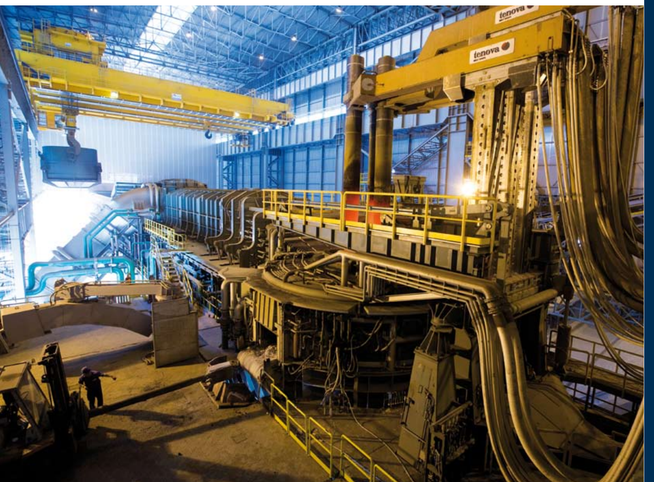
CONSTEEL® EVOLUTION: AN INNOVATION WITH SOLID ROOTS

Consteel® Evolution is a new generation of furnaces resulting from an intensive, continuous research activity and the long-standing experience and engineering expertise Tenova developed in the steelmaking sector. This drive for innovation has now produced the Consteel® Evolution system which realizes the full potential of the Consteel® system, the revolutionary technology of continuous scrap feeding and pre-heating.

The Consteel® system is the only industrial process that continuously pre-heats and feeds metallic charge (scrap, pig iron, etc.) to the EAF while simultaneously controlling gaseous emissions.
The charge is loaded, from a scrap yard or from a railcar, into the charge conveyor and pre-heated by process off-gas as it is continuously fed into the EAF, where it is melted by immersion in liquid steel. The EAF operates in constant flat-bath conditions, a key advantage over conventional batch processes where scrap is melted by the direct action of the electric arc.
The EAF gases are sent to a fume-cleaning plant in conditions suitable for the complete combustion of carbon monoxide and other pollutants without any fuel consumption.
Through the use of iRecovery® technology, the ideal complement to a Consteel® system, the waste gas residual energy can be recovered as steam, with an efficiency ranging from 35% up to 70%.

After more than 20 years from its first commercial installation, Tenova's Consteel® EAF is a proven and reliable steelmaking technology, with 40 installations before Consteel® Evolution, guaranteeing efficient use of energy and raw materials, easy operation and maintenance, and environmental friendliness.



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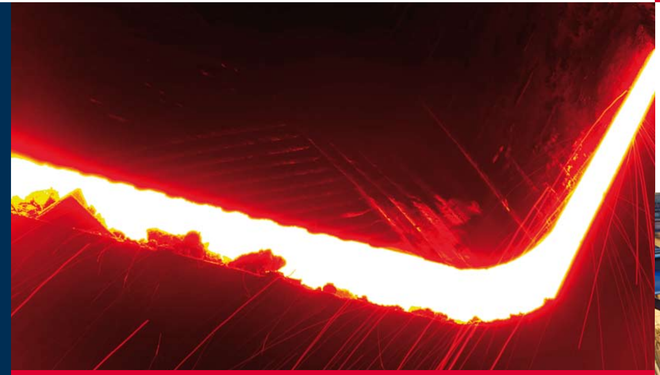


Consteel® Evolution

The ultimate technology for the steel industry

TENOVA is a worldwide supplier of advanced technologies, products and engineering services for the iron & steel and mining industries.

tenova
MELT SHOPS

Tenova is a worldwide supplier of advanced technologies, products and engineering services for the iron & steel and mining industries providing innovative integrated solutions. By combining process automation and metallurgical know-how enhanced value is delivered to the customer. Tenova is committed to develop technology in the areas that most impact the future of the industries it serves: quality of the products delivered by the customers, energy savings and benefits including reductions in greenhouse gas emissions.

Tenova Melt Shops is a leader in the design and supply of equipment for crude steel production. The Tenova Melt Shops heritage embraces historical brands such as Tagliaferri Electric Arc Furnaces and innovative technologies such as Consteel®, a continuous scrap feeding and pre-heating system, Goodfellow EFSOP®, an off-gas dynamic control tool, and iRecovery®, a heat recovery system. Tenova Melt Shops projects range from completely new melt shops to the customized technological upgrading and revamping of existing production units. Its success is built largely on innovative technology, flexibility in meeting customer requirements and timely project execution. For Tenova Melt Shops, energy saving and effective pollution reduction are the key to sustainable development in its customers' industries.

THE CONSTEEL® EVOLUTION SYSTEM

The Consteel® Evolution system boosts productivity and improves energy efficiency with minimum environmental impact.
The key characteristic of the latest Consteel® generation is the introduction of new solutions to increase the amount and efficiency of the chemical energy used in the process. Developed through laboratory trials and extensive use of CFD analysis, the new system features wider conveyors to increase the exchange surface, a different tunnel profile to improve the convective heat exchange, and a new tunnel section equipped with burners, to boost chemical energy input.
In the new system, the use of chemical energy is controlled, section by section, by continuous measurement of the off-gas flow, temperature and composition, with automatic optimization of the relevant operational parameters.
The result is a more effective charge pre-heating and lower operating costs, a benefit that can be further increased by coupling the Consteel® Evolution system to a downstream *i*Recovery® system.

TECHNOLOGICAL FEATURES

PROVEN BENEFITS OF CONSTEEL® TECHNOLOGIES

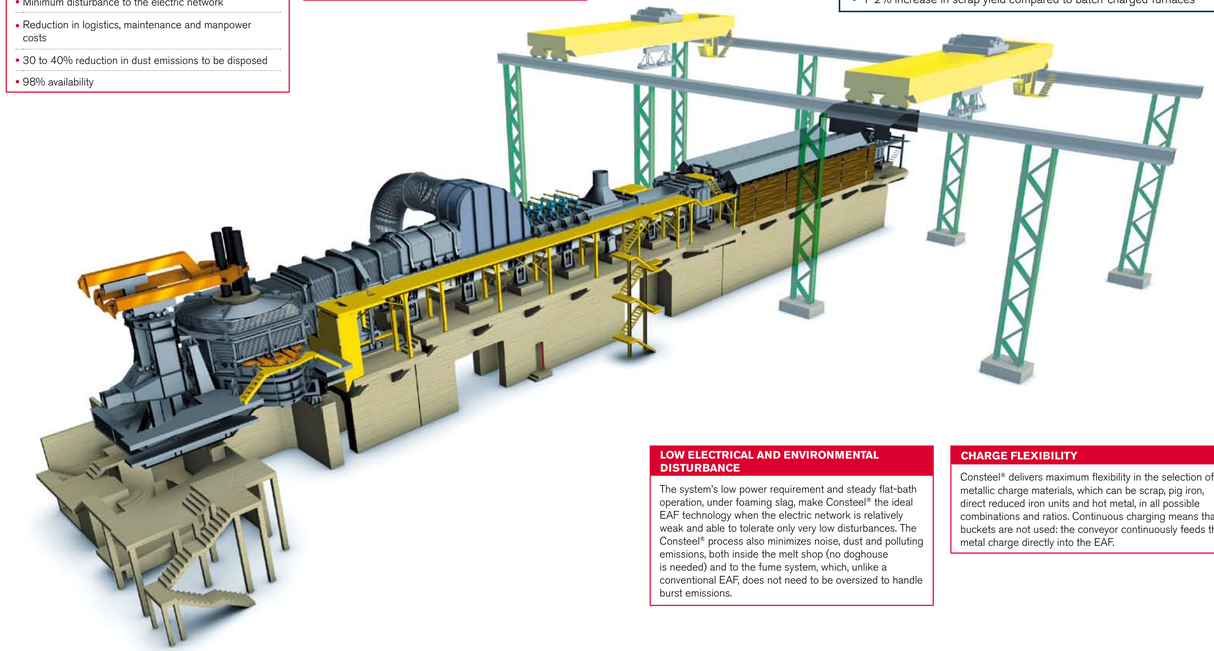
- Fast payback
- High flexibility
- Environmental friendliness
- Personnel safety
- Minimum disturbance to the electric network
- Reduction in logistics, maintenance and manpower costs
- 30 to 40% reduction in dust emissions to be disposed
- 98% availability

ADDITIONAL BENEFITS OF CONSTEEL® EVOLUTION

- Improved use of chemical energy
- Continuous control and optimization of operational parameters
- Improved charge control through automated scrap quantity and quality tracking

PERFORMANCE

- High productivity: 2.7 tls/hr/MW
- Reduced power consumption : 296 kWh/tls
- Lower electrode consumption
- 1-2% increase in scrap yield compared to batch-charged furnaces



LOW ELECTRICAL AND ENVIRONMENTAL DISTURBANCE

The system's low power requirement and steady flat-bath operation, under foaming slag, make Consteel® the ideal EAF technology when the electric network is relatively weak and able to tolerate only very low disturbances. The Consteel® process also minimizes noise, dust and polluting emissions, both inside the melt shop (no doghouse is needed) and to the fume system, which, unlike a conventional EAF, does not need to be oversized to handle burst emissions.

CHARGE FLEXIBILITY

Consteel® delivers maximum flexibility in the selection of metallic charge materials, which can be scrap, pig iron, direct reduced iron units and hot metal, in all possible combinations and ratios. Continuous charging means that buckets are not used: the conveyor continuously feeds the metal charge directly into the EAF.

THE INNOVATIONS OF THE CONSTEEL® EVOLUTION SYSTEM

A key characteristic of the new technology is greater use of chemical energy and enhanced pre-heating efficiency, thanks to the new design. The pre-heating tunnel is divided into two sections. The first contains high-efficiency burners, while the second completes combustion of the off-gas leaving the furnace. The two gas streams are mixed in an intermediate section before entering the gas treatment plant in the best possible conditions for heat recovery and abatement of polluting emissions.

The burner tunnel is also an advantage in extremely cold conditions, for rapid melting of any ice and snow in the scrap.

Consteel® Evolution is a reliable and valuable solution even when no suitable fuel is available for the burners. In this case, all the other improvements come into play to deliver good results in terms of energy savings and environmental sustainability.

The development of the Consteel® Evolution system has been carried out together with an outstanding partner, the **Centro Sviluppo Materiali** (CSM), Italian reference research centre operating in the worldwide scenario of innovation in materials and related technologies of production, engineering, design and application. Simulation models and experimental texts have been developed jointly with Centro Sviluppo Materiali to provide a forefront technology combining maximum productivity with minimum environmental impact.

Within Tenova, four different business units contribute to the development of the Consteel® Evolution system merging their know-how and engineering competences :

- **Tenova Melt Shops**, the centre for research and development of steelmaking technologies, is responsible of the EAF and Consteel® engineering and of the overall project.
- **Tenova LOI Italimpianti**, the leading global supplier of reheating and heat treatment equipment, develops the high-efficiency burners which speed up the pre-heating phase and keep it thermally separate from the EAF process.
- **Tenova Goodfellow**, the Canadian company specialized in EAF process development, provides the EFSOP® off-gas analysis and control system which maximizes post-combustion of residual carbon monoxide.
- **Tenova Re Energy**, based in Germany and specialized in heat recovery equipment, develops the technology that allows to recover a significant portion of residual heat raising the overall energy efficiency of the project.