WHITEPAPER



ANH-7852

Reducing Energy Bills Using SolarEdge ONE

Learn how SolarEdge ONE combined with Dynamic Tariffs can significantly reduce residential energy costs.



The bill saving figures presented in this whitepaper are based on a simulation performed on actual SolarEdge sites based on local electricity rate data. Details of research criteria are provided in the last chapter of this whitepaper.

Background

The European electricity market is undergoing a substantial transformation. In the Netherlands, the share of renewable energy being fed into the electricity grid is increasing, resulting in the infamous "Californian duck curve" effect: demand plummets at midday – when solar production is plentiful – and peaks during the morning and evening, causing increasingly greater disparities between supply and demand.



The demand curve in the Netherlands (2023-2026 forecast), demonstrating the "duck curve" effect. Source: ICIS, German and Dutch Negative Price Hour Analysis, July 2023

The phenomenon of negative demand drives the proliferation of negative electricity prices as buyers in the wholesale market are paid to offtake energy from the grid. The following research concludes that more hours of negative prices are expected in the coming years:



Negative priced hours 2019-2022 based on ENTSO-E data. 2023 is based on a combination of actual and modelled results. Source: ICIS, German and Dutch Negative Price Hour Analysis, July 2023 The abundance of negative pricing hours is causing a strain on the electricity grid, particularly on energy suppliers bound by the Dutch net metering law. Every unit of solar energy a household generates and feeds back into the grid is compensated at the purchase price. These suppliers, however, are also required to pay for grid imbalance and other fees in cases of under or over-demand.

The chart shows the impact of the increasing share of renewables. As more intermittent renewable energy assets are added to the grid, hourly price variances increase. Though this variance peaked in 2022 – affected by soaring gas prices – the trend has been consistent.

In parallel to these processes, Dutch consumers are increasingly electrifying their homes and lives. Battery Electric Vehicles (BEVs) accounted for 35% of car sales in the Netherlands in 2022, compared to only 15% in 2019¹. Heat pumps are becoming increasingly popular, with a 57% increase in sales in 2022 over 2021². These factors are dramatically increasing the annual electricity consumption of the average Dutch home.

Average Maximum Variance in Daily Energy Prices, Netherlands



Source: ENTSOE Transparency Platform Data (2018-2023)

1 https://cleantechnica.com/2023/07/19/45-of-new-cars-sold-in-netherlands-now-plugin-cars/

² https://www.pv-magazine.com/2023/02/17/dutch-heat-pump-association-reports-surge-in-residential-installations-in-2022/

Unraveling the Dynamics in the Netherlands' Dynamic Electricity Plans

Given these changing market dynamics, a growing number of electricity suppliers in the Netherlands are offering dynamic energy plans, where the price of energy changes hourly and is coupled to the day-ahead wholesale electricity market. These prices apply to purchased energy (paid to the supplier) and fed-in energy (paid to the consumer). This allows customers to leverage periods of low or negative prices (when demand is low and renewable generation is high). On the other hand, it exposes the customer to more risk. During peak hours, the variable hourly price can be significantly higher than in a typical fixed-rate electricity tariff, and prices can fluctuate dramatically in a matter of hours.

In the example below, energy prices in the Dutch wholesale market climb as high as €0.66/kWh and fall as low as - €1.86/kWh in the afternoon hours. This means that customers can get paid to consume energy, but can also be penalized for export. Under these conditions, a traditional PV and storage system configured for maximizing the consumption of self-generated solar energy could end up costing the customer more than using only grid-sourced energy.



Wholesale Electricity Prices, Netherlands

Source: ENTSOE Transperancy Platform

The Challenge: Mastering the Algorithm of Fluctuating Electricity Costs

While dynamic electricity rates can help consumers save on rising electricity costs, they also require the customer to actively manage their home's energy. Things become even more complex with the installation of a PV and storage system. It is no longer sufficient to simply maximize the self-consumption (energy independence) of a home because, at certain times of the day, it may be more beneficial to consume from the grid and keep the battery charged with solar energy for later use. When a dynamic plan is in place, suboptimal energy management can result in even higher energy bills than a traditional fixed-rate plan.

This challenge could prevent these smart tariffs from becoming ubiquitous, as consumers will need to make tens of energy decisions each day to take advantage of this innovative pricing model.

The SolarEdge Solution



SolarEdge ONE is an innovative, cloud-based Energy Optimization System designed to automatically adapt to each home's energy needs and preferences in real-time. It works seamlessly with SolarEdge inverters and batteries as part of the SolarEdge Home ecosystem.

SolarEdge ONE can be thought of as a personal energy Al assistant that uses the following data points to make optimal energy decisions for each specific home:

- PV Production Prediction based on each site's installed peak power, configuration, and historical performance, SolarEdge ONE is designed to continuously predict how much solar energy will be generated. It is also designed to forecast periods of clipped, excess solar energy.
- Consumption Prediction based on each site's unique consumption patterns, SolarEdge ONE predicts how much – and when – energy will be consumed throughout the day.
- Energy Cost by integrating with external data sources, such as wholesale energy markets and electricity suppliers, SolarEdge ONE calculates how much grid-sourced electricity will cost during different times of the day, and how much exported energy will be worth.
- Grid Support grid events present an opportunity for extra compensation for sites participating in Virtual Power Plant (VPP) programs. In addition, preconditioning the battery to support such events or expected outages can ensure that the battery will generate its maximum potential and value.

Based on these predictions, SolarEdge ONE is designed to make hundreds of daily decisions tailored to each home's priorities/needs to achieve the right goal at the right time: saving excess PV, taking advantage of periods of off-peak pricing to charge the battery, and maximizing feed-in revenue by discharging during peak hours. This optimization process is performed while factoring in battery health by avoiding unnecessary charge and discharge cycles.

SolarEdge ONE is built on a cloud-first architecture and does not require additional external hardware. It is designed to work intuitively and immediately with SolarEdge Home Batteries and can be activated directly by the system owner through the mySolarEdge app. This means a homeowner with an existing SolarEdge PV system can easily add a compatible battery and significantly lower their electricity bills.





SolarEdge ONE battery optimization in a residential site in the Netherlands, demonstrating a dynamic rate.

	Day 1 Scenario	Day 2 Scenario
Night (00:00-06:00)	The home relies on grid electricity for most of the night, possibly due to the battery being depleted as a result of high import prices.	A battery powers the home throughout the night. The grid is not charging the battery due to higher tariff hours.
Morning (06:00-12:00)	Import energy prices peak . The PV system turns on as the sun comes up and powers the home directly. The battery is charged with excess PV energy.	Energy is exported from the battery to the grid between 06:00 and 08:00 to take advantage of peak pricing hours. The home continues to consume stored energy from the battery.
Peak Solar (12:00-15:00)	Import energy prices drop. All PV energy is directed to charge the battery, while the home is powered entirely by the grid.	Import prices are close to zero. The home can fully run on solar energy while the grid and excess PV charge the battery.
Afternoon (15:00-18:00)	Import energy prices increase towards the evening peak. All PV energy is exported. SolarEdge ONE leverages this site's west orientation – providing a later solar peak – to maximize revenues from direct PV export.	
Evening (18:00-00:00)	Import energy prices are at their peak. The home is powered by the battery. For a short period of time, battery energy is exported to take advantage of the peak export tariff.	The home is powered entirely by PV and battery. Between 20:00 and 21:00, energy is exported from the battery to enjoy peak pricing while reserving enough energy to power the home.

Analyzing SolarEdge ONE Electricity Savings in the Netherlands

To assess SolarEdge ONE's contribution to offsetting dynamic electricity bills, we calculated the simulated savings on 50 existing SolarEdge sites in the Netherlands. These sites have attached consumption meters that allow us to analyze the consumption profile at any given moment.

For each site, four calculations were performed using the sites' actual solar production and house consumption data between 2022 and 2023:

• Full Import – the cost of total energy consumed if it were purchased in its entirety from an electricity supplier.

- Solar Only the cost of energy when using a PV system with net metering.
- Solar + Battery the cost of energy when using a PV system with net metering attached to a 10kWh battery, which maximizes self-consumption of solar energy without using using SolarEdge ONE.
- Solar + Battery + SolarEdge ONE the cost of energy when using a PV system and a 10kWh SolarEdge Home Battery optimized for dynamic pricing by the SolarEdge ONE Energy Optimization System.

Note: The cost modeling was performed using a dynamic electricity plan offered by a leading energy supplier in the Netherlands (including purchase fees but excluding energy taxes and VAT).

1800 1600 €1518 1400 1200 €1013 1000 Annual Electricity Bill (€) 800 600 €439 €373 400 €352 €253 200 €51 a -200 - €207 -400 **Full Import** Solar Only Solar + Battery Solar + Battery + SolarEdge ONE

SolarEdge ONE Annual Dutch Electricity Bill for a Dynamic Plan

2022 Pricing data from 11 22-11 23 | Pricing data from 19 22-19 23 | Prices do not include energy taxes

For residential customers with an annual consumption between 2-16 MWh

2022 Pricing data from 1.1.22-1.1.23 | Pricing data from 1.9.22-1.9.23 | Prices do not include energy taxes and VAT

Findings

Our findings show that integrating a battery system alone to maximize self-consumption at an existing PV site would not result in significant cost savings, at present, when Net Metering policy is fully applied.

However, using SolarEdge ONE and a SolarEdge Home Battery would result in substantial savings: In 2022, when energy prices soared, users would have experienced an accumulated average annual savings of 560 euros compared to only solar. Even in 2023, when energy prices decreased, the absolute annual savings would have remained significant, amounting to 388 euros compared to only solar. The savings could be even higher in larger or fully electrified homes.

In addition, the Net Metering policy in the Netherlands is anticipated to gradually phase out over the next decade, potentially increasing the annual savings using the SolarEdge Home Battery alongside the SolarEdge ONE Energy Optimization System.



Net metering phase out according to the new proposals

Source: NL National Government Cabinet Plan: Phasing Out the Solar Panel Netting Scheme 2025-2031*

^{*} https://www.rijksoverheid.nl/onderwerpen/energie-thuis/plan-kabinet-afbouw-salderingsregeling-zonnepanelen

Conclusion

The future of energy is already here for Dutch consumers. With the SolarEdge Inverter and Storage solution managed by SolarEdge ONE, Dutch homeowners can protect themselves against rising electricity prices and reduced feed-in energy incentives. They can leverage the advantages of dynamic rate electricity plans without having to invest time each day managing their home energy production and consumption. And they can start enjoying significant energy bill savings, even while net metering is still in effect.

SolarEdge ONE's architecture guarantees customers will receive wireless updates with SolarEdge's upcoming energy management capabilities, including smart EV charging and HVAC optimization.

Integrating a SolarEdge Home Battery and a SolarEdge ONE Energy Optimization System into an existing SolarEdge system is simple and straightforward.

SolarEdge ONE Battery Management for Dynamic Rates is coming soon. Want to learn more about SolarEdge ONE and smart battery management? Click here



SolarEdge Home is a personal home energy ecosystem, designed to adapt to homeowners' changing energy needs, preferences, and lifestyles, day and night. This complete ecosystem combines patented SolarEdge PV technology, including Power Optimizers, the SolarEdge Home Hub and Wave Inverters and SolarEdge Home Battery, plus innovative smart energy devices all controlled from the mySolarEdge app. With SolarEdge Home, homeowners can significantly reduce their electricity bills, lead more sustainable lifestyles, and grow their system as their needs evolve.



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