ALL INDIA INDUCTION FURNACES ASSOCIATION

AIIFA

INDUCTION FURNACE NEWSLETTER

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What's Inside

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HANDBOOK ON INDIAN STEEL INDUSTRIES
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Techno-Economic Indices & Key Performance Indicators for Induction Furnace Steel Making

P. Mishra
Sr. Executive Director, AIIFA, Delhi

Introduction : The emerging technologies in steel making & refining, shaping & heat-treatment are spurring the development of quality products, process technologies and business models that will fundamentally transform production in most cost-effective ways. Both the speed and the scope of technological change, combined with the emergence of other trends, add a layer of complexity to the already challenging task of developing and implementing strategies in mini steel plants having induction furnace steel making units promote productivity and inclusive growth. Mini steel plants need to decide how to best respond in this new production paradigm vis-à-vis their national strategies and their ambition to leverage production as a national capability which require understanding for improvement of techno-economic indices setting up benchmarking norms finding out the key parameter indicators for control and conditions in improving techno-economics of the total process of steel making to finishing.

All these have the greatest impact on the transformation of steel plant's production systems in the entire production chain earning better revenues and then assess their readiness for the future. Subsequently, governments— together with mini steel plants—can take suitable policy actions to help induction furnace to close potential gaps related to their readiness for smooth running in competitive ways by getting electrical energy at reduced rate as well as good quality imported scrap for specific grade steel making. Mini steel plants in India producing steel and alloy steels from induction furnace are under intense pressure for maintaining consistent production in the global competitive market for delivering quality products optimizing cost to satisfy customers in spite of constraints beyond their control. Global competition, changing market demands and customers' choice in the consuming sectors, availability of cheap products in the market are separating the pack, with fast-moving and growing steel making units getting ahead, while slow-to-adapt steel makers are falling behind what is happening unfortunately in many areas.

Current forecasts suggest that in 2050 the steel production will be 1.7 times today's levels (Allwood & Cullen). The rate of innovation in mini steel plants for steel making, refining , shaping and heat treatment process within the plant/ unit needs to accelerate and leadership needs confidence that among the generated data of techno-economic indices, few key performance indicators (KPI) being served up can drive decisions. Such key performance indicators are assorted variables which can be used by the plant to assess, analyze and track in steel making and processing stages and those performance measurements will evaluate success in relation to goals and objectives. Thus growth and ultimate success will be determined by the consistency of results which can only be achieved if the working personnel consistently meet desired goals and targets under the able leadership of management.

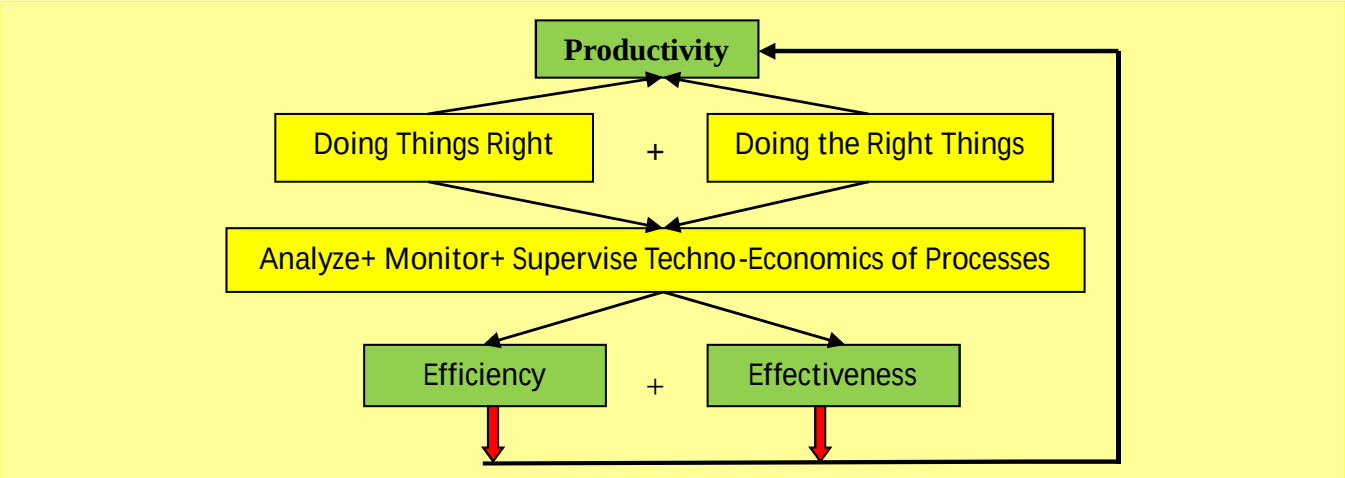
These indicators are important for monitoring the performance in the mini steel plants. Comparison of Technical Indices, Benchmarking and KPIs with similar and identical plants in the country is one method of identifying poor performing areas and estimating improvement potential. Improvement can be made identifying the priority and contribution then developing and implementing findings based on the KPIs and the benchmarking results. Overall, the enterprises that stay on top of the growth wave are moving quickly and confidently with their decision-making because those decisions are rooted in accurate and reliable data

generated and analyzed studying the root cause. The major techno-economic indices, reducing cost improving quality and productivity are to be fixed by individual plant as their own Benchmark Standard. Further, individual plant should try to capture performance data vis-à-vis performance benchmarking on techno-economics as project of "Multi-Plant Management-Performance Benchmarking" only to know the status of individual plant as well scope for future improvement.

The value of techno-economic modeling is seen almost in every plant in different countries in allied and identical production line providing a guide for invention and assurance to the entrepreneurs that the solution path is financially viable. It is a fundamental tool in valuation basis, influencing design decisions throughout the development process, providing the framework for test and analysis, and being the basis for continual improvement process. Therefore, the value of productivity can be measured based on effectiveness and efficiency, analyzing, monitoring the variables responsible for improving techno-economics of the process.

Steel Making in Induction Furnace: The paradigm shifts in steel making and processing technology is the outcome of international business. About half of India's electric-based process steel is made using electric induction furnaces rather than the internationally more common electric arc furnaces. Electric induction furnaces use induction to convert materials such as scrap, sponge iron/ direct reduced iron (DRI), or pig iron, fe-alloys into steel. These furnaces use alternating magnetic fields to induce an electric current, which then heats up the scrap because of electric resistance. Induction furnaces tend to operate at much smaller scales compared with other more common steelmaking technologies such as basic oxygen furnaces or electric arc furnaces and typically produce less than 20 tons per batch.

The improvement of quality standards by introducing secondary refining technology and modifying process technology in different processing areas have given quality products, new inventions, diversification. Technology has brought revolution in the field of steel production, designing process and products, improved properties, quality and have added a large pool of products in critical areas like armory, aero-space, modern power plants etc. Model of improving efficiency & effectiveness is shown below -



Productivity = Efficiency + Effectiveness ="Doing things right" + "Doing the right things" Kirikal and Tallinna present that the productivity is enumerated as significant factor in analyzing, monitoring, and supervising the performance which is important component in continuous improvement and successful management. Also, it can help plants to follow the missions, vision, policies, objectives and targets. Likewise, enabling to identify

the weakness and strengths along with opportunities and threats evolving from competitors and market can be the other reason as to why productivity is important in this level.

Lots of operational practices are implemented in order to reduce electrical consumption, being the highest cost, in induction furnace steel making. Below are listed some of useful practices identified as key parameter indicators (KPI) to control the ratio between power on and power off reducing overall energy consumption: - Initial scrap charging by bucket, Power on control during de-slagging operation, Ensuring full crucible of liquid steel before tapping, Minimum holding time at liquid steel stage, Proper scheduling of furnace, Scrap quality. The inductive bath agitation firstly leads to an ideal homogenization of the melt with regard to the chemical composition and temperature.

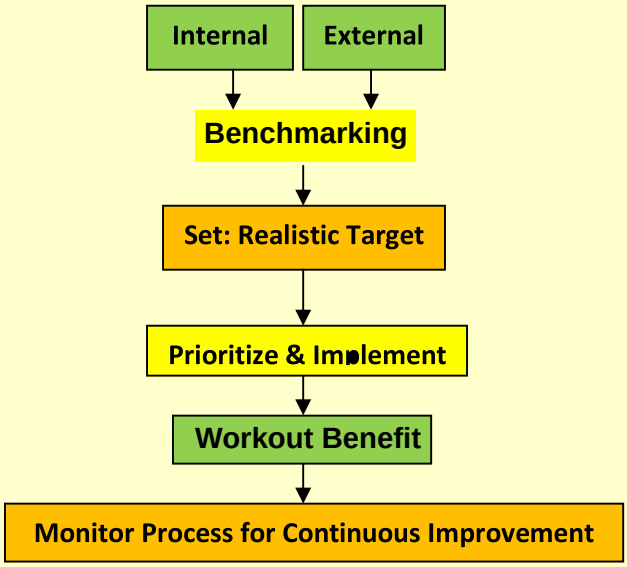
It is furthermore beneficial for heavy stirring the specific light materials, such as chips, stamping remnants, shredded scrap and sponge iron. Given a suitable method of charging, these materials are stirred spontaneously into the melt, so that optimum heat transmission conditions are created for melting the individual pieces of feed stock. The induction furnace is suitable for producing different types of steel, from simple construction steel through to high-alloyed special steels for industries like automotive/ auto-component, bearing, tool & die, aero-space, thermal power, defense etc. Differing requirements are thereby placed on both the treatment equipment and on the melting process.

Techno-Economic Indices & KPIs - Ideas for improvement are generated from the working personnel attached to melting shop, rolling mill, forging units and heat treatments shops that result in the improved efficiency or effectiveness of process which is goal oriented and designed to attain a solution to a problem whereas working personnel attached to the particular areas are the active resources that determine the solution but many times true guidance backed up by technical support is essential which may come from inside or outside in formulating highly innovative solution. The approaches may even be from unusual angles to discover problems and finding avenues of solution, questions basic assumptions related to current practices which will, hopefully, satisfy the opportunity. Improvement of the major identified areas of techno-economic indices in the process which affect performances of mini steel plants should be the starting point analysis. The need for achievement is of paramount importance to the mini steel plants.

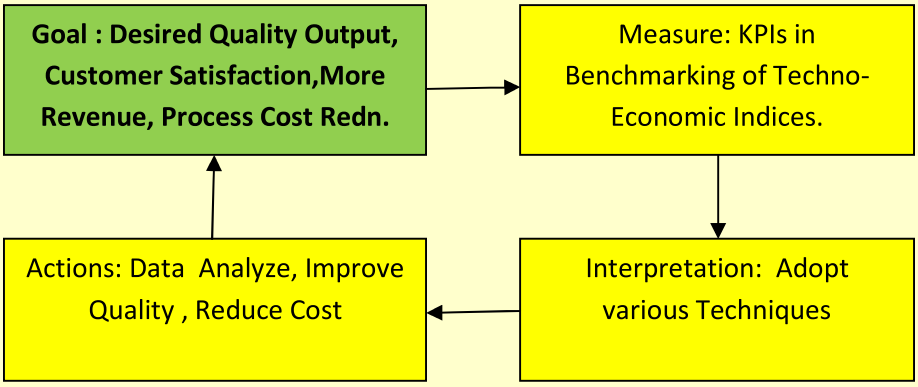
Induction furnace steel making units, in a single and common voice, should raise the issue of getting cheap and plentiful electrical power. Since energy cost is the highest in melting, efforts need to be given to reduce power cost taking various measures even installing more productive energy efficient equipments maintaining volume of production backed up by supporting orders. Since power consumption is the major factor in controlling the cost of production in induction furnace steel making, techno-economic indices related to power is to be given topmost priority for improvement identifying the key performance indicators which are to be aligned with operational strategy having clear links to the overall performance of business.

Only few KPIs are to be identified which have major contribution, under control of shop and can be studied in easier ways for implementation which are briefly stated as -.**Continuous furnace running for melting i.e. better utilization of furnace minimizing power wastage, short holding times reducing energy consumption, rapid furnace charging under full power, scrap quality, scrap heating arrangement installation (with small investment) .**

Setting Up Benchmarking Target



Activities for Achieving Goal



- **Power Consumption in IF vis-à-vis Wastage of Energy –** Year wise Power Tariff (INR) in different states in India is shown in Table 1 & State wise Tariff Variation in Table 2 below (Source AIIFA).
- **Dirty scrap** as charge materials increase power consumption wasting a tremendous amount of energy. Mud, dirt and other non-metals in the charge have about 1.5-2 times heat content and increase electrical consumption that means 1 Kg of dirt equals 1.5-2Kg of scrap melted unnecessarily wasting power for such quantity generating slag which require time to remove. Back slagging mechanism allow slag to be removed more easily, more effectively, and more quickly.

Table 1

State	2013-14	2014-15	2016-17	2017-18
West Bengal	7.36	7.83	7.53	7.94
Maharashtra	7.10	7.10	7.30	7.16
Rajasthan	6.65	7.85	7.85	7.04
Tamil Nadu	6.63	6.63	6.63	7.68
Uttar Pradesh	5.70	6.45	6.85	6.68
Andhra Pradesh	5.36	5.36	5.74	5.93
Haryana	5.30	5.80	6.15	6.45
Odisha	4.75	4.75	4.95	5.88
Gujarat	4.50	4.50	4.35	5.34
Jharkhand	4.10	4.10	5.90	5.9
Madhya Pradesh	4.10	4.10	6.15	6.35
Goa	4.00	4.00	5.00	4.37
Chhattisgarh	3.55	3.65	5.35	6.4
Telangana		5.66	5.66	7.68
Punjab	6.96	6.96	6.96	6.58
Kerala	5.72	5.72	5.72	7.7
Karnataka	6.05	6.40	7.00	7.21

Table 2

Tarrif in INR (2017-18)	States	Max	Min
>7	WB, Maharashtra, Rajasthan, Tamil Nadu, Telengana , Kerala, Karnataka	WB 7.94	Rajasthan 7.04
< 7 > 6	UP, Haryana, MP, Chattisgarh, Punjub	UP 6.68	MP 6.35
< 6	AP, Odissa, Gujrat, Jharkhand, Goa	AP 5.93	Goa 4.37

Temperature measurement and sampling —Temperature checks also may be time consuming and costly, particularly if melter frequently undershoots or overshoots target temperatures making adjustments and take additional readings. Computerized melt control systems can greatly increase the likelihood of hitting desired temperature levels. While furnace sampling is a relatively minor operation, melter should make sure that he has done everything in sample taking to optimize the process for taking as little time as possible.

Sample Analysis — It is apparent that the problem of small delays in melting affect furnace utilization, not the capacity. Further, evaluation of delays during melting also shows that the laboratory taking more time to convey analysis report of elements to the melter/ furnace operator. However, use of latest version of spectrometer and speedy checking of samples / alloy checking , such delay can be fully avoided.

Optimize pouring — At the time of liquid steel tapping, furnace is not used for melting as such tapping operation is to be completed as quickly as possible bringing and placing the heated ladle at tapping spot.

Melt Schedule and Power Usage — If available facilities are in favorable condition as per planning the heat, furnace should be kept running at a stretch continuously may be for 4 or 5 days as suits for operation when holding of furnace with liquid steel will be minimum, ending at less power consumption as well as saving refractory lining of furnace.

Importance of lid in Furnace — It has been assessed from various studies of experts/ engineers that loss of heat takes place during melting in an induction furnace by way of

1. Radiation – About 75% heat loss taking place from the top surface of the melt in air if furnace is kept open without lid,
2. The other 25% heat loss takes place via conduction through the refractory lining and also from furnace floor.

The best way to reduce heat loss through radiation is by keeping the lid on furnace while melting. This means closing the furnace lid as quickly as possible after adding charge materials and after taking temperatures or adding alloying materials. Of course, if lid doesn't fit properly due to warping or improper installation or a worn top cap and/or lid refractories, it may not be as effective. Regular maintenance to ensure correct lid fit, therefore, will save the energy that would otherwise be needed to replace radiant heat losses which may rise exponentially with melt temperature. It has been observed that a 10% increase in molten metal temperature resulting in a 33% increase in radiated heat losses. Attention has to be given to find out ways to lower peak metal temperature and/or minimize temperature overshooting to save energy as well as improving refractory life and reducing burning off added alloys.

Keeping Refractory Lining Thickness as Specified Standard — Thicker lining in furnace may extend lining life and save energy due to the higher insulating value of the additional lining. But, in case of thicker lining, the charge material will be further away from the coil resulting in a lower coil-power factor and lower coil efficiency which may produce higher current in the furnace coil causing more electrical losses resulting.

Further, since there are more electrical losses in the coil, there is less energy available to melt metal, so every melt will take somewhat longer than it would with a standard refractory thickness. This results in more conducted and radiated heat losses, increasing the amount of energy consumed even further. The best refractory design is the one the furnace manufacturer provide on the cross-section drawing of the equipment. As refractories heat and cool, same will expand and contract and over time it is normal for the diameter of the furnace coil to grow slightly due to the pressure being exerted on it by the refractories. This results in a thicker lining and a lower efficiency. It also means use of more refractory in every reline.

The solution to this condition is to have coils rebuilt and resized periodically to make sure that the diameter remains as intended by the furnace supplier. Coil growing diameter can be slowed by regularly tightening the shunts in the furnace which will help prevent the pressure of the expanding refractory from distorting the furnace coil. Furnace supplier may guide on this activity.

Configure Furnace leads — A furnace's water-cooled leads can produce unnecessary electrical losses if they are not properly maintained or configured. If they are old and have gone through many cycles of furnace tilting, there may be broken cables inside the leads that cannot be seen but cause higher resistance in the lead and higher electrical losses. Care should be taken for minimization of voltage drop and power loss in this area. Any hot spot created during operation should be repaired immediately.

Quotes Peter Drucker, father of Post-War Management Thinker may be kept in mind for performance improvement - " knowledge, the power in today's business activities, has to be improved, challenged and increased constantly which will control access to opportunity for effective action. Measure and manage performance for improvement to create and satisfy customers what they want".

Conclusion : A major breakthrough in the concept of cost and quality occurs when mass production starts. Mini steel plants try to produce products with certain degree of quality that conformed to standards maintaining standard cost. As time passed, customers became choosier and their demands increased when they shift towards both low cost better quality products. Thus, with this change in circumstances, the steel production businesses needs to pace with the customers' requirements to survive and eventually grow leading to evolution of the quality approaches and change the viewpoints about how quality can be achieved optimizing cost. In such new concept, ideas have come for improving performance from improved techno-economical indices, setting up benchmarking standard in key areas comparing performance with best achievers identifying and monitoring controllable key performance indicators. Generally, confidence moves upstream and downstream when data collected is trusted for making decisions.

References:

1. Quotes of Peter Drucker,
2. Study of Allwood & Cullen on demand forecast till 2050,
3. Dr. Erwin Doetsch, Dortmund, Germany, Improvement in IF steel making.

Circular No. 1070/3/2019 CX

F. No. 267/58/2019/CX-8
Government of India
Ministry of Finance
Department of Revenue
Central Board of Indirect Taxes & Customs

New Delhi, Dated, The 24th June, 2019

To

The Principal Chief Commissioners/ Chief Commissioners (All)/

The Principal Director Generals/ Directors Generals (All)

Sir/ Madam,

Subject: Implementation of CBIC (ICEGATE) E-payment portal from 1st July, 2019 – Revised procedure for making e-payment of Central Excise and Service Tax arrears under the new CBIC-GST Integrated portal https://cbic-gst.gov.in – Reg.

Kind reference is invited to Board's letter F. No/ IV/(23)/2/2006-Systems/699 dated 13.03.17 with regard to Implementation of EASIEST and e-payment from 01.04.2004. Further, attention is also invited to the Board's Circular No. 1069/2/2019-CX dated 8th May, 2019 with regard to the revised procedure for electronic filing of CE&ST Returns and for electronic payment of Excise Duty and Service Tax.

2. I am directed to inform that consequent to the roll out of the integrated CBIC-GST Portal- https://cbic-gst.gov.in/ with effective from 26th May 2019, all functionalities under https://www/aces.gov.in/ have since been migrated into CBIC-GST Application and the same are available for taxpayers.

3. As you are aware, currently taxpayers are making payments of Central Excise duties and Service Tax arrears through EASIEST Portal, DG Systems has now integrated payments of CE & ST with ICEGATE Portal and the new payment gate way portal "CBIC (ICEGATE) E-payment" will be operational w.e.f., 1st July, 2019 onwards. Accordingly, from 1st July, 2019 onwards, a new revised procedure has to be followed by the taxpayers for making CE & ST Payments. First, taxpayer has to create a Challan on the integrated CBIC portal. Post creation of the Challan, and on clicking Make Payment, taxpayer will be directed to CBIC-ICEGATE portal for initiating payment.

4. The revised procedure for making payments of Central Excise and Service Tax arrears is enclosed herewith. You are requested to sensitize the taxpayers under your jurisdiction and brief them about the new development. You may also interact with the banks authorized to collect Central Excise and Service Tax duties in your jurisdiction and ask them to give vide publicity to their clients.

5. Advisory with screenshot will be issue by DG-Systems shortly for easy understanding.

Yours faithfully,

Encl: As above

(Abhishek Dwivedi)
Deputy Commissioner (CX-8)

Revised Procedure for making e-payment

1. Taxpayer would access the CBIC-GST Portal https://cbic-gst.gov.in/.
2. Login with their existing user id and password.
3. Taxpayer selects "Services"->"E-Payments" in menu.
4. Taxpayer has option to "Create Challan" and "Track Challan Status" under "E-Payments".
5. On click of "**Create Challan**" system displays new screen where taxpayer can either select "Central Excise Registration Number" or "Service Tax Registration Number", enter captcha and submit.
6. Taxpayer details would be displayed. Details include CE/ST Registration number, Email Address, mobile number, Taxpayer name and address with CDR Details.
7. Taxpayer will next select account heads from drop-down option with a cap of maximum of six account heads.
8. Taxpayer then enters amount corresponding to each account head and total is auto-calculated in the same screen. Taxpayer then clicks on "Nest".
9. In the next screen, Total consolidated amount of duty heads is shown in words.
10. Taxpayer will have an option to edit or Generate Challan.
11. If "Edit" is selected, Taxpayer would be directed to the previous screen and he/she can make corrections.
12. The Taxpayer will verify the information by a fully populated Challan with total Challan amount in words. Taxpayer then clicks on "Generate Challan".
13. On selecting "Generate Challan" system will process that information and displays the generated Challan Temporary Identification Number (CTIN).

    (System will also show a Footnote – "Generated Challan will be valid for 15 days.
14. Screen will show confirmation message "Challan created successfully" and a new button "Make Payment" will be displayed.
15. On click of Make Payment, taxpayer will be re-directed to **ICEGATE Portal**.
16. List of Unpaid Challan of Taxpayer will be displayed in ICEGATE portal in next tab of browser. Taxpayer can select one or multiple unpaid Challans to make payment.
17. Taxpayer clicks on 'Pay'.
18. Taxpayer will be displayed with payment option **NEFT/RTGS**.
19. On selection of any of the option, system will generate a printable Challan **(mandate form)** against which the payment can be made at the bank.
20. Taxpayer will initiate the NEFT/RTGS transaction either online or take a print out of the mandate from present it at any authorized bank branch.
21. If payment is initiated online, confirmation of Payment message will be displayed in ICEGATE portal and then system will automatically route the taxpayer to CBIS-GST application page.

********"

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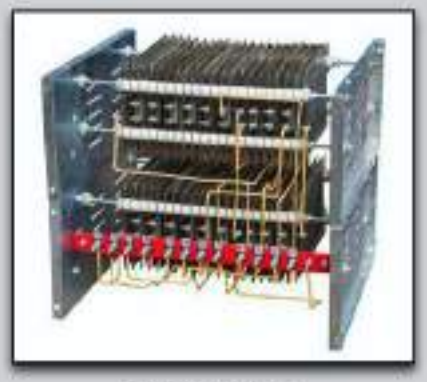

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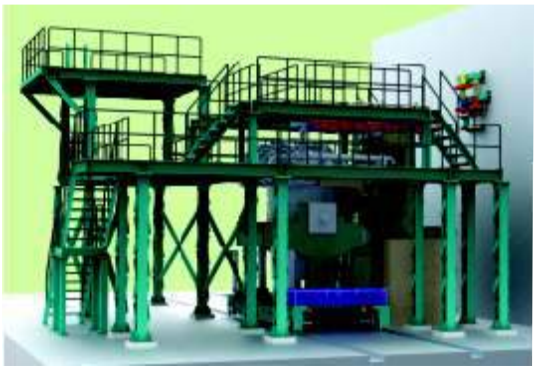

ELECTROTHERM
ENGINEERING & PROJECTS DIVISION

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