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Technology and Costs

TECH 2018S12: Thermal Energy Storage

Thermal Energy Storage is one in a series of reports published as part of Nexant's 2018 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

TES typically does not involve any chemical conversion, and therefore it is much simpler, with high efficiency, along with better economic life cycle. Moreover, TES is best suited for heat production and utilization when the main sources consist of process heat, waste heat, steam, and solar heat. Cool storage has a different set of contingencies, such as balancing refrigeration system production and demand or utilizing natural diurnally, weekly, or seasonally varying heat sources and sinks. A key influencing factor for TES is ensuring energy storage of the cooling or heating is achieved in a technically, economically, and financially viable manner. As part of any specific TES technology in an end-use application, it is paramount to utilize the most suitable materials for design and construction as well as proper process integration of TES. This has a direct impact on both the economics and efficiency of the overall energy system. This TECH report provides an overview of the various developing and commercial TES technologies in the United States and addresses the following key questions:

- What are the different types of energy storage, how is TES different, and why is TES important?
- What is the roadmap for determining potential TES opportunities in energy production plants and process industrial facilities?
- What are the specific TES technologies, end-use applications, and their current status?
- How to assess the current market for TES, and what are the applicable trends and outlook?
- What are the main factors that impact costs and techno-economics for developing TES projects?

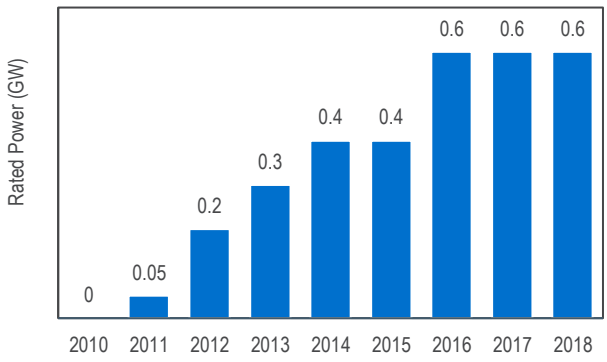
Commercial Technologies

Key metrics and parameters are reviewed based on case studies of commercially mature TES technologies for end-use applications in operational projects (i.e., chilled water, heat storage, ice storage, and molten salts). This includes an overview of TES technology types, their rated energy or power output, project status, siting and location, ownership, value chain partners, cost, performance, benefits, and any other relevant information.

Process Economics

The current approaches utilized in evaluating the costs and techno-economics of energy storage technologies follow the general principles of the energy and power sector. This TECH report provides the methodology for structuring the levelized cost of storage (LCOS). Presently, there are challenges and limitations in the review, evaluation, and assessment of the costs and techno-economics of TES technologies based on key influencing factors, and subject to their respective technology readiness levels (TRLs). Present CAPEX estimates for TES can range from below 0.45 $/kWh for very large inter-seasonal applications to above 600 $/kWh for very small PCM storage for intraday storage.

U.S. TES Growth



Commercial Overview

To date, TES growth is approximately at the same rate as electro-chemical storage (batteries). The operational TES capacity in the United States in 2018 was nearly 0.63 GW, consisting of 112 projects. Over the last decade, there has been steady growth in TES, in part due to larger project capacity and sizes. Future growth should increase, since the fast rate of build-out means that TES projects will be constructed that have not yet been announced. Key market barriers, key gaps, and regulatory risks need to be overcome for increased market deployment and penetration. The future outlook for TES and energy storage markets is good.

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The TECH program (formerly known as PERP) is globally recognized as the industry standard source of process evaluations of existing, new and emerging of interest to the energy and chemical industries.

TECH's comprehensive studies include detailed technology analyses, process economics, as well as commercial overviews and industry trends. Reports typically cover:

- Trends in chemical technology
- Strategic/business overviews
- Process Technology:
- Chemistry
- Process flow diagrams and descriptions of established/conventional, new and emerging processes
- Process economics – comparative costs of production estimates for different technologies across various geographic regions
- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
- Regulatory and environmental issues where relevant

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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program (formerly known as PERP), the Biorenewable Insights program (BI), the Sector Technology Analysis, and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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