

Press release

Munich, May 30, 2022

From a bird's-eye view: multi-sensor system and artificial intelligence ensure secure power supply

- Inspection of approximately 4,000 km of high-voltage power lines
- Artificial intelligence for automated condition detection
- CO₂ emissions decreased by reducing helicopter flights
- Digital twin for accelerating digital grid expansion planning

The German grid operators Schleswig Holstein Netz AG and Bayernwerk Netz GmbH have commissioned Siemens Energy to inspect almost 4,000 kilometers of high-voltage overhead lines. The inspection will be conducted by a helicopter equipped with a high-tech multi-sensor system using the "SIEAERO" service concept. Developed by Siemens Energy, the system collects all the necessary data during the flight, which can later be evaluated with the help of artificial intelligence and analyzed by other software tools. In the near future, this kind of holistic inspection of overhead power lines can also be performed with large drones.

A single helicopter flight feeds artificial intelligence

For the inspection, Siemens Energy attaches SIEAERO's multi-sensor system to the underside of a helicopter. Equipped with 19 cameras and state-of-the-art 3D laser scanning sensors, it captures all relevant inspection data in a single flight over the pipeline, resulting in up to 12,000 images and detailed 3D data per kilometer of pipeline. The SIEAERO's software, which uses artificial intelligence, can evaluate the images in just a few hours, whereas a human would need a few days. The artificial intelligence was previously trained with over two million images of European and North American grids to automatically detect faults in the images. This allows potential risks like trees growing too close to the line to be detected earlier. During the flights, the surface temperature of the individual components is also measured, among other things. The digital data obtained provides a precise and detailed overview of the condition of the operating equipment, and it can be combined with existing data from the grid for other evaluations.

"The use of artificial intelligence is an important advance in the inspection of power lines. The high data quality makes us more precise and more cost-efficient, and it also allows us to conduct the inspection more safely. What's more, with conventional measurement and inspection techniques, the lines would have to be flown over several times to get the same results. Each flight saved over the distance of 4,000 kilometers saves 74 tons of CO₂ emissions. This is another way that we're making an important contribution to the environment, while supporting our customers to maximize the reliability of the transmission grids," says Milena Ramos Subires, Vice President Transmission Service at Siemens Energy.

From data mountain to digital twin

Every kilometer of line flown generates 300 gigabytes of data. The SIEAERO system uses this data to create a digital twin, a highly accurate image of the network infrastructure being inspected, including poles, lines, terrain, and vegetation. With the digital twin, network operators can simulate extreme events like a tree falling on a line and causing it to fail and take the appropriate preventive measures. To guarantee a continuous power supply during the energy transition, the power grids need to be expanded. With comprehensive 3D models of the grid, the necessary expansion and modification measures can be planned and implemented more quickly.

Drone instead of helicopter?

In the future, drones could once again significantly simplify and improve the inspection of power lines. Siemens Energy has already successfully performed several test flights with a drone equipped with the SIEAERO system. Using a drone has a number of advantages: It's more environmentally friendly and quieter than a helicopter, and critical locations could be approached in a more targeted manner. Currently, however, most countries still prohibit the use of unmanned aerial vehicles beyond the visual range. As soon as the legal situation permits in these countries, Siemens Energy will also offer SIEAERO as a drone service.

Further information on the transmission network:

Roughly 1.8 million kilometers of power lines run like veins through the German energy infrastructure, ensuring that electricity reaches every socket. The high-voltage lines in the transmission grid are especially important: They ensure that large amounts of electricity can first be transported quickly over long distances to conurbations, and then the electricity can be distributed to consumers via the lower-voltage networks. Regular checks by grid operators of the high-voltage lines – which in Germany extend over some 37,000 kilometers – are essential to ensuring an uninterrupted supply of electricity. At the same time, the growing share of renewable energies is

putting a strain on the grid: A total of more than 7,500 kilometers in the German transmission grid will need to be optimized, reinforced, or newly built in the next few years.

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