Appendix A: Funding of DOE, Office of Industrial Technologies Research and Development Program

Appendix-A—Funding of the U.S. Department of Energy, Office of Industrial Technologies Research and Development Program

Program	Examples of projects in FY 1993, budget authority in ($ thousands)	FY 1992 enacted	FY 1993 enacted	FY 1994 requested
		(millions of dollars)		
Industrial wastes				
Waste utilization and conversion	Recovery of marketable plastics, metal, and fiber fuel from automobile shredder residue (2,000). Expansion of markets for surface-activated waste tire rubber (1 ,053). Conversion of tire rubber, mixed plastics, sludges, and wood and/or paper wastes to plastics (1 ,000). Bio-reactor for acetic acid production (700).	$5.9	$7.9	$11.1
Waste minimization	Reduction of: byproduct wastes in oxygenated chemicals production; metal ions in plating wastes; VOCs and CFCs in super-critical parts cleaning; and CFCs in circuit board soldering (2,790). Reduction of wastes in chemicals, chemical-using, and petroleum industries (2,300). Production of hydrogen and sulfur from hydrogen sulfide wastes; UV dual cure coatings process; reduction of wastes and emissions in silicon and ferrosilicon production; reduction of amine use in removing $C0_2$ from raw natural gas; and removal of VOCs from waste gas streams using membrane technology (1 ,578). National Industrial Competitiveness through efficiency: Energy, Environment, and Ecmomics (N ICE^3) program (1 ,500).	7.3	9.6	15.9
Municipal solid wastes Waste combustion	Sewage sludge and MSW burning technologies; natural gas reburn and lime injection to reduce acid gas emissions; and direct injection of chemicals to meet chlorine and sulfur emissions standards.	0.6	0.7	0.7
Waste data collection	Development and dissemination of energy, economic, environmental, safety, and health data on MSW processes such as Waste Thermal Energy plants and material-recovery facilities.	1.0	2.3	2.2
Cogeneration Advanced topping cycles	Ceramic components for retrofit into stationary gas tubines (3,222) Increased electricity generation from simple back pressure steam turbines (555).	3.2	4.5	9.2
Electric drives	Determine R&D requirements on electric motor systems (1 68). Initiate and organize multi-party program to demonstrate energy -efficient motor drive systems (163). Assist in establishing a training program on motor and drive selection in two resource centers (155).	—	0.7	2.1
Materials processing Metals initiative	Experimental program for direct ironmaking; design manual to support commercialization of direct iron/steelmaking; feasibility study to define concept and configuration of a demonstration plant (8,550). Sensor probe to rapidly determine chemical composition of molten iron and steel (1,419). Single-wheel thin strip steel caster, using open channel process (984). Improved cathodes for aluminum smelting (708).	17.5	17.9	19.4
Process electrolysis	Cell design, scale-up, control, and operating procedures for aluminum reduction cells based on cermet inert anodes (841). Metal ceramic inert anodes for magnesium production (430). Electrolytic method to produce neodymium metal from an oxide feed (216).	1.0	1.5	1.5

Foundries and glass	Inventory management system for coils of cold rolled sheet steel as part of "Integrated Manufacturing Information Systems" (2,975). Ultrasonic inspection and electromagnetic filtration to detect and eliminate defects in castings and increase production yield (1 ,487). Identify barriers to implementation of best available technologies for energy reduction in metals, glass, cement, and refractory industries (1 ,035). Rapid glass refiner (464).	6.7	6.4	9.0
Separations Membranes	Hybrid distillation/facilitated transport membrane system for separation of propane and propylene (930). Catalytic ceramic membrane reactor to ethylbenzene or isobutane dehydrogenation (671).	1.8	1.9	—[a]
Pulp and paper	Black liquor pulsed combustion and gasification (2,377). Black liquor recovery boiler computer model (663). Demonstration of hot solids firing of black liquor (470). Develop programs to address technology needs for the pulp and paper mill of the future (132).	2.8	3.9	6.2
Food, chemicals, textiles, and agriculture	Disseminate strategic R&D and management plan for Alternative Feedstocks Utilization Programs and initiate R&D on high-volume, starch-to-chemicals processes (2,280). Develop programs to address technology needs for the petroleum refinery and textile industry of the future (250).	1.0	2.5	6.8
Sensors and controls	Sensors and controls for various pulping and papermaking process parameters (1 ,215). Sensors and controls for various agriculture and food processing parameters (530).	2.4	1.8	1.8
Bioprocessing	Metal catalyst for the production of maleic anhydride; bimetallic catalysts for combustion of pollution gases; and zeolite catalysts for processing petroleum feedstocks into chemicals (1 ,786). Biocatalyst for use in both aerobic and anaerobic systems (1 ,470). Fixed-bed and fluidized-bed bioreactors for organic acids and alcohol production (1 ,000). Use of dehydrogenation, electroreduction, and methane selective oxidation reactions to produce chemicals from renewable feedstocks (600).	4.9	5.2	5.1
Enabling materials Continuous fiber ceramic composites	Processing and fabrication technologies for continuous fiber ceramic composites (4,700). Performance requirements for continuous fiber ceramic composites (2,205).	6.7	6.9	7.5
Engineered industrial materials	Develop and characterize intermetallic alloys, including aluminizes of nickel, iron, and titanium (2,672). Coordinate ceramics research and apply work to specific industrial uses; apply titanium diboride fabrication techniques to other composites; flame spraying and other coatings techniques; reactive metal infiltration composite systems; silicon carbide powder synthesis; infrared opacification of aerogels and modification of the materials for applications such as membranes, catalysts carriers, and filters (2,396). Develop and deploy composites formed by chemical vapor deposition of silicon carbide (1 ,200).	4.7	6.3	8.0

Materials manufacturing technologies	Microwave processing of glass and ceramic powders; use of conducting polymers, thin film surface modification techniques, magnetic field processing, and bimetallic coatings in membrane applications (3,086).	3.7	3.9	3.3
Improved combustion efficiency	Spray dynamics processes, with focus on nonpetroleum backup fuels for natural gas furnaces and process heaters (600).	1.1	1.8	2.1
General combustion processes	Control on nitrogen oxide in combustion of natural gas (400). Catalytic combustion to achieve higher heat release rate and lower emissions in gas turbines and radiant burners (395). Pulse combustors for industrial applications (385).			
Engine combustion processes	Eliminate soot particles and reduce nitrogen oxide from diesel combustion emissions (1,175). Stratified charge combustion in 2-stroke engines (686). Combustion kinetics and knock in burning gasolines of the future in existing engines (525).	4.2	2.8	—
Industrial combustion equipment	Ferrous scrap preheater fueled by natural gas and oil on the scrap (1 ,226). Work piece temperature analyzer for use in metallurgical heat treatment and ceramic processes (1,1 12). Wet oxidation technology (992). Porous ceramic burner technology (666).	1.4	4.1	1.9
Process heating and cooling	Liquid vapor-and solid vapor-chemical heat pumps (890).	1.9	2.2	1.7
Heat pumps	Process integrated heat pumps for use by corn syrup processors, petroleum refineries, and pulp and paper mills (801).			
Recuperators	Syn-gas chemical reactor unit and a unit for indirect burning of hazardous waste to operate a gas turbine (1,731).	2.4	2.3	2.7
Thermal science	Design data and performance prediction methods for use in developing enhanced surfaces for high-efficiency heat exchangers; analysis of transport mechanisms for advancing understanding of membrane separation technologies (1 ,477).	2.4	2.6	2.5
Implementation and deploymentt	Energy Analysis and Diagnostic Centers (EADCs) located at 25 universities (3,937). Technology transfer activities, including workshops, demonstrations, document preparation and dissemination, and other outreach activities (275).	3.5	4.5	7.5
Capital equipment		0.9	2.8	1.6
Program management		7.8	5.9	7.2
Total budget		96.7	112.8	137.1

[a]Incorporated within the food, chemicals, textiles, and agriculture area of the Separations program.

KEY: VOC = volatile organic compounds; CFC = chlorofluorocarbons; CO_2 = carbon dioxide; MSW = municipal solid waste; R&D = research and development.

SOURCE: U.S. Department of Energy, *Congressional Budget Request, FY 1994, Volume 4,* April 1993.