LONG-LASTING BATTERY

endurance + TECHNOLOGY

NOVEA

GROUPE RAGNI

SOLAR LIGHTING,
DESIGNED TO LAST

endurance + TECHNOLOGY
A BATTERY DESIGNED TO LAST

SCIENTIFICALLY-PROVEN TECHNOLOGY!

Renowned for the quality and durability of its autonomous lighting solutions, NOVEA has confirmed its position as a leader in energy storage technology with the design of its **endurance** + TECHNOLOGY battery.

NOVEA has focused on designing its own technology using a scientific approach for this component that is crucial for the proper functioning and durability of autonomous solar lighting. NOVEA has therefore teamed up with well-established laboratories for the technical expertise and guarantees required in the development of this project.

Over 6 years of Research & Development in partnership with the CEA in Grenoble and industrialization have enabled us to create the most efficient and durable battery technology available on the solar-powered street lighting market today.

Lithium Iron Phosphate (LiFePO4) technology has been selected over other Lithium Ion, Nickel Metal Hydride (NiMh) or Lead technology for its durability, resistance to high temperatures and energy efficiency. It has been scientifically approved by the CEA as the most suitable solution for solar-powered street lighting.

The LiFePO4 cells carefully selected by NOVEA have undergone extensive laboratory tests, so that only the best materials that meet NOVEA's high requirements for longevity and reliability are used.

endurance + TECHNOLOGY is therefore a battery that has been technically tried and tested and is perfectly mastered by NOVEA. Numerous examples fitted for several years all over the world are proof of this.

endurance + TECHNOLOGY

endurance + TECHNOLOGY, designed by Novea, offer the best lifespan of the market thanks to its lithium LiFePO4 cells and its unique management of energy flows. LiFePO4 batteries have been documented by scientists as most efficient and most suitable for public solar lighting market.

Production facility for endurance + batteries

Laboratory Tests

ABOUT THE CEA

cea

The French Alternative Energies and Atomic Energy Commission (CEA) is a public scientific, technical and industrial research organization (EPIC).

Located at the heart of a vibrant scientific, industrial and university research area, the CEA Grenoble centre devotes most of its research to the development of new technologies in the fields of energy, health, information and communication.

From electric batteries to nanotechnology, materials and biotechnology, the CEA Grenoble centre is at the cutting edge of technological research and actively engages in sharing its knowledge with the industry.

KEY STRENGHTS

The longest lifespan on the market :
> 10 years (4 000 cycles at 40% DoD at 35°C; i.e. 4 000 nights, > 10 years).

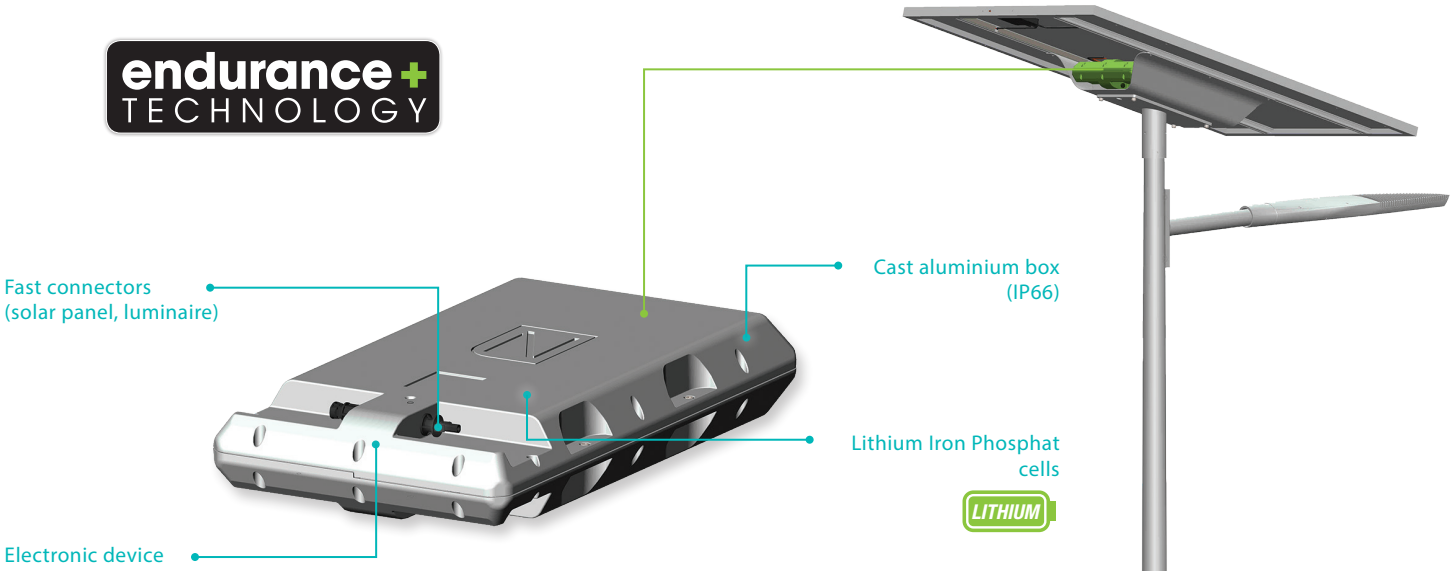
Fully functional at extreme temperatures :
-20 °C to +65 °C.

Maximum energy efficiency :
Advantage : Reduction of the required nominal capacity compared to other types of technology.
Usage rate : **higher for Lithium Iron Phosphate technology (90%) than for NiMh (80%) and Lead (80%) technologies, without impacting the service life.**
Yield : 95% for Lithium Iron Phosphate. Better conversion of the energy produced by the solar panels into actually stored energy compared to NiMH (85 %) and Lead (85 %).

Lighter and less bulky compared to other technologies
(3 times less than lead, 1.5 times less than Nimh).

More environmentally friendly
The components used (aluminium for the envelope separator, Lithium, Iron and Phosphate) limit the environmental impact during production and facilitate recycling.
Less primary resources are used thanks to:
- its energy efficiency and therefore its reduced size
- its long service life (fewer batteries to manufacture and recycle)

endurance+ TECHNOLOGY



ABOUT endurance+

The product includes :

- **a Lithium Iron Phosphate battery developed in partnership with the C.E.A.** as part of a Research and Development project lasting more than 6 years,
- **a circuit board dedicated to this battery and entirely developed by NOVEA** to optimize its management and life span,
- **die-cast aluminium casing to provide robustness and reliability. It has been designed entirely by NOVEA** and combines the lithium battery pack and the electronic control system in a single sealed unit.

PROVEN, TRIED AND TESTED TECHNOLOGY

A BATTERY NEVER DIES, IT CAN ONLY BE KILLED!

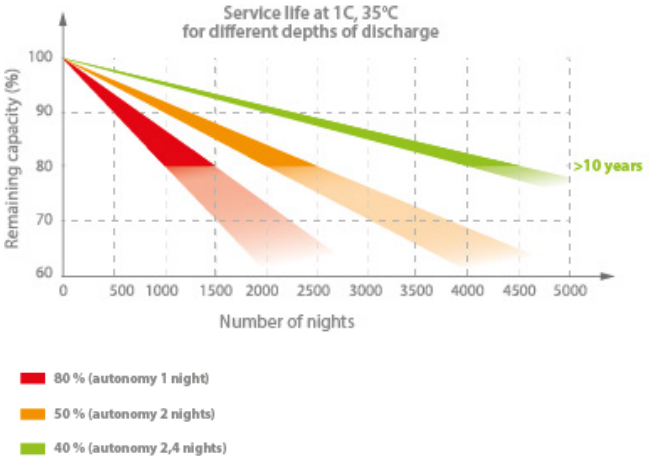
Draconian selection of storage cells, good charge and discharge management with a high-performance electronic regulator offer a very long battery life.

For example, the **endurance +** battery has a service life of more than 10 years if it is discharged by up to 40% per night at an average temperature of 35°C.

Simply put, the more you discharge a battery, the less it will last!

For optimal year-round performance NOVEA has limited the daily discharge of its battery to 40% to guarantee a minimum of 2 nights running time and a lifespan of more than 10 years (at 80% of the initial capacity).

This discharge rate is controlled by the operating system of the lamppost, which will limit energy consumption.



THE LONGEST-LASTING, MOST EFFICIENT BATTERY ON THE MARKET

DESIGNED FOR AUTONOMOUS STREET LIGHTING

1. HIGH PERFORMANCE, SELF-CLEANING SOLAR PANEL
2. UNIT : **endurance +** BATTERY AND REGULATOR IN A CAST ALUMINIUM HOUSING
3. UNIT BOX
4. MOUNTING FOR UNIT BOX
5. LED LUMINAIRE
6. GALVANIZED POWER-COATED STEEL MAST

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NOVEA

THE DIMENSIONING OF A endurance+ BATTERY

Our products are designed to operate all year round, at the specified power and lighting hours. Our energy ratings are authoritative and clearly indicate the operating conditions (lighting power, hours of operation per night and number of nights of autonomous operation without sunlight).

This scientific and transparent approach lets our customers know exactly what they are getting.

▸ Engineered for year-round operation at the same power level

NOVEA ensures that the design can deliver a 100% service rate for the entire lifespan of the lamppost. This is why we oversize the batteries and the solar panel right from the product design stage. We also take into account the possible usage of the battery and its energy efficiency.

Unlike some of its competitors, NOVEA does not claim that its products have a service rate of «xx» %. This highly imprecise statement means that the product does not provide 100% service, but rather 90% service, for example. This means that for part of the year (10% of the time according to the example) it will operate in (very) degraded mode, or not at all. Such a situation is unacceptable for an urban lighting system that is intended to ensure the safety of the surrounding area.

▸ Built to hold 2 to 10 nights of charge

Depending on the geographical area, the battery will be **designed to offer an autonomy of minimum 2 nights** (i.e. 40% of daily discharge maximum) for sunnier regions. For certain zones, we can **offer up to 10 nights of charge**.

« Continuous service » function: in the event of abnormally low energy production (below the statistical calculations in the energy report), the energy consumption level will adapt to the battery charge level in order to provide a minimum level of lighting.

▸ Optimized battery life and solar panel power for LiFePO4

The energy performance of a battery, characterised by its rate of use and efficiency, has an influence on the calculation of the battery capacity. The **endurance +** offers considerable advantages:

- **The rate of use** is the amount of energy that can be used (useable capacity) in relation to the nominal capacity of the battery. To ensure a consistent service life for solar lighting applications (10 years or more), a Lithium Iron Phosphate battery will be able to use 90% of its total energy while the rate will be 80% for NiMH. Therefore, for a given amount of total energy, the Nimh battery will need to have a higher total capacity (CEA data).

A NimH battery should have 12.5% more capacity than the LiFePO4 endurance + battery in order to provide the same service with an optimised lifespan.

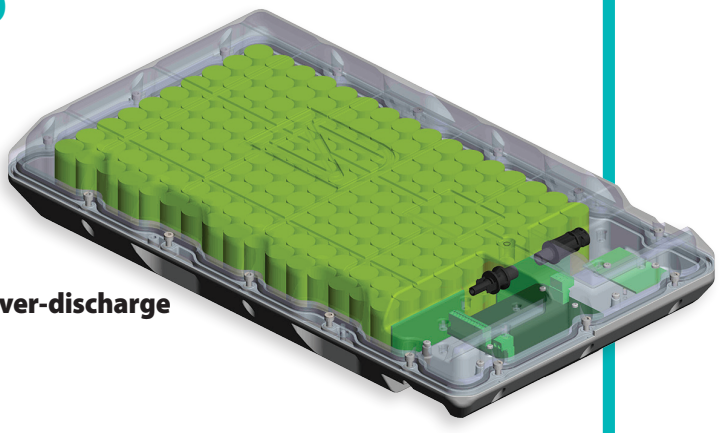
- **Energy efficiency** indicates the rate of conversion of the energy that reaches the battery (via the solar panel) compared to the energy that is actually stored. Lithium Iron Phosphate offers the best efficiency, 95%, compared to NiMh which will be at most 85% (CEA data). Therefore, to recharge the same amount of energy, the solar panel that provides this energy will have to be larger for NiMH than for Lithium Iron Phosphate.

A NimH battery will need to be powered by a solar panel 11% larger than a LiFePO4 endurance + battery to store the same amount of solar energy daily.

A STABLE, SAFE AND RELIABLE BATTERY

endurance + TECHNOLOGY

- **overvoltage protection**
- **protection against overcharge and over-discharge**
- **short-circuit protection**
- **overcurrent protection**



COMPARISON OF THE MOST COMMONLY USED TYPES OF BATTERY TECHNOLOGY

This comparative table only reflects the technology currently available on the solar lighting market.
As the Lithium families are very varied, with a very wide range of properties, in this comparison we only show the data for our Lithium Iron Phosphate (LiFePO4 or LFP) **endurance +** battery.

	Sealed Lead/Acid (Pb VRLA)	**Ni-MH** Nickel Metal Hydride	**endurance +** Lithium Iron Phosphat
Energy stored	25-50 Wh/kg	30-80 Wh/kg	80-120 Wh/kg
Service life (estimated) (Nb. nights, cycles at 80 % DoD / 35 °C)	< 1 year (< 300 cycles)	3 to 4 years (1 000 to 1 500 cycles)	> 4 years (> 1 500 cycles)
Service life (estimated) (Nb. nights, cycles at 40 % DoD / 35 °C)	< 4 years (< 1 500 cycles)	5 to 7 years (2 000 to 2 500 cycles)	> 10 years (> 4 000 cycles)
Warranty found on the market	1 to 2 years	2 to 5 years	5 years
Auto discharge (% / month at 35 °C)	3 to 5 %	5 to 20 %	+/- 2 %
Rate of use Usable capacity to achieve the specified service life	80 %	80 % maximum	90 %
Performance Usable capacity to achieve the specified service life	85 %	85 %	95 %
Operating temperature	-20 °C +50 °C	-40 °C (special cells) +85 °C	-20 °C (special cells) +65 °C +85 °C (special cells)
Rare and/or polluting resources Used in manufacturing	Lead	Nickel, rare earth	Lithium

Novea's endurance + battery is the safest technology offering great value for money with an exceptional service life.

- Its key strength is its high number of cycles. **endurance +** is capable of achieving 2 times more charge/discharge than a conventional Ni-MH battery and 5 times more than a lead acid battery. Its longevity greatly reduces maintenance costs.
- **endurance +** has a high energy capacity and allows you to reduce the weight and volume of your batteries significantly. Its efficiency means you can reduce the size of the solar panel.
- **endurance +** TECHNOLOGY is environmentally friendly with limited use of scarce and polluting resources, and is safe, with no risk of fire or explosion.

LEXICO

Cycle : A sequence of charging followed by discharging is called a cycle. This term is used in particular to refer to the expected service life of a battery, because the number of cycles affects the life of a battery more than the passing of time alone. The number of cycles a battery will be able to perform depends on the depth of discharge (DoD), the deeper the cycles, the shorter the life. Service life is generally specified by manufacturers for 80% DoD cycles, the service life in number of cycles will be greater at 40% DoD.
Maximum depth of discharge (DoD : Depth of Discharge) : This is the ratio of the ampere-hours extracted from the battery to its rated capacity. For example, 40 Ah discharged from a battery with a nominal capacity of 100 Ah corresponds to a depth of discharge of 40%.
Autonomy : The energy provided by a photovoltaic system is stored in a battery to supply a load constantly and without interruption for a specified period of time. The battery must be able to store enough energy to cover daily needs and also have enough reserves to ensure a continuous supply during periods without sunlight. This system autonomy, indicated in nights, is dependent on the type of system, the location and the lighting programme.

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Edition 122021.01 - www.artographe.fr
3D Illustrations : Artographe - Non-contractual photos

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