LIST OF ON-GOING R&D PROJECTS OF CIL
[As on 31.03.2026]

Sl. No.	Name of the projects and its details	Date of start	Date of completion	Approved outlay [Rs. In lakh]
1.	**Scaling up the conversion of CO2 to methanol and other value-added chemicals with 500 Kg CO2/day capacity.** **[Project code: CIL/R&D/04/14/2021]** **Implementing agencies:** Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Jakkur, Bangalore; Singareni Collieries Company Limited (SCCL), Kothagundem, Telengana; and BREATHE Applied Sciences Pvt Ltd, Bangalore **Objectives:** • To develop an integrated technology for the conversion of CO2 to methanol and other value added chemicals at industrial relevant scales having commercially viable conversion efficiencies. • To develop end-to-end technology of thermo-catalytic CO2 reduction by integrating 4 sub-technologies, which are • (a) CO2 capture, (b) Hydrogen generation, (c) Reduction of CO2 and (d) Product purification.	1st Oct 2021	28th Feb 2026	1998.57 JNCASR–1998.57 SCCL - Nil
2.	**Development of tandem approach for Paste Fill Technology and extraction methodology by continuous miner (CM) deployment for Shyampur B Colliery of Mugma Area, ECL** **[Project code: CIL/R&D/04/18/2022]** **Principal Implementing Agency**: ECL, Sanctoria **Sub-Implementing Agency:** CIMFR, Dhanbad **Objectives:** • Development of suitable paste backfill system. • Development of suitable mining method in tandem with paste backfill. • Subsidence monitoring and prediction for paste fill panels. • Procurement, erection, commissioning and monitoring of paste backfilling system as well as the monitoring of mining methods, strata and surface.	15th Sept 2022	30th Sep 2025	4997.45 ECL: 4822.66 CIMFR: 174.79

3.	**Prototyping of Bi-facial Perovskite Module Leading to 4-T Perovskite-Si Tandem Structure.** **[Project Code: CIL/R&D/04/19/2023]** **Principal Implementing Agency**: IIT Bombay **Objectives:** • **Development of the Bi-Facial Perovskite Module** Here a process is proposed to be developed to produce bi-facial perovskite modules of area 100 cm2 to achieve ~ 20% efficiency at the module level and ~ 24% at the cell level with projected stability for ~ 10 years. The reliability of the devices will be measured as per the ISOS protocol. • **Implementation of the 4-Terminal tandem structure:** It is expected a 4T Si-Perovskite tandem structure with a projected efficiency of >25% at the module level and >30% at the cell level.	20th July 2023	19th July 2026	1770.00 IIT Bombay: 1770.00
4.	**5G Captive Non-public Network for Integrated Voice, Video & Data Communication in Opencast Coal Mines** **(Project Code: CIL/R&D/05/03/2024)** **Implementing Agencies:** ME Division, CMPDI (HQ), Ranchi & Centre for Development of Advanced Computing (C-DAC), Thiruvananthapuram **Objectives:** • Setting up of 5G Captive Non-Public network at an opencast coal mine; Design, development and demonstration of 5G use cases (Digital twin of load haul dump operation, collision avoidance system, 5G drone based digital mapping and remote monitoring, 5G camera based traffic control, voice & video calls, surveillance & asset tracking, AR/VR application, environmental monitoring).	24th Jan 2024	23rd Jan 2026	2406.54 CMPDI: 88.50 C-DAC. 2318.04

5.	**Design of Geotechnical structures for extraction of coal seam at higher depth using Continuous Miner** **Project code:** CIL/ R&D/1/80/2024] **Implementing Agency**: NIT, Rourkela **Sub implementing Agencies:** RI-V, CMPDI, Bilaspur, University of Wollongong, Australia & SCCL, Kothagudem **Objectives:** • To develop design norms for different geotechnical structures involved during CM based coal extraction at depth range of 200-600 m depth. • Assessment and classification of rock mass based on available approaches on core procured from freshly drilled boreholes. • Study of geotechnical structures' behaviour of the selected site through simulated models. • Assessment of strata behaviour including underground structures through instrumentation and continuous monitoring during actual mining operation at the selected underground coal mines. • Validation/comparison of simulated design with results of actual operation/field investigations in continuous miner/mechanised working at the selected site. • To develop numerical models for design of geotechnical structures like pillar/coal block, cut-out distance, galleries, fender/rib/snook, applied supports including manner of pillar extraction by varying relevant parameters. • To develop of design for stress management technique at higher depth of cover. • To develop design norms for novel method of pillar/coal block extractionke Wongawilli/others by CM for the considered depth range.	1st July 2024	30th June 2027	303.38 NIT, Rourkela: 303.38 RI-V,CMPDI – Nil
6.	**Development of Energy Efficient Ergonomically Designed (EEED) Chair Lift Man Riding System** **(Project Code: CIL/R&D/1/81/2024)** **Principal Implementing Agency:** IIT- ISM, Dhanbad	1st July 2024	30th June 2026	53.95 IIT(ISM): 53.95 BCCL: NIL

	Sub Implementing Agencies: DGMS, Dhanbad &BCCL, Dhanbad **Objectives:** • To develop a test rig of novel closed-loop Hydro Static Transmission (HST) system representing the power pack of chair lift man riding system. • To analyze the energy consumption of the proposed closed-loop system with the conventional system. • To analyze the whole-body vibration of a rider on a suitably designed test rig. • To investigate outcomes of the above for feasible implementation of a newly designed chair lift system fit for use in steeply incline mine. This would greatly optimize on time utilization and render safety, comfort of workmen resulting in productivity enhancement			
7.	**Study on post –mining accelerated reclamation in coal mining area using soil microbial community** **Project Code:** CIL/R&D/04/21/2024 **Principal Implementing Agency**: CIMFR, Dhanbad **Sub-implementing agency:** BCCL, Dhanbad **Objectives:** • Isolation and screening of nutrient • recycling soil microbial community from mining and nearby forest area. • To develop microbial consortium to enhance soil nutrient cycle and soil fertility for accelerated plant growth. • Ex-situ models to check the efficacy of microbial consortium to improve soil nutrient cycle.	15th Sep 2024	14th Sep 2026	51.23 CIMFR:51.23 BCCL:NIL
8.	**Assessment of coking coal quality with respect to active components present in coking coal.** **Project code: CIL/R&D/03/04/2024** **Implementing agencies:** National Metallurgical Laboratory Jamshedpur; Central Mine Planning & Development Institute (CMPDI), Ranchi **Objectives:** • Identification and characterization of the	20th Sep 2024	19th Dec 2026	195.64 NML: 62.21 CMPDI: 133.43

	active component in various coking coal. • Isolation of active components in coking coal by physical separation. • Characterization of vitrinite, inertinite, and reflectance of active components as well as in raw coking coal. • Establishment of a correlation between active component and vitrinite, inertinite, and reflectance. • Formulating a mathematical model to assess the coking coal quality with respect to the active component.			
9.	**Creation of research facilities for examining the mental state and improving mental health including dementia** **Project code:** CIL/R&D/01/82/2024 **Principal Implementing agency**: IIT Mandi, Himachal Pradesh **Sub implementing Agencies:** CCL, Ranchi & CMPDI, Ranchi **Objectives:** • To develop research facilities for the early detection of mental health issues of the Indian population including mine workers and CIL employees. • Health screening of mining workers entering mines based on their mental health. • To develop neuro feedback-based interventions for faster cognitive enhancement.	20th Dec 2024	19th Dec 2026	333.56 IIT Mandi:333.56 CCL:Nil CMPDI:Nil
10.	**Carbon electrode based indigenous low-cost perovskite solar cells development** **Project Code:**CIL/R&D/04/22/2025 **Implementing Agencies:** Indian Institute of Technology, Roorkee; NaCCER, CMPDIL, HQ, Ranchi **Objectives:** • Fabrication and advance characterization of carbon electrode. • Fabrication of high efficiency HTL-free carbon-based PSC. • Cost benefit analysis of the perovskite module. • Demonstration of prototype in IITR	01st May 2025	30th April 2027	492.05 IIT,Roorkee: 456.65 NaCCER:35.40

11.	**Indigenous Development of IoT-Enabled Technology for Monitoring, Analysis and Interpretation of Longwall Shield Pressures for Improving Safety and Productivity (Phase-II, TRL 5 to 8)** **Project Code:** CIL/R&D/01/84/2025 **Implementing Agencies:** NaCCER, CMPDI, HQ, Ranchi; Indian Institute of Technology (IIT), Kharagpur and Eastern Coalfields Limited (ECL) Sanctoria **Objectives:** • To develop a comprehensive system for monitoring the entire longwall panel's shield pressure and shearer position. Pressure sensors will be installed in all shields of the longwall panel, and position sensors at strategic positions will be integrated into designated shields to collect shearer position data every 60 seconds. • The master data acquisition system (MDAS) will be placed at a suitable location on the energy trolley so that the length of the RS485 cable can be shorter and the problem of moving the MDAS trolley can be eliminated. In other words, the layout of the entire system is in a compact form. • Effective layout mechanism of the communication and power cables at the longwall face such that they do not get cut or disturbed due to the movement of shields. • Upgrading the software for data collection and early forecasting of periodic roof weighting, shield leakage, and other maintenance information	01st May 2025	30th April 2027	337.06 NaCCER:.92.93 IIT KGP: 244.13
12.	**Development of an Indigenous Optical Fiber Based Instrument for Measuring In-The-Hole Velocity of Detonation (VOD) and Analyze the Performance of Explosives & Accessories in Field Condition (Phase-II, TRL 5 to 8/9)** **Project Code:** CIL/R&D/01/85/2025 **Implementing Agencies:** NaCCER, CMPDI, HQ, Ranchi; Blasting Division, CMPDIL HQ, Ranchi, Regional Institute – VI, CMPDI Singrauli **Objectives:** A. Technical Objectives:	01st May 2025	30th April 2026	282.30 NaCCER: 282.30

	• Enhance the instrument's robustness, accuracy, and reliability for operational deployment. • Validate the system's performance under real-world explosive conditions in confined environments. • Optimize the automated reporting software to comply with industry standards and user requirements. B. Operational Objectives: • field trials to confirm system performance and reliability. • Initiate the certification processes for deployment in hazardous and explosive environments. C. Commercial Objectives: • Refine the prototype for scalable manufacturing • Develop end-user training, documentation, and maintenance support systems			
13.	**Automation, Control & Wireless Communication in Underground Mines on 4GLTE/5G ready Communication Network in Jhanjhra Mines ECL.** **Project Code: CIL/R&D/05/04/2025** **Principal Implementing Agency:** M/s Indian Telephone Industries (ITI Ltd.), Lucknow **Sub-Implementing Agencies:** **(**i) Mine Electronics (ii) NaCCER, CMPDI, Ranchi. **Objectives:** • To establish 4G LTE/5G Ready Communication Network in the Underground Coal Mines. • To provide seamless voice and video communication between underground workers and control centres using 5G CNPN/4G LTE • To automate conveyor belts, pumps, and other critical systems to enhance operational efficiency and reduce manual intervention • To deploy IoT-based sensors for monitoring gases (CH4, CO2), temperature, humidity, and air velocity inside the mine • To implement an asset and miner	15th June 2025	14th June 2027	2184.91 ITI (L):1992.93 ME Deptt: 111.74 NaCCER: 80.24

	tracking system for improved safety and resource management.			
14.	**A Pilot Project on Underground Coal Gasification (UCG) to establish technology in Indian geo-mining conditions -Phase-2** **Project Code No:** CIL/R&D/04/23/2025 **Principal Implementing Agencies:** CMPDIL HQ Ranchi and ECL Sanctoria **Sub-Implementing Agency:** Ergo Exergy Technologies Inc, Montreal Qc, Canada **Objectives:** • Development of detailed design of the UCG Pilot Plant, construction, commissioning, operation and controlled shutdown, followed by post-shutdown monitoring. The final feasibility study report on UCG Pilot Plant operation with suitable recommendation for commercial operations will be submitted at the end.	20th June 2025	19th Sep 2026	4839.32 EETI,Canada:4076.63 CMPDI,Ranchi:193.77 ECL,Sanctoria:NIL; Forex conversion charges/other taxes:568.92
15.	**Revolutionizing Mine Safety: An AI-Enabled Fire Detection System for Underground Active and Closed/Abandoned Mines** **Project Code No:** CIL/R&D/01/86/2025 **Principal Implementing Agency**: Indian Institute of Engineering Science and Technology (IIEST), Shibpur. **Sub-Implementing Agencies:** Milieu Global IT Solutions Pvt Ltd., Hyderabad & CCL Ranchi **Objectives:** • Identification and installation of gas and video monitoring stations at different locations of active and closed/abandoned underground mines and acquisition of real-time gas concentration levels and videos. • Prediction of the likelihood and intensity of fire hazards at different locations of active and abandoned/closed underground mines, using deterministic and probabilistic, crisp and fuzzy time series	10th Aug 2025	09th Aug 2027	420.74 IIIEST:53.99 MGISPL: 366.75

	forecasting (TSF) of gas concentration levels, leveraging AI-driven models, including machine learning, deep learning and hybrid models on real-time gas sensor data • Detection of the ongoing or imminent fire incidents and other abnormal situations in active and abandoned/closed underground mines, using AI models, especially computer vision and deep learning models.			
16.	**Sustainable Solutions for Removal of Fluoride from Groundwater in Mining Area of Col India Ltd in Jharkhand, Odisha and West Bengal for Safe Drinking Water, Phase-I** **Project Code No:** CIL/R&D/04/24/2025 **Principal Implementing Agency:** CSIR-Institute of Minerals and Materials Technology (IMMT), Bhubaneswar **Sub-Implementing Agencies:** Reseapro Scientific Services Private Ltd; CMPDI Regional Institute RI-VII, Bhubaneshwar; Regional Institute RI-III, CMPDI, Ranchi **Objectives:** The broad objective is to conduct R&D intervention comprising of sampling and analysis from random sites within certain radius around the coal mining areas in phase-1, and then implement the fluoride removal technological solutions developed in phase-1, in the high fluoride contamination areas in the CIL operational areas in the State of Jharkhand, Odisha and West Bengal. This will be accomplished through the following detailed activities: Phase-1 1. Contamination Assessment • Identify fluoride contamination sources in different regions in in mining areas of Coal India Limited's operations. • Conduct water sampling and lab analysis. 2. Development & Optimization of fluoride Removal Methods	1st Sep 2025	31st Aug 2026	1291.06 IMMT:318.10 CSIR:884.21 RI VII, CMPDI, BHUBANESHWAR: 44.37 RI-III, CMPDI, RANCHI:44.37

	• Adsorption-based techniques: Activated alumina/ nano alumina, activated carbon, etc. • Electrolytic Defluoridation (EDF) for cost-effective treatment. 1st Sep 2025 31st Aug 2026 1291.06 IMMT:318.10 CSIR:884.21 RI VII, CMPDI, BHUBANESHWAR: 44.37 RI-III, CMPDI, RANCHI:44.37 10 • Modification of the terafil filter catridge with fluoride adsorbent materials. 3. AI/ML Integration for Water Quality Assessment and Fluoride Contamination Monitoring • IoT-Enabled Sensor Kits: Continuous real-time measurement of critical water quality parameters including fluoride concentration, pH, TDS, turbidity, and volumetric flow rate. • Geo-Spatial Tagging: Each sampling point will be GPS-mapped to enable location-accurate trend monitoring and longitudinal data analysis. • AI/ML Dashboard: A cloud-integrated digital platform will serve as the central command center for predictive modeling, trend detection, and risk-level classification.			
17.	**Non-Invasive Health Screening and Smart Monitoring Systems for Coal Miners' Safety and Well- being** **Project Code No:** CIL/R&D/01/87/2025 **Principal Implementing Agency:** Indian Institute of Engineering Science and Technology, Shibpur (IIEST) **Sub-Implementing Agencies:** ECL, Sanctoria **Objectives:** Non-Invasive Oral and Lung Carcinoma Screening in Coal Miners with Occupational Exposure Using Electronic Bio Sensing Systems.	10th Sep 25	09th Sep 27	470.57 IIEST: 470.57 ECL, Sanctoria: Nil

18.	**Development of Innovative Extraction Method for Safer Extraction of Coal Seam by Underground Method with Higher Productivity and Percentage of Extraction using Continuous Mining System** **Project Code No:** CIL/R&D/01/88/2026 **Principal Implementing Agency:** IIT(ISM) Dhanbad **Sub-Implementing Agencies:** National Centre for Coal and Energy Research (NaCCER), Eastern Coalfields Limited (ECL) **Objectives:** • Design of the block mining system including panel layout, sequence of extraction, coal evacuation system, etc. • Assessment of the cut-out distance for CM/Bolter miner under this innovative mining system. • Determination of suitable size of rib/remnant pillars by assessing the failure characteristics of the surrounding rock mass and the pillars. • Support design of the roadways, junctions and the goaf edge by assessing the yield zone during the extraction under this method. • Optimisation of fleet management system along with transportation path for coal evacuation. • Cycle time study to assess the performance against the existing B&P methods. • Techno-economic feasibility study for comparison with B&P mining method. • Preparation of the strata control and monitoring plan based on the failure characteristics of the rock mass under the developed mining methods.	2nd Mar 2026	01st Mar 2027	160.48
19.	**Pilot scale paste backfilling to evaluate the effectiveness of paste fill technology in conventional bord and pillar coal mining working using LHD/SDL** **Project Code No:** CIL/R&D/01/89/2026	Scheduled from date of Fund Disbursement	6 months from date of Fund Disbursement	83.83 NaCCER: 46.27 IIT (ISM) Dhanbad: 16.05; CSIR-CIMFR: 21.51 SECL: NIL

	Principal Implementing Agency: NaCCER **Sub-Implementing Agencies:** IIT(ISM) Dhanbad, CSIR-CIMFR Dhanbad, SECL **Objectives:** • Identifying and developing suitable paste backfill material using the available waste material near the selected mine site. • Laboratory studies to determination of Physico-mechanical properties of identified material, determination of mix recipe of paste fill, determination of geo-technical properties and flow behavior of identified paste mix • Drilling of Borehole for the recovery of core for the study site, • Determination of Physico-mechanical properties core drilled from the proposed experimental site • Design of a dismantling paste-fill plant along with the technical specification. • Designing suitable extraction methodologies by conventional bord and pillar mining with paste backfilling. • Simulation of effect of blasting on the adjacent filled voids by paste material. • Study of the physico-chemical and thermal properties of the paste fill material and its impact on spontaneous heating and fire propensity inside the depillaring panels. • Simulation and design of ventilation system with paste fill as per the selected panel. • Investigation of the leaching properties of paste material and its impact of the ground water.			
20.	**Design, Development and Demonstration of a Closed-Loop Low-Head Surface Hydrokinetic– Based Pumped Storage (SHK-PSP) Technology utilizing stabilized Overburden Dump as Upper Reservoirs and Mine Voids as Lower Reservoirs for sustainable Energy Storage solutions (Phase-I)**	Scheduled from date of Fund Disbursement	6 months from date of Fund Disbursement	466.99

	Project Code No: CIL/R&D/05/05/2026 **Principal Implementing Agency:** Western Coalfields Limited (WCL) **Sub-Implementing Agencies:** MACLEC Technical Project Laboratory (P) Ltd. **Objectives:** • To scientifically design, validate and establish engineering methodologies for the stabilization and hydrological conversion of overburden (OB) dump zones into safe, stable and impervious upper reservoirs suitable for mine-based low-head pumped storage applications. • To undertake fundamental research, advanced engineering design, site specific customization demonstrates ofa closed-loop, low-head Surface Hydrokinetic Pumped Storage Plant (SHK-PSP) by integrating stabilized OB dump–based upper reservoirs with water-filled abandoned mine voids as lower reservoirs, interconnected by scientifically designed hydraulic channels for controlled water flow and optimized energy recovery. • Pilot-Scale Demonstration of a Customized SHKT-PSP Technology for an Abandoned Mine Pit as a Sustainable and Scalable Post-Mining Energy Storage Solution with nationwide applicability.			