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| ДП УКРНТЦ   |   | SE UKRRTC  |
| <b>ЕНЕРГОСТАЛЬ</b>  |  | <b>ENERGOSTAL</b>  |
| ДЕРЖАВНЕ ПІДПРИЄМСТВО<br>«УКРАЇНСЬКИЙ НАУКОВО-ТЕХНІЧНИЙ ЦЕНТР<br>МЕТАЛУРГІЙНОЇ ПРОМИСЛОВОСТІ «ЕНЕРГОСТАЛЬ»  |    | STATE ENTERPRISE<br>«UKRAINIAN RESEARCH & TECHNOLOGY CENTER<br>OF METALLURGY INDUSTRY «ENERGOSTAL» |
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**MAIN TRENDS OF WORKS AND SERVICES  
OFFERED FOR IMPLEMENTATION  
AT ENTERPRISES IN THE IRON AND STEEL,  
ENGINEERING, METAL MINING  
AND OTHER INDUSTRY SECTORS**

SE “UkrRTC “Energostal” is the organization under projects of which a number of metallurgical, Ferro-alloy, pipes and refractory manufacturing plants of former USSR and other countries are built and are operating under developed technologies – in the present time is the largest engineering complex in Ukraine and CIS countries in the field of development of new, reconstruction and modernization of functioning enterprises and production facilities of mining and smelting complex, engineering and other sectors; creation of new productions, technologies and processes; industrial ecology; energy efficiency; use of secondary resources; industrial and domestic wastes recovery. A number of developments of SE “UkrRTC “Energostal” are widely known outside CIS countries and have made great contributions in the development of metallurgy worldwide. The most famous achievements of the center are:

- for the first time in the world the steel continuous casting plant was developed, built and commissioned;
- for the first time in the world high efficiency evaporative cooling of metallurgical units was developed and implemented;
- for the first time in Europe the technology of pig iron production with coal injection in blast furnace was developed;
- first blooming mills and sintering plants were developed and built;
- for the first time in the USSR the system of entirely closed (zero-discharge) reverse water supply of industrial enterprises;
- powerful branch of iron-and-steel industry of USSR was created – Ferro-alloy manufacturing;
- for the first time in the USSR technologies and equipment for production of roll-formed shapes were developed and implemented on metallurgical enterprises;
- for the first time in the USSR the technology of production of rail of high operational reliability was developed and mastered;
- for the first time in the USSR technologies of rolling on the universal beam mill were developed and implemented;
- at the absolute majority of metallurgical plant of CIS countries high efficiency technologies developed by the Center of rolling production, thousands of new efficient hot-rolled and roll-formed shapes;
- for the first time in the USSR several generations of adjustable equipment, technological processes and tools for processing of the number of types of metallurgical production of high-duty were developed and implemented on metallurgical enterprises;

- for the first time in the USSR control systems and cleaning of technological gases and unorganized emissions with use of bag hoses with impulse regeneration etc. were developed and implemented.

Present offer includes the list of main trends of works and services, which may be implemented on the enterprises of ore mining and smelting (and other branches) industry (ref. attached List)

Overwhelming majority of technologies and equipment listed in the List are patented in Ukraine and Russia. These developments also contain know-how and engineering and may be submitted to the Customer as at concluding of the corresponding contracts, and as under license agreement for transfer of know-how and engineering.

Virtually all technologies and equipment created by SE “UkrRTC “Energostal”, including unique software complexes for the automated process control systems, are protected as copyright objects and may be handed over to the Customer within the framework of concluding license agreements.

Throughout the entire above-cited list, the Center is ready to provide the Customer with a full complex of works and services on a “turnkey” basis – starting from scientific research, development of technologies, designing, engineering and manufacturing of equipment up to its delivery and commissioning operations.

The level of scientific and technical products developed by SE “UkrRTC “Energostal” is characterized by hundreds of successfully implemented projects in practically all the ferrous metallurgy plants, as well as at numerous enterprises of machine building, power engineering, transport, chemical production and other segments of industry in Ukraine, former USSR and far-abroad countries. The Center has sold 96 licenses, under which unique industrial complexes were created and are currently operated in Australia, Belgium, Great Britain, Germany, Spain, Italy, India, Canada, Luxembourg, the Netherlands, USA, Japan and other countries.

**Main trends of works and services that are offered for realization at metallurgical, engineering, ore mining enterprises and other industry sectors**

| №№<br>III   | Name of works, services  | Stages of executed works and rendered services |   |  |                                 |                                     |   | Novelty, efficiency, special features of technology and productions, completeness of offers and etc.  |
|---|--|--|---|--|---------------------------------|-------------------------------------|---|---|
|   |  | Technology development                         | Full set of complex project works including designer supervision  | Development, manufacturing and supply of equipment | Construction and erection works | Commissioning works, staff training | Warranty, post-warranty service maintenance |   |
| 1   | 2  | 3  | 4   | 5  | 6                               | 7                                   | 8   | 9   |
| <b>1. General design/establishment of new plants and industrial complexes</b> |  |  |   |  |                                 |                                     |   |   |
| 1.1   | Creation, start-up of new metallurgy, ferro-alloy, pipe, fireproof, metal plants that as per technical and economical indexes correspond to modern level of technical development. | +  | Complex development of project documentation for construction of object in all parts of a project including basic and detail engineering, designer supervision of construction. | +  | +                               | +                                   | +   | <ul style="list-style-type: none"> <li>- Construction of new modern metallurgy plants including mini- and micrometallurgy plants that operate on local raw materials using metal scrap of ferrous and non-ferrous metals;</li> <li>- usage of modern energy efficient technologies in all ranges;</li> <li>- production of high quality metal products providing production profitability at the level of leading world enterprises;</li> <li>- usage of free-waste and low waste technologies;</li> <li>- realization of highly efficient of low cost energy efficient measures;</li> <li>- maximal use of secondary energy resources including own-produced waste;</li> </ul> |

**Remark:** "+" – SE "UkrRTC "Energostal" executes this kind of work or services in full scope;

"-" – doesn't execute

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| <b>2. Sintering production</b>    |   |   |   |   |   |   |   |   |
| 2.1                               | Construction of new and modernization of existing sinter plants with the purpose to get required capacity, quality sinter and reduction of hazardous substances emissions to the atmosphere | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- preparation of sinter mixture with homogenization of material as per grain composition, weight measuring (reduction of fuel consumption on 5-7%, coke consumption at cast iron production 7-8 %);</li> <li>- sintering treatment in high layer, its cooling, crushing, screening (the fuel consumption reduces on 6-8%, dust lost from layer, the completeness of fuel combustion);</li> <li>- after-sintering mixture with crushing, cooling on ring-type and line coolers, multi screen separation;</li> <li>- localization of dust emissions at overloads and raw material treatment with cleaning in bag filters;</li> <li>- weight measuring with automation control of mixture components which due to permanence in basicity and chemical structure allows increase productivity on 1-2%, reduce expenses of solid fuel on 1,8-3,5 kg/t of sinter;</li> <li>- use of preliminary processed mixture, that allows to reduce on 2-3% coke consumption and increase blast furnace productivity;</li> <li>- decrease of dust concentration in purified smoke gases from 50 to 20 mg/nm<sup>3</sup> due to installation of bag hoses after rotary, shaft furnaces and fluidized-bed kilns;</li> <li>- intensive mixing and pelletizing of the mixture.</li> </ul> |
| 2.2                               | Creation and start-up of sinter gas cleaning systems from dust and sulfur compounds.  | + | + | + | + | + | + | Reduction of emissions of sulfur dioxide on 90 % and dust up to values, which correspond to world standards.  |
| <b>3. Blast-furnace processes</b> |   |   |   |   |   |   |   |   |
| 3.1                               | Creation of new and modernization of existing blast-furnace shops and furnaces with   | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- Actual blast furnace with the top arrangement;</li> <li>- Designing of new constructions of cooling of blast furnaces, including the instrumentation</li> </ul>  |

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|   | required productivity. |   |   |   |   |   |   | <p>and automatics (Instrumentation), automated process control systems (APCS ) at application of one of ways of cooling:</p> <ul style="list-style-type: none"> <li>- demineralized water in the closed cycle;</li> <li>- vapour cooling system;</li> <li>- service water;</li> <li>- combined integral cooling system of various sections of a blast furnace: demineralized water with service water, vapour cooling with service water (or demineralized water) etc.;</li> <li>- top arrangement equipment with cone-free furnace-charging gear with nitrogen suppression of emissions at furnace loading.</li> <li>- Casting yards:</li> <li>- designing of casting yards of blast furnaces of the round and traditional right-angled form;</li> <li>- installation of launders of cleaning of pig-iron and slag, allowing to apply modern highly resilient refractory body, modern hydro equipment of launders, completely mechanize all cast house works;</li> <li>- application of highly effective aspiration systems with installation both fabric filter and electrostatic precipitators;</li> <li>- providing casting yards with installations of a graining of slag.</li> <li>- Mixture supply system :</li> <li>- Designing of modern conveyor mixture supply with disposing of mixture materials in the constrained conditions of the acting blast-furnace plants, which allow to use not only cold, but also hot sinter (to 800 °) with aspiration of emissions to atmosphere and utilization of a ferruginous waste; supply of mixture to the furnace mouth is carried both skips, and conveyor transport;</li> <li>- Installation of new modern high-temperature hot-blast stoves with gas and combustion air</li> </ul> |

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|     |  |   |   |   |   |   |   | heating units;<br>– Designing and installation of new highly effective systems of the blast-furnace gas cleaning with application of gas utilization compressorless turbines for the power production;<br>– Designing of installations of the deep sulphur elimination of pig-iron with use of any reagents or installation of 'wire feeding machine' with aspiration of harmful emissions;<br>– Designing of the complexes of casting machines and warehouses of cold pig-iron;<br>– Designing of input ventilation of premises and air conditioning systems;<br>– implementation of water chemical refining projects to meet the demands of cooling of blast furnaces;<br>– development of designs of the electric-power supply and electric lighting of the blast furnaces complex. |
| 3.2 | Creation and start-up of devices for preparation and blowing of pulverized coal fuel (PCF) in blast-furnace furnaces | + | + | + | + | + | + | – Reduction of natural gas consumption for 100 m <sup>3</sup> for 1t of pig iron with possibility of complete withdrawal of oil gas from blast process;<br>– reduction of coke consumption below 170 – 200 kg per 1t of pig iron.<br>– Possibility of blowing into the blast furnace mixture of different kinds of coal..  |
| 3.3 | Creation and start-up of sludge dewatering facilities of blast-furnace gas cleaning                                  | + | + | + | + | + | + | – Ready slag may be recovered at sinter plant (by way of return to sinter and blast-furnace production)<br>– Liquidation of sludge discharge to sludge tank.   |

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| <b>4. Steel melting production</b> |  |   |   |   |   |   |   |  |
| 4.1                                | <p>Creation of new and modernization of existing steel melting productions:</p> <ul style="list-style-type: none"> <li>- electric-furnace melting shops with electrical furnaces with capacity 25-200 t;</li> <li>- converter shops equipped with converters wit capacity 50-350 t with modern gas exhausting ducts;</li> <li>- areas of melted steel secondary treatment at ladle-furnace and vacuum vessel (chamber, batch and circulation);</li> <li>- continuous steel casting departments with continuous casting machine (CCM) including:               <ul style="list-style-type: none"> <li>- billets of CCM with pass quantity from 3 to 8 (blank section from square 100x100 to 200x200 mm, round billet with diameter from 200mm to 500 mm and others);</li> <li>- slabs of CCM with pass quantity from 1 to 2 (slab sections 100-300x1000-2000 mm and others);</li> <li>- blooms of CCM (bloom sections 250x350 and others);</li> </ul> </li> </ul> | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- implementation of modern steel melting technologies of wide steel grades;</li> <li>- installation of electrical arc furnaces of large unit power with melting length of 30-35 min.;</li> <li>- implementation of secondary steel treatment technology and vacuum treatment (reducing specific power consumption on 3-5 kW h/t of steel);</li> <li>- implementation of deep high-voltage input 110 kV directly on furnace transformer instead of traditional 35 kV;</li> <li>- implementation of direct current furnaces that allowing reduce consumption of power, firebrick, electrodes, exclude expensive filter-compensative devices and others;</li> <li>- implementation of technology of preliminary scrap heating with process gases;</li> <li>- implementation of converters of large unit power up to 350 t;</li> <li>- equipment of gas exhaust ducts of converters with highly efficient cooling stacks for converter gases (OKG), gas cleaning system;</li> <li>- increase of converter capacity, highly efficient waste gas cleaning, heat utilization of waste gases, partial or full after-combustion of carbon oxide, converter gas recovery with operation “without after-combustion”;</li> <li>- use of modern furnace cooling systems;</li> <li>- implementation of circulating water supply system;</li> <li>- use of combined blowing in converter (with oxygen-over through lance, with inert gas through bottom) providing saving of slag-forming, cast iron, ferro-alloys and increase of metal yield;</li> </ul> |



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|     |  |   |   |   |   |   |   | <ul style="list-style-type: none"> <li>- implementation of cast iron desulphuration technology;</li> <li>- transfer of the part of purifying operation and metal alloying to pouring ladle (addition of bulk material and ferro-alloys to ladle at tapping, secondary steel treatment);</li> <li>- use of production wastes as slag-forming and additive materials (palletizing into dust pellets from gas cleanings and addition of pellets to charging materials);</li> <li>- hot cast iron supply to converter shop in movable mixer ladles that provides increase of cast iron temperature that poured into converter on approx. 50 °C;</li> <li>- use of special modes of heating of ladle lining before receipt of melted metal up to 1100-1200 °C, that decreases refractory consumption;</li> <li>- use of modern two-level automation control system of technological process that provides receiving of carbon content and metal temperature at the end of the blowing that allows avoid additional converter shutdowns and heat losses when executing corrective operations, reduce consumption corrective additives during the melting.</li> </ul> |
| 4.2 | Construction of new and modernization of exciting gas treatment facilities behind technological aggregate with bag filters installation. |   |   |   |   |   |   | Reduction of pollutant emissions to atmosphere up to standard rates.   |
| 4.3 | One - two- and four-run wire addition systems for supply of the powdered wire in metal melt.   | + | + | + | + | + | + | Use of alternating-current motors with frequency speed control of twirl, compactness, profitability and reliability at a wide assortment of the wire and velocity band of supply of the wire.  |

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| <b>5. Rolling production</b> |   |   |   |   |   |   |   |  |
| 5.1                          | <p>Construction of new and modernization of exciting rolling productions with use of modern vacuum mills of hot and cold rolling:</p> <ul style="list-style-type: none"> <li>• small-size, large-size, hot-rolled plate, hot rolling mills including those with heat treatment in process stream;</li> <li>• rail and structural steel mill</li> <li>• wide strip mill;</li> <li>• And also for production of: <ul style="list-style-type: none"> <li>• electric-welded pipes,</li> <li>• molded sections</li> <li>• metalware production;</li> <li>• - wide range of section bars with low-tonnage lots including those from offgrade semifinished rolled stock</li> </ul> </li> </ul> | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- Rolling of strand directly from CCM (with exclusion of cake repartition), increase of the output of suitable and economy of fuel and energy resources (FER) - 10÷15 %;</li> <li>- Controllable rolling and adjustable cooling of high-quality and rolled sheet;</li> <li>- Use of "sliting-process", small-size blocks, systems of continuous monitoring of sizes and form of ready profile;</li> <li>- Equipment of mills with power efficient cooling systems, including completely closed, zero-discharge circulating water supply systems;</li> <li>- Equipment with modern highly effective systems of automated process control system and instrumentation;</li> <li>- implementation of the modern electric equipment, including systems of frequency regulating of speeds of the twirl providing energy saving to 5÷6 %;</li> <li>- Use of systems of a computer-aided design of processes (an optimality of the rolling shedule, drauhgting shedule, gaugings, etc.);</li> <li>- maximum approach of the vacuum mill to CCM, that provides economy of FER upto 70 kg u.t./t of rolling.</li> </ul> |
| 5.2                          | Rolling production technologies and equipment   |   |   |   |   |   |   |  |
| 5.2.1                        | Technology and equipment for production of high-quality and slab metal blocks on CCM (multiple-strand, combined)  | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- exclusion of cake repartition;</li> <li>- increase of the output of suitable production upto 10 %;</li> <li>- economy of FER upto 15 %.</li> </ul>  |
| 5.2.2                        | Production engineering and equipment for manufacture of transport metal (high-strength  | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- Enhancement of operational characteristics;</li> <li>- Contact-endurance strength for 15÷18 %;</li> </ul>   |

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|       | railway rails, linings, etc. aspects of rail braces): <ul style="list-style-type: none"> <li>• production engineering and equipment for manufacture of rails of the increased operational durability for work in especially heavy conditions;</li> <li>• production engineering of intensifier hardening of rails.</li> </ul> |   |   |   |   |   |   | <ul style="list-style-type: none"> <li>- wear resistances for 20÷25 % in comparison with extensional heat-treated.</li> <li>- Reception of rails with the raised Contact-endurance strength and wear resistance, economy of FER upto 18÷20 %.</li> </ul>   |
| 5.2.3 | Production engineering and equipment for deformative-heat processing of high-quality and rolled sheet in the stream of mills  | + | + | + | + | + | + | Improvement of the complex of mechanical properties and steel structure, reinforcement of rolling, decrease in expenses for alloying and high-heat treatment in furnaces.  |
| 5.2.4 | Production engineering and equipment for manufacturing of cold-worked profiles and wire in roller dies  | + | + | + | + | + | + | Energy-saving process of reception of the accurate mechanically reinforced profiles of the various form of the cross-section, including multiserial corrugated wire for reinforcement of concrete elements (CE).   |
| 5.2.5 | Technology and equipment for rolling molded section production of wide consumer orientation including perforated one.   | + | + | + | + | + | + | Receipt of increased production readiness output. Convenient installation, reliability in maintenance, interchangeability. Production of molded sections instead of hot rolled saving complex of physical and mechanical properties when amount of metal reducing up to 50% will provide increase of quality and other application properties. |
| 5.2.6 | Production engineering and equipment for manufacturing of elastic profiles  | + | + | + | + | + | + | Manufacture of elastic roll-formed sections with high strength properties and high quality of the surface promotes development of the space and special aspects of mechanics, tools and radio engineering, creation of ultralight transformable metalworks and systems.  |

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| 5.2.7                         | Production engineering and equipment for high-heat treatment of steel rolled spheres in diameter of 30-120mm, providing reception of volume hardness to 60HRC   | + | + | + | + | + | + | Use of steel rolled spheres of high hardness provides decrease in their specific consumption in comparison with spheres of usual quality at wet crushing of raw materials in 3-5 times, and at dry - at 5-10 times, decrease of transport charges and expenses for materials handling to 30 %.   |
| 5.2.8                         | Production engineering of special types of the rolled sheet with the corrugated surface of high industrial readiness  | + | + | + | + | + | + | Use in engineering industry and building of the rolled sheet with the corrugated surface provides economy of energy and labor expenditures to 40 % and more depending on the application range.  |
| <b>6. Ferroalloy Industry</b> |   |   |   |   |   |   |   |  |
| 6.1                           | Construction of new and reconstruction of existing ferroalloy plants; factories, workshops and separate departments for the manufacture of a broader assortment (more than 200 denominations) of silicon, chromium and manganese ferroalloys, complex hardeners with titanium, molybdenum, tungsten, niobium and other elements, with introduction of the ore-smelting electrothermy technology, refining processes in electric furnaces, methods of vacuum degassing, nitrogenization, metallothermy, electrolysis, hydraulic metallurgy, blending of flaming melts etc. Capacity of the installed electric furnaces ranges from 1,5 to 75 MBA and | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- Creation of new types of ferroalloys which are not produced in the given region;</li> <li>- organization of the manufacture of scarce types of ferroalloys, hardeners etc;</li> <li>- equipping of the ferroalloy furnaces with high performance gas cleaning facilities ensuring standard emissions;</li> <li>- introduction of circulating fully closed water supply systems;</li> <li>- output of fractionate finished products;</li> <li>- extensive application of “flaming” ferroalloy slags;</li> <li>- application of ferroalloy gas for electric power and steam generation.</li> </ul> <p>Installation of modern ferro-alloy electric furnaces to 75 MVA with airproof with low canopies, symmetric short net, use of "flaming" conversion alloys and gas</p> |

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|  | higher.   |   |   |   |   |   |   | cleaning system with bag hoses with impulse regeneration provide with power economy of technological energy for 3–5 %, increase of productivity to 25 %.<br><br>Preparation of ready ferroalloys in fractionated kind increases profitability of manufacture to 40 %. |
| <b>7. Technologies and Equipment of Metallurgical and Engineering Enterprises; energy-saving; automation; APCS</b> |   |   |   |   |   |   |   |   |
| 7.1  | Development of technology and commissioning of equipment for the manufacture of high-quality cast iron cylpebses with the nominal diameter of 8-60 mm and hardness of up to 62HRC.                          | + | + | + | + | + | + | Reduction in the consumption of batch materials to 10 %, economy of energy carriers up to 7 %, enhancement of performance properties (hardness, shock and wear resistance) up to 25 %.  |
| 7.2  | Development of technology, creation of the new age equipment, modernization of the operating equipment for heat treatment of metal products and details   |   |   |   |   |   |   |   |
| 7.2.1  | Development of the technologies for different kinds of heating, hardening, tempering, annealing and surface impregnation (cementation, nitrogenization, nitrogen case-hardening, catalytic nitrogenization) | + | + | + | + | + | + | Application of up-to-date energy-saving technologies, ensuring increase of operational characteristics of the products, saving of the heat energy up to 30 %.   |
| 7.2.2  | Creation of thermal sections for heating, heat hardening, release, annealing, surface impregnation  | – | – | + | + | + | + | Equipment of sections with modern production engineering and thermal equipment.   |
| 7.2.3  | Working out of the thermal equipment of new generation with electric and gas heating of various design for various types of heat treatment of metal, including vacuum treatment                             | + | + | + | + | + | + | Decrease of the energy consumption for 25÷35 %, heat treatment quality improvement.   |

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| 7.2.4 | Working out of the electrothermal equipment: <ul style="list-style-type: none"> <li>• The thermal vacuum equipment for drying and impregnating of active parts at manufacture and repair of power and measuring transformers;</li> <li>• Enamel units for manufacture of the enameled copper and aluminium wire</li> </ul> | + | + | + | + | + | + | Maintenance of high quality of a paper insulation, residual moisture content makes 0,2÷0,5 %.<br><br><hr/> High quality of electric insulation of the wire, decrease of the electric power consumption to 30 % due to catalytic oxydation (after-burning) of dissolvents of the varnish covering (xylene, toluene, etc.).   |
| 7.2.5 | Reconstruction and modernisation of the operating equipment, including transfer of gas furnaces to electric heating.   | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- Improvement of work and thermal balances of the thermal equipment, decrease of energy consumption for 25÷30 %. Improvement of the heating quality, full refusal from natural gas use in the equipment with the heating temperature to 1100°C. Exclusion of harmful emissions to environment.</li> <li>- Advantages of the electric heating:</li> <li>- high efficiency of use of thermal energy (HAF=1,0, heat-availability factor);</li> <li>- high uniformity and controllability of process of heating;</li> <li>- absence of harmful affecting of kiln gases on the surface of heated up products;</li> <li>- compactness of the construction, simplicity and convenience of service;</li> <li>- full absence of harmful emissions.</li> </ul> |

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| 7.3 | Creation and commissioning of casting shops and sections.   | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- increase of the output of suitable casting;</li> <li>- decrease in charcoal fumes of metal;</li> <li>- decrease of weight of handsheets on 10 %;</li> <li>- automation of forming operations;</li> <li>- implementation of technology of producing of small rods from cold solidified mixes under «cold-box» process;</li> <li>- implementation of modern molding machines of shock-free operation;</li> <li>- replacement of shaking molding machines by an automatic block line of pulsing forming;</li> <li>- implementation of manufacturing methods of rods with use of amin-processes;</li> <li>- decrease of quantity of attendants;</li> <li>- improvement of sanitary-and-hygienic working conditions.</li> </ul> |
| 7.4 | Working out of production engineering and commissioning of the equipment for manufacturing of high-grade rolled grinding spheres with diameter of 30-100 mm and volumetric solidity to 60HRC from carbonaceous and alloyed steel types. | + | + | + | + | + | + | <p>Use of induction heating of pre-form provides:</p> <ul style="list-style-type: none"> <li>- high efficiency of use of thermal energy;</li> <li>- high controllability of heating process;</li> <li>- absence of harmful affecting of furnace gases on the surface of heated pre-forms;</li> <li>- absence of harmful emissions to the environment.</li> </ul> <p>Increase of operational properties of grinding</p>  |

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|       |  |   |   |   |   |   |   | bodies for 20 %.<br><br>Economy to 10 % of power consumption at manufacture.   |
| 7.5   | Development, manufacturing, delivery and commissioning of the equipment. |   |   |   |   |   |   |  |
| 7.5.1 | Systems of removal and clearing of technological and aspiration gases.   | + | + | + | + | + | + | Bag hoses with pulsing regeneration with productivity of cleared gas up to 1500000 m <sup>3</sup> /hour, residual concentration of the dust in the cleared gases less than 20 mg/m <sup>3</sup> , temperature of cleared gases upto 250°C. |
|       |  | + | + | + | + | + | + | Electrostatic precepitators with capacity to clear gas (at estimated speed of 1 km/s) below 2,0 million m <sup>3</sup> /hour, temperature of cleared gases below 330°C, separation efficiency of gases below 99,95 %.                      |
|       |  | + | + | + | + | + | + | Mechanical dust collectors.  |
|       |  | + | + | + | + | + | + | Equipment of apparatuses of wet gas cleaning (quencher, Venturi tubes, demisters, injectors, etc.).  |
|       |  | + | + | + | + | + | + | Equipment of dedusting systems (devices for debarking of the dust, devices for loading and transportation of the dust of dry gas cleaning systems, pelletizers).   |
|       |  | + | + | + | + | + | + | Shut-off, throttle, suckling valves with electric drives on the basis of electric single-turn mechanism (ESM) and pneumatic high-speed mechanism (PHSM).   |
|       |  | + | + | + | + | + | + | Fibrous filters for acid aerosols and chromic anhydride clearing of pickle and electroplating baths.   |
|       |  | + | + | + | + | + | + | Replacement of electrostatic precipitators with modern bag hoses.  |



| 1     | 2  | 3 | 4 | 5 | 6 | 7 | 8 | 9  |
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| 7.5.2 | Cooling and energy-saving systems  | + | + | + | + | + | + | Equipment of cooling systems of rolls, rollers of the roller bed, rulers, loopers, mill.<br>Equipment of energy-saving systems, including: exhaust-heat boilers for cooling of gases from chambers of dry suppression of coke, recuperators for periodically and continuously working fuel furnaces, water-cooled lances, steel refrigerating plates, thermo-siphon heat exchangers, installations for emulsifying of fuel oil, etc. |
| 7.5.3 | Completely closed systems of circulating water supply of separate assemblies and industrial factories as a whole | + | + | + | + | + | + | Equipment of cleaning systems of industrial and household drainages, Surface water run-offs, including pressure filters, electrofluctuational units, units of water electric stabilization treatment, oil-catching devices, etc.   |
| 7.6   | Development, manufacturing, delivery and commissioning of the automated process control systems (APCS)           | + | + | + | + | + | + | Automated process control systems for blast-furnace plants, including management of fusion process, stock-conveying system, blast-furnace gas exhaust ducts control, aspiration systems.   |
|       |  | + | + | + | + | + | + | Automated process control systems for converter departments, including control systems of fusion, stock-conveying system, gas exhaust duct.  |
|       |  | + | + | + | + | + | + | Automated process control systems for of electric-furnace shops, including ferro-alloy, including control systems of fusion, stock-conveying system, gas exhaust duct.   |
|       |  | + | + | + | + | + | + | Automated process control systems for systems of the water-treatment and reverse water supply cycle.   |
|       |  | + | + | + | + | + | + | The automated control systems of "dry" and "wet" gas cleaning ducts working in the conditions of increased dustiness.  |
|       |  | + | + | + | + | + | + | Automatic-control systems for electrostatic precepitators.   |
|       |  | + | + | + | + | + | + | Automatic-control systems for regeneration of bag hoses.   |
|       |  | + | + | + | + | + | + | Automatic-control systems for dedusting.   |

| 1                             | 2  | 3 | 4 | 5 | 6 | 7 | 8 | 9  |
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| 7.7                           | Conducting of power diagnostic inspection of the basic productions and factory as a whole with development of measures for decreasing of power consumption. Conducting of the ecological diagnostic inspection of productions and the factory as a whole | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- Development of the program for energy-saving; rendering of the scientific and technical and methodical help at its implementation;</li> <li>- implementation of author's design procedures through power consumption of products as effective mechanism for adoption of administrative solutions; delivery of the software and training of Customer' s specialists.</li> </ul>  |
| 7.8                           | Solution of environmental problems of the factory in matters of normalizing of emissions and discharges of contaminants. Development of offers for approach of these parametres to parametres of the European Union and EPI (USA).                       | + |   |   |   |   |   | <ul style="list-style-type: none"> <li>- Development of the complex of activities to achieve norms of emissions.</li> </ul>  |
| <b>8. Auxiliary Processes</b> |  |   |   |   |   |   |   |  |
| 8.1                           | Creation and commissioning of a lime-roasting plant with rotary shaft furnaces with out-of-furnace heat exchangers, shaft surfaces with systems of smoke gases from dust in bag hoses  | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- 20-25 % reduction in the specific fuel consumption for the manufacture of 1 kg of burnt lime from 7130-8950 to 5430-6800 kJ owing to the application of rotary furnaces with extra-furnace heat exchangers and adiabatic seasoning areas; shaft straight-through-counterflow-regeneration furnace</li> <li>- decrease of dust concentration in the filtered flue gases from 50 to 20 mg/nm<sup>3</sup> due to the installation of bag filters after the rotary and shaft furnaces.</li> </ul> |

| 1   | 2  | 3 | 4 | 5 | 6 | 7 | 8 | 9   |
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| 8.2 | Creation and commissioning of the department of processing of the dump and flowing steel-smelting slags with power of 1–2 million t/year | + | + | + | + | + | + | Two-stage fractional magnetic separation of slags with application of highly effective drum-type and suspension magnetic separators with re-crushing of large fractions of slag and scrap clearing of slag increases the metal concentration in slag for 15 %.  |
| 8.3 | Creation and commissioning of departments of air separation and oxygen stations of various productivity                                  | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>– Decrease of power consumption in the blast-furnace and steel-smelting manufactures;</li> <li>– Increase of profitability of manufacture.</li> </ul>  |
| 8.4 | Creation and commissioning of roll-turning sections of vacuum mills  | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>– Increase of the overall performance of the replaceable equipment - rolls;</li> <li>– Expected increase of operation life of rolls;</li> <li>– Decrease of complete sets of the work rolls necessary for work of mills.</li> </ul>                                      |
| 8.5 | Creation and commissioning of specialised workshops on repair:<br>- steel-smelting equipment;<br>- rolling equipment.                    | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>– Profitability and production efficiency increase;</li> <li>– Increase of operational life of the equipment.</li> </ul>   |
| 8.6 | Creation and commissioning of sections of scissors cutting of the scrap  | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>– Installation of the efficient scrap shearing machine;</li> <li>– reception of a scrap with the increased bulk weight;</li> <li>– separation of the scrap with allocation of allogenic inclusions;</li> <li>– Automation of loading of transport facilities.</li> </ul> |
| 8.7 | Creation and commissioning of sections of preparation of ferroalloys and loose materials   | + | + | + | + | + | + | Production efficiency increase  |

| 1  | 2  | 3 | 4 | 5 | 6 | 7 | 8 | 9   |
|--|--|---|---|---|---|---|---|---|
| 8.8  | Creation and commissioning of departments of hot-dip galvanizing   | + | + | + | + | + | + | Production profitability increase   |
| 8.9  | Working out of the project of sheds area for repair of movable hot-metal mixers  | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- increase of manufacture profitability;</li> <li>- mechanisation of repair of the furnace lining;</li> <li>- Increase of operational life of the lining.</li> </ul>   |
| <b>9. Low-Waste Technologies for the Utilization of Valuable Components from Dust Piles and Slurries</b> |  |   |   |   |   |   |   |   |
| 9.1  | Development of the technology, engineering and commissioning of plants for the complex processing of slurries and dusts from the gas cleaning facilities of basic units in the metallurgic industry with the capacity ranging from 300 ths. t/year to 2,0 ths. t/year. | + | + | + | + | + | + | <p>Iron and zinc production:</p> <ul style="list-style-type: none"> <li>- high-grade zinc concentrate with the zinc content of up to 79%;</li> <li>- dezincing pre-reduced pellets suitable for recycling in the basic processes with the iron content of at least 57%;</li> </ul> <p>Peculiar features of the technology:</p> <ul style="list-style-type: none"> <li>- dewatering, delivery, unloading and storage of batch components (zinc-containing dusts, slurries and undersized coke);</li> <li>- preparation, dosage and mixing of the batch;</li> <li>- batch pelletization, drying and screening of the pellets;</li> <li>- Waelz process, entrapment of zinc fumes, cooling and screening of dezincing iron-ore pellets (pills);</li> <li>- dosage, packaging and shipment of finished products (zinc concentrate and pre-reduced iron-ore pellets) to the consumers.</li> </ul> <p>Payback of a complex with the raw material output capacity of 110 ths. t/year shall be achieved within 2-2,5 years.</p> |

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| 9.2 | Creation, commissioning of plants for the complex processing of slurries from gas cleaning facilities in the non-ferrous metallurgy.  |   |   |   |   |   |   | Introduction of technology for the extraction of vanadium, nickel, chromium, manganese, tantalum and niobium from waste products and their recycling in the engineering process.   |
| 9.3 | Creation, commissioning of plants for the complex processing of bulk waste products of the chemical industry – in particular, enterprises for the manufacture of mineral fertilizers. |   |   |   |   |   |   | Obtainment of raw materials for the building industry: <ul style="list-style-type: none"> <li>- dry pack mortars,</li> <li>- alabaster binding material,</li> <li>- wall panels.</li> </ul>  |
|     |   |   |   |   |   |   |   | Implementation of the proposed technologies for the utilization of valuable components (see cl. 9.1, 9.2, 9.3) enables to solve the technical, economic, environmental, hygienic and social problems of enterprises and the region: <ul style="list-style-type: none"> <li>- process the stale and freshly-formed slurries at the enterprises of metallurgical and chemical industry;</li> <li>- reduce ecological payments for the waste disposal;</li> <li>- diminish the degree of natural environment pollution;</li> <li>- create additional jobs;</li> <li>- enhance the level of health care for the population.</li> </ul> |

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| <b>10. Equipment for Waste Processing by the Method of Thermochemical Breakdown</b> |   |   |   |   |   |   |   |   |
| 10.1  | Construction and commissioning of complexes for the processing of rubber-containing and polymer waste with the generation of fuel | + | + | + | + | + | + | The developed technology is absolutely waste-free, whereas all the end products of processing are available energy resources and can be used as fuel for the generation of thermal and/or electric power in boiler houses, steam and electric power stations.   |
| <b>11. Processing of Solid Domestic Waste (SDW)</b>                                 |   |   |   |   |   |   |   |   |
| 11.1  | Construction and commissioning of enterprises for the processing of solid domestic waste  | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- Utilization of up-to-date environmentally sound technologies for the processing of SDW with multistage system of the gas cleaning providing observance of the European norms on level of atmospheric emissions of harmful substances.;</li> <li>- low degree of waste formation in the applied technology (8-10% of slag).</li> <li>- maximum utilization of secondary energy and raw material resources (generation of thermal and electric power, utilization of the raw material constituents of SDW).</li> </ul> |
| 11.2  | Construction and commissioning of mobile plants for the incineration of solid domestic waste on automobile and railway platforms  | + | + | + | + | + | + | <ul style="list-style-type: none"> <li>- Complex solution of the problems with SDW handling securing their environmentally sound incineration immediately in the sites of their accumulation;</li> <li>- application of up-to-date environmentally sound and energy-saving technologies of SDW incineration;</li> <li>- low degree of waste formation in the applied technology (8-10% of slag);</li> <li>- application of the dry gas cleaning technology</li> </ul>   |

| 1    | 2  | 3 | 4 | 5 | 6 | 7 | 8 | 9  |
|------|--|---|---|---|---|---|---|--|
| 11.3 | Construction and commissioning of mobile and stationary plants for the incineration of clinical waste and especially hazardous waste with organic pollutants | + | + | + | + | + | + | - Solution of problems with the handling of clinical waste securing their environmentally sound incineration immediately in the sites of their formation and accumulation. |

Director General of SE "UkrRTC "Energostal"



D. V. Stalinsky