

EUROPEAN ENERGY STORAGE SYSTEM COSTS



What does the European Commission say about energy storage? The Commission adopted in March 2023 a list of recommendations to ensure greater deployment of energy storage, accompanied by a staff working document, providing an outlook of the EU's current regulatory, market, and financing framework for storage and identifies barriers, opportunities and best practices for its development and deployment.



Why is energy storage important in the EU? It can also facilitate the electrification of different economic sectors, notably buildings and transport. The main energy storage method in the EU is by far 'pumped hydro' storage, but battery storage projects are rising. A variety of new technologies to store energy are also rapidly developing and becoming increasingly market-competitive.



How much energy storage capacity does the EU need? These studies point to more than 200 GW and 600 GW of energy storage capacity by 2030 and 2050 respectively (from roughly 60 GW in 2022, mainly in the form of pumped hydro storage). The EU needs a strong, sustainable, and resilient industrial value chain for energy-storage technologies.



How much energy storage will Europe have in 2022? Many European energy-storage markets are growing strongly, with 2.8 GW (3.3 GWh) of utility-scale energy storage newly deployed in 2022, giving an estimated total of more than 9 GWh. Looking forward, the International Energy Agency (IEA) expects global installed storage capacity to expand by 56% in the next 5 years to reach over 270 GW by 2026.



How big will energy storage be in the EU in 2026? Looking forward, the International Energy Agency (IEA) expects global installed storage capacity to expand by 56% in the next 5 years to reach over 270 GW by 2026. Different studies have analysed the likely future paths for the deployment of energy storage in the EU.

EUROPEAN ENERGY STORAGE SYSTEM COSTS



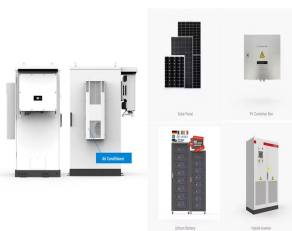
How many GW of energy storage will Europe have in 2050? Different studies have analysed the likely future paths for the deployment of energy storage in the EU. These studies point to more than 200 GW and 600 GW of energy storage capacity by 2030 and 2050 respectively (from roughly 60 GW in 2022, mainly in the form of pumped hydro storage).



(e.g. 70-80% in some cases), the need for long-term energy storage becomes crucial to smooth supply fluctuations over days, weeks or months. Along with high system flexibility, this calls for storage technologies with low energy costs and discharge rates, like pumped hydro systems, or new innovations to store electricity economically over longer



European average Italy Germany % attachment rate 93GW/ 196GWh Cumulative residential energy storage capacity in 2030 78% New home solar systems that Germany 6.2x Cumulative residential energy storage market size in 2030



Battery storage projects at European Energy. This will potentially mean lower energy costs as we reduce the need for fossil fuel based peaking plants. The types of batteries used in our energy storage systems are thermally and chemically stable and are not rated as a health risk. In addition, they are made from materials such as iron



The European energy system is increasing its renewable share, primarily that of wind and solar photovoltaic energy. FIG. S17: Cost-optimal Europe-aggregate storage energy capacity of storage-X

EUROPEAN ENERGY STORAGE SYSTEM COSTS



Energy Storage Grand Challenge Cost and Performance Assessment
2022 August 2022 iii Foreword to 2022 Report The Department of Energy's (DOE) Energy Storage Grand challenge (ESG) is a comprehensive program



Rising energy prices, particularly in the second half of 2021 and during 2022, resulted in higher than usual energy expenditures for all European households. Energy price increases in 2022 disproportionately affected the most vulnerable, low-income households, who spent an estimated 12% of their total budget on energy in 2022, up from 7.8% in



This is the third year in a row in which the annual energy storage market in Europe has doubled. Also see: Battery costs fallen by more than 90%. According to the "European Market Outlook for Battery Storage 2024-2028" by SolarPower Europe, battery storage systems with a capacity of 35.8 GWh were installed in the EU at the end of 2023.



as a priority in energy systems, partly because the of the aspects touching on energy storage. The European Parliament published a report in 2020 on a wide-ranging European approach to energy storage (2019/2189(INI)), in which highlights the needs for on energy storage. It states that "a cost-efficient



The electricity Footnote 1 and transport sectors are the key users of battery energy storage systems. In both sectors, demand for battery energy storage systems surges in all three scenarios of the IEA WEO 2022. In the electricity sector, batteries play an increasingly important role as behind-the-meter and utility-scale energy storage systems that are easy to ???

EUROPEAN ENERGY STORAGE SYSTEM COSTS



According to data from the European Energy Storage Association (EASE), Europe will achieve 4.5GW of energy storage installed capacity in 2022, a year-on-year increase of 80.9%, of which large storage and commercial and industrial energy storage will be approximately 2GW, and household storage will be approximately 2.5GW.



The technology for storing thermal energy as sensible heat, latent heat, or thermochemical energy has greatly evolved in recent years, and it is expected to grow up to about 10.1 billion US dollars by 2027. A thermal energy storage (TES) system can significantly improve industrial energy efficiency and eliminate the need for additional energy supply in commercial ???



According to recently published research "Cost projections for utility-scale battery storage: 2021 Update" by NREL (National Renewable Energy Laboratory) [61], the estimated cost of energy components in 2020 is around 280 \$/kWh (238 ???/kWh), and the estimated cost for power components is 250 \$/kWh (212.5 ???/kWh).



Energy storage can stabilise fluctuations in demand and supply by allowing excess electricity to be saved in large quantities. With the energy system relying increasingly on renewables, more and more energy use is electric. Energy storage therefore has a key role to play in the transition towards a carbon-neutral economy. Hydrogen



The figure shows that the renewable electricity generation potential included in the cost minimization of the European energy supply system is about 14,000 TWh. The potential of about 6000 TWh has a levelized cost of electricity (LCOE) of 35 ???/MWh; the potential of 8000 TWh is available at an LCOE of about 50 ???/MWh.

EUROPEAN ENERGY STORAGE SYSTEM COSTS



The system cost for a highly decarbonised European power system was found to be robust to different weather years 60, but more analysis is needed on the impact of inter-annual weather variability



The CO₂ management is developed to account for transportation and storage costs (??? 20 a picture of a future European energy system that is self-sufficient in domestic green hydrogen



According to the recent European Battery Markets Attractiveness Report published by Aurora Energy Research, the UK, Italy and I-SEM (the wholesale electricity market for the island of Ireland) were the three European markets with the heaviest investments in FOM battery storage systems in 2023. These leading regions benefit from strong political



Energy storage, international trading and demand-side flexibility, electric mobility as well as hydrogen production provide the necessary flexibility in this electricity system of the future. Hence, the district heating generation mix has only a minimal impact on the overall European energy system costs. District heating generation reaches

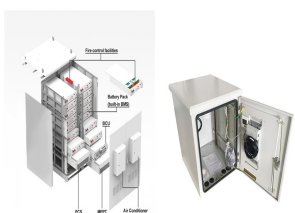


Even when assuming comparatively low aboveground storage cost, it will not exceed 1.7% (1.9 TWh H₂,LHV) of total hydrogen storage capacities in a cost-optimal European energy system. Regarding the amounts of annually stored hydrogen, aboveground storage could play a larger role, reaching a maximum share of 32.5% (168 TWh H₂,LHV a -1) of total

EUROPEAN ENERGY STORAGE SYSTEM COSTS



Financing and transaction costs - at current interest rates, these can be around 20% of total project costs. 1) Total battery energy storage project costs average \$580k/MW. 68% of battery project costs range between \$400k/MW and \$700k/MW. When exclusively considering two-hour sites the median of battery project costs are \$650k/MW.



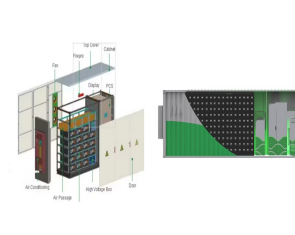
NOTICE This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. -AC36-08GO28308.



Overall, total energy storage in Europe is expected to increase to about 375 gigawatts by 2050, from 15 gigawatts last year, according to BloombergNEF. We spoke with Grebien about ???



In IRENAs REmap analysis of a pathway to double the share of renewable energy in the global energy system by 2030, electricity storage will grow as EVs decarbonise the transport sector, ???



This subsegment will mostly use energy storage systems to help with peak shaving, integration with on-site renewables, self-consumption optimization, backup applications, and the provision of grid services. We believe BESS has the potential to reduce energy costs in these areas by up to 80 percent.

EUROPEAN ENERGY STORAGE SYSTEM COSTS

114KWh ESS



TSI BMS CE MSD UN38.3

"TEN-E Regulation") [1]. The energy storage CBA methodology has been developed to ensure a harmonised energy system-wide cost-benefit analysis at Union level and that it is compatible in terms of benefits and costs with the methodology developed by the ENTSO for Electricity and the ENTSO for Gas pursuant to Article 11(1) of TEN-E Regulation



This will ensure a self-sufficient European energy economy by maximising utilisation of local. renewables, reducing reliance on external fossil fuel imports, in turn alleviating the high electricity prices seen today. REPowerEU. it is estimated at least 600 GW of energy storage will be needed in the energy system.