Battery systems for renewable energy applications

Proven capability for a maturing market

Clipperton Scientific Expedition

June 2006

Saft battery systems
as renewable markets evolve

Efficient, reliable energy storage is essential to harness an unpredictable natural resource. Saft has solutions today and, as the market evolves, is developing cutting-edge systems with exceptional capability for the future.

Specific challenges…

Typically, renewable energy system installations are

- sited in remote locations
- subject to harsh temperatures and punishing humidity
- challenged by inherently variable and unpredictable wind, sunshine and tide.

…particular requirements

For these applications an energy storage system should offer

- high reliability and availability
- ability to operate at high temperature with little effect on operating life
- good capacity availability at low temperature, no risk of freezing or other damage at extreme low temperature
- good electrical and mechanical abuse resistance
- high charge efficiency
- good cycling capability
- ability to operate at partial state of charge over long periods
- minimal maintenance
- low weight and volume if transported to remote places
- favourable life cycle cost

A broad capability
diversity on demand

Power efficiency in a diversifying world

The renewable energy system market is moving rapidly. A key feature of this expansion is the widening range of applications, from stand-alone to hybrid power and grid-connected.

Saft's portfolio of technologies provides optimised and cost-effective battery solutions matching the various power requirements of renewable energy system applications.

Stand-alone

In off-grid photovoltaics and stand-alone wind turbines, Saft batteries

- provide energy storage (Wh) for long discharge periods of hours and days
- ensure loads in periods where no or insufficient energy from renewable sun or wind sources is available.

Hybrid power

For wind-hybrid systems and photovoltaic-generator systems a much smaller battery is sufficient as the system draws energy from multiple sources. The battery will

- support one or more renewable energy system sources
- cover peak power demands
- bridge to diesel generators or fuel cells operation in the event of extended periods without sun or wind

Grid-connected

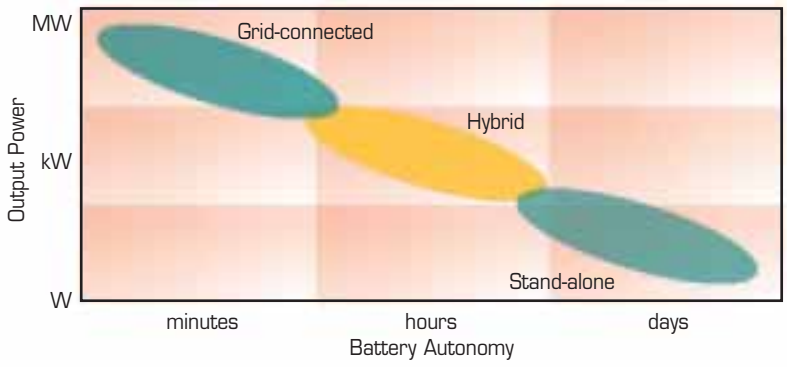
Wind generation is inherently variable and can have the effect of destabilising weak grids, typically characterised by a lack of spinning reserve. In such high voltage systems ranging from hundreds of kW to several MW, Saft batteries

- stabilise wind generation
- bridge to other forms of generation supplying larger blocks of energy
- provide sufficient output stability and ramping control to make wind generation network-compatible.

From concept to reality

Saft has provided optimised, high tech and cost-effective battery solutions for photovoltaic systems over many decades in navigation aids, offshore platforms, telecom applications in Chile, Australia, Europe and all around the world. Saft is now proactive in anticipating future demands of the evolving renewable energy system market.

For example, high power batteries are providing rapid reserve to an innovative wind/hydrogen power generation system on one Norwegian island. Saft batteries are working in conjunction with wind turbines to enable an energy-independent community.



Unbeatable performance
for the present...

Proven Ni-Cd for new applications

Saft's mature, proven, alkaline pocket plate technology is at the heart of the Sunica.plus Ni-Cd battery. Sunica.plus is designed specifically for photovoltaic and wind energy electrical storage applications, performing beyond conventional limits.

Sunica.plus is built with the robustness to ensure 20 years of reliable operation in harsh environments and widely fluctuating temperatures, with only minimal maintenance.

Nickel-metal hydride

In remote locations, applications such as navigation aids and telecom repeater stations rely on energy storage.

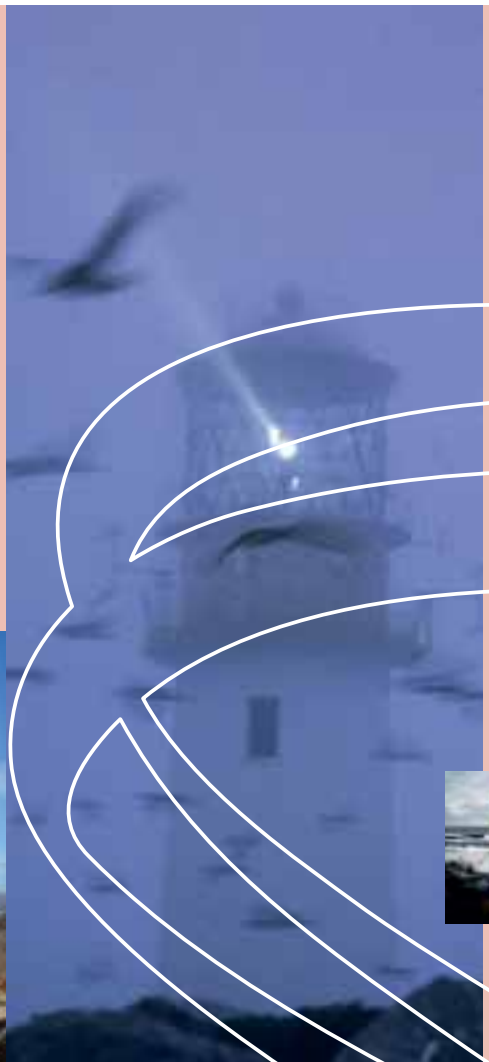
Saft Ni-MH batteries precisely answer this need with the ideal combination of excellent charge efficiency, zero maintenance and 15 years service life.

Ni-MH is state-of-the-art, sealed alkaline technology, series produced to provide a compact solution with very high energy density.

Sunica.plus is in action

The versatile Sunica.plus is extensively installed in diverse applications from Norwegian lighthouses and Dutch buoys to an Indonesian off-shore platform, and the solar powered telecoms and operating system critical to a Sudanese oil pipeline.

In Australia, a hybrid photovoltaic and diesel generator energy system provides reliable DC power for television microwave transmission equipment. A total of 54 SUN 84-1 cells support two 3 kW solar arrays at night and at times of peak demand.



Safe and secure in remote locations

The Northern Lighthouse Board, serving Scotland and the Isle of Man, has completed its ambitious programme of Ni-MH installation linked to photovoltaic panels for its most remote and sensitive sites.

The Sule Skerry lighthouse is located off the north coast of Scotland in desolate seas 60 km from the nearest land. Here, two Ni-MH batteries comprising 30 NHE 2-500 modules provide a nominal 24 V and 1500 Ah capacity. The battery stores sufficient energy from solar panels in spring and autumn months to ensure reliable winter operation to safeguard shipping lanes in these treacherous waters.

...and into the future

Saft's programme includes research, development and implementation of the next generation of intelligent technologies in order to meet the future needs of a maturing market.

Exceptional performance

Saft Li-ion technology offers outstanding performance for both energy, storage and other high power applications:

- extended life time, even at high temperature
- very high energy efficiency, vital in unpredictable conditions
- sealed, maintenance-free reliability
- unbeatable cycling capability in shallow and deep cycling
- intelligent system state of charge and state of health remote monitoring

These characteristics make Li-ion the most promising technology for both energy storage and other high power applications. They match the needs of the energy generation systems of the future where high power output smoothing, ramping control or bridging are inherently necessary functions.

Saft Li-ion : ideal for Clipperton

Saft is already supplying Li-ion battery systems for a number of industrial applications, including the high profile scientific expedition 1300 km off the Pacific coast of Mexico on Clipperton atoll. Saft Li-ion batteries harnessed energy from the hybrid solar/wind system and provided energy to support 20 people for 4 months, maintaining vital scientific equipment and living, working, and communication systems.

Saft battery systems

Saft delivers Li-ion battery systems for various high tech applications ranging from transport and communication to defence and space, and is designing dedicated system solutions for renewable applications.

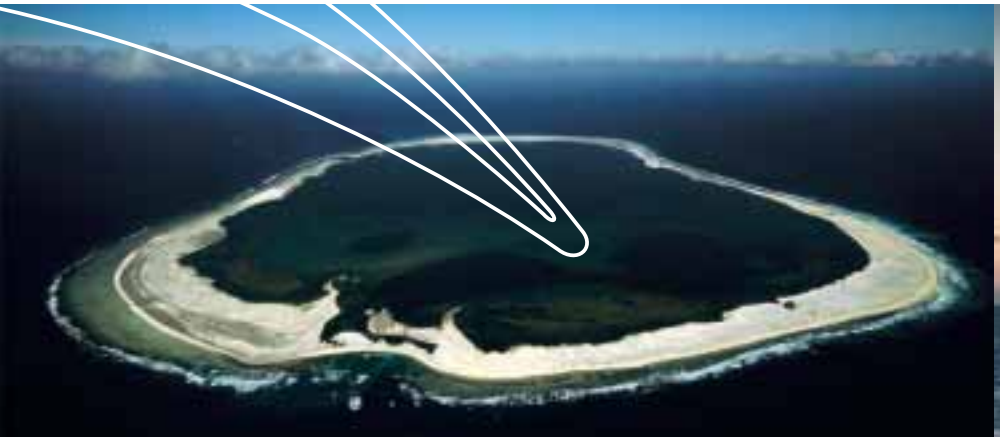
New solutions for new demands

Saft's innovative Intensium Flex is a modular Li-ion system in rack mount format, integrating battery management, protection and communication functions.

For renewable energy systems, the adaptable Intensium Flex can be optimised for high power rapid reserve in wind hybrid systems, for example, or for traditional photovoltaic applications.

Saft technologies – the future for renewable energy systems

Saft battery solutions are already supporting research and demonstration projects essential to the future global deployment of renewable energy systems. As this market evolves, photovoltaic and wind energy generation will be optimised by Saft systems technology and supported by our ongoing commitment to provide worldwide service and technological excellence.



Saft is committed to the highest standards of environmental stewardship.

Implementing this commitment to minimise the impact of its products and operations on the environment means that Saft gives priority to recycled over unrecycled raw materials, reduces its plant releases into the environment year after year, minimizes water usage, and ensures that its customers have recycling solutions for their batteries at the end of their lives.

Regarding industrial Ni-Cd batteries, Saft has had partnerships for many years with collection companies in most EU countries as well as in North America. This collection network receives and dispatches our customers' batteries at the end of their lives to fully approved recycling facilities, in compliance with the Laws governing transboundary waste shipments. Saft offers these services free of charge to its customers.

Please find a list of our collection points on our web site.

In other countries, Saft assists its customers in finding environmentally sound recycling solutions. Please contact your sales representative for further information.

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