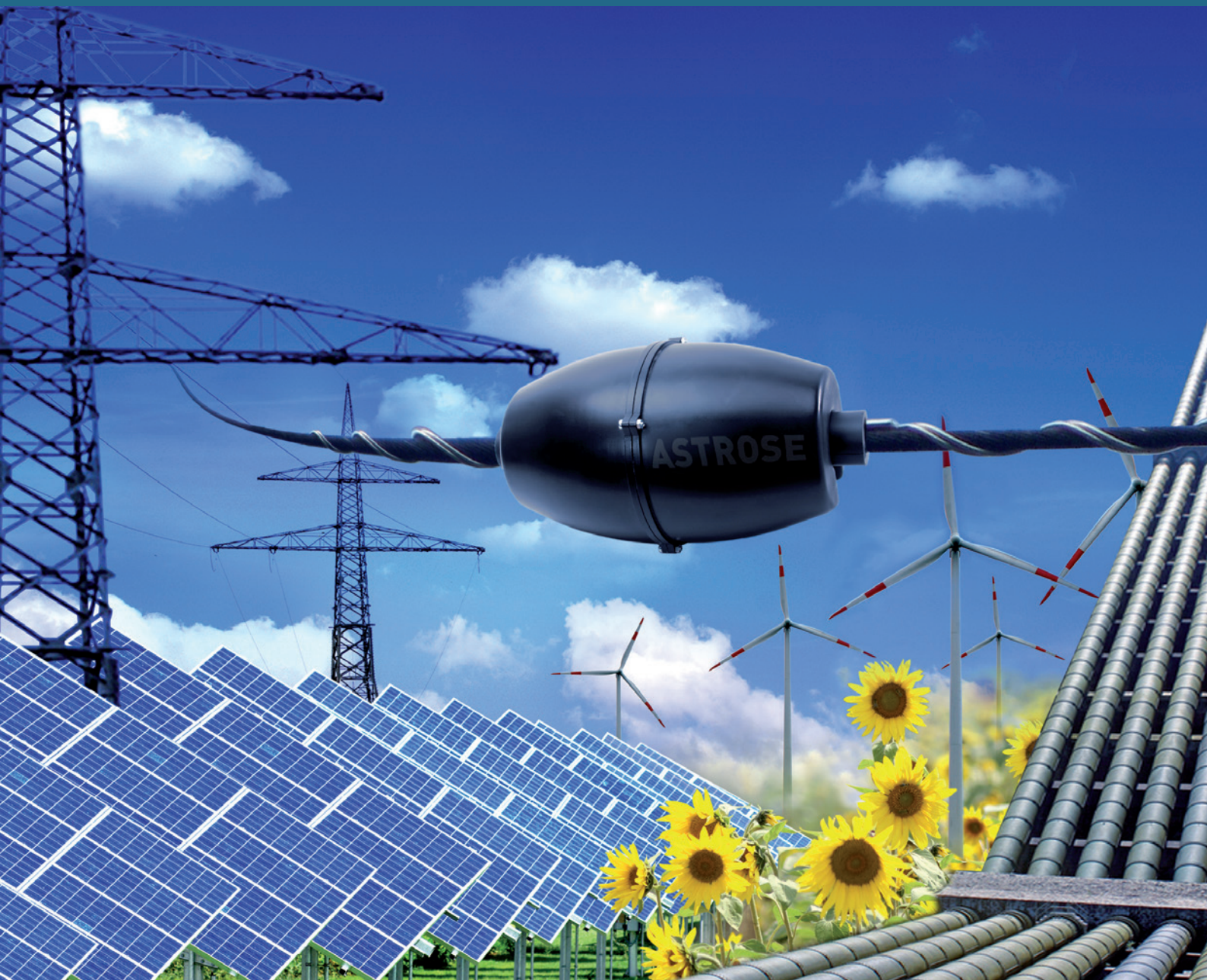
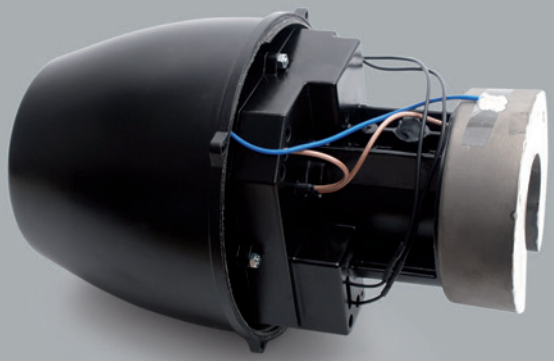
Fraunhofer

ASTROSE® – MONITORING FOR HIGH AND VERY HIGH VOLTAGE OVERHEAD LINES





Facing the Challenges of the Future

A safe and reliable supply of power is the great challenge for all actors in the energy industry, creating many major and novel problems. One important aspect of ensuring reliable energy supplies is providing power when it is needed and where it is needed. The burden of mastering this challenge lies mostly on the operators of power grids.

Sensor-based monitoring of power grids is an important means for maintaining and increasing the capacity of existing and new grids. Grid operators use many different ways to monitor their grids and ramp up their capacities at short notice. Local and decentralized data on the state of their grids is a great advantage in the optimization of their operations. The effect of wind, light and shade, frost, snow, and ice can be monitored at high frequency to optimize the utilization of grid capacity.

Monitoring Overhead Lines with ASTROSE®

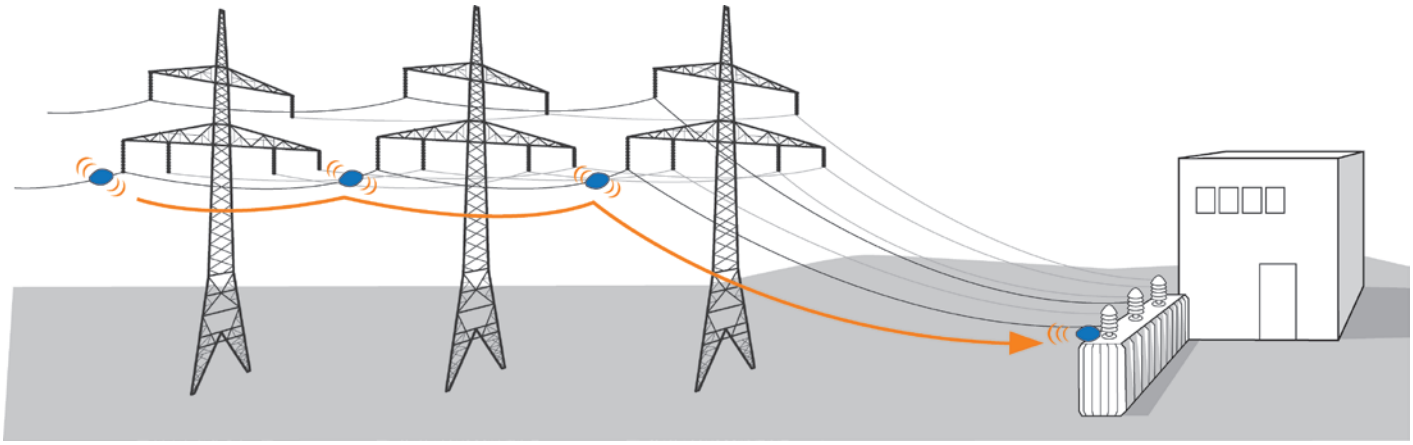
ASTROSE® offers a comprehensive technology for remote monitoring with the decentralized tracking of important indicators:

- Line temperature
- Line tilt
- Current (including short circuit and voltage detection)

The modular design of the ASTROSE system is flexible enough to accommodate other indicators.

ASTROSE® uses autonomous ASTROSE sensor nodes to track these indicators immediate on the line. The radio sensor nodes are located at intervals of up to 500 m, typically immediately next to a pylon. The data is forwarded wirelessly from node to node until it reaches a dedicated feed point, where it enters the operator's control systems. ASTROSE® is based on the system of autonomous sensor nodes. They draw the power they need directly from the line, relying on the static energy of the high-voltage current. An integrated no-maintenance power buffer allows the nodes to cope with brief outages or drops in the current of up to 20 minutes without the network having to relaunch itself again. When the required power is fed through the line, the sensor nodes automatically start operating and establish their wireless connections with the control systems. A base station uses a serial interface or LWL technology to transmit the data it receives to the operator's IT.

The sensor data is processed and analysed by the grid operators. ASTROSE® is desig

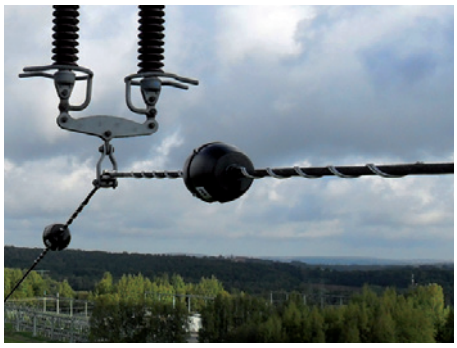


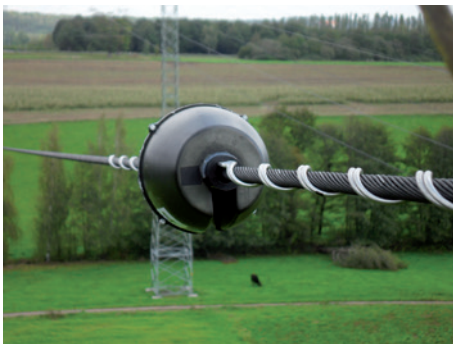
gned to continue operating reliably in the often harsh operating conditions and environments of power lines, coping with high voltage, dirt, damp, or low and high temperatures.

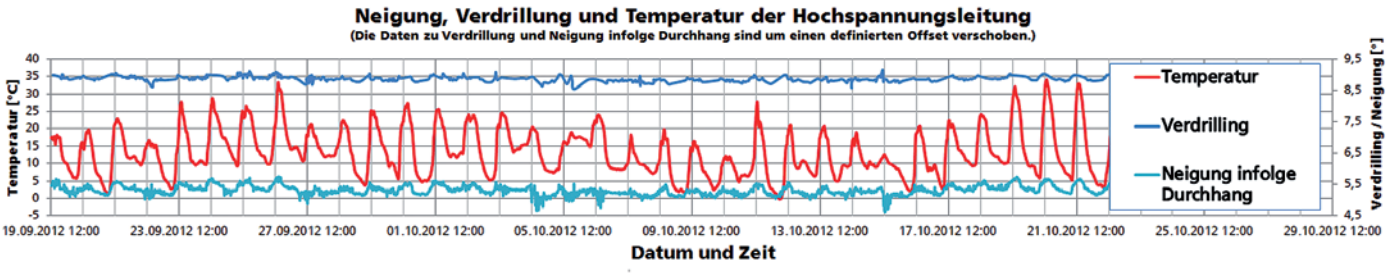
The ASTROSE project consortium developed the sensor network and its communication interfaces during the eponymous, BMBF-funded project. First field trials of the autonomous sensor network was completed in 2012 at the project partner MITNETZ STROM.

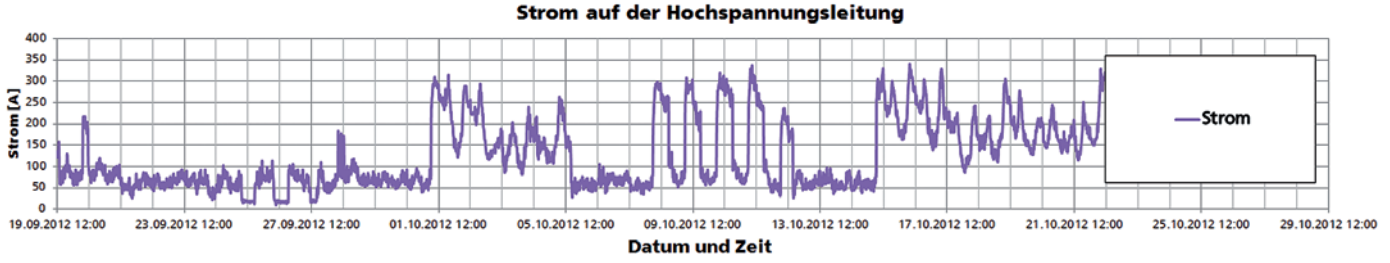
Properties and features of the autonomous sensor network ASTROSE®

- Designed for 110 kV, 220 kV, and 380 kV lines (AC transmission)
- Data recorded every 15 minutes (configurations adjustable by software)
- Geographic placement of all ASTROSE nodes identifiable with unique node IDs
- Self-sufficient power supply
- Automatic recognition of the operating state, e.g. line activation
- Automatic relaunch of the sensor network after longer power outages
- Redundant communication systems
- Free wireless communication using the 2.4GHz ISM band







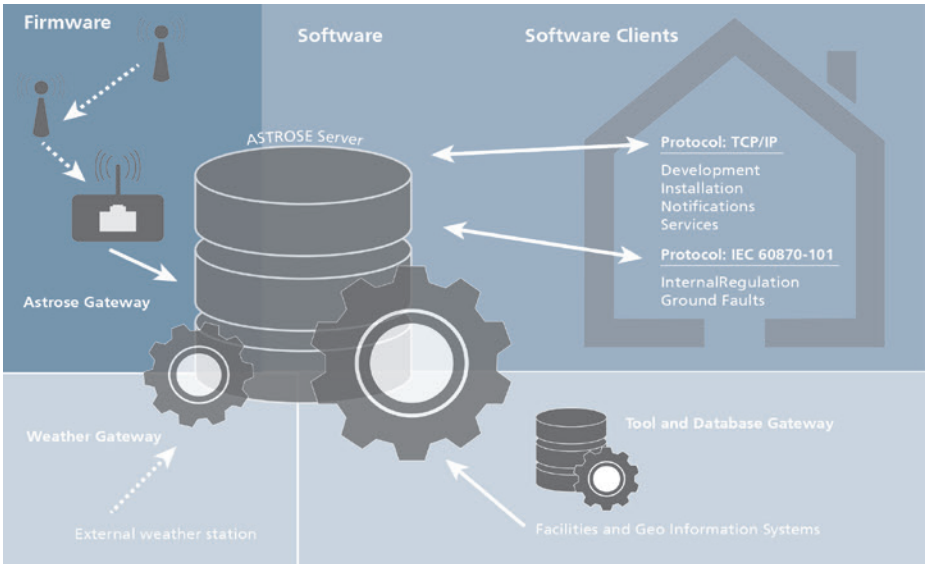


Line Monitoring and Data Transfer

The chain of sensor to sensor communication ends in a base station e.g. at a substation. The received sensor data is stored on the ASTROSE server and made available for analysis. A mobile base station is available for installing the sensor chain in the field and for controlling and measuring activities in the working network.
The ASTROSE server transmits the analysed to the end user via a dedicated software client, using a networking protocol selected by the user. A client for line tilt and line temperature analysis is currently employed, using the IEC protocol 60870-101, while a sensor functional analysis client uses the TCP/ IP protocol.

Pilot and Evaluation

The ASTROSE system has been trialled in cooperation with MITNETZ STROM GmbH since October 2014.



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ASTROSE

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Astrose-Pilot

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Note: All data given within this paper are temporary and can be changed. Furthermore the described system is not a product.