

Section 1

Summary of Energy Saving Effects

1. Iron & steel industry

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
86	1	IS-PE-1	Improvement in segregated charging of sintering materials	By improving segregated charging of sintering materials, return ores are reduced.	Specific coke consumption 2.8% reduced, coal addition rate 0.54% reduced.
87	2	IS-PE-2	Pulverized coal injection for blast furnace	By injecting pulverized coal into a blast furnace, energy to produce cokes is reduced.	Reduction in crude oil equivalent: 19,460 kL/y
88	3	IS-PE-3	BF top-pressure recovery turbine	A top-pressure recovery turbine utilizes the high-pressure BF gas and generates electricity.	Reduction in crude oil equivalent: 29,000-39,000 kL/year
89	4	IS-PE-4	DC arc furnace with water cooled furnace wall	Large energy saving is achieved in an arc furnace which melts and refines ferrous materials such as scrap.	Reduction in crude oil equivalent: 4,380 kL/y
90	5	IS-PE-5	Continuous casting machine	Molten steel is continuously cast into semi-finished steel materials (semis) such as slabs and blooms.	Reduction in crude oil equivalent: 25,940 kL/y
91	6	IS-PE-6	Hot charging and direct rolling mill	High-temperature semi-finished materials is charged into the heating furnace. Further, the semis are directly sent to the rolling mill.	Reduction in crude oil equivalent: 16,200kL/t
92	7	IS-PE-7	Continuous annealing line	Annealing, cooling, temper rolling, and recoiling are integrates into one line.	Reduction in crude oil equivalent: 10,400 kL/y
93	8	IS-PE-8	Convection heating type heat treatment furnace for wire rod coil	A forced circulation fan improves the heat transfer efficiency and shortens the treatment time.	Approx. 25% of fuel is saved for heat treatment.
94	9	IS-PE-9	Low temperature forge welded pipe production method	The temperature of steel hoops at the exit of a continuous heating furnace for forge weld pipe production was reduced.	Reduction in crude oil equivalent: 7,500 kL/y
95	10	IS-PE-10	High frequency melting furnace	A melting furnace for steel and nonferrous metals.	Specific consumption reduced by 12.3%, production increased by 19.5%, electricity saved by 840,000 yen/month.
96	11	IS-PE-11	Channel induction furnace for cast iron melting	An induction furnace for cast iron melting.	Overall efficiency is increased by about 20% over a crucible-type furnace.
97	12	IS-PE-12	Ferroalloy furnace for effective energy utilization	An electric furnace for smelting HC-FeCr which reduces energy consumption and recovers the combustible exhaust gas.	Reduction in crude oil equivalent is 12,570 tons/y. When applied to 7 furnaces, reduction is 80,000 tons/y.

1. Iron & steel industry

[Machinery & Equipment]

98	13	IS-ME-1	Coal drying and moisture control equipment for coke oven	Equipment which reduces the moisture in the coal by heating in order to reduce fuel consumption in the coke oven.	Energy saving: 40,000-80,000 kcal/t-coal. Coke quality is improved.
99	14	IS-ME-2	Coke dry quenching	Equipment which cools red heat coke by exchanging heat with inert gas.	Reduction in energy consumption: 92,000 kcal/t-pig
100	15	IS-ME-3	Exhaust heat recovery system for sintered ore cooling equipment	Red-heat sintered ore just after sintering is air-cooled and sensible heat of hot exhaust gas is recovered.	Reduction in crude oil equivalent: 3,500 kL/y
101	16	IS-ME-4	Sensible heat recovery from main exhaust gas of sintering machine	The main exhaust gas of the sintering machine is returned back, enhancing the heat recovery	Reduction in crude oil equivalent: 8,430 kL/y
102	17	IS-ME-5	Hot stove exhaust heat recovery equipment	Combustion air and fuel gas for a blast-furnace hot stove are preheated by utilizing the sensible heat of combustion waste gas.	Reduction in crude oil equivalent: 9,700 kL/y
103	18	IS-ME-6	BOF exhaust gas recovery device (including sealed BOF)	Energy of exhaust gas generated during a BOF refining process is recovered and utilized.	Recovered energy is 200,000 kcal per ton of crude steel.
104	19	IS-ME-7	BOF gas sensible heat recovery apparatus	Sensible heat of the BOF gas is recovered as steam by installing a boiler in the gas recovery system.	Energy saving in crude oil equivalent : 9,700 kL/y
105	20	IS-ME-8	Raw material preheater for electric arc furnace	Sensible heat of the high-temperature exhaust gas from the electric furnace is utilized to preheat the scrap.	Reduction of specific power consumption: 60,000-80,000 kcal/t
106	21	IS-ME-9	Heating furnace with regenerative burners	A pair of regenerative burners are used to recover the waste heat from combustion.	Reduction of specific fuel consumption: 10-30%
107	22	IS-ME-10	Ladle heating apparatus with regenerative burners	Regenerative burners are used to heat the refractories of a molten steel ladle.	Fuel saving rate: 56%
108	23	IS-ME-11	High performance heating furnace	A steel-product heating furnace with strengthened exhaust-heat recovery and precise combustion	Energy saving: 50,000-200,000 kcal/t
109	24	IS-ME-12	Recovery of sensible heat from skid cooling water in heating furnace	Pure water is supplied as cooling water and the heat is recovered as steam.	Recovery amount of steam: 9 t/h (71,100 t/y)
110	25	IS-ME-13	Descaling pump (conversion to plunger pump)	To save power, the turbine pump was converted to the plunger pump.	Annual power consumption reduced by 5,800 MWh.
111	26	IS-ME-14	High efficiency gas separation apparatus	An apparatus which selectively separates and recovers a gas from air or by-product gas from production processes in a highly efficient manner.	Specific power consumption is reduced by about 10%.

1. Iron & steel industry

[Operation & Management]

112	27	IS-OM-1	Automatic combustion control of coke oven	Program heating adjusts and optimizes the heating condition in each coking chamber.	Amount of coking energy reduced: about 70,000 kcal/t-coal
113	28	IS-OM-2	Blast furnace operation control system	An expert system which stably controls the furnace according to the materials and operating conditions.	Stabilization of the operation against fuel change, and optimum control of the air-fuel ratio of a hot
114	29	IS-OM-3	Blast furnace hot blast valve control system	The hot blast flow rate at each of the tuyeres is individually controlled to improve the circumferential balance.	Energy saving: 134,000 kcal/t
115	30	IS-OM-4	Blast furnace burden distribution control	This technology controls the burden distribution along the radial direction in the blast furnace.	The shaft efficiency is improved. The coke volume is reduced by 5-15kg per ton of hot metal.
116	31	IS-OM-5	Energy saving operation of electric arc furnace	Power consumption of small and medium size electric furnace is reduced.	Reduction in specific power consumption: 77 kWh/t
117	32	IS-OM-6	Operation improvement of heat treatment furnace	A continuous plating furnace equipped with a direct-firing reducing heating zone.	Better heat response and faster treatment speed.
118	33	IS-OM-7	Centralized energy management (Energy center)	A system which manages the energy supply and demand in an integrated steel plant to minimize the energy cost.	The energy balance is adequately forecasted, resulting in reduced BOF gas dissipation, etc.

2. Non-ferrous metal industry

Aluminum

[Machinery & Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
126	1	NA-ME-1	Immersion melting plating furnace	A furnace which melts zinc, aluminum, etc., by immersing a combustion-heating ceramic tube.	Reduction in crude oil equivalent: 20.2 kL/y (per one furnace)
127	2	NA-ME-2	Installation of a small capacity variable pump for keeping hydraulic pressure	A small-capacity pump is installed and operated in place of the main pump in order to compensate leaks.	Reduction in crude oil equivalent: 981 kL/y
128	3	NA-ME-3	VVVF control of pumps and fume blowers, and flow rate reduction of by-pass circuit	The coolant pumps and fume blowers are controlled by VVVF. Throttling of the bypass circuit valve is optimized.	Reduction in crude oil equivalent: kL/y
129	4	NA-ME-4	Improvement of thermal efficiency for rapid aluminum melting furnace	Energy is saved by such measures as molten metal mixing, burner combustion control through the molten metal temperature and furnace pressure, and installation of the recuperator.	Reduction in specific energy consumption: 27 kcal/kg
130	5	NA-ME-5	Improvement of thermal efficiency for rapid aluminum melting furnace	Various kinds of examples concerned with improvements of thermal efficiency of the melting furnace used for melting aluminum ingot and return materials.	Reduction in crude oil equivalent: kL/y

[Operation & Management]

131	6	NA-OM-1	Operation method by reduced number of revolutions of circulating fan	Energy is saved by reducing the number of revolutions of the circulating fan.	Reduction in crude oil equivalent: 115 kL/y
132	7	NA-OM-2	Heat loss improvement of energy saving type electric holding furnace	A much energy consuming holding furnace is improved.	Reduction in crude oil equivalent: 28 kL/y
133	8	NA-OM-3	Improvement of operation of hot air circulation fan for aluminum annealing furnace	The operating pattern of the hot air circulation fan of an annealing furnace is improved.	Reduction in crude oil equivalent: 53.1 kL/y (per one furnace)

2. Non-ferrous metal industry

Copper

[Machinery & Equipment]

134	9	NC-ME-1	Efficiency improvement in autogenous furnace in copper smelting process	Settler injection to prevent the furnace-bottom build-up and a highly oxygen-enriched burner are introduced.	Reaction heat is increased due to the high slag quality operation, reducing auxiliary fuel consumption by about 50%.
135	10	NC-ME-2	Waste heat recovery of copper smelting shaft furnace using heat pipes	Waste heat is recovered by a rotary heat pipe heat exchanger.	Reduction in crude oil equivalent: 431 kL/y

[Operation & Management]

136	11	NC-OM-1	Energy saving in copper electrolysis process	The resistance of the electrolytic solution and heat radiation from the electrolysis tank are reduced, thus steam consumption is reduced.	Reduction in crude oil equivalent: 1,058 kL/y
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3. Chemical industry

Ammonia

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
147	1	CA-PE-1	Multi-effect evaporator	Multiple evaporators are connected in series to improve the evaporation efficiency.	Energy consumption of a triple-effect type is 40% of a conventional single-effect type.
148	2	CA-PE-2	Heat exchanger type primary reformer for waste heat recovery in ammonia production process	Waste heat at the exit of the secondary reformer is utilized as the reaction heat in the primary reforming process.	Reduction in crude oil equivalent: 10,708 KL/y
149	3	CA-PE-3	High conversion rate synthesis reactor for ammonia production	The heat of exit gas is effectively recovered through heat exchange with the reactor inlet gas.	Heat recovered as steam: 0.14×10^6 kcal/t-NH ₃
150	4	CA-PE-4	Low pressure difference synthesis reactor for ammonia production	The direction of gas flow within an ammonia synthesis reactor is controlled to reduce the pressure loss.	Reduction in crude oil equivalent: 6,931 kL/y
151	5	CA-PE-5	Isothermal CO converter for ammonia production	A reactor with a built-in heat exchanger to implement CO conversion in a single stage and recover reaction heat.	Reduction in crude oil equivalent: 1,794 kL/y
152	6	CA-PE-6	CO oxidizer in ammonia production process	A unit to conduct two-stage CO conversion followed by oxidizing the residual CO with air to obtain CO ₂ .	Reduction in crude oil equivalent: 2,851 kL/y

3. Chemical industry

Ammonia

[Machinery & Equipment]

153	7	CA-ME-1	Waste heat recovery unit for synthesis gas compressor exit gas in ammonia production process	Boiler feed water is injected into the process gas for temperature control. Feed steam to the reboiler is decreased.	Reduction in crude oil equivalent: 1,454 KL/y
154	8	CA-ME-2	Membrane separation hydrogen recovery unit in ammonia production process	Highly efficient gas separation membrane used for hydrogen gas recovery.	Heat recovered as steam: 0.14 x 10 ⁶ kcal/t-NH ₃
155	9	CA-ME-3	High pressure water power recovery turbine in ammonia production process	A high-pressure water turbine is utilized to recover power from the high-pressure liquid from the carbon-dioxide removal process.	Reduction in crude oil equivalent: 1,794 kL/y
156	10	CA-ME-4	Installation of pre-reformer in ammonia reforming process	A pre-reformer is installed in the reforming stage.	Reduction in crude oil equivalent: 5,354 KL/y
157	11	CA-ME-5	Primary reformer waste heat recovery unit for ammonia plant	This unit preheats the combustion air in the primary reformer by hot flue gas.	Reduction in crude oil equivalent: 19,988 KL/y

[Operation & Management]

158	12	CA-OM-1	Humidification process prior to primary reforming in ammonia production process	Process condensate is sprayed into the preheated process gas and vaporized, increasing the humidity.	Reduction in crude oil equivalent: 8,809 kL/y
159	13	CA-OM-2	Ammonia production process: Improvement in heating feed to ammonia stripper	An additional preheater is inserted in the feed line to the ammonia stripper to increase its temperature.	Reduction in crude oil equivalent: 4,240 kL/y
160	14	CA-OM-3	Ammonia production process: Carbonate removal process	Energy saving in the carbonate removal process in an ammonia plant.	Reduction in crude oil equivalent: 23,733 kL/y

3. Chemical industry

Caustic soda

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
161	15	CS-PE-1	Quadruple-effect concentration for diaphragm-type electrolytic caustic soda production	The existing triple-effect concentration method is modified to the quadruple-effect concentration	Reduction in crude oil equivalent: 57,077 KL/y
162	16	CS-PE-2	Energy saving ion exchange membrane electrolysis bath for caustic soda production	A NaCl ion-exchange-membrane electrolysis bath with less voltage drop compared with a conventional multi-polar bath.	Reduction in crude oil equivalent: 3,183 kL/y
163	17	CS-PE-3	Ion exchange membrane NaCl electrolysis bath for caustic soda production	The method employed in the NaCl electrolysis bath for caustic soda production is switched to the bag ion exchange method.	Reduction in crude oil equivalent: 22,390 kL/y

[Machinery & Equipment]

164	18	CS-ME-1	Brine preheater using recovered heat of NaCl electrolysis in caustic soda production process	Brine fed to the electrolysis bath is preheated using sensible heat of gases generated in the electrolysis bath.	Reduction in crude oil equivalent: 1,468 kL/y
165	19	CS-ME-2	Improvement of active cathode for ion exchange membrane electrolysis for caustic soda production	Overvoltage is reduced by a new coating method which significantly widens the surface area of the electrode.	Reduction in crude oil equivalent: 3,645 kL/y

[Operation & Management]

166	20	CS-OM-1	Caustic soda production process: Switching from diaphragm electrolytic process to ion exchange membrane electrolytic process	High concentration and high purity caustic soda is produced using ion exchange membrane.	Reduction in crude oil equivalent: 30,843 kL/y
167	21	CS-OM-2	Reduction of electrolytic power for NaCl electrolysis bath in caustic soda production process	Power consumption is reduced by reducing the electric current load of NaCl electrolysis.	Reduction in crude oil equivalent: 3,208 kL/y

3. Chemical industry

Naphtha Cracking

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
168	22	CN-ME-1	Switching quenching tower trays to packing in naphtha cracking process	Switching the quenching tower trays to packing, the pressure difference is reduced.	Reduction in crude oil equivalent: 4,508 KL/y
169	23	CN-ME-2	Installation of turbo-expander in top gas line of demethanizing column in naphtha cracking process	A turbo-expander is installed in the top gas line to recover low-temperature heat.	Reduction in crude oil equivalent: 6,874 KL/y
170	24	CN-ME-3	Cold heat recovery from demethanizing column bottom liquid in naphtha cracking process	Cold heat of the bottom liquid is utilized to reduce the power of the propylene refrigerator.	Reduction in crude oil equivalent: 1,614 KL/y
171	25	CN-ME-4	Combustion air preheating for boilers using cooling tower bottom hot water in naphtha cracking process	Hot water at the bottom of the cooling tower is used to preheat the combustion air for the boiler.	Reduction in crude oil equivalent: 8,480 KL/y
172	26	CN-ME-5	Hot water heating by distillation column top vapor	Hot water and waste heat of the top vapor of the rectifying column are utilized as heat sources of the reboiler.	Reduction in crude oil equivalent: 3,032 KL/y

[Operation & Management]

173	27	CN-OM-1	Control of excess air ratio at cracking furnace in naphtha cracking process	The excess air ratio is controlled using an oxygen analyzer mounted to each cracking furnace.	Reduction in crude oil equivalent: 4,454 kL/y
174	28	CN-OM-2	Change of feed step for depropanizing column in naphtha cracking process	The feeding step of the depropanizing column is lowered, and steam consumption at the reboiler is reduced.	Reduction in crude oil equivalent: 1,598 kL/y
175	29	CN-OM-3	Pressure control of ethylene rectification column by suction pressure of propylene refrigerator in naphtha cracking process	Propylene refrigerator power is reduced by improving the DCS control method.	Reduction in crude oil equivalent: 486 kL/y
176	30	CN-OM-4	Naphtha cracking process: Energy saving in ethylene cracker	Operation technology on uniform and low oxygen combustion of fuel gas for heating.	Fuel consumption is reduced by 30Nm ³ /h.

3. Chemical industry

BTX

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
177	31	CB-ME-1	Recovery of top vapor heat of ortho-xylene separation column in aromatics production process	Waste heat of the separating column top vapor is recovered and used for power generation by a steam turbine.	Reduction in crude oil equivalent: 10,024 kL/y
178	32	CB-ME-2	Waste heat recovery from heating furnace flue gas in BTX production	The heating furnace was modified from natural draft type to forced draft type. Heat of flue gas is utilized to generate steam.	Reduction in crude oil equivalent: 1,166
179	33	CB-ME-3	Steam turbine power generation using waste heat of distillation column top vapor in BTX production process	The distillation column top vapor is recovered and used to generate power by a condensing turbine.	Reduction in crude oil equivalent: 11,978 kL/y
180	34	CB-ME-4	Combustion air preheating using heating furnace flue gas in BTX production process	Combustion air is preheated by recovered flue gas and natural draft is changed to mechanical draft.	Reduction in crude oil equivalent: 6,975 kL/y

[Operation & Management]

181	35	CB-OM-1	Change of washing system in amine desulfurization process for BTX production	By reducing the circulation rate of amine, the steam rate to the reboiler is reduced.	Reduction in crude oil equivalent: 342 kL/y
182	36	CB-OM-2	Reboiler heating by waste heat of top vapor of distillation column in BTX production process	Heat of condensation of the top vapor of the crude toluene column and heat held by condensate of reboiler steam are utilized at the reboiler of the pure benzene column.	Reduction in crude oil equivalent: 967 kL/y
183	37	CB-OM-3	Waste heat recovery from heating furnace flue gas in BTX production	A unit to separate H ₂ S dissolved in oil after hydrogenation of sulfur compounds.	Reduction in steam consumption: 125 kg/h
184	38	CB-OM-4	Control of reflux ratio of distillation column using on-line analyzer	Analog control of the benzene distillation column is changed to DCS reflux ratio control.	Reduction in specific steam consumption: 20%

3. Chemical industry

General

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
185	39	CG-PE-1	Gelatin drying system using heat pump in pharmaceutical production process	Hot air drying is switched to the heat pump method for energy saving and quality improvement.	Energy cost is reduced by 50%.
186	40	CG-PE-2	Powder detergent drier utilizing turbine flue gas	Gas discharged from the gas turbine is used as heat sources for drying powder detergents.	Energy efficiency: power generation 20%, waste heat recovery 75%

[Machinery & Equipment]

187	41	CG-ME-1	Ethanol recovery unit using steam recompression heat pump at alcohol distillation column	Heat of condensation of top vapor of the distillation column is recompressed and utilized to heat the bottom liquid.	Reduction in crude oil equivalent: 636 kL/y
188	42	CG-ME-2	Reduction of waste water to be incinerated using reverse osmosis membrane in phenol production process	Waste water is processed by the RO membrane and the volume of concentrated liquid to be incinerated is reduced.	Reduction in crude oil equivalent: 1,385 kL/y
189	43	CG-ME-3	Improvement of oxygen enrichment process for bulk pharmaceutical production	Energy is saved by switching the vacuum concentrator to a ultra-filtration membrane concentrator.	Reduction in crude oil equivalent: 3.6 kL/y (per one line)
190	44	CG-ME-4	Power generation by turbo-expander in telephthalic acid production process	Energy of the flue gas from the reaction process is recovered using a gas expander.	Reduction in crude oil equivalent: 2,445 kL/y
191	45	CG-ME-5	Waste heat recovery from solvent separator vapor using absorption heat pump in butadiene production process	Waste heat of solvent separator vapor is recovered as hot water using a heat pump.	Reduction in crude oil equivalent: 1,900 kL/y
192	46	CG-ME-6	Low temperature catalyst combustor	A catalyst to oxidize waste gas containing organic matters, etc., used for deodorizing and effective use of oxidization heat.	Compared with direct heating, fuel cost is 30-35%.

4. Oil refining industry

[Machinery & Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
198	1	OR-ME-1	Vacuum distillation unit: Reduction of injection steam by recycling overhead steam	Overhead steam injected into the atmospheric distillation column is recycled by using an injector, thereby achieving energy saving.	Energy reduction in crude oil equivalent of 8,562 kL/y.
199	2	OR-ME-2	Fluid catalytic cracking (FCC) unit: Power recovery system (1)	A portion of pressure energy of coke combustion gas from the regenerator is recovered in the form of power by installing an expander turbine.	Energy reduction in crude oil equivalent of 13,600 kL/y.
200	3	OR-ME-3	Fluid catalytic cracking (FCC) unit: Power recovery system with humid steam condensing turbine at a fluid catalytic cracking unit (2)	The power recovery system that combines the fluid catalytic cracking unit with a steam turbine in a tandem arrangement.	Energy reduction in crude oil equivalent of 10,935 kL/y.
201	4	OR-ME-4	Petroleum refining unit: Installation of waste heat boiler to sulfur recovery unit	A waste heat recovery boiler to recover and effectively utilize heat from combustion of hydrogen sulfide, H ₂ S	Energy reduction in crude oil equivalent of 1,761 kL/y.
202	5	OR-ME-5	Oil refining unit: Installation of a side reboiler on a distillation column in the petroleum refining process	Installation of a side reboiler around the central levels of a process distillation column in petroleum refining to reduce consumption of heating steam.	Energy reduction in crude oil equivalent of 483 kL/y.
203	6	OR-ME-6	Petroleum refining unit: Installation of a membrane separator for hydrogen	Installation of a membrane separator for hydrogen realizes energy saving and reduction of cost by recovering hydrogen from refinery byproduct gas.	Energy reduction in crude oil equivalent of 6,466 kL/y.

[Operation & Management]

204	7	OR-OM-1	Vacuum distillation unit: Hot charge to the vacuum distillation unit	An increase in temperature of the feed charged from the atmospheric distillation to the vacuum distillation unit reduces the specific consumption of energy required for the vacuum distillation unit.	Energy reduction in crude oil equivalent of 1,314 kL/y.
205	8	OR-OM-2	Atmospheric crude oil distillation column: Recovery of waste heat of heavy gas oil	Reduction in steam consumption for the reboiler of stripper by effectively utilising waste heat of heavy gas oil from the atmospheric distillation column.	Energy reduction in crude oil equivalent of 938 kL/y.
206	9	OR-OM-3	Vacuum distillation unit: Recovery of waste heat of the overhead vapor	The utilization of waste heat of the overhead vapor as a heat source for preheating the water of the boiler reduces the steam required for heating the heater.	Energy reduction in crude oil equivalent of 454 kL/y.
207	10	OR-OM-4	Vacuum gas oil desulfurization unit: Improvement of heat recovery system	Improvement of heat recovery system of the entire plant and installation of a new hot separator achieve a significant energy saving.	Energy reduction in crude oil equivalent of 7,738 kL/y.

4. Oil refining industry

208	11	OR-OM-5	Heavy oil direct desulfurization unit: Reduction of oxygen content in the flue gas	Improvement of the burner arrangement and performance, and of damper clearances to enable the furnace operation with reduced oxygen content in the flue gas.	Energy reduction in crude oil equivalent of 519 kL/y.
209	12	OR-OM-6	Heavy oil direct desulfurization unit: Rotation control of the recycle gas compressor	Control of r.p.m. of the compressor reduces pressure drops across control valves.	Energy reduction in crude oil equivalent of 1,582 kL/y.
210	13	OR-OM-7	Fluid catalytic cracking (FCC) unit: Improvement of heat recovery by modification of operating conditions of the main fractionator.	Optimization of heat recovery from the overhead, middle and bottom refluxes improves the energy saving effects.	Energy reduction in crude oil equivalent of 1,884 kL/y.
211	14	OR-OM-8	Fluid catalytic cracking (FCC) unit: Energy saving by reducing the pressure inside the regeneration column	The reduction of pressure inside the regeneration column reduces the consumption of steam for driving the air blower for the regeneration column.	Energy reduction in crude oil equivalent of 1,024 kL/y.
212	15	OR-OM-9	Oil refining process: Reduction of the quantity of the recycled gas in the reforming unit	Reduction in recycled gas quantity to the allowable limit saves the power for recycling the gas and the heat power required for the furnace.	Energy reduction in crude oil equivalent of: 1,268 kL/y.
213	16	OR-OM-10	Catalytic Reforming Unit: Energy Saving by Low-pressure Operation of Distillation Columns	Energy saving by operating the distillation column at a lower pressure and a lower throughput.	Energy reduction in crude oil equivalent of 1,166 kL/y.
214	17	OR-OM-11	Petroleum refining process: Rearrangement of heat exchangers of a distillation plant	Addition and rearrangement of heat exchangers increase heat recovery rate, thereby reducing the load of the furnace.	Energy reduction in crude oil equivalent of 1,219 kL/y.
215	18	OR-OM-12	Hydrogen production unit: Reduction of steam/carbon ratio	Improvement by reducing the steam to carbon ratio.	Energy reduction in crude oil equivalent of 3,848 kL/y.
216	19	OR-OM-13	Hydro desulfurization process: Effective utilization of steam	Operation improvement by effectively utilizing steam generated from the waste heat boiler of the Claus furnace.	Energy reduction in crude oil equivalent of 1,223 kL/y.
217	20	OR-OM-14	Hydrogen production unit: Computer-controlled reduction of surplus hydrogen	The minimization of surplus hydrogen production and reduction in energy consumption of flare required to combust the gas by computer control.	Energy reduction in crude oil equivalent of 1,431 kL/y.
218	21	OR-OM-15	Petroleum Refining Process: Flare Gas Recovery System	Improvement by recovery of the flare gas.	Energy reduction in crude oil equivalent of 900,000 kL/y. (for 300 kL/t)
219	22	OR-OM-16	Increased concentration of amine solution in the off-gas desulfurizing process	Increased concentration of amine solution decreases the circulation quantity of amine solution and thereby reduces the steam used for dissipating the absorbing gas (H ₂ S) in the regeneration tower.	Energy reduction in crude oil equivalent of 6,980 kL/y.
220	23	OR-OM-17	Vacuum gas oil desulfurization unit: Reduction of steam supply to the reboiler for the amine regenerator	Saving in the steam for regeneration by realizing operation at a fixed rate of throughput.	Energy reduction in crude oil equivalent of 5,936 kL/y.

5. Ceramic industry

Cement

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
227	1	YC-PE-1	Cement raw material preparation: Introduction of a large vertical roller mill for raw material crushing	Introduction of vertical roller mills that have a high crushing energy efficiency and requires a smaller installation area	Energy reduction in crude oil equivalent Of 544 kL/y
228	2	YC-PE-2	Cement clinker burning process: Adoption of suspension preheater (SP)	Installation of a facility to effectively dry and preheat the previously blended raw materials using the flue gas stream from the kiln.	Energy reduction in crude oil equivalent of 264,000 kL/y, production increased.
229	3	YC-PE-3	NSP-type cement calcining furnace	The NSP-type kiln, or modified version of SP, increases capacity and enables extended continuous operation without increasing diameter of the kiln.	The maximum capacity per unit rotary kiln of 7,000 to 10,000 ton/d
230	4	YC-PE-4	Cement clinker burning process: Adoption of vertical roller mill for coal crushing	Improvement by introduction of highly efficient vertical roller mills capable of simultaneously crushing, drying coal, and classifying crushed coal.	20 to 25 percent reduction of specific electric power consumption compared with conventional tube mill and separator.
231	5	YC-PE-5	Cement production finishing section: Introduction of pre-grinding roll crusher (Roller press)	Pre-grinding the clinkers to be fed to the finishing section under extremely high pressures reduces the total consumption of electric power in the cement clinker grinding section.	Specific power consumption of 10 kWh/t for preliminary crushing, 100 % increase of crushing productivity, 26% reduction of specific power consumption
232	6	YC-PE-6	Cement production finishing section: Introduction of clinker pre-grinding roll crusher (Pre-grinder)	Installation of a high efficiency pre-grinding roll crusher reduces the load of the ball mill.	Energy reduction in crude oil equivalent of 1,531 kL/y
233	7	YC-PE-7	Adoption of a high-efficiency separator in the finishing process	Operation improvement by introduction of a high-efficiency separator.	Approx. 10 percent reduction of power consumption in the finishing grinding process.
234	8	YC-PE-8	Cement clinker burning process: Adoption of high-efficiency quenching cooler	Improvement by adoption of a high-efficiency quenching cooler and utilization of the air heated by the burned clinkers.	Energy reduction in crude oil equivalent of approx. 2,240 kL/y

5. Ceramic industry

[Machinery & Equipment]

236	9	YC-ME-1	Rock crushing process: Adoption of external rock transfer system to the roller mill crusher	Reduction in the power consumption of the draft fan by reducing the amount of the crushed rocks transferred within the roller mill.	Approx. 50% reduction of power consumption compared to the internal transfer system.
237	10	YC-ME-2	Cement burning process: Modification of a conventional suspension preheater to a five-stage cyclone suspension preheater	Energy saving improvement by adopting a five-stage cyclone suspension preheater instead of a four-stage cyclone suspension preheater.	Energy reduction in crude oil equivalent of 4,770 kL/y
238	11	YC-ME-3	Clinker burning process: Small-pressure-drop suspension preheater	Improvement by introduction of a small-pressure-drop suspension preheater.	Energy reduction in crude oil equivalent of 243 kL/y
239	12	YC-ME-4	Burning of used tires as substitute fuel for cement kiln	A portion of heavy oil and coal fuels is substituted by used tires.	Substitution ratio of used tires in the combined fuel of max. 10 to 13 percent
240	13	YC-ME-5	Cement production process: Medium-to-low-temperature flue gas power plant	Use of waste heat recovery boiler to generate power by recovering waste heat from SP and the clinker cooler, and to dry cement raw material using its flue gas.	Energy reduction in crude oil equivalent of 12,636 kL/y

Glass

[Production Equipment]

241	14	YG-PE-1	Introduction of electric furnace instead of crucible furnace for melting glass	Improvement by introduction of an electric furnace instead of crucible furnace for melting glass.	Energy reduction in crude oil equivalent of 176 kL/y
242	15	YG-PE-2	High-efficiency melting furnace and shaping system for glass	Introduction of a system that automatically feeds raw materials into the furnace and automatically conducts shaping operation.	Approx. 30% reduction of energy consumption compared to the present electric furnace.

[Machinery & Equipment]

243	16	YG-ME-1	Adoption of a combustion system with oxygen burners for melting glass	Use of oxygen instead of air for burners of the furnace to melt glass.	Fuel reduction of 60%
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[Operation & Management]

244	17	YG-OM-1	Intensified insulation of tank furnace for melting glass	Improvement of thermal insulation of a tank furnace for E-fiberglass by changing the material of the refractory side blocks.	20 to 30 % reduction of fuel consumption by adoption of optimum furnace structure.
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6. Pulp & paper industry

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
248	1	PP-PE-1	Improvement of chemical pulp cooking process for energy saving	A continuous digester which saves energy.	Reduction in specific steam consumption: 40-70%
249	2	PP-PE-2	Medium-concentration replacement-type pulp washer for pulp manufacturing	A technology which enables the continuous replacement washing at a medium concentration.	Reduction in crude oil equivalent: 1,000 kL/y
250	3	PP-PE-3	Secondary separation pulper in maceration process of waste paper	A secondary separation pulper which removes foreign materials without crushing them.	Processing capacity is increased by 20%.
251	4	PP-PE-4	High-concentration size press	This improvement enables to coat high-concentration sizing fluid, and reduces the drying load.	Steam consumption for drying is reduced by 50%.
252	5	PP-PE-5	Oxygen delignification for delignification process of chemical pulp	A two-stage oxygen treatment method which can remove more lignin using the same amount of oxygen and reduces electric power consumption.	Reduction in specific power consumption: 1,130 kWh/t
253	6	PP-PE-6	High-concentration pulper for maceration process of waste paper	A new pulper which macerates waste paper by slowly agitating at a high concentration of about 15%, consuming only the same level of power as a low-concentration pulper.	Reduction in crude oil equivalent: 130 kL/y

6. Pulp & paper industry

[Machinery & Equipment]

254	7	PP-ME-1	High-temperature odorless Heat Recovery Boiler	Development of the black liquor condensing technology enhanced the thermal efficiency of recovery boilers.	Reduction in crude oil equivalent: 9,543 kL/y
255	8	PP-ME-2	Plate-type multi-effect liquid-film evaporator for condensing black liquor of chemical pulp	A plate-type multi-effect liquid-film evaporator is adopted to achieve a high degree of energy saving.	Steam consumption reduced by about 40%, power by about 20%.
256	9	PP-ME-3	Dryer with dryer bars installed inside for paper-making machine	A number of fixed siphon tubes are installed inside of the dryer drums in order to increase the heat transfer efficiency.	Reduction in specific steam consumption: 20%
257	10	PP-ME-4	Installation of steam-recompression heat pump on paper-making dryer	Energy is saved by reusing steam after recompressing it.	Reduction in crude oil equivalent: 1,175 kL/y
258	11	PP-ME-5	Heat recovery from thermo-mechanical pulp (TMP) in mechanical pulp manufacturing	Heat generated as the refiner consumes electric power is recovered.	Reduction in crude oil equivalent: 1,200 kL/y
259	12	PP-ME-6	High efficiency dehydrator for dryer of paper-making machine	The dehydration effect is enhanced by applying a high pressure on some area of the paper web, thereby saving steam.	Reduction in steam consumption: 5%
260	13	PP-ME-7	Heat recovery by sludge incinerator	A fluidized-bed incinerator for burning sludge discharged from paper mills, which incorporates waste heat recovery.	Reduction in crude oil equivalent: 9,543 kL/y
261	14	PP-ME-8	Re-powering system and gas turbine waste heat boiler	By re-powering of gas turbines, energy is utilized in multi-stage in a cascade.	Reduction in energy consumption: 14.5% (input energy)
262	15	PP-ME-9	Medium-concentration chemical mixer in oxygen delignification and bleaching processes for manufacturing chemical pulp	A compact but highly efficient mixer which contributes to energy saving.	Reduction in crude oil equivalent: 132 kL/y
263	16	PP-ME-10	Integration of punched metal screen, slit screen and maceration machine for processing waste paper	Screening and maceration are integrated into a single unit.	Reduction in energy consumption: 26-31%
264	17	PP-ME-11	Multi-functional combined screen for waste paper processing	An improved screen for waste paper processing with power consumption held low.	Reduction in power consumption: 39.3-70.2% (slit screen)
265	18	PP-ME-12	Energy saving in crown controlling roll	A crown roll which reduces hydraulic power loss by controlling its crown.	Reduction in crude oil equivalent: 369 kL/y
266	19	PP-ME-13	High-temperature soft calender for paper making	A highly efficient machine to calender the feed paper on line.	Reduction in power consumption: 40%
267	20	PP-ME-14	AC driving of paper-making machine and winder system	Energy efficient AC motors with inverter control is applied to the paper-making machine.	Conversion to the SCR system: about 20-25% energy saving, etc.
268	21	PP-ME-15	Rotation control of equipment in paper-making process	Rotation control is incorporated to promote energy saving.	Reduction in crude oil equivalent: 503 kL/y

6. Pulp & paper industry

[Operation & Management]

269	22	PP-OM-1	Improvement of dryer part hood to closed type	The hood of the dryer part is completely closed and waste heat is recovered.	Reduction in crude oil equivalent: 40%
270	23	PP-OM -2	Energy saving of vacuum pump for paper-making machine	By controlling the rotation of the vacuum pump, power consumption is reduced.	Reduction in crude oil equivalent: 503 kL/y
271	24	PP-OM-3	Energy efficient production process of thermo-mechanical pulp (TMP)	A new process which can produce TPM with less power without sacrificing the quality.	Reduction in power consumption: 15-23%

7. Food industry

Sugar

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
280	1	FS-PE-1	Drum-type beet slicer	The drum-type beet slicer to cut the sugar beet into sticks (cosset).	Reduction in crude oil equivalent of 1,200kl/y.
281	2	FS-PE-2	Horizontal twin-screw pulp press	The twin-screw pulp press enables the removal of water in an efficient manner while compressing the beat pulp.	Reduction in crude oil equivalent of 1,200kl/y.
282	3	FS-PE-3	Clarifying sugar solution with magnesia	The use of magnesia absorbent to clarify sugar solution achieves a simplification of the clarification process.	70 % reduction in specific power consumption, 75% reduction in specific fuel consumption
283	4	FS-PE-4	Forced circulation automatic crystallizing evaporator with mixer	The use of the forced circulation automatic crystallizing evaporator with a mixer reduces the heat energy required as well as the amount of water necessary to prevent over-concentration.	Reduction in crude oil equivalent of 4,500kl/y.
284	5	FS-PE-5	Uniform fan nozzle washer (washing nozzle for centrifuge)	Improvements to the washing nozzle employed in centrifuges increase separation efficiency.	Savings in wash water of approximately 15%.

7. Food industry

[Machinery & Equipment]

285	6	FS-ME-1	Recovery of waste heat from the sugar solution concentration process and crystallizing evaporator	Improvements by adoption of mechanical vapor recompression system in the sugar solution concentration process and recovery of waste heat from an evaporator.	Reduction in crude oil equivalent of 1,200kl/y.
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[Operation & Management]

286	7	FS-OM-1	Steffen waste water concentration	The use of the RT Saccharate method to uniformly disperse lime powder in steffen waste water to increase concentration of the dilute sugar solution saves the amount of the waste water and auxiliary fuel as well.	Reduction in heavy oil equivalent of 2,200kl/y.
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Beer

[Production Equipment]

287	8	FB-PE-1	Malt extract boiling equipment using hot water	Improvements by recovering the heat from the water used in cooling boiled malt extract and from exhaust gas discharged from the bolt boiling flask in the form of hot water.	75~100% reduction in the energy required to boil water and reduction in steam consumption equivalent to 530 kL/y of crude oil.
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[Machinery & Equipment]

288	9	FB-ME-1	Use of a heat pump with a malt extract boiling flask	The screw type steam compression heat pump is a highly durable equipment, which overcomes the disadvantages of M.V.R. (mist, surging, and erosion etc.).	Reduction in heavy oil equivalent of 1,400kl/y.
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7. Food industry

Edible oil

[Operation & Management]

289	10	FE-PE-1	Edible oil refining process: Energy-saving improvements in vacuum equipment for deodorization towers	Reduction in steam consumption through control of ejector drive steam by measuring water temperature in the first barometric condenser of a 4-stage steam ejector.	Reduction in crude oil equivalent of 2,250kl/y.
290	11	FE-PE-2	Edible oil refining process: Energy-saving improvements in solvent removal equipment	Improvement of the operating efficiency and reduction in steam consumption by improving the ability of the solvent removal equipment to remove the solvents.	9.6% reduction in steam consumption and 16.6% reduction in solvent losses

Food in general

[Production Equipment]

291	12	FG-PE-1	High temperature, high humidity drying equipment	A drying method providing good heat efficiency through the use of a high humidity, high temperature air stream.	Reduction in crude oil equivalent of 2,400 kL/y
292	13	FG-PE-2	Fluidizing granulation spray dryer	The fluidizing granulation spray dryer incorporating the functions of spray drying and fluidized layered granulation.	Reduction in crude oil equivalent of 2,800 kL/y (for production of powdered milk)
293	14	FG-PE-3	New ion exchange membrane method for salt production	Concentration of salt in sea water by electrical dialysis via an ion exchange membrane, and evaporation and crystallization of table salt from the concentrate using a multi-effect evaporator.	Reduction in crude oil equivalent of 2,700 kL/y

[Machinery & Equipment]

294	15	FG-ME-1	Use of waste products as an energy source	Use of waste products of the food manufacturing process as boiler fuel, and recovery of heat in the form of steam or hot water.	Reduction in crude oil equivalent of 4,900 kL/y
295	16	FG-ME-2	Anaerobic waste water treatment equipment	Waste water containing organic waste products is processed through a combination of anaerobic treatment, and activated sludge treatment.	Reduction of 50 % in power costs for waste water treatment and reduction of 50% in costs of treating sludge.
296	17	FG-ME-3	Gas turbine co-generation	A power-heat cogeneration system that can be operated at loads of 25~100% based on the power demand.	Reduction in crude oil equivalent of 3,261 kL/y.

8. Textile Industry

Fiber

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
303	1	TF-PE-1	High performance Rapier Loom	A new rapier is used, which is equipped with a small metal fitting at its tip to hold the weft.	Reduction in specific power consumption: 10% from a conventional one at 450 rpm.
304	2	TF-PE-2	Water Jet Loom	The weft is transported by high-pressure water jet.	Reduction in specific power consumption: about 25% from a conventional one.
305	3	TF-PE-3	High speed comber	A machine which produces a highly oriented and uniform sliver.	Reduction in specific power consumption: 8-9% from a conventional one.
306	4	TF-PE-4	High speed ring-type fine spinning apparatus	An apparatus which twists the sliver by a ring-and-traveler-type device, and winds it into a pirn.	Productivity increased and power consumption reduced by 10-20%.
307	5	TF-PE-5	High speed spinning apparatus of a dope spinning type (except for urethane polymer)	An apparatus which spins in three steps in high speed, and winds into a high-speed winder.	Reduction in power consumption: 35%
308	6	TF-PE-6	High-speed, multi-filament, spinning apparatus of a melt spinning type (for nylon and polyester filament production)	An apparatus which directly spins fully drawn yarn in high speed.	Reduction in specific power consumption: 55% from a conventional one.
309	7	TF-PE-7	High speed carding machine	A high-performance, high-energy-saving carding machine which works at a high spinning speed above 100 m/min.	Reduction in specific power consumption: about 50%

[Machinery & Equipment]

310	8	TF-ME-1	Highly efficient driving system for draw-twist yarn machine	The motor speed control is changed to a frequency control system for energy saving.	Reduction in crude oil equivalent: 101 kL/y
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8. Textile Industry

Dyeing
[Production Equipment]

311	9	TD-PE-1	Micro-wave dyeing machine	A machine which allows rapid diffusion of dyestuff into the inner part of the cloth.	Reduction in crude oil equivalent: 1,169 kL/y compared with a similar machine.
312	10	TD-PE-2	Jet dyeing machine	An highly efficient dyeing machine which dyes the cloth by forcibly contacting the jet flow of dyestuff solution.	Power consumption reduced by 22%, steam by 80%.
313	11	TD-PE-3	Counter flow cleaning machine	A machine which effectively removes impurities and residual chemicals from the cloth in each process for cloth dyeing.	Reduction in energy consumption: 50%
314	12	TD-PE-4	LP microwave drying machine for cheese dyeing	The low pressure (LP) microwave drying method which shows excellent efficiency and prevents over-drying.	Reduction in crude oil equivalent: 52 kL/y

[Machinery & Equipment]

315	13	TD-ME-1	Steam consumption saving by adopting a steam heating unit at dyeing process	Energy is saved by installing a steam-heating unit (radiant-tube heater) to the steamer.	Reduction in specific energy consumption: 38-46%
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9. Electricity Generation

[Production Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
319	1	EG-PE-1	High efficiency steam turbine blade	A steam turbine that provides a high thermal efficiency by adopting the latest blade design	Reduction in crude oil equivalent: 3,500 kL/y (with the utilization of 38%)
320	2	EG-PE-2	Supercritical pressure power generation	Supercritical pressure steam is generated in the boiler and used for driving the turbine.	Thermal efficiency is increased by 1-2%.
321	3	EG-PE-3	Combined gas and steam turbine power generation	A steam turbine is driven by the steam generated by recovering the exhaust gas heat of the gas turbine.	Power generation efficiency is about 48% with a 150,000 kW class.
322	4	EG-PE-4	Waste heat recovery power generation	Thermal energy of high temperature waste gas is used to generate power by a steam turbine.	Generated power is a 100% energy-saving product.
323	5	EG-PE-5	Fluidized bed combustion coal fired boiler	Coal is injected into the fluidized bed composed of desulfurizers for combustion, generating steam for power generation.	With a 500,000 kW power boiler, 3 sets of 940 kW pulverizers are dispensed with.
324	6	EG-PE-6	Pressurized fluidized bed composite coal fired power plant (PFBC)	A highly efficient power generation plant using coal as a fuel.	Reduction in crude oil equivalent: 3% compared with a coal-fired power plant of the same size.

[Machinery & Equipment]

325	7	EG-ME-1	Rotating regenerative air preheater automatic seal gap controller	Air leakage of a rotating regenerative air preheater is prevented.	Reduction in crude oil equivalent: 738 kL/y
326	8	EG-ME-2	Carbon-sealed regenerative air preheater for	Carbon sealing is adopted to a large capacity	Boiler efficiency: 0.27%
327	9	EG-ME-3	Separate type heat pipe heat exchanger	Treated exhaust gas is reheated through heat exchange with inlet gas to the desulfurizer.	Reduction in crude oil equivalent: 488 kL/y
328	10	EG-ME-4	Removal method of scale from inside condenser tubes	A scale removal method free from deterioration, able to restore and maintain the heat exchange effectiveness of the condenser.	Reduction in fuel consumption: 0.65 t/h
329	11	EG-ME-5	Air cooler for gas turbine combustion air	An air cooler using a spray nozzle utilizing latent heat of water.	Reduction in crude oil equivalent: 15,000 kL/y (500 MW class boiler)
330	12	EG-ME-6	Large sized boiler soot blower	The heating surface is cleaned by periodically jetting out high pressure or compressed air.	Reduction in efficiency is prevented.
331	13	EG-ME-7	Repowering combined cycle system of exhaust repeat combustion type	A power plant is remodeled into an exhaust repeat combustion type combined cycle plant by combining the gas turbine and steam power generation.	Reduction in crude oil equivalent: 549,900 kL/y
332	14	EG-ME-8	Industrial repowering system	The capacity of an industrial thermal power plant is strengthened.	Reduction in crude oil equivalent: 858 kL/y
333	15	EG-ME-9	Rotation speed control of large boiler blower and exhauster through wet type multi-plate speed reducer	Rotation speed is controlled by a wet type multi-plate speed reducer.	Reduction in crude oil equivalent: 858 kL/y

9.Electricity Generation

[Operation & Management]

334	15	EG-OM-1	Low-pressure operation of natural circulation boiler	Reduction of thermal efficiency is minimized under low load operation.	Gross thermal efficiency is increased by 0.5-0.6%.
335	16	EG-OM-2	Operation method of increased temperature of main steam at boiler outlet	Fuel consumption is reduced by raising the temperature of main steam at the boiler outlet.	Reduction in crude oil equivalent: about 1,100 kL/y
336	17	EG-OM-3	Gas recirculating steam temperature control system	Boiler exhaust gas at the economizer outlet is recirculated by the recirculation fan to the furnace bottom to balance the thermal absorption.	Thermal efficiency is increased by 0.5%.
337	18	EG-OM-4	Reduction of starting-up time of cold plant	Energy loss in starting up is reduced by reducing the starting-up time.	The starting-up time from ignition to turbine start is reduced by 4 hours 45 minutes.
338	19	EG-OM-5	Stop of operation of high pressure gas feeding apparatus by developing high back pressure ejector for high pressure feeding of LPG	The use of the high pressure gas feeding apparatus is stopped by developing a high back pressure ejector for gas feeding.	Reduction in crude oil equivalent: 233 kL/y
339	20	EG-OM-6	Conversion of heat source of absorption type air-conditioner by utilizing excess boiler steam of gasification equipment	A gas-fired absorption air-conditioner is converted to a hot water type utilizing excess steam as a heat source.	Reduction in crude oil equivalent: 393 kL/y

10.Many Industries

[Machinery & Equipment]

Page	Serial No.	Item No.	Technology Item/Title	Outline	Energy saving effect
343	1	MI-ME-1	Energy saving combustion system for small to medium sized boilers	A combustion system with the optimum O ₂ control for small to medium sized boilers.	Reduction in crude oil equivalent: 119.3 kL/y
344	2	MI-ME-2	Impulse city gas combustion system for industrial furnaces	The city gas combustion system which controls the temperature through changing the ON-OFF time ratio of plural burners.	Reduction in specific energy consumption: 181kWh/t (improved by 23%)
345	3	MI-ME-3	Intelligent burner system for industrial heating furnace	A burner control system that permits precise control of furnace conditions following optimum patterns by computers.	The air ratio is improved from 1.4 to 1.1 (1,000 [□]).
346	4	MI-ME-4	Oxygen enriched combustion system	The efficiency of a heating furnace is improved by oxygen enriched combustion.	Reduction in fuel consumption: more than 30%
347	5	MI-ME-5	Vacuum steam heating system	A system which permits uniform heating below 100 [□] utilizing the latent heat intrinsic to steam.	The productivity is tripled, reducing specific energy consumption to 1/3.
348	6	MI-ME-6	Improvement in recovering steam drain in plywood factory	All the steam drain from thermal processing in a plywood factory is recovered.	The drain recovery rate is over 95%, increasing the apparent boiler capacity by 3.65%.
349	7	MI-ME-7	Control of exhaust gas humidity of plywood dryer by high temperature hygrometer	A zirconia-based hygrometer is applied for process humidity control of a plywood dryer.	Steam saving of more than 11%.
350	8	MI-ME-8	Waste heat recovery vacuum type hot water producing system	A system to recover heat from waste gas, which is used to heat a heating medium in a vacuum.	Hot water of 65-90 [□] is recovered.
351	9	MI-ME-9	Heat pump type steam recompression cylinder dryer for drying process	Heat-pump-type steam recompression cylinder dryer is introduced in the drying process of the dyeing industry.	Reduction in crude oil equivalent: 20.3 kL/y
352	10	MI-ME-10	Introduction of heat pump using cooling water for air compressors as its heat source	Cooling water for compressors is used as a heat source for a heat pump.	Reduction in crude oil equivalent: 76 kL/y
353	11	MI-ME-11	Heat pump type low temperature vacuum concentrator	Applying a heat pump, evaporation and concentration of waste liquid is conducted under a normal temperature by keeping the inside of the apparatus evacuated.	Reduction in power consumption: more than 30%
354	12	MI-ME-12	Refrigerating machine waste heat recovery system	Heat of condensation generated by a refrigerating machine is recovered by using a plate-type heat exchanger.	Reduction in crude oil equivalent: 367 kL/y
355	13	MI-ME-13	Effective use of exhaust heat from waste incineration	Exhaust heat generated when incinerating municipal waste is effectively used. Reduction in crude oil equivalent: 10,200 kL/y	
356	14	MI-ME-14	Waste heat boiler cogeneration system with secondary burner	A gas turbine cogeneration system which minimizes the electricity purchase.	Reduction in crude oil equivalent: 5,000 kL/y
357	15	MI-ME-15	Gas turbine cogeneration system with variable heat-electricity ratio	A gas turbine cogeneration system most suitable in the applications where the demand ratio for heat and electricity drastically changes.	Compared with a conventional type, the power output is increased by 1.77 times by full steam injection.

10.Many Industries

358	16	MI-ME-16	Recovery of power by installing steam turbine in steam pressure reducing line	A steam turbine is installed in place of a pressure reducing valve for driving a refrigerator.	Reduction in crude oil equivalent: 557 kL/y
359	17	MI-ME-17	Introduction of low pressure steam expansion turbine	An expansion turbine is installed between the low-pressure system and the atmosphere, contributing to effective use of energy.	Reduction in crude oil equivalent: 5,989 kL/y
360	18	MI-ME-18	Low pressure condensing steam turbine	A power generating turbine is installed to make use of surplus low-pressure process steam.	Output is increased by about 53%.
361	19	MI-ME-19	Mixed steam extraction turbine power generator	A steam turbine that generates electricity by using steam of different pressures (high and low pressures). Reduction in crude oil equivalent: 18,427 kL/y	
362	20	MI-ME-20	Introduction of hydraulic coupling to high pressure injection pump	A hydraulic coupling is installed to a high pressure water injection pump which frequently repeats the on-off operation.	Reduction in crude oil equivalent: 5,249 kL/y
363	21	MI-ME-21	Energy saving improvement of blowers and pumps	The capacity of blowers and pumps for production, construction, air conditioning, etc., is optimized.	Reduction in power consumption: 30-80%
364	22	MI-ME-22	Energy saving through improving efficiency of sludge dehydrator in factory waste water	In a sludge treatment process for factory waste water, an energy-saving belt-press sludge dehydrator is used.	Reduction in crude oil equivalent: 331 kL/y
365	23	MI-ME-23	Improvement of flow rate control for reverse osmosis (RO) system for pure water	In the RO membrane system for producing pure water for semiconductor manufacturing, flow control is improved.	Reduction in crude oil equivalent: 210 kL/y
366	24	MI-ME-24	Improvement of a motor for a plastic extruder	The inverter control drive system replaces a VS coupling motor.	Reduction in crude oil equivalent: 948 kL/y
367	25	MI-ME-25	High efficiency inverter driven screw compressor	Inverter drive is incorporated in a screw compressor.	Energy saving of approx. 15-22% over the previous machines.
368	26	MI-ME-26	Air volume control of forced draft fan for boiler by microcomputer	Air-volume control of a forced draft fan for a boiler is improved by employing microcomputer cascade control.	Reduction in crude oil equivalent: 130 kL/y
369	27	MI-ME-27	PAM motor with variable number of poles	Electricity is saved by introducing a PAM (Pole Amplitude Modulation)-type motor.	Reduction in crude oil equivalent: 1,069 kL/y
370	28	MI-ME-28	High efficiency illumination system with constant current electric power transfer method	The overall efficiency of the illumination system including its maintenance is improved.	Reduction in power consumption: 22%
371	29	MI-ME-29	Refrigerating dehumidifier	The cold from the freezer is used to condensate and remove moisture from the air, which is reheated for use.	Electricity is saved by 30-40% in comparison with chemical dehumidification.
372	30	MI-ME-30	Hot-blast-generating cupola	The air is preheated by a heat exchanger using waste heat of the cupola.	Specific fuel consumption is improved from 0.09 kL/t to 0.07 kL/t.
373	31	MI-ME-31	Cogeneration system directly utilizing waste heat at drying oven	A large gas engine of a high power generation efficiency is adopted, and its waste gas is directly used at the drying oven.	Reduction in crude oil equivalent: 1,469 kL/y

10.Many Industries

[Operation & Management]

374	32	MI-OM-1	Improvement for full recovery of waste heat from steam drain	A plate-type heat exchanger is used to fully recover waste heat from the power-generating boiler.	Reduction in crude oil equivalent: 390 kL/y
375	33	MI-OM-2	Multistage recovery of flash steam	Recovery of flash steam is enhanced by using a multistage cascade system.	Reduction in crude oil equivalent: 132 kL/y
376	34	MI-OM-3	Improvement of drain recovery by plate type heat exchanger	A plate-type heat exchanger is adopted, thereby recovering the drain and feeding it to the pure water unit.	Reduction in crude oil equivalent: 318 kL/y
377	35	MI-OM-4	Improvement of thermal efficiency of dryer for refractory brick	Energy is saved by strengthening heat insulation, and improving the operation method and heat balance.	Reduction in crude oil equivalent: 805 kL/y
378	36	MI-OM-5	Reduction of coke ratio in cupola	Combustion efficiency is improved, thereby reducing coke ratio.	Reduction in crude oil equivalent: 135 kL/y
379	37	MI-OM-6	Improvement of pressure control method for in-house power generation boiler	The detection point of the pressure control of a boiler is changed to the turbine inlet pressure.	Reduction in crude oil equivalent: 273 kL/y
380	38	MI-OM-7	Improvement of efficiency of turbo air compressor	To increase the efficiency, the impeller and the diffuser of a turbo air compressor are improved.	Reduction in crude oil equivalent: 476 kL/y
381	39	MI-OM-8	Improvement of efficiency of melting process by continuous desulfurization	Paralleled production is rationalized, and power is saved by a low-frequency induction furnace.	Reduction in crude oil equivalent: 5.2 kL/y