

## R&D Projects undertaken under the R&D scheme with financial assistance from Plan Fund:

*(Rs. in Lakhs)*

Sl. No.	R&D Projects	R&D Agency	Total Project Cost	Sanctioned Government Funding	Fund released till Dec 2016	Project Status
1	Improvement in sinter productivity through deep beneficiation and agglomeration technologies for rational utilization of low grade iron ores and fines	CSIR-NML	1,255.80	1,255.80	1,255.80	<ul style="list-style-type: none"> <li>• Project Completed.</li> <li>• Detailed bench scale &amp; pilot scale studies were undertaken for development of process route for beneficiation of the three iron ore samples.</li> <li>• Micro-pelletization studies on fine grained iron ore concentrate and Sintering studies were carried out using micro-pellets as the partial feed under varied conditions.</li> <li>• 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>• Techno-economic feasibility studies of the processes developed have been carried out in association with MECON.</li> </ul>
2	Development of Alternate complementary Route of Iron/Steel making with reference to Indian raw material viz low grade iron ore and non coking coal	CSIR-NML	858.00	858.00	858.00	<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.</li> <li>• Clean coal and iron ore concentrate used to produce composite micro-pellets.</li> <li>• 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</li> </ul>

						<p>was produced in the pilot oven for further melting studies.</p> <ul style="list-style-type: none"> <li>• Smelting studies carried out with the generated ferro-carbon in the SAF for steel making. 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.	CSIR-NML	237.00	237.00	237.00	<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 2nd Phase (Project SI.No.9).</li> </ul>
4	Smelting reduction of iron ore/fines by hydrogen plasma and elimination of CO2 emission	CSIT-IMMT	990.35	990.35	990.35	<ul style="list-style-type: none"> <li>• Project Completed.</li> <li>• Very futuristic technology demonstration project.</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 Mine	RDCIS, SAIL	2,769.40	1,408.20	1,100.90	<ul style="list-style-type: none"> <li>• Project initiated in Jan 2012. Approved Completion in March 2017.</li> <li>• However, pilot plant could not be setup pending statutory clearances at mine site.</li> </ul>
6	Development of pilot scale pelletization technology for Indian Goethitic/hematite ore with varying degree of fineness	RDCIS, SAIL	4,188.77	2,206.27	1,005.55	<ul style="list-style-type: none"> <li>• Project initiated in Jan 2012. Project on Progress. Approved Completion March 2017.</li> <li>• Pilot Scale pelletisation plant setup. Project to be completed in March 2017.</li> </ul>
7	CO2 abatement in Iron and Steel production by process optimization	IIT Kharagpur	84.36	84.36	84.36	<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</li> </ul>

						<p>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:</p> <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>
8	Production of low ash (10% ash) coal (coking non coking) from high ash Indian coals including desulphurisation of high sulphur North East coal	CSIT-IMMT	<b>1,943.53</b>	<b>1,688.53</b>	<b>1,688.53</b>	<ul style="list-style-type: none"> <li>● Project completed.</li> <li>● It has been established at laboratory scale that 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>
9	Development of the technology for production of CRGO Steel Sheets and other value added Steel Products (DPR)	CSIR-NML	<b>137.83</b>	<b>34.46</b>	<b>34.46</b>	DPR Completed and approved. Project to initiate after signing of Memorandum of Agreement by the stakeholders.
10	Production of low Phosphorus steel through Induction Furnace route using DRI as major ferruginous raw material – An Industrial Assessment	CSIR-NML	<b>193.00</b>	<b>193.00</b>	<b>193.00</b>	<ul style="list-style-type: none"> <li>● Project Completed.</li> <li>● Industrial Trials completed showing encouraging results.</li> <li>● Follow up industrial trials in neutral lining IF planned to achieve lower phosphorus levels.</li> </ul>
11	Development of Automation System for Optimum Coal Blending at Coal Handling Plant of Coke Oven Batteries	RDCIS, SAIL	<b>1,290.00</b>	<b>645.00</b>	<b>338.00</b>	<ul style="list-style-type: none"> <li>● Project initiated in June 2015 and 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>● Scheduled completion May 2018.</li> </ul>
12	Economic production of iron through	MNIT	<b>540.00</b>	<b>166.00</b>	<b>141.00</b>	<ul style="list-style-type: none"> <li>● Project initiated in October 2015 and is</li> </ul>

	direct reduction of Mill Scale by low grade coal of Rajasthan					<ul style="list-style-type: none"> <li>on progress.</li> <li>Preliminary experiments conducted.</li> <li>Technical specifications of the main equipments finalized and order placed.</li> <li>Scheduled completion September 2018.</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	Jadavpur University	567.26	558.26	481.00	<ul style="list-style-type: none"> <li>Project initiated in October 2015 and is on progress.</li> <li>Procurement order placed on high temperature furnace, software and P91 seamless pipes etc.</li> <li>Scheduled completion September 2018.</li> </ul>
14	Development of Cost Effective Refractory Lining Materials for Induction Melting Furnace suitable for production of Quality Steel	CSIR-CGCRI	165.00	165.00	132.00	<ul style="list-style-type: none"> <li>Project initiated in April 2016 and is on progress.</li> <li>Development of Magnesia- Mg-Al Spinel based ramming mass carried out</li> <li>Development of Magnesia-Chromite based ramming mass carried out</li> <li>Scheduled completion in March 2018.</li> </ul>
15	Development of Dry Slag Granulation Technology and Energy Recovery System for Blast Furnace Slag for Producing Clinker Compatible Product	IIT Madras	168.74	84.37	39.02	<ul style="list-style-type: none"> <li>Project initiated in April 2016 and is on progress.</li> <li>Designed low temperature physical model and carried out preliminary experiments.</li> <li>Design of pilot scale granulator and lime dissolution furnace has been completed and procurement in progress.</li> <li>Scheduled completion in March 2020.</li> </ul>
16	Development of Infrared Camera Based Torpedo Ladle Car Condition Monitoring System	MECON	308.00	154.00	134.50	<ul style="list-style-type: none"> <li>Project initiated in August 2016. Project on progress.</li> <li>Detailed design, finalization of specification and procurement of components on progress.</li> <li>Scheduled completion July 2018.</li> </ul>
17	Development of nickel free nitrogen austenitic stainless steel for biomedical applications	IIT BHU	284.45	284.45	161.00	<ul style="list-style-type: none"> <li>Project initiated in Jan 2017.</li> <li>Scheduled completion in December 2019.</li> </ul>
18	Indigenous Development of Model based Breakout Prediction System (BOPS) for	RDCIS	582.00	260.00	100.00	<ul style="list-style-type: none"> <li>Project initiated in Jan 2017.</li> <li>Scheduled completion in December</li> </ul>

	Continuous Casters					2019.
19	Development of Fluidised Bed Reduction Roasting Process for slimes & low grade iron ores by utilizing thermal grade coal for their magnetic susceptibility properties and maximizing the iron recovery	IIT Madras & JSW Steel	<b>245.52</b>	<b>122.76</b>	<b>51.00</b>	<ul style="list-style-type: none"> <li>• Project initiated in Dec 2016.</li> <li>• Scheduled completion in November 2020.</li> </ul>
20	Production of low Carbon & low Phosphorus Ferromanganese by metallothermic treatment of high Manganese Slag using Silicomanganese	NML Jamshedpur.	<b>150.00</b>	<b>150.00</b>	<b>100.00</b>	<ul style="list-style-type: none"> <li>• Project initiated in Jan 2017.</li> <li>• Scheduled completion in December 2018.</li> </ul>
21	Production of highly metallised Directly Reduced Iron from mill scale & lean grade coal in Tunnel Kiln	NML Jamshedpur.	<b>151.00</b>	<b>151.00</b>	<b>151.00</b>	<ul style="list-style-type: none"> <li>• Project initiated in Dec 2016.</li> <li>• Scheduled completion in November 2017.</li> </ul>
22	Reduction Roasting and Microwave Heating of some difficult to treat Ores for the production of Pellet Feed Concentrate	IMMT Bhubaneswar	<b>124.80</b>	<b>124.80</b>	<b>78.00</b>	<ul style="list-style-type: none"> <li>• Project initiated in Dec 2016.</li> <li>• Scheduled completion in Nov 2019.</li> </ul>
23	Modeling & Optimization of High Concentration Iron Ore fines /concentrate slurry Pipelines for Indian Iron Ore Processing Industries	IMMT Bhubaneswar & NMDC Ltd.	<b>425.00</b>	<b>212.50</b>	<b>100.00</b>	<ul style="list-style-type: none"> <li>• Project initiated in Jan 2017.</li> <li>• Scheduled completion in December 2019.</li> </ul>