

RESEARCH & DEVELOPMENT IN IRON & STEEL SECTOR

BACKGROUND

In 2018-19, India's crude steel capacity was 137.9 MT and production was 106.56 MT (Provisional) as against a production of 103.13 MT in 2017-18. In 2018-19, with an increase of 3.3% over the previous year, India has attained the position of 2nd largest steel producer in the world, after China. The Per Capita steel consumption in India as per 2017-18 data was around 69 kg as against the world average of around 208 kg.

There are primarily 2 routes of steel production:

- BF/BOF route also called the Oxygen route
- Electric route comprising of Electric Arc Furnace and Electric Induction Furnace.

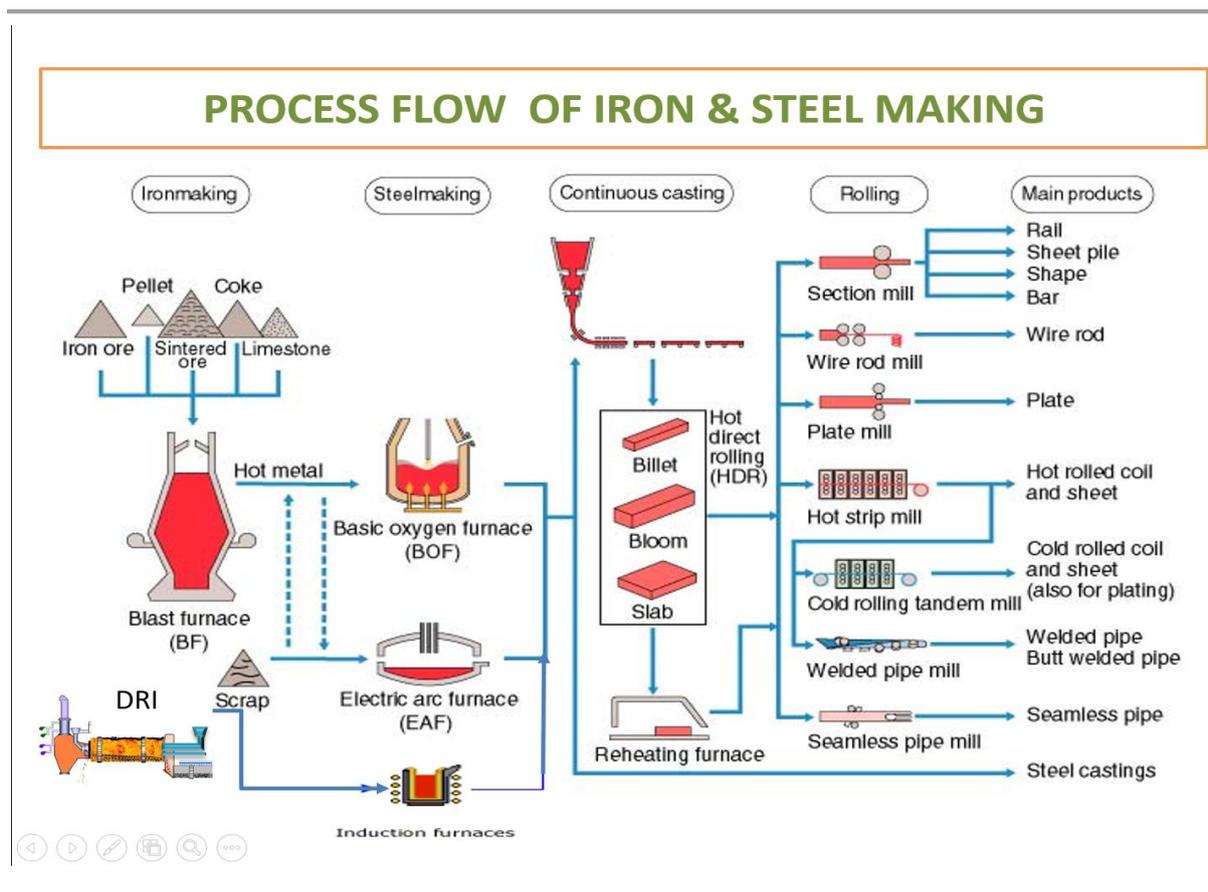
As per 2017-18 data, about 54% steel is produced through the Electric Furnace route of which about 28% steel is produced through the Electric Induction Furnace (EIF) route and 26% from Electric Arc Furnace (EAF) route. About 46% steel is produced through the conventional integrated route of BF-BOF route as against the world average of around 70%.

The structure of the Indian Iron & Steel Sector is given below:

- Blast Furnace (BF): 60
- Basic Oxygen Furnace (BOF): 18 units
- Electric Arc Furnace (EAF): 50
- Electric Induction Furnace (EIF): 999
- Rolling Mills: 1222
- Direct Reduced Iron units: 312

The Indian steel industry comprises of large producers (= > 1 MTPA) which contribute around 63% of the total production as against smaller producers (< 1 MTPA) which contribute around 37% of the total production in the country.

The layout of the process followed for iron & steel making is given below:



India is the world's largest producer of Direct Reduced Iron (DRI) or Sponge Iron. During 2017-18, total production of sponge iron is reported at around 30.511 million tonnes of which 85% are coal based plants and 15% are gas based plants.

Post-liberalization, technological profile of the Indian Steel Industry has undergone substantial change. With setting up of new large modern steel plants based on state-of-the-art technologies and modernization/ expansion of existing steel plants, there is an upward trend in efficiency parameters of operation viz. productivity, energy efficiency, environment friendliness etc.

The Indian Iron & Steel industry needs to pursue research for development & adoption of such technologies which are relevant to natural resource endowment of the country, which minimize damage to the environment, optimize resource utilization, facilitate achievement of global standards of productivity & efficiency and development of front end & strategic steel based materials. Against this backdrop, the issue of utmost importance is the R&D intervention to find out techno-economic solutions to use indigenous raw material resources. Another area that requires attention is the product development to develop and produce high performance steel indigenously.

The R&D efforts by the Indian steel companies out of their own corpus have mainly concentrated on improving internal processes related to saving costs and improving efficiency. Process improvements such as beneficiation and pelletization of iron ore have received good response in the industry. Adoption of continuous casting together with thin slab casting as well as dedicated technologies for harnessing waste heat are drawing the attention of the steel companies. These have led to improved productivity and energy efficiency in the Indian steel industries. However, there are certain constraints in raw material quality, particularly high Alumina in Indian iron ore and high ash in Indian coal, which adversely affect the techno economic performance of the whole industry. To address these constraints and also to sustain the projected high growth rate, there is an urgent need for concerted R&D and technology intervention in the iron and steel sector.

Product development is yet another challenging area being faced by the steel industry in India. While large varieties of value added steel products are now being produced indigenously, the country is dependent on import for several high performance and value added steel products like electrical steel, automotive grade steel and steels for specialized use in defence, space and nuclear applications. The technology in such high-value products is closely held by the companies in the US, Japan & Korea, who do not part with such technologies easily. Not only huge R&D investments to develop such technologies are needed but efforts are also required for technological collaborations with such companies for acquiring high-end technologies possessed by them.

STATUS OF R&D IN IRON & STEEL SECTOR

The steel companies like SAIL, Tata Steel, JSW Steel and Essar Steel have accomplished some significant work in the area of raw material beneficiation, agglomeration and product development. However, the major focus of work in these companies generally relates to incremental technology development to address the present and short term needs of various production units. As a matter of fact, barring some commendable product development efforts, their contributions towards disruptive technology development have not been noteworthy. The actual investment on R&D by the large steel companies in India varies from company to company in the range of 0.07-0.58% of their sales turnover. Secondary Steel sector has limited capacity for undertaking research and development. Ministry of Steel is therefore, pursuing several R&D projects for the benefit of the secondary sector units.

Expenditure on R&D of some of the leading steel companies in India in 2017-18

Sl.No.	Steel Company	R&D Expenditure (Rs Crore)	% of Turnover of the Company
1	SAIL	335.50	0.58
2	RINL	20.06	0.12
3	Tata Steel	182.00	0.30
4	JSW (Vijaynagar Works)	32.00	0.07

R&D scenario in Steel companies abroad, particularly, in China, Japan and South Korea is quite different. They have large outlay of funds earmarked for R&D and also have visible tie-up with external laboratories and academic institutions. Annual R&D investment in these companies is high which is upto 1% of their sales turnover. Steel industry across the globe, and particularly in the advanced countries have identified climate change as a major challenge for more than two decades and have been proactive in reducing energy consumption and green house gas emissions by aggressive R&D and technology interventions adopting the clean & green and state-of-art technologies in all areas of production. In India also, some of the R&D projects undertaken by research laboratories and steel plants are also being directed towards reduction of energy consumption and Green House Gas Emission (GHG).

GOVERNMENT POLICY FRAMEWORK ON R&D

In pursuance of the recommendations of the Parliamentary Standing Committee on Coal & Steel, Ministry of Steel has issued necessary advisory to the steel PSUs as well as private sector companies to chalk out a strategy for taking up more and more R&D activities to 1% of their sales turnover.

The National Steel Policy 2017 has set ambitious targets with regard to make Indian Steel globally competitive, to reduce carbon footprint, meeting domestic demand for high performance steel, increasing steel consumption etc. and has identified high end research as one of the focus areas.

MINISTRY OF STEEL'S INITIATIVES TO PROMOTE R&D IN STEEL SECTOR

1. R&D with Govt. Budgetary Support:

Ministry of Steel has introduced an R&D scheme viz. "Promotion of R&D in Iron & Steel Sector", for providing financial assistance for the R&D projects identified for funding by Ministry of Steel. The budget allocated for the scheme is around Rs 15 crore per year. R&D Project Proposals are invited from reputed Academic Institutions/ Research Laboratories and Indian Steel Companies for pursuing R&D projects for the benefit of the Iron & Steel Sector in the country.

A Project Approval and Monitoring Committee (PAMC) under the Chairmanship of Additional Secretary & Financial Adviser and members comprising Joint Secretary, Ministry of Steel, Director IIT Kharagpur, Director IMMT, Director NML and other members, is the decision making body for approval of R&D projects, monitoring of ongoing projects and for overall direction. Technical Division (TD) of the Ministry of Steel works as the Secretariat of the PAMC to scrutinize the research proposals, obtain views of experts and monitor the progress of the projects for reporting to the PAMC.

The PAMC has so far approved 36 R&D projects in which Rs 123.95 crore has been released from Ministry of Steel's budget, till March 2019. Major projects covered under the scheme include exclusive R&D initiatives to upgrade Indian low grade iron (including BHQ/BHJ) and Indian coking/non-coking coal. Through the completed projects processes/ technologies have been developed in laboratory/ pilot scale for beneficiation & agglomeration of iron ore & coal for the benefit of the iron & steel sector. Process has also been developed in laboratory scale for production of low Phosphorus steel in laboratory scale Induction Furnace, for which industrial trials have also been carried out. Feasibility of smelting reduction of iron ore/fines using hydrogen plasma has been explored in laboratory/ pilot scale. Process has also been developed for utilisation of Mill Scale in Tunnel Kiln for Production of DRI. The list of the R&D projects funded from Ministry of Steel's budget is given at **Annexure-1**.

The quantum of funding of the R&D projects from Ministry of Steel during the last five years are given below:

Sl.No	Year	Government Funding (Rs Crore)
1	2014-15	2.03
2	2015-16	10.26
3	2016-17	15.00
4	2017-18	14.00
5	2018-19	15.00

2. R&D with financial assistance from Steel Development Fund (SDF)

In order to augment R&D initiatives and to step up investment for it in the steel sector, the Union Cabinet had approved in 1997-98 to fund upto Rs. 150 crore per year for R&D projects in iron & steel sector, from the interest proceeds of Steel Development Fund (SDF). However, due to limited availability of liquid fund in the SDF, the quantum of financial assistance per year is around Rs 20 crore for pursuing R&D with SDF.

An Empowered Committee has been set up under the chairmanship of Secretary (Steel) and members from Ministry of Science & Technology, Steel Producers, Research Laboratories and Academic Institutes. Under the Scheme financial assistance from SDF is provided to R&D projects pursued by reputed Research Laboratories, Academic Institutions & Industries. There is a two tier structure for evaluation of R&D proposals under this scheme. An Evaluation Group (EG) comprising Ministry of Steel, Department of Science & Technology, Department of Scientific and Industrial Research and Defence Research and Development Organisation evaluates the R&D proposals and its recommendations are placed before the Empowered Committee for consideration & approval. There are also independent Empowered Board (EB) of experts for each project for review and monitoring the progress.

Under this scheme, upto March 2019, 91 R&D projects have been approved in which Rs 252.89 crore has been released from SDF. The R&D projects include basic/fundamental research as well as applied research i.e to find out ways to solve problems being faced by the industry. Research results of several R&D projects have already been implemented by plants under SAIL and in Tata Steel, resulting in improvement in productivity, reduction in energy consumption and pollution etc. The list of R&D projects pursued with financial assistance from Steel Development Fund are given at **Annexure-2**.

The quantum of funding of the R&D projects from SDF during the last five years are given below:

Sl.No	Year	SDF (Rs Crore)
1	2014-15	17.00
2	2015-16	18.21
3	2016-17	18.13
4	2017-18	25.65
5	2018-19	1.21

3. UAY & IMPRINT SCHEMES:

Ministry of Steel is actively participating in the Impacting Research Innovation & Technology (IMPRINT) & (Uchchatar Avishkar Yojana) UAY Schemes launched by MHRD. Under the IMPRINT Scheme 3 R&D projects with total cost of Rs. 11.05 crore have been approved with 50% funding from Ministry of Steel. Under the UAY scheme, 3 R&D projects have been approved with total cost of Rs. 10.09 crore with 25% funding from Ministry of Steel.

4. STEEL RESEARCH & TECHNOLOGY MISSION OF INDIA

CEOs of Major Indian Steel Companies, signed a Memorandum of Agreement with Ministry of Steel in the presence of Hon'ble Minister for Steel & Mines on 6th April 2015 for participation and financial contribution in Steel Research & Technology Mission of India (SRTMI) for taking up research projects of national importance. SRTMI was launched as a registered society on 14th October 2015. The salient features of SRTMI are given below:

- SRTMI is an industry driven initiative, setup as a registered society headed by the steel industry representative from PSU or private sector, wherein Ministry of Steel is a facilitator, as one of the members of the society.
- SRTMI is an umbrella body to coordinate and network between the steel industry, national laboratories and academic institutes to spearhead R&D in the Iron & Steel sector.
- Subsequently, it has been decided that apart from R&D, SRTMI will also pursue skill development, training and IEC initiatives for the steel sector
- SRTMI is governed and administered by a Governing Body comprising the steel CEOs, domain experts and a representative of Ministry of Steel.
- The participating companies shall pay an initial entry fee @ Rs 25/tonne of crude steel produced during 2013-14, or, Rs 5 Cr, whichever is higher, to contribute in the initial corpus for SRTMI.

However, the contribution from the Government/ SDF and also from the steel industry has been a constraint.

5. Guidelines for submission of Research Proposal for financial support from Ministry of Steel:

R&D Project Proposals are invited from Reputed Academic Institutions/ Research Laboratories and Indian Steel Companies for pursuing R&D projects for the benefit of the Iron & Steel Sector in the country

Activities Supported:

- Development of innovative/ path breaking technologies for utilization of iron ore fines and non-coking coal.
- Beneficiation of raw materials like iron ore, coal etc. and agglomeration.
- Improvement in quality of steel produced through the induction furnace.
- Development of commercially viable technology for utilization of steel plant and mine wastes including LD/EAF Slag.
- Improvement in quality of steel produced through the induction furnace.
- Development of indigenous technologies for new processes and improved products viz. Ultra High Strength Steel, High Strength High Formable steel, CGRO Steel Sheets, emerging coated products etc.
- R&D for achieving global benchmarks in Productivity, Quality, Raw material consumption.
- Development of Low carbon technology.
- Development of innovative technology for effective recovery of waste heat in different iron & steel making processes.
- Development of innovative solutions for addressing the challenges faced by the iron & steel industry.
- To pursue R&D on any other subject of national importance concerning the Iron & Steel sector

Scope of Support:

- R&D work in Lab Scale/ Bench Scale and scale-up to Pilot Scale/ Demonstration Plants will be supported.
- In case of Industrial/ Commercial organisations pursuing R&D projects with Plan Fund, financial assistance of upto 50% of the total cost is permissible.
- In case of Academic Institutions & National/ Regional Research Laboratories, financial assistance of upto 100% is permissible. However, preference will be given to R&D project having tie-up with user industry.
- For Pilot/ Demonstration Scale R&D projects, financial contribution from Plan Fund will be limited to upto 50% & the balance to be met by the industrial partner.

Industrial Tie-ups/ Commercialization:

- R&D proposals should have industrial tie-ups and also have well defined mechanism for translation of the research results by the industry.

Eligibility:

- Proposal can be submitted by a Public Entity or Private Entity.
- Industry/ Institutions should have DSIR recognized in-house R&D laboratory.
- Joint Proposals with other laboratories/ institutions/ industry are desirable for support.

In this regard, the **advertisement published in leading newspapers** seeking R&D proposals for financial assistance from Government is given at **Annex-3**.

The **Guiding format** for Research Proposal seeking full/partial financial support from Plan Fund is given at **Annex-4**. The Standard Terms & Conditions of financial support from Ministry of Steel is given at **Annex-5**. The applications as per guidelines may be initially submitted in 8 copies (along-with a soft copy of the proposal on CD) to: Joint Secretary, Technical Division, Ministry of Steel, Udyog Bhawan, Maulana Azad Road, New Delhi – 110107.

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