

7.2. Survey Results in “Energy”

7.2.1. Trends in noteworthy domains

The latest survey introduced topics relating to the outlook of the world in 30 years time. In order to determine future greenhouse gas emissions, IPCC has estimated various annual carbon dioxide emission levels using several scenarios on population and economic growth. Of these estimates, the following three were picked up as typical and used in a survey question: one in which greenhouse gas emissions will increase rapidly, one in which they will decrease, and one midway between them. Asked to provide their own forecasts by choosing one from these three, nearly 80% of respondents chose the intermediate case. Respondents were also asked to name the measure that they thought most effective in tackling global environmental problems (e.g. rising carbon dioxide emissions) from economic measures including regulatory controls, lifestyle changes and other moral measures, and various technological measures. The largest number of respondents, about half, chose economic measures, followed by technical measures, which were slightly ahead of moral measures. Significantly, expectations for technical measures were not as high as one might have hoped. In fact, this was a dismal result, which requires further study and analysis, given that technology was met with such a low level of confidence in a survey aimed at identifying technological topics which had promising developmental prospects or high developmental priority.

Against this backdrop seems to lie a sense of disappointment and powerlessness caused by the inability to find a clear solution in the face of challenges such as a finite supply of fossil fuel resources, rapid economic development in developing countries, diminishment of forests, and advancement in desertification. In this regard, we are very curious about what the results of the survey might have been, if it had been conducted in the United States, Europe and other developed countries, as well as developing countries in Asia.

Global-scale problems, such as the depletion of the ozone layer and diminishment of tropical rain forests, have been included in the questionnaire in the environment field since the previous survey, and, as this fact shows, problems caused by the heavy consumption of fossil fuel energy constitute important topics in the “energy” field. Therefore, the following two areas are discussed in overview below as future areas of attention:

- (1) Introduction of clean energy and natural energy
- (2) Resolution of energy problems on global scale

(1) Introduction of clean energy and natural energy

The Advisory Committee for Energy's recent Long-term Energy Supply-Demand Outlook reports, which have been the cornerstone of the Japanese Government's basic energy policy, have consistently been advocating a greater shift towards nonfossil energy, consisting of nuclear power and new energy sources, while pinning hopes on substantial energy conservation. This stance aims to ensure stability in Japan's energy supply structure by reducing oil dependence, as well as curbing greenhouse gas emissions from the global environmental conservation point of view. Future dependence on nuclear power is envisaged to be particularly high, with the nuclear share of electric power supply in 2010 projected as more than 40%.

Natural energy sources include solar energy, biomass, wind power and geotherm, and expectations for the widespread use of solar cells are high ó so much so that most of the growth in the use of new energy sources projected in the Long-term Energy Supply-Demand Outlook is said to be attributable to solar cells.

The results of the latest survey vividly reflect the present reality and future outlook of energy and environmental problems. Of the 20 topics with high degree of importance index scores in the “energy” field, “nuclear power” accounted for five, including the top three. “Solar cells”, on the other hand, claimed the following three topics: the practical use of high-efficiency large-area solar cells; widespread residential use of solar cells; and practical use of electric vehicles (powered by solar cells). The fact that electric vehicles will likely be carrying secondary batteries and/or fuel cells means that battery-related topics accounted for as many as 8 of the top 20 topics.

Of the remaining topics, the following two belonged to the energy conservation/clean energy

development technology category: “88. Widespread use of energy-efficient houses” and “72. Practical use of high-efficiency gas turbines”. This brings the clean energy/natural energy share of the top 20 topics to 10.

(2) Resolution of energy problems on global scale

Global warming caused by the emission of greenhouse gases such as carbon dioxide is not a problem that can be solved by Japan or any other single country. As the United Nations Framework Convention on Climate Change is ratified across the world, serious efforts are being made to reduce carbon dioxide emissions to 1990 levels.

Against this background, the “resolution of global-scale problems” was by far the greatest expected effect for topics in the “energy” field.

Concrete examples included “46: Practical use of photovoltaic power generation system in desert areas”, “47: MW-class ocean photovoltaic power generation system”, “45: Development of space photovoltaic power generating system” and “53: Practical use of an international energy supply system to transport hydrogen etc.”

Although the scope did not cover the entire world or extend to outer space, expectations for the following were also great: “71: Widespread use of solid-electrolyte fuel cells for district cogeneration and distributed small-scale power generation” and “69: Widespread use of efficient bottoming cycle power generation utilizing low temperature waste heat recovered from turbines etc.”. In this regard, the systems approach towards energy problems is attracting more interest than the development of individual technologies.

Another marked trend with topics in the energy field is the general backward shift of their forecasted realization times from the 5th survey.

It is particularly noteworthy that the “will not be realized” and “do not know” options were chosen relatively frequently in the “energy” field.

Topics that respondents thought would not be realized were “86: Development of antimatter production and storage technology and energy sources based on it”, “59: Development of fusion reactors”, “55: Widespread use of solar hot-water supply systems”, “49: Power generation by ocean thermal energy conversion”, and “44: Production of liquid fuels from carbon dioxide and hydrogen”. This is ironic because they all relate to the introduction of nuclear and natural energy and response to global-scale energy problems ó areas named important in the latest survey.

Topics whose realization times were pushed back include “58. Practical use of fast breeder reactors”, “59: Development of fusion reactors”, “43: Direct coal liquefaction”, “50: Practical use of MW-class wind power generation system”, “56: Practical use of hot dry rock power-generating technologies”, “64: Practical use of thermochemical decomposition hydrogen production”, “68: Widespread use of hydrogen cars”, “70: Practical use of molten salt fuel cells based on coal gas” and “80: Widespread use of power equipment utilizing high-temperature superconductivity, including generators”. These results clearly show that respondents were not very optimistic about the current progress of technological development.

(Kunio Yoshida)

7.2.2. Forecast topic framework

In the course of compiling forecast topics, a framework representing the organization of technologies in tabulated matrix form was drawn up for each field, with objectives and technological domains defining the rows and columns of the table, respectively. The framework is designed to present an overall picture of technological development in each field in terms of future prospects, importance, etc. as seen from the present perspective, and is also used as a working framework for future reviews of forecast topics.

Table 7.2.2-1 Forecast Topic Framework for Energy Field

Domain Objective	Primary energy			Second energy			Energy-related systems (energy conservation, combined-cycle systems, etc.)
	Oil, coal and natural gas	Solar, wind power, ocean energy, biomass and geotherm	Nuclear	Processed energy sources (hydrogen, methanol, etc.)	Electricity	Heat and mechanical energy	
Exploration, recovery and extraction	40 41				69		
Production	42	45 46 47 48 49 50 51 52	58 59 60	64 65	70 71 72 73 74		86
Storage and transportation		53			75 76 77 78 79		
Utilization	43	54 55 56	61	66 67 68	80 81 82 83	84	87 88
Environmental measures/safety (recovery and disposal)	44	57	62 63			85	

* Figures appearing in the table represent topic numbers.

7.2.3. Topics with high degree of importance

Degree of importance index scores (Note 1) averaged at 60.2 for topics in the energy field as a whole. Topics considered of particular importance to Japan (top 20 topics in terms of degree of importance index score) are listed in the table below. In this field, 63. Practical use of technology for the safe disposal of highly radioactive solid waste was rated most important (89 points). The top 20 topics included six which were forecasted to be realized in or after 2021.

Table 7.2.3-1 Top 20 Topics in Terms of Degree of Importance Index

Topic	Degree of importance index	Forecasted realization time (year)
63 <u>Practical use</u> of technology for the safe disposal of highly radioactives solid waste.	89	2019
58 <u>Practical use</u> of fast breeder reactor systems <u>including nuclear fuel cycle</u> .	80	2025
59 <u>Development</u> of fusion reactors.	80	2026 or later
81 <u>Widespread use</u> of electric vehicles with driving performance <u>equal to that of gasoline motorcars</u> .	79	2013
88 <u>Widespread use</u> of energy-efficient houses that consume less than half as much power for air conditioning as the current average house.	78	2012
62 <u>Practical use</u> of sophisticated reprocessing technologies capable of group separation. *The separation of nuclides from high-level radioactive wastes according to half-life or the like (e.g., the separation of TRU elements, ¹³⁷ Cs, ⁹⁰ Sr, and elements of the platinum group).	77	2022
48 <u>Practical use</u> of large-area thin-film solar cells with a cell conversion factor <u>over 20%</u> .	77	2013
74 <u>Widespread use</u> of high energy density (200 Wh/kg: 5 times the energy density of a conventional lead acid battery) secondary batteries (Ni-MH, Li, etc.).	71	2010
54 <u>Widespread use</u> of solar cells for residential power supply.	71	2010

Topic	Degree of importance index	Forecasted realization time (year)
72 <u>Practical use</u> of large-scale combined-cycle power generation using high-efficient gas turbines (inlet temperature over 1,500°C).	69	2010
40 <u>Practical use</u> of methane hydrate mining.	69	2019
53 <u>Practical use</u> of an <u>international</u> energy supply system in which energy recovered from clean energy sources is transported after being converted into transportable forms, such as hydrogen.	68	2023
76 <u>Practical use</u> of electric power storage equipment using secondary batteries for load leveling.	67	2014
83 <u>Practical use</u> of electric vehicles powered by fuel cells and secondary batteries.	66	2013
42 <u>Practical use</u> of power generation by coal gasification.	66	2011
82 <u>Practical use</u> of electric vehicles powered by solar cells and secondary batteries.	65	2013
87 <u>Realization</u> of <u>heat</u> industrial complexes aiming at the rationalized utilization of energy.	64	2015
60 <u>Development</u> of high-safety small to medium-scale nuclear reactors designed for cogeneration of heat and power.	62	2022
77 <u>Practical use</u> of power networks utilizing superconducting cables.	61	2025
70 <u>Practical use</u> of molten salt fuel-cell power generation with <u>the 200,000 to 300,000 MW class</u> , using coal gas.	61	2017

Note 1: Degree of importance index = (number of “high” responses × 100 + number of “medium” responses × 50 + number of “low” responses × 25 + number of “unnecessary” responses × 0) ÷ total number of degree of importance responses

7.2.4. Forecasted realization times

Forecasted realization times were distributed as shown in the diagram below.

Compared to the general trend covering all topics, forecasted realization times tend to lie in a more distant future, with the peak of their distribution located between 2016 and 2020. This tendency is characteristic to this field, and can be seen in the results of the 5th Survey as well.

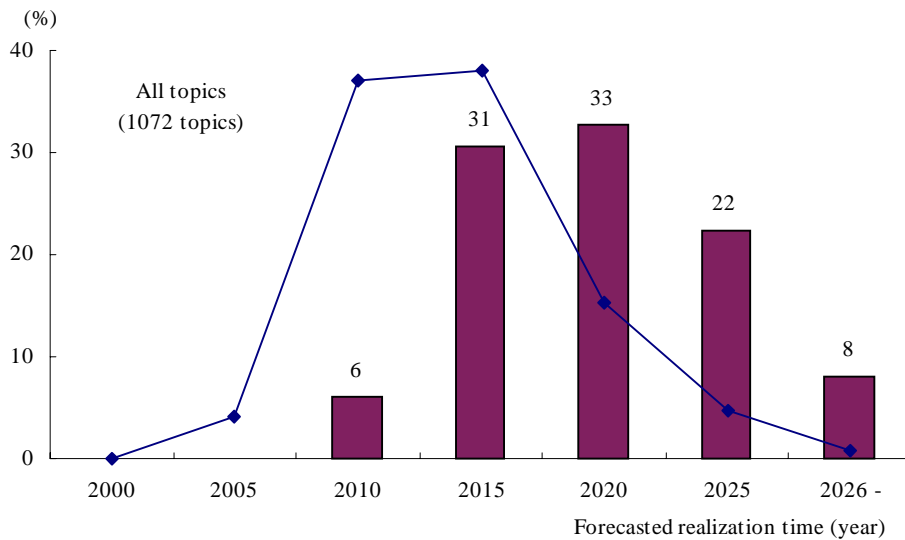


Fig. 7.2.4-1 Trends in Forecasted Realization Times

7.2.5. Current leading countries etc.

Responses to the question concerning current leading countries etc. were as shown in the diagram below. Japan was named by the greatest number of respondents, followed by the U.S., the EU and the former Soviet Union/Eastern Europe in that order.

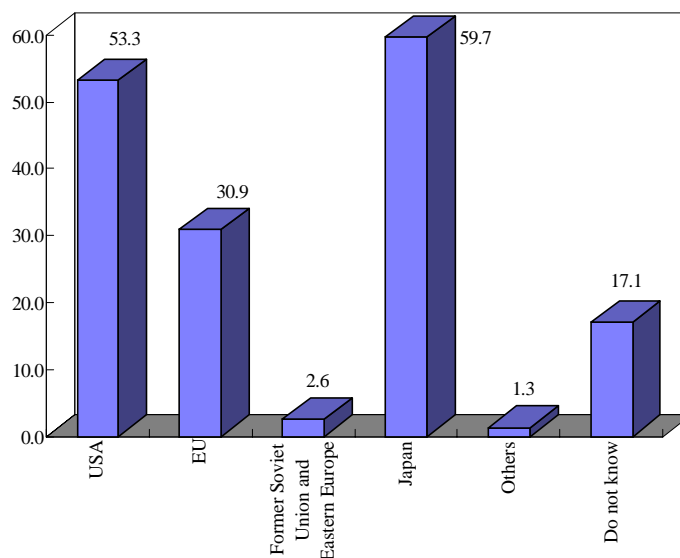


Fig. 7.2.5-1 Current Leading Countries etc. (%)

7.2.6. Comparison with the 5th Survey (previous survey)

Of the 49 topics included in the latest survey, 28 (57%) were identical to the previous survey, 6 (12%) were modified, and 15 (31%) were newly introduced. For identical topics, the results of the latest survey were compared with those of the previous survey in terms of degree of importance index scores and forecasted realization times, as shown in the table below.

Degree of importance index scores rose for 6 topics, fell for 20 topics and remained the same for 2 topics. 44. Practical use of production of liquid fuels such as methanol from carbon dioxide recovered from flue gas and hydrogen saw the greatest drop, down 17, while 53. Practical use of an international energy supply system in which energy recovered from clean energy sources is transported after being converted into hydrogen etc. saw the greatest drop, up 9 points.

From the 4th to the 5th Survey, forecasted realization times were pushed back for all topics. Likewise, from the 5th to the 6th Survey, all 29 topics saw their forecasted realization times pushed further into the future. As many as 7 topics saw their forecasted realization times pushed back 10 or more years, including 149. Practical use of power generation by ocean thermal energy conversion (12 years).

Table 7.2.6-1 Comparison with 5th Survey for Identical Topics

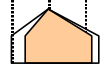
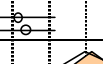
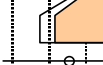
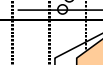
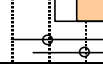

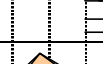
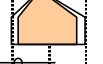
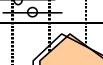
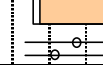

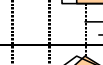
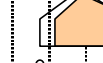

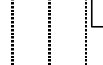

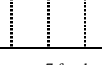
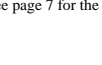

Topic	Degree of importance index/forecasted realization time (year)	
	6th survey	5th survey
43 <u>Practical use</u> of direct coal liquefaction.	56/2017	69/2007
44 <u>Practical use</u> of production of liquid fuels such as methanol from carbon dioxide recovered from flue gases of large boilers at thermal power plants etc., by use of hydrogen.	54/2019	71/2008
45 <u>Development</u> of space photovoltaic power generating system.	53/2026 or later	52/2017
48 <u>Practical use</u> of large-area thin-film solar cells with a cell conversion factor <u>over 20%</u> .	77/2013	84/2004
49 <u>Practical use</u> of power generation by ocean thermal energy conversion.	41/2020	42/2008
50 <u>Practical use</u> of MW-class wind power generation system in Japan.	44/2011	39/2004
53 <u>Practical use</u> of an <u>international</u> energy supply system in which energy recovered from clean energy sources is transported after being converted into transportable forms, such as hydrogen.	68/2023	59/2013
54 <u>Widespread use</u> of solar cells for residential power supply.	71/2010	73/2007
56 <u>Practical use</u> of hot dry rock power-generating technologies.	50/2021	50/2011
57 <u>Widespread use</u> of technologies that make it possible to treat and reuse wastes and to obtain energies such as methane at low cost using biotechnology.	57/2016	60/2007
58 <u>Practical use</u> of fast breeder reactor systems <u>including nuclear fuel cycle</u> .	80/2025	85/2017
59 <u>Development</u> of fusion reactors.	80/2026 or later	89/2020 or later
61 <u>Realization</u> of nuclear power facilities (reactors, nuclear fuel cycle facilities) with a high degree of full automation by application of remote monitoring and robot system.	60/2019	70/2009
62 <u>Practical use</u> of sophisticated reprocessing technologies capable of group separation. *The separation of nuclides from high-level radioactive wastes according to half-life or the like (e.g., the separation of TRU elements, ¹³⁷ Cs, ⁹⁰ Sr, and elements of the platinum group).	77/2022	83/2014
63 <u>Practical use</u> of technology for the safe disposal of highly radioactives solid waste.	89/2019	92/2009
64 <u>Practical use</u> of thermochemical decomposition processes for hydrogen production.	59/2019	64/2010
65 <u>Practical use</u> of production methane and methanol from <u>coal and biomass</u> by use of hydrogen obtained from non-fossil sources.	55/2018	55/2012
66 <u>Widespread use</u> of fuel cells using as highly efficient, <u>environmentally safe</u> , and portable power sources, e.g., for electric vehicles.	60/2015	63/2006
68 <u>Widespread use</u> of hydrogen cars.	56/2021	55/2013

Topic	Degree of importance index/forecasted realization time (year)	
	6th survey	5th survey
69 <u>Widespread use</u> of efficient bottoming cycle power generation utilizing low temperature waste heat recovered from turbine or factor (e.g. kalina cycle).	56/2014	57/2008
70 <u>Practical use</u> of molten salt fuel-cell power generation with <u>the 200,000 to 300,000 MW class</u> , using coal gas.	61/2017	62/2010
72 <u>Practical use</u> of large-scale combined-cycle power generation using high-efficient gas turbines (inlet temperature over 1,500°C).	69/2010	78/2006
75 <u>Practical use</u> of superconductive energy storage systems with a capacity (1000 MWh) as large as that of pumped hydro storage.	60/2024	69/2019
76 <u>Practical use</u> of electric power storage equipment using secondary batteries for load leveling.	67/2014	65/2007
78 <u>Practical use</u> of DC power transmission in the <u>1,000 KV class</u> .	55/2015	61/2008
80 <u>Widespread use</u> of power equipments utilizing high-temperature superconductivity, including generators in industry.	56/2022	66/2013
81 <u>Widespread use</u> of electric vehicles with driving performance <u>equal to that of gasoline motorcars</u> .	79/2013	76/2008
86 <u>Development</u> of antimatter production and storage technology and energy sources based on it.	45/2026 or later	47/2020 or later

Note: Up until the 5th Survey, realization meant realization in Japan unless otherwise specified. However, this was changed to mean realization somewhere in the world in the 6th Survey. Therefore, care should be taken when comparing forecasted realization times from the two surveys.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)										
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	Will not be realized (%)		Do not know (%)		USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries		Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects			
					2001	2006	2011	2016	2021	2026	2001	2006	2011	2016	2021	2026	2001	2006	2011	2016	2021	2026	2001	2006	2011	2016	2021	2026	2001	2006	2011	2016	2021	2026	2001	2006	2011	2016	2021	2026	2001
Oil, coal and natural gas	40	Practical use of methane hydrate mining.	1	161	9	19	71	69	44	42	13	1	33	92	2	7		4	8	50	17	18	22	2	29	50	42	14	2	63	6	4	60	9	3	3					
			2	134	10	19	72	69	43	49	9	0	34	93	2	4		3	6	59	10	14	22	2	24	53	43	12	1	72	2	2	65	8	1	1					
			X	13	100	0	0	92	85	15	0	0	62	92	0	0		0	0	69	8	46	31	0	0	62	62	15	0	85	8	15	54	8	0	0					
	41	Practical use of large-scale underground coal gasification.	1	186	7	28	65	47	20	35	37	8	31	90	6	6		16	12	51	22	18	20	3	24	44	35	14	1	44	6	6	60	25	1	1					
			2	159	7	27	66	45	15	40	39	6	28	89	4	2		16	10	58	23	11	16	3	25	52	37	9	3	54	4	5	71	22	1	1					
			X	11	100	0	0	57	27	45	27	0	36	82	18	0		18	18	64	27	36	27	0	0	73	36	9	0	64	0	0	55	18	0	0					
	42	Practical use of power generation by coal gasification.	1	262	14	29	58	64	38	44	16	2	40	91	5	4		3	7	51	42	8	56	2	14	34	47	18	2	59	8	3	46	11	3	2					
			2	223	14	26	60	66	37	53	9	1	39	89	4	1		1	6	52	42	4	60	0	12	34	52	13	1	68	6	2	53	10	1	1					
			X	31	100	0	0	95	90	10	0	0	71	84	13	0		0	0	74	68	3	68	3	0	42	58	19	3	84	16	0	26	13	0	3					
	43	Practical use of direct coal liquefaction.	1	235	12	21	67	55	25	50	21	4	35	88	6	5		10	11	52	34	9	54	6	15	43	42	17	2	58	4	4	39	9	2	4					
			2	197	10	22	68	56	23	58	17	3	32	86	4	3		10	9	55	30	3	59	6	14	43	47	12	1	67	3	3	44	7	1	3					
			X	20	100	0	0	69	45	40	15	0	40	80	5	5		25	0	65	25	0	85	5	5	50	50	20	5	55	0	10	35	5	5	5					
	44	Practical use of production of liquid fuels such as methanol from carbon dioxide recovered from flue gases of large boilers at thermal power plants etc., by use of hydrogen.	1	254	15	22	63	54	30	36	25	9	30	90	4	4		18	13	32	23	3	51	2	27	40	41	17	2	50	6	2	29	9	2	4					
			2	217	14	22	64	54	25	46	24	5	27	91	2	3		18	9	31	20	2	57	1	28	42	41	14	1	59	5	3	32	7	1	2					
			X	30	100	0	0	58	33	37	27	3	40	80	0	3		27	7	27	13	0	87	3	10	37	53	17	0	47	0	3	20	3	3	3					
Solar, wind power, ocean energy, biomass and geotherm	45	Development of space photovoltaic power generating system.	1	272	10	22	68	54	29	35	28	7	41	90	3	12		16	16	73	13	10	32	0	16	47	35	18	1	56	4	5	46	19	6	5					
			2	225	10	24	66	53	25	42	27	6	36	90	2	10		17	12	77	8	6	30	0	14	53	35	14	1	64	3	5	52	20	4	2					
			X	22	100	0	0	66	45	36	9	9	59	86	0	14		18	0	91	14	9	59	0	5	55	45	23	0	82	0	0	68	32	0	0					
	46	Practical use of 100 MW-capacity photovoltaic power generation system in desert areas.	1	304	14	28	58	43	16	35	38	11	41	94	8	6		6	8	65	29	3	54	2	13	36	38	14	1	53	8	7	38	6	4	5					
			2	259	14	27	59	41	12	38	40	10	37	95	3	2		5	6	70	24	1	58	2	12	42	44	8	1	61	6	5	47	3	3	2					
			X	36	100	0	0	60	33	47	11	8	53	97	3	6		3	8	86	39	0	83	6	0	50	64	8	0	75	3	6	47	0	8	3					
	47	Practical use of MW-class ocean photovoltaic power generation system.	1	283	14	28	58	55	27	44	23	5	41	90	8	4		10	12	42	21	2	57	0	23	33	40	14	1	57	10	4	48	7	2	4					
			2	245	13	28	58	53	22	50	24	5	38	93	4	3		12	8	48	18	0	65	0	21	37	46	9	1	70	8	4	58	5	2	2					
			X	33	100	0	0	57	30	39	27	3	48	91	3	6		9	3	67	21	0	94	3	0	36	67	6	0	85	6	6	64	3	0	6					
	48	Practical use of large-area thin-film solar cells with a cell conversion factor over 20%.	1	284	17	28	56	75	53	39	6	1	54	95	13	11		2	5	61	30	1	85	1	7	48	47	24	1	67	9	1	24	5	3	4					
			2	245	16	25	60	77	57	37	5	1	54	92	10	6		2	4	56	22	0	86	1	7	53	49	18	0	74	8	1	32	4	1	1					
			X	38	100	0	0	92	84	16	0	0	68	95	5	8		3	0	79	34	0	97	5	0	66	55	24	0	89	3	3	21	5	3	0					
49	Practical use of power generation by ocean thermal energy conversion.	1	262	5	21	74	41	12	36	44	8	31	90	5	4		22	14	37	18	1	47	0	26	39	32	15	2	47	8	5	46	3	2	4						
		2	230	5	22	73	41	10	39	46	5	27	92	3	2		24	9	40	13	0	56	0	25	43	34	9	1	59	6	3	57	2	1	2						
		X	12	100	0	0	52	33	17	42	8	33	83	0	0		17	0	50	33	0	100	0	0	67	67	25	0	83	0	0	67	0	0	0						

(Note) See page 7 for the interpretation of the graphs.

Division Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)								
				High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	Forecasted realization time						USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
				2001	2006	2011	2016	2021	2026	Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects										
Solar, wind power, ocean energy, biomass and geotherm	50 Practical use of MW-class wind power generation system in Japan.	1	284	8	23	69	46	19	34	41	6	27	89	7	2		17	12	74	45	2	36	0	7	29	32	14	3	48	21	5	46	12	2	5			
		2	245	9	22	69	44	16	35	44	5	23	93	5	2		16	8	76	44	1	34	0	8	30	36	8	2	59	20	3	52	9	2	4			
		X	22	100	0	0	73	55	32	9	5	36	95	5	5		0	5	82	68	0	45	0	0	41	45	5	5	73	27	0	68	9	5	9			
	51 Widespread use of high-efficient energy production processes using biomass as raw material.	1	230	7	23	70	50	22	39	33	5	39	92	6	7		13	10	49	34	3	28	6	26	47	38	17	12	49	8	4	47	5	7	4			
		2	199	8	22	71	48	16	48	33	4	33	91	6	4		13	8	56	36	3	27	5	22	54	42	11	10	53	6	4	57	4	4	2			
		X	15	100	0	0	73	53	33	13	0	60	93	13	0		7	0	80	80	7	40	0	0	60	60	20	0	60	0	7	73	0	0	7			
	52 Practical use of energy plantation.	1	167	8	19	73	48	17	43	36	4	39	90	10	5		11	14	47	25	1	22	4	29	38	42	11	11	43	7	5	44	8	4	5			
		2	147	10	16	75	43	8	53	34	4	33	93	6	1		13	7	54	26	0	22	4	28	42	50	10	6	52	7	3	55	6	1	1			
		X	14	100	0	0	59	29	50	21	0	43	93	14	0		14	0	71	36	0	36	7	7	36	57	7	0	57	7	14	64	0	0	0			
	53 Practical use of an international energy supply system in which energy recovered from clean energy sources is transported after being converted into transportable forms, such as hydrogen.	1	279	14	28	58	67	44	38	14	3	51	94	5	6		10	14	46	38	3	46	1	24	44	43	18	3	53	13	2	27	27	4	3			
		2	247	12	30	58	68	44	43	11	2	46	94	3	2		11	11	50	37	0	53	1	23	52	45	13	1	63	11	2	30	32	2	3			
		X	30	100	0	0	87	77	20	0	3	47	100	3	7		7	0	57	60	0	80	3	3	50	47	27	0	73	10	7	40	27	3	3			
	54 Widespread use of solar cells for residential power supply.	1	354	18	30	52	70	48	36	15	1	50	90	34	2		3	6	47	39	1	76	1	10	22	35	12	2	47	47	10	19	14	7	5			
		2	298	18	30	52	71	48	41	10	1	46	90	29	1		2	3	50	38	0	83	1	6	18	41	7	1	55	54	6	22	12	3	4			
		X	55	100	0	0	83	70	22	7	0	55	98	27	0		0	0	60	64	0	91	2	0	20	40	7	2	53	55	11	27	18	2	4			
55 Widespread use of solar hot-water supply systems in most Japanese households (current rate 20%).	1	334	12	23	64	56	28	41	29	2	28	82	37	1		24	12	18	15	1	69	2	17	12	25	7	2	29	32	10	15	8	4	6				
	2	290	11	22	67	53	21	51	27	1	21	84	36	0		24	8	18	12	0	81	2	12	11	28	3	1	33	41	8	16	6	2	4				
	X	32	100	0	0	81	68	19	13	0	31	97	41	0		13	3	28	28	0	94	9	0	19	44	6	0	50	44	13	34	9	3	13				
56 Practical use of hot dry rock power-generating technologies.	1	210	7	22	71	51	21	43	33	3	22	90	4	6		9	13	42	21	4	56	2	20	33	36	14	1	58	14	0	60	10	0	1				
	2	176	6	27	68	50	18	45	36	1	19	94	2	5		7	7	50	27	2	64	2	17	39	43	7	0	67	9	1	69	8	0	0				
	X	10	100	0	0	73	50	40	10	0	30	100	0	0		20	0	70	40	0	70	0	0	40	70	0	0	70	0	0	90	20	0	0				
57 Widespread use of technologies that make it possible to treat and reuse wastes and to obtain energies such as methane at low cost using biotechnology.	1	248	8	21	71	59	28	55	16	2	40	90	22	4		6	9	30	33	0	41	2	29	39	39	13	10	49	19	2	33	8	7	3				
	2	215	7	18	74	57	22	64	13	1	35	93	19	2		3	6	33	37	0	50	1	26	45	47	5	5	58	16	1	39	8	4	0				
	X	16	100	0	0	72	44	56	0	0	44	94	13	0		0	0	50	56	0	75	0	0	50	44	0	6	56	38	0	50	6	0	0				
Nuclear	58 Practical use of fast breeder reactor systems including nuclear fuel cycle.	1	230	17	24	60	76	62	22	10	6	34	91	7	12		16	14	27	60	17	77	1	6	45	40	22	2	58	10	8	41	43	15	3			
		2	191	17	21	62	80	69	18	7	5	36	89	5	7		16	8	24	71	12	80	1	5	51	42	17	1	68	8	8	47	55	10	2			
		X	33	100	0	0	95	91	6	3	0	42	91	9	12		3	3	9	73	36	97	3	0	67	58	12	0	82	9	9	30	33	9	6			
	59 Development of fusion reactors.	1	217	15	25	59	73	58	23	13	6	38	91	6	23		25	19	71	61	27	66	1	11	47	32	23	3	58	3	6	39	33	12	1			
		2	183	13	29	58	80	67	20	9	4	37	91	3	14		28	17	79	64	17	75	0	8	61	34	21	2	67	2	6	44	45	8	0			
X	23	100	0	0	89	82	9	9	0	61	87	9	30		22	9	83	83	26	96	0	4	65	48	22	9	74	0	17	30	39	13	0					

(Note) See page 7 for the interpretation of the graphs.

Division Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)						
				High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	Will not be realized (%)		Do not know (%)		USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
				2001	2006	2011	2016	2021	2026	1	2	X	1	2	X	1	2	X	1	2	X	1	2	X	1	2	X	1	2	X	1	2	X	1	2	X
Nuclear	60 Development of high-safety small to medium-scale nuclear reactors designed for cogeneration of heat and power.	1	195	16	23	61	61	37	38	20	5	37	89	10	6		14	13	39	38	17	39	3	24	36	30	19	2	45	18	5	39	35	15	3	
		2	167	17	20	63	62	37	42	16	5	33	89	8	3		15	7	50	49	11	53	3	17	43	34	13	0	56	19	5	46	50	9	2	
		X	28	100	0	0	75	56	33	11	0	32	82	11	7		4	0	50	54	36	71	4	4	43	39	14	0	79	25	11	43	43	4	11	
	61 Realization of nuclear power facilities (reactors, nuclear fuel cycle facilities) with a high degree of full automation by application of remote monitoring and robot system.	1	174	11	20	69	58	33	39	21	7	38	67	20	7		12	11	40	33	3	58	0	23	30	43	21	2	46	13	3	24	40	10	2	
		2	147	11	19	70	60	32	48	17	3	35	77	18	4		10	8	47	34	1	65	1	19	33	50	17	1	55	13	2	24	47	9	1	
		X	16	100	0	0	69	44	44	13	0	44	75	13	6		19	0	56	63	6	69	0	13	19	63	19	0	50	25	0	44	44	6	0	
	62 Practical use of sophisticated reprocessing technologies capable of group separation. *The separation of nuclides from high-level radioactive wastes according to half-life or the like (e.g., the separation of TRU elements, ¹³⁷ Cs, ⁹⁰ Sr, and elements of the platinum group).	1	131	19	24	57	72	53	32	12	3	30	84	11	13		8	15	41	49	11	56	1	18	51	43	23	4	60	6	3	39	30	11	1	
		2	109	18	19	62	77	60	30	8	2	25	92	6	7		8	11	44	57	8	69	1	15	52	41	20	4	70	6	3	44	34	10	1	
		X	20	100	0	0	88	79	16	5	0	20	85	5	5		15	0	45	85	15	85	0	5	65	45	35	5	80	10	0	40	30	5	5	
	63 Practical use of technology for the safe disposal of highly radioactives solid waste.	1	185	15	28	57	83	69	27	3	1	24	88	17	5		5	9	58	69	8	58	2	14	42	46	28	1	55	18	4	49	34	15	2	
		2	151	15	27	58	89	80	17	2	1	19	95	12	3		6	5	62	71	3	63	2	11	45	49	22	1	66	15	3	54	37	9	3	
		X	23	100	0	0	91	83	17	0	0	13	87	13	4		0	4	83	91	0	78	4	4	61	39	35	0	74	17	9	48	26	13	4	
Processed energy sources (hydrogen, methanol, etc.)	64 Practical use of thermochemical decomposition processes for hydrogen production.	1	197	11	26	63	60	34	42	21	3	38	90	4	9		9	15	45	30	4	51	1	22	46	44	17	2	52	8	3	24	16	2	5	
		2	166	13	25	62	59	30	50	16	4	33	89	1	5		10	11	51	28	1	55	0	20	49	43	13	2	58	5	2	27	16	1	3	
		X	21	100	0	0	71	52	38	0	10	48	81	0	10		10	5	43	14	0	90	0	0	57	48	19	5	67	5	0	29	24	0	5	
	65 Practical use of production methane and methanol from coal and biomass by use of hydrogen obtained from non-fossil sources.	1	197	13	29	58	57	28	47	22	3	34	92	5	5		9	13	45	31	4	47	1	25	46	46	15	4	50	8	2	28	9	2	4	
		2	170	14	28	59	55	23	50	26	1	28	95	2	4		8	8	55	29	0	53	1	21	48	51	7	2	60	7	2	34	8	0	2	
		X	23	100	0	0	68	45	36	18	0	39	87	0	13		4	0	57	30	0	70	4	9	43	48	17	4	57	9	9	35	17	0	9	
	66 Widespread use of fuel cells using as highly efficient, environmentally safe, and portable power sources, e.g., for electric vehicles.	1	247	15	22	63	61	31	50	18	1	43	89	23	4		6	9	57	29	0	55	2	18	40	43	13	1	52	23	2	27	18	4	4	
		2	207	15	20	64	60	28	56	15	0	42	91	15	2		5	7	66	27	0	63	3	14	39	46	6	0	61	23	2	31	16	2	2	
		X	32	100	0	0	77	58	35	6	0	50	88	28	6		6	0	84	38	0	81	6	3	41	53	19	0	69	31	3	34	22	3	3	
	67 Widespread use of methanol as fuel.	1	248	11	25	64	53	20	53	26	1	33	88	11	2		8	12	44	26	2	37	14	23	31	36	9	2	34	29	4	28	15	2	4	
		2	211	11	21	68	52	16	61	21	1	30	92	7	1		7	8	54	26	0	41	15	19	29	41	6	1	44	31	4	33	14	1	1	
		X	23	100	0	0	69	45	41	14	0	26	96	0	4		4	0	78	22	0	52	22	4	26	39	17	0	39	43	9	30	17	4	0	
68 Widespread use of hydrogen cars.	1	264	9	19	72	54	26	42	29	3	41	87	16	4		11	17	40	34	0	44	1	28	39	41	14	2	45	28	3	21	31	3	2		
	2	224	10	15	75	56	26	47	24	3	38	92	10	3		11	11	49	37	0	57	1	23	38	44	9	0	53	28	2	18	37	0	1		
	X	22	100	0	0	71	52	29	19	0	32	100	9	5		9	0	55	68	0	77	0	0	36	45	18	0	55	27	0	23	36	0	0		
Electricity	69 Widespread use of efficient bottoming cycle power generation utilizing low temperature waste heat recovered from turbine or factor (e.g. kalina cycle).	1	180	9	29	62	58	27	53	19	1	33	90	7	3		4	8	39	30	2	48	0	24	34	41	14	2	44	18	2	26	11	1	3	
		2	161	9	28	63	56	19	69	13	0	29	94	3	2		2	6	42	32	2	61	0	22	34	44	11	1	57	17	1	29	7	0	2	
		X	14	100	0	0	73	50	43	7	0	29	93	0	7		7	0	57	43	0	100	0	0	36	43	14	0	57	21	0	29	0	0	0	

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)								
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources							USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					2001	2006	2011	2016	2021	2026	Will not be realized (%)	Do not know (%)																											
Electricity	70	Practical use of molten salt fuel-cell power generation with the 200,000 to 300,000 KW class, using coal gas.	1	197	19	25	56	62	34	47	17	2	34	92	6	6		6	13	62	18	2	64	0	15	41	46	13	2	59	15	3	23	12	1	3			
			2	179	17	22	61	61	30	56	13	2	32	93	3	3		7	11	68	14	0	72	0	12	45	52	10	1	66	12	3	30	9	0	2			
			X	31	100	0	0	77	61	29	6	3	23	94	3	3		10	6	87	19	0	94	0	0	39	48	16	0	81	19	6	23	13	0	0			
	71	Widespread use of solid-electrolyte fuel cells with tens of MW for district cogeneration and diversified small-scale power generation.	1	232	16	29	55	63	33	53	13	0	48	93	14	6		3	9	64	23	1	63	0	14	39	46	17	1	53	25	3	16	14	4	4			
			2	203	16	25	60	60	25	66	9	1	45	94	8	4		3	9	71	22	0	68	0	12	40	52	9	0	63	24	2	22	14	1	2			
			X	32	100	0	0	71	50	41	3	6	38	91	13	9		6	6	94	34	0	72	0	0	53	41	13	0	78	16	6	13	16	3	0			
	72	Practical use of large-scale combined-cycle power generation using high-efficient gas turbines (inlet temperature over 1,500°C).	1	228	14	32	54	70	44	48	8	0	43	91	5	3		2	9	64	32	2	69	0	13	31	44	22	2	51	10	4	19	11	0	3			
			2	196	15	29	56	69	41	55	5	0	42	92	3	1		2	5	72	30	1	79	0	7	32	52	21	2	60	9	2	22	10	0	2			
			X	30	100	0	0	92	83	17	0	0	50	97	7	3		3	0	77	30	3	83	0	0	20	57	27	0	53	3	3	27	27	0	3			
	73	Practical use of hydrogen-fueled turbines for power generation.	1	166	13	23	64	58	27	54	17	2	37	89	4	5		7	17	47	25	1	45	0	27	43	40	24	3	53	8	3	19	27	2	1			
			2	147	14	20	66	56	21	62	14	2	28	93	1	3		6	14	54	27	1	53	0	22	47	48	21	1	60	6	1	20	27	1	1			
			X	20	100	0	0	76	60	30	5	5	35	95	10	5		10	5	55	40	5	95	0	0	40	60	40	0	65	10	0	30	20	0	0			
74	Widespread use of high energy density (200 Wh/kg: 5 times the energy density of a conventional lead acid battery) secondary batteries (Ni-MH, Li, etc.).	1	201	16	26	58	70	44	48	8	0	59	77	30	5		1	4	58	23	1	79	0	12	44	49	14	3	54	11	1	25	18	3	2				
		2	166	16	25	58	71	44	51	5	0	61	80	17	2		1	2	59	19	0	82	0	11	45	63	9	1	60	9	2	29	16	0	1				
		X	27	100	0	0	91	81	19	0	0	74	93	30	4		0	4	67	19	0	100	0	0	48	70	7	4	52	19	4	30	30	0	0				
75	Practical use of superconductive energy storage systems with a capacity (1000 MWh) as large as that of pumped hydro storage.	1	193	9	22	68	62	37	43	16	4	42	84	4	10		12	17	54	20	2	59	0	21	42	44	24	3	58	7	3	26	23	2	2				
		2	165	10	24	67	60	30	52	15	2	38	88	1	7		13	13	59	18	2	63	0	18	47	47	19	0	66	7	1	30	25	1	1				
		X	16	100	0	0	77	53	47	0	0	44	94	0	0		13	13	75	6	0	88	0	0	38	56	25	0	81	6	0	38	13	6	6				
76	Practical use of electric power storage equipment using secondary batteries for load leveling.	1	212	15	28	57	65	37	52	10	1	40	85	12	3		2	8	46	24	1	67	0	19	28	44	17	1	49	19	2	16	18	3	2				
		2	178	16	27	57	67	37	56	6	1	39	90	7	2		3	4	51	24	0	76	0	14	32	52	8	1	60	17	3	16	20	0	1				
		X	29	100	0	0	83	67	33	0	0	45	93	3	3		3	0	59	21	0	93	0	0	38	45	7	0	52	31	3	24	17	0	3				
77	Practical use of power networks utilizing superconducting cables.	1	181	9	24	66	62	36	42	18	3	48	81	6	12		17	15	55	28	2	57	1	22	34	40	21	3	50	8	2	17	18	3	3				
		2	157	8	24	68	61	32	51	14	3	49	87	4	6		15	9	60	26	0	68	0	18	32	46	16	1	61	6	3	24	23	1	1				
		X	13	100	0	0	87	77	15	8	0	62	92	0	0		8	15	92	46	0	92	0	0	54	46	15	0	77	23	8	23	31	0	8				
78	Practical use of DC power transmission in the 1,000 KV class.	1	143	12	24	64	57	26	53	18	3	39	73	4	3		2	13	43	28	13	50	1	22	29	38	19	2	45	8	4	24	20	0	3				
		2	125	12	24	64	55	20	62	17	2	33	81	5	0		1	9	48	23	10	60	2	19	27	45	12	2	55	10	4	26	23	0	1				
		X	15	100	0	0	67	40	47	13	0	33	93	0	0		0	0	53	47	27	67	7	0	33	20	13	0	47	7	7	33	13	0	0				
79	Practical use of electricity storage using hydrogen produced by electrolysis.	1	205	10	24	66	56	28	43	27	3	40	84	6	5		9	11	42	30	3	44	1	30	35	39	16	2	47	15	2	14	30	2	3				
		2	176	9	26	65	56	25	51	22	2	35	89	3	3		10	9	49	30	1	55	1	27	38	48	11	2	56	13	2	15	36	1	2				
		X	16	100	0	0	63	44	25	25	6	31	94	0	0		19	0	75	44	0	81	0	6	44	50	13	6	63	19	0	25	25	0	0				

(Note) See page 7 for the interpretation of the graphs.

Division Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)						
				High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	Will not be realized (%)		Do not know (%)		USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
				2001	2006	2011	2016	2021	2026	9	18	56	30	4	66	0	18	45	38	18	3	57	3	3	13	16	3	2								
Electricity	80 Widespread use of power equipments utilizing high-temperature superconductivity, including generators in industry.	1	193	8	20	72	59	29	51	18	2	60	70	8	13		9	18	56	30	4	66	0	18	45	38	18	3	57	3	3	13	16	3	2	
		2	163	8	20	72	56	21	62	15	2	59	80	4	7		10	14	64	28	2	72	0	15	51	42	16	2	69	1	1	13	21	1	0	
		X	13	100	0	0	75	54	38	8	0	62	92	0	8		8	15	92	31	0	100	0	0	54	69	31	8	85	0	0	15	15	0	0	
	81 Widespread use of electric vehicles with driving performance equal to that of gasoline motorcars.	1	306	12	21	68	74	53	41	6	1	60	89	38	4		4	7	70	43	0	74	0	9	31	49	14	1	49	35	4	21	12	8	5	
		2	254	11	20	69	79	60	36	4	0	57	89	32	2		5	5	74	40	0	83	0	4	28	57	11	0	58	37	3	23	12	4	2	
		X	28	100	0	0	84	71	21	7	0	64	96	39	4		11	0	93	46	0	100	0	0	29	61	18	0	71	46	0	36	14	7	4	
	82 Practical use of electric vehicles powered by solar cells and secondary batteries.	1	293	14	24	63	65	40	42	16	2	51	89	29	3		7	10	63	37	1	69	0	13	31	47	15	1	45	29	2	20	13	6	5	
		2	249	13	23	64	65	38	47	13	2	49	88	22	2		4	7	73	35	0	82	1	6	33	53	10	0	57	30	2	24	12	2	2	
		X	33	100	0	0	69	45	39	15	0	61	94	33	3		6	0	88	48	0	100	0	0	33	48	6	0	76	45	0	33	15	6	3	
	83 Practical use of electric vehicles powered by fuel cells and secondary batteries.	1	269	16	21	63	66	40	44	15	2	55	88	26	3		5	11	67	36	0	60	0	14	35	43	13	1	45	29	3	20	17	5	4	
		2	235	14	20	66	66	38	52	10	1	51	91	20	0		4	8	73	36	0	71	0	10	37	53	8	0	59	30	3	23	18	2	3	
		X	34	100	0	0	72	50	38	12	0	53	94	29	0		6	0	88	56	0	82	0	3	35	53	12	0	76	41	3	21	24	3	3	
Heat and mechanical energy	84 Widespread use of household solid polymer electrolyte fuel cells for cogeneration.	1	204	18	21	62	53	24	44	30	2	43	78	31	5		11	12	51	21	0	55	3	21	33	35	14	1	47	28	1	15	17	6	3	
		2	181	17	18	65	51	19	49	30	2	42	85	26	3		8	9	59	20	0	70	2	16	39	51	10	0	61	28	2	18	18	3	2	
		X	31	100	0	0	65	39	45	16	0	48	90	23	3		16	6	87	39	0	90	6	3	39	52	16	0	65	48	3	19	23	0	3	
85 Widespread use of highefficient heat pumps utilizing untapped energy held by river water, groundwater, etc. (COP for cooling 6 or more)	1	241	16	24	61	54	23	51	22	3	38	88	22	3		6	13	25	22	1	65	0	22	27	43	15	2	45	24	5	35	8	5	2		
	2	211	16	24	60	55	22	57	18	2	36	91	15	3		3	9	26	22	0	75	0	18	27	56	11	1	52	26	3	41	8	2	0		
	X	34	100	0	0	73	47	50	3	0	53	100	6	6		3	12	32	26	0	94	0	6	35	56	9	0	53	38	0	53	6	0	0		
Energy systems (energy conservation, combined-cycle, etc.)	86 Development of antimatter production and storage technology and energy sources based on it.	1	93	9	15	76	45	22	33	26	19	19	63	5	44		46	25	37	20	5	16	0	44	45	20	18	1	33	3	4	32	19	10	2	
		2	75	8	16	76	45	21	33	32	14	15	68	3	44		47	19	43	21	3	13	0	48	60	21	17	1	35	4	7	43	25	7	0	
		X	6	100	0	0	63	50	17	17	17	17	100	0	0		50	0	83	33	0	33	0	0	50	33	17	0	33	0	0	50	33	0	0	
87 Realization of heat industrial complexes aiming at the rationalized utilization of energy.	1	217	12	27	60	66	40	46	14	1	53	88	12	3		7	12	28	38	6	47	0	30	29	49	13	0	37	39	4	25	17	7	4		
	2	190	11	28	61	64	35	51	13	0	46	89	5	3		5	10	26	42	2	57	0	24	31	59	9	1	41	45	3	32	16	2	2		
	X	21	100	0	0	76	57	33	10	0	52	100	5	10		14	5	29	38	5	62	0	14	38	57	5	0	43	48	5	29	14	5	0		
88 Widespread use of energy-efficient houses that consume less than half as much power for air conditioning as the current average house.	1	281	15	28	58	73	50	44	5	1	43	87	47	3		3	6	28	46	1	56	1	18	25	50	16	2	39	42	7	14	14	9	4		
	2	242	16	24	60	78	58	38	3	1	40	89	42	2		2	4	24	45	0	67	1	16	21	58	11	1	43	51	5	16	13	4	2		
	X	39	100	0	0	89	79	21	0	0	46	95	56	3		0	3	33	67	0	69	5	10	26	64	8	0	51	51	10	28	26	3	5		

(Note) See page 7 for the interpretation of the graphs.