Construction of a mini-CHP plant

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Mini-CHP plants (combined heat and power plants) are autonomous energy complexes that supply enterprises, residential complexes, and industrial facilities with both electrical and thermal energy. Their construction requires consideration of many technical, legal, and environmental aspects, which makes the process complex, multi-stage, and requiring highly qualified specialists. In this article, we will look at the key stages, features, and advantages of mini-CHP construction, as well as regulatory requirements and control by government agencies

Types of mini-CHP plant designs

Mini-CHP plants can vary significantly in terms of design, capacity, and operating conditions, which requires an individual approach to each project. The following design options are available:

Mini-CHP plants can vary significantly in terms of design, capacity, and operating conditions, which requires an individual approach to each project. The available options are:

1. **Stationary mini-CHP plants** are installed in permanent buildings or structures and require lengthy site preparation and a solid foundation.
2. **Block-modular mini-CHP plants** are assembled in a factory and delivered in ready-made blocks, which simplifies and speeds up installation. This is a proprietary development of the MKS Group of Companies.
3. **Mini-CHP plants in noise-proof enclosures** — used in conditions with increased requirements for noise reduction.
4. **Floating mini-CHP plants** — placed on pontoons for operation on water, which reduces the cost of land works.
5. **Mini-CHP plants with shielding** — equipped with additional protective structures for operation in harsh climatic or industrial conditions.
6. **Complexes with additional generation** — may include boiler rooms, heat recovery systems, and fuel modules (e.g., running on husks, wood chips, or biomass).

Each of these types has its own characteristics in terms of design, installation, and operation, which affects construction time, cost, and technical specifications.

Stages of mini-CHP plant construction

The process of constructing a mini-CHP plant includes the following mandatory stages:

1. Obtaining technical specifications (TS)

Technical specifications are a document containing requirements for equipment, materials, and technologies.

- Agreeing on connection parameters with network organizations (electricity, gas, heat) to determine the connection conditions.
- Preparing the necessary documents, including power calculations, planned loads, and equipment specifications.
- Obtaining official TC regulating connection to electrical, heating, and gas networks.

Once the technical specifications have been received, the development of project documentation begins.

2. Development of project documentation

Creation and coordination of design solutions and technical diagrams.

- Preparation of design solutions and technical diagrams. Development of drawings, diagrams, and technical solutions for construction.
- Approval by supervisory authorities. Interaction with regulatory authorities (Rostekhnadzor, Pozhnadzor,
- Rospotrebnadzor, etc.) to coordinate project documentation. Conducting state examination of project documentation. Submitting documents for examination and obtaining conclusions.

After successful completion of the expert review and approval of the project documentation, preparation of the construction site begins.

3. Construction site preparation

Preparation of the site for the start of construction work.

- Conducting engineering surveys. Studying the site to determine soil characteristics, terrain, and other engineering parameters.

- Developing a master plan. Creating a general construction plan, including the location of buildings, structures, and utilities.
- Preparing foundations for main equipment and clearing the site. Removing vegetation, debris, and other obstacles.
- Organizing access roads and temporary infrastructure. Creating temporary roads and infrastructure to provide access to the construction site.

Once the site has been prepared and all necessary permits have been obtained, excavation work can begin.

4. Earthworks

Work on creating pits and trenches for foundations and utilities.

- Digging pits and trenches. Preparing bases for foundations and utilities.
- Installing drainage systems. Creating water drainage systems.

After completion of earthworks and verification of compliance with design requirements, foundation construction begins.

5. Foundation laying

Creation of bases for equipment and buildings.

- Geodetic marking. Marking the territory for the precise location of foundations and equipment.
- Preparing foundations for main equipment. Creating foundations specifically designed for the installation of main equipment.
- Formwork construction, reinforcement, and concrete pouring. Creating forms for pouring concrete, installing reinforcement, and pouring concrete mix.
- Installing embedded parts and fasteners for further equipment installation.

After the concrete has set and the quality of the foundations has been checked, equipment installation begins.

6. Delivery and installation of equipment

Installation of main and auxiliary equipment.

- Delivery of main components (gas piston units, heat exchangers, control systems).
- Installation of equipment on prepared foundations.
- Connection of engineering systems and communications.

After completion of equipment installation and preliminary configuration, construction of buildings and structures begins.

7. Construction of buildings and structures

Erection of structural elements of buildings.

- Erection of walls and roof: Construction of main structural elements.
- Installation of internal partitions and finishing works: Completion of internal works.

After completion of construction works and quality control, installation of engineering networks begins.

8. Electrical installation works

Installation and commissioning of electrical, heating, ventilation, water supply, and sewerage systems.

- Laying cable lines and power lines.
- Connection of generators, distribution boards, and protective devices.
- Configuration of automation and dispatching systems.

After completion of the installation and testing of engineering networks, commissioning work begins.

9. Commissioning work

Checking and configuring equipment, trial runs.

- Checking all systems for leaks and operability.
- Adjusting operating modes.
- Training customer personnel.
- Conducting trial runs: Testing systems and equipment.

After successful completion of commissioning and obtaining all necessary permits, commissioning begins.

10. Commissioning

Each of these bodies has the right to conduct inspections, issue orders, and impose restrictions in the event of violations.

- Obtaining permits and certificates (commissioning certificates, energy passports) to start operating the facility.
- Conducting control tests and officially launching the mini-CHP plant.

- Transferring the facility to the customer.

After commissioning, regular maintenance and monitoring of the mini-CHP plant begins.

11. Service maintenance and monitoring

Official launch of the mini-CHP plant and start of operation.

- Continuous technical support.
- Remote dispatching and control of operating parameters.
- Scheduled repairs and technical maintenance.

These stages ensure consistent and organized work performance, which is critical for the successful construction and commissioning of mini-CHP plants.



construction of mini-CHP plants

Proprietary development of the MKS Group of Companies

Block-modular mini-CHP plants are a proprietary development of the MKS Group of Companies and are distinguished by their high construction speed and operational flexibility. These power centers are manufactured in factory conditions, which significantly reduces construction time and installation costs. Thanks to their modular design, such stations can be quickly installed on prepared sites and easily scaled up if necessary.

Advantages of block-modular assembly

The main advantages of block-modular solutions:

1. Reduced construction time due to factory-ready modules.
2. Simplified transportation and installation, as the equipment is delivered in the form of ready-made blocks.
3. Flexible configuration options for various operating conditions.
4. High maintainability thanks to the modular structure.
5. Increased reliability, as all components and systems are pre-tested at the factory.
6. Possibility of integrating additional modules, such as heat recovery systems, boiler rooms, and emission control systems.

Type of mini-CHP plant	Design	Capacity (MW)	Application	Advantages	Disadvantages
Stationary	Capital buildings	1-25	Industrial enterprises, large residential complexes	High reliability, possibility of installing heavy equipment	Long construction period, high cost of foundations
Block-modular	Factory production, quick assembly	0.5-10	Industrial facilities, remote areas	Quick installation, high maintainability, flexibility in scaling	Limited capacity, dependence on assembly quality
In noise protection enclosures	Compact modules with noise-absorbing protection	0.5-5	Cities, areas with high noise requirements	Low noise level, mobility	More complex maintenance, high cost of enclosures
Floating	Pontoon platforms	1-15	Coastal areas, rivers, lakes	Minimal land work costs, flexible placement	Complex maintenance, increased sealing requirements
With shielding	Reinforced structures with protective screens	1-25	Industrial areas, harsh climatic conditions	High equipment protection, resistance to external influences	High cost, complex installation

With additional generation	Integration with boiler rooms, heat pumps	1-25	Industrial enterprises, agricultural complexes	High efficiency, use of secondary resources	Complex maintenance, high equipment cost

Construction timeframes for mini-CHP plants

Thanks to the use of modular technologies and the twenty years of experience of the MKS Group of Companies, the construction of mini-CHP plants usually takes one calendar year. This includes the entire cycle from the preparation of technical specifications, development of project documentation, approvals, installation work to commissioning procedures and commissioning.

The timing of specific stages may vary depending on the type and size of the facility, site conditions, configuration features, and required approvals. The table below shows the approximate timing for a typical project with a capacity of up to 25 MW:

Project stage	Deadlines	Key influencing factors
Obtaining technical specifications	1–2 months	Speed of interaction with network organizations
Development of project documentation	2–3 months	Project scope and complexity, expert review
Construction site preparation	1–2 months	Engineering surveys, foundation preparation
Equipment installation	1–2 months	Type and quantity of equipment, logistics
Electrical installation work	1 month	Complexity of electrical networks and automation systems
Commissioning work	2–3 weeks	System features and staff training
Commissioning	2 weeks	Obtaining permits

Thus, the total project implementation period is approximately 9–12 months, which is significantly faster than traditional solutions thanks to the use of modular technologies and the comprehensive approach of the MKS Group of Companies. This allows customers to start reaping the economic benefits of their own electricity and heat generation more quickly.

Features of the terrain for the construction of mini-CHP plants

When constructing mini-CHP plants in difficult climatic and geological conditions, specific requirements for foundations, materials, and equipment must be taken into account. For example, in northern regions, reinforced thermal insulation, frost-resistant materials, pipeline heating systems, and backup fuel equipment are used to maintain stable operation in low-temperature conditions. In areas with high humidity, corrosion protection, reinforced sealing of cable entries, and air dehumidification systems are required to prevent damage from condensation and material decay.

In desert and steppe areas, protection against overheating, dust protection, the use of dry coolers to reduce evaporation, and special filtration systems to prevent air intake systems from clogging with sand and dust are required. In earthquake-prone regions, reinforced foundations, anti-vibration supports, additional equipment fastenings, and automatic emergency shutdown systems are used.

Special requirements apply to the construction of mini-CHP plants in marshy areas, where the soil has low bearing capacity and high humidity. In such conditions, pile foundations (drilled, screw, or reinforced concrete) are used, which are driven into solid rock to ensure stability. Additionally, slab foundations with reinforced reinforcement are used for even load distribution, which prevents settlement and skewing of equipment. Drainage systems are necessary to remove groundwater, and methods such as the use of geotextile materials, cementation, or injection grouting are used to increase the bearing capacity of the soil. Constant monitoring of subsidence using geodetic equipment is also mandatory to prevent accidents.

Environmental standards and innovative technologies

The MKS Group of Companies implements modern technologies aimed at improving environmental safety in its mini-CHP projects. The use of gas piston units, such as the MWM TCG 2020, ensures high efficiency and low emissions. Our company develops and applies its own purification systems, including low-noise silencers and Cyclone gas purification units, which help reduce environmental impact.

Regulatory control and supervision of mini-CHP plant construction

Key regulatory documents

The construction of mini-CHP plants is subject to strict regulatory control. The key documents governing this process are:

Federal Law No. 190-FZ "On Heat Supply"	establishes rules for the design, construction, and operation of heat and power facilities.

Federal Law No. 123-FZ "Technical Regulations on Fire Safety Requirements"	defines measures to ensure fire safety.
Decree of the Government of the Russian Federation No. 87 of February 16, 2008	regulates the composition and procedure for developing project documentation.
SNiP 41-02-2003 "Heating Networks"	contains requirements for the design and construction of heating networks.
SP 89.13330.2012 "Gas Distribution Systems"	establishes standards for the design and installation of gas pipelines.

The supervisory authorities are:

Authority	Functions
Rostekhnadzor	Checks compliance with technical regulations and safety requirements.
Pozhnadzor	Monitors compliance with fire safety regulations.
Rospotrebnadzor	Responsible for sanitary and epidemiological safety.

Each of these bodies has the right to conduct inspections, issue orders, and impose restrictions in the event of violations.

Stages of mini-CHP plant construction supervision

The construction of mini-CHP plants in Russia is supervised by several government agencies and involves several key stages:

1. Preliminary coordination and obtaining permits

During the project preparation stage, it is necessary to compile and approve a package of documentation, which includes:

- Technical specifications (TS) from network organizations (gas, electricity, heat).
- Environmental impact assessment (EIA) of the project.
- Feasibility study (FS) of the project, confirming its profitability.
- Positive conclusion of the state environmental review.
- Building permit issued by local authorities (district or city administration).

2. Review and approval of project documentation

Project documentation undergoes mandatory state review, which checks:

- Compliance of design solutions with safety and reliability requirements.

- Environmental safety (checked by emission levels and impact on the environment).
- Energy efficiency of the facility.
- Compliance with building codes (SP, SNiP, GOST).
- The main regulatory authorities at this stage are:
- Rostekhnadzor (supervision of the safety of technological processes and equipment).
- Pozhnadzor (fire safety control).
- Rospotrebnadzor (sanitary and epidemiological control).

3. Control during the construction phase

During construction, compliance with building codes and regulations, the quality of materials and equipment, and the accuracy of design solutions are monitored. This includes:

- Control of geodetic accuracy during foundation laying.
- Quality control of welded joints in pipelines and metal structures.
- Testing of automation and dispatching systems.
- Checking the reliability of power cable fastenings and electrical equipment connections.
- Those responsible for control at this stage may include:
- The customer's technical supervision.
- Construction control engineers (SRO).
- Representatives of local government authorities.

4. Acceptance and commissioning

Before commissioning the facility, it is necessary to undergo a final inspection, which includes:

- Carrying out start-up and commissioning works.
- Checking the operability of all engineering systems.
- Drawing up equipment acceptance certificates.
- Obtaining energy passports and other permits.
- Conducting tests for compliance with the declared power and reliability parameters.
- The final operating permit is issued by Rostekhnadzor and local authorities.

Legal formalities for the construction of a mini-CHP plant

Main stages of legal formalities

The legal formalities for the construction of a mini-CHP plant are a complex and multi-stage process that requires careful documentation and interaction with numerous government agencies.

The first important step is to register the project itself and obtain a construction permit. To do this, an application is submitted to the local architectural and construction control authorities, accompanied by a complete set of project documentation, including a positive conclusion from the state expert review.

The next stage is coordination with environmental and sanitary authorities. Here, it is necessary to obtain permits confirming that the project complies with environmental legislation and sanitary standards. Without these documents, further work is impossible.

A very important element is the contractual basis with resource suppliers — the gas supply company, power grids, and heat supply organizations. Concluding contracts with these entities regulates issues of connection, tariffs, the volume of resources supplied, and the responsibilities of the parties.

During the construction process, technical supervision is carried out by both the customer and independent organizations — certified self-regulatory organizations (SROs). Supervision ensures compliance with all norms and standards, which is recorded in special reports and acts.

Upon completion of construction, it is necessary to obtain acceptance certificates for the work performed, as well as technical passports for the facility, which confirm that the mini-CHP plant is ready for operation. To this end, a series of tests and commission inspections are carried out with the participation of representatives of regulatory authorities.

It is mandatory to obtain licenses and certificates for the operation of energy equipment, which are issued by Rostekhnadzor and other relevant authorities. The availability of these documents is the legal basis for the lawful operation of the mini-CHP plant and a guarantee of compliance with safety requirements.

Table of stages of legal formalization of mini-CHP plant construction

For a better understanding, below is a table with the main stages of legal formalization of mini-CHP plant construction, supervisory authorities, and deadlines for their interaction:

Legal formalities stage	Main regulatory authorities	Description of actions	Approximate timeframes	Legal significance

Obtaining a building permit	Local architectural control authorities	Submission of documents, project approval, obtaining a permit	1-3 months	Mandatory permit to commence work
Approval of environmental documentation	Rosprirodnadzor, local environmental protection services	Obtaining conclusions and permits confirming environmental safety	1-2 months	Guarantee of compliance with environmental standards
Obtaining sanitary and epidemiological conclusions	Rospotrebnadzor	Verification of compliance with sanitary standards, issuance of sanitary conclusions	1 month	Ensuring public health safety
Concluding contracts with resource supply organizations	Gas and electricity companies	Determining the terms of gas, electricity, and heat supply	Depends on contracts	Regulation of commercial and technical relations
Technical supervision and control	SRO, customer technical inspections	Conducting regular inspections, drawing up technical supervision reports	During construction	Ensuring quality and compliance with standards
Obtaining licenses and certificates	Rostekhnadzor, Ministry of Energy	Obtaining permits for equipment operation	1-2 months after completion of construction	Right to legal operation and safety guarantee

Geography and project implementation experience

Since its foundation in 2005, MKS Group has implemented more than 61 projects with a total capacity of over 300 MW throughout Russia, from the Kaliningrad Region to the Chukotka Autonomous Okrug. This demonstrates the company's high level of expertise in adapting solutions to various climatic and geological conditions.

Conclusion

Mini-CHP plants from the MKS Group of Companies are an efficient and environmentally safe solution for supplying enterprises with heat and electricity. Their flexibility, scalability, and adaptability to various conditions make them an attractive choice for your enterprise.