BEE's List of Energy Efficient Technologies (as on 13-March-2023)

Sl. No.	Name of Technology	About Technology	Potential Savings (%)	Sector	Average Investment (Rs. Lakhs)	Annual Monetary Saving (Rs. Lakhs)	Estimated Payback Period (Months)	Equipment Capacity
Electrical								
1	Automation and Control System	Automation and control system provides effective monitoring of process and utility for better resource utilization and loss reduction	5-15 %	Cross-sectoral - Electrical	20-25	25-30	8-10	Not Applicable
1.1	Automation of Withering Troughs	The automation of withering trough will ensure achieve optimum temperature and ensure effective control thereafter for proper withering of tea leaves	10-15%	Cross-sectoral - Electrical	15-20	6-8	30-36	8 nos. of Enclosed Trough & 96 HP Motor
1.2	Combustion Control System for Boiler	Combustion control system in boiler provides effective monitoring of flue gas parameters, their temperature and pressure for complete combustion	15-20%	Cross-sectoral - Electrical	9-10	4-5	25-30	12 TPH
1.3	Energy Management System	The EMS is effective in managing energy flow and consumption, reduce wastage and do necessary rectification in case of any fault	15-30%	Cross-sectoral - Electrical	7-10	3-4	24-36	For 300 smart energy meters
2	AI&ML based IoT platform for Energy and Asset management	AI&ML based IoT platform is a full-featured, cloud-based asset and energy management solution for reducing risk and down- time, optimizing cost, time, and energy across buildings & cities. The AI-powered platform is designed to increase the efficiency, sustainability, and reliability of building spaces and convert aging buildings into smart buildings, as well as help design new smart and sustainable buildings and	15-20%	Cross-sectoral (Electrical)	10-12	5-6	18-24	All types of buildings & industries
3	Electrical Servo Drives	The servo drive is quite efficient in smooth start and stoppage of machine having frequent load fluctuation, and helps reduce energy wastage as well as wear and tear of machine	20-30%	Cross-sectoral - Electrical	10-15	10-20	10-12	200 KVA
4	Energy Efficient Pumps - 5 Star Rating Pumps	EE pumps have optimum impeller design, thereby leading to optimum discharge flow and pressure and energy consumption	15-30%	Cross-sectoral - Electrical	0.7-4.5	0.25 - 5	20-25	10 - 20 HP
5	Energy Efficient Screw Compressor	The screw compressors are the most efficient one to generate compressed air as well as less heat compared to normal air compressor	25-40%	Cross-sectoral - Electrical	2.5-6.5	1.5 - 7.5	20-25	15 - 150 HP
6	Energy Efficient Turbo Blower	Turbo blower is made of anodized aluminium impellers and air foil bearings. As a result it has low weight and high corrosion resistance bearings to provide excellent control over varying rpm	30-45%	Cross-sectoral - Electrical	30-40	20-25	18-24	20,000 and 50,000 rpm
7	Gasifier for Electrical Application	Gasifier gasifies coal or biomass to produce gas that can be used for power generation in gas genset or gas turbine	15-25%	Cross-sectoral - Electrical	20-25	9-12	20-24	50 KW
8	Hanger Shot blast Machine	Shot blasting systems offer you nearly unlimited options from deflashing, descaling, sanding and rust removal to roughening, matting, smoothing, edge rounding and shot peening	30-40%	Cross-sectoral - Electrical	18-20	8-10	24-30	500 Kg
9	Harmonic filter	The harmonic filter is essential in ensuring the power quality and help prevent and fault in electronic component	3-8%	Cross-sectoral - Electrical	8-10	5-7	15-18	3rd & 5th Harmonic Filter
10	IGBT based Induction furnace	An induction furnace is a clean, energy-efficient furnace which provides well-controlled melting process, compared to conventional means of metal melting	20-30%	Cross-sectoral - Electrical	20-25	15-20	15-18	750 KG
11	IGBT based temperature control	Installing Insulated Gate Bipolar Transistor (IGBT) based temperature controller for furnace ensures precise controlling of temperature.	10-15%	Cross-sectoral - Electrical	18-20	5-6	38-40	50-60 KW Furnace
12	Infrared (IR) Heaters	Use of IR Heaters results in uniform heating and reduces the baking time. Infrared heaters are extremely quiet and energy-efficient heating devices that produce a very gentle heat.	10-20%	Cross-sectoral - Electrical	3.5-10	1.8-2.0	18-24	100 Kg-5 MT per hour
13	Light emitting diode (LED) Lighting	Light emitting diode (LED) is a semiconductor light source that emits light when current flows through it. These are energy-efficient lights with long life, durable, and offer better light quality than other types of lighting	35-50%	Cross-sectoral - Electrical	13-15	30-35	3-5	connected load 625 kW
14	Light Pipe	Light Pipes are primarily used for illuminating deep interior spaces where there is poor daylighting provisions from doors /windows	15-20%	Cross-Sectoral - Electrical	5.00	2.27	26	25 nos. Light Pipe for 9 KW Lighting Load

15	Micro Turbine	Micro-turbines are tiny gas turbines that can generate both electricity and heat, and may vary in electrical output from around 25 kW to 250 kW	15-30%	Cross-sectoral - Electrical	40-45	25-40	14-20	20 - 60 KW
16	Motors (IE3 or IE4 or IE5)	EE motors are constructed with improved manufacturing techniques and superior materials, longer insulation and bearing lives, lower waste heat output, and less vibration, all of which increase efficiency and reliability	25-40%	Cross-sectoral - Electrical	5-7	2-3	20-25	connected load 730 kW
17	Screw Compressor with Permanent Magnet (PM) mo	Screw Compressor is driven by Permanent Motors and thus there is no rotor loss or transmission loss that results from rotor winding	15-20%	Cross-sectoral - Electrical	6-7	3.5-4	18-24	20 HP; 92.5 CFM
18	Static Reactive Power Generator with Harmonics Filter	In an electric power system, a load with a low power factor & Higher Harmonics draws more current and this results in higher current withdrawal and energy losses. The Static Reactive Power Generator, an IGBT based INVERTER, helps to compensate reactive power as well as selective harmonics (5th, 7th, 11th & 13th Order Only) created by the load and unbalance in the system. This helps to minimize losses	4-5%	Cross-sectoral - Electrical	5	6	11-12	100 KVAr

19	Temperature controller for cooling tower fan	This intervention increase the efficiency of electrical energy utilization in the cooling tower by automatic control of cooling tower fans, based on a feedback from the water temperature from the cooling circuit	10-25%	Cross-sectoral - Electrical	0.2-0.3	0.2-0.3	12-15	Not applicable
20	Tri-generation	Tri-generation technology provides thermal, cooling and electrical energy and it has higher efficiency compared to power generation and cogeneration plants	20-25%	Cross-sectoral - Electrical	2500-3000	700-1000	36-40	Capacity: 2.75 MW, 20 TPH
21	Variable Frequency Drives (VFD)	To control speed of various appliances like motors, pumps, compressor motors, ID fan, FD fan, hydraulic press, jet drying machine, Thermic Fluid Pump, Grinding Machine etc	30-40%	Cross-sectoral - Electrical	2.5-3	3.5-4	8-10	connected load 430 kW
22	Variable Refrigerant flow (VRF) in HVAC	Variable Refrigerant Flow (VRF) Systems are an excellent choice for buildings that require both heating and cooling to coexist simultaneously. VRF systems have the ability to regulate the flow of refrigerant to various indoor units so that one location can stay cool while the other remains warm	15-20%	Cross-sectoral - Electrical	45-50	15-20	36-48	100 TR
23	Vertical Roller Mill (VRM)	Vertical roller mill is a type of grinder used to grind materials into extremely fine powder for use in mineral dressing processes, paints, pyrotechnics, cements and ceramics. It is an energy efficient alternative for a ball mill. Typical Sector: Cement, Ceramics, limestone, etc	6-10 KWH per MT raw material	Cross-sectoral - Electrical	20-24	5-6	36-48	1 TPH
			Thermal					
24	Back Pressure Turbine	The back pressure turbine is used for supplying process steam to the facilities in private-use power producers. This type of steam turbine supplies not only electricity but also the process steam to the facilities.	15-30%	Cross sector (Thermal)	55-70	55-90	7-12	200 - 250 TPD Plant
25	Cogeneration	Cogeneration technology provides thermal and electrical energy both and it has higher efficiency compared to power generation plant	30-50%	Cross-sectoral - Thermal	1000-1200	200-250	50-60	2 MW and 12 TPH extracted steam at 6.5 kg/cm2 and 245 C
26	Condensate recovery system in boiler/jet dying machine	For applications with zero contamination, the condensate recovery system can be effectively used to conserve and reuse water in boiler	10-15%	Cross-sectoral - Thermal	12-15	7-8	18-20	4 TPH
27	DeSuperheater for Chiller Compressors	A desuperheater recovers the heat from the super-heated refrigerant gas at the compressor outlet	10-15%	Cross-Sectoral - Thermal	4-5	1-2	30-36	41 KW Compressor
28	Electric Dry Vacuum Pumps	Electric dry vacuum pumps do not require any fluid to generate vacuum compared to steam ejectors, thereby eliminating the contamination of process vapours and providing better solvent recovery	40-50%	Cross-sectoral - Thermal	18-20	Dec-15	18-24	6 TPH Boiler
29	Energy Efficient Boilers	Energy Efficient Boilers offer effective combustion of fuel with maximum utilization of energy	10-15%	Cross-sectoral - Thermal	25-30	5-6	55-60	4 TPH
30	Energy efficient Refrigeration Compressor	The refrigeration compressor of latest technology, having good automation and higher Coefficient of Performance (COP) must be used to save electrical energy during refrigeration cycle	10-15%	Cross-sectoral - Thermal	3.5-5	2-3	18-24	60 HP
31	Gas fired Annealing furnace	The gas-fired annealing furnace is essential to ensure high level of operational efficiency of the furnace w.r.t the electrical-fired furnace, due to high GCV of Gas w.r.t electricity	20-30%	Cross-sectoral - Thermal	14-15	5-6	30-36	1000 MT
32	Ground & Water source Heat Pumps (GSHP)	GSHPs use water-to-water or water-to-air approaches to treat this stable thermal environment as a heat source in the heating season and a heat sink in the cooling season	35-40%	Cross-sectoral - Thermal	1-1.5	0.2-0.3	36-60	1 TR
33	Heat Pump	A heat pump is a device that can heat a building/utility by transferring thermal energy from the outside using the refrigeration cycle	30-40%	Cross-sectoral - Thermal	30-35	20-25	15-18	339 KW
34	Hot Air Generator from Briquette	Briquette is locally available and commercially cheap alternative fuel compared to coal /wood, prepared by using agro waste, and can be used for low temperature application	20-30%	Cross-sectoral - Thermal	50-55	35-40	18-20	10 Lac Kcal /Hr
35	Hot Water Generator	The hot water generator is of natural draft system and doesn't have FD and ID fans. They are the efficient and cost-effective way to generate hot water instantly	20-25%	Cross-sectoral - Thermal	2.5-3.5	1.68 - 1.85	19-23	1000 - 80000 Kcal/hr
36	Mechanical Vapor Recompression (MVR) Evaporator	The term "evaporator" refers to process equipment used to extract liquid by vaporization. Unlike the alternative thermal vapor compression, mechanical vapor compression does not require an extra steam supply. Because there is no fluid mixing, all of the available vapor may be compressed for energy recovery. It consumes 45-50% less energy than multi effect evaporators	20-25%	Cross-sectoral (Thermal)	60-80	40-60	18-24	5000 LPH
37	PUF insulation	Polyurethane Foam (PUF) is the most effective thermal insulation material and having high strength to weight ratio at low temperature, are durable for years, with high mechanical strength	20-30%	Cross-sectoral - Thermal	3.5 - 4.0	0.6-0.7	60-72	100 sq.m surface of 120 mm thickness

38	Steam operated pumping traps	Steam operated pumping traps are operated on steam and is used for condensate evacuation under all operating conditions, thereby enabling high system uptime and enhanced productivity	3-5%	Cross-Sectoral - Thermal	1.51	1.54	12	2 TPH Boiler
39	Turbulators (for gas fired boilers)	In a firetube boiler (Two- and Three-Pass), hot combustion gases pass through long, small-diameter tubes, where heat is transferred to water through the tube walls. Firetube boilers are categorized by their number of "passes," or the number of times that the hot combustion gases travel across the boiler heat-exchange surfaces. Turbulators can be a cost-effective way to reduce the stack temperature and increase the fuel-to-steam efficiency of single-pass horizontal return tubular (HRT) brick-set boilers and older two- and three-pass oil- and natural-gas-fueled firetube	Improves boiler efficiency by 2-3%	Cross-sectoral (Thermal)	5 - 6	8 - 12	6-9	2 pass boiler with 250 tubes
Thermal - Waste Heat Recovery (Low Temperature)								
40	Heat Exchanger	A heat exchanger is a system used to transfer heat between a source and a working fluid.	10-15%	Cross-sectoral - Thermal	4-4.5	8-8.5	6-12	7000 Kg/h
41	Hot water generation from cement kiln	The waste heat, which otherwise would escape in atmosphere may be recovered using appropriate heat exchanger to pre-heat water for use in utility or process	20-25%	Cement - Thermal	100-125	30-40	30-36	3000 TPD kiln 60 TR VAM system
42	Low-Grade Waste Heat Recovery System (LGWHRS)	Waste heat even below 100 C is recovered by LGWHRS and can be used in the low temperature applications. These heat exchangers are specially designed for low-grade waste heat recovery.	10-15%	Cross-sectoral - Thermal	10-15	5-7	30-36	24-36 TPH
43	Thermo Compression	Utilization of waste flash steam in chiller and process usage	20-25%	Cross-sectoral - Thermal	150-200	70-80	24-30	3000TR

Thermal - Waste Heat Recovery (Medium Temperature)								
44	Air Pre Heater & Drying Bed in furnace	Use of waste flue gas to pre-heat the material and save fuel	18-20%	Cross-sectoral - Thermal	5-5.5	5.5-6	12-14	1.5 TPH
45	Economiser in boiler/Thermic Fluid Heater	The use is Economizer is highly recommended to save fuel in thermal application by use of high heat content in flue gas to pre-heat water, which can then be used in utility or process application	10-15%	Cross-sectoral - Thermal	3-3.5	4-4.25	6-8	4 TPH
46	Gas-fired Reheating Furnace with WHR System	A fully automated system ensures better control on temperature of metals in rolling mills, with efficient combustion owing to the use of gas as fuel. In addition, the WHR system will save substantial energy by preheating the metal to the extent possible before reheating	15-45%	Cross-sectoral - Thermal	19-21	16 - 28	9-14	2 - 12 TPH
47	Waste Heat Recovery Boiler	WHR Boiler is a system which recovers various kinds of waste heat generated from the production process of steel, chemical, cement etc and convert such recovered heat into useful and effective thermal energy	10-15%	Cross-sectoral - Thermal	3.5-4	3-3.5	12-15	4 TPH
48	Waste Heat Recovery System for Coke Drying Quenching (CDQ)	Smelting furnace generates flue gas at high temperature. This flue gas temperature is utilized to heat the atmospheric air that is utilized for coke drying	20-25%	Cement - Thermal	300-350	200-250	18-24	7 TPH Coke Drying from 15% - 2% W/W
49	Waste Heat Recovery for power generation	The WHR process is a fuel conservation measure where the heat from waste stream of gases is recovered to generate steam which in turn is used to drive turbine and generate power, instead of using conventional process of burning fuel	10-15%	Cross-sectoral - Thermal	900-1100	230	54-60	1 MW
Thermal - Waste Heat Recovery (High Temperature)								
50	Recuperators	A recuperator is used to recover the waste heat, usually from the exhaust flue gas generated from furnace and use it to preheat the combustion air, thereby ensuring fuel saving and process efficiency	20-25%	Cross-sectoral - Thermal	4.5-5	3.5-4	12-14	3 MT
51	Recuperative burner for heat recovery for high medium temperature furnaces	A recuperative burner is the one where recuperator is the integral part of the burner, and the waste heat is recovered to pre-heat the combustion air, thereby ensuring substantial energy saving	25-30%	Cross-sectoral - Thermal	200-225	200-225	12-15	15TPH rolling mill
52	Regenerative burners for high temperature furnaces	In regenerative temperature can go to 1000 degC, resulting huge energy savings and improved furnace productivity. Applicable only for gas fired furnaces	15-20%	Cross-sectoral - Thermal	20-30	20-30	12-15	One unit burner for 110 TPH furnace
Sectoral								
53	Alternative Fuels & Raw Material (AFR) Utilization	Utilize Alternative Fuels such as PTA Sludge, Syngenta Waste, Pines leaves etc, Municipal Solid Waste for thermal energy generation	Thermal Substitution rate of 5-10%	Cement	8000-10000	1600-2000	60-72	3.1 MTPA
54	Adiabatic Pre-reformer	Adiabatic pre-reforming is a well-established process in modern syngas production and implies both economic and operational benefits. The adiabatic prereformer converts hydrocarbon feed-stocks by steam reforming reactions in the low temperature range, 350–550°C	4-10%	Fertilizer	1500-1600	600-900	20-30	2000 TPD
55	Air-Dyeing Technology	Air dyeing technology uses air instead of water to apply colours into textile materials. This method will help to save water up to 95% and energy up to 86%. This method can be only applying on synthetic fibre materials	86%	Textile (Synthetic Dyeing)	2000-3000	2500-3500	12-15	400-450 Kg
56	BEE 5 Star Rated AC	Replacement of Conventional Split/Window AC with 5-star AC having higher COP or EER /ISEER	20-45%	Building	0.40-0.50	0.18-0.20	24-30	connected load 57 kW
57	Black Liquor Gasification	Black Liquor Gasification is an emerging commercial technology that removes the biomass material from black liquor by gasifying them in a high temperature chamber. Black Liquor Gasification with gas turbine electric generation can produce enough electricity to make the pulping industry a net exporter of electric power	15-20%	Pulp & Paper	9000-13800	2000-3500	40-48	115-200 TPD plant
58	Bleached Chemi Thermo Mechanical Pulp (BCTMP)	It is an advanced technology for the production of high-quality chemi-mechanical pulps from hardwoods and annual plants, which is very reliable and achieves highest pulp quality at minimum operating cost and	15-20%	Pulp & Paper	40000-45000	10000-12000	48-50	1 Lac TPA BCTMP
59	Boiler Conversion: Atmospheric Fluidised bed to Spouted bed	A spouted bed combustor is a heterogeneous system where combustion takes place in the presence of circulating particles. This results into enhanced HP steam generation to rated capacity, due to increased bed	25-30%	Pulp & Paper	1000-1200	1200-1300	10-12	117 TPH
60	Carbon Fiber Fan	Carbon Fiber Fan impellers provide next-level speed, strength, and corrosion resistance for those who routinely need to move air in challenging environments without compromising strength	15-20%	Textile	70-80	150-170	6-8	1200 mm dia for 100 fans
61	Cascaded Condensate Recovery System	Installing cascaded condensate recovery system increases condensate recovery up to 90%	5-7%	Pulp & Paper	8-Oct	30-35	3-May	Not applicable

62	Cement Calcining Process - Suspension Preheater	The Suspension Preheater process improves calcining efficiency by drying and preheating the feedstock using the kiln exhaust gas (waste heat).	14.3 kg of standard coal per ton of clinker	Cement	4100-4200	4000-4200	10-12	2000 TPD
63	CNC Machine (Special Purpose Machine)	CNC machine helps enhance productivity and lower Specific Energy consumption as one machine take care of all cutting, boring, drilling, milling, grinding operations, etc	30-35%	Machine Tool	35-40	25-30	17-20	400 KN
63.1	CNC Bending Machine	As above	32%	Machine Tool	36.35	26.07	17	400 KN
63.2	CNC Gear Hobbing Machine	As above	25%	Machine Tool	225.00	72.27	38	NA
63.3	CNC Grinding Machine	As above	23%	Machine Tool	45.61	33.73	16	NA
63.4	CNC Horizontal M/c Centre	As above	30%	Machine Tool	151.00	67.73	27	NA
63.5	CNC Lathe Machine	As above	30%	Machine Tool	40.80	14.88	33	NA
63.6	CNC Milling M/C	As above	30%	Machine Tool	73.41	28.86	31	NA
63.7	CNC Turn –Mill Centre	As above	25%	Machine Tool	50.48	17.62	35	NA
63.8	CNC Turret Punch Machine	As above	41%	Machine Tool	88.66	51.27	21	20 TON
63.9	CNC Wire Cut Machine	As above	35%	Machine Tool	61.00	26.07	28	NA
64	Compressed Bio-Gas (CBG)	Compressed Bio Gas or CBG is a purified biogas (methane content more than 90%) with zero trace of carbon dioxide and hydrogen sulphide gases and compressed to maximum 250 bar and filled up in cascades (group of high pressure cylindrical vessels).	25-30%	Oil & Gas Sector	700 - 800	140 - 150	60-72	5 TPD
65	Direct Rolling in mini steel plants	The Direct Rolling Technology refers to converting the billet in to a rolled product without any intermediate reheating arrangement, thereby avoiding wastage of sensible heat of steel. Here, the hot billets produced from continuous casting machine is not taken into the storing yard where they will cool down to ambient temperature thereby loosing energy, but are diverted in hot condition directly to the rolling section.	10-15%	Iron & Steel	100-120	600-700	2-3	18 TPH
66	Divided blast cupola	For replacement of conventional cold blast cupola for better melting of metals, generated less pollution and saves coal as well	20-25%	Foundry	6-8	3-4.5	20-24	2 MT/Batch
67	Drum pulpers	Drum Pulper integrates efficient pulping of stock upto 15-18% consistencies and separates gently and effectively fibers and contaminants, resulting in energy saving during these operations when performed separately in the mill. The drum pulper is suitable for writing & printing, newsprint and kraft paper production from recycled fiber.	20-30%	Pulp & Paper	90-120	50-65	20-25	300 T/d deinked pulp production

68	Electrical Annealing Bogie Furnaces	The energy cost in electrical annealing furnaces is low comparatively with wood fired furnaces due to more efficiency of electrical heating, less manpower cost and low energy cost. Further, this also ensures maintain uniform temperature throughout the furnace	25-30%	Brass & Aluminium	8-10	4-5	22-24	60 kW
69	Energy Efficient Brushless Direct Current (BLDC) Fan	BLDC fans consumes lower energy compared to conventional fans, having high reliability and life expectations as well	35-50%	Building	4-6	1-2	24-36	connected load 243 kW
70	Energy efficient cyclone	Energy efficient cyclone has 97.5% efficiency and it can be installed at the last stage in Pre-heater	1.03 KWH & 7000 KCal/MT of Clinker	Cement	600-650	200-220	36-40	105 TPH
71	Energy efficient gas fired pot furnace	It has several pots or crucibles in which different small batches of glass can be melted	30-35%	Glass	10-15	10-15	10-12	10-12 pots, each of 500-550 Kg capacity
72	Energy efficient impeller	Energy efficient Impeller 84% efficiency. The can improve the performance of Fans installed in industries	1.08 KWH/MT Clinker	Cement	100-120	42-45	24-30	250 Ton of Clinker
73	Energy Efficient Modulating Burner	These burners are provided with variable air/fuel ratio leading to better heat generation and drying of leaves, thereby producing good quality tea	10-15 %	Tea Processing	5-7	8-10	9-12	Dryer 1 @450 kg/h; Dryer 2@250kg/h.
74	Energy Efficient Tank furnace	Tank Furnaces are primarily used in glass industry where continuous flow of glass is needed to feed automatic glass forming machines.	15-20%	Glass	400-450	200-300	24-30	25-40 TPD
75	Energy Efficient technology for ECBC/Eco-niwas Samhita	The efficient building envelope helps prevent heat loss /gain between inside space of building and outside atmosphere, thereby ensuring more comfort, maintain appropriate building temperate and also reduce heating /cooling load, thereby saving electrical energy to a great extent.	15-25%	Building	220-240	230-250	10-12	connected load 15000 kW
76	Energy Efficient Tray Dryer	The Tray drying is a batch process used to dry materials that are liquid or wet cake, and works well for material that requires more gentle processing or cannot be atomized in an air stream due to viscosity.	15-20%	Chemical	10-12	6-8	15-20	400 Trays
77	Exhaust humidity measurement & control system	To control outlet moisture of Fabric on stenter and control blower motor speed and power consumption as well	5-15%	Textile	2-2.5	1-1.25	24-30	1 unit
78	Fabricated Water Ring Vacuum Pumps	Fabricated water ring vacuum pumps have precise design, reduced dead weight and reduced wear and tear compared to conventional cast iron water ring vacuum pumps	30-40%	Pulp & Paper	50-55	45-47	18-24	230 GSM duplex paper with 2.62 TPH capacity
79	Falling Film Chillers	Falling Film Chillers are suitable for continuous chilling of liquids close to their freezing point. They are installed before Ice Bank Tank (IBT) to pre-chill the incoming process return water at higher temperature	20-22%	Dairy	35-40	35-40	12-15	350 TR
80	Fiberglass Reinforced Plastic (FRP) Fan in Withering Units	The Fiberglass Reinforced Plastic (FRP) is light in weight compared to metallic blade and can resist any weather situation and withstand corrosion, waterborne bacteria, and organisms	10 - 15 %	Tea Processing	8-10	12-15	6-8	31 troughs, 39 nos. fans
81	Fluidised Bed dryer system	The Fluidised dryer system will ensure better quality tea by ensuring effective drying of tea leaves	10-15%	Tea Processing	15-20	7-10	24-30	500-700 Kg/hr
82	Forging Furnace	The energy efficient forging furnace provides effective heat for the heating and reheating of large steel ingots, blooms and cast parts, with better temperature control and reduced skin losses from outer surface of chamber	15-20%	Forging	20-25	20-25	10-12	250 KW
83	Gas Engine based co-generation technology	A Cogeneration is a system having gas engine produces heat and electricity simultaneously in a single plant, powered by gaseous fuel having better combustion and less ash generation, thereby guaranteeing a better energy yield	30-40%	Ceramics	800-1000	320-350	30-35	2.72 MW
84	Gas fired hot air generator system	For replacement of conventional wood fired hot air generator system with better combustion control and less emission	20-25%	Chemical	4-5	3.5-5	10-12	120000 Kcal/hr
85	Gas fired stenters	The thermic fluid heaters are used to provide the heating requirements of stenters and dryers. In this system, a fluid is heated and circulated in the plant through transmission lines. Heat is transferred from the hot fluid to the chambers using radiators. Substantial heat loss happens in the thermic fluid boilers, transmission lines and radiators. In the new system, air is directly heated by gas fired burners and the required temperature is obtained by circulating hot air through the chambers	30-40%	Textile	35-40	38-40	10-12	1600 mm stenters
86	Gasifier For Kilns	The Gasifier is a cheaper energy source having better yield compared to conventional fuel for combustion in kilns	30-35%	Limestone	55-65	24-30	28-32	30 TPD
87	Gasifier for Melting And Reheating Process	Rice husk works as renewable source of energy. Hence use of rice husk reduced cost of production and waste utilization as well	20-25%	Brass & Aluminium	40-45	25-30	18-24	500 KG

88	Hi-Consistency Pulper	Hi-consistency pulper requires lesser amount of water compared to low consistency pulper.	10-15%	Pulp & Paper	45-50	15-17	36-40	130 kW
89	High Efficiency Refiner	Refiners are used for mechanical pulping (TMP refiners) and the post-refining of GWP (Ground wood Pulp) mills. Energy efficient refiners can reduce no-load power caused by motor, pumping, and friction losses.	7-20%	Pulp & Paper	480-500	450-500	Dec-15	300 TPD
90	High Pressure Moulding Line in Moulding Area	High pressure moulding line has advantages such as continuous mould preparation, fast pattern changing time, fully automatic machine and it does not require mould transportation, storage and maintenance which can reduce mannower	50-60%	Foundry	150-175	26-30	60-72	2500 kg
91	High Speed Blunger	Blunger is a machine which can rapidly blunge raw material without changing non plastic raw material structure using stator rotor mechanism	35-40%	Sanitaryware & Potteryware	12-15	6-7	22-24	24 TPD Charge production
92	High-speed carding machine	The high speed carding machine is large and each machine consumes considerable amounts of electricity. On the other hand, since productivity is high, 1/3 the number of new machines and half the total power can produce the same production capacity as ordinary carding machines	30-40 %	Textile	80-100	50-70	18-24	27kW/machine
93	High-speed Ring spinning frame	This machine has an increased operating speed by 10 – 20% with similar power consumption as compared to conventional equipment. It results in higher production for same amount of energy consumption	10-20%	Textile	70-80	35-40	24-28	45kW conventional ring spinning machines
94	Hot Charging of Billets	Hot charging of billets can serve as an energy efficient alternative for this process in which the steel is melted at slightly higher temperature of 1650°C and then the molten steel is fed into CCM where the temperature of the billet (1150°C) at the output is controlled by PLC, which is directly sent to the rolling bay, thereby eliminating the need of re-heating.	100% - Complete elimination of re-heating	Iron & Steel	150-200	300-350	6-Aug	1 Lacs TPA
95	Hydraulic Hammer	Hydraulic hammers are 30-40% energy efficient than pneumatic hammers. Operation of the hydraulic hammers are very smooth and noise free as compared with pneumatic hammers.	30-40%	Forging	150-170	50-70	46-50	10 ton
96	Ice Bank Tank (IBT)	This process of direct cooling ensures no cooling loss or addition of external heat and ensures low energy consumption at compressor due to higher suction pressure	25-30%	Dairy	70.00	27.00	31	170 TR
97	Induction Billet Heater	For replacement of Oil Fired Furnaces with having better control on temperature and energy saving as well	20-25%	Forging	38-42	37-42	10-12	3-4 ton capacity oil-fired furnace
98	Installation of Pulverized Coal Injection in Blast Furnace	Pulverized coal injection (PCI) is a process which involves injecting large volumes of fine coal particles into the raceway of the blast furnace (BF). Pulverized coal is an important auxiliary fuel used in the BF ironmaking.	30-40%	Iron & Steel	1500-2000	1200-1600	12-15	150 kg/thm
99	Installation of Top Recovery Turbine in Blast Furnace	TRT is basically an energy saving measure at the BF which utilizes the waste pressure energy of the BF top gas to generate electric power.	10-15%	Iron & Steel	2500-3000	2000-2500	15-18	6.57 MW
100	Latest Generation High Efficiency Clinker Cooler	It offers significant potential for electrical and thermal energy saving; The total heat loss of latest generation clinker is less than 100 Kcal /Kg Clinker compared to conventional cooler where heat loss is more that 120-150 kCal /Kg Clinker	15-20%	Cement	1800-2000	400-500	48-60	3000 TPD Clinker
101	Light weight bobbins	In ring frames, yarn is collected on bobbins. The heavier the bobbins are, the more energy is required for the rotation of bobbins and hence spindles. The light weight spindles are 7-20% lighter results in similar amount of energy saving	7-20%	Textile	45-50	48-50	10-12	15000 TPA Spinning Mill (90 nos. Ring Frames)
102	Light weight carbon reinforced spinning pot	Conventionally, steel reinforced spinning pots are used in synthetic fiber production plants. Steel reinforced spinning pots can be replaced with carbon reinforced spinning pots (in man-made fiber production). They are lighter by approx 20% which results in energy savings	18-20%	Textile	15-18	15-18	12-15	man-made spinning plant with 20 ring spinning machines
103	Liquid Ring Compressor	This Liquid Ring Compressor will function as flare gas recovery system (FGRS) to recover the flare gas and sending it to Delayed Cooker Unit (DCU) wet gas compressor suction, which will further be directed to Fuel gas header to use it as fuel gas in refinery fired heaters. This has also avoided the requirement of dedicated FGRS	10-15%	Refineries	500-600	800-900	6-8	8.5 MT per day fuel oil equivalent
104	Louisiana State University (LSU) Port Dryer	This technology ensured uniformly dried product and can be used for different types of grains as well	25-40%	Food Processing	30-35	16-20	22-25	24 MT

105	Low Consistency Refining (LCR)	The refining of pulp prior to papermaking process is one of the most energy intensive and involves the alteration of cell structure of pulp fibers by imparting mechanical action. Low consistency refining can optimize the current refining process to enhance the productivity and save significant amount of energy and chemicals.	20-30%	Pulp & Paper	15-20	22-25	8-Oct	200 TPD

106	Low Thermal Mass cars in Tunnel Kiln	The reduction in weight of kiln cars in Tunnel kilns provides significant amount of energy saving and improved material to car weight ratio	10-13%	Glass & Ceramic	0.55 per car	2.5-3	2-3	1130 Kg per car
107	Medium frequency Induction Furnace	The medium frequency induction heating furnace adopts the basic principle of induction heating. It is a high-tech product replacing the traditional oxygen, oven and salt slag furnace. It can save energy, save time, fast and improve the quality of the product	10-15%	Iron & Steel	30-35	13-15	24-30	250 KW
108	Membrane Filter Press	For replacement of conventional Filter Press with better drying of sludge	30-40%	Chemical	40-45	15-20	30-35	60 Plates
109	Modern Brownstock Washers (BSWs)	Efficient removal of fiber and dissolved matters from the unbleached pulp in modern BSWs primarily results in higher solids black liquor, which reduces the evaporation energy significantly. Additionally, better washing leads to less soda loss with pulp, affecting the bleach chemical consumption significantly	10-20%	Pulp & Paper	100-130	70-90	18-24	300 T/d pulp production
110	Natural Gas fired Boiler	Replacement of conventional Coal /Wood fired boiler with NG fired Boiler	20-30%	Foundry	6-Aug	2-2.5	36-40	300 kg/hr
111	Nutsche Filtration and Drying Process	ANFD is used for active pharmaceutical ingredient (API) filtration. It is a combination of slurry filtration, product washing, and vacuum drying processes into a single unit.	10-20%	Pharmaceutical	25-30	20-25	15-18	3 KL
112	Oxyfuel Burner	To increase the oxygen content, the induction furnaces are used with oxyfuel burners along with standard burners which also reduces the content of nitrogen from the air. This improves the efficiency of combustion process	30-40%	Pulp & Paper	300-325	45-50	72-84	200 TPD
113	Palletisation plant - Sponge Iron	The palletisation ensures agglomeration of fine iron ores which is easy to handle in blast furnace or EAF	10-15%	Sponge Iron	4000-5000	800-1000	48-60	0.3 MTPA
114	Photocells for Speed Frames	In conventional machines, whenever any breakage of roving occurs at the suction, it keeps drawing the rove till the break is detected. This leads to roving losses in addition to the energy consumption for the pneumafil blower. On installation, photocell detects breakage immidiately and the machine is stopped, which eliminates the requirement of the Pneumafil blower and also roving losses	0.05 kWh/kg	Textile	350-370	200-220	20-24	15000 TPA Spinning Mill (90 ring frame machines)
115	PLC based dyeing machine	Conventional jiggers do not have a variable liquor ratio, which is why the quantities of water, pigments and chemicals cannot be adjusted properly to the varying quantities of fabric being processed. These jiggers make use of a heat exchanger, allowing the heat to be removed and applied elsewhere in the plant. Because of additional features such as a vacuum system and sprinklers, the number of passages in washing cycles can be reduced significantly. It can give energy savings of upto 26%, water savings of upto 19%, and upto 5% reduction in the use of chemicals.	20-25%	Textile	4-6	3-4	22-24	23 kW jigger
116	Pocket Ventilation System	Pocket Ventilators improve the drying rate, moisture profile and production for paper machines. The ventilators prevent sweating, corrosion and fibre build up.	5-15%	Pulp & Paper	30-35	75-80	5-Jul	Not applicable
117	Pulser dyeing technique	Pulser dyeing is a major breakthrough in the yarn dyeing process, where in liquor requirement per kg of yarn is reduced to 4:1 as against conventional 10:1 requirement, and pumping requirement to maintain flow an pressure of water is reduced to 1/3rd, thereby substantially reducing energy, water, chemical requirement	20-30%	Textile	10-12	20-30	6-8	50-1500 Kg
118	Radiant Cooling	Radiant cooling is a hydronic system that circulates chilled water through PEX pipes embedded in the floor or ceiling, or through copper pipes embedded in ceiling panels. Water passing through these pipes first cools the floor/ceiling surface, which then cools the enclosed space through radiation	30-50%	Building	1.2-1.5	0.3.-0.4	36-48	1 TR
119	Rapier or Auto Loom	For replacement of conventional Power Loom thereby ensuring enhanced productivity and production, reduced energy and manpower cost	15-20%	Textile	50-52	25-30	24-30	220 rpm
120	Recovery of BOF gas and sensible heat in Basic Oxygen Furnace	The gas produced in the BOF has a temperature of approximately 1200°C and a flow rate of approximately 50-100 Nm3/t-steel. The gas contains approximately 70-80% CO when leaving the BOF and has a heating value of approximately 8.8 MJ/Nm3 (NEDO, 2008) or 0.84GJ/t-steel	3-5%	Iron & Steel	3753.3	1003.8	45	30-400 MT
121	Replacement of steam turbine drive with high speed motor drive	Replacement of steam turbine drive with high speed motor drive will result in saving of steam and extra power generation	15000 Ton of NG per year	Refineries	22500-25000	7500-8000	48-50	7.5 MW High Speed Motor
122	Screw Washer	For replacement of twin drum washing system with high efficient screw washer to save energy	10-15%	Paper	45-50	18-20	24-30	20000-22000 TPA

123	SITRA Excel fans	South India Textile Research Association (SITRA) developed "SITRA Excel Fans" specially for ring spinning. The fan offer significant reduction in weight, is is dynamically balanced using digital balancing machine and has superior finish with special powder coating technique to provide saving of 20 per cent pneumafil power in ring spinning and 30 per cent in carding	15-20%	Textile	35-55	70-110	4-6	90 nos. Ring Frames
124	Shoe Press	Shoe press technology is a papermaking procedure that uses a large concave shoe instead of one of the conventional rotating cylinders; this extends dwell time, thus improving mechanical de-watering compared to that of conventional roll presses	20-30%	Pulp & Paper	8000-9000	300-350	30-36	Paper machine of 5 m
125	Synthetic sandwich tapes	Used in Ring Frame machine, synthetic sandwich tapes offers good dimensional stability, reduced breakage, and results in less weak-twist yarn, and reduced fiber sticking, thus saving energy substantially	5-15%	Textile	35-50	25-45	15-20	15000 TPA Spinning Mill (90 nos. Ring Frames)
126	Thermal Energy Storage for Bulk Milk Coolers (BMC)	This system uses vapour compression cycle to form ice which is later used to provide cooling without the need of grid availability during cooling process, thereby eliminating the exposure of milk to higher temperature for a longer duration during their collections and also preserve freshness and aroma	15-20%	Dairy	4.00	7.30	6	2000 Lit. BMC
127	Tube ice plant	Tube ice machine performs continuous Freezing and Harvesting function, thereby ensuring steady supply of high quality ice at a rate determined by the user	10-15%	Ice Making	17-20	8-10	30-35	20 TPD Plant
128	Ultra-High Power Electric Arc Furnace	Ultra High Power (UHPs) have become one of main tools for the steel making process since they have high productivity, low cost and high quality of products	10-15%	Iron & Steel	723.7	714	12	100-400 MT
129	Vacuum blower	Vacuum pumps are used to maintain vacuum at various sections of Paper Machine to remove water by the flow of air. Vacuum pumps consume significant amount of power for their operation in a paper machine. Latest trend is to replace vacuum pumps with vacuum blowers. The efficiency of vacuum pumps is around 40% where as that of vacuum blowers is around 60%. The replacement with vacuum blowers will reduce the energy consumption by about 40%.	20-25%	Pulp & Paper	110-130	140-160	15-20	Paper Machine of 70 TPD
130	VAM Chillers	The working principle of VAMs is based on absorption where a concentrated salt and water solution is used to absorb water vapour and then pressurized by a low-pressure pump to generate chilled water	30-40%	Building	200-250	100-125	24-36	10,000 TR
131	Veneering for Industrial furnaces	Reduction in surfaces heat losses from furnaces and also store the residual heat during non-firing time	20-25%	Foundry	6-7	6-7	11-12	Hearth area - 40 sq ft
132	Vertical Agitator System for Reaction Vessel	The vertical agitation system is more versatile compared to horizontal agitation system, allowing mixing various feed material in one go, is easy to maintain and operate	20-25%	Chemical	2-2.5	1-1.5	20-24	20 KL
133	Vertical shaft brick kilns	It is a continuous, updraft, moving ware kiln in which the fire remains stationary while there is counter current heat exchange between air (moving upward) and bricks (moving downward)	15-20%	Bricks	10-15	5-7	24-30	40-50 Lacs bricks per year
134	Waste heat recovery in centrifugal compressor	The waste heat is recoverd from each stage of compressor owing to losses in the form radiation loss and/or condensation heat and using them in pre-heating of boiler feedwater or process application	10-20%	Textile	30-35	25-30	12-15	3000 CFM
135	Waterless Dyeing Technology	Waterless Dyeing Technology uses supercritical CO_2 gas rather than water to infuse fabric with color. Special temperature- controlled pressure chambers force the carbon dioxide to act as a fluid similar to water (the supercritical fluid CO_2) which causes the polymer fiber to swell allowing the dispersed dye to easily diffuse within the polymer, penetrating the fibers, and carrying the dyes into the fabric and dyeing it.	60-65%	Textile (Polyester Dyeing)	2000-3000	2500-3500	12-15	20-200 Kg
136	Zig-Zag Firing	The zig-zag type firing ensure better turbulence and contact time between flame and bricks, thereby better productivity and reduced SEC	20-25%	Bricks	30-50	15-20	24-36	20,000-60,000 bricks per day
Innovative Decarbonisation Technologies								
137	Aluminium pipe for distribution of compressed air system	Aluminium pipe doesn't rust, unlike mild steel pipes, due to moisture present in compressed air and this avoid leakages and saves 10-20% of losses	10-20%	Cement, Iron & Steel, Textile, Other sectors	300-350	120-150	24-36	6000 MT per day of Clinker
138	Electric Vehicles and Charging Infrastructure	Electric vehicles are power by battery and electric motor	1 Liter Diesel per 15 km	Transportation	12-15	3-4	48-60	Diesel sedan car

139	Fuel efficient industrial furnace burners specially for rotary kiln	Improved overall combustion efficiency of burners in rotary kilns in Alumina, chemical, lime, sponge iron plants using gas and liquid fuel	5-7%	Cement, Iron & Steel	30-35	15-20	20-24	Not Applicable
140	Nano composite surface treatment for condenser in power plant	It protects from fouling, scaling, and deposition resulting improvements in power generation efficiency	13000 tons of coal/Yr	Power Plant	250-300	250-300	12-15	135 MW
141	Plasma Technology in steel melting shop	The use of Plasma Technology ensures superhot electrically heated gases that are extremely efficient in melting metals	15-20%	Iron & Steel	8000-10000	3200-4000	30-36	20 crore for each plasma torch
142	Torrefaction Technology	Torrefaction is thermochemical conversion method to produce coal fuel (bio char) from biomass. It is carbon rich material can be easily burnt in industrial furnaces, boilers driers, etc.	Not applicable	Power Plant	15-20	15-20	12-15	
143	XPLATE on FD Fan to improve boiler combustion efficiency	XPLATE technology breaks the clusters of gaseous fluid flows inside the boiler and releases trapped molecules of Oxygen (O2) & Nitrogen (N2) in the clusters. This provides more reacting oxygen inside the boiler that enables more complete combustion	3-5%	Multiple sectors	50-60	20-25	36-40	55 TPH
144	Oxygen Depolarized Cathodes (ODCs)	Replacement of the hydrogen evolving cathodes in the classical membrane cells by ODCs allows for reduction of the cell voltage and correspondingly the energy consumption of up to 25-35%	25-35%	Chlor-Alkali Industry	13500-14000	1100-1200	140-150	250 TPD
145	Hisarna Ironmaking Technology	Hisarna is a new type of furnace in which iron ore is directly injected and liquefied in a high temperature cyclone so that it drips to the bottom of the reactor where powder coal is injected. The two react into liquid iron.	15-20%	Iron & Steel	25000-25500	Dec-15	38-40	4.6 MT per day
146	Extended Delignification System for Cooking of Wood	The extended delignification system recycles majority of the heat generated in the pulping process and stores the recycled heat in the form of black liquor and white liquor	50-60%	Pulp & Paper	4000-4500	1100-1200	42-48	200 Tons of BD pulp/day

Innovative Decarbonisation Technologies (Part-2)								
Sl. No.	**Name of Technology**	**About the Technology**	**CO_2 Capture Percentage (%)**	**Sector**	**Avg. Investment Potential (Rs. Lakhs)**	**CCU Capacity (MTPA)**	**Estimated Payback Period (months)**	**Equipment Capacity**
147	Amine-based Post-Combustion Capture (PCC) Technology	Amine-based carbon capture is a regenerative process using an amine solvent to remove CO2 from flue gas. Reversing the reaction releases pure CO2 for capture and frees up the solvent for re-use. This technology is primarily used for Carbon Capture & Storage	90%	Refineries	110000-130000	1 MTPA	NA	5 mtpa crude processing
148	Gasification Based Production	CCUS unit will undertake purification and compression of high conc. CO2 stream for further disposition. Source of CO2 stream is Outlet of the acid gas removal unit	90%	Refineries	8000-10000	1 MTPA	NA	70 ktpa H_2
149	NG Based Steam Methane Reforming (SMR) for H2 production	Cryogenic separation has been considered for CO2 capture from tail gas as it ensures high purity CO2 (99.9%) with additional H2 recovery. Source of CO2 stream is tail gas	60-65%	Refineries	70000-80000	0.7 MTPA	NA	130 ktpa H_2
150	Pressure Swing Adsorption (PSA) Technology	Pressure Swing Adsorption (PSA) Technology has been applied to separate gas mixtures, such as carbon dioxide capture in ammonia production and in hydrogen purification. PSA is highly cost-effectiveness, simple to operate, high performance at ambient temperatures, high regeneration rate, and low energy intensity.	90%	Cement	160000-180000	2 MPTA	NA	2.5 mtpa clinker
151	Water Gas Shift Reactor	Water gas shift has been considered to ensure maximum CO2 capture from a single point and potential H2 recovery from the BF gas. Source of CO2 stream is BF gas	50%	Iron & Steel	160000-200000	2 MTPA	NA	2.0 mtpa BF BOF based ISP