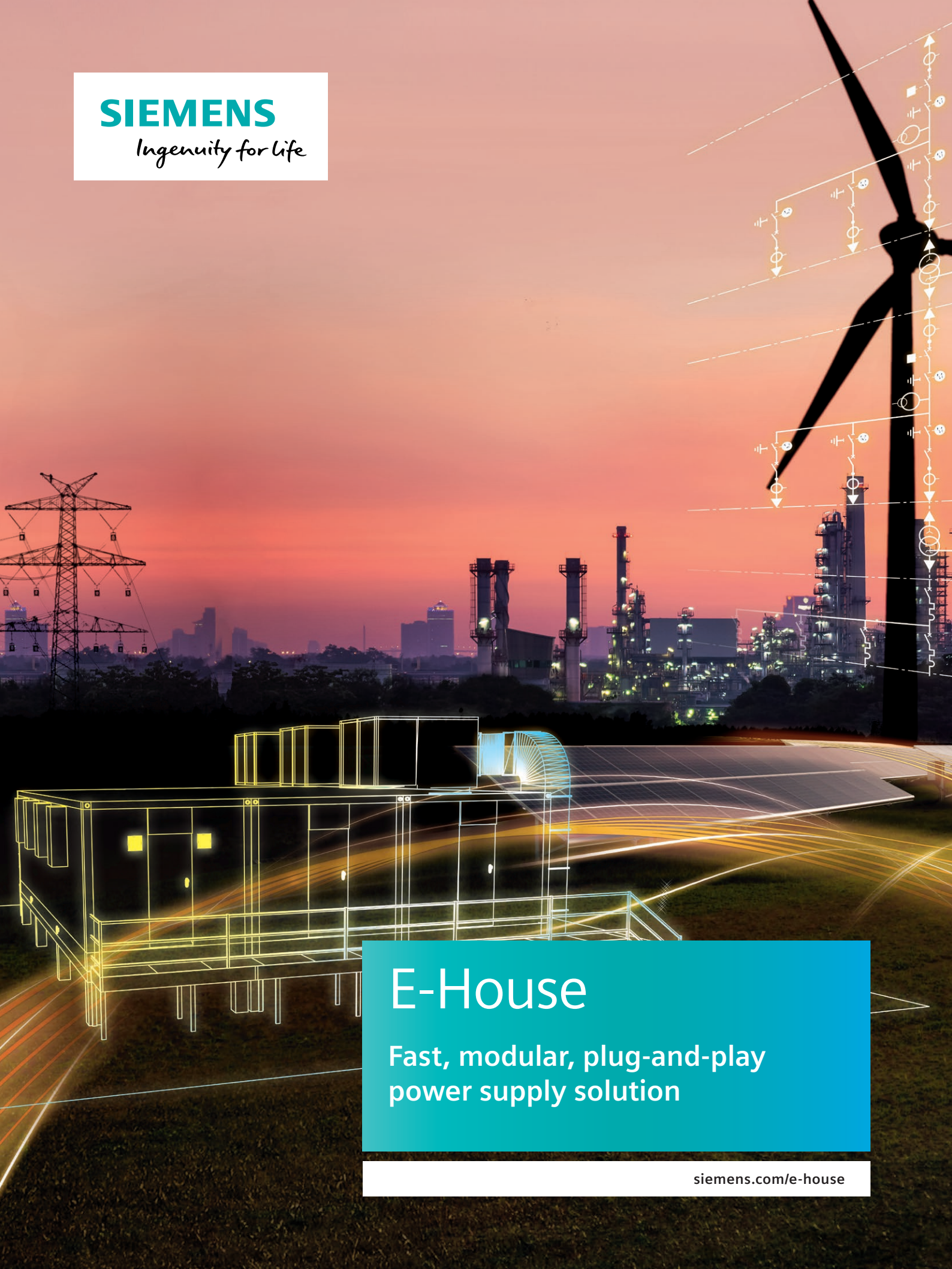
SIEMENS

Ingenuity for life



E-House

Fast, modular, plug-and-play power supply solution

siemens.com/e-house



The new approach

Time and cost efficient

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E-House

Bringing power to wherever it's needed

As an integral part of the Totally Integrated Power concept of Siemens, E-House provides electrical power to wherever it's needed – quickly, flexibly and reliably. With E-House, Siemens offers customized plug-and-play power supply solutions that cover everything from the planning and engineering to the installation and commissioning. E-Houses reduce construction lead time. They are quickly and easily installed and the footprint and lead time are optimized thanks to the high-quality design.

Ready to use

An E-House can consist of one or several modules equipped with high-quality components, including medium-voltage air-insulated switchgear (AIS) or gas-insulated switchgear (GIS), low-voltage switchboards, power transformers, medium-voltage/high-voltage (MV/HV) cable drums, protection, monitoring and control systems, Power Management Systems (PMS), Variable Frequency Drives (VFD) as well as AC and DC auxiliary power and building management systems. Completely developed, manufactured, assembled and pretested at the factory or assembly yard prior to delivery, an E-House simply needs to be connected and put into operation on-site.

Numerous applications

Industries, utilities, and infrastructures benefit from our E-Houses, whether it's for power distribution needs or electrical network extensions. They are ideally suited for a broad range of applications as space-saving solutions, for example, in areas with difficult access, in harsh environments, as a temporary power distribution solution, or as a mobile power solution for relocation.

International standards

The electrical equipment as well as the E-House are designed and constructed according to the respective standards, e.g. American Standards (ANSI/NEMA/ASTM/AWS) or European Standards (IEC/EN/BS) and are tested and certified for the different markets (UL/CE/GOST&EAC).

Benefits at a glance

- **Cost savings:**
  Using an E-House helps to reduce both capital expenditures (CAPEX) and operational expenditures (OPEX)
- **Time efficient:**
  Delivered ready to use, an E-House saves time on-site
- **Improved safety:**
  EHS performance is improved thanks to minimized on-site presence
- **Optimized footprint:**
  Due to its modularity and qualified design
- **One-stop solution:**
  Everything from one partner, from the planning to the installation and commissioning



Types of E-Houses

For a large range of applications

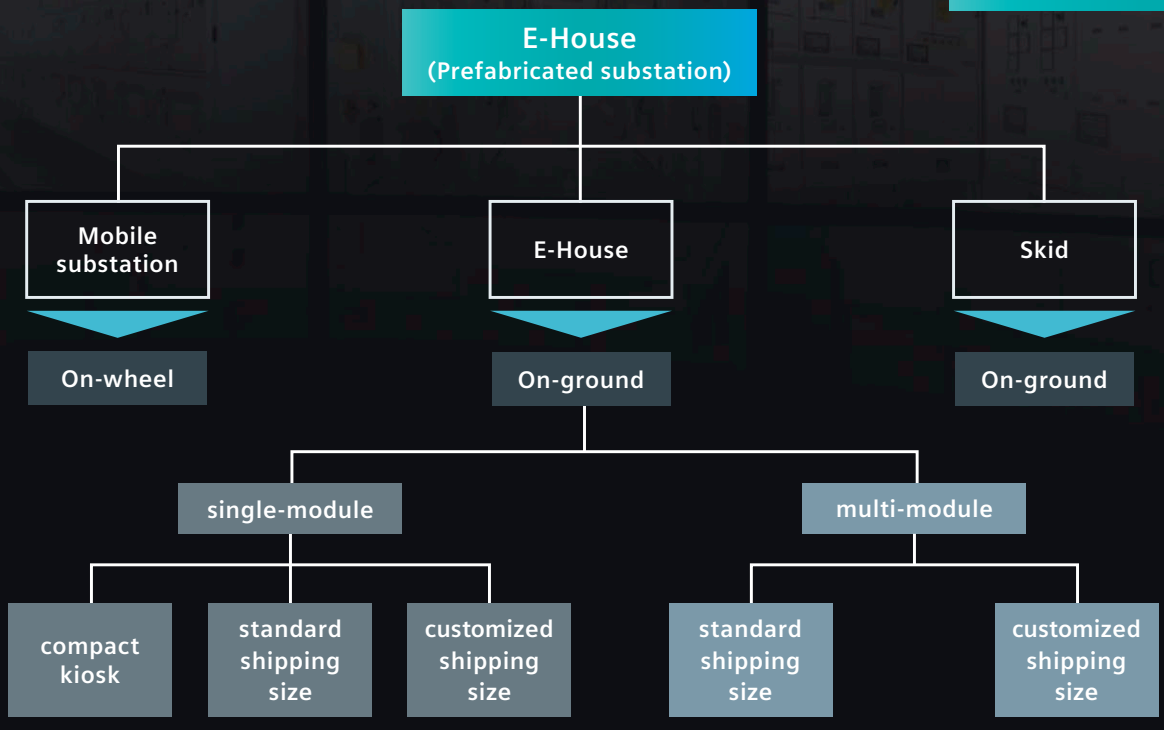
We have various types of E-houses to suit any application requirement. E-Houses are designed in accordance with the customers' requirements. They are generally installed on raised platforms to enable the installation of an external cable tray and bus duct systems underneath the E-House. A standard E-House consists of one module on a pre-cast foundation, whereas a mobile substation is an E-House module on wheels or other support that can be relocated with its base.

Multimodular E-Houses consist of several modules that are placed on a foundation next to each other. With our engineering expertise, we are also able to install them on two or more levels to ensure optimal use of available space. Skids are a special kind of compact and mobile solution with all electrical equipment in outdoor housings mounted directly on and interconnected via a common base frame. Skids are used especially for relocation, for example, in mines.



Worldwide experience

We have successfully delivered more than 300 E-Houses worldwide. The experience we've acquired around the globe has only been possible with the right global network of local solution competence centers supported by E-House expert engineering hubs. This setup enables us to deliver E-House solutions wherever they're needed and to any standard required.



A cost-efficient solution

CAPEX reduction

As a standardized solution, E-House offers the potential for substantial savings. Planning costs can be reduced by up to 50%.

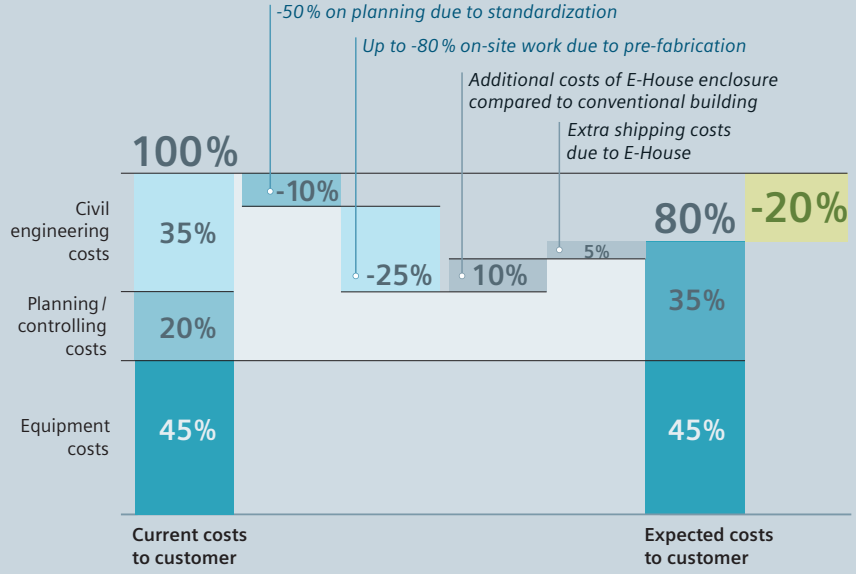
As a pre-fabricated electrical building, the E-House is delivered fully integrated and pre-tested. This reduces worker presence on-site for construction, and installation time is significantly reduced. E-House users also benefit from an optimized footprint thanks to its modularity and compact design. This alone adds up to total savings of up to 20% of the total costs of ownership (TCO) when compared to conventional power distribution substations.

OPEX reduction

Independent from CAPEX reduction, Siemens E-Houses also enable potential OPEX reduction, e.g. reduced energy consumption of HVAC systems thanks to the optimized building volume and system design.

Cost-savings potential of up to 20%

Expected cost reductions for typical E-House projects



E-House saves money

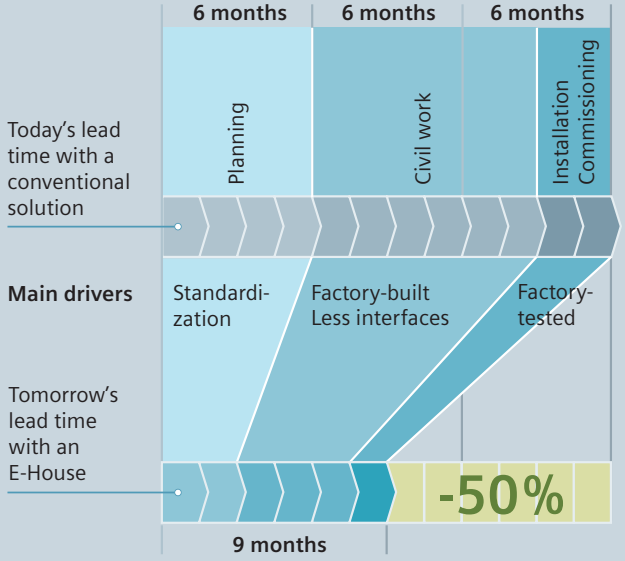
- Potential cost savings of up to 20 % thanks to standardization
- Reduced planning costs
- Reduced presence on-site
- Optimized footprint for space-saving
- Possible interim and relocation solution (mobile)



A time-efficient solution

E-House power supply solutions are fast and easy to install. Compared with conventional site-built constructions, an E-House reduces overall lead time by up to 50%. That's because the pre-fabricated and pre-tested solutions only require installation, connection, and commissioning following delivery.

Reduced lead time up to 50%
Scenario simulation with a conventional solution and an E-House



E-House saves time

- Reduced lead time by up to 50%
- Reduced civil engineering work
- Enhanced installation time thanks to plug-and-play
- Reduced construction delays (e.g., due to weather)
- Minimum interference with other on-site activities

A comprehensive solution

Siemens E-Houses can be fitted with a wide range of power equipment and components from our comprehensive MV and LV portfolio of power solutions. As a pre-fabricated solution, all power supply components are pre-configured before being installed inside and ensure a high degree of functionality and reliability.

Siemens medium voltage switchgear (types 8DA/B, NX PLUS C or NX AIR) is usually designed for E-House solutions to switch electrical power supply up to 40.5 kV and up to 5000 A. It is accompanied by the low-voltage switchboard SIVACON S8 up to 7000 A. This very cost-efficient and flexible solution for constant distribution of electrical power guarantees the highest level of personal and system safety.

All equipment is smartly intelligently interconnected. The Siemens protection, automation and monitoring devices (SIPROTEC) and the motor and control devices (SIMOCODE) can be easily connected to the power management systems (PMS) provided by Siemens.

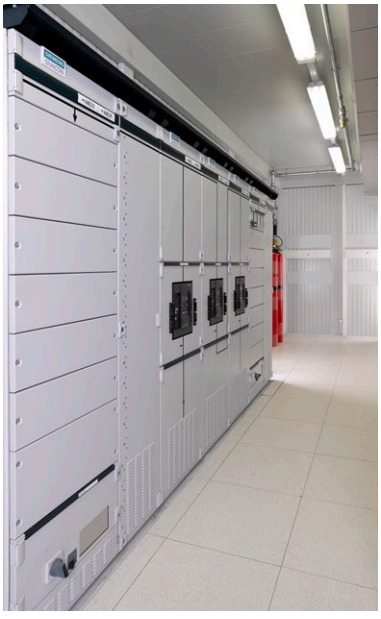
Siemens also has Motor Control Centers and products to drive and control low-voltage and medium-voltage motors.

The low-voltage busbar trunking systems SIVACON 8PS can be used for power connection to our dry-type transformers (cast-resin transformer GEAFOL).

Siemens also provides building technology systems designed to ensure the protection of equipment and people.

Other electrical equipment like batteries and uninterruptible power supply (UPS) systems are sourced by world-class suppliers approved by Siemens or the customer.

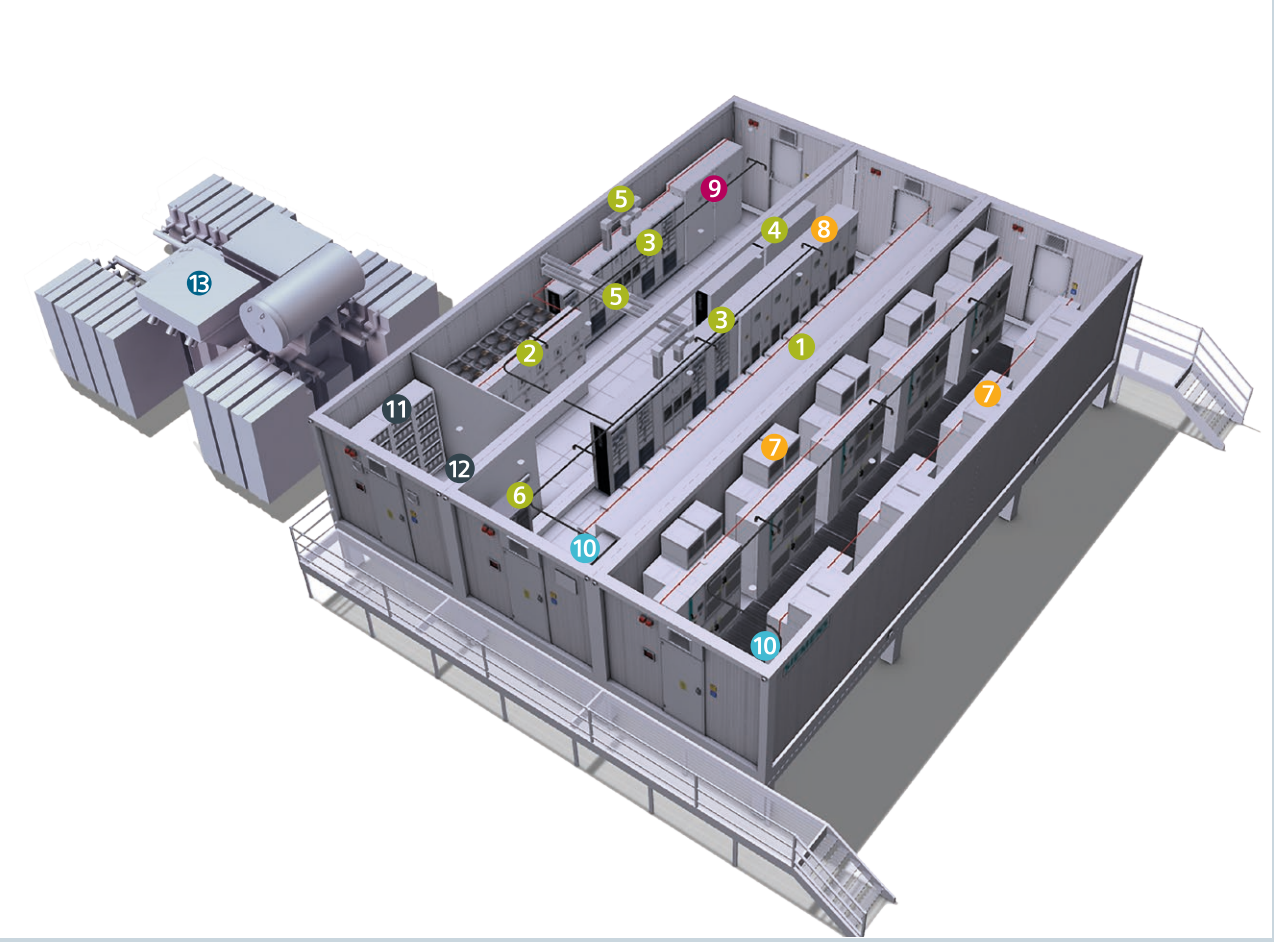








Configuration example with perfectly fitted components



LV + MV components

1. NXPLUS C gas-insulated medium-voltage switchgear
2. 8DA10 gas-insulated medium-voltage switchgear
3. SIVACON S8 low-voltage distribution board
4. SIVACON S8 low-voltage MCC board
5. SIVACON 8PS busbar trunking system
6. SIVACON auxiliary distribution board

VSD (Variable Speed Drives)

7. ROBICON medium-voltage drive converters
8. SINAMICS G150 cabinet units: Universal drive solution for single drive

Energy automation

9. SCADA connection system / RTU (Remote Terminal Unit) cabinet, e. g., SICAM by Siemens

HVAC, fire and safety equipment

10. Fire detection and extinguishing system (e.g., Sinorix 1230 by Siemens)

Battery room

11. Battery rack
12. UPS (uninterrupted power supply)

Transformer

13. Outdoor power transformer or indoor/outdoor auxiliary transformer



Flexible solution for your power grid

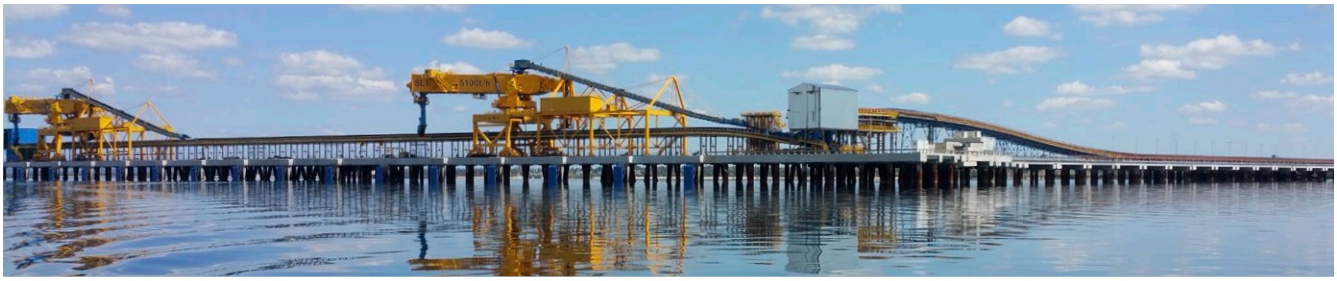
Plug-and-play

Wherever and whatever your network needs, we'll keep you powered up.

Power grid operators, utilities, electricity producers, and energy intensive infrastructure facilities must be able to ensure a reliable power supply for their customers. Power demand must be met at all times, without interruption – regardless of construction time frames, operational restrictions, natural disasters, or other circumstances.

E-Houses are commonly used as housings for electrical switch or inverter rooms for distribution grids, but also for applications like grid coupling, balancing fossil and renewable energy sources at plants, as part of reliable power supply solutions for critical processes, or for housings of electrical energy storage systems.





Example of references



E-House for a seaport

The new deep-water seaport in Nacala-a-Velha in Mozambique relies on low and medium-voltage switchgear from Siemens as a power source for the coal mines in the mountainous Tete region. The 5 pre-fabricated E-Houses were shipped from Germany to the CLN (Corredor Logistico Integrado Nacala) joint venture as a plug-and-play solution. They are protected from coal dust, overpressure and the salty sea air by special offshore coatings that comply with local environmental regulations. Fully equipped and pre-tested prior to transport, they were quickly put into operation.

E-House for a hydroelectric power plant

For the construction of tunnels to a power plant in Colombia, the power supplier ordered 16 E-Houses in 20 containers along with 6 skid-mounted E-Houses from Siemens Colombia. Siemens delivered a complete solution comprising the E-House design, engineering, manufacturing, testing, transport and commissioning.

E-House for utilities

The utility Georgian State Electrosytem (GSE) was confronted with the challenge of modernizing Georgia's electrical network. For this task, it opted for 14 E-Houses with 260 AIS panels as well as substation automation equipment delivered as a turnkey solution. These are now located all over Georgia at different locations. "Siemens has performed with great commitment in the procurement, delivery, and installation of the E-Houses, despite tough geographical and weather conditions," said Sulkhan Zumburidze, Chairman of the Management Board of GSE.



Ideally suited for industries

Reliable solution for challenging tasks

Reliably covering our energy demand while keeping costs in check is essential for our business.

Power substations used for the energy intensive oil and gas, chemicals or metal and mining industries, among others, need to be able to operate reliably in extremely harsh environments and under the most challenging conditions. E-House solutions will not let you down.

E-House performs reliably

With E-House solutions, power failures from hazardous weather conditions and harsh environments are no longer an issue. Well suited for use in all types of mission-critical applications, E-Houses are built to meet rigorous industry standards. In addition to temperature extremes, they are designed to withstand dust, dirt, moisture, fog and humidity. An exceptionally resistant housing protects from high snow loads as well as high wind speeds and seismic risks, as well as external fire that may result from an adjacent transformer failures.

Reduced interference and fewer construction risks

With a conventional power substation building, even the shortest delay can have a devastating impact on the whole project schedule. E-House is the ideal solution. It can be installed quickly, which minimizes worker presence on-site and reduces interference with other activities. E-House significantly enhances on-site environment, health and safety (EHS) performance. Since it is delivered fully-equipped and pre-tested, there is no risk of delay due to weather conditions, for example. As a result, E-House can be installed at almost any location – performing reliably at all times.





Example of references



E-House for gas-to-liquids

Projects in the oil and gas industry require profound industry expertise. That's why Siemens was chosen to deliver an E-House for one of the world's largest gas-to-liquids (GTL) projects in Qatar to power the development, processing, and transport of previously untapped gas field reserves. Delivered in three modules on a pre-cast foundation, it reliably supplies electricity for the site as well as for the employee accommodations in accordance with high environmental, health and safety standards.

E-House for a crude oil pipeline

An oil pipeline in Colombia that covers 836 km on land and 12 km underwater needed a fast and reliable power supply on the oil rigs and to transport crude oil. Siemens successfully installed customized, fully equipped, and pre-tested modular E-Houses. They contain a comprehensive portfolio of medium-voltage switchgear, low-voltage switchboards, and busbar trunking systems.

E-House for copper mines

For several extension projects at copper mines in Peru and Australia, Siemens supplied completely integrated low-voltage and medium-voltage power supply solutions, including up to 20 E-Houses equipped with customized power distribution systems. The power supply package comprised engineering, project management, pre-assembly in individual modules, commissioning and testing prior to transport.

From planning to plug-and-play installation

Siemens has all the necessary expertise in-house along with outstanding design know-how for each project step.

Everything starts with the design. Siemens provides E-House-specific design expertise that takes into consideration the customer's power distribution needs, project specific requirements (e.g. logistical and site restrictions), Health & Safety as well as Operation & Maintenance requirements.

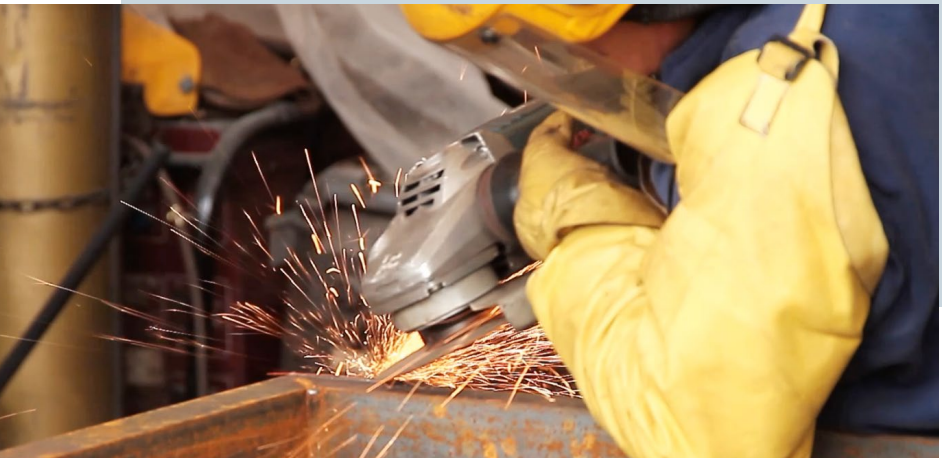
STEP 1 Design

Understanding that every power supply task is unique, we plan and design the E-House to optimally fulfill your needs – quickly and cost-efficiently.

- Overall electrical design
- Equipment layout
- Mechanical design
- Design of auxiliary equipment and systems (e.g. fire detection, air-conditioning, etc.)



STEP 2 Manufacturing



Following the detailed planning of your E-House, high-quality products and materials are procured and the E-House is constructed to suit your specific requirements.

- Procurement of high-quality materials
- Manufacturing
- Skilled labor

STEP 3 Pre-assembly



All elements of the E-House's metal housing, including the steelframe, floor, roof and wall panels are pre-assembled in a controlled factory environment.

- Construction and coating of steel-frame
- Installation of roof, wall and floor elements
- Mechanical installation of equipment

STEP 4 Electrical installation

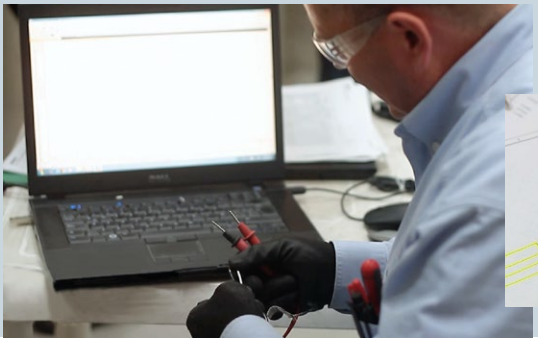


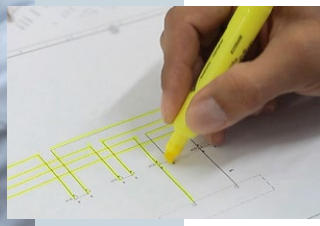


Whatever the individual power component arrangement of your E-House – our engineering team ensures optimal integration.

- Power equipment
- Auxilliary equipment and systems
- Connection of internal cables

STEP 5 Pre-commissioning and testing





The high level of quality and functionality of the E-House power equipment and auxiliary systems are assured by fulfilling an extensive inspection and test plan prior to shipping to the project site.

- Pre-testing of all installations
- Pre-commissioning of equipment
- Testing of functionalities

STEP 6 Transport

From planning and calculating load capacities to choosing modes of transport and more – we handle all of the logistics.

- Expertise in heavy and oversized transport
- Safe, fast and efficient transportation
- Logistics management

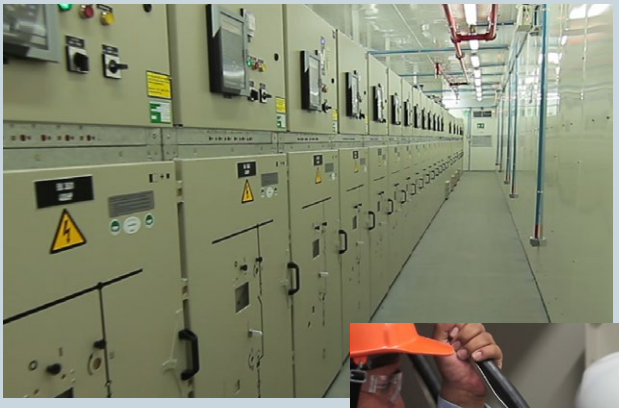




STEP 7 Plug-and-play

After arrival on site, E-House solutions are lifted directly onto their foundations and subsequently installed – the plug-and-play concept minimizes costs, time, and efforts.

- Lifting and mechanical installation of E-House
- Electrical installation of external cables
- Commissioning
- Energization







Designed to customer specifications

Electrical design
The customer's need for electrical power distribution to process-relevant equipment is specified in the single-line diagram (SLD) of the project. This is the most important design requirement for the functionality of an E-House application. The electrical design defines the type of product along with the respective dimensions and weight. The comprehensive product portfolio of Siemens offers an outsanding diversity of perfectly fitted products and systems, for example, reliable switchgear and switchboards, protection devices and monitoring systems.

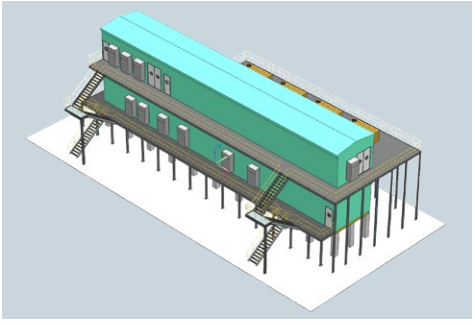
Requirements management
Our certified project managers and experienced lead engineers are the primary contact for the customers. A professional project team ensures that all of the internal electrical design interfaces have been properly specified and logically implemented, while a pro-active interface management team coordinates the external design interfaces.

Equipment layout
A key element for the optimization of the E-House's overall footprint and smart operation is the intelligent arrangement of the power equipment. This significantly influences the design to the logistics concept and offers the greatest leverage for an optimized footprint. Siemens engineers take all specific technology requirements into consideration, from internal arc protection and air-flow requirements to battery protection measures.



Structural and mechanical design
The structural design of the bearing frame is based on the weight distribution resulting from the equipment arrangement. The mechanical design allows deflections to be limited during lifting and operation. It takes into account all components such as the wall and roof elements, doors, flooring, and ancillary equipment installations. Appropriate products are selected according to the project-specific requirements such as environmental conditions and fire resistance.

The Siemens Global Engineering and Excellence Center (GEEC) has the unique expertise and experience needed to design multi-level E-Houses (for example, two-level E-House) as well as E-Houses that are resistant to external blasts.



Design of auxiliary systems
Auxiliary systems are important for the protection of the initial investment and for prevention of potential process downtime due to failures in the power distribution system. Smoke detection systems provide time for owners to react, and fire extinguishing systems offer immediate action in the unlikely case of a fire within the E-House. Air-conditioning systems control the temperature and humidity within acceptable limits, thereby assuring functional reliability and life-cycle requirements. Overpressure systems prevent the ingress of ambient air if contaminated with particles being harmful to humans or equipment. Access control systems and burglar alarms can be installed to offer a high level of safety and protection for the equipment.

Digitalized engineering for optimized footprint

Standardization advantages

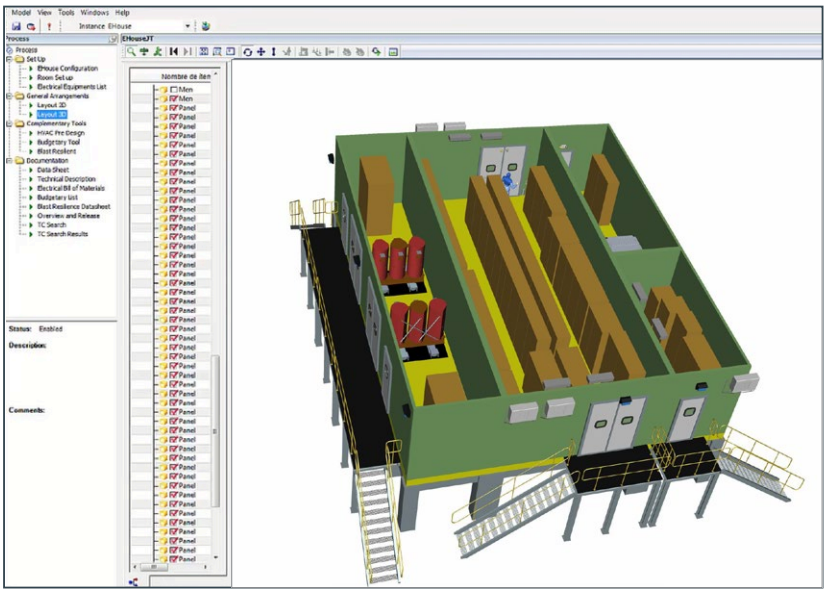
An E-House configuration tool is used for the conceptual design. It optimizes the equipment layout by applying standardization, thereby helping to reduce the total footprint and related costs. This also means that Siemens can offer customers advice on budgetary and technical considerations (technical datasheets and specifications...) during the front-end engineering design (FEED) phase of a project.

E-House configuration tool

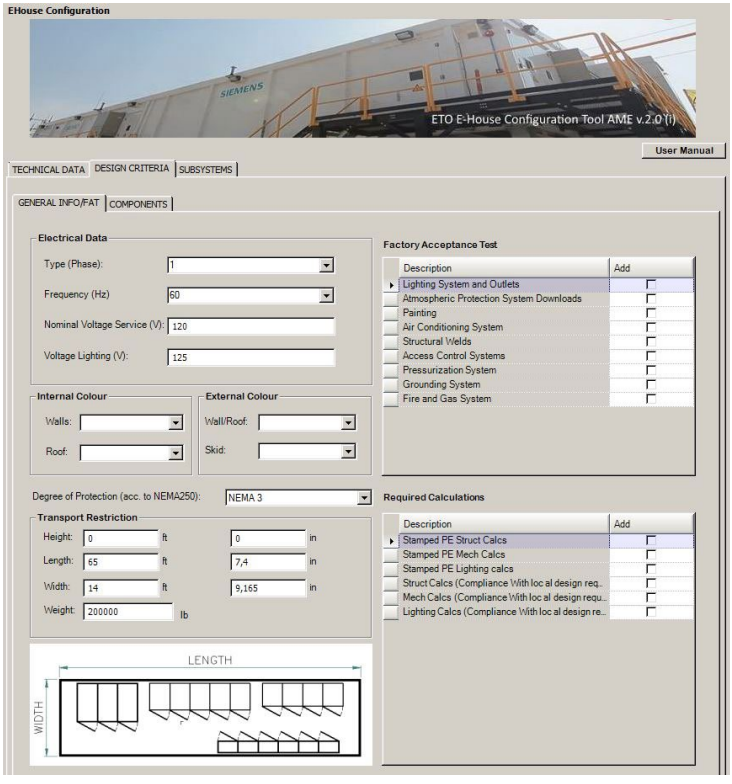
We perform conceptual designs for E-Houses fast and with high quality. The tool input is based on customer specifications and the project-specific equipment design outlined in the equipment list. Intelligent and logical links ensure the application to best-practice solutions and compliance with all relevant design requirements and standards.

It also helps with the design of auxiliary systems, including air-conditioning, fire detection, and fire-fighting, and provides state-of-the-art systems and the most economic solution.

The configuration tool is optimally designed for the future needs of digitalized engineering and work processes.



Layout of an E-House in a 3D visualisation



E-House configuration tool

Modular design

With Siemens, you benefit from a modular design that enables flexibility for the conceptual and overall electrical design. We are committed to providing the highest level of expertise with our design capabilities.

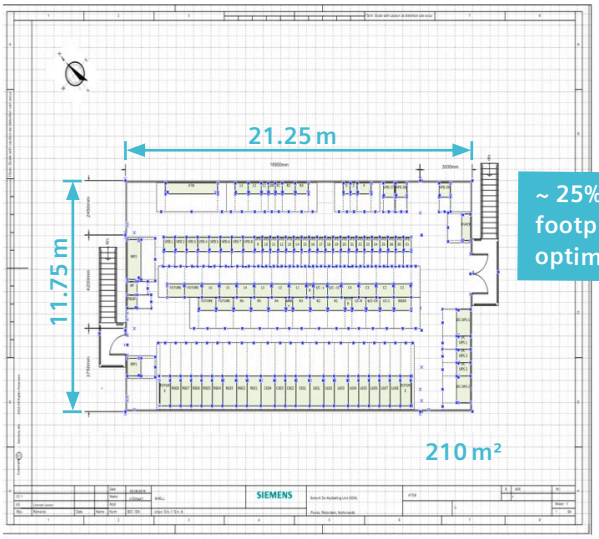
The size of an electrical substation frequently exceeds transportable dimensions. A "single-lift E-House" often involves special transport arrangements, such as port-to-platform or port-to-port, for example, for installation offshore or at a nearby port.

However, the majority of power supply substations are located onshore and come with on-site space or site access restrictions. Therefore, in many cases, the best approach is a multi-module E-House, whereby each module can be shipped individually and assembled on-site.

For these types of E-House projects, the maximum allowable transport restriction along the entire logistics chain defines the maximum dimensions of the modules. Siemens takes all of these logistical aspects into account when developing its prefabricated solutions, thereby saving additional costs for heavy goods transports on vessels and roads. The configuration tool, for example, helps to optimize the original footprint by applying a modular E-House design. It can proportionally save 10% and more of the total project cost, depending on the substation size and quantity.

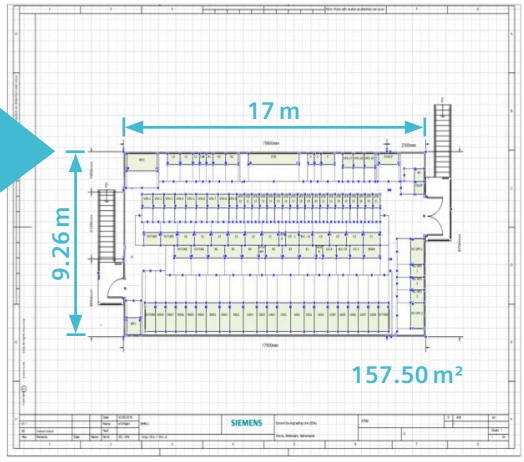
Example

Original layout



~ 25% footprint optimization

Optimized layout



Optimized arrangement in order to reduce costs

The Siemens difference

Siemens accompanies its customers every step of the way, through all phases of the project. Siemens experts provide their project management expertise with regard to safety, excellence and quality.

Safety

Siemens Zero Harm for our customers, employees and contractors throughout the project execution is our mission. Siemens project managers are responsible for the implementation of the project-specific Environmental Health and Safety Management Plan (EHSMP) and for upholding the EHS-appropriate awareness and measures for all stakeholders throughout the entire project lifecycle. E-House projects from Siemens usually have excellent EHS Key Performance Indicators (KPIs).

Siemens is certified according to the international standard for "Environmental Management Systems" (EMS, ISO 14001:2004), which identifies and controls the environmental impact of its activities, products and services. Siemens also fulfills the internationally recognized British standard "Occupational Health and Safety Management Systems – Requirements" (BS OHSAS 18001). All contractors involved in E-House projects must be certified and are monitored according to the EHSMP.

A centralized company-wide strategy was developed for Environment, Health and Safety (EHS) at Siemens



Excellence

For Siemens, excellence means outstanding project management (PM) and E-House overall engineering performance. E-House solutions are projects involving complex interfaces that require world-class PM expertise and profound engineering excellence. The PM@Siemens program upholds the highest levels of qualification, while the global E-House expert community makes certain that each customer receives a state-of-the-art solution.

Siemens examines each company's unique situation, identifies all potential opportunities, and helps select the best solution. As a global player, we support the local creation of value, and ensure that competent local support is provided from the first consultation to the after-sales service.

Quality

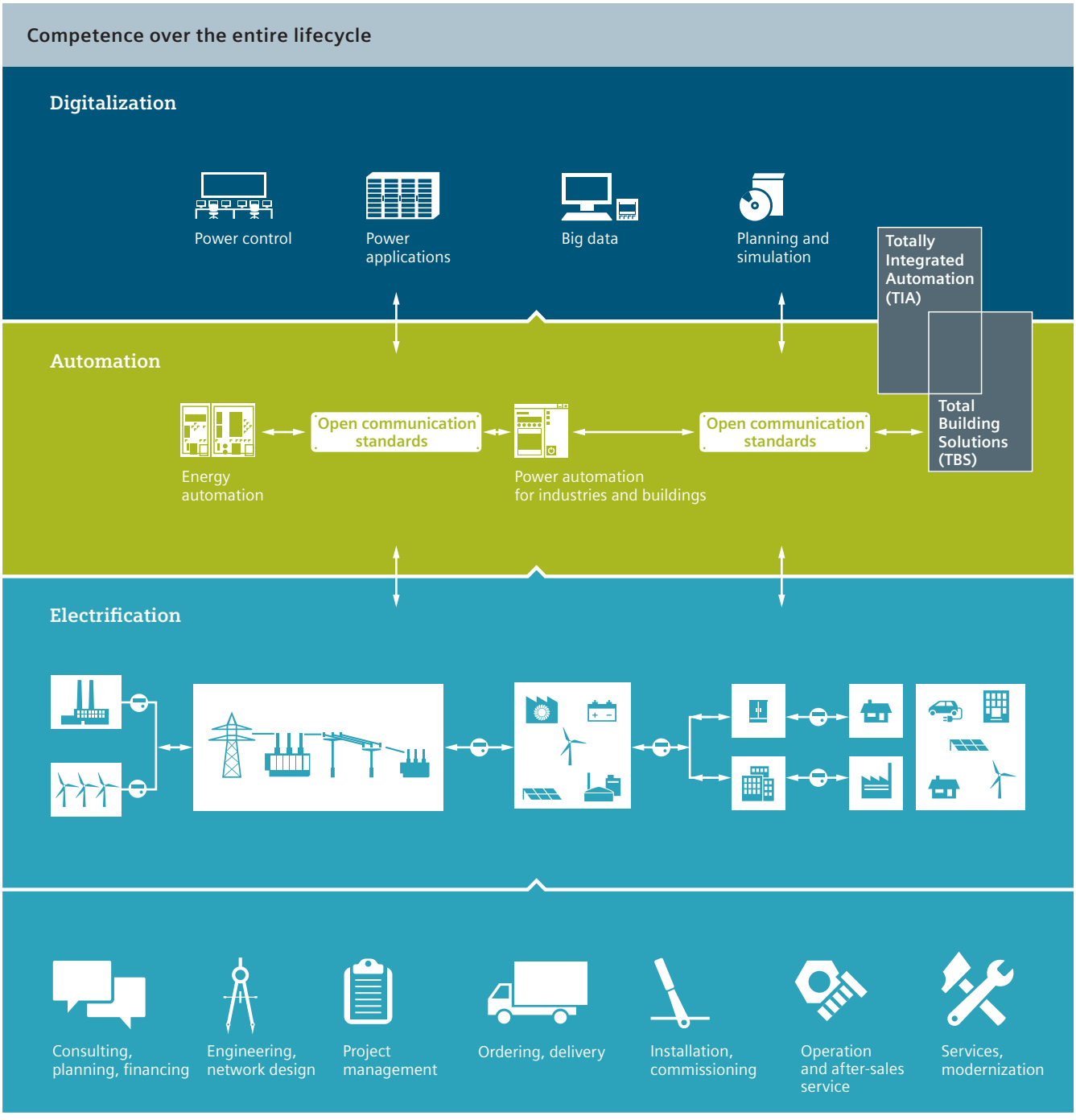
Customer satisfaction is our priority in each and every respect. Based on extraordinary quality assurance during the electrical design and the reliability of our products, smart E-House solutions fulfill all project requirements and international standards. We provide impressive project quality for everything from documentation and adherence to delivery dates through the plug-and-play integration of all equipment and systems to efficient commissioning and operational staff training.

Siemens is certified according to international quality management standards (ISO 9001:2015 and ISO 14001:2004) and is fully committed to delivering the utmost quality throughout our projects.



One-stop solution

Today, virtually everything runs on electricity. With Totally Integrated Power (TIP) from Siemens, it can run even better – from start to finish, across the entire value chain. By integrating power supply with industrial automation and building solutions, Siemens is able to deliver unique, future-oriented energy offerings for all types of demands. Our solutions are designed to provide reliable and efficient power distribution wherever and whenever it's needed.



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