



SMART ENERGY

Intelligent solutions for decentralized energy systems



ENERGY IS NOT SMART, SAY THE PHYSICISTS. SURE.

But when households and companies are supplied with heat, electricity, gas and water at the same optimal level, when you as the operator have centralized control over decentralized systems, when virtual power plants become a reality, when you get a handle on the energy transition – that’s already pretty smart, right?



We have the concepts, systems and experience for it. And the competence and capacity to always be there for you – during planning, all engineering phases, implementation and commissioning and at any time during normal operation.

The result is digitalized energy systems that intelligently optimize existing structures, save energy, reduce costs and lower CO₂ emissions.

**SMART ENERGY. IT EXISTS.
IF WE WANT IT TO.**

A photograph of industrial machinery, possibly a gas engine or turbine, with a strong red glow emanating from the center, creating a dramatic, high-contrast scene. The machinery is complex, with various pipes, valves, and structural elements visible.

DECENTRALIZED ENERGY SYSTEMS AS A CORE COMPETENCE

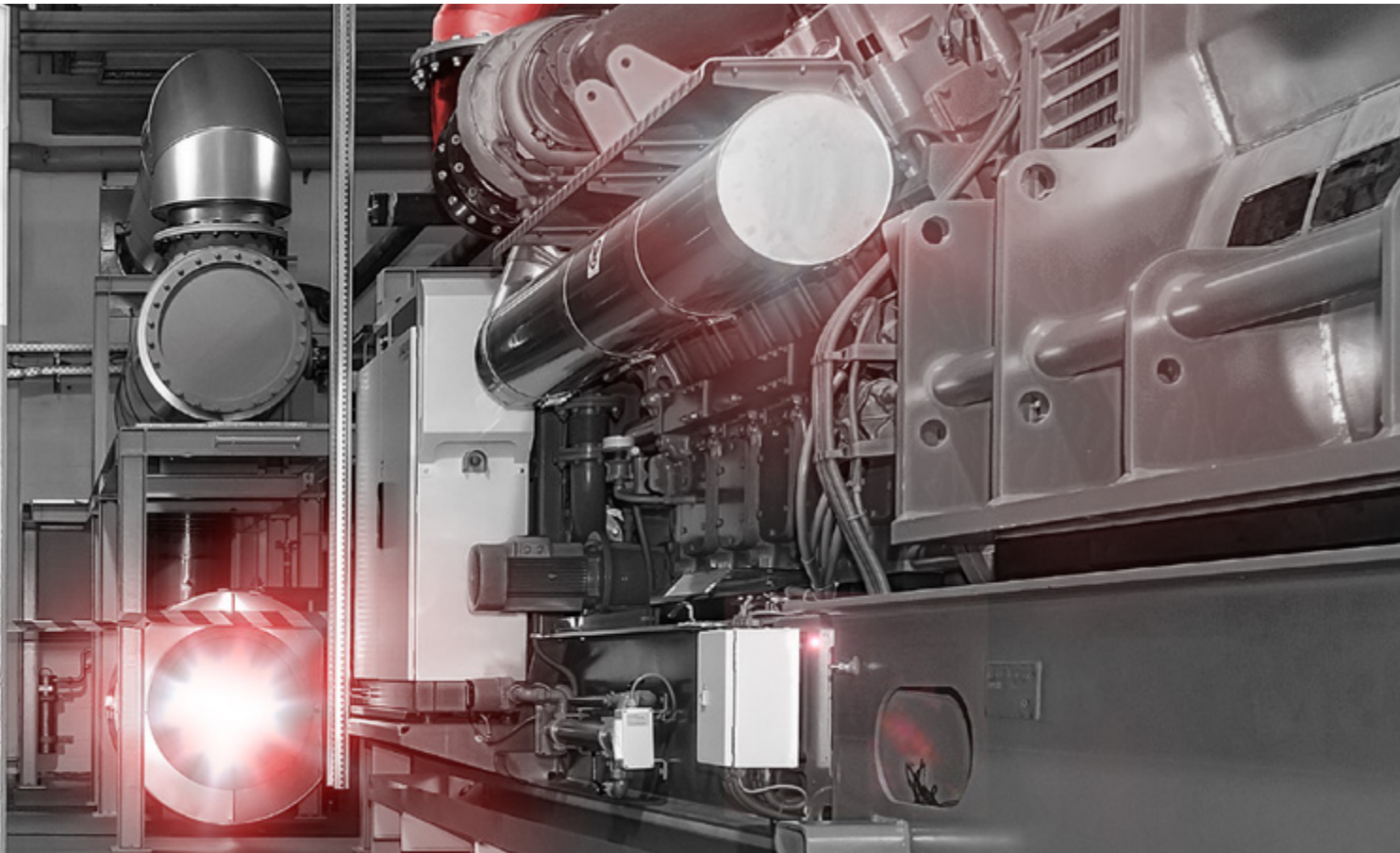
AVAT in a few words? Let's try: We develop, produce and maintain digital control systems for CHP gas motors. We are also one of the leading solution providers for cross-sector energy supply, including generation, storage and distribution. As a pioneer in combined heat and power, we developed an extensive modular system based on MSR technology in addition to solutions for the control level, holistic energy management and smart energy networks.

Our customers comprise municipalities, municipal and regional utilities, real estate and plant manufacturers, including industrial and commercial parties as well as operators of hospitals and swimming baths.

From the time Frank Ganssloser founded AVAT as a startup in 1993 until now, incredible things have been done at the intersection of the energy economy and digitalization. And we have been an active part of this with our ideas and solutions ever since. Our team grew to over 100 employees and we just recently opened a company headquarter in Asia.

Despite all the changes over the past 25 years, we espouse the same core values: Our founder is still the sole owner, which gives us maximum independence. The share of engineers in our workforce is also constant: 75%. And that also underpins our self-image:

AVAT. THE ENERGY ENGINEERING COMPANY.



CONSULTING AND PLANNING

Efficiency up, emissions down: This succinct requirement applies in all our projects. But that's where the similarities usually end. And that's a good thing. Because one of our strengths is the ability to put ourselves in your shoes. Regardless of whether you want to modernize existing plants or are in charge of planning a new one.

And regardless of whether or not you task us with technical implementation, we always have two things in mind for each project: It has to work. And it has to be profitable for you. This guides us in the allocation of inventory and definition of objectives, in project evaluations and feasibility studies – and even more so in our technical recommendations, including subsequent project planning and management.

ENERGY AND ENGINEERING

Our software solutions are full of ideas and smart ways to succeed. We focus on utility and innovation and strive to remain independent. That is why we develop our solutions on vendor-neutral programming systems.

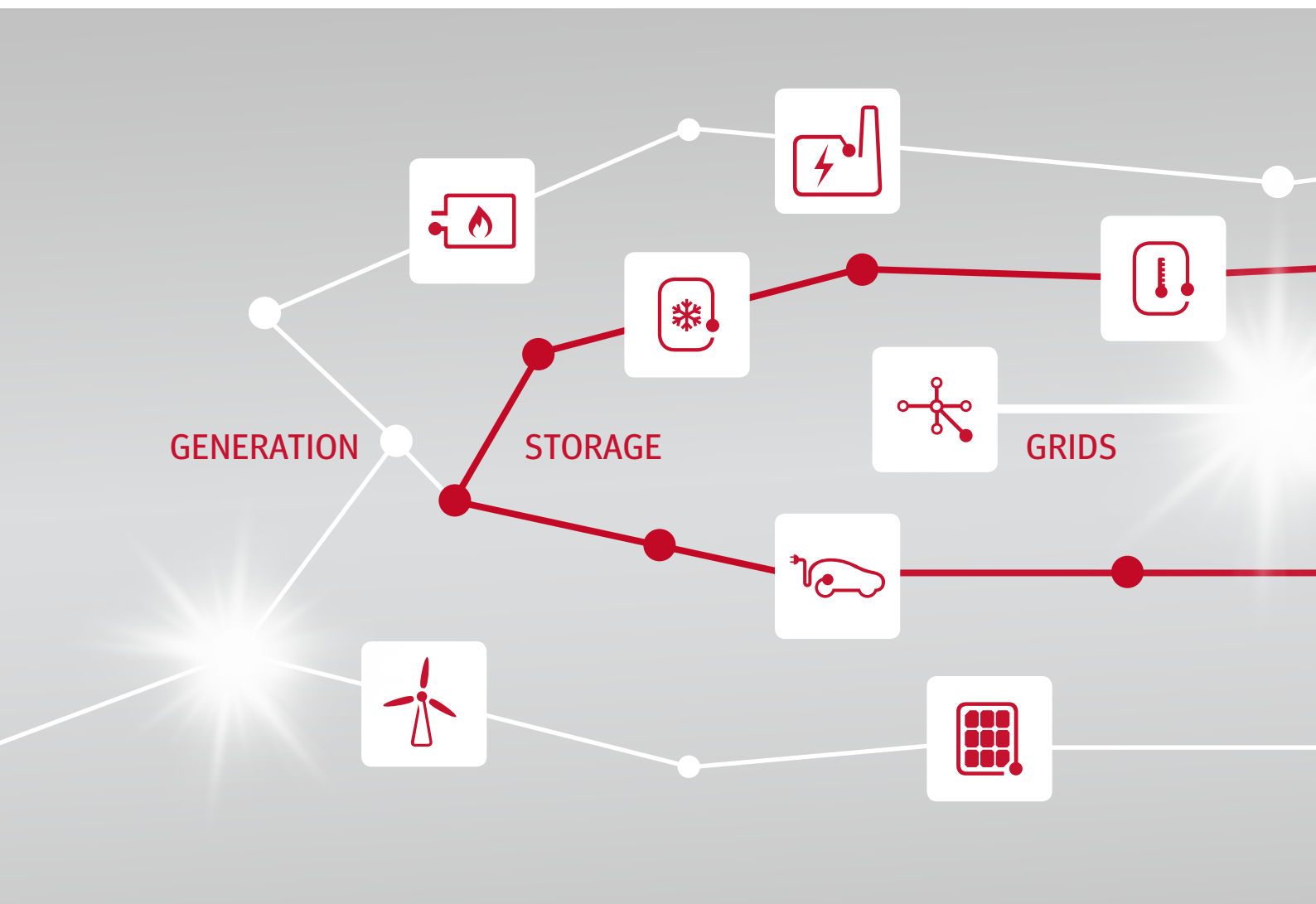
Together with our intelligent and automatic control technology, a powerhouse for maximum operational safety is created. You can add modules and scale up the system at any time.

IMPLEMENTATION AND COMMISSIONING

The concept is defined, the software is written – what now? If things get tight, we will of course be at your side. We build and assemble switchboard of the highest quality. In the end your system will be commissioned by the same project engineers who were involved in the project from the very beginning.

SERVICE AND SUPPORT

Hot air in the hotline? No worries, an engineer or technician will answer the phone and either answer your questions or make their way to your location. We will gladly offer you professional competence and energetic commitment in the form of a maintenance agreement.

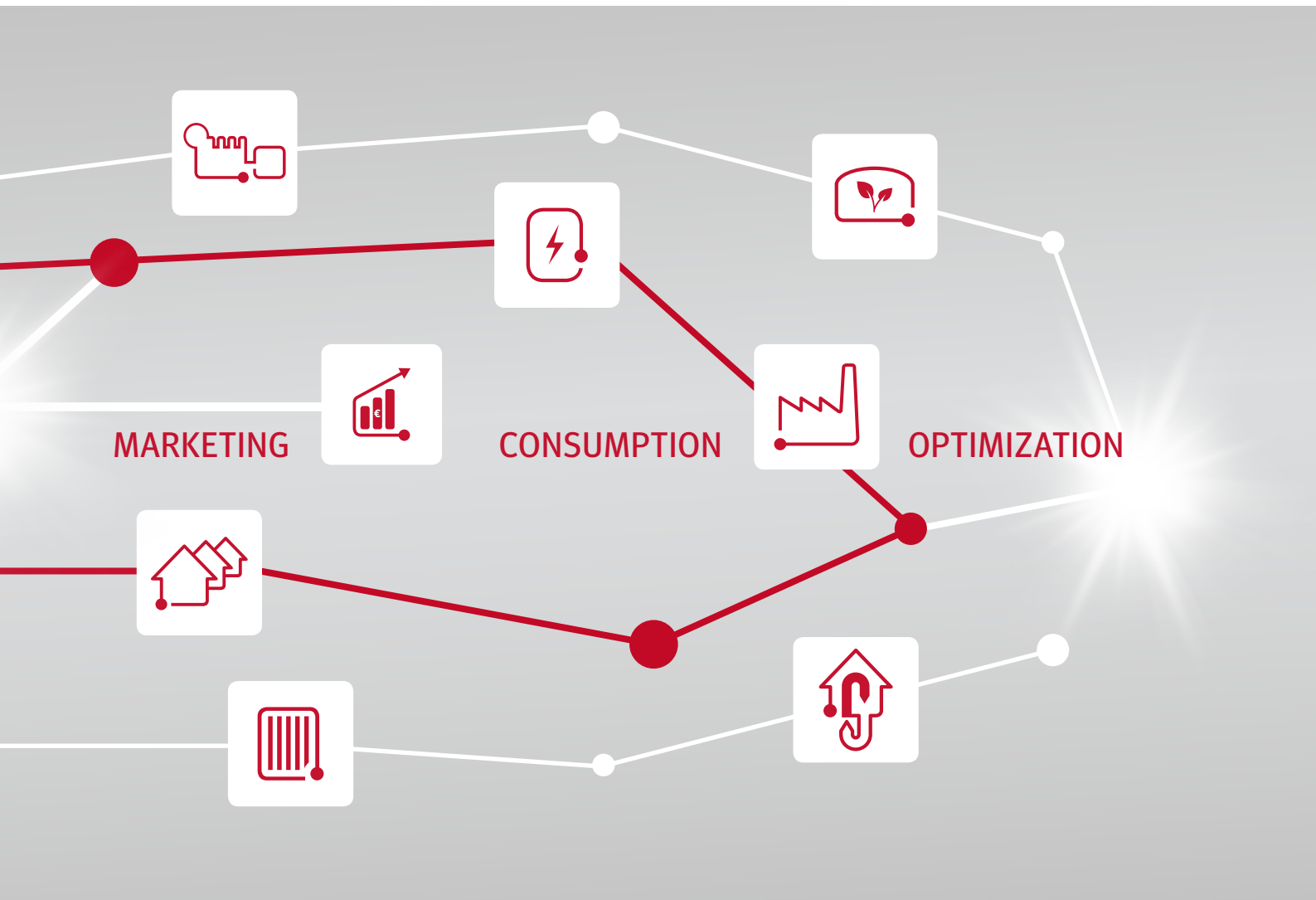


IF ONLY EVERYTHING WOULD BE SO EASY

THE TASK CAN BE NICELY AND CLEARLY FORMULATED: TO PROVIDE THE RIGHT KIND OF ENERGY IN THE REQUIRED QUANTITY AT THE EXACT TIME AND SUITABLE PLACE.

THE SOLUTION IS EASY WITH US.

AND YOU DON'T HAVE TO WORRY ABOUT ANY OF THE COMPLICATED STUFF THAT COMES IN BETWEEN.



Anyone who tries to describe cause and effect in an energy system will quickly reach the limit of handy formulas. Dependencies and interactions are enormously complex. Both technically as well as economically.

Our offer to you: We solve the complex problem of energy logistics. And you have the system as a whole under your control! We can live up to this promise because we have solutions and take responsibility at all levels and in all positions and nodal points of the entire system framework.

We ensure energy and cost efficiency, integrate renewable energy and displace fossil fuels, thus minimizing CO₂ emissions. We also provide you with market options that bring additional revenue such as, for example, an operating mode for power generating and consuming units that is determined by the spot electricity price to ensure maximum use of the renewable energy potential. We will work together closely and intensively to transform the energy system and help make a significant contribution to climate protection.

IF DECENTRALIZED ENERGY SYSTEMS ARE INVOLVED, THEN SO ARE WE.



SMART ENERGY SUPPLY

All sectors. All sizes. All parameters. **All satisfied.**

Do you want to get the maximum level of flexibility, cost-efficiency and reliability out of your decentralized energy system? Then looking into measurement, control and control technology is the right move for you.

Do you also want to have operational management be simple, convenient and customizable in all aspects? Then you will likely appreciate advanced grid control technology that is seamlessly compatible with the technology for measurement and control and can be added as a complete package with all services.

Are we correct in this assumption? Then our smart energy station control system is the right choice for you. Given that each of its two pillars is strong:

CONFIGURATION TOPS PROGRAMMING

PROJECT-SPECIFIC CUSTOMIZATION DETERMINES THE VALUE OF THE SOLUTION. BUT HOW MUCH EFFORT SHOULD BE DEDICATED TO CUSTOMIZATION? WHILE COST-INTENSIVE PROGRAMMING IS COMMON IN THIS MARKET, A SIMPLE CONFIGURATION PROCESS IS SUFFICIENT FOR US.

THAT'S WHAT WE CALL SMART.

Measurement and control technology

AVAT SE²MASTER AND AVAT SE²BASE

- Superordinate control of hybrid power stations including storage management and grid feed-in control
- Convenient configuration and automated connection to the grid control system
- Interfaces to the energy management system and the virtual power plant
- Color touch panel, which can be accessed directly or remotely, ensures optimal ease-of-use down to the individual controller
- SE²BASE: Substation controller, including storage connection

What makes our systems so special?

- Integrated, cross-sector complete solution
- Solutions for decentralized energy systems that cover all levels and segments of combined heat, power and cooling: Local and district heating networks, districts, cogeneration plants, heating stations, storages and local substations
- Renewable energies such as solar thermal, biogas, biomass and photovoltaic are optimally integrated
- Standard components in robust industrial design make the systems reliable and easy to maintain

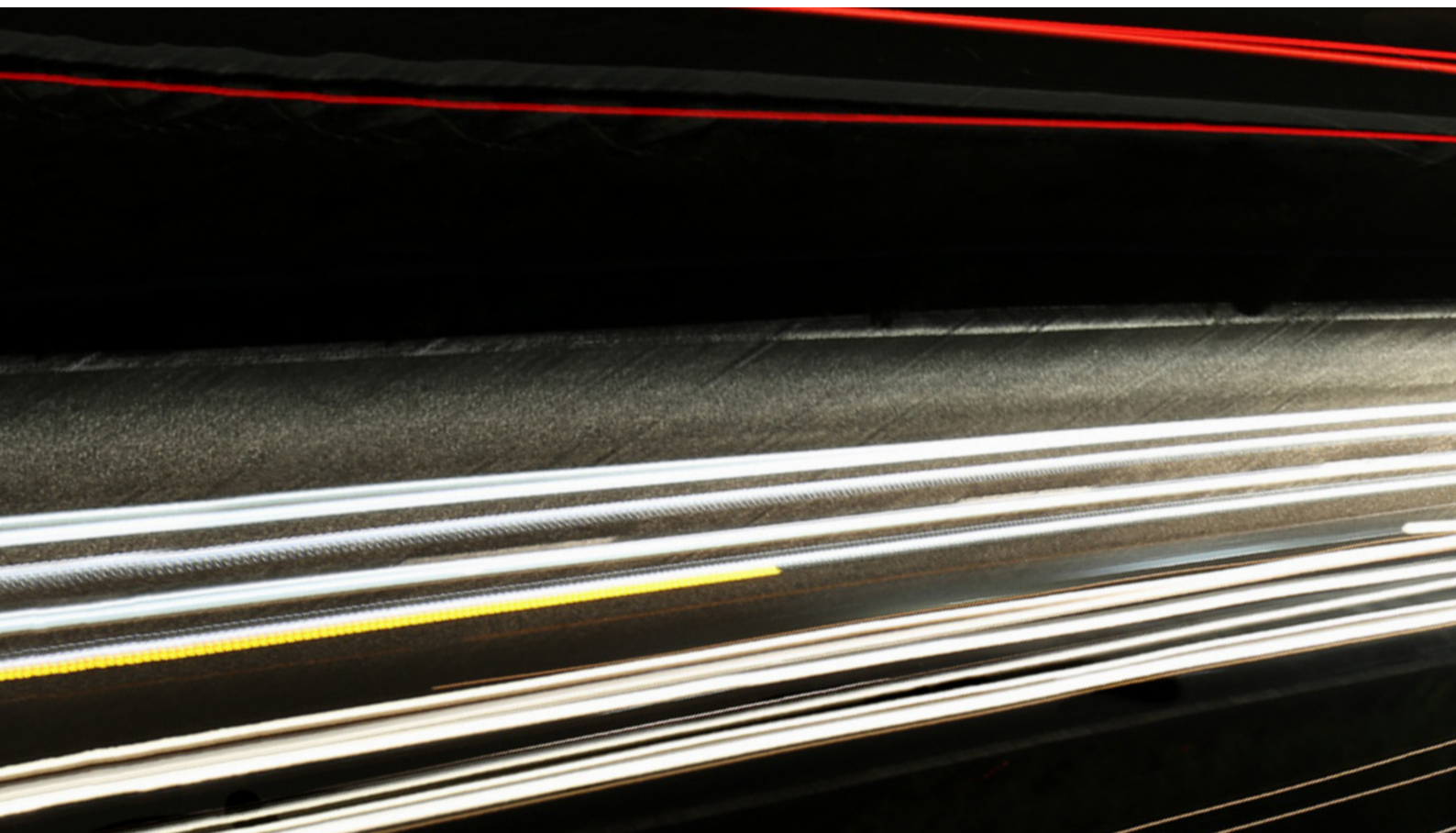
Grid control technology

AVAT SE²OPERATOR

- Optimized for energy supply infrastructures
- System visualization and configurable trend curves
- Operational management and optimization
- Monitoring and alert function
- Emergency planning

Our grid control technology can also be called grid control technology because it's leading the way:

- Integrated system based on a standard object-oriented SCADA system with high-performance process database
- Cross-sector application solution for the energy economy
- Open system with numerous communication interfaces
- Optional heating network control
- Comprehensive service package with everything from configuration to training



SMART ENERGY MANAGEMENT

More knowledge. More abilities. More savings. **More future.**

Energy management is a necessity. One can arrive at this conviction while walking in nature with children, reflecting on the future of our climate and our environment.

A completely different train of thought may arise when viewing a business balance sheet: When energy is moved, money inevitably falls by the wayside. The only question is how much. Our energy management systems can answer that to your advantage.

So far so good. But what should not be forgotten: How much personal energy do we need to invest in energy management – either once or continuously? This aspect plays a central role in all of our solutions. That is why our visualizations are not the only thing based around the user.

STANDARD FEATURES WITH FUTURE PROSPECTS

NO MATTER WHERE YOUR ENERGY MANAGEMENT WILL BE IN THE FUTURE, YOU CAN ALREADY PREDICT ONE THING TODAY: OUR SYSTEMS ARE OPEN FOR YOUR FUTURE PLANS. WHETHER "DOWN" TO OTHER SYSTEMS, METERS AND MEASURING POINTS FROM OUR COMPANY OR "UP" TO BUILDING CONTROL TECHNOLOGY OR BILLING SYSTEMS.

THAT'S WHAT WE CALL SMART.

AVAT SE²MANAGER AND AVAT SE²DAQ

- Comprehensive energy management system with high-performance process database and various SCADA functions
- Topological representation of building structure, system locations and measuring points
- Heat maps, Sankey diagrams, curve and bar graphs
- Web-based reporting
- Meter management including overview plans
- Cost center allocations
- Energy performance indicators (EnPI) according to ISO 50006 with relevance level function
- SE²DAQ: Intelligent data logger for recording of all measuring and meter data points and for automated connection to energy management system

For all your requirements regarding database features, monitoring, analysis, reporting, alerts and interfaces, you can rely on user-friendly services:

- A comprehensive energy management system
- Performance indicator supported ISO 50001
- Decision-making guide for system optimization
- Cause analysis based on real KPIs
- Extensive analysis options
- New or existing systems can be connected at any time



SMART VIRTUAL GRIDS

Big ideas. Big action. Big profit. **Big thing.**

Flexibility is the new commodity of the energy economy. And the jump to the virtual power plant is a business decision that you don't just make based on a gut feeling. Have you already done the calculations and determined the economic prospects? Do you want to achieve maximum use of the renewable energy potential and make a significant contribution to CO₂ reduction?

If you are just looking for the certainty that comes with having competent and consistent assistance during the implementation of your project, then we have something interesting to talk about.

Regardless of which mix of energy sources and plants you want to combine as a grid and which infrastructures already exist: Our solutions will fit. Project-specific customization, but with a maximum number of standard technologies and existing software modules.

On this basis, when you redo the calculations, the first result will be confirmed or even exceeded: The virtual power plant technology makes great profit. In the real world.

THE ENERGY TRANSITION IS COMPLEX. BUT ALSO COMPLICATED?

THE VIRTUAL POWER PLANT TECHNOLOGY IS COMPARATIVELY NEW. AND ANYTHING NEW IS OFTEN COMPLEX. SIMPLICITY NEEDS TIME TO DEVELOP. THE GOOD NEWS IS THAT WE HAVE BEEN WORKING WITH THESE UNDERLYING TECHNOLOGIES FOR A QUARTER OF A CENTURY ALREADY. THAT MAKES OUR SOLUTIONS STABLE, RELIABLE AND USER-FRIENDLY AS WELL AS ECONOMICAL AND ECOLOGICAL.

THAT'S WHAT WE CALL SMART.

AVAT SE²DIRECTOR

- Central VPP Control System for pooling several plants
- Optimized management with grid-beneficial operation
- Integration of electricity price and weather data forecasts
- Aggregated timetable management in a network
- Creation and transfer of the scheduled timetables

AVAT SE²OPTIMIZER AND AVAT SE²BOX

- AI-based load forecasts for heat, gas and electricity demand
- Optimization via weather and electricity exchange forecasts
- On-site timetable creation for day-ahead marketing
- Consideration of all plant-specific conditions
- Inclusion of personnel costs and energy contracts
- SE²BOX: Direct RE plant access (wind, PV, biogas, CHP, etc.)

We will demonstrate the technically and economically useful optimization potential, suggest suitable marketing options and ensure the successful technical implementation.

- Sector coupling
- Flexibility marketing
- Demand side management
- Forecast-based generation, load and storage management
- Timetable optimization according to operating strategies
- Operators retain full control the system and data

In a nutshell:

- Decentralized: load forecasts, optimization & timetable
- Centralized: aggregation, timetable management & marketplace



DO ALL OUR SOLUTIONS OFFER THE SAME ADVANTAGES? IN PRINCIPLE YES.

Energy is flow and movement. And energy economy is anything but rigid and static. More important than whether a solution is good or not is whether a solution remains good when circumstances change: Consumers are added, others fall away, infrastructures grow, the energy mix shifts along with price trends and regulations.

You will also be impacted by such changes. That is why the following applies: The longer you work with one of our solutions for decentralized energy generation and supply, the more you benefit from our core principles.



Principle 1

OUR SOLUTIONS ARE INTEGRATED

From gas engine controllers and energy station controls to grid control technology combined with our energy management system and connection to a virtual power plant: Everything communicates with each other homogeneously and easily and the control concept remains uniform.

Principle 2

OUR SOLUTIONS ARE MODULAR

An integrated system plus a multitude of interfaces are the best conditions for ensuring that your solution does not come "off the shelf", but rather is combined with modules individually tailored to your needs. That applies the same for hardware and software.

Principle 3

OUR SOLUTIONS ARE EXPANDABLE

Growth for our solutions is not an incision, but organic, unbroken development. As the operator, you respond only when larger capacities are really needed. But then it goes very fast.

Principle 4

OUR SOLUTIONS ARE CONFIGURABLE

Doesn't sound so special? But it is: Project-specific adjustments on the software level normally requires programming work. That costs time and money, and comes with risk of errors. Our energy station controllers, on the other hand, offer easy, fast and secure configuration.

