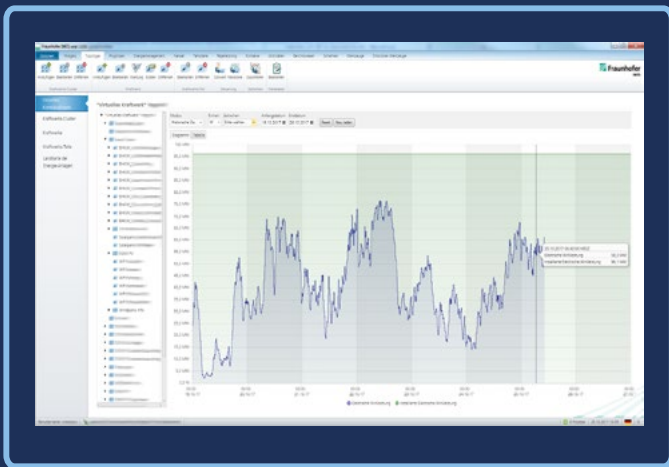


BUSINESS FIELD

VIRTUAL POWER PLANT





AN ESSENTIAL TOOL FOR REALIZING INNOVATIVE BUSINESS MODELS

CHALLENGES OF DIGITALIZATION

The process of digitalizing the energy transition presents great challenges as well as major opportunities for companies in the energy industry. The handling of large amounts of data is thus increasingly drawing the industry's attention and there is a need for high performance solutions that efficiently and cost-effectively collect power unit data. This data has to be processed and interpreted for commercial applications.

Taking care of various SCADA-systems' protocols for different manufactures is one essential part of the changeover. In addition to this capability, scalability and knowledge of underlying processes of the energy industry is required.

With digitalization in place, the following questions are coming more into focus:

- How can new markets be developed or new business models be implemented with cutting-edge IT on short notice, in order to be one of the first in the market?
- How can the business models of large-scale power plants be applied to the more numerous plants of distributed energy resources?
- What is the significance of the smart meter rollout for creating energy portfolios?

THE VIRTUAL COMBINED POWER PLANT IEE.VPP

The Virtual Combined Power Plant IEE.vpp is a modular real-time system that allows renewable energy resources to be supervised, controlled, aggregated and optimized according to different strategies.

IEE.vpp is based on state-of-the-art information technology and is well-suited integrating large numbers of distributed energy resources. The modern system architecture highlights the implementation of specific customer requirements and the solutions to practical questions. The modularity and flexibility of IEE.vpp has proven itself in practice and achieved full customer satisfaction in the energy industry.

The IEE.vpp's development relies on the long-term expert knowledge of the Fraunhofer IEE with regard to renewable energies and virtual power plants. The system has been further developed and applied in numerous research projects to solve issues of the energy economy:

- Combined Power Plant («Kombikraftwerk»)
- RegModHarz
- Combined Power Plant 2
- Control energy through wind turbines («Regelleistung durch Windkraftanlagen»)
- Regio:VK
- Balancing energy from wind and photovoltaic farms («Regelleistung durch Wind- und PV-Parks»)



MONITORING AND CONTROL OF DISTRIBUTED ENERGY RESOURCES

SUPPORT OF THE FOLLOWING USE CASES

- Remote control and remote parameter-reading according to the German EEG §20
- Provision of control reserve with distributed energy resources
- Provision of control reserve with wind turbines
- Optimization of schedules

MONITORING OF DISTRIBUTED ENERGY RESOURCES

IEE.vpp allows swift configuration and integration of power installations into a portfolio:

- Monitoring of single units as well as entire parks
- Data request and storage with a resolution of up to 1 second
- Active supervision of communication links

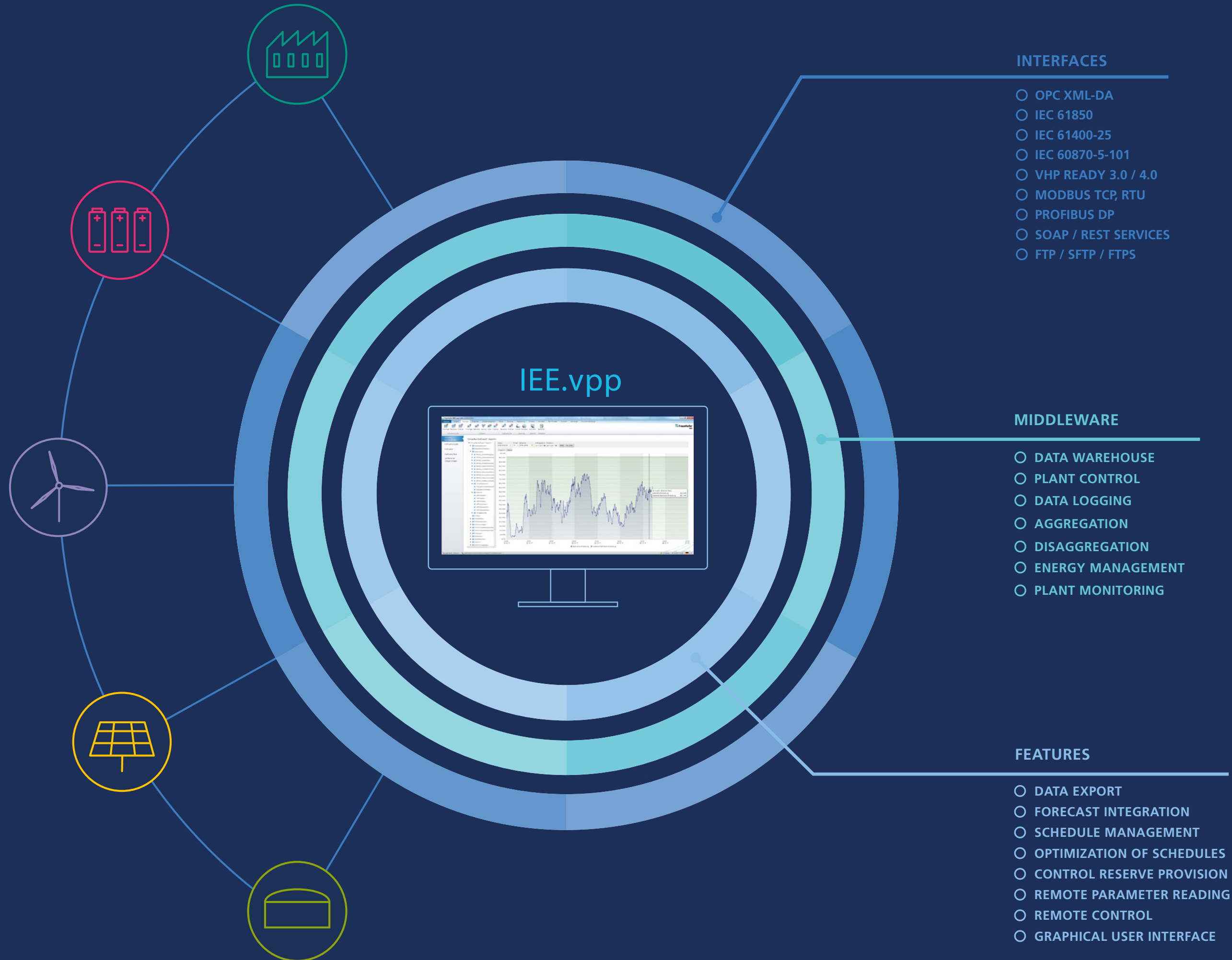
CONTROL OF DISTRIBUTED ENERGY RESOURCES

To control power units or pools IEE.vpp provides:

- Set-point-setting for single power installations
- Scheduling for individual plants
- Schedule management, e.g. conversion of schedules into set-point parameters for each unit
- Control criteria in dependence of the portfolio's operating point
- Calculation of portfolios' schedules according to the selected energy management strategy

SUPPORTED MANUFACTURERS

- ENERCON
- Nordex
- Senvion
- Vestas
- Siemens
- Skytron
- Janitza
- Gantner
- Solar Log
- SMA
- Fraunhofer IWES Box
- OGEMA



INTEGRATION IN CLIENT INFRASTRUCTURE

PROCESSING DATA FOR YOUR BUSINESS MODEL

- Export of historical data with different resolutions of up to 1 second
- Data aggregation of fully configurable portfolios
- Range of different interpolation strategies

INTEGRATION INTO YOUR INFRASTRUCTURE

- Interface to access current and historical data
- Open REST-web service interface
- OPC XML DA based interface for providing data to business partners like grid operators
- Customer-specific programming of interfaces for existing infrastructure
- Client-bibliography to prepare data analysis based on plants' data information
- Provision of an ergonomic user interface or connection of in-house user interface solutions

INTEGRATION OF FORECASTS AND MAINTENANCE

- Integration of various forecast providers
- Predictions from our Institute
- Other providers of price and energy forecasts
- Automatized request of maintenance intervals

ENERGY MANAGEMENT

- Spot market, intraday and control reserve optimization
- Consideration of grid restrictions
- Loads and generators
- Cross-sectoral restrictions

ADDITIONAL FUNCTIONALITIES

- Export of all time series in CSV-format
- User role concept with different permissions
- Connection to a redundant data repository

We support your project with our research know-how



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The Fraunhofer Institute for Energy Economics and Energy System Technology IEE in Kassel researches for the national and international transformation of energy systems.

The Institute emerged from the Energy System Technology branch of Fraunhofer IWES in 2018 and was founded as Institut für Solare Energieversorgungstechnik ISET in Kassel in 1988.

OUR OFFER FOR YOUR RENEWABLE ENERGY RESOURCES

- Provision of the software for an on-site installation based on a license agreement
- Hosting of the IEE.vpp software at our premises and deployment as SaaS
- Support of the development of a virtual power plant including the up-link of your power installations
- Support the integration of your software and operating landscape
- Adaptation of system configurations alongside of your requirements
- Guidance through the entire project's lifetime beginning at the first idea until the final step of operational implementation

SELECTED REFERENCE PROJECTS

- Renewable energy virtual power plant of ARGE Netz GmbH & CO KG
- Regio:VK
- SEMIAH
- Combined Power Plant («Kombikraftwerk«)
- Regelleistung durch Wind («Regelleistung durch Windkraftanlagen«)
- Regelleistung Wind und PV («Regelleistung durch Wind- und PV-Parks «)