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STANDING COMMITTEE ON COAL AND STEEL (2015-2016)

SIXTEENTH LOK SABHA

MINISTRY OF STEEL

RESEARCH AND DEVELOPMENT IN IRON AND STEEL SECTOR

TWENTY -FIRST REPORT

LOK SABHA SECRETARIAT
NEW DELHI
AUGUST, 2016/SRAVANA, 1938(Saka)

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STANDING COMMITTEE ON
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(SIXTEENTH LOK SABHA)

MINISTRY OF STEEL

RESEARCH AND DEVELOPMENT IN IRON AND STEEL SECTOR

Presented to Lok Sabha on 10.08.2016

Laid in Rajya Sabha on 10.08.2016

LOK SABHA SECRETARIAT
NEW DELHI
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Shri Rakesh Singh* - Chairperson

MEMBERS

Lok Sabha

2. Shri A Arunmozhithevan
3. Shri Kalyan Banerjee
4. Shrimati Jyoti Dhurve
5. Shri Faggan Singh Kulaste
6. Shri Shailesh Kumar
7. Dr. Banshilal Mahato
8. Shri Godam Nagesh
9. Shri Devji M. Patel
10. Shrimati Riti Pathak
11. Shrimati Ranjit Ranjan
12. Dr. Ravindra Kumar Ray
13. Shri Neiphiu Rio
14. Shri Tamradhwaj Sahu
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21. Shri Krupal Balaji Tumane

Rajya Sabha

22. Shri Ali Anwar Ansari
23. Dr. Pradeep Kumar Balmuchu
24. Shri Md. Nadimul Haque@
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26. Shri Jugul Kishore
27. Shri Avinash Pande
28. Dr. Satyanarayan Jatiya #
29. Shri Sanjay Raut
30. Shri Nand Kumar Sai
31. Shri Dilip Kumar Tirkey

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* Shri Rakesh Singh appointed w.e.f. 27.11.2014 vice SHri Hansraj G. Ahir appointed Minister.

\# Dr. Satyanarayan Jatiya nominated w.e.f. 25.09.2014 vice Shri Basawaraj Patil.

@ Shri Md. Nadimul Haque nominated w.e.f. 08.01.2015 vice Shri Srinjoy Bose.

COMPOSITION OF THE STANDING COMMITTEE ON COAL AND STEEL(2015-16)

Shri Rakesh Singh - Chairperson

Name of the Member

Lok Sabha

2. Shri A Arunmozhithevan
3. Shri Kalyan Banerjee
4. Shrimati Jyoti Dhurve
5. Shri Godam Nagesh
6. Shri Fagga Singh Kulaste $
7. Shri Shailesh Kumar
8. Dr. Banshilal Mahato
9. Shri Devji Mansingram Patel
10. Shrimati Riti Pathak
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12. Dr. Ravindra Kumar Ray
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22. Shri M.J. Akbar@
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28. Shri Jugul Kishore#
29. Shri Avinash Pande#
30. Shri Sanjay Raut#
31. Shri Dilip Kumar Tirkey
32. Shri Narayan Lal Panchariya*
33. Shri Beni Prasad Verma*

$ Ceased to be a Member of the Committee w.e.f. 05.07.2016 on his induction in the Council of Ministers.

@ Ceased to be a Member of the Committee w.e.f. 17.06.2016 after his resignation from Membership of Rajya Sabha

Ceased to be a Member of the Committee w.e.f. 04.07.2016 after his retirement from Rajya Sabha

*Nominated w.e.f. 25.07.2016.

SECRETARIAT

1.Shri U.B.S. Negi - Joint Secretary
2.Shri Ajay Kumar Garg - Director
3.Shri Arvind Sharma - Additional Director
4. Mrs. Vandana Pathania Guleria - Sr. Exe. Asstt.

INTRODUCTION

I, the Chairperson, Standing Committee on Coal and Steel having been authorized by the Committee to present the Report on their behalf, present this Twenty-First Report (Sixteenth Lok Sabha) on the subject "Research and Development in Iron and Steel Sector" relating to the Ministry of Steel.

2. The Standing Committee on Coal and Steel (2014-15) had selected the subject for detailed examination and report to the Parliament. The Committee were briefed by the representatives of the Ministry of Steel and Steel PSUs on 15.06.2015 and they took oral evidence on 26.08.2015. Due to paucity of time, the Report on the subject could not be finalized and presented by the previous Committee. However, the Standing Committee on Coal and Steel (2015-16) decided to carry forward the unfinished work of the predecessor Committee and thereby reselected the subject. Based on the oral and written testimony submitted to the Committee, a report on the subject was prepared.

3. The Committee wish to express their sincere thanks to the predecessor Committee for the significant contribution made by them in examination of the subject. The Committee considered and adopted the Report at their sitting held on 09.08.2016.

4. The Committee wish to express their thanks to the officials of the Ministry of Steel and Steel PSUs for placing before them and in furnishing material/information from time to time as desired by the Committee.

5. The Committee place on record their profound appreciation for the valuable assistance rendered to them by the officials of the Lok Sabha Secretariat attached to the Committee.

6. For facility of reference and convenience, the observations and recommendations of the Committee have been printed in bold letters in Part-II of the Report.

NEW DELHI;
09 August, 2016
18 Sravana, 1938(Saka)

RAKESH SINGH
Chairperson
Standing Committee on Coal and Steel

REPORT

PART-A

CHAPTER-I

INDIAN STEEL INDUSTRY

1.1 Steel is a core industry critical for India's future growth and development. Indian Steel Sector contributes nearly 2% to the country's gross domestic product (GDP) and nearly 7% through the output multiplier effect. Sectors like automobiles, construction, consumer durables and infrastructure are the major demand drivers of the steel industry. A vibrant steel sector would be critical for India to achieve and sustain annual GDP growth of 9-10%. No country has become industrially developed without an indigenous steel industry.

1.2 In 2014-15, India produced 88.25 MT of crude steel and was ranked the 4th largest steel producer in the world after China, Japan and the US. The Indian Steel Industry is amongst the fastest growing worldwide with a growth rate of 8% last year. However, the per capita steel consumption in India is low at 60 kg as against the world average of around 225 kg. This justifies the need for a rapid increase in capacity and production of steel in the years to come. As per the World Steel Association data, India had already attained the 3rd position in world steel production during the Jan-April 2015 period. Further, as per the present projections, it is expected that India will emerge as the 2nd largest steel producer soon. To sustain and further improve the competitiveness of the Indian Steel Industry, there is an urgent need for adoption of modern and state-of-the-art technologies in both existing and new plants. This would require development of indigenous technologies and innovative products by pursuing appropriate R&D programmes as well as adoption of new technologies.

PRODUCTION PROFILE OF THE INDIAN STEEL INDUSTRY

1.3 The production-mix of the Indian Steel Industry stands in a unique position today. About 57% of steel produced in India is through the Electric Arc/Induction Furnace route of which about 32% is produced through the Electric Induction

Furnace (EIF) route and 25% from Electric Arc Furnace (EAF) route. Only about 43% steel is produced through the conventional integrated route of Blast Furnace-Basic Oxygen Furnace (BF-BOF) route as against the world average of around 68%. India is the world's largest producer of Direct Reduced Iron (DRI) or Sponge Iron. During 2014-15, total production of sponge iron is reported to be around 23.44 million tones, of which 85% is from coal-based plants and 15% is from gas-based plants.

1.4 The first R&D Laboratory in the steel sector in India was set up in 1936 at Tata Iron & Steel Company (TISCO). SAIL set up their Corporate R&D Centre in 1972 at Ranchi. R&D facilities in newer plants of JSW Steel and Essar Steel came into being in 2000's. Besides the steel companies, substantive R&D is also carried out in several National / Regional Laboratories/ Institutes under Council of Scientific and Industrial Research (CSIR). Amongst them, National Metallurgical Laboratory (NML), Jamshedpur and Institute of Minerals and Materials Technology (IMMT), Bhubaneswar are the pioneers. In addition, some academic institutes, like Indian Institutes of Technologies (IITs) and National Institute of Technologies (NITs), are also engaged in carrying out sponsored research work in the area of iron and steel.

1.5 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 problem solving approach and/ or incremental technology development to address the present and short term needs of various production units. As a matter of fact, barring some commendable raw material beneficiation and product development efforts, contributions towards disruptive technology development have not been noteworthy.

TECHNOLOGY PROFILE

1.6 The technology profile of the Indian steel industry is also fast changing. The green-field integrated steel plants set up in the 1990s or thereafter, have mostly adopted state-of-the-art technologies. Within a very short span of time, most of

these plants have also expanded their capacities adopting clean and green state-of-the-art technologies. With a major modernization plan of Public sector, existing steel plants which were set up in 1960s have been expanded and modernized with the latest available technologies. India can now boast to have quite a few numbers of very large blast furnaces of the order of 4000 cubic meter or more, which are already demonstrating world class performance. In the steel industry, there is a thrust now in improving efficiency parameters of operations, viz. productivity, energy efficiency, environment-friendly production, etc.

PRODUCTION, CONSUMPTION AND GROWTH OF STEEL

1.7 The table below shows the trend in production for sale, import, export and real consumption of total finished steel (alloy+ non alloy) in the country for the last five years and April-December 2015-16:-

Year	**Total Finished Steel (alloy + non alloy) (Million Tonnes or MT)**			
	Production for Sale	**Import**	**Export**	**Real Consumption**
2010-11	68.62	6.66	3.64	66.42
2011-12	75.70	6.86	4.59	71.02
2012-13	81.68	7.93	5.37	73.48
2013-14	87.67	5.45	5.98	74.09
2014-15	92.16	9.32	5.59	76.99
April-December 2015-16*	67.71	8.39	2.91	58.94

Source: JPC; *provisional

CHAPTER-II

R&D IN STEEL SECTOR

2.1 When asked about the details of the R&D Schemes being currently pursued by the Ministry of Steel, institutes/steel companies/laboratories engaged in R&D alongwith their objective, allocation and stages of completion, the Ministry of Steel in its written reply, stated as follows:-

> "Ministry of Steel is pursuing the following two R&D schemes to supplement the R&D initiatives pursued by public & private steel companies in India, laboratories & academic institutions:
>
> (a) Research and Development through Steel Development Fund (SDF)
> (b) Research and Development through Plan Fund."

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

2.2 To supplement R&D in steel sector and to step up R&D investment in the sector, the Government had decided in 1997-98 to extend financial assistance from the interest proceeds of Steel Development Fund (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. Guidelines for submission of R&D proposals have been uploaded on Ministry of Steel's website. Advertisements are also published in leading newspapers seeking R&D proposals from time to time.

2.3 Under this scheme so far 91 R&D projects have been approved with a total cost of Rs. 950.75 crore with SDF contribution of Rs. 536.26 crore. The year-wise release of funds under the scheme for the last five years is given hereunder:

(Rs. Crore)

S. No.	Year	Amount released
1	2010-11	20.65
2	2011-12	03.01
3	2012-13	08.92
4	2013-14	17.41
5	2014-15	16.87
6	2015-16	18.21

2.4 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.

2.5 In addition to funding specific R&D projects, Ministry of Steel in the year 2008-09 has launched a capacity building programme thereby creating state-of-the-art R&D facilities for human resource development in the steel sector with financial assistance from SDF. These initiatives were taken in pursuance of the recommendation of a sub-committee headed by Prof S P Mehrotra, former Director NML Jamshedpur. Under this scheme, one centre of excellence namely, Steel Technology Centre has already been operationalized at IIT Kharagpur with a financial assistance of Rs.16.20 crore from SDF. This centre has facilitated students towards research in Iron & Steel sector. Based on this success story, three more centres have been approved at IIT Bombay, IIT BHU & IT Madras with financial assistance of Rs.33.06 crore, Rs.30.98 crore and Rs. 35.55 crore respectively.

2.6 Further, in pursuance of the aforesaid committee, Ministry of Steel has started Ministry of Steel Chair Professor & Scholarships scheme since 2008-09. The Chair Professor scheme has been started in order to partly address the shortage of faculty for teaching/ research in metallurgical engineering. The scholarship scheme on the other hand has been started to attract bright students of metallurgical engineering to pursue their career in Iron & Steel sector. The success of the scheme has been established through an independent study carried out by Administrative Staff College of India (ASCI), Hyderabad.

2.7 Under the SDF funded scheme, 91 R&D projects have been taken up costing of Rs. 950.75 crore. Out of these, 55 projects have been completed and 24 projects are in progress. Under the Plan Fund, 16 R&D projects have been taken up of which 7 projects have been completed and others are in progress.

2.8 There is a two tier structure for evaluation of R&D proposals under this scheme, An Evaluation Group 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 of experts for each project for review and monitoring the progress.

2.9 Technical Division of the Ministry of Steel works as the Secretariat of the Empowered Committee to scrutinize the research proposals, obtain views of independent experts and monitor the progress of the projects for reporting to the Empowered Committee. However, R&D and investment thereof even under this Scheme over the years has not been very encouraging. This is mainly because of limited number of overall R&D infrastructure in steel companies or in laboratories resulting in limited number of applications. In between, R&D work under the scheme also had a slow pace because of limited availability of liquid fund in the SDF upon waiver of loans amounting to around Rs. 5000 crore advanced to SAIL from SDF as part of its restructuring plan in the year 2000. Further, Tata Steel has got a stay from the High Court on restricting the utilization of their contribution in the SDF.

Working Group on Steel Industry

2.10 The Planning Commission vide its letter No. I&M 3(30)/2011 dated 29th April, 2011 constituted the Working Group on Steel sector for the Twelfth Five Year Plan (2012-17) under the Chairmanship of Secretary, Ministry of Steel. The Working Group submitted its report on Working Group in November, 2011.

2.11 On being asked about the recommendations of the Working Group for the Steel Industry for the 12th Five Year Plan(2012-17) for R&D activities in Indian Steel Sector, the Ministry in its written reply stated as under:-

> "Working Group has observed that the lack of seriousness on R&D activities in the Indian steel sector has resulted in the following:

- High capital costs for modernization and building new steel capacities as India continues to depend on the West for import of major equipment and technologies
- High level of dependence on imported raw materials and especially coking coal as we have failed to develop indigenous technologies which are compatible to resource endowment of the country
- Increased threats on sustainability of resources especially adequacy of iron ore resources as the country is yet to develop cost effective beneficiation / pelletisation technologies suited to Indian ores
- Large scale imports as R&D in product development area is inadequate to meet the growing demands of growing sectors such as automobiles, power, ship building etc.

To overcome the above mentioned challenges, the following strategies are suggested for implementation in the 12th plan:

- Aim at achieving a strategic goal of increasing R&D expenditure to 1% of turnover, by the end of terminal year of 12th plan (2016-17). This will require stepping up R&D expenditure both by the Industry and Government.
- Linkages between the R&D systems in the public funded institutions and the industrial sector need to be substantially improved to pursue translational research needs of the country.
- To create a policy framework that takes into account the entire life cycle of ideas beginning with discovery/creation to commercialization, extension and value addition."

2.12 As regards non-achievement of objectives of R&D Working Group on Steel, Secretary, Ministry of Steel during evidence submitted as under:-

हम मानते हैं कि हमसे जो अपेक्षा की जा रही थी, उसके अनुरूप कार्य नहीं हो पाया। इसमें कोई शक नहीं है कि हमारे देश में साइंटिफिक टैम्पर का जनरल अभाव है। अगर हम किसी भी विकसित देश या चीन के साथ कम्पेयर करें तो पता लगेगा कि कितने लोग एक साल में पीएचडी करते हैं, कितने पेटेंट फाइल होते हैं। स्टील क्षेत्र में इंस्टीट्यूशन्स का अभाव है। मैटलर्जी के साइंटिफिक काम में एजुकेशनल इंस्टीट्यूशन्स को सुदृढ़ बनाने में भूमिका निभा सकते हैं। आईआईटी एनआईटी सैटअप पर बहुत ज्यादा ध्यान देने की आवश्यकता है। हमारे पास लैब्स हों और प्रापर इन्फ्रास्ट्रक्चर हो जहां आरएंडडी का काम हो सके और इसके अलावा लोग हों जो यह काम कर सकें, यानी एक सुदृढ़ साइंटिफिक मैन पावर की जरूरत है। इन दोनों क्षेत्रों के बारे में प्रेजेंटेशन में बताया गया है कि किस तरह से हम इंस्टीट्यूशन्स को सुदृढ़ कर रहे हैं। हम चाहते हैं कि लोगों का रुझान मैटलर्जी की तरफ बढ़े। हम इसमें भी प्रयास कर रहे हैं लेकिन और प्रयास करने की जरूरत है। हमारे पास फ्रेमवर्क नहीं था, आर्गेनाइजेशन नहीं थी, जो देश में आयरन स्टील के क्षेत्र में आरएंडडी को आगे बढ़ा सके। प्लांट्स अपना काम कर रहे थे, सेल अपना काम कर रहा था, प्राइवेट सैक्टर अपना काम कर रहे थे लेकिन कोई एक केंद्रित संस्था नहीं थी जो आरएंडडी को कम्पोजिट तरीके से देख सके।

Guidelines for submission of Research Proposal for financial support from SDF

2.13 According to the 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 and Steel Sector in the country. The following activities are supported from SDF:-

- Development of innovative/path breaking technologies for utilization of Indian iron ore fines/slimes and non-coking coal.
- To pursue R&D projects to address climate change issues in line with other countries.
- Beneficiation/up gradation of low grade iron ore, coal etc. and agglomeration.
- 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.
- 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 and steel industry.

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 organizations 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 upto 50% and the balance to be met by the industrial partner.

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.

2.14 As regards the Details of expenditure showing utilisation of the SDF for 2013-14 and 2014-15, the Committee were informed as under:-

Item of expenditure	Amount: 2014-15 (Rs crore)	Amount: 2013-14 (Rs crore)
R&D projects	17.05	17.41
SSIC rebates reimbursement	17.68	20.04
UNDP Aus Aid Project	0.22	8.22
Economic Research Unit	5.74	7.36
Cash award for Hon'ble P M's Trophy	6.00	0.00
Market Development Project	0.11	0.12
Total	**46.80**	**53.15**

B. R&D with Financial Assistance from Plan Fund

2.15 In order to further augment the resources for R&D, the Government started a new scheme viz. "Promotion of R&D in Iron and Steel Sector", during the 11th Five Year Plan with an allocation of Rs. 118 crore. As per the approval of the Expenditure Finance Committee (EFC),the three broad areas to be pursued under this scheme are:

i. Development of innovative/ path breaking technologies for utilization of iron ore fines and non-coking coal.
ii. Beneficiation of raw materials like iron ore, coal etc. and agglomeration.
iii. Improvement in quality of steel produced through the induction furnace.

2.16 A Project Approval and Monitoring Committee (PAMC) under the Chairmanship of Secretary (Steel) and members comprising Additional Secretary & Financial Adviser and Joint Secretary, Ministry of Steel, Director IIT Kharagpur, Director, Institute of Minerals & Materials Technology (IMMT), Director, National Measurement Laboratory (NML) and other members, is the decision making body for approval of R&D projects, monitoring of ongoing projects and for overall direction. Technical Wing (TW) 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, Project Review Committees (PRCs) comprising domain experts also monitors the progress and fund utilization of each project.

2.17 Under the scheme, in the 11th Plan 8 R&D projects were approved with a total cost of Rs.123.27 crore involving Plan Fund of Rs. 87.28 crore. 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. Out of the 8 approved projects in 11th Plan, so far six projects have been completed and work on remaining two projects is in progress in 12th FY Plan. In these projects, so far Rs. 73.72 crore has been released. Year wise status of release of fund in respect of aforesaid 8 projects is as follows:

Year	Amount released (Rs. in crore)
2009-10	04.14
2010-11	27.05
2011-12	09.63
2012-13	24.90
2013-14	08.00
Total	**73.72**

2.18 When asked about the achievements vis-à-vis objectives of R&D Scheme in Iron and Steel Sector, the Ministry of Steel replied in writing as under:-

> "In the 11th Plan, 8 R&D projects were approved in which six projects have been completed and two projects are in progress. 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 using DRI. Further, feasibility of smelting reduction of iron ore/fines using hydrogen plasma has been explored in laboratory/ pilot scale. Through the two R&D projects on progress, R&D pilot plants are being setup for beneficiation and pelletisation of iron ore slimes.
>
> In the 12th Plan, 8 new R&D projects were approved. These are Detailed Project Report (DPR) on development of CRGO steel, industrial trials for production of quality steel through induction furnace route and development of automation system for optimum coal blending for coke ovens. Development of Friction Stir Welding, utilizsation of mill scale, development of refractory lining, dry slag granulation and Torpedo ladle car monitoring system. The industrial trials for production of quality steel through induction furnace route using DRI, have been completed with very encouraging results. This will go a long way to help the Induction Furnace based industry which

uses predominantly DRI as input material, to produce quality steel as per BIS standards. For the CRGO project, the DPR is being prepared. Other projects have been initiated and are in progress."

Assistance from Plan Fund in 12th Plan

2.19 In 12th Five Year Plan, Government has approved Rs. 200 crore for continuing some of the ongoing projects and also for new projects. Accordingly, with the due approval of the Standing Finance Committee (SFC), the following two new objectives were added in 12th Plan along with the three existing objectives, namely:

- Development of technology for CRGO Electrical Steel Sheets and other value added innovative steel products
- To pursue R&D on any other subject of national importance concerning the Iron & Steel sector

2.20 Under this scheme, 8 new R&D projects have been taken up during the 12th FY Plan as mentioned in 2.18 para above. During 2014-15 and 2015-16, Rs. 4.36 crore has been released in respect of the aforesaid three projects:

Year	Amount released (Rs. In crore)
2014-15	2.03
2015-16	10.26
Total	12.29

C. Steel Research & Technology Mission of India (SRTMI)

2.21 On being asked about the vision/goal of Ministry of Steel regarding R&D in steel, both in primary and secondary sectors, the Ministry of Steel in its written reply submitted as under:-

"The R&D programme of Ministry of Steel addresses problems & issues both in the public & private sector. Further, Ministry of Steel has been facilitating setting up of Steel Research & Technology Mission of India (SRTMI) to facilitate joint collaborative R&D proposals of national importance inter-alia to ensure raw material security, develop relevant technologies suitable for Indian raw materials, to ensure reduction in energy consumption & Green House Gas (GHG) emissions to address climate change issues."

2.22 The Ministry of Steel is facilitating an Industry driven institutional mechanism namely Steel Research & Technology Mission of India (SRITMI) to facilitate joint collaborative research projects of national importance in the iron & steel sector in India. SRTMI is an industry led imitative and will be setup as a registered society in close co-operation amongst the steel companies, Ministry of Steel, academia and relevant R&D institutions in the country. Initial corpus for setting up of SRTMI is Rs. 200 crore of which 50% is to be provided by Ministry of Steel and the balance by the participating steel companies. A Memorandum of Agreement has been signed by Ministry of Steel with the major steel producers to this effect on 6th April 2015. SRTMI was envisaged to be set up as a registered society. The registration of SRTMI was done on 14th October, 2015.

2.23 Asked about how much fund has been contributed for SRTMI by the public and private sector steel companies, the Ministry of Steel in its written reply stated as under:-

> "The steel companies have committed to contribute @ Rs 25 per ton of crude steel produced in the year 2013-14 as their contribution in the initial corpus for SRTMI. Accordingly, the contributions committed are as under:

Sl.No.	Company	Crude Steel Production (2013-14) MT	Contribution @Rs 25/TCS or Rs. 5 crore whichever is higher(Rs. crore)
1	SAIL	13.575	33.94
2	RINL	3.202	8.00
3	NMDC	-	5.00
4	Tata Steel	9.155	22.89
5	JSW	12.228	30.57
6	JSPL	2.836	7.09
7	MECON	-	5.00
	Sub Total (A)		112.49
8	Ministry of Steel (B)	-	100.00
	Total (A+B)		**212.49**

> CEO 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 the initiative. SRTMI has been registered on 14th October, 2015."

Initiatives to produce Cold Rolled Grain Oriented (CRGO) Steel Sheets

2.24 When the Committee asked about the indigenous production of CRGO steel in the country, Ministry of Steel in its written reply stated as under:-

"There is hardly any production of CRGO steel sheets in the country, except some quantities (about 10,000 TPA) by Thyssen Krupp Electrical Steel (India) Ltd. The technology is closely held by a few producers globally who are reluctant to share technology with Indian steel makers. Ministry of Steel has therefore, decided to develop the product indigenously by setting up a pilot plant in association with CSIR-NML Jamshedpur, Tata Steel & RINL. MECON is preparing the DPR for the project. DPR has been submitted by MECON which is being examined by stakeholders."

Roadmap for Research & Development and Technology for Indian Iron & Steel Industry

2.25 On being asked about the initiatives/roadmap for R&D in Iron and Steel Sector, the Ministry of Steel in its written reply stated as under:-

"The R&D and Technology Roadmap delineated the thrust areas for R&D and technology development in Indian Steel Sector which encourages/facilitates development and 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 and strategic steel based materials. In this regard, the R&D and Technology Roadmap recommended the R&D and Technology programmes of national importance required to be pursued in the short & long terms. The R&D and Technology Roadmap had also taken a stock of the low R&D investment in the country and recommended that major steel companies must increase their R&D investment during the 12th Five Year Plan and achieve a target of 1% of sales turnover by the terminal year (2016-17) and 2% by 2020**.**The roadmap was widely circulated among the steel companies, research laboratories & academic institutions. Based on the recommendations of the roadmap SAIL & RINL have decided to augment their R&D and technological development capabilities and also evolved their individual master plans in this regard. The steel companies in the private sector like Tata Steel, JSW & Essar Steel have also carried out extensive R&D and technology development initiatives."

CHAPTER-III

R&D BY STEEL COMPANIES

3.1 The R&D efforts by the Indian steel companies out of their own corpus have mainly been 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.

3.2 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.

3.3 When asked about details of the guidelines regarding investment in R&D issued by Department of Public Enterprises (DPE) for Central PSUs, the Ministry of Steel in its written reply stated as under:-

> "DPE has issued R&D guidelines for CPSEs vide OM No 3(9)/2010-DPE (MoU) dated 23rd September 2011. The guidelines provide the following:

- Maharatna&Navaratna category of CPSEs are required to invest in R&D @1% of PAT
- Miniratna category of CPSEs are required to invest in R&D @ 0.5% of PAT."

3.4 The R&D and Technology Roadmap has taken a stock of the low R&D investment in the country and recommended that major steel companies must increase their R&D investment during the 12th Five Year Plan and achieve the target of 1% of sales turnover by the terminal year (2016-17) and 2% by 2020. The Working Group on Steel Industry for the 12th Five Year Plan has also recommended a minimum 1% investment in R&D by the steel companies of their sales turnover.

3.5 These guidelines are being adhered to by the CPSEs steel companies' viz. SAIL & RINL. However, these guidelines also provide that CPSEs should make an attempt to benchmark R&D spending with internationally prevalent best practices in the sector. This also needs to be taken up in right earnest by the private sector to make the thrust on R&D effective.

Investment in R&D by Steel Companies

3.6 According to the Ministry of Steel, the annual R&D investment by steel companies abroad is very high and varies in the range of 1-2% of their sales turnover. However, the annual investment by Indian Steel Companies ranges from 0.11 to 0.56% of their sales turnover. Indian Steel Industry trails behind their counterparts abroad in terms of efficiency, R&D and technology development. Main problems in the steel industry are related to technological obsolescence in older plants.

3.7 When enquired about the main reasons for low priority accorded to the R&D sector by the steel companies, the Ministry of Steel in its written reply submitted as under:-

"The main reasons for low priority on R&D by the Indian Steel companies are as follows:

- Relatively smaller size/ capacities of many steel companies
- Limited R&D infrastructure.

- Limited manpower
- Limited investment

3.8 The details of actual investment on R&D by the steel companies in India which varies from company to company in the range of 0.05-0.5% of their sales turnover. Actual R&D investment in leading steel companies in terms of % of their turnover is given as under:-

(Rs. In crore)

Company	2012-13			2013-14			2014-15		
	Sales Turnover	R&D Investment	% of Turnover	Sales Turnover	R&D Investment	% of turnover	Sales Turnover	R&D Investment	% of Turnover
SAIL	49750	156	0.32	52609	121	0.23	50357	282	0.56
RINL	13534	31.13	0.23	13586	50.27	0.37	11817	33.09	0.28
NMDC	11118	12.23	0.11	12385	17.34	0.14	11925	19.08	0.16
Tata Steel	39820	59.73	0.15	42373	80.51	0.19	41875	134	0.32
JSW Steel	37261	48.44	0.13	46066	27.64	0.06	45840	22.92	0.05
ESSAR Steel	15035	25.56	0.17	13323	22.65	0.17	15284	29.07	0.19
Total	**166518**	**333.09**		**180342**	**319.41**		**177098**	**520.15**	

3.9 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 is very high and varies in the range of 1-2% of their sales turnover.

3.10 When enquired about details of year-wise allocation for R&D sector by the Ministry/Steel PSUs and private steel companies for the last 5 years and utilization thereof, the Ministry of Steel in a written reply have informed the Committee as under:-

"<u>Ministry/ PSU Steel Companies</u>:

(Rs in crore)

Year	SDF		Plan Fund		RINL		SAIL	
	Allocation	Utilization	Allocation	Utilization	Allocation	Utilization	Allocation	Utilization
2010-11	**20.00**	**20.65**	**29.00**	**27.05**	**14**	**20.29**	**113**	**137**
2011-12	**20.00**	**3.01**	**29.00**	**9.63**	**14**	**31.13**	**134**	**142**

2012-13	**20.00**	**8.92**	**26.49**	**24.90**	**50**	**50.27**	**145**	**156**
2013-14	**20.00**	**17.41**	**8.00**	**8.00**	**70**	**33.09**	**121**	**121**
2014-15	**20.00**	**17.00**	**7.00**	**2.03**	**50**	**6.26**	**250**	**250**

Private Steel Companies:

(Rs in crore)

Year	Tata Steel Limited		Essar Steel Limited		JSW Steel Limited, Vijaynagar Works	
	Allocation	Utilization	Allocation	Utilization	Allocation	Utilization
2010-11	**47**	**80.57**	**NA**	**22.14**	**37.49**	**49.68**
2011-12	**52**	**52.98**	**NA**	**24.41**	**96.40**	**62.18**
2012-13	**71**	**59.73**	**NA**	**28.57**	**70.57**	**48.44**
2013-14	**76**	**80.51**	**NA**	**23.99**	**27.05**	**27.64**
2014-15	**92**	**133.8**	**NA**	**25.08**	**7.58**	**19.68**

NA: Not Available."

R&D BY PUBLIC SECTOR STEEL COMPANIES

A. Steel Authority of India Ltd. (SAIL):

3.11 Steel Authority of India Ltd. has a corporate R&D setup at Ranchi to carry out R&D activities in the iron and steel. The major efforts of R &D are directed towards development of new steel products, process improvement, cost reduction, energy saving, quality improvement and value-addition to products of SAIL plants and providing application engineering support to SAIL's products at customers end.

3.12 R&D Centre has created state-of-art facilities to ensure in-depth scientific research in diverse fields of iron and steel technology. It is equipped with more than 500 advanced diagnostic equipment and 5 pilot facilities under 15 major laboratories. Testing and characterization of raw material and finished products are done using a wide variety of diagnostic facilities, which can be classified under three heads:

- Simulation & pilot facilities
- Facilities for process research
- Metallurgical investigation and material characterization

Highlights of R&D carried out during the last 3 years:

- Automation of Stacker cum Reclaimer (SCR) in RMHP, DSP
- Development of Roll Bite Lubrication system for Finishing Stands of HSM, BSL:
- Development of PLC based control system for Sinter Machine #3, Sinter Plant, BSL
- Improvement in productivity of SP#1, DSP
- Improvement in the lining life of converters in SMS-II, RSP
- Improvement in Hot Blast Temperature of BF#4 at DSP
- Improvement of Ignition Furnace life in all three machines of Sinter Plant, BSL

Product Development Initiatives at SAIL: Research & Development Centre for Iron & Steel (RDCIS) is the nodal centre for product development activities at SAIL. New product commercialization is being carried out by CMO in support of RDCIS & Plants for promotion of the product by intense customer interaction, arranging customer meets in different branches & regions. Application engineering support is also being provided by RDCIS & CMO at the customer's end for specific products.

3.13 RDCIS has undertaken 85 R&D projects during the year 2015-16, out of which 48 projects are scheduled for completion by March, 2016. Pursuing R&D in different areas provide technological inputs to SAIL plants/units with thrust on cost reduction, value addition, quality improvement and development of new products. During 2015-16 RDCIS has filed 19 patents and 26 copyrights from April to December, 2016. As many as 64 technical papers were justified and 117 papers were presented. In addition, RDCIS undertook contract research work and provided significant consultancy services and know-how to organizations outside SAIL, yielding external earning of Rs. 58.38 lakh during April-December, 2015. In recognition of the contributions made by the Centre, RDCIS has bagged several prestigious awards during April, 2015 to December, 2015 like The BT-STAR PSU Award for Excellence in Innovation (Tech/R&D), National Metallurgist (Industry), Metallurgist of the year, Young Metallurgist of the Year SAIL Award etc.

3.14 During the last 3 years, 72 products have been developed by SAIL (2014 - 15: 24, 2013 - 14: 24, 2012 – 13: 24). Highlights are as under:

- High strength steels such as IS 2062 E 450 HRC & plates for petrochemical industry and pressure vessel applications,
- Corrosion resistant SAILCOR HR coil for railway coaches,

- Duplex stainless steel for offshore platform,
- EQR E 250 / E 350 grade HRC / plates for construction segment,
- 0.5% B containing C-Mn steel sleeves for nuclear power plant,
- Super formable LPG grade HRC for export quality cylinders,
- M-36 CRNO grade for electrical machinery,
- IS – 1786 Fe 415/Fe 500 S grade earth quake resistant TMT rebars for construction segment,
- Rails with high fracture toughness,
- SAIL EME grade customised plates for earth moving equipments,
- HSFQ 350 grade HRC for auto,
- DMR 249 Gr. A plates for warships & corvettes,
- ASTM A 387 Gr. 22 Cl2 / Gr. 12 Cl.2 plates for boilers and special vessels.
- Soft iron magnetic grades have been developed for the first time in India for neutrino observatory and armour plates for bullet proof applications such as bullet proof / mines proof armoured vehicles.

Collaboration with major academic institutes/R&D organisations in India and abroad: Major on- going collaboration are:

- Deakin University Australia, on product and rolling technology,
- CSM Italy on product development and energy conservation,
- IMMT Bhubaneswar on dry coal beneficiation,
- IISc. Bangalore on nano-steels,
- ARAI Pune on crash worthiness of auto body steel
- IOCL, Faridabad on roll bite lubrication oil development.
- IIT Roorkee for performance evaluation of EQR rebars,
- Jadavpur university on development of magnesia based nano carbon refractories,
- IIT Kharagpur for dry slag granulation of BOF slag
- IIT Delhi on biological process for coke oven effluent treatment.

Expenditure on R&D

(Rs. in crore)

Year	SAIL's Turnover	R&D Expenditure			
		Capital	Revenue	Total	% of Turnover
2011-12	50348	5.37	129.08	134.45	0.27
2012-13	49350	2.56	145.07	147.63	0.30
2013-14	51866	4.38	106.05	110.43	0.21
2014-15	50627	32.14	232.06	264.20	0.52

Future Orientation

1. R&D Master Plan: SAIL has embarked upon an ambitious Master Plan for R&D during 2011-12, aiming at integrating R&D activities with business goals of the company. R&D Master Plan has been evolved with the following objective:

❖ To enable SAIL to achieve its operation & business goals.

- ❖ To gain competitive advantage by
  - Improving efficiencies
  - Reducing costs
  - Meeting market demands
- ❖ To upgrade current steel technologies.
- ❖ To develop technologies and new products in collaboration with key customers.
- ❖ To increase R&D expenditure gradually to 1% of turnover

B. Rashtriya Ispat Nigam Ltd. (RINL)

3.15 At RINL, R&D initiatives are directed towards meeting the present requirements and future challenges of the plant. Accordingly, the thrust areas on R&D are process improvement, waste management, cost reduction, new product development, new technology development and environment protection**.** Projects have been taken up internally in these areas as well as in collaboration with different research/ academic institutes.

3.16 A dedicated R&D Centre is being setup with state of the art infrastructural facilities, laboratories and sheds for pilot plants etc., as envisaged in the Roadmap of R&D at an estimated cost of Rs 100 crores.

Highlights of R&D carried by RINL during the last 3 years:

S. No.	Title of the Project	Objective
1	Mathematical modeling of sintering process	Process optimization, consistent sinter quality and improvement in productivity
2	Lance design for optimal performance of BOF	Improvement of blowing conditions and process optimisation
3	Improvement of MgO-C brick quality to enhance converter life	To improve converter life
4	Development of value added ceramic products utilizing solid wastes generated at VSP	To effectively utilize solid waste generated at VSP
5	Optimization of design & operating parameters on Calcium recovery & its efficacy for inclusion modification	Optimum design and operating parameters for effective Calcium recovery, inclusion modification of ultra-low Aluminium steel
6	Effect of iron ore micro-fines on sintering process	Know how to maximize iron ore micro fines usage without effecting sinter productivity and quality
7	Feasibility studies of enrichment of BF gas for	Enhancement of calorific value of BF gas

	enhancement of calorific value	
8	Development of Thermo Mechanically Treated Bars having improved seismic resistance	To manufacture EQRS TMT bars (having diameter of 16mm to 36mm) with seismic resistant property having high UTS/YS ration ≥ 1.25, uniform elongation ≥ 8% for high NSR and better market share
9	Studies on Development of Carbon dioxide (CO_2) Sequestration technique using LD Converter slag (steel slag) to control the Green House Effect of Carbon Dioxide	Studies on carbonation technique of LD slag; demonstration of steel slag carbonation and feasible sequestration technology through a pilot project after successful completion of laboratory trials
10	Development of Boron Steel Grades at VSP	To develop Boron grade steels like 10B21 and 15B24 for better NSR and market share.
11	Suitability of BF slag as a replacement for river sand in civil construction	Use of BF slag as replacement of river sand in civil construction
12	Minimization of crumbling of steel slag	To select a suitable method to prevent crumbling of slag
13	Optimization of operating parameters for Ca-Si treatment of liquid steel at SMS-2 for improving castability of steel	To optimize operating parameters to facilitate smooth casting

Expenditure on R&D

(Rs. in crore)

Year	**Actual Expenditure**	**Expenditure as % of Turnover**
2011-12	20.29	0.14
2012-13	31.13	0.23
2013-14	50.27	0.37
2014-15	33.09	0.28
2015-16 till Dec., 2015	16.24	0.20

Future Orientation

3.17 With the expansion of plant to 6.3 MTPA coming on stream and directional plan drawn to expand to 20 MTPA, a road map on R&D has been prepared, to provide required technological solutions for sustainable growth of RINL – VSP. The R&D Strategy has been formulated with focus on:

a. Assimilation of new technologies for full exploitation and knowledge development
b. Process development, process control, automation, instrumentation and process modelling activities
c. Development of new and high end products
d. Major technology development programs
e. Development of competence of R&D personnel, inculcating technology awareness among plant employees and undertake technology management activities

The Features of R&D strategy include:

1 **Funds** – To increase R&D expenditure to Rs. 100 crores.
2 **Human resources** – To expand manpower 100 Engineers/ Scientists and 80 Technical Staff: Direct recruitment of qualified and experienced engineers is being taken up.
3 **Facilities** – To setup a state of the art R&D Centre with requisite diagnostic and research facilities, pilot plants and simulation facilities: The process for setting up of a separate R&D Centre housed in the most modern state-of-art green building with LEED/IGBC certification has been initiated. The centre will have requisite diagnostic and research facilities, pilot plants and simulation facilities.
4 **Collaboration** with expert Academic and Research Institutions in India and abroad: Collaboration with international agencies like McMaster University, Ontario, Canada; IC-IMPACTS, Vancouver, Canada etc. have been taken up.

C. National Mineral Development Corporation (NMDC) Limited

3.18 R&D Centre of NMDC at Hyderabad is one of the best equipped laboratories of its kind capable of taking up any assignment in the field of ore beneficiation and mineral processing. The Centre's latest research facilities backed up by the expertise of qualified and experienced Scientists/ Engineers provide for comprehensive mineral investigation studies for mineral industries. The facilities of the Centre includes Mineralogy, Batch Ore Dressing, Mineral Beneficiation Pilot Plant, Agglomeration, Hydrometallurgy, Nano-Tech Lab, New Product Development, Bulk Solids Flowability Study, Sponge Iron Plant (Hydrogen reduced), Analytical Chemistry etc.

Highlights of R&D carried during the last 3 years:

- Utilization of blue dust:
  - 300 TPA Carbon Free Sponge Iron Powder Plant
  - Nano Iron Powder From Grade-I Concentrate (Blue Dust)
- Flow sheet developmental works on BHJ & BHQ mine waste:

- Beneficiation Studies of Banded Hematite Jasper [BHJ].
- Beneficiation & Pelletization Studies of Slime

- Utilization of Ultra Fine Slime as Sinter Feed [Hybrid Pellet Sintering].
- Dry beneficiation of blue dust.
- Making of tiles from lean grade iron ore.
- Utilization of kimberlite waste:
  - Kimberlite as Binder In Iron Ore Pelletization
  - Kimberlite as Flux In Iron Ore Sintering
- Investigations on the caking behavior of fine bulk solids and its influence on silo design parameters
- Study on Value Addition To Mill Scale, Generated From Steel Rolling Mills By Using Hydrogen Gas As Reductant In Lab Sintering Furnace for Production of Iron Powder
- Beneficiation of Low grade Iron ore from Bailadila
- Evaluation of flow properties of Low grade Iron ores of Bailadila, Bacheli complex and functional design of reliable flow storage silos/bunkers and transfers Chutes
- Development of technology for making of roof tiles and pavement block from beneficiated lean grade iron ore slimes.
- Process development for extraction of TiO2 from kimberlite waste (Rich silica Residue) at lab scale level by Hydrometallurgical route
- Reduction behaviour of Self Reducing [SR] grade iron ore pellets
- Investigations into the effect of bulk solid size distribution and liner surface roughness parameters on the coefficient of wall friction of different liner materials
- Feasibility of filtration of tailings generated from iron ore processing & associated issues related to their transportation and stacking
- Pelletization studies with iron ore concentrate obtained by beneficiation of BHJ/BHQ from Donimalai region
- Feasibility study on reduction of coarse size (-500 to+ 212 micron) blue dust concentrate by hydrogen gas.
- Characterization of BIF from Bailadila Sector with reference to possible association of magnetic mineral/minerals
- Feasibility of filtration of tailings generated from iron ore processing & associated issues related to their transportation and stacking: Phase-2
- Utilization of Dolo-char waste in iron ore sintering processes to partially replace coke.

3.19 NMDC has its own R&D Centre extending technology support to their existing mines, other organizations in India and abroad. The Centre is committed to maintain its excellence in undertaking product and Technology Development Missions related to ore and Minerals through continual improvement in process performance for enhanced customer satisfaction.

The R&D Centre functions in the following Thrust Areas:

i. Ensuring conservation of high grade ore by blending with low grade ores.
ii. Developing technologies for enhanced utilization of iron ore fines and utilisation of tailings/waste.
iii. Providing technical solutions to the problems related to quality and productivity of NMDC mines.
iv. To extend its expertise to in-house projects of NMDC and other domestic & foreign organizations,in the field of Mineral processing, Hydrometallurgy, Agglomeration, Bulk solids handling, Mineralogy and Chemical analysis.
v. Identification of new projects and development of cost effective process technology in tune with the long term objectives and strategic plans of the corporation.
vi. Expanding R&D expertise in Coal Carbonization and Iron & Steel

Development projects being pursued by NMDC are:

i. Studies on the influence of temperature on flow properties of bulk solids
ii. Beneficiation studies on BHQ from Kirandul
iii. Preparation of nano-structure TiO2 from silica base kimberlite
iv. Bulk concentrates production for 15 million ton slurry pipeline - rheological studies and flow sheet
development for 2 mt beneficiation plant at Bacheli
v. Development of special grade ferrite for NMRL (DRDO)
vi. Characterization and beneficiation studies on slime samples received from Bacheli and Kirandul.
(ISM)
vii. Pelletization study with iron ore concentrate from fines and slimes of Bacheli and Kirandul as part
of setting up of 2.0 MTPA Pellet Plant at Nagarnar.

R&D Investment

(Rs. in Crore)

Year	**Investment on R&D**			**Annual Turnover of NMDC**	**Percentage w.r.t turnover (%)**
	Revenue	**Capital**	**Total**		
2012-13	11.98	0.25	12.23	10704.27	0.11
2013-14	14.42	2.32	16.74	12058.00	0.14
2014-15	17.16	1.33	18.49	12356.41	0.15
2015-16 (Up to Dec' 15)	11.30	0.63	11.93	4925.85	0.25

Expenditure on R&D

(Rs. in crore)

Year	Expenditure on R&D			Annual Turnover	% w.r.t. turnover
	Revenue	Capital	Total		
2011-12	13.76	1.57	15.33	11261.89	0.14
2012-13	11.98	0.25	12.23	10704.27	0.11
2013-14	15.02	2.31	17.33	12000.00	0.14
2014-15	17.16	1.33	18.49	12356.41	0.15
2015-16 (upto Dec.' 2015)	11.30	0.63	11.93	4925.85	0.25

D. MECON Ltd.

3.20 MECON completed the following R&D projects successfully during 2015-16:

- Conceptual design & simulation of Air Warrior Body Ventilation Vests for Defence personnel
- Development of non-contact linear displacement sensor and limit switch by laser spotting at R&DDivision of MECON, Ranchi.
- Environmental Impact Assessment (EIA) on Ozone at RSP, Rourkela.
- Extraction of Iron, Aluminium and Titanium from Red Mud-GHARDA Chemicals
- Commercialization of Thermoelectric Direct Cooled Helmet for Industrial Application.

R&D Expenditure

Year	Turnover (Rs. in Crore)	R&D Expenditure (Rs. in Crore)	% of R&D Expenditure w.r.t. Turnover
2012-13	511.65	2.38	0.47
2013-14	341.29	2.70	0.79
2014-15	389.92	2.07	0.53
2015-16 (April to Nov. 2015)	450.00	1.61	0.36

E. MOIL Ltd.

3.21 MOIL has carried out R & D activities to improve the safety and productivity in the mines by introducing modern technology with CSIR-R&D Laboratory, Academic and R&D institutions of the country. Major activities during 2015-16:

- Ventilation reorganization studies for deeper levels to improve the face ventilation and productivity of underground sections of Balaghat and Gumgaon Mine.
- Mechanized stopping operation has been prepared and implemented for mechanized stopping operations and support systems at Ukwa Mine.
- Mill tailings of Malanjkhad Copper Projects have been utilized for hydraulic stowing operation at Ukwa Mine.
- Study for filling of underground sections at Ukwa Mine by bottom ash on experimental basis.
- Making collaborative research for slope stabilization with National Institute of Technology, Raurkela for Slope Monitoring Instruments.

R & D Expenditure:

(Rs. in Crore)

Year	Expenditure on R&D	% of Turnover
2012-13	8.29	0.86
2013-14	9.19	0.90
2014-15	6.00	0.73
2015-16 (April to Dec,15(Prov)	6.03	0.90

F. KIOCL Ltd.

3.22 Highlights of R&D Achievements

- Indigenization of Roll Press control system Pellet Plant
- Study on Heat Recovery system from Flue Gases in Pellet Plant.
- Feasibility study of Secondary Grinding of Iron Ore Fines for improving the throughput of grinding system at Port Facilities Department.

R&D BY PRIVATE COMPANIES

G. Tata Steel Limited (TSL), Jamshedpur

3.23 Specific Areas of R&D Work carried out in TSL during the last three years:

- Raw Materials beneficiation.
- Cost reduction and productivity improvement.
- Development of new products
- Reduction in energy consumption and GHG emission.

Benefits Derived:

- Coal leaching technology has been demonstrated successfully at pilot scale for producing 8% ash clean coal from washery tailings.

Regeneration of the chemicals and reduction of energy cost are the remaining challenges for commercial exploitation of the technology.

- Promising results obtained for extracting low ash (4%) coal with reasonable coking properties from some non-coking coals through organo-refining process. Energy reduction and technology up-scaling are the remaining challenges going forward.
- Successful pilot scale demonstration made for recovering concentrate with <2.5% alumina from iron ore ultra-fines rejects (<25 micron). The process has been included in the iron ore total beneficiation scheme.
- Remarkable improvement in pellet strength and RDI has been achieved by adopting a new flux combination (Pyroxenite & Limestone). Future challenges include decreasing the dust generation during pellet making and pellet handling.
- R&D studies have helped in eliminating inconsistency in liquid steel chemistry prior to continuous casting for welding electrode steels at LD1.
- Implementation of new SEN designs developed by R&D for reducing slivers in coils, process improvement has been recorded at LD2, product testing is under way.
- NEST IN Brand has been developed jointly with M&S FP. Response is good – price optimization in process.
- Thin organic coating (TOC) for GI tubes (Tata Pipes) developed by R&D for the first time in India, process facility commissioned in Tubes Division, optimization is the challenge ahead.
- Successful commercialization trials of Fire Resistant Steel for Structura Tubes completed.
- Application of laser-cladded rolls has resulted in significant life enhancement of LD2 foot rolls.
- Major EVI carried out with M&S FP for Tata Motors, TVS and Bajaj. Cost savings have been reported by M&S. VAVE workshop hold with Volkswagen globally for the first time.

3.24 New process/Product developed (April-Dec., 2014)

i. Developed a selective flocculation process for minimizing the Cr203 losses in tailing stream from chrome ore beneficiation plant.
ii. Studies for removal of hexavalent chromium by ion exchange and bio-remediation in collaboration with national Metallurgical Laboratory, Jamshedpur.
iii. Designed a novel rotary reactor for synthesis and hydrogen gas production from molten Ferrochrome slag.
iv. Developed a physic-chemical process at lab scale for selective leaching of low grade Mn ores.
v. Undertaken Scale up tests @ 25 Kg scale for development of <0.5%CFeMn.

R&D Investment:

(Rs. in crore)

Year	Amount				% of Turnover
	Recurring	Capital	Total	Turnover	
2010-11	75.69	4.88	80.57	29396.35	0.27
2011-12	52.3	0.68	52.98	33933.46	0.16
2012-13	55.77	3.96	59.73	38199.43	0.15
2013-14	68.45	12.06	80.51	41711.03	0.19

Future Plan & Vision on R&D

3.25 Commercialization of the following R&D projects is planned and there are proposals worth more than Rs. 200 crore for putting up pilot plants:

- Utilization of high alumina Indian iron ore slime.
- Innovative grinding/beneficiation of coal for producing low ash coal from low grade Indian coal

H. JSW Steel Ltd.

3.26 The R&D Centres at JSW are equipped with modern facilities & infrastructure viz. Pilot Scale Facilities, Material Characterization Lab, Coal and Coke Lab, Mechanical Testing Lab, High Temperature Lab, Beneficiation and Agglomeration Lab, Corrosion and Tribology Lab, Chemical Testing Lab, Water Modeling Lab, Mathematical Modeling Lab (Simulators) etc.

Highlights of R&D Work Carried Out in the last three years

S.No.	Key R&D Project	Benefits accrued
1.	Beneficiation of low grade iron ore	Achieved production targets in-spite of non availability of iron ore.
2.	Developed new coal blends for coke making with higher percentage of non coking inert material.	Optimized the coke making cost and achieved a benefit of Rs. 600 Cr/yr and helped conservation of coking coal.
3	Waste water treatment for recirculation in processes.	Helped in achieving zero water discharge and conservation of water.
4	Treatment & Usage of Granulated BF slag as a replacement to river sand in construction and steam aged slag for road making.	Helped in waste utilization and conservation of river sand. Promoted Green sand for the first time in the country.
5	Developed Fe 500 S grade Steel for TMT bars for Seismic	JSW is the first and only company in the country, who has developed certified BIS

	applications	grade. Saved foreign exchange by import substitution and can now capable of exports.
6	Implemented utilization of Fe bearing dusts through micro pelletization and briquetting.	Achieved conservation of iron ore and waste utilization.
7	Developed BOF bottom purging process with 8 plugs.	Achieved an increase of 0.12 % productivity translating to 4500 TPA of LS.

R&D Investment

Indicators	**2011-12**	**2012-13**	**2013-14**	**2014-15 (April-Nov., 2014)**
Vijayanagar Works				
Annual Turnover	24755	27204	29897	-
Investment in R&D	57.14	43.42	22.04	14.63
R&D Investment against Annual Turnover	0.231	0.160	0.074	-
Dolvi Works	6.547	6.516	5.919	6.052
Annual Turnover	11272	9700	12200	-
Investment in R&D	12.40	0.97	2.44	1.015
R&D investment against Annual Turnover	0.11	0.01	0.02	-

Future Plans

- Dry granulation of BF slag to produce clinker and energy recovery.
- Development of advanced high strength steels (>1000MPa).
- Development of electrical steels.
- Development of a new fluidized bed reduction roasting process for iron recovery from slimes and low grade ores /BHQ/BHJ.
- Process development for utilization of non coking coals in coke making.
- Development of Hydrogen generation process for use in DRI.
- Development of Large scale CO2 sequestration process.
- Development of value added products from process wastes.

I. ESSAR STEEL LTD.

3.27 Essar steel has a full fledged corporate R&D department, providing support to its entire operations. R&D department is engaged in three broad areas of research: Raw materials, Process and product development. The R&D department has collaboration with many national and international associations in product

development areas and characterization such IBM Nagpur, IITs, CFRI, CSIR-IMMT, CBMM, BARC and joint development of products with customers. Some of the major achievements are:

Highlights of R&D Work Carried Out in the last three years

3.28 25% of the total sales revenue is from product developed during the last 3 years. Among them include new generation high strength light weight steels for fuel savings and safety for automotive and general engineering segments. Major accomplishments in different areas are:

Raw material and Process

- Developed beneficiation cycle for use of Red ochre lean iron ore with approx. 44-46% Iron content in Blast furnace for industrial production.
- Briquetting of coal fines for Corex.
- Briquetting of cold Direct Reduced Iron (CDRI) fines to be recycled in Steel making process.
- Micro-Pelletization of Electric arc furnace (fume extraction system) dust, Effluent treatment waste sludge & lime fines.
- In-house development of process models for iron making and rolling
- Steel Waste Recycling (contribution in terms of zero waste for environment)
- Developed technology for utilizing steel slag for manufacturing Paver blocks, ceramic tiles.
- Research on utilization of un-granulated blast furnace slag (slag pit) as filter media for industrial waste water treatment

Product Development

- Indigenization of advanced high strength special steel for defense. (war ships, ballistic and armor steels, DMR 1700)
- Wear resistant plates and high strength structural quality plates for yellow good segment.
- Low alloy steel for boiler and pressure vessel segments.
- High strength special steel for oil and gas transportation.
- Special steel soft magnetic applications for atomic energy sector.
- High strength high fatigue steel (700MC) for yellow goods
- Stretch Flangable steels
- Hot forming grades
- High strength grades for making long members of trucks
- Dual phase steels for automotive wheels
- High strength bainitic steels and bake hardening steels
- Crash resistant steel, high strength steel up to 440 MPa and dent resistant steel
- High strength steel grade with strength of 700 MPa for making long members
- It has also executed a successful order for Mazagon Dock for building war ships for Indian Navy

Future Plans

3.29 R&D expenditure is about 0.2% of sales turn over. The R&D expenditure mostly constitute for the Product Development and Process improvement pilot scale

trials. Future program of research are largely based on modeling and simulation leveraging the information technology available worldwide. Hence augmentation in terms of equipments is considered based on the need of the research. As ESSAR is gearing up for reach production levels of >10 million tons in the coming few years, R&D expenditure spent is expected to rise by 3 to 4 times that of current levels in the next 5 years.

CHAPTER-IV

CHALLENGES FACING R&D IN CONTEXT OF INDIAN STEEL SECTOR

A. Raw Material

Development of Technology for utilization of low grade Iron Ore Fines

4.1 Indian Steel Industry has already been utilizing iron ore (coarse-fines) in the production of sinter and utilizing it to the extent 60-70% of the Blast Furnace burden. For utilisation of low grade & finer iron ore fines, several beneficiation & pelletisation plants have already been commissioned in the recent past. To address the problems of difficult-to-beneficiate/pelletise low grade iron ore fines, Ministry of Steel has sponsored several R&D projects which have developed technology in laboratory scale. Some R&D pilot plants are also under commissioning. Similar initiatives have also been taken up by the steel companies themselves.

4.2 Asked about any research that has been done on the matter of utilising fines to produce steel in India as is being done by other steel producing countries like China, Korea, Malaysia, Thiland etc. and about the plan to equip any specific plant to enable it to utilise fines under the current ongoing Modernisation & Expansion programme of SAIL, the Ministry in its written reply stated as under:-

> "Indian Steel Industry, particularly the Integrated Steel Plants, use iron ore fines extensively (60-70%) in the form of sinter for production of Iron & Steel. Further, some of the steel companies have set up pelletisation facilities to utilise finer variety of iron ore fines in the form of pellets. Plants like JSW Steel Ltd. Bellary, use even low grade iron ore fines after necessary beneficiation & agglomeration. Similarly, large number of units in the private sector, have set up beneficiation &pelletisation facilities to utilise low grade iron ore fines for production of pellets/ sponge iron.
>
> However, there are problems & issues in beneficiation &pelletisation of several lower grades of iron ore fines/ slimes which are being addressed by R&D and technology interventions.
>
> In last one decade, Institute of Minerals and Materials Technology (CSIR-IMMT) Bhubaneswar, has carried out number of R&D projects to utilize the low grade iron ore fines, slimes, BHQ/BHJ/BGQ to recover the iron values as in-house and sponsored projects from Ministry, Public sectors and private sectors. Based on these projects, a number of beneficiation plants have been set up by the steel companies, some of which are as under:

- Essar Steel India Ltd., Barbil has set up 15 MPTA
- Bhushan Power & Steel Ltd, Jharsuguda. has set up 6MPTA
- BRPL, Barbil has set up 6MPTA
- JSPL, Barbil has set up 15 MPTA
- BMM Ispat, Hospet has set up 2.0 MPTA

CSIR-IMMT, Bhubaneswar is making negotiation with L&T to provide full package of pelletisation technology starting from 0.3 to 2.0 MPTA straight grate technology based on the Indian iron ore characteristics.

RDCIS, SAIL has taken a R&D project to develop suitable process in utilization of gothetic/hematite iron ore, which is difficult to beneficiate &pelletise.

Under the current Modernisation& expansion plan of SAIL, Gua Iron Ore Mine of Raw Material Division of SAIL is being expanded to 10 Mtpa of finished product with Beneficiation facilities and 4.0 Mtpa Pellet Plant for utilizing low grade iron ore fines.
Further, 1.0 Mtpa Pellet Plant with Slime Beneficiation System at Dalli Ore Mines of Bhilai Steel Plant, 2.0 Mtpa Pellet plant with beneficiation plant at Rourkela Steel Plant and 1.5 Mtpa Pellet Plant on BOO basis at Bokaro Steel Plant are planned to be installed under AMR projects."

4.3 On being asked about the constraints in production of steel from fines which are generally available in sufficient quantity in the country, the Ministry in its written reply stated as under:-

"The possible sources of fines and the associated problems are as follows:

- Waste dump fines from earlier workings utilising preferentially the high grade lumps leaving behind the fines un-utilised. These fines (<10 mm) are of low grade with high alumina and silica impurities and can not be used as such for iron making. However, once these are beneficiated,these can be used as sinter or pellets for iron making.

- Ultrafine/ Slimes from Hematite Iron Ore Washing Plants. These slimes are typically below -0.15 mm with high levels of impurities and cannot be charged to the furnace for iron making due to fine granulometry and furnace permeability problem. But slimes can be beneficiated and pelletized for iron making.

- The third source of fine grained concentrate could be from beneficiation of low grade and fine grained iron ores. The products from beneficiation of low grade iron ores are normally fine grained and can be used with suitable agglomeration(sintering/pelletization).

4.4 The characterisation of Indian iron ore, poses challenges for beneficiation and pelletisation which are highlighted as under:

- In general, Indian hematite ore contains good amount of clay minerals. Therefore, at the beginning, iron ore should be de-slimed using attrition technique using drum scrubber (below 40 mm size) or screw scrubber (below 10 mm size) to remove clay minerals. The suitable dispersing chemical additive can be used to maximize removal of clay minerals.
- Indian hematite ore is fragile nature and proper closed circuit is to be designed either using screen or hydro-cyclone or both to produce closed range particles having S-curve particle size distribution.
- Due to the flaky nature of ore, it creates problem in jigging process. Fluid dynamics control has to make properly to provide sharp separation of heavy and light particles by proper design of compartments to provide suitable amplitude to reduce the misplacement of the particles.
- As hematite is associated with goethite, the iron ore concentrate after beneficiation, it has high LOI. It may not be suitable for existing pelletisation processes. It is essential to blend with low LOI concentrate to meet the desired specification.
- The main impurities in iron ore are kaolinite. The suitable reagent has not been developed to float kaolinite minerals. Hence reverse flotation is not suitable to meet the requisite specification of downstream. Hence conventional flotation is used to recovery the iron values. The surface of iron phase minerals becomes more hydrophobic nature which has negative impact on the pelletisation process. In pelletisation process, partially, it may be blended with other products to minimize the negative impact in pelletisation.
- Temperature profile in existing pelletisation technology is not suitable for goethtic-hematite Indian ore."

4.5 Asked about the steps taken for improving the quality of raw material the Secretary, Ministry of Steel submitted as under:

> रॉ मैटीरियल के बारे में आर एंड डी की बहुत आवश्यकता है। जो लो ग्रेड मैटीरियल है, जहां तक आयरन ओर में आयरन की मात्रा कम होने का सवाल है, तो उसकी टेक्नोलॉजी हैं और उसमें बेहतरी हो सकती है। बेनिफिसियेशन है, पैलेटाइजेशन है, उससे उसे यूजेबल बनाया जा सकता है। ऐश कन्टेन्ट और फास्फोरस कन्टेन्ट में आर एंड डी की एक विशे-न आवश्यकता है और हम उसे करना चाहेंगे।

4.6 The Committee were informed about inferior quality of Indian raw materials which results in higher specific energy consumption and also higher slag volumes. On being asked about the developments made so far in beneficiation of inferior quality of raw materials and also the present initiatives taken in this regard, the Ministry of Steel in its written reply stated as under:-

"Substantial R&D is being carried out by the R&D labs, academic institutions & the steel companies themselves to develop commercially viable beneficiation processes with improved yields for iron ore & coal with higher impurities. Ministry of Steel has also provided financial assistance in this regard. The following is some of the highlights of development made so far:-

- Extensive R&D studies were carried out on Sub grade iron ore from Bailadila sector for development of economical process flow sheet. Subsequently, Process flow-sheet was developed for beneficiation of sub-grade iron ore from Bailadila Deposit 5, 10 & 11 A by NMDC.

- After extensive R&D studies, flow sheet was developed for processing of slimes from Donimalai Iron Ore Mines for setting up 1.89 MTPA Slime Beneficiation Plant at Donimalai by NMDC.
- Pelletization study was carried out with iron ore concentrate obtained from beneficiation of Donimalai slimes for 1.2 MTPA Pellet Plant at Donimalaiby NMDC.
- Process flow sheet was developed for beneficiation of Banded Hematite Jasper (BHJ) of Donimalai Mines for setting up 0.36 MTPA Beneficiation Plant at Donimalaiby NMDC.
- Process flow sheet was developed for beneficiation of goethite rich iron ore from Bailadila Deposit 14 & 11Cby NMDC.
- Samples of Banded Hematite Quartzite (BHQ) from Kirandul were studied and process flow-sheet was developed for beneficiationby NMDC.
- Flow sheet was developed for processing of slimes from Deposit 5 of Bailadila for setting up 3.2 MTPA Beneficiation Plant at Bacheliby NMDC.

- Bench and Pilot scale Iron ore beneficiation studies carried out for developing process flow sheet, unit operations required, data for selection and sizing of equipment for setting up of 10 MTPA beneficiation plant at Kirnadul (6 MTPA) and Bahceli (4 MTPA) by NMDC.

- Extensive R&D investigations have been carried out by JSW to utilize low grade ores like the BHQ &BHJ ores in Hospet -Bellary regions. JSW has set up a 2 TPH pilot plant for continuous process upgradation and optimization.

- JSW has also initiated R&D programs to develop new technologies to beneficiate other difficult to treat ores for effective utilization through their JSW-IITM Centre for applied research.

- SAIL is pursuing R&D project in association with Ministry of Steel for beneficiation &pelletisation of slimes generated in Barsua Mines, Sundargarh, Odisha.

- SAIL is also setting up following facilities for processing iron ores:

- 12.5 MTPA beneficiation plant & 4 MTPA pellet plant in Gua Ore Mines, West Singbhum, Jharkhand.
- 6.53 MTPA & 8.05 MTPA beneficiation plant at Bolani, Koejhar, Odisha.
- 1 MTPA Pellet Plant with 1.2 MTPA upstream Slime/Low grade Beneficiation Plant at Dalli iron ore Mines, Durg, Chhattisgarh
- 7/15 MTPA beneficiation plant at Manoharpur Iron ore Mines (Chiria), West Singhbhum, Jharkhand
- 14 MTPA beneficiation plant at Rowghat iron ore Mine, Kanker, Chhattisgarh
- 2 MTPA Pellet Plant with 3.3 MTPA beneficiation plant at RSP."

4.7 The Committee were apprised that the problem of excess phosphorus and sulphur in Iron Ore has been going on since many years. There is also reported to be high alumina contents in iron ore and ash in coking coal which results in consumption of high energy and production of higher slag volume. On being asked whether any specific R&D projects have been taken up/are currently going on to eradicate/ minimise this problem, the Ministry in its written reply stated as under:-

> "The level of sulphur and phosphorous is not so high in these ores but they contain high level of aluminous and siliceous impurities. For integrated steel plant phosphorous is not a big problem, because it can be removed easily in Basic Oxygen Process. But high phosphorous content of iron ore poses major problem to secondary steel sector as they use Direct Reduced Iron (DRI) as the major feed material in Induction furnace where there is no refining process adopted. The sulphur comes from coal."
>
> In particular, high alumina in iron ore is deleterious and has adverse affects on blast furnace productivity. Council of Scientific and Industrial Research – National Metallurgical Laboratory (CSIR-NML) has been engaged in beneficiation of iron ore from different sources within India and abroad towards reduction of alumina/silica and enrichment of iron content. It has developed beneficiation processes for reduction of alumina in iron ores and based on the process developed, a number of iron ore washing-beneficiation plants have been commissioned in the country under public and private sectors.
>
> Substantial R&D is being carried out by the R&D labs, academic institutions & the steel companies themselves to develop commercially viable beneficiation processes with improved yields for iron ore & coal with higher impurities. The Ministry of Steel has also provided financial assistance in this regard. The Committee were informed of some of the following are some of the highlights of development made so far:

(i) CSIR-NML and other laboratories such as CSIR-CIMFR, CSIR-IMMT have been involved in studies on ash reduction in coals. Based on CSIR-NML's work earlier flotation plants were commissioned for ash reduction in coking coal by

Tata Steel and BCCL. CSIR-NML has also developed column flotation technology and is collaborating with Tata Steel for its application for beneficiation of coking coal fines.

(ii) In last one decade, CSIR-IMMT has carried out number of R&D projects to utilize the low grade iron ore fines, slimes, BHQ/BHJ/BGQ to recover the iron values as in-house and sponsored projects from Ministry, Public sectors and private sectors. Based on these projects, a number of beneficiation plants have been set up by the steel companies.

(iii) Extensive R&D studies were carried out on Sub grade iron ore from Bailadila sector for development of economical process flow sheet. Subsequently, Process flow-sheet was developed for beneficiation of sub-grade iron ore from Bailadila Deposit 5, 10 & 11 A by NMDC.

(iv) After extensive R&D studies, flow sheet was developed for processing of slimes from Donimalai Iron Ore Mines for setting up 1.89 MTPA Slime Beneficiation Plant at Donimalai by NMDC.

(v) Pelletization study was carried out with iron ore concentrate obtained from beneficiation of Donimalai slimes for 1.2 MTPA Pellet Plant at Donimalaiby NMDC.

(vi) Process flow sheet was developed for beneficiation of Banded Hematite Jasper (BHJ) of Donimalai Mines for setting up 0.36 MTPA Beneficiation Plant at Donimalaiby NMDC.

(vii) Process flow sheet was developed for beneficiation of goethite rich iron ore from Bailadila Deposit 14 & 11Cby NMDC.

(viii) Samples of Banded Hematite Quartzite (BHQ) from Kirandul were studied and process flow-sheet was developed for beneficiation by NMDC.

(ix) Flow sheet was developed for processing of slimes from Deposit 5 of Bailadila for setting up 3.2 MTPA Beneficiation Plant at Bacheli by NMDC.

(x) Bench and Pilot scale Iron ore beneficiation studies carried out for developing process flow sheet, unit operations required, data for selection and sizing of equipment for setting up of 10 MTPA beneficiation plant at Kirnadul (6 MTPA) and Bahceli (4 MTPA) by NMDC.

(xi) Extensive R&D investigations have been carried out by JSW to utilize low grade ores like the BHQ &BHJ ores in Hospet -Bellary regions. JSW has set up a 2 TPH pilot plant for continuous process upgradation and optimization.

(xii) JSW has also initiated R&D programs to develop new technologies to beneficiate other difficult to treat ores for effective utilization through their JSW-IITM Centre for applied research.

(xiii) SAIL is pursuing R&D project in association with Ministry of Steel for beneficiation & pelletisation of slimes generated in Barsua Mines, Sundargarh, Odisha.

(xiv) SAIL is also setting up following facilities for processing iron ores:

a. 12.5 MTPA beneficiation plant & 4 MTPA pellet plant in Gua Ore Mines, West Singbhum, Jharkhand.
b. 6.53 MTPA & 8.05 MTPA beneficiation plant at Bolani, Koejhar, Odisha.
c. 1 MTPA Pellet Plant with 1.2 MTPA upstream Slime/Low grade Beneficiation Plant at Dalli iron ore Mines, Durg, Chhattisgarh
d. 7/15 MTPA beneficiation plant at Manoharpur Iron ore Mines (Chiria), West Singhbhum, Jharkhand
e. 14 MTPA beneficiation plant at Rowghat iron ore Mine, Kanker, Chhattisgarh
f. 2 MTPA Pellet Plant with 3.3 MTPA beneficiation plant at RSP.

The Ministry of Steel had also provided financial assistance for pursuing the following R&D projects on beneficiation of Iron Ore & Coal:

(i) Improvement in sinter productivity through deep beneficiation and agglomeration technologies for rational utilization of low grade iron ores and fines, by NML, Jamshedpur
(ii) Production of low ash (10% ash) coal (coking non coking) from high ash Indian coals including desulphurisation of high sulphur North East coal by Institute of Minerals & Materials Technology (IMMT) Bhubaneswar
(iii) Beneficiation of Iron Ore slimes from Barsua by Research and Development Centre for Iron and Steel (RDCIS), SAIL, Ranchi."

Prospecting and Exploration of Deposits

4.8 When asked whether the technology/ method used to find out the availability of Iron Ore Deposits in the country is of world standard, the Ministry of Steel in its written reply stated as under:

> "Yes, NMDC has technology to explore Iron Ore Deposit of world standard. NMDC is doing reconnaissance/ detailed exploration using remote sensing, geophysical methods for delineating ore body. NMDC is carrying out detailed geological mapping in 1:2000 scale.
>
> NMDC is equipped with state of art/latest technologies for drilling. Along with existing old conventional drills, four new generation exploratory drills with high drilling capacity (one reverse circulation drill & 3 diamond core), which are being used to achieve the drilling targets at various projects of NMDC at faster pace."

4.9 When asked about the last mapping for Iron Ore done and the next phase planned, the Ministry of Steel in its written reply stated as under:-

"NMDC has done preliminary and detailed geological mapping in Sasangda

North East block PL in Karampada RF, District West Singhbhum, Jharkhand over an area of 115.46 ha in 1:2000 scale along with topographical survey to delineate different iron ore types in 2014-15**.**Exploratory drilling work is pending for want of Forest permission. NMDC is also planning to do preliminary mapping in 3 iron ore areas in MP."

B. Technical Manpower

4.10 On being asked about the number of researchers/scientists currently employed in the public Sector Steel companies to carry out Scientific and Research Studies, the Ministry in its written rely stated that in SAIL; 229 technical executives and in RINL; 26 technical executives are engaged in R&D activities. According to the Ministry, almost all technical executives are involved in research projects activities only.

4.11 On being asked about the reasons for non-availability of technical manpower in the country to carry out R&D works and the steps taken to encourage students opting for metallurgical engineering, the Ministry in its written reply stated as under:

"Government of India under SDF mechanism has started a scheme for Ministry of Steel's Chair Professor and student's scholarship for the students who want to pursue their career in Metallurgical Engineering. This scheme was started in the year 2008. By introduction of this scheme, IITs and NITs are getting bright students for pursuing their education in the metallurgy engineering discipline. It has also facilitated human resource development by pursuing higher education by these students in metallurgical engineering. Through appointment of Chair Professor in the metallurgical engineering department by IITs and NITs, Ministry of steel are able to retain good faculties for guiding the students for M.Tech and Ph.D level courses. Ministry of Steel had assigned a work to IIT, Kanpur for a study on requirement and availability of technical manpower for steel industry in India for a production of 300 MT by 2025. Ministry of steel has received the final report. The study has revealed that if future steel plants employ modern technology & automation then no shortfall is envisaged for graduate engineers in any discipline including metallurgical engineering. However, if steel plants continue to remain at the same level as these are today, there is like to be some shortfall in the supply of graduate metallurgical engineers and to some extent ceramic engineers. However, no shortage is anticipated in the case of diploma engineers &ITI trained personal."

4.12 On being enquired about the special perks/benefits provided by the

Government to attract people with excellent academic background into PSUs and the strategy employed to retain such talent, the Ministry in its written reply stated as under:-

> "Competitive compensation package at entry level, established brand equity combined with other benefits & facilities for work-life balance, makes the PSU steel companies a choice for employment by the candidate from premier institutes. The PSU steel companies employ a Performance Management System which is unique & comprehensive. Growth opportunities for every young entrant are immense and one can aspire for career growth upto the Board level positions. Competitive compensation package at entry level also draws employees towards SAIL who are looking to be rewarded with 'apt compensation' for their talent and skill. This is combined with other benefits and facilities for work-life balance etc."

CHAPTER-V

TECHNOLOGY DEVELOPMENT TO PRODUCE HIGH END VARIETIES OF STEEL

5.1 The country has been producing normal grades of automotive steels and also CRNO electrical steels for quite some time. However, high end varieties of auto grade & CRGO electrical steels are not produced in the country as the technology is closely held by a handful of leading steel manufacturers worldwide. However, the Indian steel industry has signed some major MOUs & agreements with foreign companies to produce high end varieties of automotive & electrical steels, which are given hereunder:

- SAIL has signed an MOU with Arcellor Mittal, Luxemberg, for development/ production of automotive grade steel sheets. The MOU has been recently signed and joint feasibility studies are in progress. Firm agreement is expected to be signed by end of 2015-16.
- RDCIS, SAIL has signed an MOU with Mishra Dhatu Nigam Limited (MIDHANI), Hyderabad in June, 2015 to jointly develop process technology for production of CRGO steel indigenously using technical strengths of both the organizations. Experimental work has already started in July 2015. Additionally, interactions have been initiated by SAIL with international steel companies for transfer of technology for commercial production of CRGO steel.
- Tata Steel has set up a joint venture (51%:49%) with Nippon Steel & Sumitomo Metals Corporation for development & production of automotive grade steel sheets. The dedicated facility has been commissioned and already started production of several grades. Trial runs for producing advanced grades of automotive steel are in progress.
- JSW Steel has entered in a strategic alliance with JFE Japan (with 15% equity participation in JSW) for technological support for development & production of value added steel products particularly automotive grade steel & electrical steel. It is an ongoing agreement and JSW has already commissioned and started production of automotive & CRNO steel sheets.JSW steel has plans to set up CRGO facility with external collaboration for technology in the next 5 year period.
- Essar Steel has signed umbrella agreement with Kobe Steel Japan, for production of value added steel products. Under this agreement, technology transfer for development & production of exposed panels for automobiles has been executed.
- 2 renowned foreign companies namely POSCO, South Korea and China Steel Corporation, Taiwan have set up their 100% subsidiaries in India to produce value added flat steel products.

5.2 Government has also decided to pursue an R&D project namely "Development of Technology for Cold Rolled Grain Oriented Electrical (CRGO) Steel Sheets", for indigenous development of the technology for CRGO steel sheets. Salient features of the project are given below:

- This is a joint collaborative research project by NML Jamshedpur, Tata Steel, RINL& Ministry of Steel.
- The estimated cost of the CRGO Pilot project is Rs. 500 crore out of which Rs. 150 crore is to be provided from Plan Fund of Ministry of Steel.
- MECON has submitted a final DPR which is under consideration.

5.3 On being questioned as to how the new technology, whether from abroad or from within, can be adopted to bridge the huge gap in production levels between China & India, the Ministry of Steel in its written reply stated as under:-

> "The Indian Steel industry is taking a two pronged strategy for improving the technological face of the steel sector through modernisation & expansion of the existing plants and setting up of green-field plants with the state-of-the-art technologies. Several steel processing units have been set up in India by foreign companies for production of value added steel products hereto mostly imported. Further, MOUs and Joint Ventures have been signed with foreign technology providers to enable Indian steel industry to produce quality steel & value added steel products at competitive costs."

JV in R&D Projects

5.4 As regards any PSU pursuing Joint Venture in R&D projects with any other PSU or academic institute, the Ministry of Steel in its written reply stated as under:-

> "RDCIS under SAIL has gone in a big way for entering into collaborations with academia, research organizations and industry, both at national and international levels for pursuing research work in emerging fields related to steel industry. They have made international collaboration with Deakin University, Australia, Swerea MEFOS, Sweden, CSM, Italy and Indian collaboration with IIT, Kanpur, IIT, Bombay, IIT,Roorkee, MIDHANI, Hyderabad, NML,Jamshedpur, IMMT, Bhubaneswar, C-DAC, Pune and LPSC/ISRO Thiruvananthapuram.
>
> RINL has made joint venture with IISc Bangalore, IIT, Kharagpur, IMMT, Bhubaneswar, CGCRI, Kolkata, NIOT, Chennai, NML, Jamshedpur and IIT, Kanpur for pursuing R&D project .
>
> NMDC has made collaborative research projects with IMMT, Bhubaneswar, IIT, Hyderabad and JNTU, Hyderabad."

CHAPTER-VI

COST OF STEEL PRODUCTION

6.1 When asked about the average cost of production of steel in India compared to the global average and the reasons for variation, the Ministry of Steel in their written reply have furnished as follows:-

> "Ministry of Steel does not maintain data on the cost of production of individual companies. Companies are reluctant to share such data, being commercially sensitive. However, as per a study undertaken by World Steel Dynamics, the break-up of the average cost of production in different countries is given in the table below:

($ per tonne)	Brazil	China	CIS	Western Europe	India	Japan	South Korea	Latin America	Middle East	USA Inte.	USA Mini	Global Avg.
Raw Materials	250	292	224	322	263	305	287	253	263	340	423	**293**
Labor	71	81	27	117	60	123	107	70	82	163	51	**86**
Other	173	150	170	179	160	186	143	178	152	166	138	**163**
Energy	111	106	45	127	94	75	106	88	65	60	50	**84**
Energy Credit	-99	-83	-61	-114	-108	-77	-108	-87	-48	-71	-35	**-81**
Total	**507**	**546**	**405**	**631**	**468**	**612**	**535**	**502**	**514**	**658**	**627**	**546**

Source : World Steel Dynamics "

6.2 Indian Steel Industry is very competitive. Inherent structural issues adversely affect the total cost of production of Steel. When asked to list the factors which add to the cost of production, the Ministry of Steel have submitted the reply as under:-

> "The major factors which lead to higher costs under Indian conditions are as follows:
>
> a) Higher capital & interest costs.
> b) Relatively less operational efficiencies.
> c) Dependence on other countries for technology and capital equipments.
> d) Dependence on imports for coking coal.
> e) Higher transport & logistics costs.
> f) Higher cost of electricity etc."

6.3 Indian Steel producers are lowest cost producers of steel after CIS countries. However, it is at a disadvantage, when the landed price of imported steel is compared with domestic steel, due to cost which are external to steel producers such as cost of power, cost of finance, cost of logistics, government levies etc. These additional costs incurred by Indian producers are elaborated as under:-

a) Specific consumption of power in production of steel is about 450 kWh per tonne. At the present rate of per kWh power in India, the Indian steel producers are placed at a disadvantage of Rs.800 – Rs.900/- per tonne as compared to producers in China, Japan and Korea.

b) As major steel production is transported by Rail network, the cost on account of reaching finished steel material to the customers are higher by about Rs.1000/- per tonne as the Sea freight has become very low and the major consumptions near the coastal areas are largely met by imports coming at lower freight. Indian producers can be provided a level playing field by changing the classification of steel goods from class 165 to class 145. In other words, Steel is required to be put under the same tariff class as Coal (Class 145). This will help reduce logistic cost of finished steel by 13.8%, which will partly offset the burden Indian producers have.

c) Unlike the foreign exporters of steel, who are not subjected to various levies and duties in their countries in production of steel, the Integrated Steel producers in India pay various levies and duties in the form of District Mineral Fund (DMF), NMET, Duty on import of raw material such as coking coal (@2.5%), Levy of Clean Energy Cess on Coking Coal as well as higher compensation for land acquisition etc.

While it is logical to impose Clean Energy Cess on Thermal Coal for use in power plants as alternate energy sources are cleaner and thus a Cess would help encourage alternate energy use. Unlike this coking coal apart from being cleaner source having lower ash content is an essential input material for production of steel and there is no alternate input material, which can substitute coking coal. Hence, Clean Energy Cess needs to be exempted for coking coal.

Similarly, Duty on Coking Coal @ 2.5% needs to be removed as 90% of coking coal are procured through imported sources due to lack of domestic availability of desired variety.

Due to the inherent conditions of India in terms of various costs detailed above, it is felt that a barrier in the form of Import Duty is essential to be levied to all imports of steel to create a level playing field for Indian steel compared to imported steel and not allowing any exemption be it in the form of CEPA or FTA agreements.

It further states, at present, India follows the lesser duty rule in anti-dumping investigations and subsidy investigations. As per this method, anti-dumping duty/countervailing duty is levied on the lesser of 'margin of dumping/amount of subsidy'[1] or 'margin of injury'[2].

Major jurisdictions such as the United States of America, Canada and China, however, do not adopt the lesser duty rule. These jurisdictions are of the view that their domestic industry has to be protected from unfair dumping/subsidy at all costs and the most effective way to accomplish that would be if anti-dumping duty/countervailing duty is levied to the full extent of the margin of dumping/amount of subsidy. As a consequence, these countries do not give the benefit of lesser duty rule to erring exporters as they realise this method is not effective because it always leaves room for the exporters to continue dumping practices. Similarly, it gives less relaxation to exporters from countries that offer trade distortive subsidies.

It is noted that General Agreement on Tariffs and Trade, Agreement on Implementation of Article VI of the General Agreement on Tariffs and Trade 1994 (Anti-Dumping Agreement) and Agreement on Subsidies and Countervailing Measures permit WTO members to levy anti-dumping duty/countervailing duty to the full extent of the margin of dumping/amount of subsidy. In fact, WTO commitments do not mandate that countries should follow lesser duty rule in anti-dumping investigations.

The lesser duty rule was introduced in the WTO at the instance of import dependent countries, to give them an elbow room for levying duties that are lower than the dumping margin. India has a vibrant domestic industry which is capable of producing products across a wide spectrum of industries. Import dependence is a choice but not a necessity in today's India except for a very small range of products. Make in India forms main thrust of the present Government in increasing production Therefore, it may be advantageous to impose antidumping duty/countervailing duty to the full extent of the dumping margin/amount of subsidy and stop the practice of giving only partial protection against dumped imports/subsidised imports. As mentioned above, this will also be keeping in line with the "Make in India' vision.

With a focus on Make-in-India and also as China is a powerhouse of Global

[1] Margin of dumping is the difference between the normal price of the product when sold in the domestic market of the country of export and the ex-factory export price of the product. Similarly, the amount of subsidy is the amount of countervailable subsidies, shall be calculated in terms of the benefit conferred on the recipient which is found to exist during the investigation period for subsidisation.

[2] Margin of injury is the difference between the fair price of the product when offered for sale by the Indian domestic industry and the landed value of the imported product.

Manufacturing, imposition of duty to the full extent has assumed importance, as China uses its financial leverage to subsidise its exporter, who in turn are in a position to dump their product. China also guides and ensures focus of its exporters to export product under such Harmonic codes, which can help save them from Trade actions by importing Countries. In the shadow of China, Indian Steel Industry has experienced dumping by Korea and Japan as they have set up Steel Plants only for exports.

It has been recently argued in the context of the WTO Doha negotiations that the divergence of methodologies for the lesser duty rule across WTO members introduces distortions into the global trading system in several ways: countries that apply the lesser duty rule create an advantage for exporters of the country concerned – if the injury margin is found to be lower than the dumping or subsidy margin, they are subject to a lower duty than without the application of the lesser duty rule. Conversely, the rule puts non-dumping or non-subsidised third country exporters at a relative disadvantage compared to the exporters of the subject country, as they would still have to compete with exports priced at less than fair value.

In light of the same, India should do away with the lesser duty rule; and should impose duties to the full extent of dumping margin in all anti-dumping investigations. This will ensure adequate and effective protection to the Indian domestic industry and will send a strong message to erring exporters to correct their unfair practices. It will also facilitate future sunset reviews as the erring exporters have to submit the data. In the Indian context, it is the Domestic producer, who becomes liable to prove the injury margin and thus exporters are spared.

In order to introduce the system of levying antidumping duties to the full extent of the dumping margin, amendments have to be made to the anti-dumping and anti-subsidy rule.

6.4 When enquired about the solutions including R&D works to overcome the factors which add to the cost of production, the Ministry in its written reply stated as under:

"The overall cost of production depends on various factors like raw material quality and cost, optimum utilization of raw materials resources, adoption of cost effective and energy efficient technologies and optimum utilization of By-products & waste. Some of the important solutions including R&D interventions for improvement in operational efficiency and reduction of cost are as follows:

(a) Modernization and renovation of old/obsolete plants and facilities: Some of the integrated steel plants in the country have already modernized and expanded and some of are in the process of modernization and expansion thereby phasing out older plants and facilities with latest energy efficient, clean and green technologies which directly effects the cost of production.

(b) Improvement in quality of raw materials and utilization of low grade inputs: In case of main raw materials like iron ore and coking coal, there are several problems relating to beneficiation of low grade iron ore and slimes, high ash and high sulphur coal. R&D interventions are required for addressing issues to develop relevant beneficiation technologies and operational parameters for utilization of typical iron ore containing high Alumina and chemical bonded water molecules abundantly available in the country**.** Similarly, R&D interventions are considered necessary for optimum coal blending with imported coking coal which directly affect the coke property and hence operation of blast furnace and ultimately the cost of production.

(c) Harnessing waste heat/energy and optimum re-use/recycle By-products/waste: R&D interventions are necessary for optimization and improvement of resource consumption and thereby harnessing waste heat and energy to the fullest extent besides optimum recycling/reuse of by-products and waste."

R&D for Consumption of Steel

6.5 Generally the focus in R&D is on increasing production. Of late there has been a steady demand that R&D should also be utilised for increasing consumption in steel sector in our country which is currently in a dismal state. When the Ministry asked to give details of the R&D steps taken to ensure increased steel consumption in the country, the Ministry in its written reply stated as under:-

"For engineering enhanced steel consumption in the country, R&D had been focusing on following:

- Development of cost effective quality steels for construction and rural sectors. Development of Fe500D TMT rebars in all sections and cost effective steels for agricultural implements. The steel industry has successfully developed world-class seismic resistant Fe500S grade TMT rebars for the construction segment.
- Concerted application engineering efforts by the steel industry are continually being made for promoting steel usage in various segments

including rural/ agricultural sector.

- The steel industry is also working closely with Institute for Steel Development & Growth (INSDAG) for promotion of steel intensive construction in the country."

6.6 As regards, R&D efforts for increase in consumption of Steel, the Secretary, Ministry of Steel while deposing before the Committee on 15th June, 2015 stated as under:-

'महोदय, एक प्वाइंट यह उठा कि महारत्न और मिनी रत्न को जो एक परसेंट का दिया गया है, वही हमने प्रजेंटेशन में भी लाने की कोशिश की है, कई बार अलग-अलग आधार, अलग-अलग अथॉरिटी और एजेंसी अलग-अलग टारगेट्स दे देती हैं। अब उन्होंने डीपीई ने जो टारगेट दिया, जो कि एमओयू साइन करते हैं, उन्होंने टारगेट वन परसेंट ऑफ प्रॉफिट ऑफ्टर टैक्स दे दिया। अगर उसको लेकर चलें तो सेल ने 13 प्रतिशत खर्च किया है, जो वन परसेंट उन्होंने रखा। हमने फिर उनसे निवेदन किया कि आप इसको प्रॉफिट ऑफ्टर टैक्स से मत जोड़िए, पैट से न जोड़िए, आप इसे टर्न ओवर पर करिए। टर्न ओवर पर सेल का खर्चा करना 500 करोड़ बनता है और पैट की बिना पर 20 करोड़ बनता है। अब इस बार वे माने हैं कि आपकी बात ठीक है। हर जगह जहाँ यह तुलना होती है, वह टर्न ओवर से होती है, प्रॉफिट ऑफ्टर टैक्स से नहीं होती है। दूसरा मैं समझता हूँ कि अभी एक बहुत ही महत्वपूर्ण सुझाव दिया गया कि हमें सिर्फ प्रोडक्शन में आर एंड डी पर ही ध्यान नहीं देना चाहिए, कंजम्प्शन ऑफ स्टील पर जो आर एंड डी होनी चाहिए, उस पर भी ध्यान देने की जरूरत है। तभी हमारा जो 60 किलो पर कैपिटा कंजम्प्शन है, वह बढ़कर उस स्तर पर जाएगा। मैं इसके लिए समिति को धन्यवाद देना चाहूँगा। इस चीज पर हम जरूर एक टेक्निकल कमेटी बनाएंगे और इस पर ध्यान देंगे, क्योंकि उसको प्रोत्साहन देने की बहुत ज्यादा जरूरत है। मैं उदाहरण के तौर पर एक बात शेयर करना चाहूँगा, हमारे यहाँ जितने फ्लाई ओवर बनते हैं, जितने ब्रिज बनते हैं, वे कंक्रीट टेक्नोलॉजी से बनते हैं। मुझे अभी मौका मिला था, मैं तीन महीने पहले पोस्को से कुछ बातचीत करने के लिए कोरिया गया था, जितने ब्रिजेज और फ्लाई ओवर्स मुझे उनकी कैपिटल सिओल में दिखाई दिए, मेरा अपना मानना होगा कि वे 80 परसेंट स्टील के बने हुए हैं। इससे जल्दी बनते हैं, ऑफ साइट आप कर सकते हैं, वहाँ पर लाकर, उनके कॉलम्स को जोड़कर बहुत जल्दी इसको तैयार किया जा सकता है।'

PART-B

OBSERVATIONS/RECOMMENDATIONS

1. The Committee note that during the year 2014-15, the country produced 88.25 MT of crude steel and was ranked the 4th largest steel producer in the world after China, Japan and the United States of America. Although, the Indian Steel Industry is amongst the fastest growing world wide with a growth rate of 8%, the per capita steel consumption in the country has remained abysmally low at 60kg against the world average of around 225 kg. The Committee are, therefore, of the firm view that there is ample scope for sustained growth and development of steel sector in the country. In the opinion of the Committee, to sustain and improve the competiveness of the Indian Steel Industry, adoption of modern and state-of-the-art technologies both in the existing and new plants is of utmost importance by pursuing appropriate R&D Programmes. While examining the R&D in Iron and Steel Sector in detail, the Committee have made their observations and recommendations in the succeeding paragraphs.

2. The Committee observe that lack of seriousness on R&D in Indian Steel Sector has resulted in high capital cost for modernization and building new steel capacities as the country still depends on the western countries for import of major equipment and technologies. Also, the dependence on imported raw materials especially coking coal has discouraged the development of indigenous technologies compatible to resource endowment, threat to sustainability of resources especially adequacy of iron ore resources as the country is yet to develop cost effective beneficiation/pelletisation technologies suited to domestically produced iron ores. The Committee note that although an allocation of Rs. 118 crore was made during 11th plan period for 'Promotion of R&D in Iron and Steel Sector' with focus on 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

and improvement in quality of steel produced through the induction furnace, only Rs. 73.72 crore were released for R&D projects approved with a total cost of Rs. 123.27 crore involving plan fund of Rs. 87.28 crore. The Committee are unhappy to note that although 6 R&D projects have reportedly been completed, yet pilot plants for commercialization of processes/technologies are yet to be established by the steel industry. The Committee, therefore, recommend that there is an urgent need to speed up the implementation of technologies/processes developed by setting up of pilot plants/Industrial trials for beneficiation and pelletization of iron ore slimes, optimum coal blending, production of low phosphorous steel, production of quality steel through induction furnace route so that the country can become self reliant in utilization of raw material resources in producing quality steel.

STEEL DEVELOPMENT FUND

3. The Committee are unhappy to note that Steel Development Fund which was set up in 1997-98 for R&D initiatives with an annual expenditure target of Rs. 150 crore to be pursued by public and private steel companies for development of innovative/path breaking technologies, beneficiation/upgradation of low grade iron ore, achieving, global benchmarks in productivity, quality, etc. has failed to yield desired results even after funding of 91 R&D projects costing Rs. 950.75 crore under the scheme. Although, 55 of these 91 R&D projects have been completed and 24 projects are in progress, the Committee are concerned to note that even after expending Rs. 950.75 crore on these 91 R&D activities, during 2014-15, 9.32 MT of finished steel was imported. While deprecating the non-focused approach on R&D activities by the Government and domestic steel Industry during the last 2 decades, the Committee feel that it is high time now that Indian Steel Industry focus on R&D on better resource utilization, better cost efficiency and production of world class products. The Committee would, therefore, like to be apprised

of the sustained efforts made by the Ministry of Steel and domestic steel companies to produce quality steel for automotive sector, electrical equipment and ship building etc.

STEEL RESEARCH AND TECHNOLOGY MISSION OF INDIA (SRTMI)

4. The Committee note that to spearhead R&D activities of national importance through joint collaborative research programmes in steel sector, an Industry led initiative called SRTMI has been setup in close cooperation amongst the steel companies, Ministry of Steel, academia and relevant R&D institutions in the country. The mission will facilitate joint collaborative R&D proposals of national importance inter-alia to ensure raw material security, development of relevant technologies suitable for domestic raw materials to ensure reduction in energy consumption & Green House Gas (GHG) emissions to address climate change issues. The Committee have been given to understand that after introduction of SRTMI, a major bottleneck will be overcome as earlier all the Institutes, PSUs, Private Sector companies were busy doing their own R&D without consulting, coordinating and sharing any information amongst themselves. According to Ministry of Steel, this will be a single umbrella under which all diverse R&D works will be clubbed under one roof. As regards funding of the project, the Committee note that initial corpus for setting up of SRTMI is Rs. 200 crore of which 50% is to be provided by the Ministry of Steel and the balance by the participating Steel Companies. According to Ministry of Steel, major steel companies like SAIL, RINL, NMDC, Tata Steel, JSW, JSPL and MECON have committed to contribute @ Rs. 25 per tonne of crude steel produced in the year 2013-14 as their contribution in the initial corpus for SRTMI amounting of Rs. 212.49 crore. While appreciating the efforts of Ministry of Steel in setting up of SRTMI to facilitate joint collaborative R&D works, the Committee also note that CEOs of major India Steel Companies have signed a Memorandum of Agreement with Ministry of Steel on 6th April, 2015 for participation and financial contribution in the initiative. The Committee hope that the benefits from R&D projects undertaken would be

shared by all and not remain confined to members of SRTMI only. Taking note of the fact that there are a large number of smaller and secondary units in the steel sector which are not part of the SRTMI, the Committee apprehend that these units will not be benefited from the research carried by SRTMI. The Committee, therefore, recommend the Ministry of Steel to evolve appropriate mechanism in SRTMI to address the issues faced by the Smaller and Secondary Steel Sector. The Committee also desire that adequate attention should also be paid to the on-going R&D projects as well as implementation of the projects already completed to ensure that their findings can be put into commercial use by various steel PSUs and private players.

R&D BY PUBLIC SECTOR STEEL COMPANIES

SAIL

5. As regards the R&D by public sector steel companies, the Committee observe that Research & Development Centre for Iron & Steel (RDCIS) is the nodal centre for product development activities at SAIL. New product commercialization is being carried out by Chief Marketing Officer (CMO) in support of RDCIS & Plants for promotion of the product by intense customer interaction, arranging customer meets in different branches & regions. While observing a considerable increase in R&D expenditure from Rs. 106.05 crore in 2013-14 to Rs. 232.06 crore during 2015-16, the Committee are happy to note that out of 85 projects undertaken by RDCIS during 2015-16, 48 projects with thrust on cost reduction, value addition, quality improvement and development of new products were completed by March, 2016. Moreover, RDCIS has filed 19 patents and 26 copyrights from April to December, 2015. The Committee appreciate the research work undertaken by RDCIS during the last 3 years and particularly the development of Soft iron magnetic grades developed for the first time in India for neutrino observatory and armour plates for bullet proof applications such as bullet proof / mines proof armoured vehicles. The

Committee recommend that to achieve its operational and business goal, SAIL should continue to make concerted efforts in R&D Sector including consistent upgradation of its current steel technology thereby improving efficiency and reduction in the cost of production.

RINL

6. The Committee observe that actual expenditure on R&D by RINL during 2013-14 rose to Rs.50.27 crore from Rs.31.13 crore during 2012-13. However during 2014-15, the expenditure on R&D fell down to Rs. 33.09 crore. There has been a further decline in R&D expenditure during 2015-16 and only Rs. 16.24 crore were expended by RINL till December, 2015. The Committee also note that with the expansion of its plant to 6.3 MTPA and further plans of RINL to expand its production capacity to 20 MTPA, a roadmap on R&D has reportedly been prepared by RINL and a dedicated R&D Centre is being set up with state-of-the-art infrastructural facilities at an estimated cost of Rs. 100 crore. The Committee also note that the other features of the R&D strategy include expansion of manpower to 100 engineers/scientists and 80 technical staff, assimilation of new technologies for full exploitation, process development, process control, automation, development of new and high-end products, development of competence of R&D personnel, etc. While appreciating the efforts being made by RINL on R&D activities and also putting into place a robust R&D strategy for achieving the planned goals, the Committee would like to be apprised of the benefits accrued to the company on account of R&D initiatives in a quantified manner. The Committee further recommend that setting up of the proposed separate R&D Centre with requisite diagnostic and research facilities, pilot plants and simulation facilities should be carried out in a time bound manner.

NEED FOR HIGHER INVESTMENTS IN R&D

7. The Committee note that steel PSUs like NMDC Ltd., MECON Ltd., MOIL Ltd. and KIOCL Ltd. also carry out independent R&D works in the field of ore beneficiation, mineral processing and safety and productivity in mines etc. The Steel Companies like SAIL, TATA Steel, JSW Steel and ESSAR Steel have accomplished some significant R&D works in the area of raw material beneficiation, agglomeration and product development. However, the actual investment on R&D by the Steel Companies in India has remained very low in the range of 0.05-0.5% of the sales turnover compared to R&D investments in Steel Companies abroad. For instance, in the countries like China, Japan and South Korea etc., annual R&D investments are very high and varies in the range of 1-2% of their sales turnover whereas during the year 2014-15, the SAIL's share of expenditure was only 0.56% of the turnover of the company. Similarly, the expenditure on R&D by RINL, NMDC Ltd., MOIL Ltd. and MECON Ltd. during 2014-15 was 0.28 %, o.15%, 0.73% and 0.53% respectively of their total turnover. The Committee note that as per Department of Public Enterprises guidelines, Maharatna and Navratna category of CPSEs are required to invest 1% of their PAT and Miniratna Companies have to invest 0.5% of their PAT in R&D. Besides that, the Working Group on Steel Industry for the 12th Five Year Plan has also recommended a minimum 1% investment in R&D by the steel companies of their sales turnover. While the main focus of R&D by Indian Steel Companies have remained on improving internal processes like saving costs and improving plant efficiency, want of adequate R&D investments for development of high end technologies and products remains a major concern for the Committee. The Committee feel that enhanced R&D investments and adoption of new technologies are imperative for competitiveness of Indian Steel Industry. The Committee, therefore, recommend that taking into account the requirement of laying focus on indigenous development of technology, continuous and augmented efforts should be made for R&D initiatives by all concerned including the Ministry of Steel, Public and Private Sector

Companies, Institutes of Technological Research and Advancements, etc. The Committee also recommend that the Indian Steel Companies, both public and private enterprises should make an attempt to benchmark their R&D spending with internationally prevalent best practices in the Sector. The Committee would like to be apprised of the steps taken by all Steel PSUs and private sector companies in this regard.

UTILIZATION OF IRON ORE FINES

8. The Committee note that the main source of iron ore fines are the waste dump fines from earlier workings utilizing the high grade lumps and leaving behind the low grade fines containing high silica and alumina impurities and cannot be used as such for iron making. Similarly, the ultra fines/slimes from Hematite Iron Ore washing plants with high level of impurities cannot be charged to the furnace for iron making. The Committee, however, note that such iron ore fines lying unutilized can be used if these are beneficiated and used as sinter or pellets for iron making. In this regard, the Committee also note that to address the problems of difficult-to-beneficiate/pelletise low grade iron ore fines, Ministry of Steel have sponsored several R&D projects which have resulted in development of technology at laboratory scale besides some R&D pilot plants under commissioning. According to the Ministry, Indian Steel Industry, particularly, the integrated steel plants are already using iron ore fines extensively to the tune of 60-70% in the form of sinter for production of iron and steel. Further, some steel companies have set up pelletisation facilities to utilise finer varieties of iron ore fines in the form of pellets. Similarly, large number of units in the private sector have set up beneficiation and pellitisation facilities to utilize low grade iron ore fines for production of pellet/sponge iron. As regards public sector companies are concerned, the Committee note that RDCIS, SAIL has taken a R&D project to develop suitable process in utilization of gothetic/hematite iron ore which is difficult to beneficiate and pelletise. Taking note of the fact

that during 1998-2004, there was an enormous surge in export of fines and the precious resources of the country were given away at throw away prices, the Committee are concerned to note that no serious initiatives have been taken to develop a system or a technology to utilize these fines to produce steel. While observing that utilization of fines leads to conservation of minerals as well as better economics of operation and avoiding long range transportation of fines for economic and environmental reasons, the Committee feel that the development of innovative and path breaking technologies for better utilization of iron ore fines is the need of the hour. The Committee desire the Ministry of Steel to seriously pursue the various R&D projects sponsored by them and extend all possible assistance/guidance to encourage the Indian Steel Companies in their initiatives being taken in this direction.

POOR QUALITY OF RAW MATERIAL

9. The Committee note that although growth of the Indian Steel Industry is attributed to domestic availability of low cost raw materials like iron ore and coal, but at the same time the country is also plagued with a major handicap regarding the poor quality of raw material available. The Committee note that though India is self sufficient in its reserves of iron ore, for growth and development of steel sector, but high alumina content, high alumina silica ratio and high alkali loading in inputs etc. have resulted in high slag volumes and high specific energy consumption which in turn adversely affect the operation and productivity of blast furnace, quality of hot metals and unnecessarily adds to the cost of production. Even the coking and non-coking coal available in our country are reported to be of very inferior quality which significantly influence the productivity and efficiency of the steel making process. Due to the presence of these impurities, techno commercial solutions for raw material quality is the need of the hour. The Committee feel that the technology for improving the quality /efficiency of coking coal needs to be developed urgently failing which there is heavy dependence on import of large quantity of coking

coal. The Committee also feel that the focus of R&D should be on acquiring technology for steel making from low grade raw material inculding ash reduction in coking coal, utilization of low grade iron ore fines, slimes, beneficiation of iron ores and production of low phosphorous steel etc. The Committee also stress on the urgent need for implementation of beneficiation techniques developed so far for converting the available raw material suitable for blast furnace operation. The Committee would like to be apprised of the implementation of all R&D schemes financed by Ministry of Steel at various plants/mines of steel PSUs for ash reduction in coking coal, beneficiation of iron ores, utilization of low grade iron ore fines, etc.

NEED FOR FRESH MAPPING FOR IRON ORE DEPOSITS

10. Considering the prospects of growth of steel sector in our country and the ambitious production target of 300 MT by 2025, the Committee feel that in addition to the already identified/proven iron ore reserves, there is an imperative need for exploration of new iron ore reserves. In this regard, the Committee, however note that the data of iron ore mapping available has become old and obsolete. The Committee have also been given to understand that NMDC Ltd. is equipped with state of the art/ latest technologies for drilling and exploration work but the work is pending in some of the mining areas pending forest clearances. The Committee, therefore, recommend that the process of exploring fresh iron ore deposits should be initiated at the earliest so that latest data is made available and exploration work does not suffer on account of lack of availability of data. Taking note of the fact that exploratory works are held up pending statutory clearances and that substantial R&D works in the field of mapping and exploration of iron ore has not been done in the past, the Committee feel that this aspect should no longer remain neglected and immediate steps be taken for updation of mapping data of iron ore and pending forest clearances. The Committee also desire that the Government should not only take advance action to ensure availability of

raw material for production of 300 million tonne of steel by 2025 but should also explore the prospects of acquiring iron ore assets abroad.

TECHNICAL MANPOWER IN STEEL SECTOR

11. The Committee note that the Ministry of Steel had assigned the work to IIT, Kanpur for a study on requirement and availability of technical manpower for steel industry in India for production of 300 MT by 2025. The study has revealed that if future steel plants employ modern technology & automation then no shortfall is envisaged for graduate engineers in any discipline including metallurgical engineering. However, if steel plants continue to remain at the same level as these are today, there is likely to be some shortfall in the supply of graduate metallurgical engineers and to some extent ceramic engineers. However, no shortage is anticipated in the case of diploma engineers and ITI trained personnel. Taking note of delayed modernization and expansion of existing steel plants by SAIL, the Committee are apprehensive that if steel plants continue to remain at the same level as they are today, there will be shortage of graduate metallurgical engineers. The Committee, therefore, recommend that the Ministry should chalk out a time bound plan for modernization and automation of all the existing steel plants in the country to check shortfall of graduate engineers including metallurgical engineers.

PERSONNEL ENGAGED IN R&D

12. The Committee observe that for any industry to succeed, it requires a dedicated technical manpower having depth of knowledge and expertise required to perform the assigned job for various activities such as engineering(design), project, operation, maintenance, development of new technology through R&D etc. The technology and R&D positions need to be manned by technical professionals who have the ability to do self-study, understand state-of-the-art or benchmark processes, analyze complex problems and explore new solutions. Such positions demand personnel

with high learning ability, mental agility and application orientation. The Committee, therefore, feel that there is a need to encourage students from IITs/IIScs to take up metallurgy for which adequate jobs have to be created. The Committee ,however, observe that engineering graduates, in general, prefer white collared jobs with the highest available pay package. As a result, there is dearth of quality manpower for the manufacturing sector where salaries are low and working conditions are strenuous. It's a known fact that a person will give his best productivity and output if he is assured that his financial needs will be satisfactorily met. For this, the Committee recommend that remuneration provided to the scientists and research scholars should be upgraded from time to time to ensure retention of such talent. The Committee also note that Academic institutions from which these personnel pass out also play a major role in shaping up their vision. Though, there is no dearth of quality institutes or well versed faculty in our country, yet the infrastructure provided is not at par with foreign institutes which might be another reason why very few people opt for metallurgy for their research. The Committee, therefore, desire that existing faculty may be trained with the help of industry and Research Institutions. The Committee also recommend that creation of 'Steel Technology Centres' at the location of the Steel Plant sites will quickly help in the development of faculty. Furthermore, the Committee desire that the Government/steel companies should persuade the institutes imparting education and training in metallurgical field to invite faculty for lectures from foreign institutes having expertise in this field which can contribute to the growth of mindset and vision of our researchers.

13. As regards the strategy employed by steel industry to retain the technical manpower, the Committee were informed that Competitive compensation package at entry level, established brand equity combined with other benefits & facilities for work-life balance, makes the Steel Public Sector Undertaking (PSU) a choice for employment by the candidate

from premier institutes. The Committee further observe that the Steel PSU employ a Performance Management System which is unique and comprehensive. Growth opportunities for every young entrant are immense and one can aspire for career growth upto the Board level positions. However, in view of the increased capacity of private sector steel plants, during the last decade, the Committee would like to be apprised of the details of officers of public sector steel companies who have left them to join private sector steel companies. The Committee would also like to be apprised of the strategy of the public sector steel companies to retain their officers in future expansion programme of steel sector.

JOINT VENTURES FOR R&D

14. The Committee note that some of the steel companies in India have also been partnering with world leaders through joint ventures for acquiring technology and process know-how to enable them to improve their performance and produce value added products. For example, Steel Authority of India Limited (SAIL) has signed an MOU with Arcelor Mittal for development/production of automotive grade steel sheets. JSW steel has entered into partnership with JFE, Japan for technological support for development and production of value added steel products particularly automotive grade steel and electrical steel. Further, Tata Steel Limited has entered into partnership with Nippon Steel and Sumitomo Metals Corporation for development and production of automotive grade steel sheets. In addition, 2 renowned foreign companies namely POSCO, South Korea and China Steel Corporation, Taiwan have set up their 100% subsidiaries in India to produce value added flat steel products. Though, the Committee appreciate these efforts and feel that with these initiatives India's dependence on import of value added products will substantially decrease, yet at the same time, the Committee desire that concerted efforts are also required not only for technological collaboration with such

companies but for acquiring/transfer of high-end technologies pursued by them. The Committee would like to be apprised of the targeted investments and stipulated dates by which the aforementioned Joint Ventures by the Indian Steel Companies could be set up.

STEEL PRICING

15. The committee were informed that cost of production of steel by individual companies is not available with Ministry of Steel as the matter is commercially sensitive and companies are reluctant to share such data. However, from a study undertaken by World Steel Dynamics, the Committee note that average cost of production of steel in different countries varies from $658/tonne(highest in U.S.) to $405/tonne [lowest in Commonwealth of Independent States (CIS)]. Further, the average cost of steel production in India is reported at $468/tonne as compared to $546/tonne in China. The Committee were also apprised of the major factors leading to higher cost of production such as higher capital and interest costs; relatively less operational efficiencies; dependence on other countries for technology and capital equipment; dependence on imports for coking coal; higher transport and logistics costs; and higher cost of electricity, etc. The Committee are, however, concerned to note that the process of modernization and expansion of some of the integrated steel plants by phasing out older plants and facilities with latest energy efficient, clean and green technologies, which directly affects the cost of production, has not yet been completed. While stressing the need for completion of modernization and expansion of integrated steel plants at the earliest, the Committee also recommend that R&D interventions required to address problems relating to manufacturing of technological and capital equipment, beneficiation of low grade iron ore and slimes in the country, optimum coal blending with imported coking coal should be stepped up for improvement in operational efficiency and reduction of cost. The Committee would like to be apprised of the action plan of the Government/Steel companies to address these R&D

interventions/equipment manufacturing in the country to bring down the cost of steel production.

16. According to Ministry of Steel, domestically produced steel is at a disadvantage as compared to imported steel due to certain costs which are external to steel producers such as cost of power, cost of finance, cost of logistics, Government levies etc. The Committee have been given to understand that at the present rate of per KWH power in the country, domestic steel producers are at a disadvantage of Rs. 800-Rs. 900 per tonne as compared to steel producers in China, Japan and Korea. The Committee have also been apprised of certain levies and duties in the form of District Mineral Fund (DMF), National Mineral Expansion Trust (NMET), duty on import of raw material such as coking coal (@2.5%) levy on clean energy cess etc. which are imposed on steel producers in India. The Ministry of Steel has desired that duty on clean energy cess and on coking coal be removed as 90% of coking coal is procured through imported sources due to lack of domestic availability and it being cleaner source having lower ash content and essential input material for production of steel. While concurring with the suggestions of Ministry of Steel, the Committee recommend that the Ministry should take up the matter at the highest level with the authorities and also the states concerned and impress upon them for waiving off the import duty and clean energy cess on coking coal as it being the major and cleaner raw material for production of steel.

ANTI-DUMPING DUTY ON STEEL

17. While reiterating their earlier recommendation in 20th Report on Demands for Grants (2016-17) of Ministry of Steel whereby the Committee appreciated the measures like hiking of import duty, imposition of provisional safeguard duty on certain items, imposition of anti-dumping duty, invoking the Steel and Steel products (Quality Control Order) etc.

taken by the Government to protect the interest of beleaguered domestic steel industry, the Committee note that India follows the lesser duty rule in anti-dumping investigations and subsidy investigations. As per this method, anti-dumping duty/countervailing duty is levied on the lesser of 'margin of dumping/amount of subsidy' or margin of injury. According to the Ministry of Steel, major jurisdictions such as the United States of America, Canada and China, however, do not adopt the lesser duty rule. These jurisdictions are of the view that their domestic industry has to be protected from unfair dumping/subsidy at all costs and the most effective way to accomplish that would be if anti-dumping duty/countervailing duty is levied to the full extent of the margin of dumping/amount of subsidy. As a consequence, these countries do not give the benefit of lesser duty rule to erring exporters as they realize this method is not effective because it always leaves room for the exporters to continue dumping practices. Similarly, it gives less relaxation to exporters from countries that offer trade distortive subsidies. . The Committee were further apprised that General Agreement of Tariffs and Trade, Agreement on Implementation of Article VI of the General Agreement on Tariffs and Trade 1994 (Anti-Dumping Agreement) and Agreement on Subsidies and Countervailing Measures permit WTO members to levy anti-dumping duty/countervailing duty to the full extent of the margin of dumping/amount of subsidy. In fact, WTO commitments do not mandate that countries should follow lesser duty rule in anti-dumping investigations. In view of the foregoing and the fact that the lesser duty rule was introduced in the WTO at the instance of import dependent countries, to give them an elbow for levying duties that are lower than the dumping margin, the Committee feel that the country which has a vibrant domestic industry capable enough of producing a wide spectrum of products with increase of steel production to give a boost to the 'Make in India' Vision should consider imposition of anti-dumping duty/countervailing duty to the full extent of the dumping margin/amount of subsidy and stop the practice of giving only partial protection against dumped imports/subsidized imports. According to the Ministry of Steel,

scrapping of 'lesser duty' rule in relation to anti-dumping investigations and subsidy investigations do not require changes in the parent act and these charges can be effected by change in Rules alone. The Committee therefore, recommend the Ministry of Steel to take up the matter at the appropriate level in the Government so that elaborate policy initiatives be taken and a level playing field and adequate and effective safeguards are provided to the domestic steel Industry.

CONSUMPTION OF STEEL

18. The Committee note that focus of R&D has been mainly on increase in production of steel by phasing out of obsolete technology and introduction of new state of the art technology. No attention has been paid to the fact that per capita steel consumption in the country is as low as 60 kg against the world average of around 225 kg. There is no doubt about the fact that India is a young emerging economy which has a huge potential for consumption of steel in areas beyond infrastructure and automobile industry. The need of the hour is to focus on exploring new avenues for utilization of steel which in turn would have a proportionate effect not only on increase in production but consumption too. The Committee are of the firm view that R&D should not be restricted to technologies/innovation to increase production, rather R&D is required to focus and identify the areas where consumption can be increased. The Committee feel that a lot of work needs to be done in this area as no attention has been paid till now. The Committee, therefore, recommend that besides real estate and home/industrial appliances, innovative techniques like usage of steel in hitherto unutilized sectors like construction of bridges by replacing concrete/cement with steel, road railings in hilly areas, etc. should also be encouraged. The Committee would like to be apprised of the steps taken by the Ministry of Steel/Steel Companies to identify the areas where consumption of steel can be increased.

NEW DELHI;
09 August, 2016
18 Sravana,1938(Saka)

RAKESH SINGH
Chairman
Standing Committee on Coal and Steel

ANNEXURE-I

NOTE OF DISSENT TO THE REPORT

I strongly dissent with the recommendations given in the draft Coal and Steel Committee report on "Research and Development in Iron and Steel Sector". Many of these recommendations jeopardize the federal structure of this country and work against interest of the states. My specific objections to the report have been expressed in this letter.

Clean energy cess should not be removed

On Page 67, it is stated that the committee concurs with the suggestions of the Ministry of Steel and recommends removal of clean energy cess on coking coal. I strongly object to this since people in my constituency have to bear the brunt of waste, pollution and displacement due to coal mining.

I insist that the committee should instead recommend sharing 60% of the clean energy cess with coal bearing states to take up different developmental activities and provide relief to those affected by indiscriminate coal mining. My Chief Minister, Mr Naveen Patnaik, has time and again asked the government to invest the collected cess in a proper manner. At present, the Centre collects a clean energy cess which is mostly spent on western states while producing states like Orissa have to bear the negative repercussions of environmental damage caused due to coal mining.

I express my dissent and insist that the committee should not recommend removing this
cess.

Forest clearances should not be sanctioned by the Union Ministry

On Page 61, the draft report mentions expediting the process of obtaining forest clearances for the purposes of mapping, drilling and exploration work. In the past two years, many forest clearances have been given by the Ministry of Environment without getting proper impact assessment surveys done, thus causing irrevocable damage to the environment.

The Committee report must reiterate that mandatory approval of District Magistrate should be taken before conducting exploration and drilling activities in any area. Mandatory impact assessment surveys should be conducted in consultation with the local administrative bodies before Iron Ore mapping work is done.

Alternative modern methods of mapping, exploration and drilling are already available with international mining companies. This technology is off-the-shelf. Destroying and denuding forests must be strictly avoided. Prospecting license holders must invest in modern technology since the Ministry tends to combine Prospecting alongwith Mining licenses.

The committee should recommend private companies to come up with alternative methods that do not cause harm to the environment and the indigenous population.

Pricing policy on Steel should be based on proper data

On Page 66, the draft report says the companies are unwilling to share cost of production information with the committee since it's commercially sensitive. I insist that unless the Ministry and the committee have proper data regarding production pricing, we should not make recommendations at this stage.
The report also recommends imposition of a higher antidumping duty, which is a fair proposition since it is being done to protect indigenous steel companies. However, these recommendations should be made after conducting a proper investigation regarding how much losses these companies are incurring. Unless the exact production costs are known, we cannot know whether the losses reported by these companies are correct. There is a possibility that they might be inflating their production costs and forcing the government to make industry friendly policies. This might even lead to profiteering.

The draft report mentions the average cost of production for Indian steel companies is $468/tonne. I would like to know how this figure was arrived at if the companies did not share their production costs. Unless we, the members of Standing Committee on Coal & Steel, ourselves calculate the real average production cost & have a sense of the real picture, we should not recommend policy changes for Steel Pricing.

Sd/-
(Tathagata Satpathy)
M.P., Lok Sabha
09.08.2016

ANNEXURE-II

MINUTES OF THE SITTING OF THE STANDING COMMITTEE ON COAL AND STEEL HELD ON 15th JUNE, 2015 IN COMMITTEE ROOM 'B', PARLIAMENT HOUSE ANNEXE, NEW DELHI.

The Committee sat from 1130 hrs. to 1400 hrs.

PRESENT

Shri Rakesh Singh- Chairperson

Lok Sabha

2. Shrimati Jyoti Dhurve
3. Shri Faggan Singh Kulaste
4. Shri Shailesh Kumar
5. Dr. Banshilal Mahato
6. Shri Godam Nagesh
7. Shri Devji M. Patel
8. Shri Neiphiu Rio
9. Shri Tathagata Satpathy
10. Shri Janardan Singh "Sigriwal"
11. Shri Pashupati Nath Singh

Rajya Sabha

12. Dr. Pradeep Kumar Balmuchu
13. Shri Md. Nadimul Haque
14. Shri Jugul Kishore
15. Shri Avinash Pande
16. Dr. Satyanarayan Jatiya
17. Shri Sanjay Raut

SECRETARIAT

1. Shri Shiv Singh - Joint Secretary
2. Shri Arvind Sharma - Additional Director

WITNESSES

MINISTRY OF STEEL AND ITS PSU's

Sl. No.	Name	Designation
1.	Shri Rakesh Singh	Secretary, Ministry of Steel
2.	Shri Sunil Barthwal	Joint Secretary, Ministry of Steel
3.	Shri S. S. Mohanty	Director(Tech.), SAIL
4.	Dr. B.K. Jha	Executive Director (RDCIS), SAIL
5.	Shri P. Madhusudan	CMD, RINL
6.	Shri P.C. Mohapatra	Director (Oprn.), RINL
7.	Shri S. Chattopadhyay	Director (Proj.), MECON
8.	Shri A.K. Jha	Director (Prod. and Planning), MOIL

2. At the outset, the Chairperson welcomed the Secretary and other representatives of the Ministry of Steel and Steel PSUs to the sitting of the Committee convened in connection with examination of the subject, "Research and Development in Iron and Steel Sector". The Chairperson then drew attention of the witnesses to Direction 55 of the "Directions by the Speaker, Lok Sabha.

3. Thereafter, a visual presentation on the subject was made by representatives of Ministry of Steel. The Committee broadly discussed the issues relating to technology improvement through breakthrough measures in the R&D sector, competition of domestically produced steel with major steel producers in the world, enhanced R&D investments, steps taken for energy efficient and environment friendly production, R&D investments by domestic steel companies vis-a-vis companies abroad, initiatives for technological advancements and dedicated R&D efforts needed to improve quality of domestically produced raw material, etc.

4. The Members raised their queries on the above issues and the clarifications were furnished by the representatives of the Ministry of Steel. The Chairperson directed the representatives of the Ministry of Steel to furnish written replies to the queries raised by the Members which could not be responded to.

5. The Committee also decided to undertake a study tour in the last week of June/First week of July, 2015 in connection with examination of the subjects selected by the Committee.

A copy of verbatim proceedings of the sitting of the Committee has been kept on record separately.

The Committee then adjourned

ANNEXURE-III

MINUTES OF THE SITTING OF THE STANDING COMMITTEE ON COAL AND STEEL HELD ON 26th AUGUST, 2015 IN COMMITTEE ROOM No. 139, PARLIAMENT HOUSE ANNEXE, NEW DELHI.

The Committee sat from 1130 hrs. to 1430 hrs.

PRESENT

Shri Rakesh Singh- Chairperson

Lok Sabha

2. Shri A. Arunmozhithevan
3. Shrimati Jyoti Dhurve
4. Shri Shailesh Kumar
5. Dr. Banshilal Mahato
6. Shri Godam Nagesh
7. Shri Devji M. Patel
8. Shrimati Ranjit Ranjan
9. Dr. Ravindra Kumar Ray
10. Shri Tamradhwaj Sahu
11. Shri Tathagata Satpathy
12. Shri Pashupati Nath Singh
13. Shri Sunil Kumar Singh
14. Shri Sushil Kumar Singh
15. Shri Rama Kishore Singh
16. Shri Krupal Balaji Tumane

Rajya Sabha

17. Dr. Pradeep Kumar Balmuchu
18. Shri Md. Nadimul Haque
19. Shri B. K. Hariprasad
20. Shri Jugul Kishore
21. Shri Avinash Pande
22. Dr. Satyanarayan Jatiya
23. Shri Sanjay Raut

SECRETARIAT

1. Shri Shiv Singh - Joint Secretary
2. Shri Ajay Kumar Garg - Director
3. Shri Arvind Sharma - Additional Director
4. Ms. Miranda Ingudam - Under Secretary

WITNESSES

MINISTRY OF STEEL AND ITS PSU's

Sl. No.	Name	Designation
1.	Shri Rakesh Singh	Secretary, Ministry of Steel
2.	Smt. Bharathi S. Sihag	AS &FA, Ministry of Steel
3.	Shri Syedain Abbasi	Joint Secretary, Ministry of Steel
4.	Shri Sunil Barthwal	Joint Secretary, Ministry of Steel
5.	Urvialla Khati	Joint Secretary, Ministry of Steel
6.	Shri Mahabir Prasad	Director, Ministry of Steel
7.	Shri S. S. Mohanty	Director(Tech.), SAIL
8.	Dr. B.K. Jha	Executive Director (RDCIS), SAIL
9.	Shri P. Madhusudan	CMD, RINL
10.	Shri D. N. Rao	Director (Oprn.), RINL
11.	Shri A. K. Tyagi	CMD, MECON
12.	Shri Narendra Kothari	CMD, NMDC
13.	Shri G. P. Kundargi	CMD, MOIL

2. At the outset, the Chairperson welcomed the Secretary and other representatives of the Ministry of Steel and Steel PSUs to the sitting of the Committee convened in connection with examination of the subject, "Research and Development in Iron and Steel Sector". The Chairperson then drew attention of the witnesses to Direction 55 of the "Directions by the Speaker, Lok Sabha.

3. Thereafter, a visual presentation on the subject was made by representatives of Ministry of Steel. The Committee broadly discussed the issues relating to Roadmap for R&D for Iron and Steel industry, major thrust areas for improvement in R&D sector, focus on adoption of modern technologies by changing the current technology profile of Indian Steel Industry, steps taken for energy efficient and environment friendly production, current status of investment in R&D sector by Steel Research & Technology Mission of India (SIRTMI) and expenditure on R&D by various steel PSUs and steel companies in private sector, R&D works for increasing the usage/consumption of steel in the country, etc.

4. The Members raised their queries on the above issues and the clarifications were furnished by the representatives of the Ministry of Steel. The Chairperson directed the representatives of the Ministry of Steel to furnish written replies to the queries raised by the Members which could not be responded to.

A copy of verbatim proceedings of the sitting of the Committee has been kept on record separately.

The Committee then adjourned

ANNEXURE-IV

MINUTES OF THE SITTING OF THE STANDING COMMITTEE ON COAL AND STEEL HELD ON 9TH AUGUST, 2016 IN ROOM NO. '112', FIRST FLOOR, PARLIAMENT HOUSE ANNEXE, NEW DELHI.

The Committee sat from 1500 hrs. to 1530 hrs.

PRESENT

Shri Rakesh Singh - Chairperson

Lok Sabha

2. Shri A. Arunmozhithevan
3. Shri Kalyan Banerjee
4. Smt. Jyoti Dhurve
5. Shri Shailesh Kumar
6. Shri Devji M. Patel
7. Smt. Riti Pathak
8. Smt. Ranjit Ranjan
9. Dr. Ravindra Kumar Ray
10. Shri Tamradhwaj Sahu
11. Shri Tathagata Satpathy
12. Shri Janardan Singh"Sigriwal"
13. Shri Pashupati Nath Singh
14. Shri Sunil Kumar Singh
15. Shri Sushil Kumar Singh
16. Shri Krupal Balaji Tumane

Rajya Sabha

17. Dr. Pradeep Kumar Balmuchu

SECRETARIAT

1. Shri U.B.S. Negi - Joint Secretary
2. Shri Ajay Kumar Garg - Director
3. Shri Arvind Sharma - Additional Director
4. Ms. Miranda Ingudam - Deputy Secretary

2. At the outset, Chairperson welcomed the Members to the sitting of the Committee.

3. The Committee thereafter took up for consideration the following Draft Reports:-

(i) Draft Report on "Research and Development in Iron and Steel Sector" of the Ministry of Steel;

(ii) ** ** ** **

(iii) ** ** ** **

4. The Committee also considered the letter of dissent dated 09.08.2016 given by Shri Tathagata Satpathy, M.P. in respect of certain recommendations contained in its draft Report relating to "Research & Development in Iron and Steel Sector" of the Ministry of Steel.

5. The Committee adopted the Reports with minor changes/modifications in Draft Report on "Research and Development in Iron and Steel Sector". The Committee decided that a copy of the aforesaid letter of dissent given by Shri Tathagata Satpathy be appended to the Report in terms of Rule 331I.(3) of Rules of Procedure and Conduct of Business in Lok Sabha. The Committee then authorized the Chairperson to finalise the Reports on the basis of factual verification from the concerned Ministries and present the same to both the Houses of Parliament.

The Committee then adjourned.

**Do not pertain to this Report.