

# **Cost of integrated photovoltaic and energy storage systems in Finland**





## Overview

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Energy storage is an emerging solution to mitigate the intermittency of solar photovoltaic (PV) power generation and includes several technologies that could also be applied in small-scale residential applications.

Can energy storage systems be integrated with solar PV in detached houses?

In order to evaluate the financial feasibility of integrating energy storage systems with solar PV system in detached houses, economic indicators able to compare the costs of the different storage scenarios with one another are needed.

How big a solar PV system does a detached house need?

The modelled results now instead show how a larger solar PV system up to 13.5 kW would be needed to meet the renewable energy demand of detached houses without energy storage, whereas a 5.1–10.8 kW solar PV would be sufficient with an energy storage system.

Is LIB storage a good alternative to a stand-alone solar PV system?

While the costs of all energy storage systems remain too high to be considered financially attractive without further support mechanisms, LIB storage is clearly the best storage alternative in all scenarios with a LCC 1000–7500 € higher and a LCOE 0.005–0.04 €/kWh higher than the costs of a 13.5 kW stand-alone solar PV system.

What is the optimal capacity of solar energy storage systems?

Hence, the optimal capacity of all the energy storage systems is zero, whereas the feasible solar PV size is limited to below 20 % when using the 2019 electricity prices as comparison.

Which energy storage technology is most financially feasible?

It was also shown that out of the considered energy storage technologies, LIB storage is the most financially feasible storage technology in small-scale applications with a LCOE close to the that of solar PV systems in some



scenarios.

What is the difference between thermal energy storage costs and HP costs?

For the thermal energy storage, the cost estimates are derived from the costs of presently installed thermal energy storage systems in larger applications, whereas the HP costs are an estimate of the total price of installing a GSHP system in a detached house in Finland.



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This paper evaluated the costs of integrating LIB storage, H<sub>2</sub> storage and TES into detached houses with a solar PV system in southern Finland, as energy storage systems

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### The costs of solar power

In addition to the price of solar panels and inverters, the installation environment has a significant impact on the cost of the project. The surroundings and the terrain will determine how the ...

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This thesis focuses on the economic viability of residential energy storage systems (ESS) with integrated photovoltaic (PV) systems in Finland. The thesis evaluates how market conditions, ...

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In terms of the application of electrical energy storage, the most economic potential in Finland lies in renewables integration. Right after it are ancillary services and peak shaving. Grid deferral ...



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However, there are a couple of problems with the energy storage sector in Finland even though a lot of developments have been made. This comprises of the fact that advanced ...

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