needed, and over the past 10 years we have found Saft to be a good technical and commercial partner. We looked around, and Saft was the right company with the right technology". But ABB was not just looking for a battery manufacturer. "We were developing an innovative solution where battery storage is a key element, so we needed a development partner who knew about battery management systems and integration into applications", adds Peter Lundberg. "Saft worked with us to adapt their products to our application. People from their Bordeaux facility came to Sweden to provide valuable input, and Saft engineers also played an active role during qualification and testing of the complete system".

Testing and a pilot field demonstration…

The battery system has successfully completed commissioning and bench testing at ABB's facilities in Sweden. The next stage, a pilot project due to begin in March 2009, will involve installation of an SVC Light with dynamic energy storage in an EDF Energy distribution network in Britain (between Ormesby and Martham in Norfolk), which has a high penetration of wind power.

The Martham pilot will deliver dynamic voltage control in an 11 kV grid and at the same time enable dynamic storage of surplus energy from nearby wind farms, energy that can be used to level out peaks in grid loading.

"This installation will improve the usability of power from the wind farms and avoid the destabilising effect it can have on the grid", says Per Eckemark. "It will also provide a useful reference project for energy storage".

… and then moving up to the next level

Looking further ahead, Saft is now working with ABB on full-scale applications involving tens of kV and tens of MW.

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INNOVATION

Li-ion storage for Europe' s largest photovoltaic energy project

Saft has now teamed up with Voltwerk and Tenesol in the EU-backed Sol-ion project to develop **a new concept in energy conversion and storage for grid-connected photovoltaic (PV) systems.**

The Franco-German Sol-ion partnership, launched in August 2008, is developing an integrated energy kit able to be produced on an industrial scale for decentralised on-grid, residential PV systems.

Li-ion batteries will be used in PV systems on the biggest scale ever tested in Europe: 75 systems will be deployed in France and Germany to assess the performance of the technology, its economic viability, the added value of energy storage in an on-grid system and the benefits to stakeholders.

Validating a new concept

Most grid-connected PV systems do not include energy storage and the electricity produced is fed into the grid directly, in real time. The advantage of the Sol-ion storage concept is that solar energy can be "time-shifted" to periods when there is no sun. This enables the system to maximise a household's self-consumption of PV energy (in accordance with the new German feed-in tariffs), with only minimum impact on the grid. The project will demonstrate the benefits to the environment and to stakeholders of storing PV energy. One key benefit will be to reduce the impact of intermittent injection to power grids, thus allowing a high penetration rate of PV energy in the electricity mix.

Li-ion is the only technology that meets the project's need for 20-year battery life in demanding environmental conditions

Leveraging partnership expertise

Saft's partners in the project are leading PV systems providers and integrators: Germany's Voltwerk (a subsidiary of Conergy AG, an integrated PV company), which has installed more than 70,000 systems in 20 countries; and France's Tenesol (a subsidiary of the energy group Total and the power utility EDF), which supplies integrated photovoltaic systems and also manufactures solar panels (100 MWp forecast in 2009).

Saft is providing Li-on battery modules that will be connected in series to obtain the energy and voltage required by the application. The Intensium Flex modules will include electronics for data acquisition (voltage, temperature, etc.) and cell balancing in order to optimise battery life and allow charge/discharge control. System-management interfaces are being developed jointly with Tenesol and Voltwerk, which will produce the other components and assemble the Sol-ion product (battery + inverter + system management).
25 systems will be produced and set up in Germany and 50 systems in France (including French overseas territories).

"Teamwork is essential in projects like this", says Tenesol R&D projects coordinator Jean-Christian Marcel. "Saft engineers are working very closely with Tenesol and Voltwerk on development of our system-management interfaces. Saft experts make frequent visits to Lyon and Hamburg. It is a very fruitful partnership. Both we and Saft are learning a lot".

"Once the systems are installed, actual trials will last 12 months", explains Manfred Dittmer, Head of Innovation at Voltwerk. "Then we will start improving our systems by applying the lessons we have learnt. We are confident we will end up with a good commercial product".

Li-ion technology

"Sol-ion was initiated by Saft following an ongoing partnership with Tenesol, Technofi and the French power utility EDF on a project in Guadeloupe to test the technical feasibility and economic advantages of Li-ion storage coupled with grid-connected PV systems", says Jean-Christian Marcel. "Now we have joined forces with Voltwerk to look at the self-consumption aspects too".

"We needed batteries that could handle high cycling and fluctuating charge and discharge, and do this for at least 20 years", explains Manfred Dittmer. "Li-ion technology has the right energy performance as well as good total cost of ownership (PV end-users look very closely at the capex-lifetime equation) and Li-ion is well suited to the battery-management systems we required".

Enhancing efficiency and economics

The concept being tested by Sol-ion has strong market potential. On-grid systems are the most popular solar PV solutions for homes and businesses in developed countries. Energy storage will make these systems more efficient because excess PV energy can be stored until it is needed, whether locally or on the grid. Batteries will "time-shift" the energy produced during the day, making it available on demand when needed. This will maximize self-consumption and also increase the return for the owner of the PV system because of a special financial bonus for self-consumption under German law. Furthermore, energy storage will increase home and business security of supply.

Last and certainly not least, this new concept will help drive the development of energy-self-sufficient houses and other buildings and contribute to the further growth of renewable energies as part of the global energy mix.

"Given the current climate change issue and the recent energy price volatility, there is an urgent need to move ahead fast with renewables", concludes Manfred Dittmer. "To do this, we have to combine top expertise, and preferably at international level. That's what we're doing with Sol-ion".

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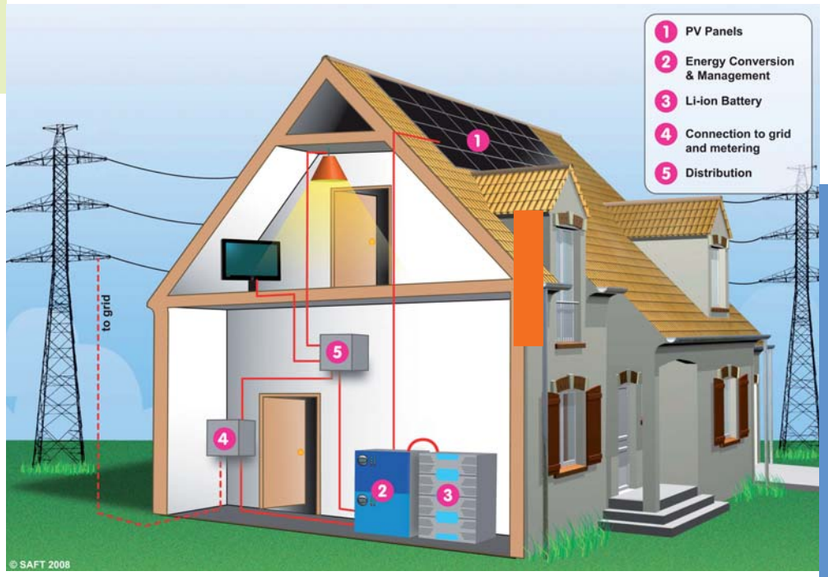


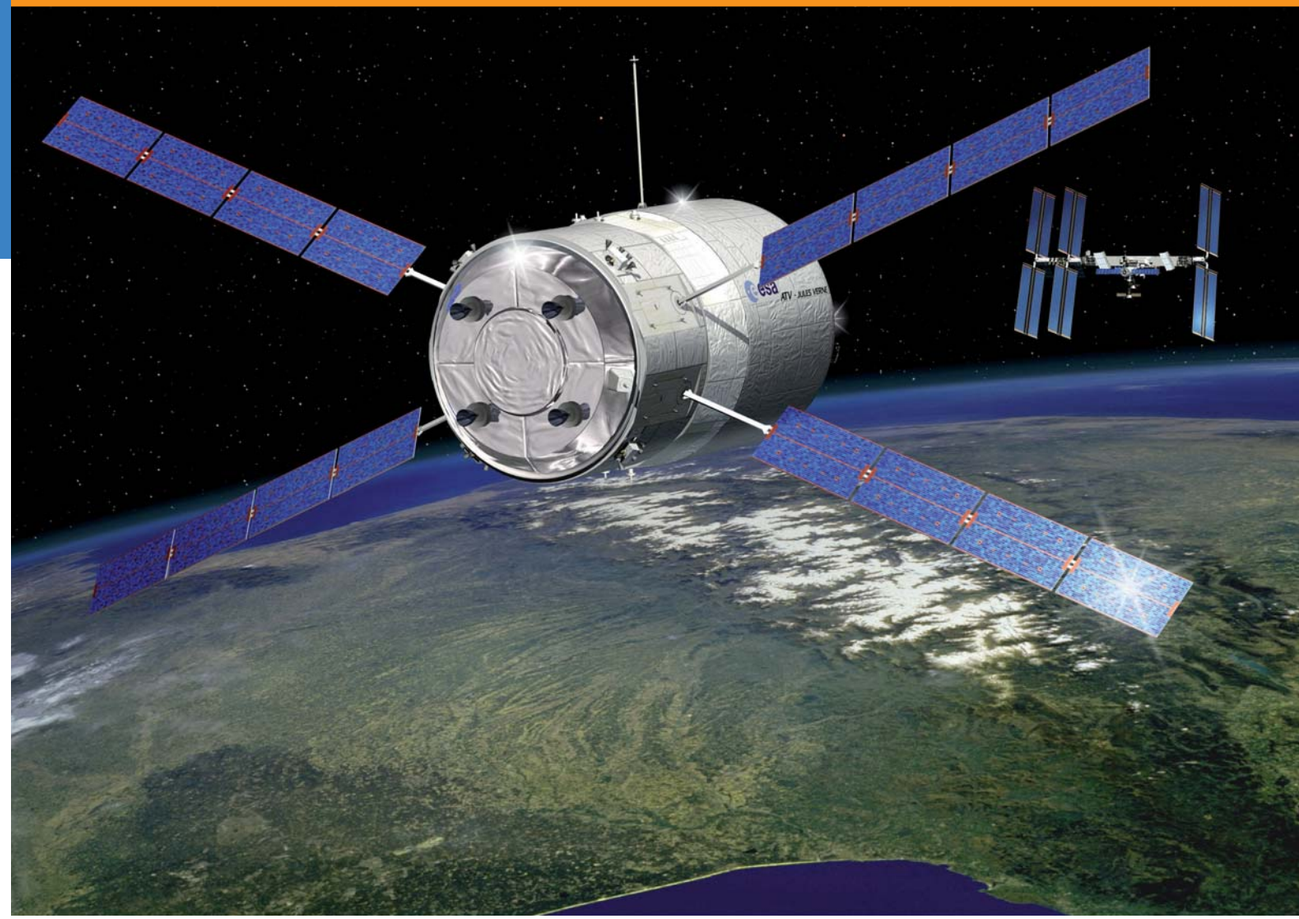
Wide-ranging partnership

Sol-ion has been recognised by the EU Eureka/Eurogia programme and has the support of the French Ministry of Economy, Finance and Employment and the German Ministry of Environment. Also associated with the Sol-ion project are a German power utility E-ON and four German and French research institutes.

EXTREME POWER

Saft batteries power the ATV Jules Verne on its mission to resupply the International Space Station

Saft supplied specialised primary lithium and rechargeable Ni-Cd batteries to support vital functions on the first European spacecraft to dock with the ISS.



Saft primary and rechargeable spaceflight batteries powered the ATV (Automated Transfer Vehicle) Jules Verne, the most challenging spacecraft ever engineered and produced in Europe, on its mission to resupply the International Space Station. In March 2008, the 19,4-tonne ATV, developed for the European Space Agency (ESA) by EADS ASTRIUM Space Transportation as the prime contractor, was placed successfully in a low earth orbit by an Ariane-5 vehicle launched from the Kourou spaceport in French Guyana.

The ATV, ferrying a load of propellants, food, water and scientific equipment into space, was the first European spacecraft to dock autonomously with the ISS. Once in place, the Jules Verne became an extension of the space station, orbiting about 300 kilometres above the Earth. When its "flawless" 6-month mission was completed on 29 September, the craft was loaded with 6.5 tonnes of waste and it separated from the space station to fully burn up during a "controlled destructive re-entry" to the atmosphere high over the Pacific Ocean.

The Jules Verne was the first in a programme of five ATVs planned to resupply the ISS at approximately 12-month intervals. The next ATV, Johannes Kepler, is now in production at the Astrium site in Bremen (Germany) and is scheduled for launch mid-2010 on an Ariane 5.

Saft designed, developed and supplied all eight onboard primary and rechargeable batteries required for the Jules Verne, and has a long-term contract with EADS ASTRIUM Space Transportation to supply all the batteries for future ATV missions until 2011. Saft's experience in the management of battery development projects is a vital element in the success of this complex programme, which required the coordination of a number of manufacturing sites and two different battery technologies.

Primary lithium batteries

Saft primary lithium ($Li-MnO_2$) batteries offer a particular advantage for spacecraft as their high specific energy helps to reduce the overall weight. They also comply with safety qualifications for manned flight missions. This is important, because while the ATVs travel as unmanned automated space vehicles, once docked they function as an integral part of the manned space station. Two primary lithium batteries will play a key role by supplying power for the separation of the ATVs from the ISS at the end of their mission, while two other identical batteries will power the emergency procedures.

Rechargeable Ni-Cd batteries

100 minutes after lift-off, the ATVs become fully automated spacecraft navigating towards the ISS. During this phase, their main power is derived from four large solar wings with backup provided by four nickel-cadmium (Ni-Cd) batteries. Once the craft docks, the Ni-Cd batteries continue to provide power for the ATV during the approximately 30-minute periods of each 90-minute orbit that its solar panels are eclipsed by the Earth's shadow.

Saft Ni-Cd batteries offer a particularly robust and reliable solution for this application, with a spaceflight heritage that goes back over 40 years. "Saft has developed an outstanding track record in delivering reliable, high performance batteries for satellites and launch vehicles. Now, with this first ATV mission, we have proved our ability to transfer this expertise to manned flight vehicles", says Philippe Jehanno, General Manager of Saft's Poitiers production site. "Furthermore, supplying primary lithium and Ni-Cd batteries has enabled us to demonstrate the scope of our product portfolio, which includes the ideal battery technology for every spaceflight application."

The ATV batteries were designed and manufactured by Saft's plant in Poitiers, France, with the support of its Bordeaux plant for the Ni-Cd batteries and the Büdingen plant in Germany for the primary lithium cells

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The Saft Group around the world

● **Specialty Battery Group production site**

High-performance, primary and rechargeable batteries for electronic, defence and space applications.

● **Industrial Battery Group production site**

Nickel-based rechargeable batteries and new technology batteries for industrial applications.

● **Rechargeable Battery Systems production site**

Small-format, nickel-based rechargeable batteries for professional applications.

● **Saft sales network**

▲ **ASB** (50% Saft, 50% EADS)

▲ **Johnson Controls-Saft** (Saft 49%, Johnson Controls Inc. 51%)

TECHNOLOGIES

New Li-ion battery system for new-generation Airbus A350 XWB

Rapidly rising fuel costs are leading makers of new-generation passenger planes like the Airbus A350 XWB to look closely at economics. They are opting for lighter materials, fuel-efficient engines and now Saft Li-ion back-up batteries with their top power-to-weight ratio.

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Saft has now been chosen by Airbus to develop and supply a lithium-ion battery system as the starting and emergency power supply on the A350 XWB aircraft. This is a significant milestone for Saft: the first Li-ion battery system aboard a commercial aircraft.

Li-ion batteries are lighter, helping to reduce fuel costs, and maintenance-free, helping to cut operating costs. The Saft batteries will be used to start the auxiliary power unit (APU) and provide emergency back-up power for crucial avionics.

Systems integration

The battery system offers a truly innovative solution and includes an integrated monitoring and charging system using proprietary Saft know-how in the relevant electrochemistry algorithms. The new battery system will be connected to the DC bus, thanks to an integrated charge control and monitoring system. It features both state-of-health (SOH) and state-of-charge (SOC) indicators and communicates with the aircraft's management system, giving pilots even better control of the aircraft.

"Saft was involved in the design of the electrical system from very early on, further to Airbus NSP (New System Policy), helping Airbus to define the optimum battery system for the plane's requirements", says Saft Aviation Director Bernard Weber. "We are now in a 3-year development phase where Saft's Bordeaux engineering team is working closely with Airbus engineers in Madrid and Toulouse to develop a mature solution with no risk of teething problems".

Long-standing partnership

As supplier of back-up batteries to Airbus, Saft has been cooperating on alkaline technologies since the origin of Airbus aircraft in the 70s. Saft provided the batteries that equip the new A380 that went into service in 2007. At the same time, Saft has built up leading-edge expertise in Li-ion battery systems. This will be the first programme in Airbus' history to use this new battery system, illustrating the successful adaptation of Saft's 10+ years of research in advanced Li-ion battery technology for specific, demanding applications. This joint effort will also enlarge the portfolio of technologies available for adaptation to each future aircraft programme.

"Li-ion battery systems, with their top power-to-weight ratio, are likely to be the preferred solution for the new generation of long-haul passenger aircraft, where weight (i.e. fuel consumption) is a very high priority", says Bernard Weber. "The majority of aircraft will continue to rely on back-up from Ni-Cd batteries for at least another 20 years, but there is a growing role for integrated Li-ion battery systems in next-generation long-haul aircraft, where weight is so crucial".

Conceived as a medium-capacity long-haul aircraft, the A350 XWB (Extra Wide Body) will be available in three basic versions, carrying up to 350 passengers.

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Ni-Cd reliability and performance for Oslo airport's Bombardier shuttle

Bombardier has chosen Saft's MATRICS MRX batteries to upgrade Flytoget's high-speed Airport Express train **running from Oslo to Gardemoen international airport.**

Faced with increasingly stringent requirements regarding performance, reliability and low maintenance, Bombardier Transportation turned to Saft's specialised rechargeable Ni-Cd on-board battery systems for the upgrade of the high-speed airport rail link. The upgrade was needed to provide additional passenger capacity for Flytoget's service, which already carried a third of all passengers using the airport (4.9 million passengers in 2006 and 5.4 million in 2007).

Major upgrade in 2008

During 2008, the fleet of 16 three-car Bombardier BM71 electric multiple units (BMUs) were given an extra coach to create four-car units. Bombardier asked Saft to provide not only MATRICS MRX units for the new coaches but also replacement batteries for the existing 48 cars – a total of 64 battery systems.

The primary role of the 110 V battery systems is to supply emergency back-up power for essential on-board systems such as lighting, ventilation, air-conditioning, door opening and communications to maintain passenger comfort and safety in the event of mains power failure.

Reliable back-up power

The batteries are supplied as part of a fully-integrated battery system comprising 2 custom-designed battery boxes with 42 MRX cells each.

The Flytoget service, which began with the opening of Oslo's new airport in 1998, is the only high-speed (210 kmh or 130 mph) rail service in operation in Norway. It whisks passengers from Gardemoen, 50 kilometres (31 miles) north of the capital, to Oslo Central Station is 19 minutes. Trains normally operate every ten minutes, with half the services continuing westwards to Asker. These serve eight stops within Greater Oslo, with plans to extend to Drammen in 2009. Founded in 1992 as a subsidiary of the Norwegian State Railways, Flytoget has been owned by the Norwegian Ministry of Trade and Industry since 2001.

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Purpose-designed back-up solution

Saft MATRICS MRX batteries are purpose designed for rail applications to deliver maximum performance and reliability as well as low total cost of ownership (TCO). They offer low maintenance and long service life, thanks to sintered /PBE technology in a compact, lightweight battery pack that brings a significant size and volume advantage compared with conventional batteries. As an added plus, Saft's Ni-Cd batteries can operate reliably in extreme temperatures (-30°C to +70°C) without suffering from the "sudden death" phenomenon that affects some battery technologies. MRX solutions are also in service aboard the Karlsruhe tram-train, the Hamburg metro, the new Paris ring-tram and France's record-breaking TGV high-speed train.

MARKETS

Hamburg Hochbahn's new-generation metro trains rely on purpose-developed Ni-Cd batteries for back-up power

Today's urban railway operators are taking a long hard look at energy consumption and operational efficiency as well. **So when OEMs are doing the engineering and selecting suppliers, they look for reduced weight and volume, along with high reliability and low maintenance. That applies to batteries too, and Ni-Cd fits the bill perfectly.**

When Hamburger Hochbahn was calling tenders for construction of new trains for the port city's new metro line, it specified that all tenderers were to use Saft… Bombardier, a Saft customer for over 20 years now, was more than happy to go along. For the electrics of Hamburg's new-generation trainsets, the leading transport OEM selected Saft's latest Ni-Cd railway battery system technology, MATRICS MRX.

Mass transit aiding urban development

Hamburg's new DT5 trains will be delivered from 2009 to 2013. They will start operating on the existing U3 line and, as of end 2011 some of the DT5 fleet will be used on the new U4 line connection between the emerging quarter of HafenCity (one of Europe's most modern urban centres) and Hamburg's city centre. The new line will run mainly underground, except for a few sections in eastern Hamburg.

The trainsets are being built by a consortium of two regular Saft customers, Alstom and Bombardier. Alstom is building the stainless steel car bodies, the bogies and the brakes, while Bombardier is supplying the electrical equipment. Hamburger Hochbahn has ordered 27 trains, each comprising three cars, with an option for another 40. The same consortium (and battery supplier…) delivered the successful DT4 previous generation, and Saft's Ni-Cd batteries have an outstanding track record for performance and reliability.

Out of your car and into the metro!

The DT5 trainsets have open gangways, allowing passengers to move freely from one end of the train to the other. And in a bid to get more car-drivers to switch to public transport, the city looked for increased passenger comfort and enhanced safety. Other features include dedicated areas for prams and wheelchairs, full air-conditioning, passenger information system with large LCD displays, fire sprinkler system, high recycling rate of the materials used, and noise-optimisation thanks to quiet, water-cooled, 3-phase AC traction motors.

Saft's MATRICS MRX batteries provide back-up power for the safety and control circuits of the trains when they pass through neutral sections of track, and they ensure emergency power for functions such as door opening and communications in case of mains power failure. MRX was purpose-designed for this application and can provide 1-hour back-up power at an extreme -20°C. Each 3-car DT5 train will have one battery, housed under the floor in a box specially designed by Alstom.

Purpose-designed batteries

The batteries in the DT5s are19 MRX230, delivering 230 Ah at 24V. The key criteria in battery selection were reduced weight and volume, as well as low maintenance. In addition, as the U4 line runs partly underground, fire prevention was a major factor. Mass transit operators are increasingly concerned about fire underground, and Bombardier specified flame-retardant plastic for all the battery cells.

Saft's MRX solution offers mass-transit OEMs significant flexibility too: a range of 90-, 100- or 115-Ah cells can be selected and assembled in the same battery box so as to vary the battery's capacity to meet specific project needs. These can extend to larger capacity for lower operating temperatures.

MRX: flexibility and reliability

Saft's MATRICS MRX solution is also extremely reliable. It does not suffer from the "sudden death" phenomenon that can afflict other technologies and it operates in temperatures from -30°C to +70°C.

The batteries also have a central water-filling system for easy maintenance. This simple-to-use feature fills all the cells in sequence from one central point, allowing the cells to be filled quickly, safely and accurately and so maximising the battery's service life.

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Partnerships for progress

21st-century transport, with its increased focus on weight and size, is a challenging segment and also a strategic area for Saft, which is the leading supplier of Ni-Cd batteries for transport applications. Saft is proud to be present in this new generation of electric vehicles alongside major players like Bombardier and Alstom. In a recent example of this partnership, MRX-type batteries provided back-up power for auxiliaries and braking when an Alstom-built French Railways high-speed train (TGV) smashed the world rail speed record in 2007.

The battery of preference

Saft's MRX-type batteries, with their reduced weight and volume and their low TCO (total cost of ownership), are proving extremely popular with rail operators and OEMs. During 2007, Hitachi chose Saft for the UK's Channel Tunnel Rail Link project, French Railways (SNCF) switched from lead-acid to MRX batteries for all its Alstom TGV Duplex (2-level) passenger coaches, Siemens preferred MRX for its new Eurosprinter family of electric locomotives, and Spanish Railways (RENFE) selected MRX for its new Civia electric trainsets being built by Siemens, CAF and Alstom.

EVOLVING PLANET

Low-maintenance Ni-MH + PV combination is ideal for shipping-hazard warning lights

Saft batteries, recharged using solar panels, have been chosen by specialist firm Sabik to provide reliable power for maintenance-free navigation-hazard lights on abandoned offshore structures in the gruelling North Sea.

Oil companies have been producing offshore for decades and the world's oil and gas basins are dotted with thousands of production platforms, either floating or fixed. But most oil and gas fields only produce for 20 to 30 years and increasing numbers of offshore fields are becoming depleted. When this happens, the platforms are decommissioned and oil companies usually dismantle them or tow them away. But some platforms in shallow-water zones like the North Sea are built on fixed concrete gravity bases. In this case decommissioning involves removal of the main superstructure (topsides and jacket), leaving only the concrete base, which needs to be marked as a hazard to shipping.

For nearly three years now, Saft Ni-MH batteries have been powering the Sabik Self-Contained 10 NM Lights (actually light+radar systems) installed on four abandoned oil platforms out in the North Sea, systems that warn approaching vessels of the hazard.

These maintenance-free and remotely-monitored light units, the first of their kind in the world, are made by a German company, Sabik Informationsysteme, which specialises in light-based signalling systems (for lock gates, port entrances, swing bridges) including those requiring remote monitoring (navigation hazards, lighthouses).

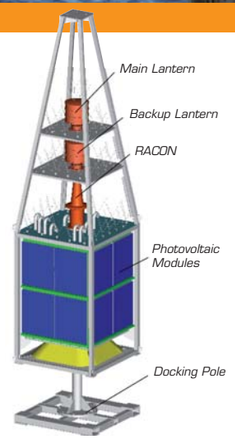
Light, racon and satellite monitoring

Sabik's stand-alone unit comprises a LED lantern (and sometimes two) for visual warning (the light is visible for 10 nautical miles), a racon (radar transponder) beacon for low-visibility recognition and a satellite monitoring unit. Sabik has delivered 8 systems to mark 4 Total platforms on the Frigg field in the Norwegian North Sea. This is a critical application so there is a back-up unit onshore ready to be helicoptered out in each case. All are operating satisfactorily.

Saft batteries based on NHE modules provide back-up power for all functions: light (12V 500 Ah = 5 x NHE2-500); racon (12V 300 Ah = 3 x NHE12-100) and monitoring (12V 100 Ah = 1 x NHE12-100).

The U.S. Coast Guard too…

In 2007, Saft Li-ion batteries were also chosen by BWT Lighting for the self-contained solar-powered navigational lanterns in the fixed-aid and buoy lanterns it supplies to the U.S. Coast Guard. These batteries – solar-rechargeable, minimum-maintenance and long-lifetime – are ideal for this application and will also outperform other battery chemistries in the harsh marine environment.



4- years maintenance-free operation

The unit is installed by helicopter and fits on a special docking pole bolted to the platform to ensure that the unit is positioned with the solar panels facing in the right direction. Once the light is in place, there is no need for maintenance. The Sabik units are engineered to operate maintenance-free for 4 years, with an overall lifetime of 15 years. Vital systems all include redundancy and the unit has separate photovoltaic (PV) systems to ensure reliable recharging. Operation is monitored via a satellite-based system that provides detailed information about the performance of all on-board systems. In the case of the Total platforms, the Northern Lighthouse Board is responsible for monitoring.

Weight, reliability and service life

As the system has to operate for years without maintenance (helicopter transport is expensive…) and has to be both light and compact enough to transport, the choice of battery was crucial. "There were three main criteria", says the firm's Managing Director Morten Christensen. "The key issue was weight, as our system had to be transported by helicopter. Then came reliability and long service life. Ni-MH was chosen for its weight and size advantage. This is a critical application: we needed the best and were prepared to pay a premium".

"Saft was strongly recommended to our customer Total by the Northern Lighthouse Board", adds Mr Christensen. NLB had itself been a Saft customer for many years, and Sabik's Finnish parent group had also been buying Saft batteries for more than 10 years, for use in Scandinavian lighthouses. "Not only are the batteries performing well, but Saft's French and German teams gave us really good technical support in the early phases of the project, with battery sizing, for example. They even sent an engineer from Bordeaux to advise on installation and charging. They were very keen that everything was done right so we would get the very long lifetime we needed".

Actions speak even louder than words: in mid-February 2008, Sabik placed another order for Saft batteries for the same kind of application.

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Tough standards for tough conditions

As units like Sabik's Self-Contained 10 NM Light are key elements in maritime safety (especially in the often stormy North Sea) the design and performance of the unit and all its components is based on tough criteria laid down by the relevant maritime authorities: Norway's Coastal Administration (Kystverket) and Scotland's Northern Lighthouse Board.

EXTREME POWER

Self-launching sailplane flies higher and further with Li-ion

For years, gliders were laboriously winched or towed into the air. Today they often have a motor and propeller for take-off and climb. **The key challenge here is obviously to optimise the power-to-weight ratio. A high-energy, lightweight rechargeable Li-ion battery system has enabled the Antares electric motor-glider to gain both altitude and range.**

Several years ago German firm Lange Flugzeugbau, which produces a range of gliders at its production facilities in Zweibrücken, launched a prototype Antares e-powered glider with Ni-MH batteries. Why electric? "Because 2-stroke engines don't always start when you need them to", says the firm's founder and CEO Axel Lange. But the company was not fully satisfied with the machine's performance, so they asked Saft to provide lighter, more powerful Li-ion batteries instead. Lange also revised and simplified the glider's electronics to make the system fully reliable, earning German Aviation Authority (LBA) certification as a manufacturer.

Flying test bed

Lange recently won a contract from the German aerospace technology institute DLR to develop a "flying test bed" for aviation fuel cells. The new Antares DLR-H2 glider, built in 2008, is naturally powered by Saft batteries.

World records

Lange's move up-market pleased the firm's customers too, as the Antares "motor-glider of the future" gained both altitude and range. Some 45 of the gliders have been delivered so far. "Saft's challenge was to help Lange get their product into the winning class", says Saft's German representative Holger Schuh. Mission accomplished: in April 2007, an Antares 20E set several records, including a British distance record of 1,141 kilometres, in 10 and a half hours.

The 20-m wingspan Antares is equipped with a high-performance, almost silent 42kW (56hp) brushless electric motor and a slowly-revolving 2-metre diameter pusher propeller. After take-off and climb, the pilot simply pulls a lever and the motor and propeller retract into the fuselage for better aerodynamics. The revolutionary craft can reach an altitude of 3,000 meters in powered flight.

Light, powerful, compact and in the wings

Lange's design team decided on Saft MR (Medium Range) Li-ion cells, which pack maximum power into a lightweight, compact package. The cells have a nominal capacity of 41 Ah and a nominal voltage of 3.6 V, giving the glider a significant increase in power from a much lighter battery. "We use Saft Li-ion batteries in this demanding application simply because we have found them to be the best on the market", says CEO Axel Lange. "The Antares demonstrator LF-20E flew on Ni-MH batteries and performed well. But the extra power available when we switched to the Saft Li-ion batteries has enabled us to more than double the launch height using a battery system that weighs 26% less".

The battery system comprises 72 cells in series, providing nominal voltage of 260 V. The total weight of the batteries, split into two customised packs in the inner wings, is about 80 kg, accounting for 12% of the craft's maximum take-off weight. The batteries are fitted with a dedicated electronic management system to monitor charge and discharge voltages, as well as electrical heating to prevent the cold from sapping the battery's performance. The system takes 8 hours to charge at 220 V and the glider is fitted with its own charger for cross-country flights.

The Antares has been the leading sailplane in its high-end segment for more than four years now. Lange still has a long waiting list of customers, most of whom are export business. Proof of the quality of this "absolutely unique" glider, and of the reliability and long service-life (up to 20 years in this application) of the Saft batteries that power it.

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Outclimbing the competition

At the most energy-efficient power setting, the Antares can reach 1,000 metres – twice the height achieved by a good winch launch – in under 4 minutes.
The battery system can provide about 13 minutes of maximum power, which will take the glider to over 3,000 metres. Even in no-lift conditions the craft, whose published glide ratio is an impressive 1:56, will then take an hour and 40 minutes to glide back to earth.

PARTNERSHIP

Naval propulsion systems: Li-ion goes to the next level

Saft has signed a framework agreement with DCNS, Europe's leading player for naval defence systems, strengthening their alliance in electrical energy storage technologies for naval applications. **The main focus will be on submarines and torpedoes.**

Under this agreement, the two companies will operate as a centre for innovative technologies covering electrical energy storage for all naval vessels including frigates, submarines, torpedoes and autonomous underwater or surface vehicles (AUV-ASV).

"Following years of ad hoc cooperation on energy storage, our two companies will now be working together on a long-term basis", says Philippe Jehanno, head of Saft's Space & Defence division.

The new partnership is intended to capture increased synergies. Saft focuses on innovative energy storage technologies (batteries and accumulators) for industrial applications. DCNS designs and builds naval vessels fitted with multiple systems (platform management, propulsion, weapons, etc.) that involve very stringent technical requirements. The optimisation of electrical energy storage is a key factor in the technical performance of these systems.

"DCNS is working right at the frontiers of propulsion technology and we wanted a long-term partner able to work at those frontiers with us", says Jacques Mouysset, DCNS Senior Vice-President Strategy & Development. "We have been working with Saft for many years on a number of projects and DCNS has been very satisfied with their cooperation and their products. We are confident in Saft's technological expertise and above all their ability to develop innovative solutions".

Innovative technologies

Closer cooperation will enable Saft and DCNS to make better technological and investment decisions at a very early stage based on market developments and to increase their competitive advantage.

The immediate focus will be to adapt innovative Li-ion technologies to conventional submarine propulsion and torpedoes, while extending cooperation on AgO-Al batteries for torpedoes.

"Electric propulsion for surface naval vessels has strong potential but is still very experimental, and concrete projects are some way off", explains Jacques Mouysset. "Nevertheless, Saft's ability to innovate will be invaluable here. In the more immediate future, the main focus of our cooperation will be torpedoes and submarines".

Saft and DCNS have already seen very fruitful cooperation in the field of torpedoes powered by seawater-activated AgO-Al batteries. This should be a high-growth area in the next few years, and Saft is currently expanding its production tool in Poitiers.

"Battery storage is crucial to submarines and we think that Li-ion has a very important role to play", adds Jacques Mouysset. "The many advantages of Li-ion (lower weight, better endurance and higher energy density per volume) give this technology a very significant edge over other electro-chemistries, but we need to demonstrate that this technology is a truly viable alternative to lead-acid. That's where Saft's know-how comes in".

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High-energy, high-reliability, low-weight Li-ion for Russia's GEO satellites

Saft has been chosen by Russia's leading commercial satellite builder, JSC ISS-Reshetnev Company, to supply Li-ion battery modules to power geo-stationary earth orbit (GEO) commercial satellites based on its Express-1000H platform.

"This contract establishes Saft as an important supplier for Russia's largest commercial satellite company", says Philippe Jehanno, head of Saft's Space & Defence Division. "It also consolidates our leadership in state-of-the-art battery technology for commercial GEO satellites".

Saft's contract with JSC ISS stems from negotiations begun in 2006, when JSC ISS decided to develop a new competitive, highly-effective platform by using modern technologies. "Both Saft and our Russian partner are well-established players in our fields and we wanted a long-term relationship", adds Philippe Jehanno. "Our first challenge was to bridge the gap between our two cultures. Both top management and technical teams now see eye to eye and we are looking forward to very fruitful synergies given the quality and level of our interaction".

"The mass of a satellite's storage battery is half of the whole power system mass, so enhanced battery efficiency is a big plus in reducing the mass", says Alexander Korenko, Leading Design Engineer in the JSC ISS Spacecraft Power Systems department. "When we were looking for a Li-ion battery specialist, Saft was N°1 for energy efficiency and battery life. Our specialists studied Saft's production technology and certifications then looked at the development prospects of the company's Li-ion technology for space applications. Then we made our decision".

Maximizing payload and revenue

Saft's first order under this multi-option contract is to supply the battery system for the AMOS-5 communications satellite now under construction for Israeli operator Spacecom. Discussions are already under way on subsequent Express-1000H spacecraft.

The battery system for AMOS-5 will comprise two modules consisting of 40 of Saft's latest generation VES 180 SA Li-ion cells. These cells, which have a nominal capacity of 50 Ah, comply with all relevant ESA standards and are designed to meet the specific needs of today's space projects, especially in terms of performance and reliability.

Thanks to their high specific energy of 170 Wh/kg, made possible by Saft's advanced Li-ion technology, VES 180 SA cells offer weight savings of 30-50% compared with a conventional battery. This means JSC ISS can dedicate more of the satellite's critical mass to payload, which will help the operator generate increased revenue.

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PARTNERSHIP

Li-ion endurance and power for the French Navy's new mine hunter AUV

Saft's Li-ion technology is now powering the French Navy's latest Autonomous Mine Warfare Underwater Vehicle (AUV) during mine detection missions

The state-of-the-art mine hunter AUV was developed and built for the Navy by the France-based robotic systems specialist ECA, which has worked with Saft for the last six years.

Safts advanced-technology Li-ion battery system, delivered at the end of 2008, enables the new AUV to stay submerged for long periods and cruise at 4 knots (7.4 km/h). Li-ion is the only technology capable of providing this combination of endurance and power within the restricted space of the AUV's design.

The 135V, 23 kWh battery system powers both the propulsion and the electronic systems of the Mine Warfare AUV. The battery system, based on Saft MP 176065 Li-ion cells, is supplied as a fully-integrated and turnkey solution including mechanical assembly, electronic control management system for the monitoring of charge and discharge voltages and cell temperatures, and EMC filtering.

Since 1960, ECA has designed and produced more than 600 robotic vehicles (subsea and land-based) used for command & control missions, mine-detection/destruction, nuclear power plant inspection, deep-offshore oil operations, anti-terrorist missions, hazmat, etc.

A leading player

The "Guerre des Mines (Mine Warfare)" order followed the success of the identical Li-ion battery system that Saft supplied for ECAs earlier Rapid Environment Assessment AUV, Daurade. "ECA has worked with Saft since 2002 and chose the company's Li-ion expertise to equip its AUV range because this technology is the best solution in terms of density, energy and mass for this type of cell", says ECA project manager Stéphane Meltzheim.

Saft is now emerging as a front runner in the Unmanned Underwater Vehicle (UUV) segment. In early 2009 a third Li-ion battery system of this type was delivered to the ASEMAR project, a partnership venture between Thales Underwater System SAS and ECA and Saft (among others) to build UUVs for civil applications such as oceanography, offshore oil and gas operations, surveillance and Homeland Security. Saft Li-ion technology is also powering the Redermor-3 experimental UUV platform developed by the French Navy's research division GESMA.

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A European ELU Summit to enhance reliability, quality and value

Faced with a number of anomalies in the ELU market, Saft has brought together the main European players to identify areas for improvement **and implement an action plan.**

At Saft's initiative, Europe's ELU industry recently organised an international summit in Paris on the theme of "Ensuring reliability, quality and value". The summit, held on 4-5 December 2008 at the Hotel du Louvre in Paris, brought together some 25 leading ELU players from all over Europe to identify ways to ensure quality, reliability and value in the ELU or, in the words of one speaker "to ensure that in future 100% of ELUs work when they have to".

The starting point of the summit was the realisation that about 30% of ELUs currently installed do not actually operate when needed, and that despite the numerous applicable standards the units are not checked as often as security devices should be.

The summit focus was on homologation, testing during installation, and annual checking and maintenance on site.

Three corrective measures

Brainstorming sessions identified five areas for improvement and delegates set up an ELU Club du Louvre to implement an action plan covering the 3 most urgent corrective measures:

- to persuade insurance companies to insist on annual checks and to include this in building insurance contracts,
- to push for mandatory ENEC labelling for all ELUs in Europe and ensure life-duration criteria are met (ageing test),
- to work towards an international/European standard equivalent to NFC 71830 covering yearly checks, servicing and maintenance training.

Three working groups, two of them chaired by Saft personnel, were set up as a result of the summit and these groups will be meeting regularly to discuss the concrete details of action to be taken and to move the ideas into practice.

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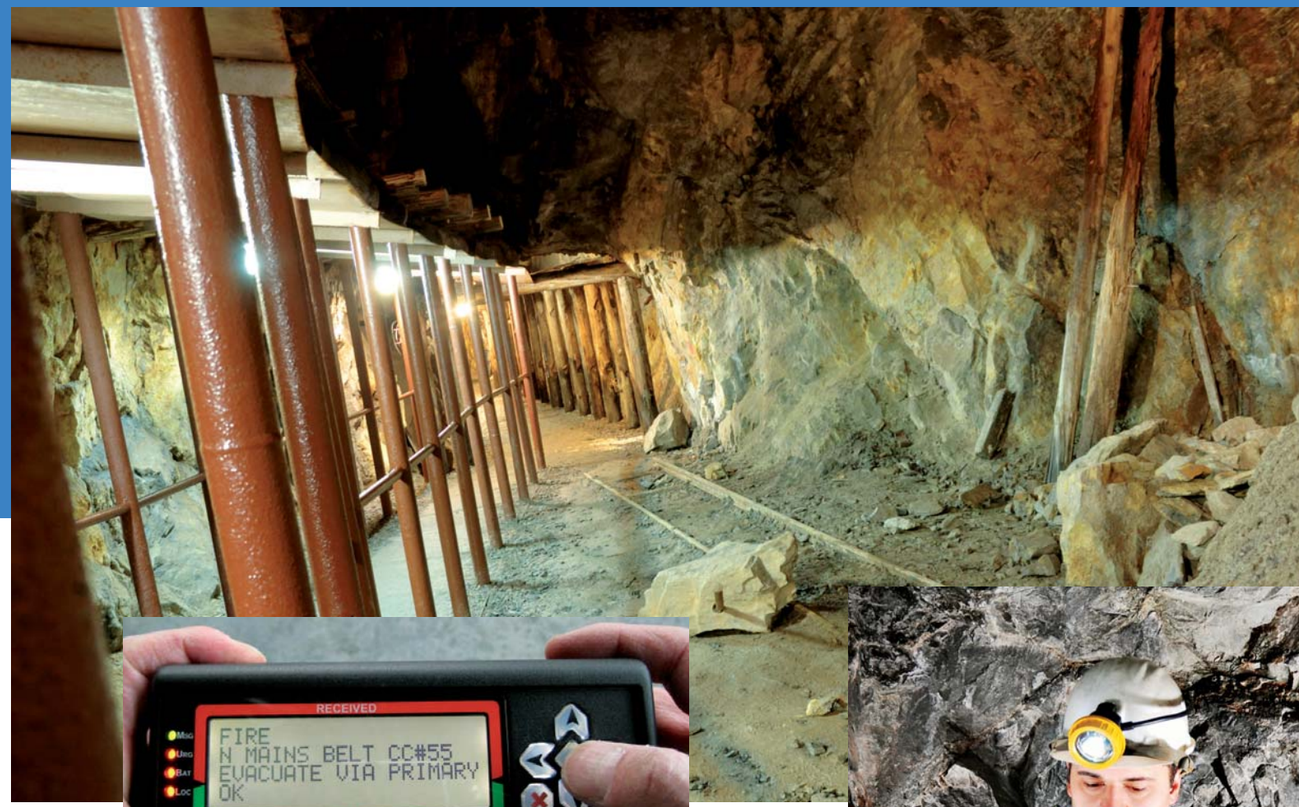
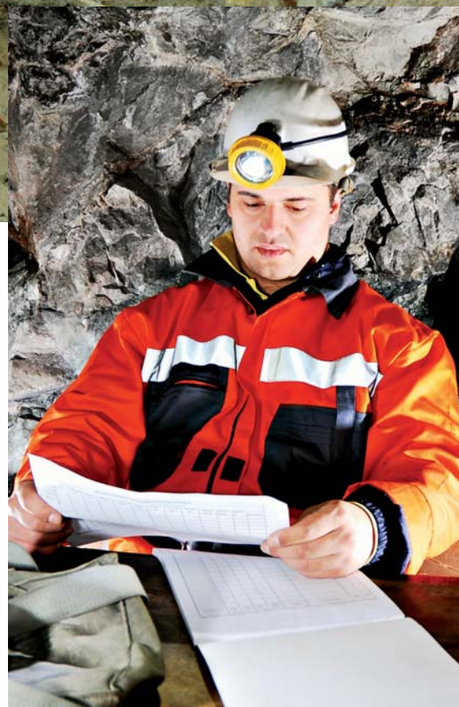
Improved mine safety in the US thanks to Li-ion powered MineTracer™ tracking system

With increased public awareness of mine safety, more underground mine operators are looking to personnel-tracking systems to ensure that rescue teams will be able to locate miners who may be trapped or in trouble rapidly in the event of an accident underground. **A new system using Li-ion battery back-up was the first to be approved by the US government and is currently being deployed.**





Venture Design Services, Inc. (VDSI) has chosen Saft's intrinsically safe (IS) Li-ion batteries to provide life-saving back-up power for its new mine emergency wireless tracking and communication system.

MineTracer™, the first system of its kind available to mine operators, guides rescue teams straight to miners trapped underground after accidents. The Venture Design Services system uses a wireless mesh network to provide real-time tracking of a worker's location to within 75 feet. Miners carry a personal location tag or a 2-way text device that communicates with Wireless Access Points (WAP) which relay tracking data and text between the miner and the system operator above ground.

The system normally operates on mains power but during an emergency, power is usually shut off to reduce the risk of methane gas ignition, especially in collieries. Hence, emergency equipment must rely on battery power. For MineTracer™, VDSI chose Saft's single-cell, intrinsically safe MP batteries, which are installed in the WAPs and each miner's Text Communicator. The Li-ion batteries can power the system for at least 48 hours after an accident.

Safer batteries for safer mines

"Our major requirement was an IS battery", says VDSI Engineering Manager Jim Barrett, "and I have long believed that Li-ion is the best technology in terms of most key battery characteristics - volume density, density vs mass, charge cycles, shelf life, etc." Saft's IS batteries are also designed to operate in a potentially explosive atmosphere.

"We chose Saft because they are highly regarded and have experience with some of our Group's partner companies such as Hewlett-Packard", adds Jim Barrett. "And Saft was the only supplier of a Li-ion battery approved as IS by several other regulatory agencies in the world. When we tested the samples I was even more impressed, particularly by the energy density. And we were pleased with Saft's technical support when we were making our decision".

Stringent certification criteria

Fatalities have often occurred after mine accidents when rescue teams were unable to quickly locate and reach trapped miners. MineTracer™ was developed in response to the Mine Improvement and New Emergency Response (MINER) Act passed by Congress in 2006, shortly after the mine disaster in Sago (West Virginia). The MINER Act requires all underground mines to operate a wireless tracking and communication system by 2009.

MineTracer™ is the first system of this kind to be approved by the US Department of Labor's Mine Safety and Health Administration (MSHA). Because of the life-critical nature of the system, both the MineTracer™ and Saft's batteries had to undergo very extensive testing before being certified to the very stringent US mine safety standards.

Now that MSHA approval has been obtained, tracking systems like MineTracer™ should be installed very quickly. All underground coal mines in the United States must have plans developed and submitted to MSHA by June 15, 2009 "We'll be supplying the international market, too," says Jim Barrett. "There's a huge need for this technology in Europe, Africa, and China as well."

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Market leader

US-based VDSI, which has R&D facilities in Washington and California, develops wireless communication products and systems focusing on remote sensor networks and data collection. The company, which posted sales of $2.5 billion in 2008, is a leading supplier of wireless communications systems like MineTracer™.

EVOLVING PLANET

Ni-MH: breakthrough technology for off-grid energy storage

Off-grid PV systems are on a roll, particularly non-domestic applications, and new Ni-MH technology is set to take a significant share of this market. **Saft is well placed with its plug-and-play Smart VHT Modules.**

Installed off-grid, non-domestic PV capacity was estimated at 397 MW in 2007 and the market is experiencing double digit growth per year. Typical applications here are irrigation, water supply, street lighting/signage, navigation aids, wireless LAN, weather stations and environmental sensors, among many others. Lead-acid storage batteries dominate the market, but battery life and reliability are poor (meaning high replacement costs), environmental impact is a negative factor and SLA technology does not cope well with PV conditions (high number of shallow cycles, erratic charge rate and time, extreme temperatures).

Alternative energy storage for small PV systems has not been widely available, particularly plug-and-play solutions. Saft's new Smart VHT Modules with their cutting-edge Ni-MH technology now offer an ideal solution for reliable, long-life and high-performance energy storage systems for small PV units. Saft's Ni-MH electro-chemistry compares favourably with SLA in terms of:

- Performance (long life, failure resistance, temperature tolerance)
- Total Cost of Ownership (over 20 years)
- Integration of smart electronics (charge/discharge management, SOH, battery condition log)
- Environmental profile (including ozone depletion, energy depletion, air acidification, etc.).

Saft offers plug-and-play Smart Modules in a full range of solutions:

- 12V, 24V, 36V in 10Ah increments
- Other solutions available for integration with existing PV controllers (1.1Ah, 2.0Ah, 4.0Ah, 10Ah in various voltage configurations).

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