

STATUS OF THE R&D PROJECTS PURSUED WITH FINANCIAL ASSISTANCE FROM SDF

COMPLETED PROJECTS

(In Rs. Crore)

SI No	Name of the project	R&D Agency/ SDF Funding/ Timelines	Project Outcome
1	Energy efficiency improvement in secondary steel sector in India	<ul style="list-style-type: none"> ▪ MECON ▪ SDF Funding: 0.6 cr ▪ Project duration: 1998-2000 	<ul style="list-style-type: none"> ▪ MECON carried out in-depth study of selected EAF (10 nos) & IF units (5 nos) for reduction/ optimization of energy consumption by improvements in operating practice & introduction of energy efficient technologies/ equipments. ▪ The findings when implemented could lead to reduction in energy consumption upto 90 Kwh with minimum investment. ▪ The knowledge gained was implemented in some of the steel plants.
2	Chemical modification of lignite based additives and its application in beneficiation of iron ore fines and slimes	<ul style="list-style-type: none"> ▪ RRL, Jorhat ▪ SDF Funding: 0.09 cr ▪ Project duration: 1998-2001 	The lignite based additives were developed by RRL Jorhat, The performance of the additives was tested at NMDC, Hyderabad. The additives were not effective for beneficiation of iron ore fines but it could reduce alumina by 4% from iron ore slimes containing 10% alumina.
3	To improve coking characteristics of non coking Chandrapura Coal of Western Coal Field Ltd	<ul style="list-style-type: none"> ▪ IIT, Delhi & Usha Ispat Limited ▪ SDF Funding: 0.0178 cr ▪ Project duration: 1998-2000 	<ul style="list-style-type: none"> ▪ Laboratory scale experiments were carried out by Centre for Energy Studies at IIT Delhi and coke buttons was produced. ▪ Further research were also carried out at Usha Ispat & RDCIS. ▪ However, the results obtained were not encouraging.
4	Introduction of new mining methods and techniques for grounds control to enable mining of rich Manganese ore under very poor to fair grounds Conditions	<ul style="list-style-type: none"> ▪ MOIL and National Institute of Rock Mechanics ▪ SDF Funding: 0.08 cr ▪ Project duration: 2010-2012 	<ul style="list-style-type: none"> ▪ Through this project, MOIL successfully implemented a new mining method, designed & developed by NIRM Bangalore and CMRI Nagpur, in their Chikla Mine. ▪ The new method supports increase in productivity, better safety as well as reduction in the cost of production.

5	Development of on line expert system for continuous cast products (Billets/Blooms/Slabs)	<ul style="list-style-type: none"> ▪ MECON ▪ SDF Funding: 0.14 cr ▪ Project duration: 1998-2000 	<ul style="list-style-type: none"> ▪ An on line Real Time Process Control Expert System for continuously cast products was developed.
6	To achieve refractory consumption of international bench mark level in integrated steel plants	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi ▪ SDF Funding: 3.38 cr ▪ Project duration: 1999-2003 	<ul style="list-style-type: none"> • Designing of Customized Zonal lining of BOF and steel ladles. • Development of manufacturing process of MgO-C bricks. • Development of Computerized Refractory Management Systems for effective monitoring thereby reducing refractory consumption and cost. • To disseminate the know how generated seminar was organized at RDCIS, Ranchi. • The specific consumption (Kg/tcs) in trial heats achieved was 3.12 as compared to the existing average value of 6.5 kg/tcs. • The knowledge generated through the project has been implemented in in the BOF shops of BSL, RSP, BSP & DSP.
7	Simulation of Thermo-mechanical Processing of steels and Hot Workability studies of High strength steels	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi ▪ SDF Funding: 6.30 cr ▪ Project duration: 1999-2002 	<ul style="list-style-type: none"> • Thermo-mechanical Simulator and Electron Beam Wide Area Analyser were installed and thermo-mechanical processing and segregation studies of high strength steels were carried out. • Enabled SAIL (RSP) to produce HSLA steel with higher strength and superior impact toughness properties. • A Seminar was organized by RDCIS to disseminate the knowledge gained from this project. • Various plant based projects have been taken up by SAIL using the facilities/ knowledge developed through the project.
8	Development of welding consumables and assessment of weldability index for micro alloyed steels	<ul style="list-style-type: none"> ▪ Jadavpur University ▪ SDF Funding: 0.15 cr ▪ Project duration: 1999-2002 	<ul style="list-style-type: none"> ▪ Studies were conducted on the effect of shielding gas mixture (Ar+CO₂+O₂) on the performance of microalloyed steel weld using solid and flux cored wire using GMAW process. ▪ The weldability index was determined based on the properties of the weldment.

9	Development of Cast & forged microalloyed steel	<ul style="list-style-type: none"> ▪ IIT Kharagpur ▪ SDF Funding: 0.1470 cr ▪ Project duration: 1998-2001 	<ul style="list-style-type: none"> ▪ Laboratory scale trials were carried out to investigate the effect of composition and subsequent heat treatment on the structure & properties of Ti-V micro alloyed steel castings. ▪ The trials confirmed that low carbon micro alloyed steel of proper alloy design may develop mechanical properties specially required for forging & casting components in automobile industries and this can replace the costlier alloy steels presently used.
10	To study various tolerable Indian non-coking coal sources with the aim of maximizing the usage of domestic non-coking coal in the COREX process	<ul style="list-style-type: none"> ▪ Jindal Vijayanagar Steel Ltd. ▪ SDF Funding: 0.94 cr ▪ Project duration: 1999-2003 	<ul style="list-style-type: none"> ▪ Successfully completed trials of Indian Non-coking coal in both the modules of the COREX ▪ It has been demonstrated that imported coal can be replaced to the extent of 10% by domestically available non-coking coal without affecting the fuel rate and productivity.
11	Production of CC Billet/Bloom of quality suitable for single-stage conversion into special Bars	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi and Tata Iron & Steel Co. Ltd. ▪ SDF Funding: 27.09 cr ▪ Project duration: 1999-2003 	<ul style="list-style-type: none"> • An improved secondary cooling system was conceptualized, designed & developed in-house based on mathematical models. • The automated system along with Electromagnetic Stirrer were installed in Billet Caster of DSP and Bloom Caster of ASP. • The Systems were also installed and commissioned at LD#1 Shop of Tata Steel Limited. • Through this project it has been possible to produce special steels through CC route, remove internal defects, eliminate sub-surface defects & increase caster productivity substantially.
12	Desulphurisation of Assam Coal	<ul style="list-style-type: none"> ▪ IIT, Delhi ▪ SDF Funding: 0.0463 cr ▪ Project duration: 1999-2001 	<ul style="list-style-type: none"> ▪ Experiments were carried out in 20 g scale in a Quartz Reactor designed & fabricated at IIT Delhi. ▪ It was found that suitable thermochemical treatment followed by vapour extraction provided significant improvement in Sulfur removal.
13	Teaching Package on Structural Steel Design for Department of Civil/Structural Engineering	<ul style="list-style-type: none"> ▪ INSDAG, IIT Madras & Anna University Chennai ▪ SDF Funding: 0.52 cr ▪ Project duration: 	<ul style="list-style-type: none"> ▪ Teaching package on structural steel was developed with an aim to increase the steel intensive construction in India. ▪ The Teaching Package was distributed to various Engineering Colleges/ Institutes. ▪ Four Workshops were held by INSDAG.

		1999-2001	
14	Maximisation of blast furnace productivity with Indian iron ore	<ul style="list-style-type: none"> ▪ NML, Jamshedpur Tata Iron & Steel Co. Ltd and RDCIS, SAIL, Ranchi ▪ SDF Funding: 34.76 cr ▪ Project duration: 2000-2005 	<ul style="list-style-type: none"> • Under Burden Probe, Vertical Probe & Core Sampler were installed in BF#5 of Bokaro Steel Plant • Based on the data obtained from these probes, steps were taken on burden distribution control for enhancing the central working of the furnace. • The steps taken helped in substantial improvement in productivity & substantial savings. • Workshops organized by RDCIS for dissemination of the knowledge
15	Utilisation of solid waste materials generated at Steel Plants by physical beneficiation techniques	<ul style="list-style-type: none"> ▪ RRL, Bhubaneswar, TISCO and RDCIS, SAIL ▪ SDF Funding: 0.08 cr ▪ Project duration: 1999-2002 	<ul style="list-style-type: none"> ▪ Laboratory scale experimental trials were conducted to find out methods for recovery Iron & Carbon value from the Steel Plant wastes viz. BF Flue Dust, BOF Sludge from SAIL & TISCO. ▪ It was found that Carbon & Iron values in the BF Flue Dust can be recovered with reasonable yield by floatation and low intensity magnetic separation techniques. ▪ It was also found that a good concentrate of Iron could be recovered with reasonable yield from BOF sludge by scrubbing followed by classification.
16	Macromodeling of heat transfer and inclusion management in continuous and ingot casting of steel	<ul style="list-style-type: none"> ▪ IIT Kharagpur ▪ SDF Funding: 0.0758 cr ▪ Project duration: 2000-2003 	<ul style="list-style-type: none"> ▪ A comprehensive macro/micro model was developed which can be used to predict the inclusion behaviour in continuous casting slab. ▪ Through the experimental studies, distribution of non-metallic inclusion like iron oxide and iron sulphide in mild steel (0.2% C), was carried out to characterise the inclusion distribution in cast steel.
17	Design and development of TRIP aided ferrite-bainite steel for structural application	<ul style="list-style-type: none"> ▪ BESU Shibpur ▪ SDF Funding: 0.098 cr ▪ Project duration: 1999-2002 	<ul style="list-style-type: none"> ▪ On the basis of laboratory scale experiments, two target compositions of steel were selected for holding the industrial trials. ▪ Thereafter, Industrial trials were conducted for melting, casting & thermo-mechanical treatment as per the findings of the laboratory scale studies. ▪ It was found it was possible to produce TRIP induced dual phase steel of simple composition possessing high strength & ductility levels.
18	Cold Briquetting of Iron Oxide	<ul style="list-style-type: none"> ▪ RRL, Bhubaneswar and Ispat Metallica 	<ul style="list-style-type: none"> ▪ RRL, Bhubaneswar successfully developed a suitable blend ratio and binder for production of briquettes from Iron Oxide fines.

		<ul style="list-style-type: none"> ▪ SDF Funding: 0.24 cr ▪ Project duration: 2000-2003 	<ul style="list-style-type: none"> ▪ RDCIS has tested and certified that the briquettes are suitable for charging in Blast Furnace.
19	Development of ultra high strength steel in as rolled condition through thermo mechanical controlled processing	<ul style="list-style-type: none"> ▪ BESU Shibpur ▪ SDF Funding: 0.2239 cr ▪ Project duration: 2000-2003 	<ul style="list-style-type: none"> ▪ Low carbon copper bearing micro alloyed ultra high strength steel was successfully produced in laboratory scale. ▪ Further trials were conducted at Metal & Steel Factory, Ishapore for using such steel in manufacturing small arms & ammunition of the Indian Defence Services. ▪ Stabiliser blades for 125 mm HE ammunition and Barrel of 5.56 mm INSAS Rifle was successfully made from the steel produced in the trial heats and further treatments.
20	Damage assessment and integrity of welded components	<ul style="list-style-type: none"> ▪ Jadavpur University ▪ SDF Funding: 0.0358 cr ▪ Project duration: 2001-2003 	<ul style="list-style-type: none"> ▪ The project has studied the effect of different weld procedure on the performance of HSLA steel weldments including hydrogen induced cracking susceptibility using the MMAW process. ▪ The facility is being used by research students ▪ A Workshop was organized at Jadavpur University for participants from the industry, to disseminate the knowledge. .
21	Mixing and mass transfer in steel making ladles stirred with dual porous plug	<ul style="list-style-type: none"> ▪ IIT Kanpur ▪ SDF Funding: 0.10 cr ▪ Project duration: 2001-2004 	<ul style="list-style-type: none"> ▪ Laboratory scale studies were successfully completed with the help of physical modeling & also Mathematical modeling. ▪ A workshop was also organized to disseminate the finding of the experiments.
22	Setting up of a semi pilot demonstration plant (30kg/Hr capacity) for production of synthetic rutile, pig iron & high pure ferric oxide from east coast ilmenite using thermal plasma technology	<ul style="list-style-type: none"> ▪ NMDC Hyderabad ▪ SDF Funding: 0.40 cr ▪ Project duration: 2001-2003 	<ul style="list-style-type: none"> ▪ The semi pilot demonstration plant was successfully setup. metalized Ilmenite was produced in a continuous scale fluidized bed reactor. Thereafter, the metalized Ilmenite was melted in a moving bed plasma reactor. ▪ The findings has established the feasibility of producing a Titania Slag having more than 80% Tio₂ and Pig Iron having more than 97% Fe at a power consumption of about 1.5 Kwh per Kg of Titania Slag.
23	Development of process for advanced hot dip coated products	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi ▪ SDF Funding: 4.52 cr ▪ Project duration: 	<ul style="list-style-type: none"> • Two state-of-art facilities, viz, Hot Dip Process Simulator (HDPS) and Glow Discharge analyzer (GDA) were installed at RDCIS, Ranchi • The optimum process parameters required for production of mini spangled/high

		2004-2007	<p>formable galvanized sheets was established.</p> <ul style="list-style-type: none"> • Training programs were organized for 48 participants from 13 organizations on the use of HDPS. • Post completion of the project, the facility has been utilized for development of new types of Zn (Zn-Mg, Zn-Ni, Zn-Al) and Al (Al-Si) based coatings.
24	Smelting reduction of chromite for ferro chrome/charge chrome making	<ul style="list-style-type: none"> ▪ RRL, Bhubaneswar ▪ SDF Funding: 0.23 cr ▪ Project duration: 2002-2005 	<ul style="list-style-type: none"> ▪ A process was successfully developed in laboratory scale to produce ferro chrome by smelting reduction of chromite. ▪ However, the findings indicated that the process can produce ferro chrome containing only 49% Chromium and not suitable for commercial purpose.
25	Development of Micro Alloyed Steel Structural products in Secondary steel sector through Induction Furnace and Controlled Rolling Route	<ul style="list-style-type: none"> ▪ NISST & AIFFA ▪ SDF Funding: 0.04 cr ▪ Project duration: 2003-2004 	<ul style="list-style-type: none"> ▪ Technology for production of micro alloyed steel rebars through induction furnace route was developed. ▪ 0.04% V and 0.04% Nb rebars showed the best combination of properties. ▪ Workshop was organised in Mandi Govindgarh to showcase the technology.
26	Development of intelligent Mill setup model for dynamic and adaptive control of plate mill	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi ▪ SDF Funding: 11.59 cr ▪ Project duration: 2004-2009 	<ul style="list-style-type: none"> ▪ Introduction of hydraulic AGC, thickness gauge and basic automation system for better thickness control at BSP. ▪ Optimization of thermal regime in reheating furnace of plate mill. ▪ Successfully demonstrated rolling of plates up to 36 mm thickness with a tolerance level of +0.3 to -0.2 mm. ▪ The system developed is under operation at Plate Mill, BSP and has led to significant improvement in dimensional tolerance of plates ▪ The knowledge gained is being utilised in other plants of SAIL
27	Pilot Scale Smelting and pre feasibility Studies on Nickel-Chromium-Cobalt bearing Magnetite ores for commercial production	<ul style="list-style-type: none"> ▪ NML, Jamshedpur & Government of Nagaland ▪ SDF Funding: 0.29 cr ▪ Project duration: 2006-2012 	<ul style="list-style-type: none"> • It was established that multi-metallic magnetite ore deposit at Nagaland may be utilized for production of low alloy steel for casting as well as foundry grade iron making using a submerged arc furnace. • Based on the project, it was recommended to set up a medium scale commercial plant at Nagaland with the assistance of M/s M. N. Dastur & Co. or M/s MECON, Ranchi. • Ministry wrote to Directorate of Geology & Mining, Government of Nagaland for establishing a roadmap for development of a commercial scale Pilot Plant.
28	Research proposal on	<ul style="list-style-type: none"> ▪ Jadavpur University & 	<ul style="list-style-type: none"> ▪ Characterization of spot welded, coated and uncoated steel sheets of six grades

	Development & Characterization of Spot Welding Techniques for Coated Steel Sheets	<p>Tata Steel</p> <ul style="list-style-type: none"> ▪ SDF Funding: 0.11 cr ▪ Project duration: 2004-2007 	<p>(including IF & high strength steels) was carried out.</p> <ul style="list-style-type: none"> ▪ The work has provided a deeper understanding and also a database on spot welding of different galvanized steel grades. ▪ Based on the study, Tata Steel, Jamshedpur provided necessary guidance for safe welding practices to automobile manufacturers.
29	Extension of project proposal on Documentation and development of iron making process used by Tribals of India	<ul style="list-style-type: none"> ▪ NML, Jamshedpur ▪ SDF Funding: 0.14 cr ▪ Project duration: 2004-2006 	<ul style="list-style-type: none"> ▪ Detailed documentation of the ancient Indian iron making process was carried out in two types of furnace. ▪ Several technological modifications were carried out to make the processes more productive, energy efficient and cost effective so that these may be adopted by the tribals and the rural populace of the country. ▪ A laboratory scale furnace was setup and the process demonstrated in the tribal/ rural regions.
30	Development of Value added refractory products for Indian bauxite	<ul style="list-style-type: none"> ▪ CGCRI Kolkata ▪ SDF Funding: 0.16 cr ▪ Project duration: 2005-2008 	<ul style="list-style-type: none"> ▪ Experiments were carried out with various alternatives to develop technoeconomically viable refractory aggregates from Indian Bauxite. ▪ Two of the technological routes, namely, bauxite with silica sol and bauxite with rice husk ash gave promising results at laboratory level.
31	Modelling and control of microstructure & mechanism properties during hot strip rolling	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi ▪ SDF Funding: 0.57 cr ▪ Project duration: 2005-2011 	<ul style="list-style-type: none"> • An integrated mathematical hybrid model was developed to predict microstructural evolution and mechanical properties for C-Mn and micro-alloyed steel grades • An on-line predictive model has been developed and successfully installed at Bokaro Steel Plant. • The model predicts real time the properties of hot rolled coils with 95% accuracy. • Subsequently, the knowhow developed was replicated at RSP
32	Development of Coke Dry Cooling Technology (CDCT) for Non-Recovery Coke ovens	<ul style="list-style-type: none"> ▪ MECON ▪ SDF Funding: 0.46 cr ▪ Project duration: 2005-2008 	<ul style="list-style-type: none"> ▪ Various Design Aspects for adopting Coke Dry Cooling Technology for Non Recovery Ovens were studied in details and Basic Engineering was carried out. ▪ The Basic Engineering suggested some changes/ modifications in the Plant & Equipment. ▪ Technical Specifications and Basic Engineering Drawing of the Plant & Equipment was also developed.

33	High Efficiency High Temperature Top Fired Stoves	<ul style="list-style-type: none"> ▪ MECON ▪ SDF Funding: 0.25 cr ▪ Project duration: 2006-2008 	<ul style="list-style-type: none"> ▪ Indigenous design & development of High Efficiency High Temperature Top Fired Stoves with an objective for achieving 1200-1250 deg C Hot Blast Temperature in Mini Blast Furnace. ▪ Developed the Basic Engineering & Detailed Engineering Drawings and the Technical Specifications of the Stoves.
34	Secondary Steel Making and Vacuum Automation Reckoner (SVAR)	<ul style="list-style-type: none"> ▪ Kalyani Carpenter Special Steel Ltd. ▪ SDF Funding: 0.13 cr ▪ Project duration: 2006-2010 	<ul style="list-style-type: none"> • The objective of the project was to develop a model based temperature and composition control system designated as Secondary Steel Making and Vacuum Automation Reckoner (SVAR). • It was found that the work done was not as per the objectives of the project. • As directed, the R&D agency refunded the entire SDF grant along with interest.
35	Prevention of Grain Growth in 38 MnS 6 Micro alloyed steel	<ul style="list-style-type: none"> ▪ Kalyani Carpenter Special Steel Ltd. ▪ SDF Funding: 0.06 cr ▪ Project duration: 2006-2009 	<ul style="list-style-type: none"> • 38MnS6 grade microalloyed steel was successfully developed using Ti & N precipitation technology for crankshaft and connecting rod applications. • A fine grain size was obtained by optimizing the process parameters. • The technology has helped in production of crankshaft steels without quenching and tempering, thus reducing the manufacturing cost.
36	Quality Improvement of Low Grade Iron Ore	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi ▪ SDF Funding: 3.52 cr ▪ Project duration: 2007-2012 	<ul style="list-style-type: none"> • A laboratory scale setup was installed at RDCIS Ranchi, which included equipment viz. Jaw crusher & Disc pulveriser, Spiral classifier, Wet High Intensity Magnetic Separator (WHIMS), Pneumatic Jig, Pressure Filter etc. • Processes developed for beneficiation on low grade ores from Dalli & Gua Mines. • Based on the findings of the project, a slimes beneficiation system has been installed at Kiriburu & Dalli mines to recover fines of pellet grade quality from the slime in the tailing dam. • SAIL is setting up a beneficiation & pelletisation plant at RSP for processing dumped fines from Gua mines.
37	An integrated approach to fatigue behaviour of spot-welded, laser-welded and adhesive bonded high strength steel sheets	<ul style="list-style-type: none"> ▪ Jadavpur University and Tata Steel ▪ SDF Funding: 1.54 cr ▪ Project duration: 2007-2011 	<ul style="list-style-type: none"> ▪ Spot Welding, Weld-Bonding and Laser Welding experiments were carried out in Interstitial Free High Strength (IFHS) and two AHS Dual Phase (DP590 & DP780) Automotive Steels. ▪ Optimal processing conditions of various joining methods for providing the best fatigue properties were developed. ▪ It was found that the fatigue life of the weld-bonded samples were significantly higher which may be suitable for commercial applications.

			<ul style="list-style-type: none"> ▪ Based on the findings, Tata Steel has introduced adhesive joining and weld bonding among their vendors in the automotive industry.
38	Smelting reduction of manganese ore for manufacture of Ferro-Manganese	<ul style="list-style-type: none"> ▪ RRL, Bhubaneswar ▪ SDF Funding: 0.11 cr ▪ Project duration: 2007-2011 	<ul style="list-style-type: none"> • Experiments, on smelting reduction of manganese ore, 500-1000 g scale, were conducted using plasma reactor and induction furnace. • It has been established that it is possible to achieve reduction in manganese loss in slag to a level of 15.97% with 80% Mn recovery in the alloy. • By putting coke on top of the molten bath and injecting oxygen at 5l/min. for 8-10 min., it was possible to reduce electrical energy consumption by 30%.
39	Development and Implementation of Slag Detection System for Converter and Caster	<ul style="list-style-type: none"> ▪ MECON ▪ SDF Funding: 0.88 cr ▪ Project duration: 2007-2009 	MECON has successfully developed and implemented the method of slag control during steel making in Converter and Caster Shop of RSP.
40	Development of continuous NO _x monitoring system	<ul style="list-style-type: none"> ▪ MECON ▪ SDF Funding: 0.44 cr ▪ Project duration: 2007-2009 	<ul style="list-style-type: none"> ▪ Through this project MECON successfully designed and developed an indigenous Non Dispersive Infra Red equipment, capable of monitoring continuously and on-line the NO_x gas present in the flue gas. ▪ The system was installed in BSP
41	Installation of demonstration plant of Continuous Induction Furnace (CONTIFUR) for production of Iron and Steel using iron ore fines and slimes	<ul style="list-style-type: none"> ▪ Electrotherm (India) Ltd., Ahemdabad ▪ SDF Funding: 10.53 cr ▪ Project duration: 2011-2014 	<ul style="list-style-type: none"> • Through this project an innovative new process has been developed for utilization of iron ore fines through production of green pellets and using it in a Pilot Scale Continuous Induction Furnace (CONTIFUR) for production of Hot Metal as well as Steel. • Iron Making Trials were successfully completed and Steel Making Trials was partially successful. • It is possible to produce high carbon steel in the carbon range of 0.5 to 2.0 %, for foundry grade steel castings for automotive parts. • ETIL has proposed to setup a semi-commercial scale plant for iron/ steel making in association with MECON.
42	Reduction of Coke rate using probing and modeling techniques in BF No.7 of Bhilai	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi & NML, Jamshedpur ▪ SDF Funding: 6.91 cr 	<ul style="list-style-type: none"> • Technology was developed to monitor and predict the internal state of BF-7 in real time using Multi Point above Burden Probe (MPOBP) and the Real Time Process Simulator (RTPS).

	Steel Plant	<ul style="list-style-type: none"> ▪ Project duration: 2007-2011 	<ul style="list-style-type: none"> • Reduction in coke rate of 8-11 Kg/THM was achieved during trial period • Knowledge gained implemented in other blast furnace in BSP leading to reduced coke rate and increased CDI rate. • Workshops organized by RDCIS for dissemination of the knowledge
43	Develop Procedures for Friction Stir Spot Welding (FSSW) of formable quality, high strength and advance high strength steel sheets and characterize the welding joints.	<ul style="list-style-type: none"> ▪ Jadavpur University and Tata Steel ▪ SDF Funding: 1.88 cr ▪ Project duration: 2008-2013 	<ul style="list-style-type: none"> • Joining of dual phase, carbon-manganese and interstitial free steel applying Friction Stir Spot Welding was evaluated using Polycrystalline Cubic Boron Nitrate (PCBN) tool. • The operating parameters were established. • The welds were compared with standard resistance spot welds in terms of weld dimension and performance. • The tensile and fatigue properties of the FSSW joints were found superior to RSW joints. • The information generated can be gainfully utilized by the automotive industry.
44	Development of Synthetic Flux through Self Propagating Sintering of LD Sludge	<ul style="list-style-type: none"> ▪ NML, Jamshedpur ▪ SDF Funding: 0.65 cr ▪ Project duration: 2008-2011 	<ul style="list-style-type: none"> • Synthetic flux was produced at lab scale in the form of sinter using LD sludge, blast furnace flue dust and lime fines. • Due to excessive fineness of the raw materials, at first micro pellets were prepared and strengthened by gas treatment using Carbon dioxide. • The gas treated micro pellets were subsequently sintered without addition of coke breeze. • The quality of sinter was evaluated by series of tests and found to have excellent properties to use as flux in LD converter. • The results of the project were sent to the Steel Companies who commented favorably.
45	Study of the requirement of manpower at different levels	<ul style="list-style-type: none"> ▪ Indian Institute of Metals, Kolkata ▪ SDF Funding: 0.11 cr ▪ Project duration: 2007-2008 	<ul style="list-style-type: none"> ▪ The manpower requirements for a production of 200 MT of crude steel by 2020 were estimated. ▪ The gaps in the availability & requirement were also identified and some remedial measures were suggested
46	Processing of Vanadium-bearing Titaniferrous – Magnetite Ores of Eastern	<ul style="list-style-type: none"> ▪ Jadavpur University ▪ SDF Funding: 0.26 cr ▪ Project duration: 	<ul style="list-style-type: none"> • Detail study was carried out on petro mineralogical aspects, chemical analysis and electron probe micro analysis (EPMA) of the collected field samples of Eastern India with major emphasis on Baula-Nuasahi sector of Keonjhar district.

	India.	2009-2013	<ul style="list-style-type: none"> • It was established that Tinaiferous Magnetite bodies in the Eastern Field contain significant amount of Titanium and some of them contain significant amount of Vanadium too. • However, the 2nd Phase of the project (Metallurgical Part), was not proposed by the R&D agency in view of the non-availability of estimates of the reserves of the said ores in the area.
47	Development of Thermo electrically Cooled/heated Helmet for Industrial application	<ul style="list-style-type: none"> ▪ MECON ▪ SDF Funding: 0.95 cr ▪ Project duration: 2010-2012 	<ul style="list-style-type: none"> • Prototype helmets were developed and tried out at different hot locations in BSP. The helmets were found to be suitable upto 55°C operational temperature and were able to cool the internal space of the helmets by ~15°C.
48	Creation of Steel Research Centre	<ul style="list-style-type: none"> ▪ IIT, Kharagpur ▪ SDF Grant released: 15.35 crore 	<ul style="list-style-type: none"> • STC at IIT Kharagpur was approved by the EC in its 18th Meeting held on 14.08.2007 for creating a state-of-the-art R&D facility for human resource development in the steel sector. • This project was jointly funded by Ministry of Steel's SDF (80%) and Department of Science and Technology (DST) (20%). Fund was released for an initial period of five years (2008-09 to 2012-13). • A good state-of-the-art R&D infrastructure has been created and considerable work has been done at STC by pursuing B.Tech, M.Tech & Ph.D level projects and also some Joint Collaborative projects. • The STC has been setup after renovating an existing building (Foundry Section) of the Institute. Further, a new shed has also been constructed wherein major equipment procured through the project viz. cold & hot rolling mills, reheating furnace, forging press etc. have been installed. • The Centre was also inspected by a Committee under the Chairmanship of Director IMMT Bhubaneswar in April 2015. The Committee has felt that setting up of the STC at IIT Kharagpur has made a marked difference in the attitude of the students towards Iron & Steel as a career & research. • The Empowered Committee in its 25th Meeting held on 29th March 2016, also appreciated the work done at STC. • STC is being operated from the allocated budget from IIT Kharagpur. Further efforts are being made at STC to strengthen the collaborations, particularly with the steel

			industry. A number of proposals have been submitted to the Industry. Proposals have also been submitted to Government Agencies for funding.
49	A comprehensive water modeling facility for steelmaking process analysis and design	<ul style="list-style-type: none"> ▪ IIT Kanpur ▪ SDF Funding: 0.61 cr ▪ Project duration: 2011-2014 	<ul style="list-style-type: none"> ▪ Scaled water models of EAF/EBT, Tropedo, BOF, ladle, tundish (bloom and slab casting both, operated with slide gate and Stopper rod), tundish – mold assembly and ingot mould were installed at IIT Kanpur. ▪ The facilities created are used for demonstrations of steelmaking process to UG/ PG students for process design & analysis. ▪ Also provided support base to participants from the industry. ▪ The system has also been replicated at some of the steel plants namely Essar Steel Limited and JSW Steel.
50	Development of Continuous Multi Gas Monitor	<ul style="list-style-type: none"> ▪ MECON ▪ SDF Funding: 0.51 cr ▪ Project duration: 2012-2014 	The continuous multi gas monitoring system has been developed by MECON and has been successfully implemented at Coke Oven Battery No. 10 at Bhilai Steel Plant.
51	Infrared Camera Based Ladle Condition Monitoring System	<ul style="list-style-type: none"> ▪ MECON ▪ SDF Funding: 0.73 cr ▪ Project duration: 2010-2012 	The system has been successfully developed by MECON and commissioned and operationalised in SMS-II of RSP.
52	Development of suitable Gas Metal Arc Welding (GMAW) procedure for high performance weld joints of modified Ferritic stainless steel and low-nickel austenitic stainless steel	<ul style="list-style-type: none"> ▪ Jadavpur University ▪ SDF Funding: 0.68 cr ▪ Project duration: 2012-2015 	<ul style="list-style-type: none"> • The microstructural changes in welded joints were investigated to understand the microstructure & Mechanical properties to find out cost effective welding conditions for producing high performance welded joints. • Pulse mode of metal transfer using 304L filler metal and Ar + 10% CO₂ shielding gas composition exhibited the best performance and cost effective fabrication process for 409M and low nickel ASS. • The facilities created are being used by M. Tech/ Ph.D students for their research activities. • Further, the faculty members of WTC are using these facilities for sponsored research work for the industries.
53	Study on requirement and availability of technical	<ul style="list-style-type: none"> ▪ IIT Kanpur ▪ SDF Funding: 0.19 cr 	<ul style="list-style-type: none"> ▪ The gist of the report is given below: ▪ If future steel plants employ modern technology & automation and employ

	manpower for steel industry in India by IIT Kanpur	<ul style="list-style-type: none"> ▪ Project duration: 2016-2017 	<p>manpower as per global standards, then no shortfall is envisaged for graduate engineers in any discipline including metallurgical engineering.</p> <ul style="list-style-type: none"> ▪ 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. ▪ No shortage is envisaged in the case of diploma engineers and ITI trained manpower in both the scenarios.
54	Evaluation of the R&D Scheme	<ul style="list-style-type: none"> ▪ ASCI Hyderabad ▪ SDF Grant released: 0.068 crore ▪ Project Duration: 2012-13 	<ul style="list-style-type: none"> • Conclusion of the Report: Even though Steel is categorized as a medium low technology industry by OECD classification, the benefits of investing in R&D is quite substantial. India has a fairly good capability in R&D in steel and can augment it to create a competitive advantage. Post 1991 liberalization of the economy in the country, R&D has not been given the focus it deserves, resulting in lowering of internal capability of the industry to cope with competition and crisis of raw materials in the near past. The Ministry of Steel is doing a commendable job in managing a R&D scheme which is a specialized task. The R&D scheme being pursued with financial assistance from the Steel Development Fund (SDF) has contributed significantly towards the areas of national importance concerning iron & steel industry. As a whole this scheme has emerged as a fruitful scheme for R&D in steel and plays a pivotal role in developing valuable insights and innovative solutions for addressing the challenges in iron & steel industry in the country. This scheme is indispensable on the national perspective and hence should be continued in the long run.
55	Evaluation of the scheme - 'Ministry of Steel Chair Professor and scholarships to undergraduate students pursuing study in Metallurgical Engineering'	<ul style="list-style-type: none"> ▪ ASCI Hyderabad ▪ SDF Grant released: 0.0556 crore ▪ Project Duration: 2012-13 	<p>Conclusion of the Report:</p> <ul style="list-style-type: none"> • Both components of the scheme are well received in the institutes and most stakeholders agree that the scheme is beneficial in improving the quality and quantity of manpower for the iron and steel industry. • The scholarship scheme has helped attract bright and meritorious students to pursue metallurgical engineering. The average rankings of students joining this stream are going down over the years signifying the positive impact of the scheme. • The scheme had a significant positive impact on the number of students from Metallurgy joining Post graduation in Metallurgical engineering and the number of students admitted to Ph.D in Metallurgical Engineering from the same department. • Analysis of data of five institutes which have shared data on the number of

			<p>students of metallurgical engineering opting for a career in the iron and steel industry show a 200% increase.</p> <ul style="list-style-type: none"> • Scheme has been able to attract talented faculty as Chair Professors over and above the regular appointments of the institutes and the scheme has been successful in contributing to human resource development in ferrous metallurgy. • There is however, no unanimity on whether the scheme has been able to address the issue of shortage of technical manpower in the steel industry. • The scheme has impacted the steel industry positively and that many of the positive effects of the scheme will be eroded quickly, if the scheme is discontinued at this stage.
56	Development of Integrated treatment process for coke oven effluents	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi ▪ SDF Funding: 3.64 cr ▪ Project duration: 2007-2016 	<ul style="list-style-type: none"> • Laboratory Scale process for treatment of Coke Oven Effluents was completed IIT Delhi. • Based on the laboratory work, a pilot scale experimental effluent treatment plant of 1000 LPD capacity with integrated process monitoring and control facility was set up at RDCIS and trials successfully conducted. • An integrated process for coke oven effluent treatment has been developed capable of consistently achieving normative level of target constituents before effluent discharge • Based on the knowledge & results obtained set of actionable points have been identified and recommended for existing & new effluent plants of SAIL.
57	Investigation of Deformation and Damage Mechanism in Bare and Coated Automotive Steels through In-Situ Scanning Electron Microscope	<ul style="list-style-type: none"> ▪ Jadavpur University ▪ SDF Funding: 3.26 cr ▪ Project duration: 2010-2016 	<ul style="list-style-type: none"> • The project investigated the deformation & damage behavior in formable and high strength bare & coated steels through in-situ observation under Scanning Electron Microscope. • Different aspects of deformation and damage behavior of automotive grade sheet steels have been evaluated. • The project created a lot of interest among students/researchers and faculty members for research on automotive steel.
58	Development of Expert system for Indian Blast furnace	<ul style="list-style-type: none"> ▪ IIT Kharagpur ▪ SDF Funding: 0.38 cr ▪ Project duration: 2012-2015 	<ul style="list-style-type: none"> • A Diagnostic Expert System for Blast Furnace Operation was developed. • The Expert System has successfully identified the variables for optimum performance of the Blast Furnace. • MECON was requested to look into the implementation possibility in Indian blast furnaces

59	Development of Copper (Cu) – Carbon Nanomaterial (CN) Based Nanocomposite Formulations for Heat Recovery in Different Processes in a steel plant	<ul style="list-style-type: none"> ▪ IIT Guwahati ▪ SDF Funding: 2.94 cr ▪ Project duration: 2012-2016 	<ul style="list-style-type: none"> • The project involved development of highly conducting composite materials using nano technology and assessing the feasibility of its application in the heat recovery system. • Copper-carbon nanotube (Cu-CN) composites were developed. • Feasibility of the material in heat recovery, was also evaluated in lab scale.
60	Development of an Entrained flow Gasification System using non-coking coal (F-grade) blended with Dolochar for thermal applications	<ul style="list-style-type: none"> ▪ IMMT, Bhubaneswar ▪ SDF Funding: 0.73 cr ▪ Project duration: 2013-2016 	<ul style="list-style-type: none"> • A prototype entrained flow gasifier was designed and developed. • Producer gas containing CO : 8-16% and H : 6-7% was successfully generated using a feedstock of non-coking coal (F-grade) and dolochar waste. • The technology has potential for the benefit of sponge iron units.
61	Utilisation of Steel Plant Waste in manufacture of Paver Blocks and Slag Foams	<ul style="list-style-type: none"> ▪ Sathyabama University ▪ SDF Funding: 0.51 cr ▪ Project duration: 2014-2017 	<ul style="list-style-type: none"> • Paver Blocks were developed by replacing coarse aggregate with steel slag and cement with fly ash. • Concrete cubes were cast for M35 grade by partially replacing coarse aggregate with induction furnace steel slag and cement with fly ash. • It was found that 40% replacement of coarse aggregate and 20% of cement by steel slag and fly ash respectively resulted in best compressive strength values conforming to M35 grade in conventional method.
62	Computer Simulation & e-Demonstration of Reheating Furnace	<ul style="list-style-type: none"> ▪ NISST & AIIFA ▪ SDF Funding: 2.34 cr ▪ Project duration: 2013-2016 	<ul style="list-style-type: none"> • Successfully developed computer based demonstrative programme for designing of furnace/ imparting educational training/capacity building for Small and Medium Enterprises (SMEs) in the steel sector.
63	Fundamental studies on the reduction kinetics, Heat and Mass Transfer during reduction of iron ore coal composite pellets in Rotary hearth furnace	<ul style="list-style-type: none"> ▪ IIT Kharagpur ▪ SDF Funding: 0.51 cr ▪ Project duration: 2013-2017 	<ul style="list-style-type: none"> • Laboratory based study was carried out to assess the efficacy of reduction of iron ore-coal composite pellets in a rotary hearth furnace. • Effect of Carbon content and additives on the reduction efficiency of composite pellets in a 3 layer bed in RHF studied & optimum conditions identified. • Sponge Iron production demonstrated a metallization of 70%.

64	Production of quality steel through Induction Furnace	<ul style="list-style-type: none"> ▪ JAMIPOL ▪ SDF Funding: 0.22 cr ▪ Project duration: 2015-2016 	<ul style="list-style-type: none"> ▪ The aim of the project was to produce low phosphorus steel in induction furnace using JAMIPOL dephosphorisation compound. ▪ Trials were conducted at M/s A C steel, Raipur and M/s Patnaik Steel, Odisha. ▪ The results of the trials were not encouraging.
65	Creation of Chair of Professor and Five Scholarship to undergraduate students of Metallurgy in institutes teaching metallurgy	<ul style="list-style-type: none"> ▪ Various Institutes pursuing Metallurgical Engineering ▪ SDF Grant released: 21.43 crore 	<ul style="list-style-type: none"> • Ministry of Steel has started Ministry of Steel Chair Professor & Scholarships scheme in 2008-09 initially for 5 years. • The objective of the Chair Professor scheme was to partly address the shortage of faculty for teaching/ research in metallurgical engineering. • The objective of the scholarship scheme was to attract bright students of metallurgical engineering to pursue their career in Iron & Steel sector • The revised Scheme with enhanced allowances for the Chair Professor and enhanced scholarships for the students, was introduced from 2013-14 for 5 years • The Scholarship scheme was implemented in 16 institutes and Chair Professors were appointed in 13 institutes. • Total grant released from SDF, since inception till date, is Rs 21.43 crore • The success of the scheme has been established through an independent study carried out by ASCI, Hyderabad in the year 2016-17 • ASCI has reported that the Scheme has been able to attract talented faculty as Chair Professors and has contributed to human resource development
66	Development of High Strength Low Carbon Multiphase Steels	<ul style="list-style-type: none"> ▪ BESU Shibpur & Tata Steel ▪ SDF Funding: 6 cr ▪ Project duration: 2010-2018 	<ul style="list-style-type: none"> • A state of the art laboratory scale Rolling Mill has been installed at the institute. • The facility is being utilised for development of high-performance HR flat steel for the automotive sector.
67	To develop welding/joining conditions and evaluate joint performance of sheet/tubes of formable/HS/AHS Steel using different processes	<ul style="list-style-type: none"> ▪ Tata Steel ▪ SDF Funding: 10.67 cr ▪ Project duration: 2011-2018 	<ul style="list-style-type: none"> • A state of the art welding centre has been setup through the project. • The project examined weldability and weld performance of various welding processes on advance high strength steel sheets & tubes for use in the automotive sector. • The knowledge generated has been utilised by the automotive sector.
68	Study on the Interface Layer Formation during Hot Dip	<ul style="list-style-type: none"> ▪ NML, Jamshedpur with Tata Steel 	<ul style="list-style-type: none"> • A state of the art Hot Dip Process Simulator has been installed & commissioned. • The effect of various process parameters on the formation of adherent coating on

	Galvanizing of Advanced High Strength or Dual Phase Steels for Automotive Applications	<ul style="list-style-type: none"> ▪ SDF Funding: 7.04 cr ▪ Project duration: 2014-2018 	<p>Advanced High Strength or Dual Phase Steels for Automotive Applications, was examined.</p> <ul style="list-style-type: none"> • Optimization of annealing cycles for the DP steels and development of GI and GA coatings on DP steels with or without precoatings of Fe & Cu carried out. • Development of Al-Si and Zn-Al-Mg coatings on AHS grade steels was also carried out. • The knowledge gained has been utilised by Tata Steel for automotive applications.
69	Development of Diffusion bonding technology for development of fatigue and fracture resistant carbon steel and stainless steel joints with different inter-layers	<ul style="list-style-type: none"> ▪ IIT Roorkee ▪ SDF Funding: 0.78 cr ▪ Project duration: 2014-2018 	<ul style="list-style-type: none"> • Laboratory infrastructure on diffusion bonds were installed. • Studies on influence of input process parameters of pressure, time and temperature on tensile & shear strength of diffusion bonds carried out.

LIST OF PROJECTS IN PROGRESS (SDF)

(In Rs. Crore)

SI No	Name of the project & Implementing organization	Implementing Agency	Remarks
1	Setting up of the Centre of Excellence in Steel Technology (CoEST) at IIT, Bombay	<ul style="list-style-type: none"> ▪ IIT, Bombay ▪ SDF Funding: 20.37 cr ▪ Project duration: 2014-2019 	<ul style="list-style-type: none"> ▪ Ministry of Steel has taken a major initiative in 2008-09 to setup Centre of Excellences in leading Academic Institutions in the country. ▪ The main focus was to create world class research facilities to promote human resource in the are of Iron & Steel ▪ Under the Scheme financial assistance is given from SDF for the 5 years for setting up of the Centre of Excellences. ▪ Only the R&D infrastructure and the manpower costs are funded from SDF. Land & building for the Centre is provided by the institutions. ▪ So far 4 such Centres have been approved: <ul style="list-style-type: none"> IIT Kharagpur IIT Bombay IIT BHU IIT Madras ▪ The Centre at IIT Kharagpur has been fully operational since 2013-14. ▪ The Centre at IIT Bombay is going to be fully operational shortly. ▪ Setting up of the Centres at IIT BHU and IIT Madras are in progress
2	Setting up an Advanced Research Center for Iron and Steel	<ul style="list-style-type: none"> ▪ IIT BHU ▪ SDF grant released: Rs 3.9 crore ▪ Project duration: 2016-2021 	<ul style="list-style-type: none"> ▪ Ministry of Steel has taken a major initiative in 2008-09 to setup Centre of Excellences in leading Academic Institutions in the country. ▪ The main focus was to create world class research facilities to promote human resource in the are of Iron & Steel ▪ Under the Scheme financial assistance is given from SDF for the 5 years for setting up of the Centre of Excellences. ▪ Only the R&D infrastructure and the manpower costs are funded from SDF. Land & building for the Centre is provided by the institutions. ▪ So far 4 such Centres have been approved: <ul style="list-style-type: none"> IIT Kharagpur

			<p>IIT Bombay IIT BHU IIT Madras</p> <ul style="list-style-type: none"> ▪ The Centre at IIT Kharagpur has been fully operational since 2013-14. ▪ The Centre at IIT Bombay is going to be fully operational shortly. ▪ Setting up of the Centres at IIT BHU and IIT Madras are in progress
3	Centre of Excellence in Iron & Steel Technology (COEXIST)	<ul style="list-style-type: none"> ▪ IIT Madras ▪ SDF grant released: Rs 11.106 crore ▪ Project duration: 2017-2022 	<ul style="list-style-type: none"> ▪ Ministry of Steel has taken a major initiative in 2008-09 to setup Centre of Excellences in leading Academic Institutions in the country. ▪ The main focus was to create world class research facilities to promote human resource in the are of Iron & Steel ▪ Under the Scheme financial assistance is given from SDF for the 5 years for setting up of the Centre of Excellences. ▪ Only the R&D infrastructure and the manpower costs are funded from SDF. Land & building for the Centre is provided by the institutions. ▪ So far 4 such Centres have been approved: <ul style="list-style-type: none"> IIT Kharagpur IIT Bombay IIT BHU IIT Madras ▪ The Centre at IIT Kharagpur has been fully operational since 2013-14. ▪ The Centre at IIT Bombay is going to be fully operational shortly. ▪ Setting up of the Centres at IIT BHU and IIT Madras are in progress
4	Development of Microwave Assisted Iron Making Process	<ul style="list-style-type: none"> ▪ Industrial Microwave Research Center ▪ SDF Funding: 2.14 cr ▪ Project duration: 2016-2019 	<ul style="list-style-type: none"> • The project aimed to explore the feasibility of microwave assisted technology for iron making. • Project initiated in Oct 2016 and scheduled to be completed in September 2019

LIST OF PROJECTS STOPPED/ NOT PURSUED/ TRANSFERRED

(In Rs. Crore)

SI No	Name of the project & Implementing organization	Implementing Agency	Remarks
1	Documentation and development of iron making process used by Tribals of India	<ul style="list-style-type: none"> ▪ NML, Jamshedpur ▪ SDF grant released: 0.0350 crore ▪ Project Duration: 1999-2000 	Empowered Committee decided to stop the project as it was felt that this technology is redundant and cannot be improved upon. However, a new R&D project was approved to pursue further work in the area.
2	Improved leak proof design of door in coke oven battery at Rashtriya Ispat Nigam Ltd., Visakhapatnam	<ul style="list-style-type: none"> ▪ MECON Ltd, Ranchi ▪ SDF grant released: Nil ▪ Project Duration: 1999-2000 	The EC decided to stop the project as the initial design developed by MECON was not successful and there was lack of further progress in the project.
3	On-line Implementation of Indigenously developed expert system for continuously cast products in billet caster of Modern Steel, Mandi Gobindgarh	<ul style="list-style-type: none"> ▪ MECON Ltd, Ranchi ▪ SDF grant released: 0.07 crore ▪ Project Duration: 2003-2004 	Project was stopped by the Empowered Committee as the Industrial Partner did not pursue the project due to financial constraints.
4	Setting up a Mini Sinter Plant to utilize waste generated out of pig iron produced through Mini Blast Furnace (MBF)	<ul style="list-style-type: none"> ▪ Tata Metalicks, Kharagpur ▪ SDF grant released: Nil ▪ Project Duration: 2003-2004 	The EC decided to stop the project as Tata Metaliks was not willing to install pot sintering machine to meet their requirement for the two blast furnaces.
5	Documentation of traditional iron smelting by Agaria community	<ul style="list-style-type: none"> ▪ Bappa Ray Production, New Delhi ▪ SDF grant released: Nil ▪ Project Duration: 2004-2005 	The EC decided to stop the project as it was found that traditional iron making by Agaria community especially from Madhya Pradesh and Chattisgarh has been covered in documentation film sponsored by SAIL and no further work is required in this direction.
6	High Efficiency Copper Stave Coolers : by MECON Ltd	<ul style="list-style-type: none"> ▪ MECON Ltd, Ranchi ▪ SDF grant released: Nil ▪ Project Duration: 2005- 	The EC decided to stop the project because of the difficulty faced by MECON in manufacture of the copper stave coolers as per their design.

		2006	
7	Indigenous Development of Mini Pellet Plant of 0.5 Mt/yr for utilization of iron ore ultra fines	<ul style="list-style-type: none"> ▪ MECON Ltd, Ranchi ▪ SDF grant released: Nil ▪ Project Duration: 2005-2006 	The EC decided to stop the project because of lack of progress in the project by MECON.
8	To set up a Steel Research & Development Mission (SRDM)	<ul style="list-style-type: none"> ▪ SDF grant released: Nil ▪ Project Duration: 2005-2006 	In pursuance of the recommendations of the Task Force, the Empowered Committee in its 15th Meeting held on 17.01.2006 approved a project for setting up SRDM at Hyderabad (AP) and sanctioned Rs. 50 crores as an initial corpus to pursue R&D projects and Rs. 15 crores to meet the initial establishment and running cost for the first three years, upon which the centre is expected to be self-reliant. Follow up actions in this regard were taken towards actual setting up of the centre at Hyderabad. SRDM was registered as a Society at Hyderabad. However, due to limited liquid fund availability in SDF, it was decided later to rope in major steel producers for funding the SRDM. However, the steel companies showed their reluctance to extend any fund for SRDM. Consequently, SRDM could not be started due to paucity of funds.
9	Indigenous Development of Models for Dynamic BOF Process automation system at RSP	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi & IIT, Kanpur ▪ SDF grant released: 2.03 crore ▪ Project Duration: 2005-2006 	<ul style="list-style-type: none"> • The project was conceived with the idea of implementation of Static model (off-line) based on charge balance calculation, Dynamic model (on-line) based on post combustion ratio and De-oxidation model for Ferro-alloy additions in steel ladle. • Both the Static and Dynamic models were successfully developed by IIT Kanpur and field trials were carried out at SMS-II of RSP. • As planned, trials of 100 heats were completed in two batches and the performance of the models was evaluated with respect to the objectives of the project. However, the trials were partly successful. • The Static Model, Flux charging Tracking module, Data Acquisition systems etc. have been successfully implemented at BOF of RSP and are being used extensively during the blowing operation. • SAIL have benefited considerably from this R&D Project and are also working on the different aspects of the systems to improve the usability.

10	Production of Ferro-Chrome from Chrome Ore Fines and concentrates by solid state reduction in fluidized based reactor with use of natural gas	<ul style="list-style-type: none"> ▪ Facor Alloys Ltd ▪ SDF grant released: Nil ▪ Project Duration: 2006-2007 	The project was approved to be pursued in laboratory scale fluidized bed reactor. However, Facor Alloys requested to procure 1 T per hour capacity pilot plant and also enhance the SDF assistance to Rs. 3.75 crore. Because of this deviation, EC decided to stop the project.
11	Characterization and utilization of Dolochar from Sponge Iron Industries	<ul style="list-style-type: none"> ▪ RRL, Bhubaneswar & West Bengal Sponge Iron Manufacturers Association (WBSIMA) ▪ SDF grant released: Nil ▪ Project Duration: 2006-2007 	The EC decided to stop the project as RRL Bhubaneswar informed that they have come to the conclusion that the scope of the project cannot give an adequate solution for complete utilisation of the dolochar.
12	Process for Direct Reduction of Pig Iron Ore Fines using Thermal Plasma Route	<ul style="list-style-type: none"> ▪ IMMT, Bhubaneswar ▪ SDF grant released: Rs 0.43 crore ▪ Project Duration: 2009-2010 	<ul style="list-style-type: none"> • The objective of this project was to develop an innovative process through thermal plasma for direct production of pig iron from iron ore fines using carbon as reductant. • The experiment was carried out in an existing 1 Kg reactor at IMMT. The consumption of electrical energy was too high @ 18.4, 17.8 & 12 KWh per kg of iron making & further experiments were pursued to reduce the power consumption. • Further experiments were carried out at 1 Kg scale at varying basicity, smelting time & power input for optimization of Process Parameters by computer modeling. • After extensive study & optimization of various parameters, it has been possible to bring down the electricity consumption to around 7-8 KWh/Kg of Pig Iron, which is still too high. It was also reported that the quality of pig iron was very good and much better than normal pig iron. But in view of such a high power consumption & high power cost in India, the process was not found economically viable. The project was stopped at this stage.
13	Development of Coal Briquettes for iron making with upto 25% of Indian non-coking coal	<ul style="list-style-type: none"> ▪ Essar Steel ▪ SDF grant released: Nil ▪ Project Approval year: 2013-2014 	Project was not pursued by Essar Steel.

14	Development of Automation System for Optimum Coal Blending at Coal Handling Plant of Coke Oven Batteries	<ul style="list-style-type: none"> ▪ RDCIS, SAIL, Ranchi ▪ SDF grant released: Nil ▪ Project Approval year: 2013-2014 	This project has been transferred and is being pursued with financial assistance from Government Fund.
15	Production of better quality structural steel for value addition by improving fatigue strength using Common Air Induction Melting and External Dephosphorization-Desulphurization through LRF	<ul style="list-style-type: none"> ▪ NISST, Mandi Gobindgarh ▪ SDF grant released: Nil ▪ Project Approval year: 2013-2014 	Project could not be pursued due to techno commercial issues faced in selection of supplier of LRF and also selection of the industrial unit for pursuing the trials. No funds released.
16	Nickel Extraction from Lateritic Ores Overburden of Sukinda Valley	<ul style="list-style-type: none"> ▪ Tata Steel ▪ SDF grant released: Nil ▪ Project Approval year: 2016-2017 	<ul style="list-style-type: none"> • Objective is to develop an eco-friendly and economical process to recover Ni and other valuable metals from stockpiled laterite ore overburden at Sukinda • Project not pursued by Tata Steel
17	Development of Smelting Process for The Utilization of Steel Plant Wastes	<ul style="list-style-type: none"> ▪ Tata Steel ▪ SDF grant released: Nil ▪ Project Approval year: 2016-2017 	<ul style="list-style-type: none"> • To Setup a dedicated facility for production of briquettes using steel plant wastes. The briquettes will become a part of the blast Furnace burden replacing the conventional iron ore lump. • Project not pursued by Tata Steel
18	Steel Research & Technology Mission of India	<ul style="list-style-type: none"> ▪ Registered Society with SAIL, RINL, NMDC, Tata Steel, JSW, JSPL & MECON as founding Members ▪ SDF grant released: Nil ▪ Approval year: 2015-2016 	<ul style="list-style-type: none"> ▪ Empowered Committee approved contribution of Rs 100 crore from SDF. ▪ However, the proposal of funding from SDF was not approved by Ministry of Finance.