

Create clean heat



RM-Invest



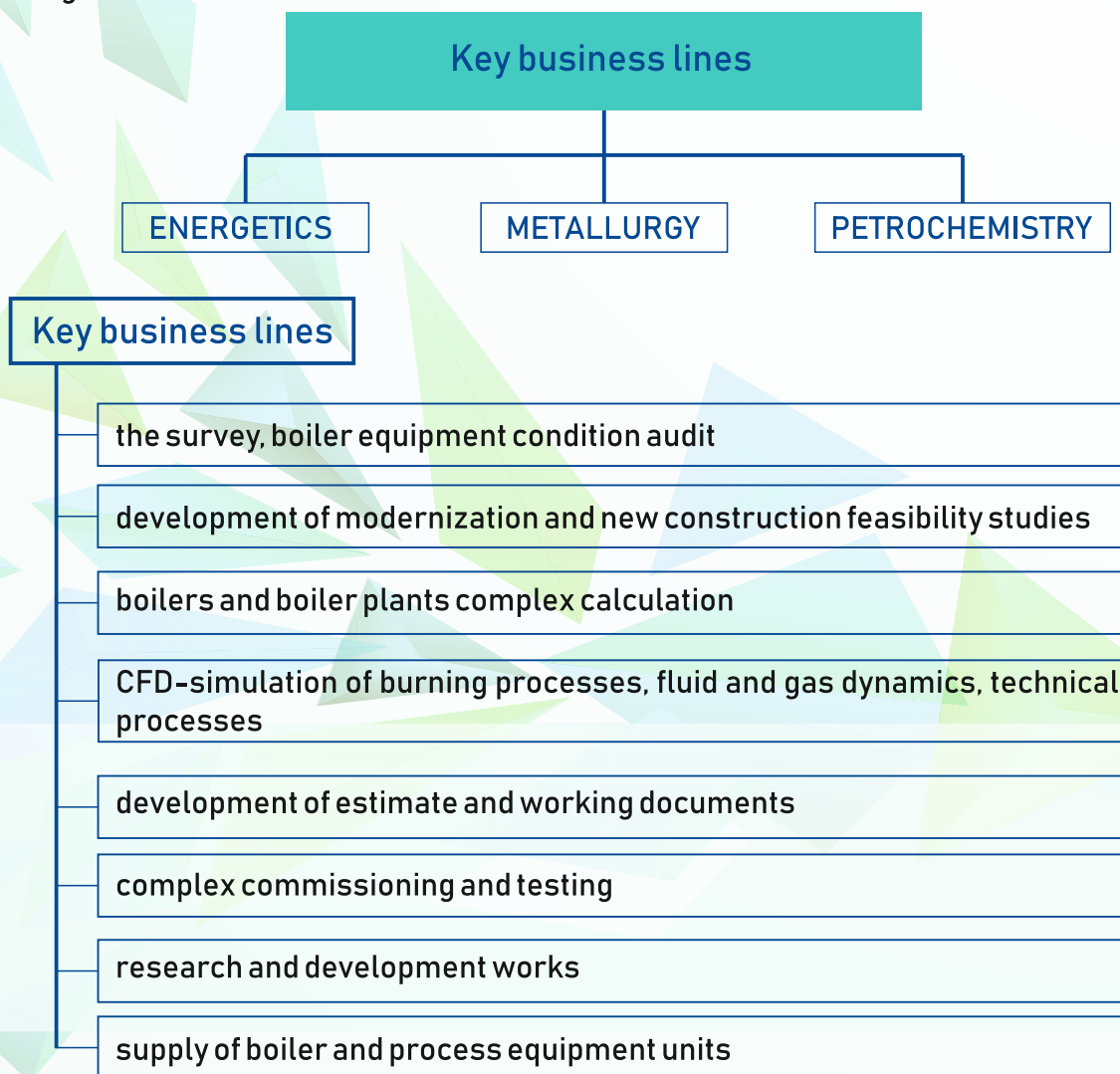
ZIO-COTES

# History

## Key business lines


ZiO-COTES Company was founded in 2009 by employees of the boiler section of COTES Company. The main shareholder and customer is Podolsk Machine Engineering Plant JSC (ZiO JSC), the largest boiler plant in Russia.

More than 200 works have been executed within 10 years of work in the market of Russia, CIS and neighbouring countries.





# Licenses, certificates, intellectual property

 Licenses issued by a self-regulatory organization (licenses for performing works at highly dangerous and process complicated facilities as well as licenses for commissioning);

 ISO 9001:2015 quality management system



 16 Russian patents for inventions and utility models



 Employee appraisal and professional improvement

 More than 200 articles published by the company's employees



# Material and technical support in the field of engineering



## CFD-simulation

Computing cluster with Intel Xeon E5-2683 V4 processors:

Total estimated peak performance (Rpeak): 6.45 TFOPS

Total number of cores - 192

Total DDR4 main memory capacity - 768 GB

Total data storage system volume - 64 Tb

ANSYS commercial licenses:

Fluent - 3 pcs (V12, V16, V17)

HPC Pack - 6 pcs

Mechanical - 1 pc

CFD PrepPost - 2 pcs (V16, V18)

Design Modeler - 1 pc

ICEM CFD - 1 pc



SigmaFlame commercial licenses - 2 pcs



## Designing

Kompas 3D V14

SolidForks

NanoCAD 5.1

NormaCS

APM FEM

Lira 10 version 6

Grand-smeta 6.0.4.7953

Techexpert



# Material and technical support in the field of maintenance

Gas sensors:

TESTO-330-2LL

TESTO-340

MRU Optima 7



Differential pressure gauges:

TESTO-510

TESTO-512



Tachometer TESTO-470

Thermocouple thermometers:

TESTO-922

TESTO-925

TESTO-735-1



Absorption pyrometers:

PROMIN-M1

Dust collection systems

Prandtl tubes

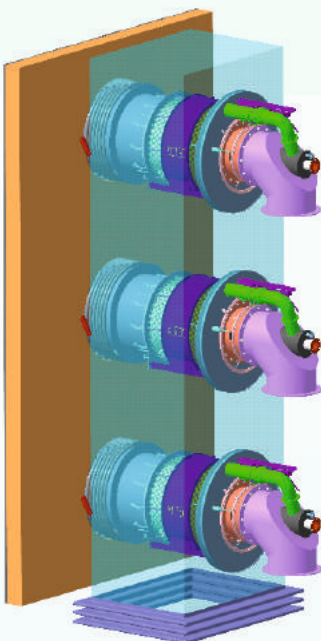
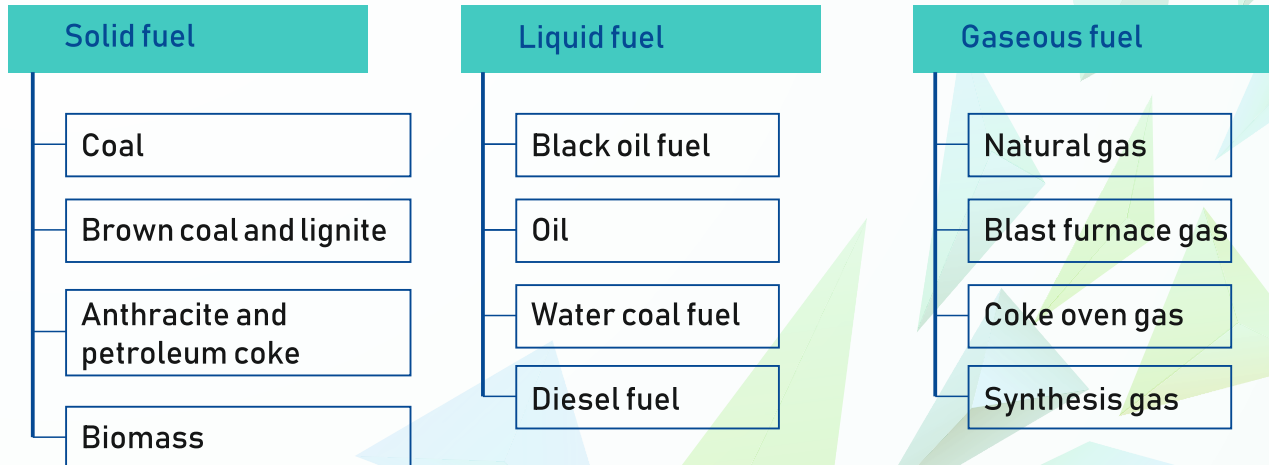




# DESIGNING

## Staged combustion systems and low-emission burners

Our main specialization is the development and design of phased combustion systems. We work with all types of fossil fuels:

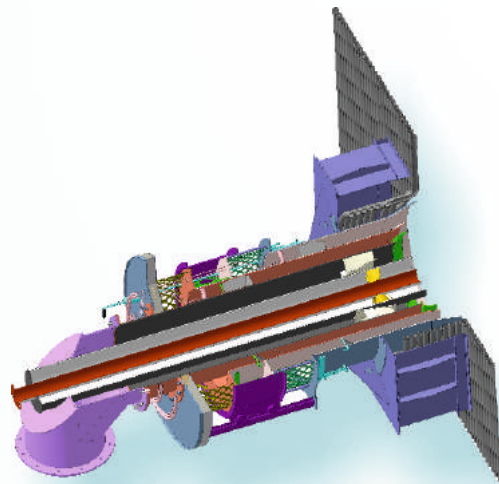
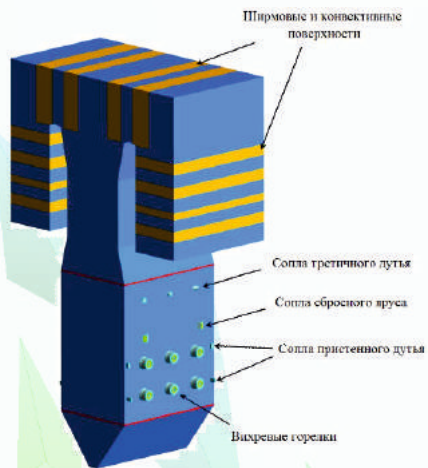


The main tasks in burners and combustion devices designing are:

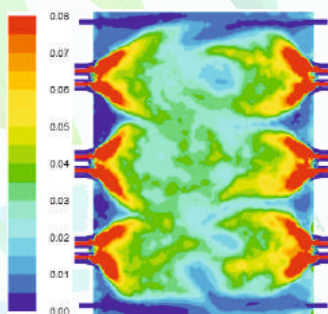
- ensuring low NO<sub>x</sub>
- smooth combustion in a wide range of loads
- small losses from chemical and mechanical underburning of fuel
- fuel flexibility (possibility of a wide range of fuels)
- reliable operation of furnace screens on the conditions of slag, corrosion and overheating

# DESIGNING

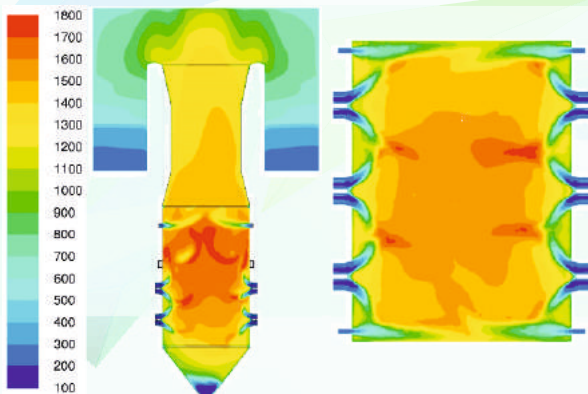
## Vortex burners for stone and brown coals



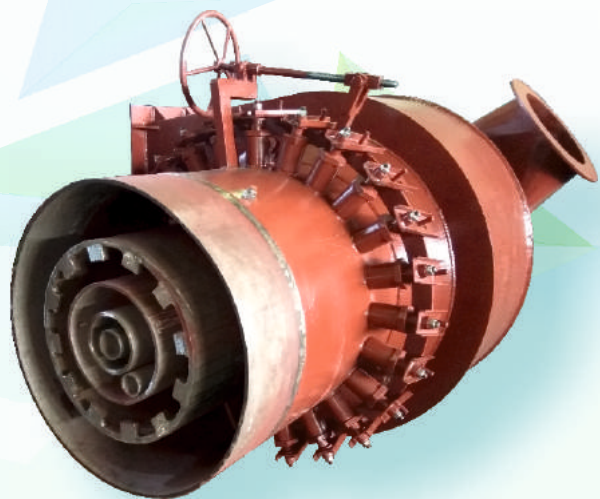
3D model of multi-channel vortex burner



Area of solid particles concentration on the burner tier, kg/kg



Temperature fields in longitudinal and horizontal sections of firing hood, °C



Burner with increased stability of the torch

Torch of coal-dust boiler 75 t/h

Before replacing burners



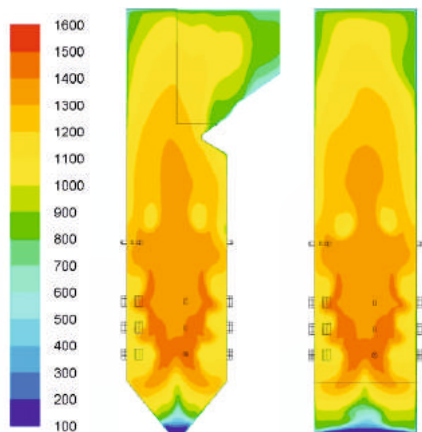
Burners of ZrO-COTES



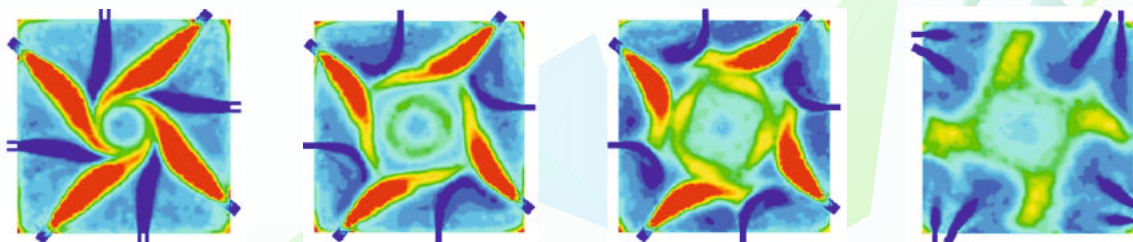
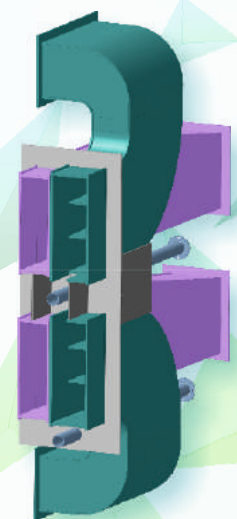
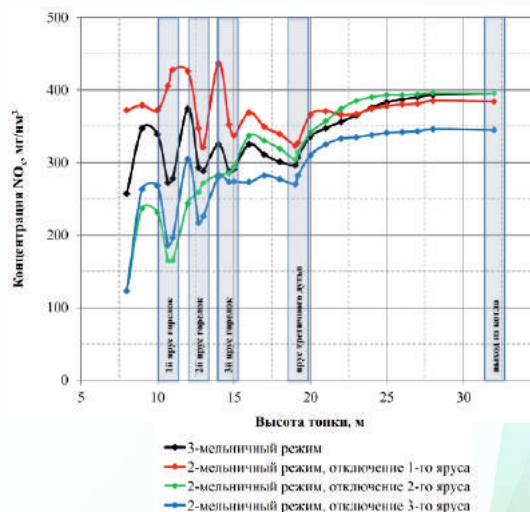


# DESIGNING

## Straight-flow burners for coal-fired boiler

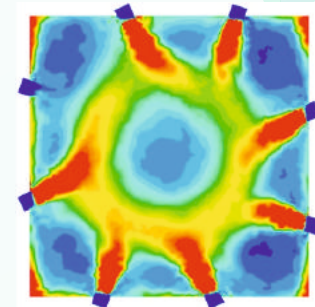
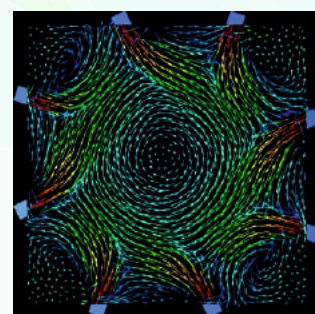
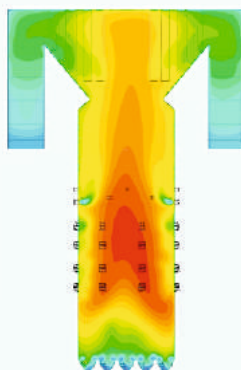
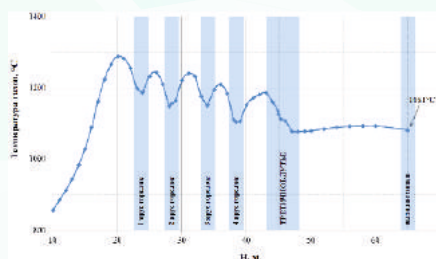
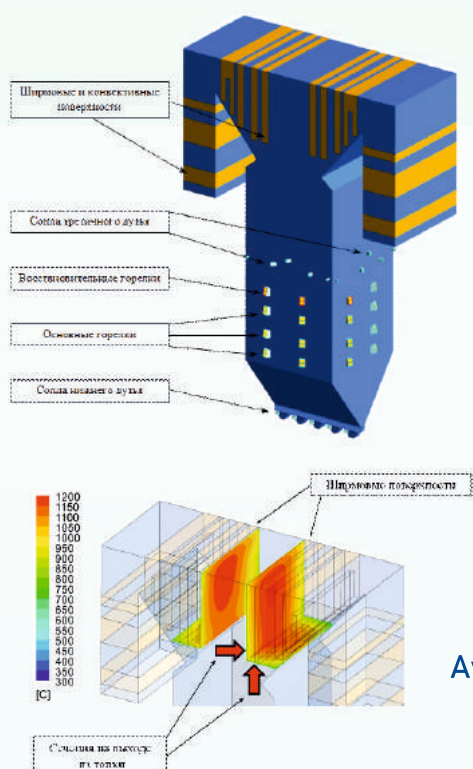


Temperature fields, °C



Dispersion phase concentration fields,  $\text{kg/m}^3$

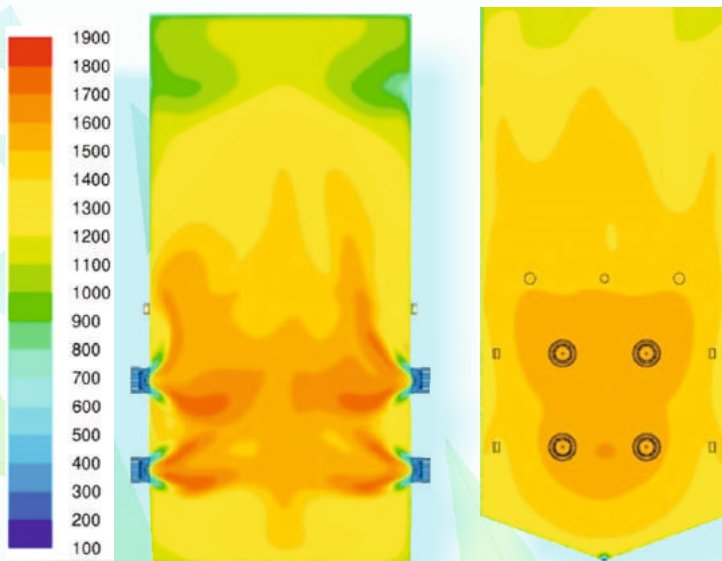
## Straight-flow burners for brown-coal-fired boiler



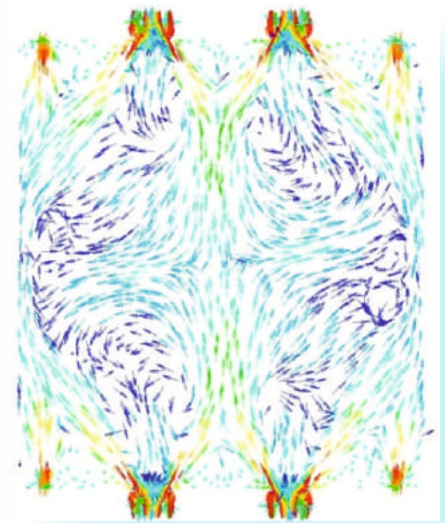
Average temperature range in the furnace height, vector velocity field on the burner tier, temperature field in the longitudinal section of the furnace, field of dispersion phase concentration on the burner tier

# DESIGNING

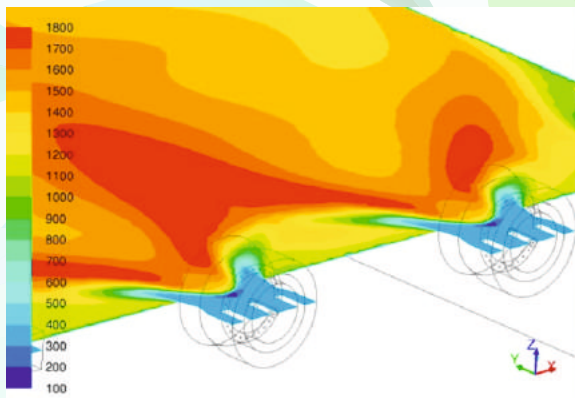
## Burner devices for gas-and-oil-fired boilers



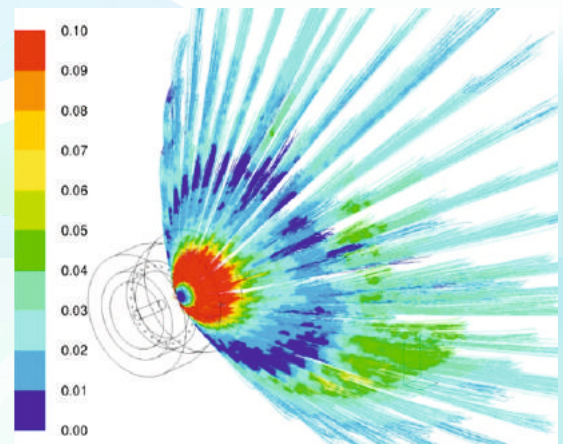
Temperature field in the axial section of the furnace and the burner axis, °C



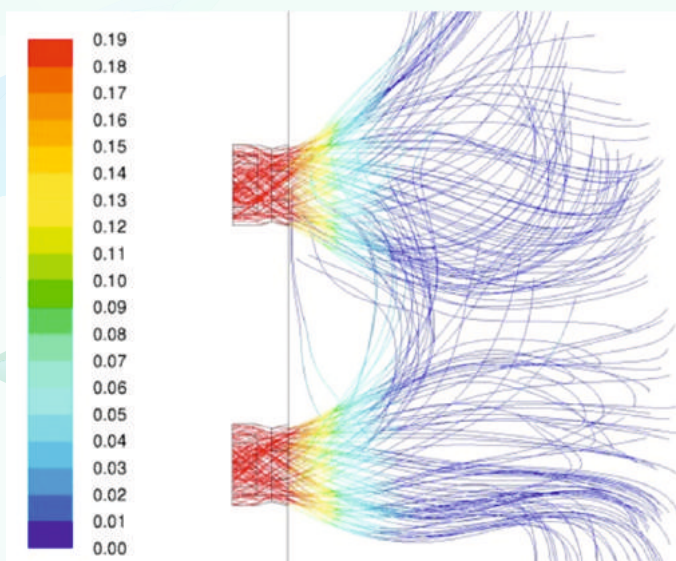
Vector velocity field on the tier



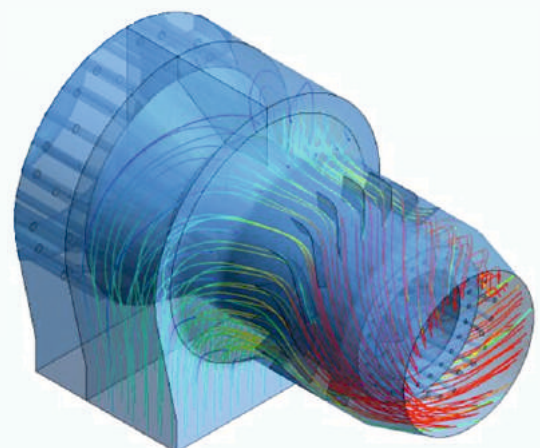
Temperature field on the burner tier, °C



Fluid fuel spraying from the nozzle



Air current lines on the burners of the 1st and 2nd tier



Burner current lines

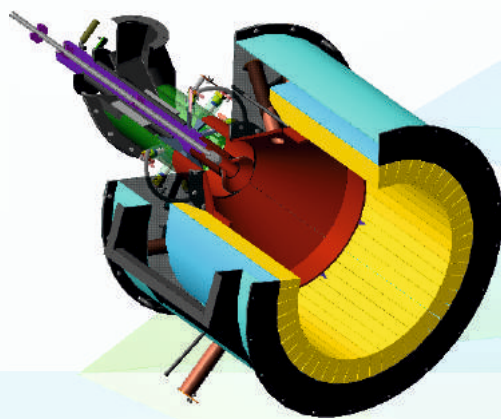


# DESIGNING

## Reduction of coal-dust boilers' technological minimum

Muffle lighting system allows to refuse lighting a pulverized fuel flame with black oil fuel and to reduce boiler's minimum load to 25–35% from nominal load at work on pulverized coal fuel under combustion stability. Technological solutions at the design stage are worked out by three-dimensional mathematical modelling of furnace processes.

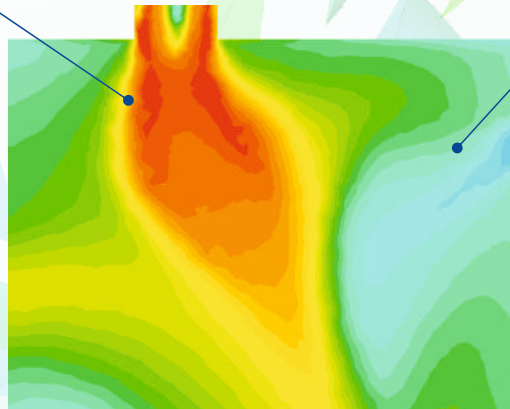
Muffle burner. General view



Muffle burner  
Torch



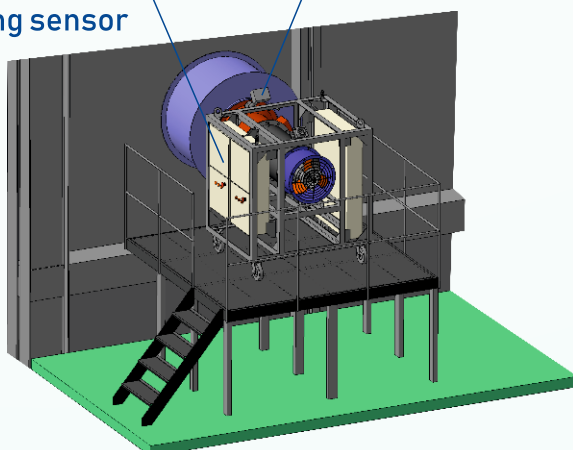
Main burner  
Torch



## Pulverized-coal burners for boiler ignition without black oil fuel

Cabinets Power  
supply and control  
monitoring sensor

Torch control  
sensor

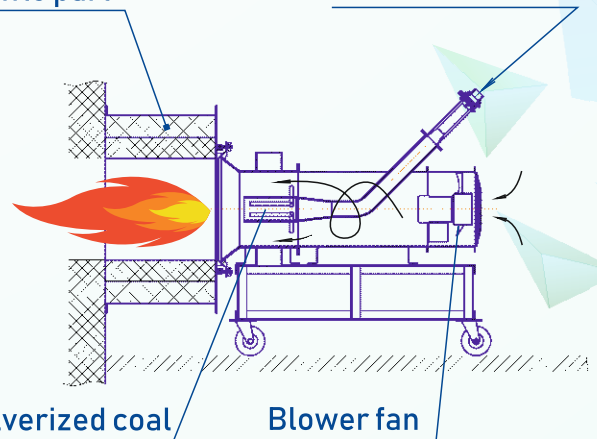


Muffle part

Dust air mixture

Pulverized coal  
fuel's plasma  
igniter

Blower fan



# DESIGNING

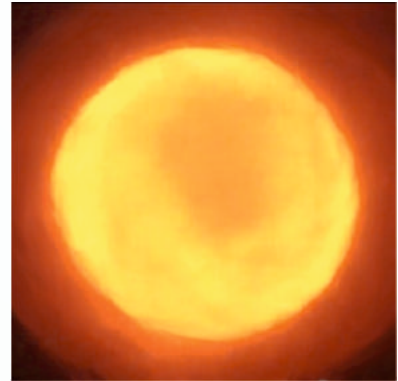
## Coal-water fuel combustion technology

ZiO COTES LLC holds calculated scientific studies and experimental development in the field of water-coal boilers burning.

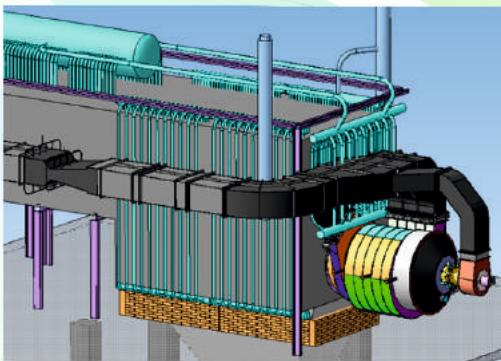
### Flame combustion



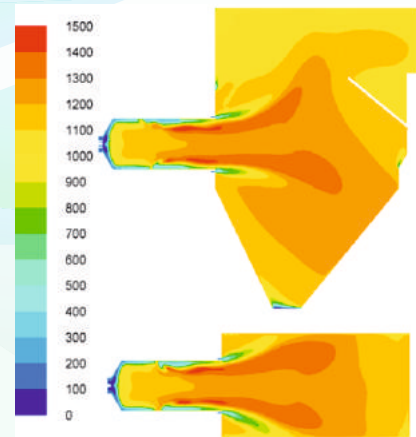
Coal-water fuel combustion stand



Coal-water fuel flame combustion

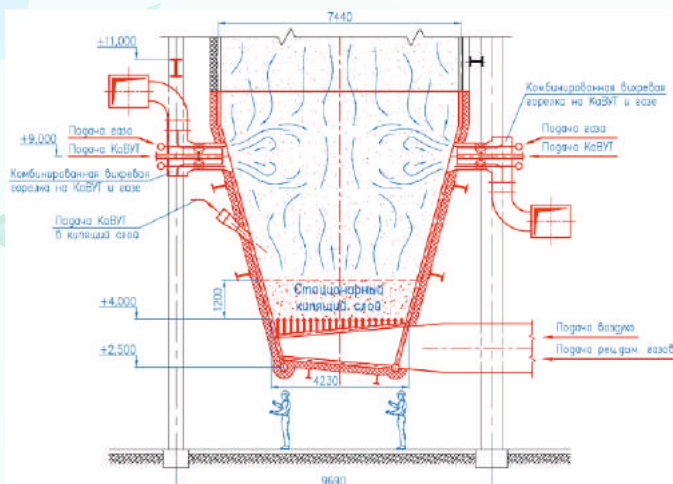


Installation of vortex furnace extension on the boiler



Temperature field when combusting coal-water fuel, °C

### Fluidized bed combustion technology



Fluidized bed combustor with vortex burners



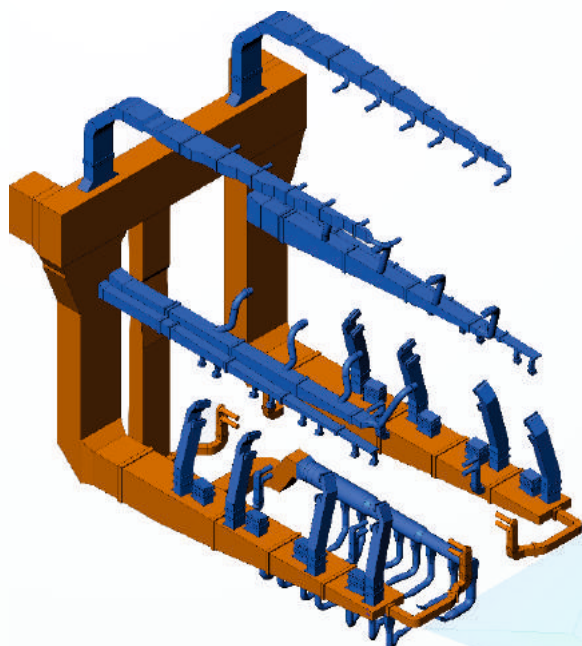
Coal-water fuel burning in the fluidized bed



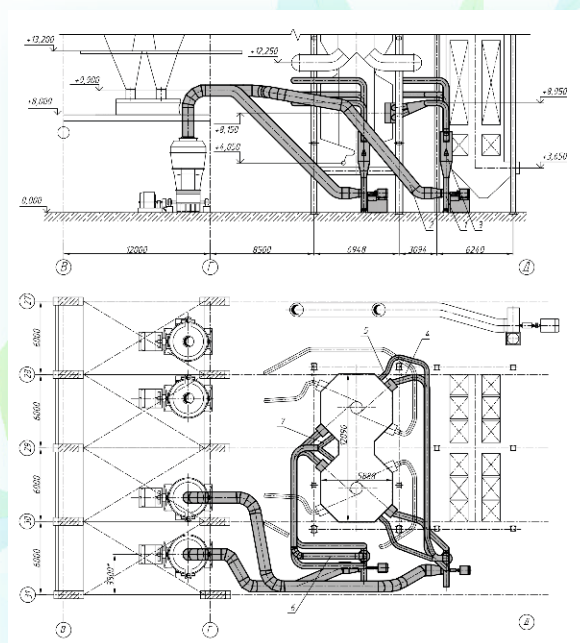
# DESIGNING

## Pulverized-coal system and dust-gas-air lines

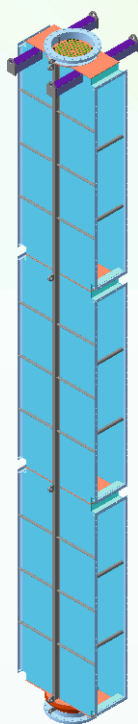
New boiler systems of large electricity generating units and grinding mills require the use of complicated agent distribution systems (coal dust, air, drying agent). We ensure compliance with any requirements of the technological process through detailed engineering and SRO-calculations.



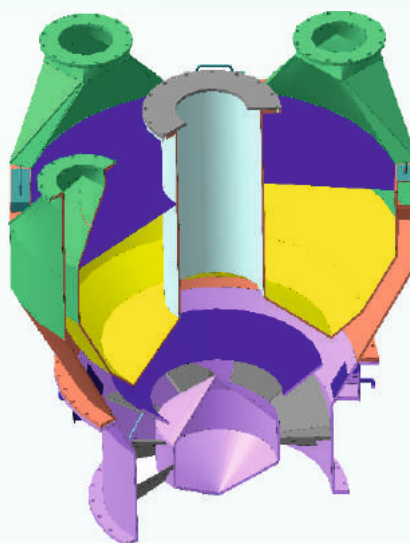
Air distribution system on the power unit boiler 300 MW



Fuel distribution through *dividers* - dust concentrators when combusting wet wood waste



Ready coal dust cooling section of the alumina refinery plant

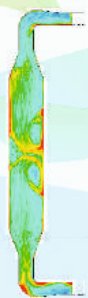
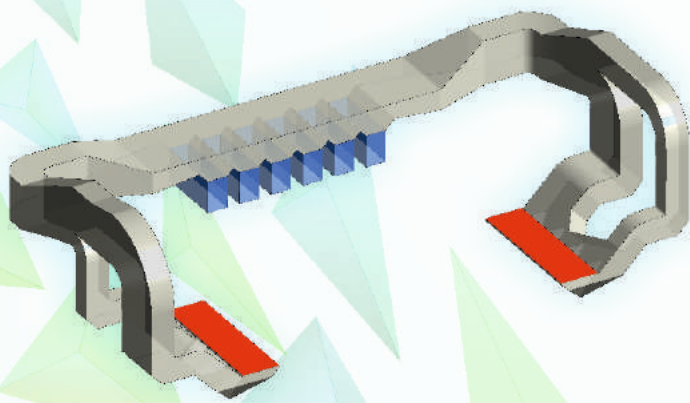


Centrifugal dust distribution device for boiler

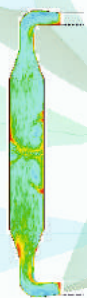
# DESIGNING

## Optimization of flues, dust pipes, air circuits

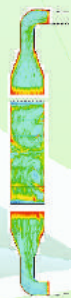
To improve the reliable performance of the auxiliary equipment, to reduce the cost of repairs, the number of accidents, cost of their wear, and to increase efficiency, the water passage and flue arrangement are optimized.



Cross section above the center

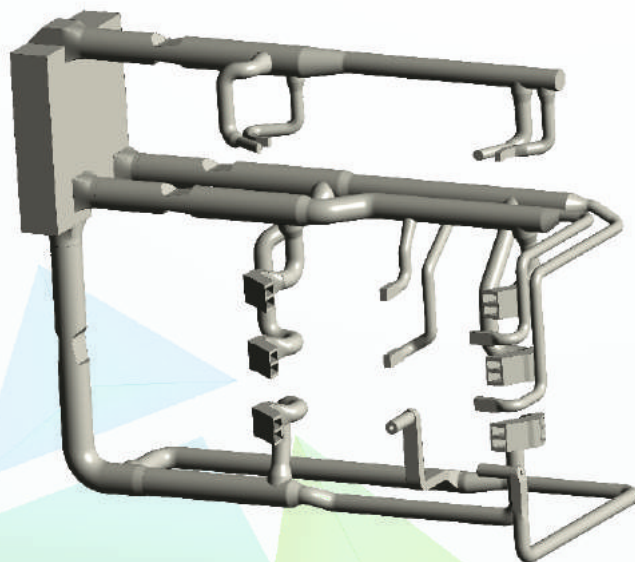


Cross section in the center

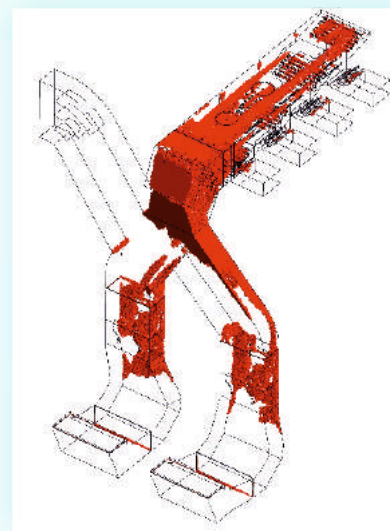
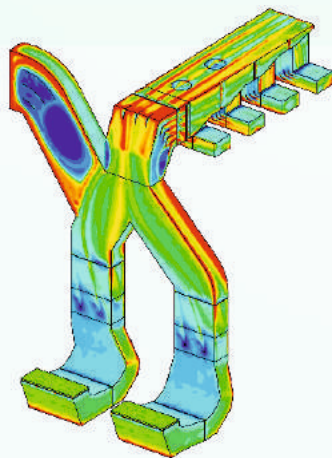
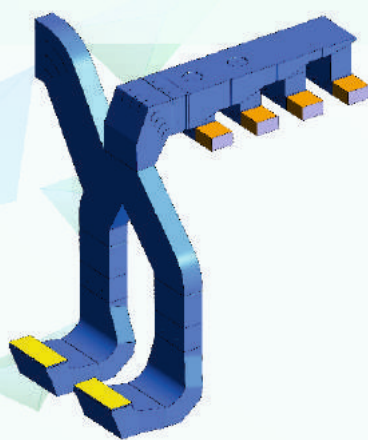


Cross section below the center

Ash particles simulation at the air heater inlet  
Power unit 200 MW



Air path resistance optimization and power consumption reduction of the blow fan



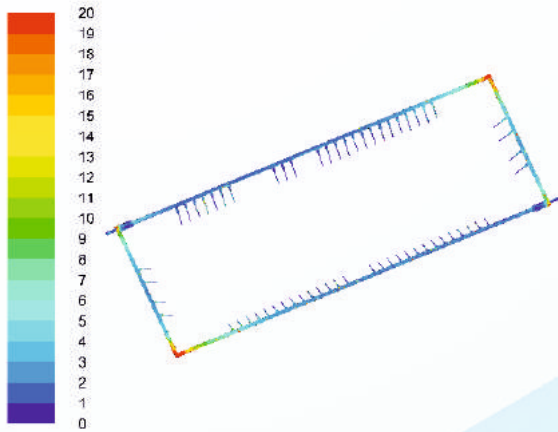
Location of high abrasive wear areas and gas flue surface from the boiler to the bag filter of unit 500 MW



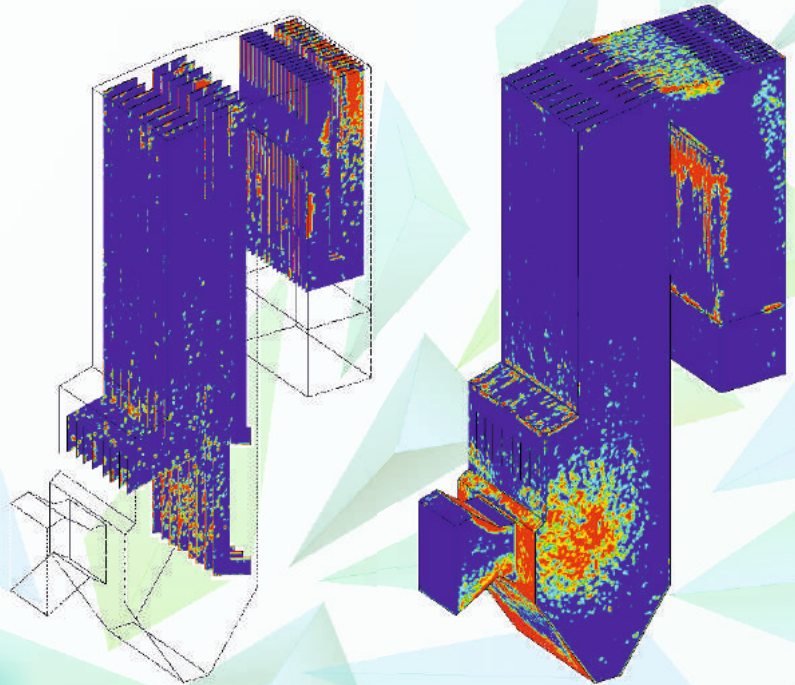
# DESIGNING

## Metallurgic furnaces and waste-heat boilers

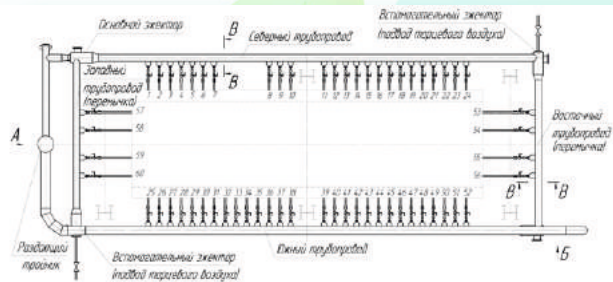
Design of technological processes in the field of metallurgy is a significant figure in the specialization of the employees of ZiO COTES LLC. Coal fuel grinding mills are similar in metallurgy and power engineering. Technological processes also have general principles in many ways.



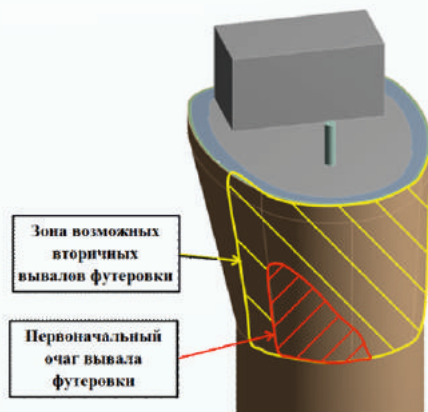
Simulation results in the form of solids concentration, kg/m<sup>3</sup>



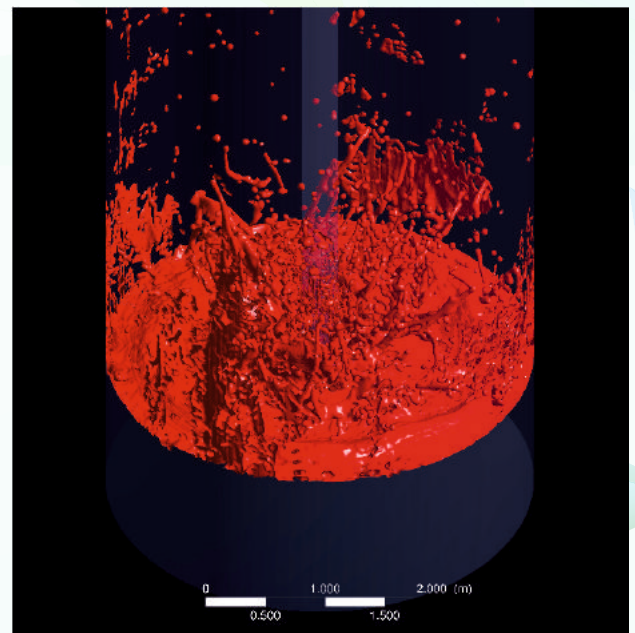
Location of recovery boiler's intense slagging areas



Development of the working project of the dust distribution system modernization in the slag-sublimation furnace



Location of refractory facing inrush areas depending on the thermal stress distribution

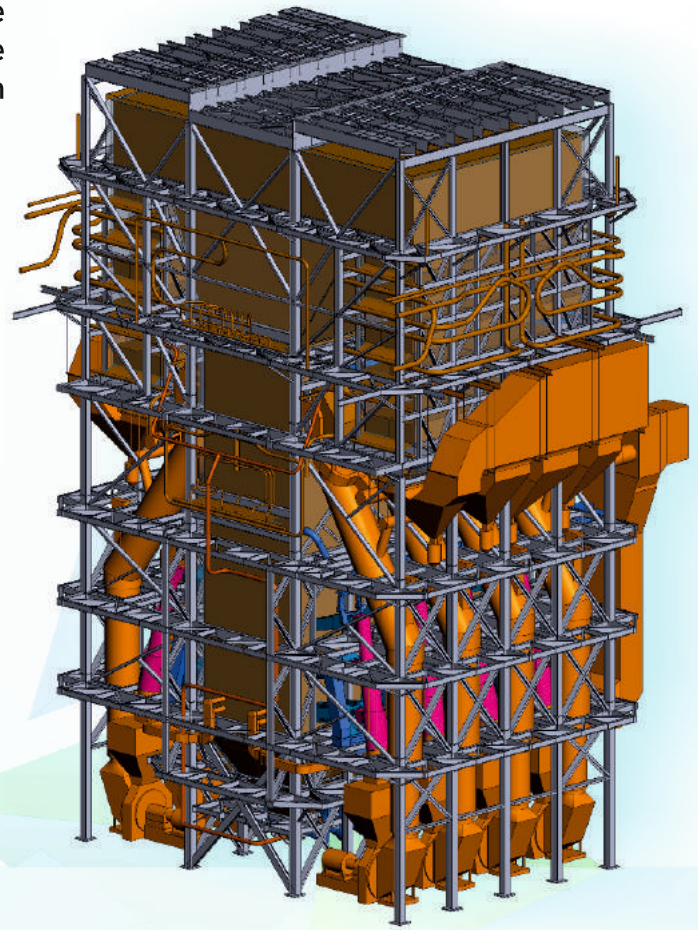
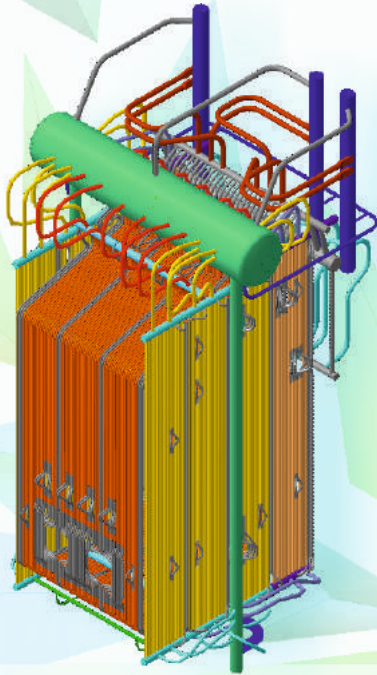


Dynamic modelling of the melt in the copper smelting furnace to determine the conditions of slag drops ingress into the transition flue

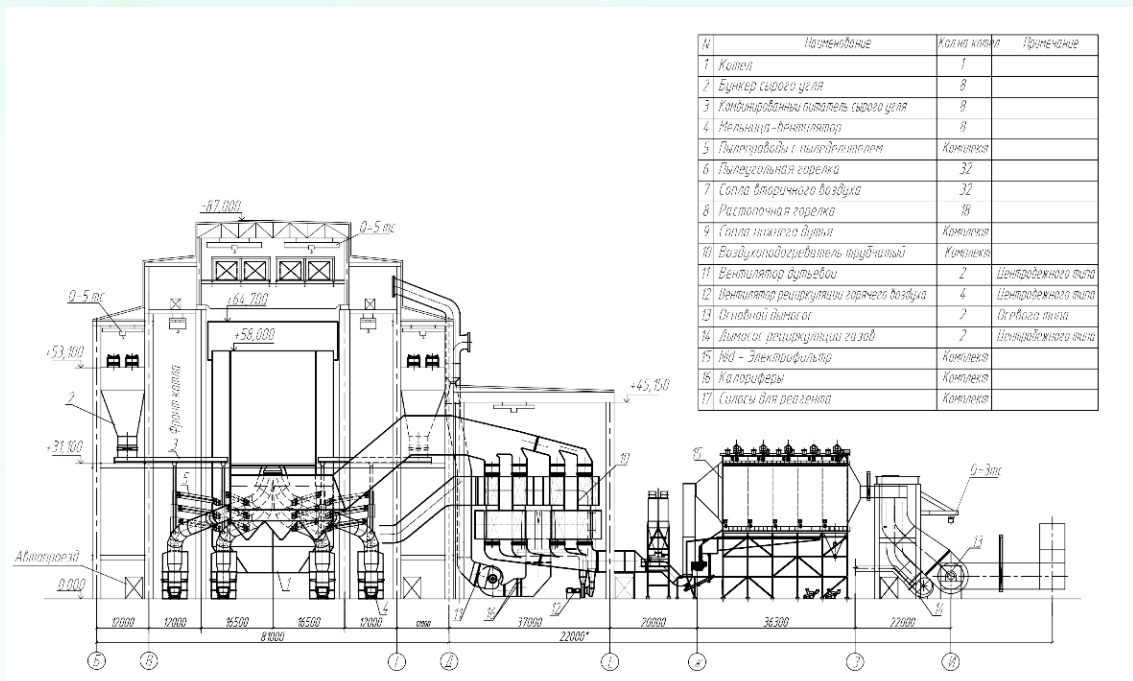
# DESIGNING

## Design and detailed documentation development

Each of our projects ends with the development of documentation to make possible the manufacturing, ordering equipment, assessing the project costs and the construction and installation works.



Complex 3D design



Boiler system design and layout



The image displays a set of architectural drawings for a building project. The drawings include:

- Top Left:** A detailed section of a wall and roof assembly, showing structural elements and insulation. It includes dimensions and material specifications.
- Top Right:** A detail view of a roof edge or corner, showing the connection between the roof and the wall. It includes dimensions and material specifications.
- Middle Left:** A large floor plan of a rectangular building. It shows the layout of rooms, corridors, and structural elements. Dimensions are provided for the overall footprint and internal spaces.
- Middle Right:** A section of a building, showing the internal structure and the relationship between different levels. It includes dimensions and material specifications.
- Bottom Left:** A detail view of a window or door frame, showing the connection between the frame and the wall. It includes dimensions and material specifications.
- Bottom Right:** A series of detail views showing various connections and components, such as roof eaves, wall corners, and floor transitions. Each detail includes dimensions and material specifications.

The drawings are presented in a technical, black-and-white style, typical of architectural blueprints. They include various lines, symbols, and text to convey the design and construction requirements of the building.










[illegible]

## 15

# Adjustment

ZiO COTES LLC commissions boiler systems with a steam capacity of 50–2650 t/h at coal-dust and oil-gas power units of HPP and HES.

Main types of work:

-  Inspection, audit and rapid testing of the main and auxiliary equipment of boiler plants before and after repair/reconstruction with developing measures to improve the combustion efficiency and stability, reduce slagging, increase steam production, etc.;
-  Boiler plant equipment commissioning;
-  Prestart steam-water-oxygen cleaning and passivation (PSWOC & P) of heating surfaces, development of technological schemes and design documentation for PSWOC & P;
-  Balance, process flow tests of the boiler systems equipment with process flow diagrams development;
-  Warranty test;
-  Experimental combustion of beyond-design fuels and development of recommendations and conclusions concerning the possibility to use these fuels in future;
-  Development of starting, commissioning and operational documentation (instructions), chief adjustment;
-  Development (adjustment) of power characteristics of the boiler equipment, warranty tests;
-  Operating personnel training.

## Reference list

Boiler	Quantity of works	Country
P-67 (800 MW)	2	Russia
P-57 (500 MW)	7	Russia, Kazakhstan
PK-39-II (300–325 MW)	4	Russia, Kazakhstan
P-64 (300 MW)	6	Bosnia and Herzegovina, Uzbekistan
P-59 (300–330 MW)	2	Russia
P-65 (200 MW)	2	Macedonia
PK-40 (200 MW)	1	Russia
TPE-216 (200 MW)	5	Russia
BKZ-820 (820 t/h)	2	Russia
BKZ-420 (420 t/h)	8	Russia, Kazakhstan
BKZ-320 (320 t/h)	4	Russia
BKZ-280 (280 t/h)	1	Kazakhstan
PK-38 (150 MW)	4	Russia
PK-20 (220 t/h)	1	Ukraine
PK-10 (210 t/h)	4	Russia
BKZ-75 (75 t/h)	6	Russia, Mongolia
E-50 (50 t/h)	2	Russia
TsKS-35 (35 t/h) China	1	Mongolia



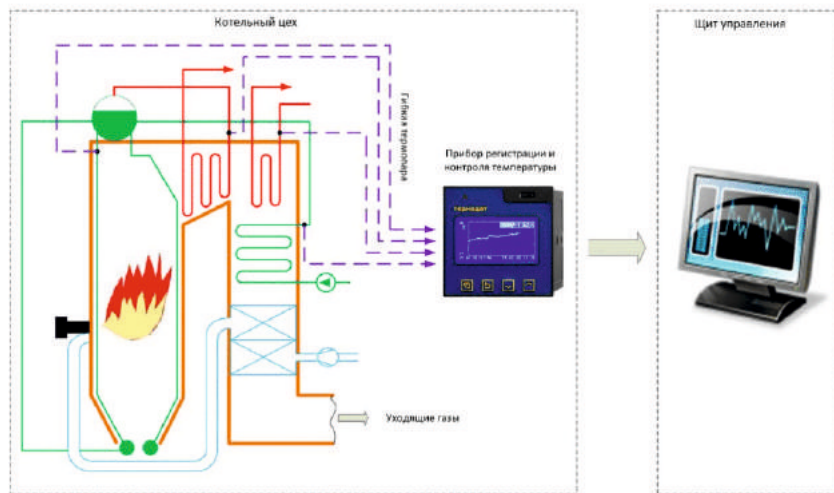


# Temperature registration complex

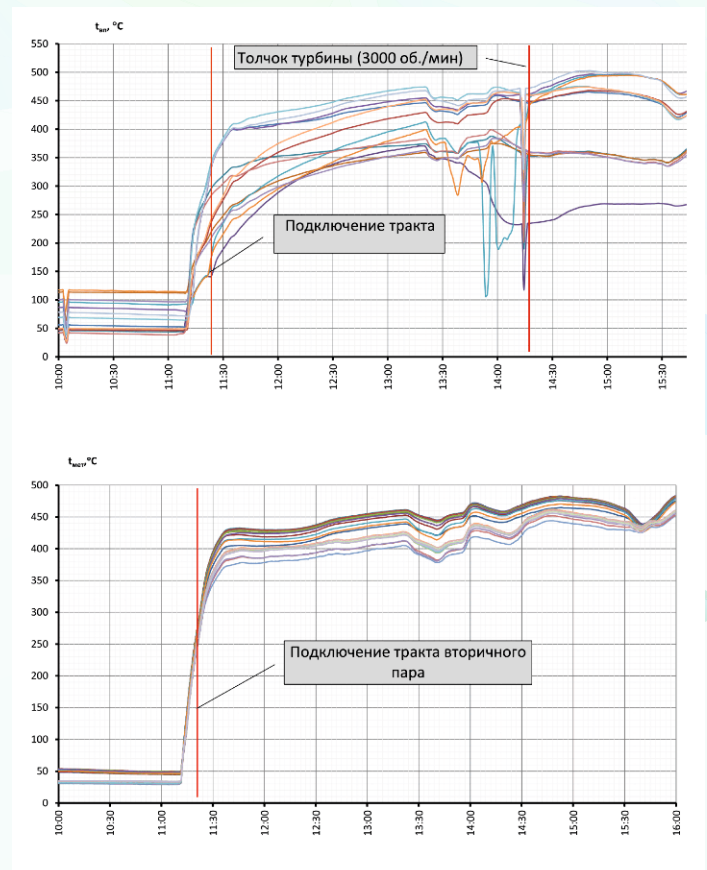
The temperature recording system allows estimating in real time the metal operating temperature of the newly mounted heating surfaces after the boiler's existing heating surfaces modernization.

The complex allows making performance tests after replacing the packages and optimizing the furnaces and burners operation. The principal objective of the complex is to point out the dynamics of metal's temperature changes dynamics over time and the upsets on the cross-section of the flue.

Early detection of thermal upsets and temperature excursions allows to increase the metal service life and to avoid significant costs for the repair works related to emergency shutdowns of the boiler.



Along with temperature control, ZiO COTES LLC produces a detailed study of the distribution of the gas temperature field to the heating surface for a deeper analysis. The results obtained with an integrated approach in identifying causes for the temperature upset are more reliable.










Representative in Europa:



**RM-Invest**





**ZIO-COTES**

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