Ansys

CASE STUDY /

Ansys + Wärtsilä

Complex Battery System Storage Modeling with Ansys Twin Builder and Ansys Fluent

"Wärtsilä uses Ansys software for complex battery storage system modeling to accurately test and make predictions about the life expectancy of our energy storage systems. With the help of Ansys simulation software, we were able to layer and build an accurate representation of our system that we can use to understand thermal management performance. Simulation also saved the team six months of development time and reduced the number of physical prototypes by three."

Dewei Guan
Product Development Engineer / Energy Storage & Optimization / Wärtsilä

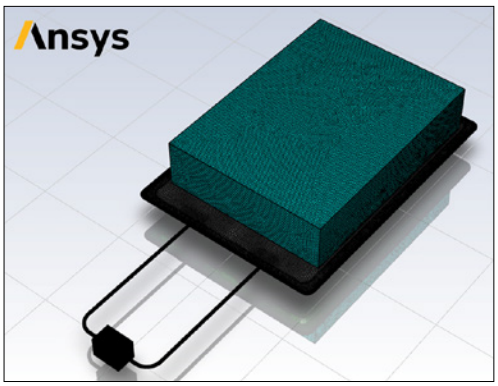
We're designing a fully integrated energy storage system for ease of deployment and sustainable energy optimization for use across solar, wind farm, and power plant applications. Every system component is pre-assembled before it is shipped to the customer site, so it is ready for immediate implementation. Ansys solutions enable us to simulate and build a fully optimized, low-maintenance, shelf-ready product with a 20-year design life that delivers high energy efficiency.

CHALLENGES

Designing an entirely new energy storage system requires building a complex system model that can simulate and capture the thermoelectric and electrochemical behavior of the battery and the complicated transient heat transfer between multiple system components. The model must be able to accurately predict battery module temperature change in transient analysis (the calculation of a circuit's response over a defined time period). Successful simulation depends on seamless data exchange between the system model and a unique software environment.

TECHNOLOGY USED

- Ansys Twin Builder
- Ansys Fluent



ENGINEERING SOLUTION

- Input battery dynamic performance data to calculate and build a 6-parameter battery cell model based on the electric circuit model (ECM)
- Built a chiller model to calculate power consumption and cooling capacity based on battery and coolant temperature
- Generated and validated a reduced order model (ROM) from a fully converged computational fluid dynamics (CFD) model of the cold plate to solve conflicts between accuracy and computational speed
- Combined the ECM and ROM models into a battery module to understand state of charge (SOC) as a function of power, coolant, and ambient temperatures to control battery charge and discharge rates
- Combined model components, resulting in an accurate battery storage system model for testing and validation

BENEFITS

Simulation enables the team to deliver an accurate, reliable model of the storage system that can be used for testing and validation of overall system performance over the life of the battery. With Ansys solutions, we can easily predict what is going to happen over the next five years. The simulation software provides intuitive, user-friendly tools that address system development and validation from every perspective. We use this comprehensive set of solvers at every stage during validation, whether working at the system level or capturing a specific electrical response. Twin Builder's ROM technology also enables us to reduce simulation time from one day to 10 minutes with a high-fidelity representation of the CFD model, resulting in faster product development.

COMPANY DESCRIPTION

Wärtsilä is a global leader in innovative technologies and life cycle solutions for the energy and marine markets. Wärtsilä Energy leads the transition towards a 100% renewable energy future. We help our customers in decarbonization by developing market-leading technologies. These cover future fuel-enabled balancing power plants, hybrid solutions, energy storage, and optimization technology, including the GEMS Digital Energy Platform. Wärtsilä life cycle services are designed to increase efficiency, promote reliability, and guarantee operational performance. Our track record comprises 76 GW of power plant capacity and more than 110 energy storage systems delivered to 180 countries around the world.

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