

Performance Targets Achieved in 2019-2020

S.N.	Objectives	Planned	Achieved
1.	Total External Cash Flow (ECF) [^]	42 Crores	30.25
	Grant-in-Aid	17 Crores	4.43
2.	Industrial ECF (a part of Total ECF)	25 Crores	25.62
	a. Foreign Sponsored	2 Crores	0.13
	b. Public Sector Units (PSUs)	17 Crores	17.97
	c. Private Industries including Testing	10 Crores	7.72
3.	Customer Satisfaction Index	4.7	4.8
4.	SCI Publications	120	123
5.	Patents	25	23
6.	Copyrights	5	3
7.	Technologies Developed#	6	3
8.	Technologies Transferred*	5	3

[^]Cash flow generated from sponsored projects of industrial, PSU and government agencies.

Technologies Developed :

1. Electrolytic Manganese Metal (EMM) from medium and low grade Mn Ores
2. Recovery of vanadium as ammonium metavanadate and vanadium pentoxide from spent sulfuric acid catalysts
3. Induction Active Sole Plate for Iron Press

* Technologies Transferred :

1. Extraction of Cobalt and Manganese from the Black cathodic material of Li-cobalt batteries (SBCON Recycling Private Limited, Ahmedabad)
2. Extraction of cobalt and gold from the black cathode material of Li-Co batteries and gold coated surface of e-waste, respectively (EXIGO Recycling Pvt. Ltd., New Delhi)
3. Extraction of cobalt metal/salt from the black powder of Li-cobalt batteries (Evergreen Recyclekaro India Pvt. Ltd, Mumbai)

Major Technological & Scientific Targets Planned and Achieved in 2019-2020

Targets Planned	Targets Achieved
<p>Advanced Ultra Supercritical Power Plant Materials evaluations</p> <ol style="list-style-type: none"> Hot corrosion study of 304H and IN 617 in simulated Indian coal AUSC condition Creep data on Alloy 617 for Advanced Ultra Supercritical Technology 	<p>The hot corrosion studies completed at 500°-900°C for 1200hr in flue gas environment.</p> <p>XRD characterization completed for samples corroded between 600° to 900°C.</p> <p>Creep tests are being carried out at 650°, 675°, 710° and 750°C. 500hr exposure completed at these temperatures. 1000 and 5000 hrs exposures in progress.</p>
<p>Optimization of annealing cycle for a Dual Phase Steel</p>	<p>Based on the designed annealing cycle desired properties were obtained including HER value (>50%), strength (>590 MPa), elongation (>30%) and energy absorption capability (~20GPa%). Actual plant trials based on laboratory simulated process parameters have resulted in improvement in HER property to > 50 % (from 20 - 30 %).</p>
<p>Technology for Dry Beneficiation of Non-coking coal for Application in Thermal power plant</p> <ul style="list-style-type: none"> Conducting characterization, washability and dry beneficiation studies on coal sample from Ib Valley, Mahanadi Coal Development of technological process flow sheet for dry beneficiation. 	<ul style="list-style-type: none"> Characterization of Ib valley coal samples was carried out with respect to proximate analysis, ultimate analysis and coal petrography Washability studies at -50mm was carried out to assess the cleaning potential of the coal. Dry beneficiation studies were carried out under varied conditions. In view of high NGM different process schemes were examined. Developed process flow-sheet for dry beneficiation of coal.
<p>Development of Process flow-sheet for Extraction of Tungsten from Hutti gold ore tailings</p> <p>Data analysis and development of technological process flow-sheet and computing material balance for beneficiation and hydrometallurgical extraction of tungsten.</p>	<p>Bench and pilot scale beneficiation of Hutti gold ore tailings sample and extraction of tungsten from pre-concentrate were carried out. The data were analysed and based on the pilot scale studies technological process flow-sheets were developed for beneficiation of tailings sample and extraction of high purity tungsten powder from pre-concentrate produced from the tailings. The final report was prepared and submitted to the sponsor.</p>

<p>Beneficiation of Low grade Limestone for Cement making</p> <ul style="list-style-type: none"> ● Bench and pilot scale beneficiation studies on low grade limestone sample from Rajasthan. ● Development of flotation based process for reducing silica content to desired limit 	<ul style="list-style-type: none"> ● Bench and pilot beneficiation studies were carried out on reduction of silica in low grade limestone for cement making. ● Target of reducing silica content < 12% in the concentrate was achieved. ● Flotation based process was developed for processing limestone with final concentrate analyzing 11.3% SiO₂ with 47.4% CaO. The product yield was 88% with 96% CaO recovery.
<p>Installation and Commissioning of 200 tonnes per day flotation column for fine coal flotation at Coal Preparation Plant of an Iron & Steel Major</p>	<p>Erection of flotation column was completed. Dry run of the installed equipment and trials using water was completed. 80% of the committed work was completed and trials using coal slurry is to be taken up shortly.</p>
<p>Installation and Commissioning of 100 tonnes per day flotation column for sillimanite flotation at Chavara, of Kerala Minerals and Metals.</p>	<p>Successful erection and commissioning of flotation column was completed. Target was achieved with return on investment realized within the period of trial runs, by Kerala Minerals and Metals, Chavara.</p>
<p>Use of briquettes from steel plant wastes as partial replacement of scrap as coolant in BOF</p> <ul style="list-style-type: none"> ● Characterization of raw materials, optimization of briquette making, evaluation of briquette properties ● Preparation of briquettes at a pilot scale under optimized condition and their characterization ● Performance study in commercial BOF 	<ul style="list-style-type: none"> ● Characterized the raw materials, namely, mill scale and iron ore slime. Cold bonded briquettes have been prepared and evaluated. ● 40 tons of mill scale briquette and 60 tons of slime briquettes have been prepared with compressive strength of cured briquettes: ~ 200 kg and drop strength of 45-60 drops. The shatter index of cured briquette was 95.8% ● These briquettes were tested in the sponsor's LD furnace (160 ton capacity per batch). Critical parameters, like, turn down temperature, phosphorous content of steel, etc., were similar to that of the operations without mill scale briquettes. Both mill scale and iron slime can be alternate coolants in steel making.
<p>Commercialization of DRI making in tunnel kiln</p> <ul style="list-style-type: none"> ● Identification of interested entrepreneur ● Installation and commissioning of production units on a turn-key basis 	<ul style="list-style-type: none"> ● Seven entrepreneurs have been identified and the Technology has been transferred to M/s. SMRW, Ranchi. Onsite training was given to the personals of M/s. SMRW for smooth running and production of DRI in Tunnel Kiln.

<ul style="list-style-type: none"> ● Hand holding for fine tuning of process 	<ul style="list-style-type: none"> ● Industrial size equipment like ball mill and disk pelletizer were installed under supervision of CSIR NML for preparations of raw materials and production of DRI in Tunnel Kiln. ● Commercial production of DRI from mill scale and lean grade non coking coal @18 TPD scale was successfully demonstrated in June 2019.
<p>Innovative material for restoration/repairing of heritage structure</p> <ul style="list-style-type: none"> ● Development of a new geopolymer material and its standardization ● Identification of heritage terracotta and sandstone structure with the help of ASI ● Repair/restoration of identified structure as per ASI protocol 	<ul style="list-style-type: none"> ● New geopolymer composition has been developed from metakaolin for restoration of heritage structure. ● The samples of old terracotta structure have been collected from ASI for laboratory evaluation.
<p>Extraction of rare earth metals from secondary resources</p> <ul style="list-style-type: none"> ● Characterization of raw materials ● Development of process flow sheet ● Separation of individual rare earth metals using suitable reagent and technique ● Characterization of products ● Process optimization 	<ul style="list-style-type: none"> ● Various secondary materials such as red mud, batteries, etc., have been characterized for rare earth elements ● REE using hydrometallurgical process has been extracted using solvent extraction. Based on the process, a flow sheet has been developed. ● The REE obtained in the salt form has been characterized.
<p>Commercial production of Sodium metal using fused salt electrolysis</p> <ul style="list-style-type: none"> ● Preparation of package for upscaling of the process ● Assistance towards selection, installation and commissioning of hardware ● Technical assistance during commercial production and fine tuning of process parameters 	<ul style="list-style-type: none"> ● The pilot scale 3000A sodium cell was operated successfully. Based on the success, the scale-up design of the commercial scale 12000A (12 nos., totaling 1,44,000A) sodium electrolytic cells are under progress. ● NML has provided Technical assistance to the sponsor for selection of the engineering consultant for this project. ● Technical assistance will be provided by NML. NML will also monitor and will attend during commission of the cell as and when required.

<p>Production of EMD and EMM from Manganese ore</p> <ul style="list-style-type: none"> ● Characterization of ore samples ● Study on reduction and dissolution of samples ● Purification of manganese leach solution ● Deposition of EMD and EMM ● Characterization of products 	<ul style="list-style-type: none"> ● Detailed physico-chemical characterization of two Mn ore samples were carried out ● Reduction of Mn ores with solid (Coke) and gaseous reductant (LPG, Producer's gas, etc.) were optimized for >90% reduction efficiencies. ● Purification methods of leach solutions were optimized at 10 - 20L batch scale to achieve Fe content <1 ppm, and total other trace impurities <50 ppm. ● Electro-deposition of EMD in bench scale was optimized. Process demonstration at 10-20 kg/day scale EMM deposit to MOIL has been initiated (MoU signed) ● Chemical characterization of several samples of both EMD and EMM carried out. Few samples have been sent to CECRI, Karaikudi for their electro-chemical characterization.
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