

## LIST OF COMPLETED R&D PROJECTS

| S. No. | Project   | Executing Agency   | MOU cost Rs Lakh | Actual cost Rs Lakh |
|--------|---|--------------------|------------------|---------------------|
| 1      | Infrastructure Facility for Pilot scale Bio-reactor for Oil-Zapper Oilivorous S&A                               | TERI               | 25.60            | 25.60               |
| 2      | Microbial Desulphurisation of Petroleum   | RRL, Jorhat        | 3.80             | 3.80                |
| 3      | Biocatalytic Process for Desulphurization of Diesel   | IIP                | 89.54            | 80.17               |
| 4      | Trial Evaluation of Spare charge Bimetallic Catalyst for Reformer at CPCL                                       | IIP                | 199.55           | 199.55              |
| 5      | Development of Low Metal / Skewed Reforming Catalyst  | IIP                | 78.00            | 78.00               |
| 6      | Catalyst and Technology Development for Hydro-treatment of Diesel and Vacuum Gas Oil                            | IIP                | 178.32           | 178.32              |
| 7      | Catalyst for Ultra Deep Desulphurisation of Gas Oil   | IIP                | 53.20            | 47.02               |
| 8      | Development of Catalyst, Technology & Process know how for conversion of C5-C6 Naphtha cuts to Aromatics and C4 | IIP/ BPCL          | 48.00            | 22.59               |
| 9      | Development of Zeolite Base Reforming Catalyst for Aromatics Production   | IIP                | 45.71            | 29.01               |
| 10     | Development of Catalyst for Reducing Sulfur in FCC Gasoline with Minimum Octane Loss                            | IIP and CPCL       | 48.11            | 34.57               |
| 11     | Catalyst for Isomerisation of Light Naphtha   | IIP and IOCL (R&D) | 41.58            | 39.02               |
| 12     | Dev. Of catalyst / tech. for Deep Catalytic Cracking  | IIP                | 25.00            | 8.76                |
| 13     | Development of Solid Acid catalyst for Alkylation Isobutane with Alkenes to form Alkylates as Gasoline blend    | IIP                | 70.00            | 51.61               |
| 14     | Catalyst Development for Isomerisation of C7+ Hydrocarbon with Industrial Feed Stocks                           | IIP                | 66.82            | 60.72               |
| 15     | Development of Process for Oxidative Desulphurization of Diesel   | IIP                | 68.20            | 60.88               |
| 16     | Catalytic Converter Technology for Auto Exhaust   | NEERI              | 21.31            | 21.31               |
| 17     | Assessment of cost benefit implications for proposed changes in BIS specifications                              | IIP                | 48.61            | 48.61               |
| 18     | Diesel Fuel Quality: Requirements for meeting future Emissions Standards  | IIP                | 130.50           | 94.97               |
| 19     | Use of Multifunctional Gasoline Additives in 2 stroke Engine Vehicles   | IIP                | 1.90             | 1.90                |
| 20     | Identification and estimation of PAHs in diesel fuel  | IIP                | 36.39            | 36.80               |
| 21     | Study on Urban Road Traffic & Air Quality   | CRRRI, NEERI, IIP  | 168.90           | 168.90              |
| 22     | Studies on the Effect of Gasoline Composition on Exhaust Emissions from Two Wheelers                            | IIP and IOCL (R&D) | 98.00            | 86.15               |
| 23     | Preparation of guidelines for Environment review of Oil Sector  | NEERI              | 0.68             | 0.68                |

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| 24     | Assessing the Impact of Regulations on Ambient Air and on Health in Delhi under Phase-1                                | TERI and CRRRI                    | 18.03            | 17.32               |
| 25     | Studies on effect of Soaker Geometrics and Internals of Visbreaking Process  | IIP                               | 13.69            | 13.69               |
| 26     | Studies on Effect of Soaker Internals – Improved Design, Kinetics & Hydrodynamics for Modelling of Visbreaking Process | IIP/ UICT/ EIL-R&D                | 86.80            | 61.56               |
| 27     | Development of Cooling Tower Technology  | EIL-R&D                           | 93.00            | 87.89               |
| 28     | Technology Development for Hydrodynamics of Trickle Bed Reactor & Cold Flow Studies for Scale-up: Phase-I              | IIT- Delhi<br>EIL-R&D,<br>IOC-R&D | 50.00            | 48.15               |
| 29     | Technology development for Hydro-dynamics of Trickle Bed Reactors & Cold Flow Studies for scale-up – Phase-II          | EIL-R&D,<br>IIT-D, IOC-<br>R&D    | 359.62           | 305.63              |
| 30     | Add-on facilities for TBR  | EIL-R&D /<br>IOC-<br>R&D/IITD     | 135.48           | 114.45              |
| 31     | Hydrocracker Pilot Plant   | IOC-R&D                           | 1500.00          | 1500.00             |
| 32     | Development of Sheet Metal Structured Packing (PARLPAK) Phase-II   | EIL-R&D                           | 18.00            | 14.98               |
| 33     | Development of Tower Internals   | EIL-R&D                           | 77.01            | 77.01               |
| 34     | Development of High Performance Internals for Distillation   | EIL-R&D                           | 21.12            | 21.12               |
| 35     | Development of High Capacity Trays   | EIL-R&D                           | 24.00            | 24.00               |
| 36     | Heat Transfer Enhancement by Tube Inserts  | EIL-R&D                           | 28.61            | 28.61               |
| 37     | Development of Improved Flash Zone Entry Device for Crude / Vacuum Column  | EIL-R&D                           | 53.00            | 46.01               |
| 38     | Studies on Application of Modern Packings in Liquid Extraction   | EIL-R&D                           | 21.14            | 21.14               |
| 39     | Cold Flow Model Studies in FCCU Area   | EIL-R&D                           | 95.20            | 91.42               |
| 40     | Burner Performance Testing and Development   | EIL-R&D                           | 197.79           | 197.79              |
| 41     | Development of Technology for Flame arrestor   | CBRI,<br>Roorkee                  | 32.20            | 10.00               |
| 42     | Development of Feed Nozzle   | EIL-R&D                           | 92.00            | 16.09               |
| 43     | Study on Boundary Lubrication Mechanism & its Applications   | IISc. IOCL-<br>R&D, IIP           | 187.70           | 140.00              |
| 44     | Development of Eco friendly & Biodegradable Lubricants base fluids   | IIP                               | 40.00            | 33.73               |
| 45     | Assessment of Residual Life of Turbine Oil: Phase-II   | IIT- Delhi                        | 24.96            | 24.03               |
| 46     | Assessment of Residual Life of Turbine Oil: Phase-I  | IIT- Delhi                        | 9.86             | 9.86                |

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| 47     | Synthetic Aviation Lubricants (SAL)   | IICT/ NAL/<br>HAL /<br>GTRE/<br>Cemilac/<br>IOC-R&D | 1732.28          | 844.90              |
| 48     | Desulphurization of RFO using Solvent Extraction route.   | IIP / CPCL  | 116.57           | 115.22              |
| 49     | Solvent Extraction studies on Pre-hydro-treated Lube Distillates                                      | IIP   | 2.25             | 2.25                |
| 50     | Development of Multipurpose Dynamic Simulator   | EIL-R&D   | 39.92            | 39.92               |
| 51     | Maintenance of Multipurpose Dynamic Simulator   | IIT-<br>Bombay                                      | 4.50             | 4.50                |
| 52     | Development of Mathematical model and simulation package for gasification of Indian coal and Pet coke | IIT-M /<br>BPCL                                     | 37.00            | 33.92               |
| 53     | Development of Computational Fluid Dynamics   | EIL-R&D   | 91.50            | 80.77               |
| 54     | R&D work on Advanced Control  | IIT-<br>Kanpur/<br>EIL-R&D/<br>IOC (R&D)            | 31.00            | 29.35               |
| 55     | Online inferencing and optimisation of Blending Operations  | IIT-Kanpur  | 50.00            | 17.26               |
| 56     | Development of Polymer Modified Bitumenous binder   | IIP   | 29.33            | 26.74               |
| 57     | Synthesis of Room Temperature Ionic Liquids (RTIL)  | IIP   | 65.40            | 58.48               |
| 58     | Literature Survey on Hydro-cracking / Liquid Membranes  | IIP   | 1.50             | 1.50                |
| 59     | Visbreaker Test Run   | IIP   | 3.15             | 3.15                |
| 60     | Furnace Efficiency Studies  | EIL-R&D   | 24.00            | 24.00               |
| 61     | Synthesis, characterisation and evaluation of Vinyl Polymer   | NCL- Pune   | 9.50             | 9.50                |
| 62     | Long Term Effects of Blue Dye Furfural doped Kerosene   | ITRC-<br>Lucknow                                    | 59.39            | 49.76               |
| 63     | Technology Development for Production of Microcrystalline Wax using Short Path Distillation Tech      | CSIR-HQ,<br>AOD, IIP,<br>RRL-J, EIL                 | 1641.22          | 1416.63             |
| 64     | Thin Film Short Path Distillation Unit  | AOD-<br>Digboi                                      | 13.15            | 13.15               |
| 65     | Development of Technology for Tracer Studies in FCCU  | EIL-R&D,<br>BPCL                                    | 25.77            | 21.64               |
| 66     | Commercialisation of Indigenous Reverse Osmosis Technology  | CSMCRI,<br>CPCL                                     | 60.00            | 50.95               |
| 67     | Etherification of C5 Olefins and Light FCC Gasoline (IBP-110 C)                                       | IIP   | 57.49            | 57.49               |

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| 68     | Up-gradation of FCC recycle oil through solvent extraction  | IIP/ CPCL/ HPCL/ EIL     | 27.86            | 36.86               |
| 69     | Development of Know-How for Super critical Solvent Recovery in PDA Technology (93L=CHT 63L+HPCL 30L)            | IIP, EIL and HPCL        | 63.00            | 23.81               |
| 70     | Development of Regenerative Process for Sulfur Dioxide Removal from Lean Gas Stream                             | IIP and EIL              | 97.36            | 76.48               |
| 71     | Pressure Swing Adsorption Technology for Hydrogen Purification and Recovery                                     | EIL-R&D & IPCL           | 129.00           | 92.52               |
| 72     | Alkylation of Isobutane   | IIT- Bombay              | 5.07             | 5.07                |
| 73     | Sour Natural Gas & Industrial Gas Treating  | IIT- Kharagpur           | 15.00            | 14.64               |
| 74     | Study on Hydro-stabilisation of Coker Distillates   | IIP                      | 5.00             | 5.00                |
| 75     | Development of Catalytic Process for Isomerisation of Waxy Stocks into Lube Oils                                | NCL- Pune                | 50.00            | 27.01               |
| 76     | Feasibility Studies on feedstock for Paraffin Wax Production  | IIP                      | 6.45             | 6.45                |
| 77     | Optimisation of Dewaxing and Wax Morphology   | IIP                      | 15.00            | 15.00               |
| 78     | Effect of Dewaxing Aids on Crystal Morphology   | IIP                      | 9.92             | 8.23                |
| 79     | Desulphurization of FO using Solvent Extraction route.  | IIP / CPCL               | 116.57           | 115.22              |
| 80     | Production of Naphthenic Base oil and Paraffin wax from waxy distillate streams in refinery                     | CSIR-IIP / IOC -AOD      | 87.28            | 64.39               |
| 81     | Feasibility study of improved 3 phase reactor configuration for Hydroprocessing applications                    | BPCL R&D, EIL R&D, IIT-D | 115.00           | 80.05               |
| 82     | Development of process know-how for indigenous production of Biphenyl for thermic fluids and other applications | BPCL R&D                 | 260.00           | 248.50              |
| 83     | Experimental and Simulation Studies on Coke Mitigation in Petroleum Refinery Systems                            | BPCL R&D / BITS- Goa     | 322.23           | 318.97              |
| 84     | Parametric Study and Technology development for desalter design   | EIL R&D / BPCL R&D       | 1675.03          | 1566.28             |
| 85     | Development and Durability testing of Ethanol-Diesel blend engine   | ARAI                     | 129.80           | 129.45              |
|        |   | <b>Total</b>             | <b>11951.42</b>  | <b>10018.42</b>     |