

Nilar EC Less is **so much more**

Introducing the Nilar Energy Compact battery:
Over 30% smaller than the previous model, and
more than 50% higher volumetric energy density.

Nilar EC. Less really is so much more.

SAFER THAN "SAFE" THANKS TO NEW PATENTED INNOVATIONS

WIDE OPERATING TEMPERATURE RANGE -20°C TO +50°C

ENVIRONMENTALLY-FRIENDLY: FREE FROM CADMIUM, MERCURY AND LEAD

FULLY RECYCLABLE



“The only thing that is constant is change”

Heraclitus, 500BC

Change is truly constant in our field and it is driving the industry forward at great speed. Since we launched our first generation of Nilar batteries we have witnessed an incredible change both in the attitudes towards sustainable energy and in the ability of batteries to capture, store and deliver energy.

Today, we see major cities announcing dates for the banning of petrol and diesel cars. We see countries that in a not-so-distant past were “coal nations”, able to meet the electricity needs of homes and businesses on coal-free power¹. And we see governments investing billions of dollars in green energy projects. These changes have a huge impact on the energy storage industry. With fewer petrol and diesel cars in our cities, we can expect to see many more electric and hybrid vehicles, all of which will require convenient access to charging stations. Reduced reliance on coal means more sustainable energy – an intermittent form of energy production that demands smart storage solutions to provide reliable back-up energy at peak times.

These changes have happened sooner than most of us predicted - even though some may claim they haven't happened soon enough. These changes are now driving the business and the innovations of Nilar in a clear direction. It's in answer to these changes that we are happy to announce the launch of our latest battery, Nilar EC.

Nilar EC is a battery designed to meet the time shifting and peak shaving needs of today and tomorrow.

1) On April 21st 2017 the UK went a full day without using coal to generate electricity, something that hasn't been possible since 1882.

Nilar EC – less is so much more

Introducing the Nilar Energy Compact high voltage battery: 34% smaller than its predecessor (9,9 dm³ vs 15,1 dm³) and 53% higher volumetric energy density (126 Wh/l vs 82 Wh/l). Less really is so much more.

- Fully recyclable
- Environmentally-friendly: free from cadmium, mercury and lead
- Wide operating temperature range: -20°C to +50°C
- Safer than “safe”¹ thanks to new patented innovations



ENVIRONMENTALLY-FRIENDLY: FREE FROM CADMIUM, MERCURY AND LEAD

FULLY RECYCLABLE

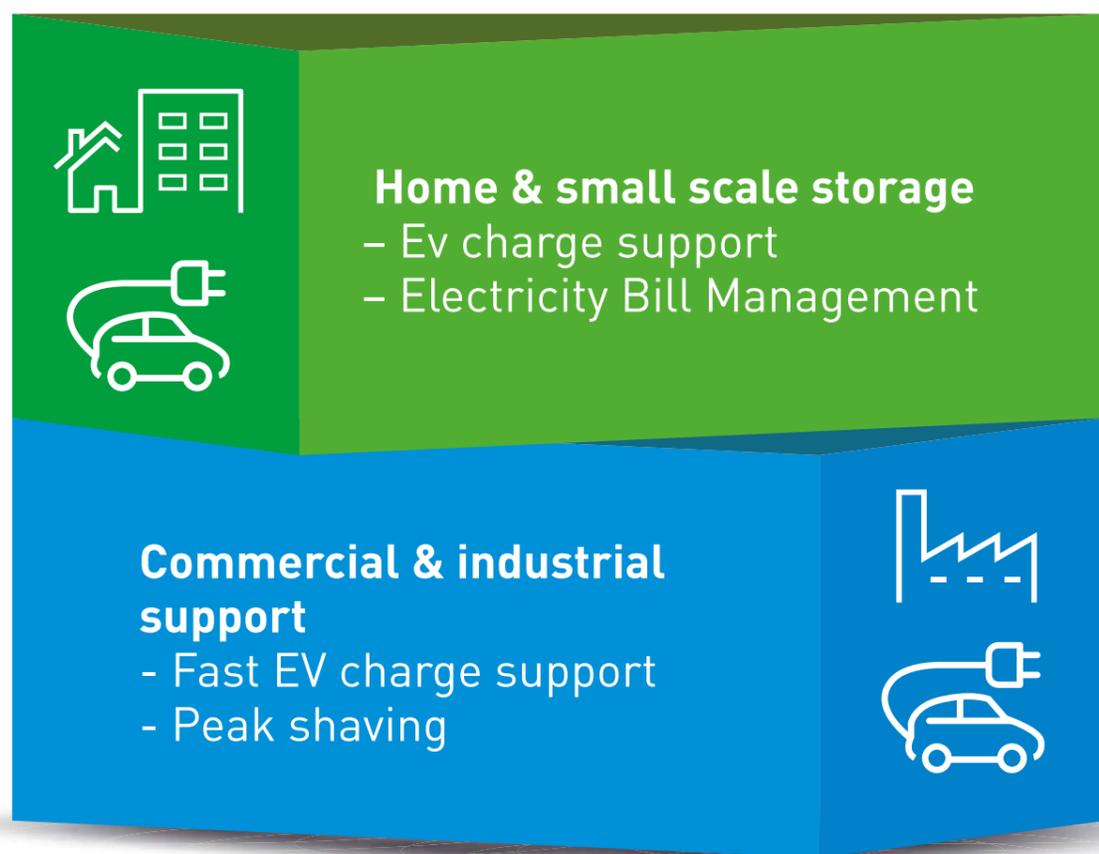
WIDE OPERATING TEMPERATURE RANGE -20°C TO +50°C

SAFER THAN “SAFE” THANKS TO NEW PATENTED INNOVATIONS

1) Nilar provides battery systems that are safer than many so called “safe” solutions available on the market. The Nilar battery system contains water based, non-flammable electrolyte. It does not generate short circuit failure even under low temperature charging. The electrodes cannot ignite spontaneously and will not cause heat propagation between modules. That’s why we argue that we are safer than “safe”.

The Nilar EC battery series

Our new battery, Nilar EC, has been developed to handle the energy storage demands of key applications and deliver on the growing need for reliable peak shaving and time shifting solutions. Combined with our advanced bi-polar NiMH battery technology we can offer our customers a safer, more reliable and greener unit that can operate on a wide temperature range, with high power and long calendar lifetime.



Features:

- Decrease your tariff fees
- Increase your share of renewable energy
- Relieve stress on the grid

Advanced energy storage:

- Small scale storage
- Commercial & Industrial storage
- EV-charging
- Uninterruptible Power Supply (UPS)

One single Nilar EC battery pack can store 1,44 kWh of energy and charge and discharge multiple times per day without impacting performance. With our powerful and compact solution we provide more energy at a lower cost, when and where it's needed.

Home & small scale storage

Nilar offers small to medium scale solutions that are ideal for safe energy storage in homes, businesses, apartment blocks and housing estates.

When connected to solar or wind power stations you get full advantage of the intermittent nature of sustainable energy. The combination of Nilar's smart Battery Management System (BMS) and our energy compact batteries deliver the ideal energy buffer to boost grid supply during busy and peak periods in order to lower tariff fees.

The Nilar solutions gives you the possibility to take control of your energy consumption, also known as Electricity Bill Management.

Commercial support

According to the European Environmental Agency, energy consumption will increase dramatically over the coming years.

Thousands of cars will be charged simultaneously in relatively concentrated areas. To prepare for this, Nilar offers energy storage solutions for reliable EV-charging while relieving stress on the grid.

Fast EV-charging requires powerful energy storage solutions that enables tariff fee reductions while delivering peak-shaving capabilities. The Nilar solutions are reliable and able to handle continuous charge and discharge for years to come. Many stations will be located in busy, well-populated areas, for which safer Nilar solutions are highly suitable. For environments with fluctuating climates, the use of Nilar batteries is advantageous as they can operate in a wide temperature range.

Industrial support

With electricity prices fluctuating throughout the course of the day, utilizing energy stored during low-tariff fee periods can deliver considerable savings.

With the right energy storage system and an understanding of the tariff fee structures of energy providers creating strong financial viability, production plants can run the way they were intended, at a lower cost.

For further savings an energy storage solution can be connected to sustainable energy sources. Energy will only be transferred from the grid at off-peak times if the intermittent sources have not provided enough energy for full charge.

A closer look at Nilar EC

The EC in Nilar EC stands for Energy Compact. That's because the battery has an energy optimized cell design and more than 50% higher volumetric energy density than its predecessor. This new design has resulted in a 30% smaller unit, which gives it a remarkable gain in power to size ratio. Nilar EC has been five years in the making through R&D, innovation and customer feedback. Here is a closer look at some of the other main features.

Environmentally-friendly

Nilar EC batteries are made with minimal hard-to-recover raw materials. Unlike most industrial batteries, nickel metal hydride batteries do not contain cadmium, mercury or lead to deliver powerful results. And unlike some other chemistries, which is often more costly to recycle than mine, nickel is an actively recycled and reused material.

Circular Economy

Nilar batteries are fully recyclable. From the nickel used to power them to the seals and casing used to the contact plates transferring the energy, the different elements that make up the battery can be reused in industrial manufacturing, such as the production of new Nilar batteries. The Circular Economy philosophy has been a central part of the R&D process for Nilar EC.

Operating temperature: -20°C to +50°C

Nilar batteries have always been recognized for their broad temperature operating range. Covering from -20°C to +50°C, you can rely on the battery to perform whatever the conditions. Added to this the robust nature of the bi-polar battery chemistry and you have a battery that provides safety and flexibility when needed.

Designed for a service life of 20+ years

Thanks to the ruggedness of the NiMH design, Nilar EC delivers a stable performance curve throughout the life of the battery. Meanwhile, it can be deep cycled thousands of times, providing reliable power for many years.



Safer than "safe"

Nilar provides battery systems that are safer than many so called "safe" solutions available on the market. The Nilar battery system contains water based, non-flammable electrolyte. It does not generate short circuit failure even under low temperature charging. The electrodes cannot ignite spontaneously and will not cause heat propagation between modules. Additionally, the newly patented cooling ensures stable temperature throughout the whole pack and decreases the risk of overheating. That's why we argue that we are safer than "safe".

Fully recyclable

Safer than "safe"

Raw Materials and Recycling – a strategic issue?

Raw materials and recycling are becoming increasingly strategic issues for battery manufacturers. Battery recycling must work properly in order to sustainably scale up the use of electric vehicles and energy storage solutions, which means that we need to safeguard our raw commodities and metals. Fortunately, Nickel has a high recycle value and is also easy to recover and reuse.



Furthermore, there are uncertainties surrounding forthcoming regulations and processes such as the Battery Directive 2006/66/EC, which is currently being rewritten and may cause new labelling and certification requirements.

Another issue is transportation of scrapped batteries, which calls for various approved packaging solutions to ensure safety. Within 10 years, there must be well developed recycling processes in place in order for battery energy storage systems to function in a sustainable way on the global market.

For many battery producers not using Nickel-based chemistries, recycling is a non-profitable process requiring high investments. Some battery chemistries

are cheaper to mine than to recycle, but even if the active material is recovered by recycling, the purity is rarely good enough to use in batteries.

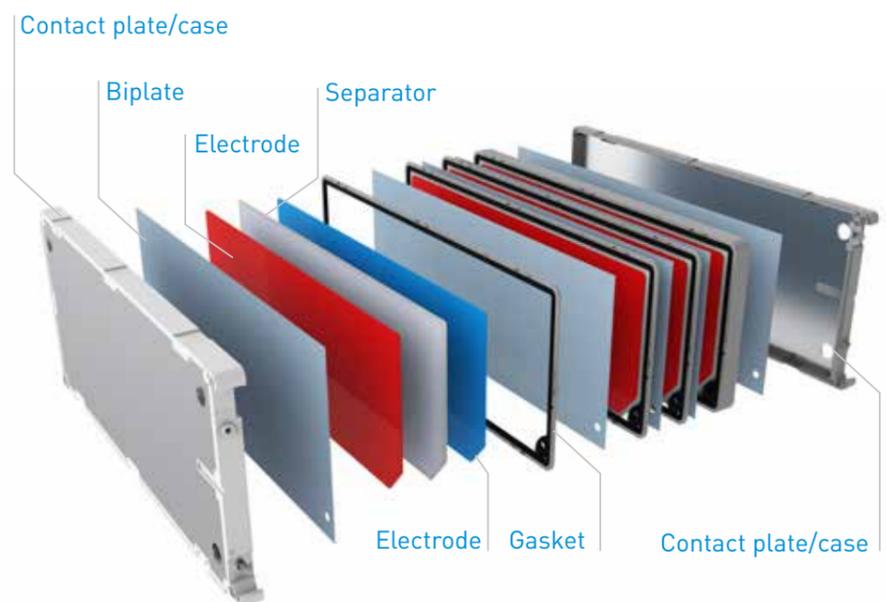
Nickel, on the other hand, has a high recycle value and is also easier to recover and reuse. In this regard, the Nilar NiMH battery is a great option, especially since its bi-polar "layer by layer" design makes it even easier to recycle. This is a huge advantage going forward, given the fact that we must consider functional refunds, resale value and recycling when choosing the battery technology of tomorrow.

Nilar has also developed a process for reuse of scrap and active materials in our production line, taking our recycling efficiency to the next level.

Nilar bi-polar modular design

Nilar fundamentally innovated battery design through developing a completely new way of building a modular, bi-polar battery. Bi-polar design has always been the holy grail of battery technology, but has up until now been difficult to realize. Nilar's design has managed to overcome previous issues through innovative thinking and modern technology, resulting in total modularity at production, battery pack and cell level. Furthermore, the bi-polar design has advantages in performance derived from inherently low internal resistance, which enables high input/output currents.

In the bi-polar design, cells are laid horizontally and stacked on top of one another to gain maximum space efficiency. This also contributes to the easy assembling and disassembling. The common/shared current collector reduces the volumetric overhead of the current collector and inherently results in uniform current flow across the cell, thus making it ideal for high rate discharge applications. As a result of this, the bi-polar design has great advantages compared to the cylindrical and prismatic technologies in terms of volumetric overhead. The uniform current and resistance paths promote uniform heat generation, which enables uniform ageing of the cells and ensures longer cell life.



US/European design, Swedish built

Nilar is a cross-continent corporation, with R&D units in the US and Europe and manufacturing facilities in Sweden. We collaborate with world's leading NiMH battery experts to design, develop and manufacture solutions on-premises.

NiMH batteries are ideal for industrial applications, where conditions are tough, regular and deep cycling are the norm, and battery life expectancy is long-term.

All Nilar batteries are manufactured from cell to system at our state-of-the-art production plant in Gävle, northern Sweden. This gives us full transparency of the complete manufacturing process. Battery production is also fully automated to ensure quality control throughout production. This way we can guarantee the quality of our energy storage solutions to meet the demands of tough industrial applications.

Powerful & scalable energy storage

Nilar energy storage solutions are available in a number of configurations. Each one is modular and can easily be scaled to meet increasing energy demands.

Nilar energy storage solutions are available in cabinet and rack configurations.

For the commercial and industrial market, 57,6 kWh rack solutions are available. They can be scaled incrementally to meet peak-shaving and load shifting requirements.

Cabinets are typically used in the home and for other small scale storage applications. These are available in 10-30 kWh configurations. These can be scaled to meet increasing energy storage requirements.

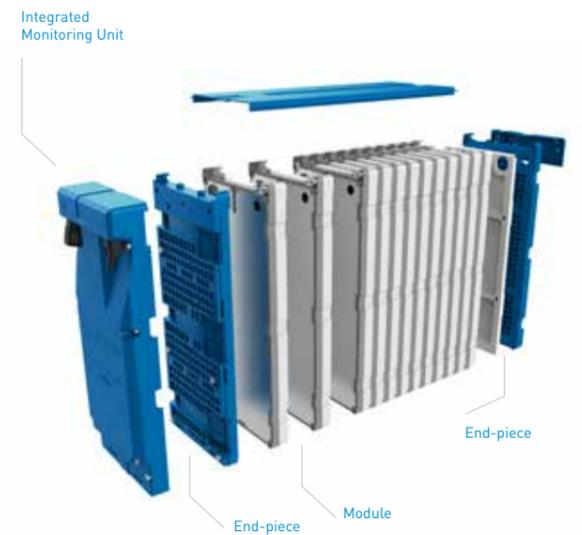


Rack



Cabinet

Nilar EC pack – Advanced NiMH battery technology



Typically, each battery pack contains between 8-12 modules (12V per module). In turn, every module contains 10 battery cells. Nilar battery packs can deliver high discharge power and accept high charge power. At low cycle duty, more charge and discharge power are available, depending on the battery system and application. Battery packs are designed to be used in systems with a maximum battery voltage up to 800 VDC.

Nilar EC – Less is so much more

- 96- 144 VDC battery pack configurations
- Integrated battery pack monitoring system
- Modular design
- Flexible system solutions
- 30% smaller than previous version
- New patented in-built cooling solution
- UL94, V0 plastics

Configuration	Length D
EC-96V-10Ah	248
EC-108V-10Ah	273
EC-120V-10Ah	293
EC-144V-10Ah	337

Battery pack specifications

Electrical Characteristics	96V	108V	120V	144V	Unit
Capacity	10	10	10	10	Ah
Energy	0.96	1.08	1.2	1.44	kWh
Cycles	2000	2000	2000	2000	cycles
Nominal Voltage	96	108	120	144	VDC
Max continuous charge /discharge	3 C	3 C	3 C	3 C	C-rate
Max charge/discharge:	7 C	7 C	7 C	7 C	C-rate
Gravimetric energy density	40.7	41.2	41.7	42.4	Wh/kg
Volumetric energy density	122.1	124.4	126.3	129.3	Wh/l
Mechanical Characteristics					
Dimensions [DxHxW]	248 x 306 x 127	273 x 306 x 127	293 x 306 x 127	337 x 306 x 127	mm
Weight	24	26	29	34	kg
Protection class					
Battery pack	IP54	IP54	IP54	IP54	IP
Integrated Monitoring Unit	IP21	IP21	IP21	IP21	IP
Operating Conditions					
Ambient temperature range	-20 to +50	-20 to +50	-20 to +50	-20 to +50	°C
Service life	20+	20+	20+	20+	years



NiMH Batteries – When Safety Matters

Nickel metal hydride is a mature battery technology that has been used commercially for over 25 years for a variety of applications including consumer products, electric vehicles, hybrid electric vehicles, and stationary power applications. The mass introduction of batteries into cars is driving safety regulations for vehicles and other battery applications, such as energy storage. Nilar's NiMH battery technology is well positioned to meet this challenge as safety is one of its main advantages.

Thanks to the stable nickel metal hydride chemistry, the Nilar bi-polar battery does not pose a risk with spontaneous energy release – a potential issue with many solutions available on the market. NiMH batteries utilise aqueous electrolyte rather than organic electrolyte. This means there is no risk of self-ignition in NiMH batteries. NiMH batteries also perform well under fluctuating conditions, such as instant drops in temperature and shocks.

One of the many functionalities of the Nilar Battery Management System (BMS) is to prevent the battery from overcharging or deep-discharging. Moreover, Nilar NiMH batteries are characterized by a high level of passive safety under abusive treatment.

There are many solutions on the market today which require strict adherence to upper voltage limits, temperature limits

and current limits. If you pass these set limits, you enter a safety critical region where thermal runaway can be triggered by internal short circuit or external heat, such as during deep discharge or over charge. The Nilar NiMH batteries are rugged and capable of managing various safety critical events such as electrical and mechanical abuse, critical environmental exposure and faulty workmanship.

Safety must not be taken lightly and it should be known that there are rugged technologies available. For a private home, office building, or at other public areas, NiMH batteries offer the safest and most environmentally-friendly energy storage solution available as they minimize the risk of harm to homeowners, passers-by or properties. They will provide energy as and when required.