

## R&D PROJECTS PURSUED UNDER THE GOVERNMENT FUNDED SCHEME: 'PROMOTION OF RESEARCH & DEVELOPMENT IN IRON & STEEL SECTOR'

### Approved during 11<sup>th</sup> Five Year Plan:

(In Rs. Crore)

Sl No	Name of the project & Implementing organization	Approved Project cost (approval date)	Plan Fund	Progress
1	Improvement in sinter productivity through deep beneficiation and agglomeration technologies for rational utilization of low grade iron ores and fines. <b>Lead Agency: NML Jamshedpur</b>	<b>12.56</b> <b>(11.02.2010)</b>	<b>12.56</b>	<ul style="list-style-type: none"> <li>• Project completed.</li> <li>• Waste Dump Fines (WDF) from Gua Mines, Iron Ore Slimes (IOS) Sample from Kiriburu Iron Ore Washing Plant, Low Grade Iron Ore (LGO) from Kiriburu Iron ore Mines of SAIL, samples collected.</li> <li>• The samples were characterised with respect to physical, chemical, mineralogical, liberation and grinding characteristics. Detailed bench scale studies were undertaken for development of process route for beneficiation of the three iron ore samples. The results of bench scale studies were validated through pilot scale studies and process flow-sheets were developed.</li> <li>• Micro-pelletization studies on fine grained iron ore concentrate were carried out towards using it as partial feed for sintering.</li> <li>• Sintering studies were carried out using micro-pellets as the partial feed under varied conditions. Use of (50%) the micro-pellets/pre-balled concentrate alongwith 50% sinter fines led to marked improvement in sinter productivity due to improved bed permeability.</li> <li>• The techno-economic feasibility studies of the processes developed have been carried out in association with MECON.</li> <li>• The PCR has also reported that results of the techno-economic feasibility studies for beneficiation process indicate post tax IRR of 33.5% (Gua waste dump fines), 24.1% (Kiriburu Slimes) &amp; 35.7% (Kiriburu low grade ore) and IRR of 62.0% for incremental cold pig production after micro-pelletisation through Gua waste dump route. These IRRs indicate that the project is techno-economically viable.</li> </ul>
2	Alternate complementary Route of Iron/ Steel making with reference to Indian raw material viz low grade iron ore and non coking coal. <b>Lead Agency: NML Jamshedpur</b>	<b>8.58</b> <b>(11.02.2010)</b>	<b>8.58</b>	<ul style="list-style-type: none"> <li>• Project completed.</li> <li>• Coal samples were procured from various sources and flow sheets developed to obtain clean coal with ~12% ash for each one of them. Clean coal and iron ore concentrate was used to produce composite micro-pellets. Micro pellets were reduced in coke oven with excess carbon to form ferro-carbon. Excellent metallization was achieved under optimum conditions. and sufficient quantity of ferro-carbon was produced in the pilot oven for further melting studies. Smelting studies carried out with the generated ferro-carbon in the SAF for steel making.</li> <li>• Although good metallization has been achieved in the Ferro Carbon (around 90%), the steel produced have around 1.5% C and 0.1% P which are not desirable.</li> <li>• Findings not encouraging for implementation.</li> </ul>

3	Production of low Phosphorus Steel using DRI through Induction furnace route adopting innovative fluxes and/or design (refractory) changes. <b>Lead Agency: NML Jamshedpur</b>	<b>2.37</b> <b>(11.02.2010)</b>	<b>2.37</b>	<ul style="list-style-type: none"> <li>• Project completed.</li> <li>• Process has been developed in laboratory scale for production of low Phosphorus steel in laboratory scale Induction Furnace using DRI.</li> <li>• Industrial Scale Trials taken up in 2<sup>nd</sup> Phase (Project Sl.No.9).</li> </ul>
4	Development of futuristic Technology for carbon free iron production using alternate reductants like hydrogen with minimum or no CO2 emission. <b>Lead Agency: IMMT Bhubaneswar</b>	<b>9.90</b> <b>(11.02.2010)</b>	<b>9.90</b>	<ul style="list-style-type: none"> <li>• Very futuristic technology demonstration project.</li> <li>• Project Completed.</li> <li>• Feasibility of smelting reduction of iron ore/fines using hydrogen plasma has been explored in laboratory/ pilot scale for which a patent has also been filed in the US</li> </ul>
5	Beneficiation of Iron Ore slimes from Barsua and other mines in India. <b>Lead Agency: RDCIS, SAIL Ranchi.</b>	<b>27.69</b> <b>(23.11.2010)</b>	<b>14.08</b>	<ul style="list-style-type: none"> <li>• Project start delayed. Considerable delay in design &amp; procurement of the pilot plant.</li> <li>• The Project Review Committee has recommended extension of the project till March 2017.</li> </ul>
6	Development of pilot scale pelletization technology for Indian Goethitic/hematite ore with varying degree of fineness. <b>Lead Agency: RDCIS, SAIL Ranchi.</b>	<b>41.89</b> <b>(23.11.2010)</b>	<b>22.06</b>	<ul style="list-style-type: none"> <li>• Project start delayed. Considerable delay in design &amp; procurement &amp; commissioning of the pilot plant.</li> <li>• The Project Review Committee has recommended extension of the project till March 2017.</li> </ul>
7	CO2 abatement in Iron and Steel production by process optimization. <b>Lead Agency: IIT Kharagpur</b>	<b>0.84</b> <b>(23.11.2010)</b>	<b>0.84</b>	<ul style="list-style-type: none"> <li>• Project completed.</li> <li>• Based on the predictions of the developed mathematical models the following optimization results has been obtained with Input conditions of moisture content 35-64 gms/Nm<sup>3</sup>, blast temperature 903-1018 C, sinter/ore ratio of 2.07-2.75 and validated during BF#3 Trials at RSP: <ul style="list-style-type: none"> <li>○ Increase of Productivity by about 10 - 12 % based on observed productivity 1.6-1.7 T/day/M<sup>3</sup> of W.V</li> <li>○ Decrease of CO<sub>2</sub> in the exit gas by about 8 -10%</li> <li>○ Decrease of Carbon rate by about 8 – 10 % based on observed C rate of around 500 kg/THM</li> </ul> </li> </ul>
8	Production of low ash (10% ash) coal (coking non coking) from high ash Indian coals including desulphurisation of high sulphur North East coal. <b>Lead Agency: IMMT Bhubaneswar</b>	<b>19.44</b> <b>(23.11.2010)</b>	<b>16.89</b>	<ul style="list-style-type: none"> <li>• Project completed.</li> <li>• It has been established at laboratory scale that the it is possible to beneficiate ROM coal with less than 30% ash to achieve 10% ash with appreciable yield.</li> <li>• Multiple flow sheets for beneficiation were developed for different grades of coking &amp; non coking coals which can be used by the user industry.</li> </ul>

## Approved during 12<sup>th</sup> Five Year Plan:

(In Rs. Crore)

SI No	Name of the project & Implementing organization	Approved Project cost (approval date)	Plan Fund	Physical Progress
9	Production of low Phosphorus steel through Induction Furnace route using DRI as major ferruginous raw material – An Industrial Assessment. Lead Agency: <b>NML Jamshedpur</b>	<b>1.93</b> <b>(17.02.2014)</b>	<b>1.93</b>	<ul style="list-style-type: none"> <li>• This is the Phase-2 of the Project at SI.No.3.</li> <li>• Project work started in September 2014.</li> <li>• Project Completed &amp; Project Completion Report (PCR) submitted.</li> <li>• Based on the findings of the PCR future course of action being taken up in consultation with the stakeholders.</li> </ul>
10	Development of Automation System for Optimum Coal Blending at Coal Handling Plant of Coke Oven Batteries by <b>RDCIS</b>	<b>12.90</b> <b>(08.12.2014)</b>	<b>6.45</b>	<ul style="list-style-type: none"> <li>• Project in progress.</li> <li>• Technical Specifications for the equipments &amp; PLC systems completed and Tendering Process initiated.</li> <li>• Algorithm development of Blending Model in Progress.</li> <li>• Likely to be completed in 2016-17.</li> </ul>
11	Preparation of DPR of project on 'Development of Technology for Cold Rolled Grain Oriented Steel Sheets'	<b>2.00</b> <b>(29.11.2014)</b>	<b>0.50</b>	<ul style="list-style-type: none"> <li>• Order for preparation of DPR placed to <b>MECON</b> in March 2015.</li> <li>• DPR submitted in Jan 2016. DPR being examined by the stakeholders for acceptance</li> </ul>
12	Economic production of iron through direct reduction of Mill Scale by low grade coal of Rajasthan by <b>MNIT Jaipur</b>	<b>5.40</b> <b>(08.12.2014)</b>	<b>1.66</b>	<ul style="list-style-type: none"> <li>• Project initiated in Oct 2015 after final approval of PAMC. Project in progress</li> </ul>
13	Develop Procedure for Joining Next Generation High Temperature Material to be used for Supercritical/ Ultra Supercritical Power Plant by Friction Stir Welding by <b>Jadavpur University in Collaboration With MECON</b>	<b>5.67</b> <b>(08.12.2014)</b>	<b>5.58</b>	<ul style="list-style-type: none"> <li>• Project initiated in Oct 2015 after final approval of PAMC. Project in progress.</li> </ul>
14	Development of Cost Effective Refractory Lining Materials for Induction Melting Furnace suitable for production of Quality Steel by <b>CSIR-CGCRI &amp; NISST</b>	<b>1.65</b> <b>(12.01.2016)</b>	<b>1.65</b>	<ul style="list-style-type: none"> <li>• Project initiated in April 2016. Project in progress.</li> </ul>
15	Development of Dry Slag Granulation Technology and Energy Recovery System for Blast Furnace Slag for Producing Clinker Compatible Product by <b>IIT Madras &amp; JSW Steel</b>	<b>1.68</b> <b>(12.01.2016)</b>	<b>0.84</b>	<ul style="list-style-type: none"> <li>• Project initiated in April 2016. Project in progress.</li> </ul>
16	Development of Infrared Camera Based Torpedo Ladle Car Condition Monitoring System by <b>MECON</b>	<b>3.08</b> <b>(12.01.2016)</b>	<b>1.54</b>	<ul style="list-style-type: none"> <li>• Project to be initiated after release of the first installment during 1<sup>st</sup> Quarter of 2016-17.</li> </ul>
<b>Total for 16 projects</b>		<b>156.97</b>	<b>107.28</b>	