

10 June 2024

Taking charge: Autarco's seamless solution for evolving energy markets

Introducing our Energy Management System



1. Executive Summary

The transition from fossil fuels to sustainable energy sources is transforming global energy markets, significantly impacting the European electricity grid. Renewable energy sources, including solar and wind, are becoming increasingly prominent in electricity supply. This shift, while beneficial for reducing reliance on fossil fuels, introduces challenges due to the decentralized and variable nature of renewable energy generation. Periods of overgeneration, particularly during favorable weather conditions, strain the grid, with moments where energy generation exceeds energy consumption.

Grid operators manage these imbalances by imposing costs on energy providers who fail to maintain supply and demand equilibrium. This has led to rising balancing costs, which are often passed down to European consumers. In the Netherlands, the presence of a net energy metering (NEM) scheme exacerbates these issues, incentivizing residential solar system owners to export excess energy to the grid, further stressing the system. Consequently, energy providers have announced charges for solar energy producers, often exceeding €300 per household annually.

In response to these challenges and expanding on Autarco's over 12 years experience in providing complete grid tied PV systems, Autarco introduces a seamlessly integrated solar solution that combines solar PV systems, battery storage and an advanced Energy Management System (EMS). This offer addresses and capitalizes on grid imbalances and ensures financial viability for consumers. The solutions are scalable, allowing consumers to start with a basic solar PV system and expand to include a battery, switch to dynamic pricing and use Autarco Negative Price Response (NPR) and other energy management functions whenever they want. Despite changing market conditions, these solutions demonstrate significant financial benefits. Autarco's seamless solutions, integrating hardware and software, offer consumers the most effective way to manage their energy production and consumption, allowing them to take charge in the evolving energy market. We strive to achieve €0 energy bills for homes and businesses everywhere, by delivering renewable energy technologies and seamless services.

Table of contents

1. Executive summary	2
Table of contents	3
2. Evolving energy markets	4
2.1 Key numbers in the European market	4
2.2 Growing grid challenges	5
2.2.1 The effect of energy generation on the grid	5
2.2.2 The costs of grid imbalance	6
2.2.3 Energy consumers' concerns	6
2.3 The need for an Energy Management System	6
3. Autarco's seamless solar solutions	7
3.1 Standalone solar PV	8
3.2 Solar PV + dynamic prices	8
3.2.1 What are dynamic prices?	8
3.3 Solar PV + dynamic prices + Autarco Negative Price Response	9
3.4 Solar PV + battery	10
3.5 Solar PV + battery + dynamic prices + Autarco Energy Management	11
4. Conclusion	13
5. Sources	14

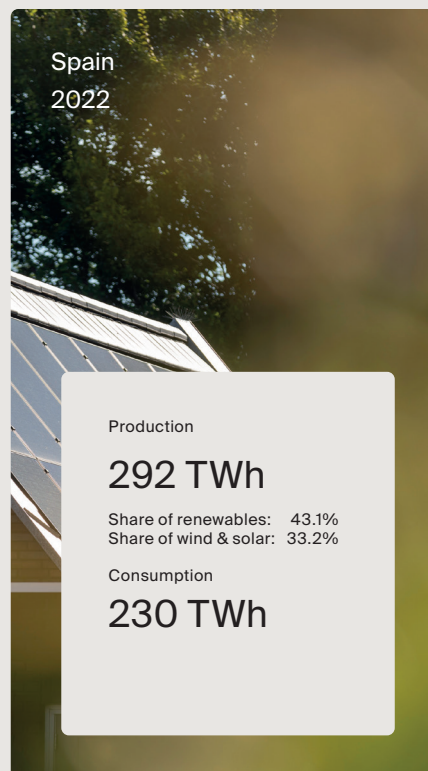
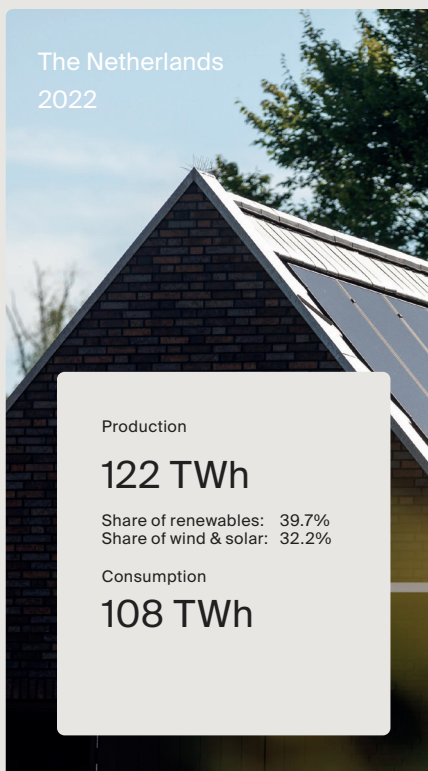
2. Evolving energy markets

As the world transitions from fossil fuels towards sustainable energy sources, the composition and dynamics of energy markets change. One of the most important consequences is the increasing pressure on European electricity grids due to energy imbalances. As such, in the Netherlands in 2022, the peak load was 17.5 GW, while installed solar power was 19.6 GW and wind power was 8.8 GW¹. These figures are expected to grow further each year. Generally, renewable energy is taking up a larger portion of the total energy supply, reducing the reliance on fossil energy. In the Netherlands, renewable energy accounted for 48% of the electricity mix in 2023 and is expected to account for more than half in the following years².

2.1 Key Numbers in the European Market

The EU-wide share of electricity from renewable sources in 2022 was 41%³. The total electricity from renewables can be split up based on its source, where the largest contributors are onshore wind (32%), hydropower (32%) and solar PV (14%). Across the EU, a total of 263 GW of solar PV capacity has been installed up until 2023. To get a better feeling for the current situation in European markets, we broke down the domestic electricity production and consumption for the Netherlands, Spain and Germany in 2022⁴.

Yearly electricity production and consumption per country



2.2 Growing grid challenges

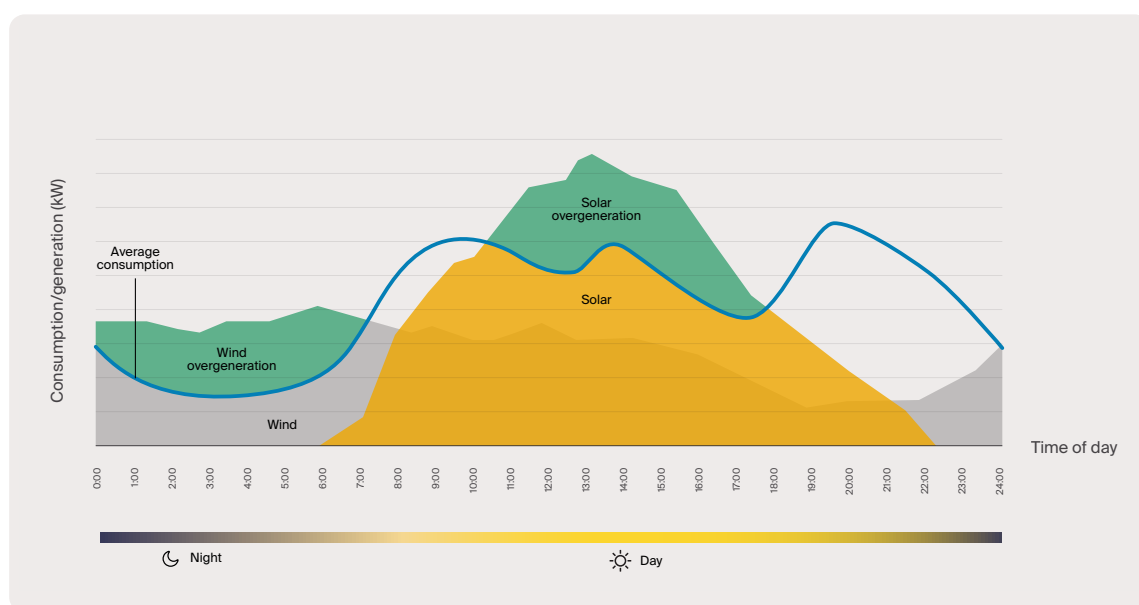
2.2.1 The effect of energy generation on the grid

The electricity grid requires a constant balance between supply and demand, meaning that consumption of energy (drawing energy from the grid) needs to equal the generation of energy (feeding into the grid) at the same moment. This is because the grid lacks the capability to store energy. Failing to maintain this balance between energy consumption and generation at a given moment results in failures in the operation of the grid and thus should be avoided.

Transmission System Operators (TSOs) are tasked with this challenge. They manage the overgeneration of energy by charging energy providers who have themselves failed to manage the balance in their portfolio at that moment. This balance has traditionally been managed by adjusting the output of fossil fuel generators in response to consumption patterns, because those types of generators can react rather easily to consumption patterns that are harder to affect. The fossil fuel generators would thus modify their power output following consumption.

While the introduction and subsequent rise of renewable energy has many benefits, there are some drawbacks for the management of the grid. The reason is that the generation of renewable energy is much more decentralized and thus less controllable than that of fossil fuels. Furthermore, the energy generation from solar and wind is much more variable, as it depends on the weather, leading to certain periods of overgeneration. Those are periods with a lot of sunshine and a lot of wind. As a consequence, these periods can disrupt the grid, which happened for example in June 2023 in the Netherlands. During those moments, the energy generation exceeded the national consumption for 140 hours⁵.

Overgeneration from solar and wind energy



In the Netherlands in particular, with the presence of a net energy metering (NEM; “saldierungsregeling” in Dutch) scheme, this is exaggerated, as owners of residential solar systems are incentivized to maximize their energy export to the grid. During sunny hours where overall energy consumption is low, this puts extra pressure on the grid. So, the higher the generation of energy when demand for energy consumption is low, the more difficult the grid management becomes.

2.2.2 The costs of grid imbalance

Balancing the grid during times of overgeneration comes at a cost. The exact amount depends on the amount of energy that is overproduced, something that has increased during the past years as just discussed. As a result, the cost of balancing the grid has escalated dramatically. Traditionally, energy providers have to pay these penalties and then distribute these costs among all of their customers. However, recently there have been energy providers stepping up with the message that those consumers who own solar systems should carry more of these costs, as they are partially responsible for the overgeneration that causes the costs. In the Netherlands, these announced charges can easily add up to over €300 per household annually. Specifically, the costs per household that has a solar system will depend on the annual kWh exported to the grid by their system.

2.2.3 Energy consumers' concerns

At Autarco, we understand that there are many uncertainties for consumers in the current solar market. In the Netherlands, the discontinuation of NEM is likely to approach in the near future. At the same time, the majority of large energy providers have recently announced the introduction of extra costs for solar energy producers (“terugleverkosten” in Dutch). This “penalty” is based on the amount of energy that a system returns to the grid and can result in hundreds of euros per year. In other countries that are already operating without NEM, similar issues still exist, but households might not be penalized in a similar way. Yet, overgeneration is not exclusive to the Netherlands due to the nature of renewable energy and the inability of the grid to use generated energy at a later moment.

2.3 The need for Energy Management System

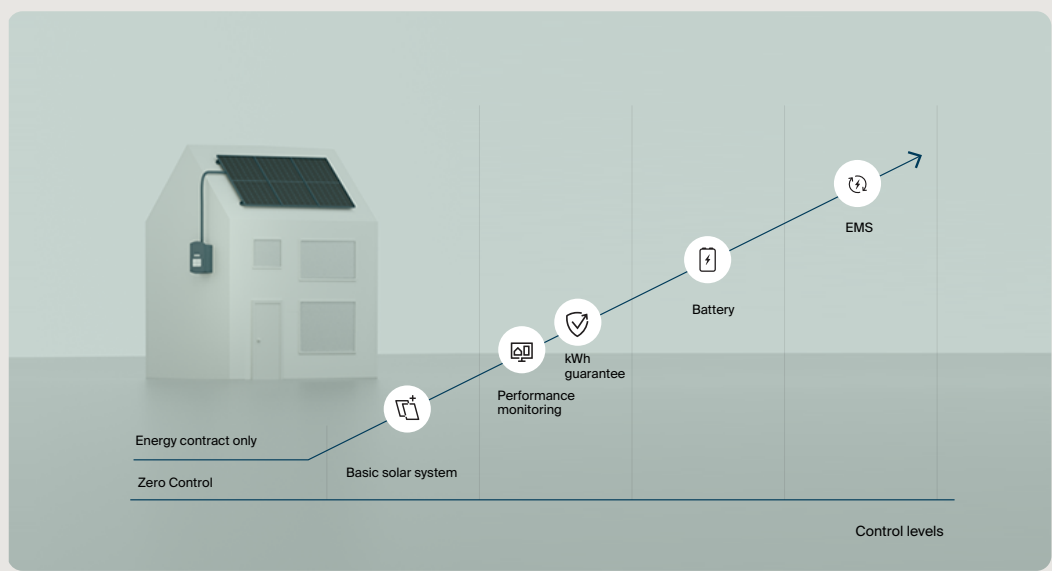
Thus, in the current energy markets across Europe, the grid is getting overexerted which can lead to extra costs for solar system owners who export to the grid. This is why Autarco, the original single brand solar PV solution innovator, is announcing a complete solar solution that seamlessly integrates solar systems, battery storage and our newest energy management software. With this complete solar solution, we address consumers' concerns and illustrate that the financial benefits remain, regardless of the ever-changing energy market.



3. Autarco's seamless solar solutions

The solution to the aforementioned problems, as well as those that might arise in the future, is moving from a grid-tied solar PV system to a total solar solution that includes a battery and energy management. These total solar solutions allow the consumer to generate energy, store for future use, and optimally use their own energy. From smart inverters to intelligent software: all parts in our system fit together seamlessly. These solutions are scalable, starting from a standard solar PV system, expanding both hardware and software along the way to reach a full Energy Management System. At Autarco, we give you, the rooftop owner, maximum control of your solar solution and thereby allow you to have maximum control of your energy bill, without having to do any of the work yourself.

The customer can determine the level of control by expanding the solution to optimally benefit from market conditions.



3.1 Standalone solar PV

Autarco is a total PV system brand, manufacturing all main components that are needed to install a turnkey system including modules, inverters, mounting systems and monitoring hardware. Despite recent and upcoming market changes, solar PV systems by themselves remain a worthwhile investment for rooftop owners. Even without NEM in the Netherlands, or with extra costs being charged to solar system owners by energy providers, this option remains financially sound. Energy consumers who choose for solar PV generate their own energy and therefore can significantly reduce their energy bill. They will have less demand for electricity from the grid and can be compensated when exporting their generated energy to the grid. While NEM is present in the Netherlands, this is even more relevant, as each kWh exported will be subtracted from the total amount of imported electricity.



The upfront investment of a standalone solar system is still relatively low, especially given that solar PV has never been cheaper than today. While the payback period can increase from ~5 years to ~7 years due to market changes (such as NEM ending in the Netherlands), the savings significantly outweigh the cost. The self-use as well as export to the grid of generated energy cause a strong reduction of the consumer's monthly energy bill, irrespective of the market conditions, resulting in savings for decades. This is especially true considering the increasing warranty periods, as many Autarco panels now come with a 25 year warranty.

3.2 Solar PV + dynamic prices

In changing markets where consumers are being penalized for exporting their generated energy to the grid, in terms of constraints or associated costs (like increasingly introduced in the Netherlands), dynamic energy contracts become increasingly attractive for energy consumers with solar systems. Dynamic energy contracts, as opposed to fixed ones, are based on energy prices that fluctuate over time, following actual market prices.

3.2.1 What are dynamic energy prices?

A dynamic tariff is an energy pricing plan where rates fluctuate. This price affects both the price of buying energy, that is taking it from the grid, and selling energy, when generated energy is exported into the grid. Some homeowners might already be familiar with a simple variable rate plan, known as time-of-use, where rates differ between day and night. The key distinction between time-of-use and dynamic tariffs is the frequency of rate changes. Unlike time-of-use plans that have a few fixed rates each day, dynamic tariffs are based on hourly market prices for electricity, often referred to as day-ahead spot prices. In some markets, these prices are broken down even further, to 30 or 15 minute intervals.

In Europe, electricity is traded on central marketplaces. A significant one for the Netherlands is the EPEX day-ahead spot market, where energy is traded hourly for the next day based on supply and demand. Daily auctions determine the new hourly spot prices for the following day, announced about 11 hours in advance.

These prices, influenced by energy supply and demand, accurately reflect renewable energy conditions. Prices are low during sunny summer afternoons when demand is low and solar generation is high, as well as during stormy winter nights with high wind energy generation. Prices rise when demand is high, and renewable generation is low, such as on dark or cloudy working days.

Overgeneration of renewable energy can even drive prices to become negative, which is an increasing trend. Negative prices occur when the market needs to eliminate excess energy. During these moments, consumers can be paid to use energy and might be limited or penalized for exporting energy onto the grid. These negative prices help balance the grid and address overgeneration.



Switching to a dynamic energy contract is especially interesting as a consequence of the introduction of a charge by the energy providers, the return cost, associated with exporting self-generated energy to the grid. Consumers with a dynamic contract avoid these charges, which can currently add up to €25 to a household's monthly energy bill.

3.3 Solar PV + dynamic prices + Autarco Negative Price Response

With a dynamic energy contract, consumers can be subject to negative energy prices. When energy prices are negative, exporting self-generated energy to the grid results in costs for the consumer. At the same time, importing energy from the grid during moments of negative prices can be attractive and result in bonus payments from certain energy providers. Negative prices occur more frequently and happen during moments of overgeneration. This is why consumers with dynamic contracts benefit from Autarco's Negative Price Response. This solution automatically adjusts the solar energy export to the grid when prices drop below zero. The solar system will limit its production so that no excess solar energy is exported to the grid during those times, thereby avoiding costs for the consumer.



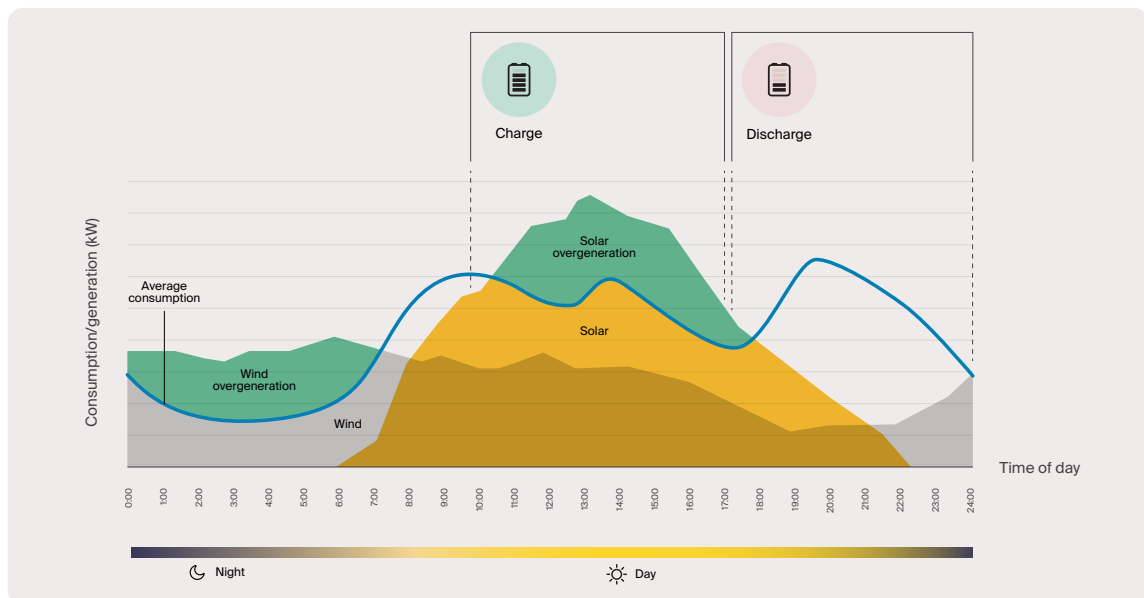
Consumers with a dynamic energy contract benefit from Autarco Negative Price Response (NPR) through savings on their energy bills by avoiding export penalties during moments of negative energy prices that occur in the market. These monthly savings are even higher when consumers are financially rewarded by their energy provider for importing energy during those moments.

Autarco will introduce Negative Price Response in Q3 2024.

3.4 Solar PV + battery

As mentioned, the main solution for overgeneration is increasing the self-consumption of generated solar energy. The key product for achieving this is battery storage. By adding a battery to your solar solution, you can store excess energy locally. The battery will charge when local generation exceeds local consumption, instead of exporting this energy to the grid. This solution mitigates export penalties and promotes the use of green energy. At a later moment, when local energy generation is low and local consumption is high, the battery will discharge and the previously generated energy will be used, instead of having to draw energy from the grid.

The battery improves self-consumption of generated energy by charging during moments of overgeneration and discharging during moments of high consumption.



Adding a battery to the solar solution includes additional upfront investment in the battery, which extends the payback period of the total system. In return, the consumer will experience extra savings on their monthly energy bill, as self-consumption increases through the ability to store generated energy for later use. The height of savings depends on the size of the solar system and the battery.

Autarco will introduce 3-phase AC coupled chargers and larger battery cabinets for the C&I segment in Q4 2024.

3.5 Solar PV + battery + dynamic prices + Autarco Energy Management

The next step, increasing consumer's control over their energy bills even further, involves an expansion of the features of Autarco Energy Management, in addition to NPR. With the presence of a battery, the dynamic tariffs can be used to optimize energy use and storage, reducing reliance on the grid and increasing savings. This means that the battery charges and discharges optimally. With smart charging, the battery charges during moments of overgeneration as well as moments when consumption and market prices are low. During negative price moments, the solar system no longer needs to limit production during moments of negative prices, but can instead store excess energy locally. In turn, the battery discharges when consumption levels are high and local generation is insufficient, especially with high market prices.

Smart charging is based on local energy generation, consumption and market prices.



Additional energy management features, such as smart charging, improve the consumer's self-consumption, maximize export profits and minimize costs. The size of the total system determines the height of the monthly savings. The addition of Autarco Energy Management can reduce the payback period of the total system through its significant savings on the consumer's energy bill by taking advantage of low-price periods and selling energy during high-price periods.

Autarco will introduce Energy Management in Q4 2024.

Autarco Energy Management will be constantly evolving, adding new features towards the end of 2024 and into the beginning of 2025. Additional features include:

- Smart Charging: charge and discharge the battery optimally based on the expected energy production, consumption and prices
- Peak Shaving: avoid peaks in energy import from the grid by consuming energy stored in the battery during peak moments
- Load Control: regulate energy consumption based on energy production and prices, including Electric Vehicle Charging

Each feature results in further control and savings for the consumer, allowing their solar solutions to reach full potential. Keep an eye out for more information on our upcoming Energy Management System solution. Let's make energy management easier – and more profitable – together.

4. Conclusion

The shift towards renewable energy is reshaping the energy landscape, presenting both opportunities and challenges for European energy consumers. The increasing prevalence of decentralized and variable renewable energy sources, such as solar and wind, necessitates advanced solutions to maintain grid stability and manage costs. Rather than combining our bolting on even more component brands to provide batteries and energy management, Autarco addresses these challenges with its seamlessly integrated solar solutions that combine solar PV systems, battery storage, and an energy management. These scalable solutions not only mitigate the issues of overgeneration and grid imbalance but also offer significant financial benefits to consumers. By enabling more effective management of energy production and consumption, Autarco ensures that consumers can achieve long-term financial stability and resilience in the face of an evolving energy market. Autarco allows energy consumers to take charge, striving to achieve €0 energy bills for homes and businesses everywhere.

5. Sources

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