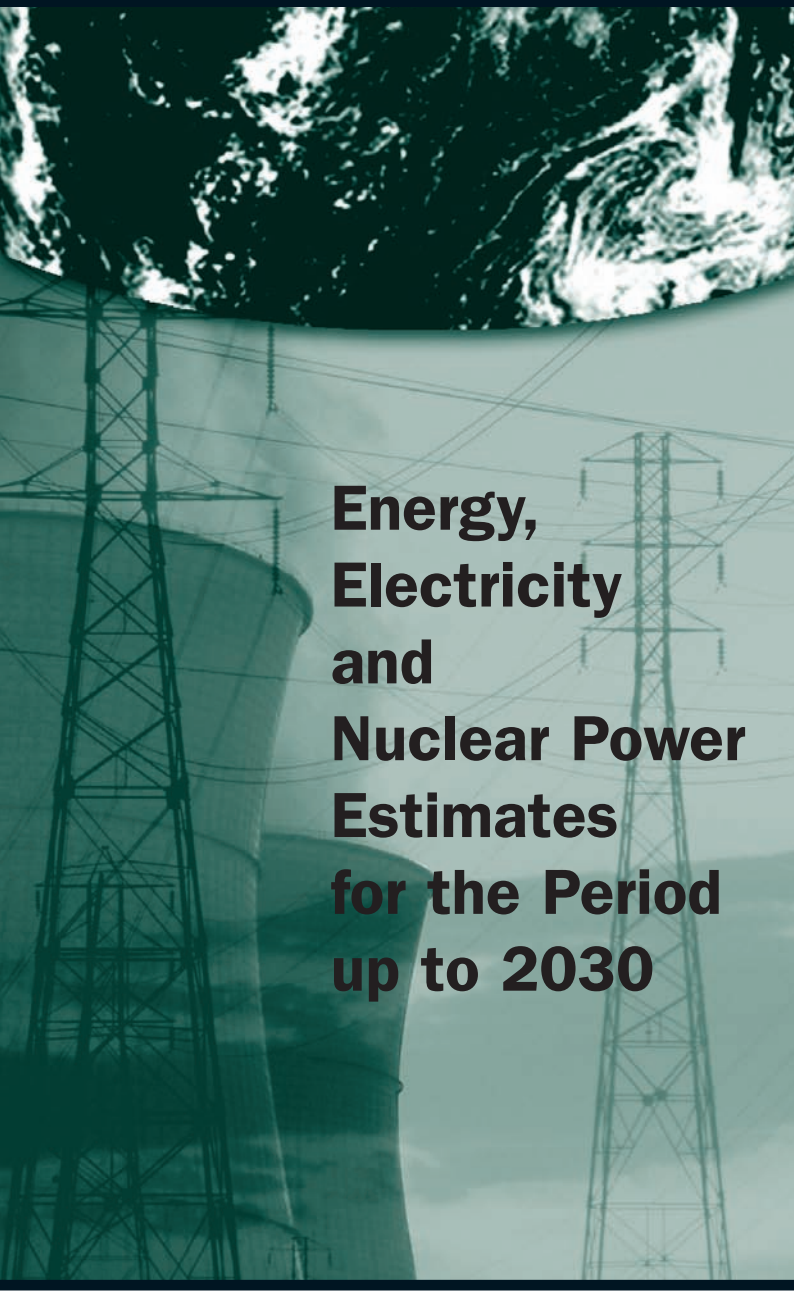
REFERENCE DATA SERIES No. 1 2009 Edition



Energy, Electricity and Nuclear Power Estimates for the Period up to 2030

IAEA
International Atomic Energy Agency

REFERENCE DATA SERIES No. 1

ENERGY, ELECTRICITY AND NUCLEAR POWER ESTIMATES FOR THE PERIOD UP TO 2030

2009 Edition

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2009

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INTRODUCTION

Reference Data Series No. 1 is an annual publication — currently in its twenty-ninth edition — containing estimates of energy, electricity and nuclear power trends up to the year 2030.

Nuclear data presented in Table 1 are based on actual statistical data collected by the IAEA's Power Reactor Information System (PRIS). Energy and electricity data for 2008, however, are estimated, since the latest available information from the Department of Economic and Social Affairs of the United Nations is for 2006. Population data originate from the World Population Prospects (2008 Revision), published by the Population Division of the UN Department of Economic and Social Affairs, and the 2008 values are estimates.

The future growth of energy, electricity and nuclear power up to the year 2030 is presented as low and high estimates in order to encompass the uncertainties associated with the future. These estimates should be viewed as very general growth trends whose validity must constantly be subjected to critical review.

The energy forecasts carried out in increasing numbers over the last years by international, national and private organizations are based on a multiplicity of different assumptions and different aggregating procedures, which make their comparison and synthesis very difficult. The basic differences refer to such fundamental input data as:

— World and regional scenarios of economic development;
— Correlation of economic growth and energy consumption;
— Assumptions on physical, economic and political constraints applying to energy production and consumption;
— Future prices of different energy sources.

The projections presented in this booklet are based on a compromise among:

— National projections supplied by each country for a recent OECD/NEA study;
— Indicators of development published by the World Bank in its World Development Indicators;
— Estimates of energy, electricity and nuclear power growth continuously carried out by the IAEA in the wake of recent global and regional projections made by other international organizations.

The nuclear generating capacity estimates presented in Table 3 are derived from a country by country 'bottom-up' approach. They are established by a group of experts participating each year in the IAEA's consultancy on Nuclear Capacity Projections and based upon a review of nuclear power projects and programmes in Member States.

The low and high estimates reflect contrasting but not extreme underlying assumptions on the different driving factors that have an impact on nuclear power deployment. These factors, and the ways they might evolve, vary from country to country. The estimates presented provide a plausible range of nuclear capacity growth by region and worldwide. They are not intended to be predictive nor to reflect the whole range of possible futures from the lowest to the highest feasible.

The low case represents expectations about the future if current trends continued and there were few changes in policies affecting nuclear power other than those already in the pipeline. This case was explicitly designed to produce a "conservative but plausible" set of projections. Additionally, the low case did not automatically assume that targets for nuclear power growth in a particular country would necessarily be achieved. These assumptions are relaxed in the high case.

The high case projections are much more optimistic, but still plausible and technically feasible. The high case assumes that the current financial and economic crises will be overcome in the not so distant future and past rates

of economic growth and electricity demand, especially in the Far East, would essentially resume. In addition, the high case assumes the implementation of policies targeted at mitigating climate change.

In the presence of the current financial and economic crises developing the 2009 nuclear power projections posed a considerable challenge. The 2009 projections are based on the rationale that the long lead times associated with the implementation of nuclear power plants may temporarily delay some projects but the underlying fundamentals of population growth, development, demand for electricity, climate change concerns, security of energy supply and the quest for stable electricity generating costs point to continued strong growth in the longer term. Worsening and prolonged economic/financial difficulties could, however, dramatically affect the projections developed, particularly in the high case.

The data on electricity produced by nuclear power plants is converted to joules based on the average efficiency of a nuclear power plant, i.e. 33 per cent; data on electricity generated by geothermal heat is converted to joules based on the average efficiency of a geothermal power plant, i.e. 10 per cent. The conversion to joules of electricity generated by hydropower or by the other non-thermal sources such as wind, tide, and solar is based on the energy content of the electricity generated (the equivalent of assuming a 100 per cent efficiency).

The total energy requirement has been calculated by summing the primary energy production, the net energy trade minus changes in international bunkers and domestic stocks.

The values shown in Table 9 refer to primary energy used for the generation of electricity. Owing to differences in conversion efficiencies, the percentage values are different from the shares of electricity generation presented in Tables 1 and 5.

Energy Units

1 MW(e) = 10^6 watts
1 GW(e) = 1000 MW(e) = 10^9 watts
1 GJ = 1 gigajoule = 10^9 joules
1 EJ = 1 exajoule = 10^{18} joules
1 EJ = 23.9 megatonnes of oil equivalent (MTOE)
1 TWh = 1 terawatt-hour = 10^9 kWh = 3.6×10^{-3} EJ

GROUPING OF COUNTRIES AND AREAS

The countries and geographical areas included in each grouping are listed below
(IAEA Member States are denoted by an asterisk)

North America

Canada*
United States of America*

Latin America

Anguilla
Antigua and Barbuda
Argentina*
Aruba
Bahamas
Barbados
Belize*
Bermuda
Bolivia*
Brazil*
Cayman Islands
Chile*
Colombia*
Costa Rica*
Cuba*
Dominica
Dominican Republic*
Ecuador*
El Salvador*
Grenada
Guadeloupe
Guatemala*
Guyana
Haiti*
Honduras*
Jamaica*
Martinique
Mexico*
Montserrat
Netherlands Antilles
Nicaragua*
Panama*
Paraguay*
Peru*
Puerto Rico
S.Georgia & S.Sandwich Islands
Saint Kitts and Nevis
Saint Lucia
Saint Pierre and Miquelon
Saint Vincent & the Grenadines
Suriname
Trinidad and Tobago
Turks and Caicos Islands
Uruguay*
Venezuela*

Western Europe

Andorra
Austria*
Belgium*
Cyprus*
Denmark*
Finland*
France*
Germany*
Gibraltar
Greece*
Greenland
Holy See*
Iceland*
Ireland*
Italy*
Liechtenstein*
Luxembourg*
Malta*
Monaco*
Netherlands*
Norway*
Portugal*
San Marino
Spain*
Svalbard and Jan Mayen Islands
Sweden*
Switzerland*
Turkey*
United Kingdom*

Eastern Europe

Albania*
Armenia*
Azerbaijan*
Belarus*
Bosnia and Herzegovina*
Bulgaria*
Croatia*
Czech Republic*
Estonia*
Georgia*
Hungary*
Kazakhstan*
Kyrgyzstan*
Latvia*
Lithuania*
Montenegro*
Poland*
Republic of Moldova*
Romania*
Russian Federation*
Serbia*
Slovakia*
Slovenia*
Tajikistan*
The Frmr.Yug.Rep. of Macedonia*
Turkmenistan
Ukraine*
Uzbekistan*

Africa

Algeria*
Angola*
Benin*
Botswana*
Burkina Faso*
Burundi*
Cameroon*
Cape Verde*
Central African Republic*
Chad*
Comoros
Congo*
Côte d'Ivoire*
Democratic Rep. of the Congo*
Djibouti
Egypt*
Equatorial Guinea
Eritrea*
Ethiopia*
Gabon*
Gambia
Ghana*
Guinea
Guinea-Bissau
Kenya*
Lesotho*
Liberia*
Libyan Arab Jamahiriya*
Madagascar*
Malawi*
Mali*
Mauritania*
Mauritius*
Mayotte
Morocco*
Mozambique*
Namibia*
Niger*
Nigeria*
Reunion
Rwanda
Saint Helena
Sao Tome and Principe
Senegal*
Seychelles*
Sierra Leone*
Somalia
South Africa*
Sudan*
Swaziland
Togo*
Tunisia*
Uganda*
United Republic of Tanzania*
Western Sahara
Zambia*
Zimbabwe*

Middle East and South Asia

Afghanistan*
Bahrain*
Bangladesh*
Bhutan
British Indian Ocean Territory
Cocos (Keeling) Islands
French Southern Territories
Heard Island&McDonald Islands
India*
Iran, Islamic Republic of*
Iraq*
Israel*
Jordan*
Kuwait*
Lebanon*
Nepal*
Oman*
Pakistan*
Qatar*
Saudi Arabia*
Sri Lanka*
Syrian Arab Republic*
T.T.U.T.J of T. Palestinian A.
United Arab Emirates*
Yemen*

South East Asia and the Pacific

Australia*
Brunei Darussalam
Cook Islands
Fiji
Indonesia*
Kiribati
Malaysia*
Maldives
Marshall Islands*
Micronesia (Fed. States of)
Myanmar*
New Zealand*
Niue
Norfolk Islands
Northern Mariana Islands
Palau*
Papua New Guinea*
Pitcairn Islands
Samoa
Singapore*
Solomon Islands
Thailand*
Timor Leste
Tokelau
Tuvalu
US Minor Outlying Islands
Vanuatu
Wallis and Futuna Islands

Far East

Cambodia
China*
Dem. P.R. of Korea
Japan*
Korea, Republic of*
Lao P.D.R.
Macau, China
Mongolia*
Philippines*
Taiwan, China
Vietnam*

TABLE 1. NUCLEAR POWER REACTORS IN THE WORLD (end of 2008)

Group and Country	In Operation		Long-term Shut Down Reactors		Under Construction		Electricity Supplied by Nuclear Power Reactors in 2008	
	Number of Units	Total MW(e)	Number of Units	Total MW(e)	Number of Units	Total MW(e)	TWh	Percent of Total Electricity
North America								
Canada	18	12577	4	2726			88.3	14.8
United States of America	104	100683			1	1165	806.7	19.7
Latin America								
Argentina	2	935			1	692	6.9	6.2
Brazil	2	1766					13.2	3.1
Mexico	2	1300					9.4	4.0
Western Europe								
Belgium	7	5824					43.4	53.8
Finland	4	2696			1	1600	22.1	29.7
France	59	63260			1	1600	419.8	76.2
Germany	17	20470					140.9	28.8
Netherlands	1	482					3.9	3.8
Spain	8	7450					56.5	18.3
Sweden	10	8996					61.3	42.0
Switzerland	5	3220					26.3	39.2
United Kingdom	19	10097					48.2	13.5
Eastern Europe								
Armenia	1	376					2.3	39.4
Bulgaria	2	1906			2	1906	14.7	32.9
Czech Republic	6	3634					25.0	32.5
Hungary	4	1859					13.9	37.2

TABLE 1. NUCLEAR POWER REACTORS IN THE WORLD (end of 2008)

Group and Country	In Operation		Long-term Shut Down Reactors		Under Construction		Electricity Supplied by Nuclear Power Reactors in 2008	
	Number of Units	Total MW(e)	Number of Units	Total MW(e)	Number of Units	Total MW(e)	TWh	Percent of Total Electricity
Lithuania	1	1185					9.1	72.9
Romania	2	1300					10.3	17.5
Russian Federation	31	21743			8	5809	152.1	16.9
Slovakia	4	1711					15.5	56.4
Slovenia	1	666					6.0	41.7
Ukraine	15	13107			2	1900	84.5	47.4
Africa								
South Africa	2	1800					12.8	5.3
Middle East and South Asia								
India	17	3782			6	2910	13.2	2.0
Iran, Islamic Republic of					1	915		
Pakistan	2	425			1	300	1.7	1.9
Far East								
China	11	8438			11	10220	65.3	2.2
Japan	55	47278	1	246	2	2191	241.3	24.9
Korea, Republic of	20	17647			5	5180	144.3	35.6
World Total (a)	438	371562	5	2972	44	38988	2597.8	14.0

Notes:

(a) Including the following data in Taiwan, China:

— 6 units in operation with total capacity of 4949 MW(e); 2 units under construction with total capacity of 2600 MW(e);

— 39.3 TWh of nuclear electricity generation, representing 17.45% of the total electricity generated.

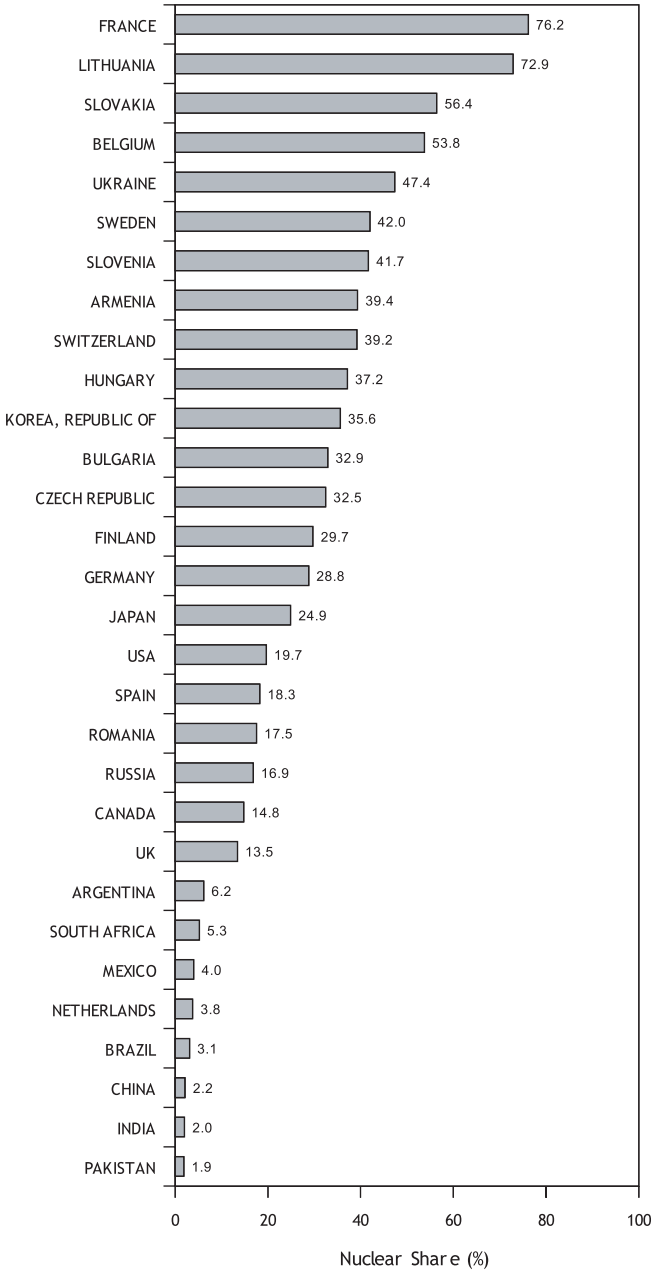


FIGURE 1. NUCLEAR SHARE OF TOTAL ELECTRICITY GENERATION IN 2008

Note: the nuclear share of electricity generation in Taiwan, China was 17.4%.

TABLE 2. NUMBER OF COUNTRIES WITH NUCLEAR POWER REACTORS IN OPERATION OR UNDER CONSTRUCTION (end of 2008)

Country Group	Number of Countries in Group	Countries with Nuclear Power Reactors			
		In Operation	Long-term Shut Down	Under Construction (1)	Total (2)
North America	2	2	1	1	2
Latin America	45	3		1	3
Western Europe	29	9		2	9
Eastern Europe	27	10		3	10
Africa	57	1			1
Middle East and South Asia	25	2		3	3
South East Asia and the Pacific	27				
Far East	11	3	1	3	3
World Total	223	30	2	13	31

Notes:
(1) May include countries having reactors already in operation.
(2) Total number of countries in each group that have nuclear power reactors in operation, or under construction.

TABLE 3. ESTIMATES OF TOTAL AND NUCLEAR ELECTRICAL GENERATING CAPACITY

Country Group	2008			2010 (*)			2020 (*)			2030 (*)		
	Total Elect. GW(e)	Nuclear		Total Elect. GW(e)	Nuclear		Total Elect. GW(e)	Nuclear		Total Elect. GW(e)	Nuclear	
		GW(e)	%		GW(e)	%		GW(e)	%		GW(e)	%
North America	1282	113.3	8.8	1296 1314	114 115	8.8 8.7	1440 1545	126 130	8.8 8.4	1568 1807	127 168	8.1 9.3
Latin America	297	4.0	1.3	303 311	4.0 4.0	1.3 1.3	379 432	6.9 8.0	1.8 1.9	483 636	10.8 23	2.2 3.5
Western Europe	780	122.5	15.7	793 793	119 122	14.9 15.4	880 948	90 131	10.3 13.8	984 1171	82 158	8.4 13.5
Eastern Europe	494	47.5	9.6	498 498	47 47	9.5 9.5	587 602	68 81	11.6 13.4	681 775	83 121	12.2 15.6
Africa	118	1.8	1.5	124 126	1.8 1.8	1.5 1.4	162 201	2.8 4.1	1.7 2.1	222 344	6.1 17	2.8 5.0
Middle East and South Asia	364	4.2	1.2	379 394	7 10	1.9 2.5	538 639	13 24	2.5 3.8	729 991	20 56	2.7 5.6
South East Asia and the Pacific	170			189 193			249 283	0.0	0.0	318 411	0.0 5.2	0.0 1.3
Far East	1157	78.3	6.8	1200 1222	79 80	6.6 6.6	1665 1969	138 165	8.3 8.4	2186 2822	183 259	8.4 9.2
World Total Low Estimate	4662	371.6	8.0	4782	372	7.8	5901	445	7.5	7171	511	7.1
World Total High Estimate				4852	380	7.8	6619	543	8.2	8958	807	9.0

Note:
(*) Nuclear capacity estimates take into account the scheduled retirement of the older units at the end of their lifetime.

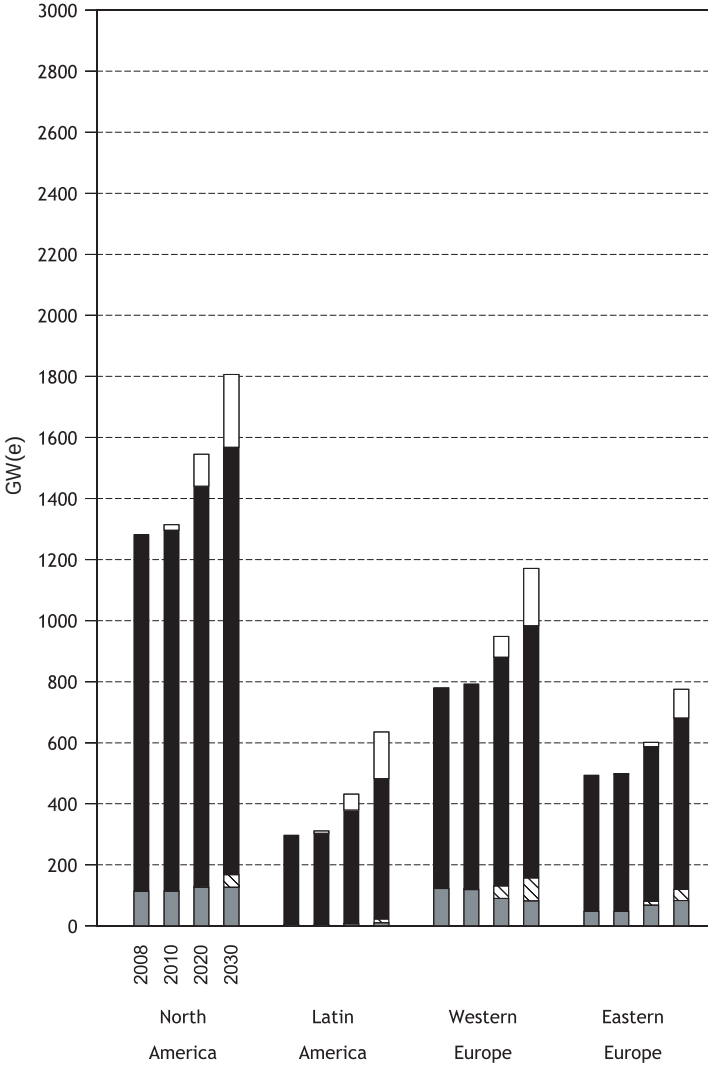


FIGURE 2. TOTAL AND NUCLEAR ELECTRICAL GENERATING CAPACITY

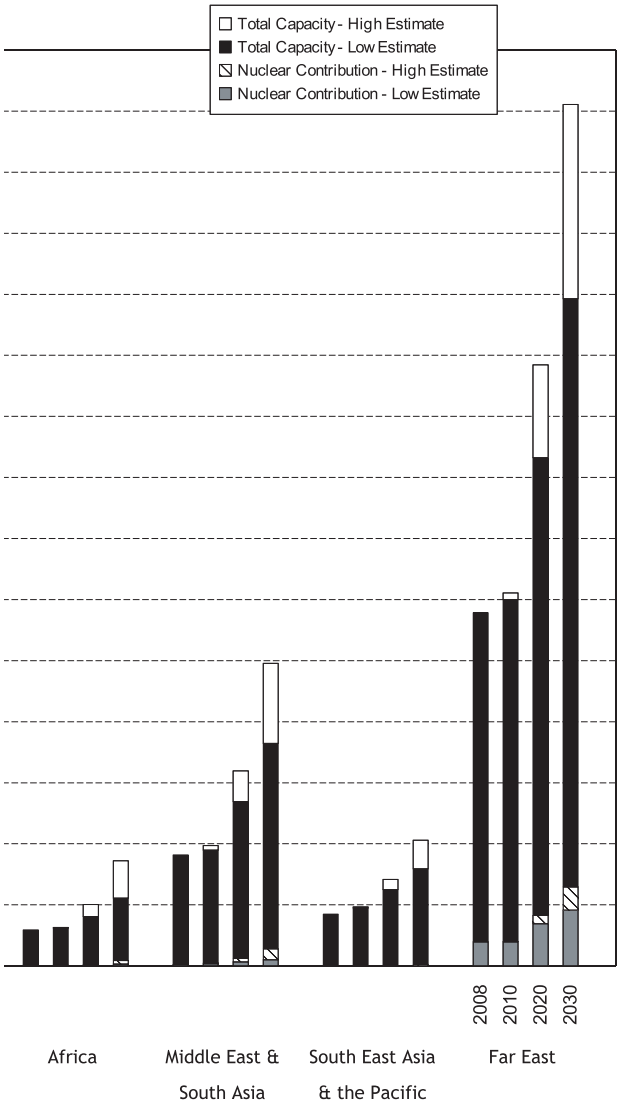

Total Capacity - High Estimate
Total Capacity - Low Estimate
Nuclear Contribution - High Estimate
Nuclear Contribution - Low Estimate
2008
2010
2020
2030
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

TABLE 4. ESTIMATES OF TOTAL ELECTRICITY GENERATION AND CONTRIBUTION BY NUCLEAR POWER (*)

Country Group	2008			2010			2020			2030		
	Total Elect. TWh	Nuclear		Total Elect. TWh	Nuclear		Total Elect. TWh	Nuclear		Total Elect. TWh	Nuclear	
		TWh	%		TWh	%		TWh	%		TWh	%
North America	4700	895.0	19.0	4801 4867	902 903	18.8 18.6	5605 6016	995 1028	17.7 17.1	6400 7376	999 1324	15.6 18.0
Latin America	1236	29.4	2.4	1261 1295	29 29	2.3 2.3	1589 1808	51 59	3.2 3.3	2034 2679	82 172	4.0 6.4
Western Europe	3082	822.3	26.7	3150 3150	872 900	27.7 28.6	3540 3812	681 987	19.2 25.9	4015 4781	636 1216	15.8 25.4
Eastern Europe	1822	333.3	18.3	1853 1856	332 332	17.9 17.9	2292 2348	477 564	20.8 24.0	2780 3165	582 847	20.9 26.8
Africa	603	12.8	2.1	629 642	14 14	2.3 2.2	785 976	22 33	2.8 3.3	1032 1597	48 137	4.7 8.5
Middle East and South Asia	1501	14.9	1.0	1566 1630	43 59	2.8 3.6	2246 2667	82 148	3.7 5.5	3071 4176	128 362	4.2 8.7
South East Asia and the Pacific	742			825 840			1070 1215	0	0.0	1345 1737	0 34	0.0 1.9
Far East	4828	490.1	10.2	5011 5105	538 547	10.7 10.7	6985 8262	953 1144	13.6 13.8	9210 11892	1295 1838	14.1 15.5
World Total Low Estimate	18514	2597.8	14.0	19096	2732	14.3	24113	3261	13.5	29887	3771	12.6
World Total High Estimate				19384	2785	14.4	27103	3962	14.6	37402	5930	15.9

(*) The nuclear generation data presented in this table and the nuclear capacity data presented in Table 3 cannot be used to calculate average annual capacity factors for nuclear plants, as Table 3 presents year-end capacity and not the effective capacity average over the year.

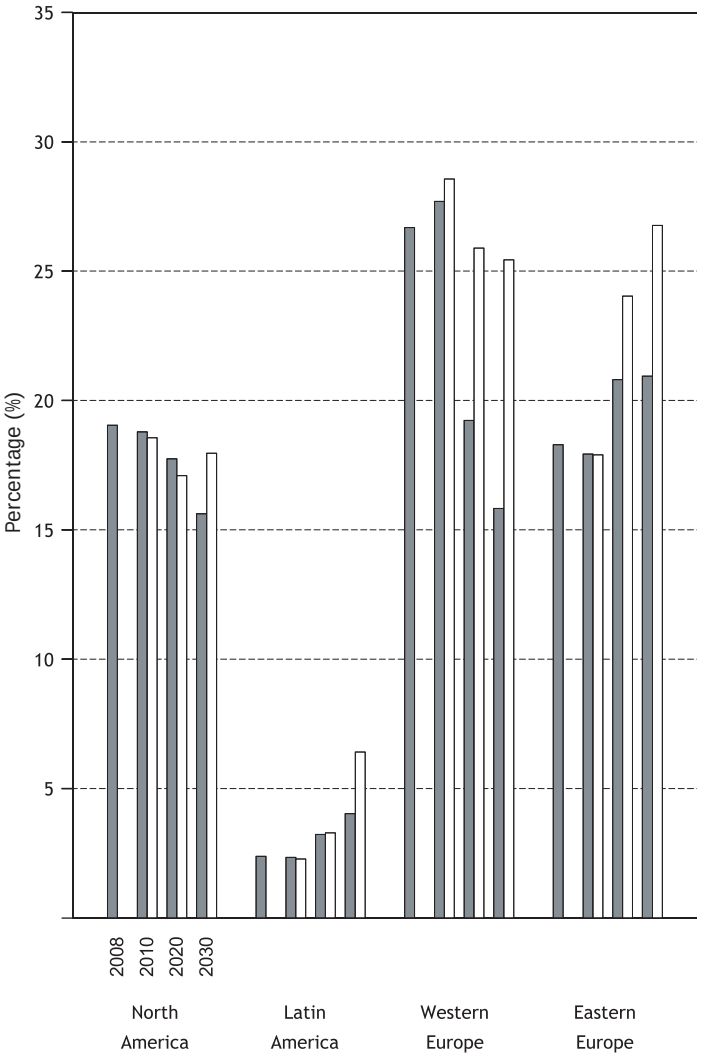


FIGURE 3. PERCENTAGE OF ELECTRICITY SUPPLIED BY NUCLEAR POWER

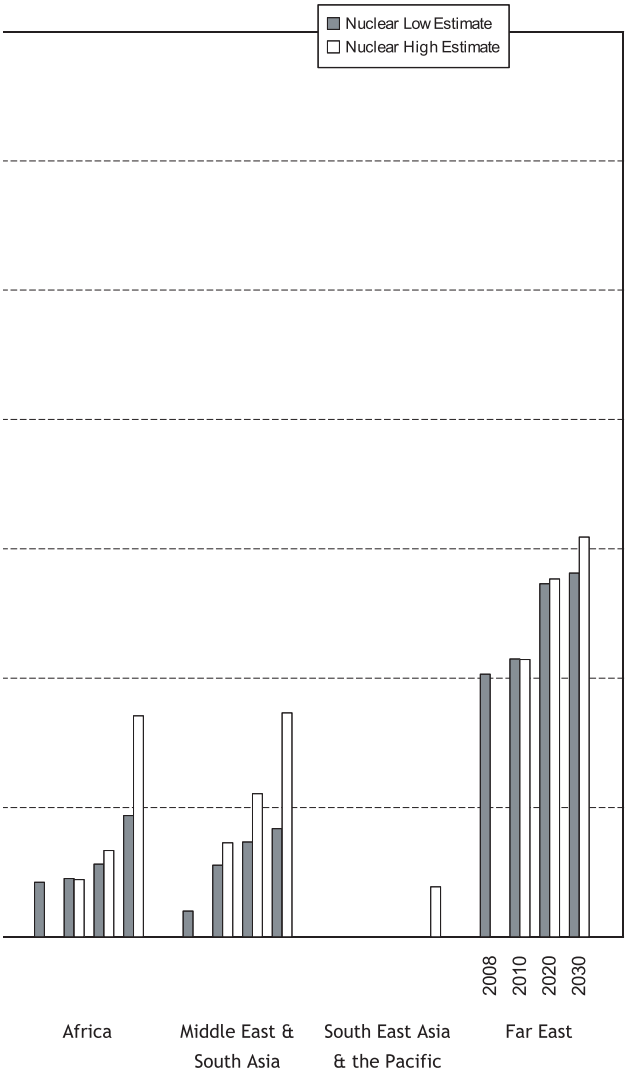

Nuclear Low Estimate
Nuclear High Estimate
2008
2010
2020
2030
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

TABLE 5. ESTIMATES OF TOTAL ENERGY REQUIREMENT (EJ), PERCENTAGE USED FOR ELECTRICITY GENERATION, AND PERCENTAGE SUPPLIED BY NUCLEAR ENERGY (*)

Country Group	2008			2010			2020			2030		
	Total Energy Requirement	% Used for Elect. Gen.	% Supplied by Nuclear	Total Energy Requirement	% Used for Elect. Gen.	% Supplied by Nuclear	Total Energy Requirement	% Used for Elect. Gen.	% Supplied by Nuclear	Total Energy Requirement	% Used for Elect. Gen.	% Supplied by Nuclear
North America	106.2	35.1	9.2	107	36	9.2	112	39	9.7	118	42	9.3
				107	36	9.2	115	41	9.7	124	47	11.6
Latin America	33.3	25.5	1.0	34	26	1.0	38	29	1.5	44	32	2.0
				34	26	0.9	41	31	1.6	52	36	3.6
Western Europe	69.6	39.2	12.9	71	40	13.5	74	41	10.0	77	44	9.0
				71	40	13.8	80	42	13.4	93	46	14.3
Eastern Europe	57.4	39.9	6.3	59	40	6.2	66	43	7.9	69	50	9.1
				59	39	6.1	75	39	8.2	81	48	11.3
Africa	27.9	22.4	0.5	29	23	0.5	34	24	0.7	41	26	1.3
				29	23	0.5	39	26	0.9	54	31	2.8
Middle East and South Asia	59.2	34.3	0.3	61	35	0.8	75	40	1.2	92	45	1.5
				62	35	1.0	86	42	1.9	119	47	3.3
South East Asia and the Pacific	23.5	31.7		24	34		29	37		34	40	0.0
				25	34		31	40	0.0	40	44	0.9
Far East	121.8	42.4	4.4	124	43	4.7	157	47	6.6	196	50	7.2
				127	43	4.7	184	48	6.8	251	51	8.0
World Total Low Estimate	498.9	36.4	5.7	508	37	5.9	586	41	6.1	672	44	6.1
World Total High Estimate				514	37	5.9	651	41	6.6	814	46	7.9

Note:
(*) Total energy requirement is estimated as production of primary energy plus net trade (import - export) minus international bunkers and stock changes.

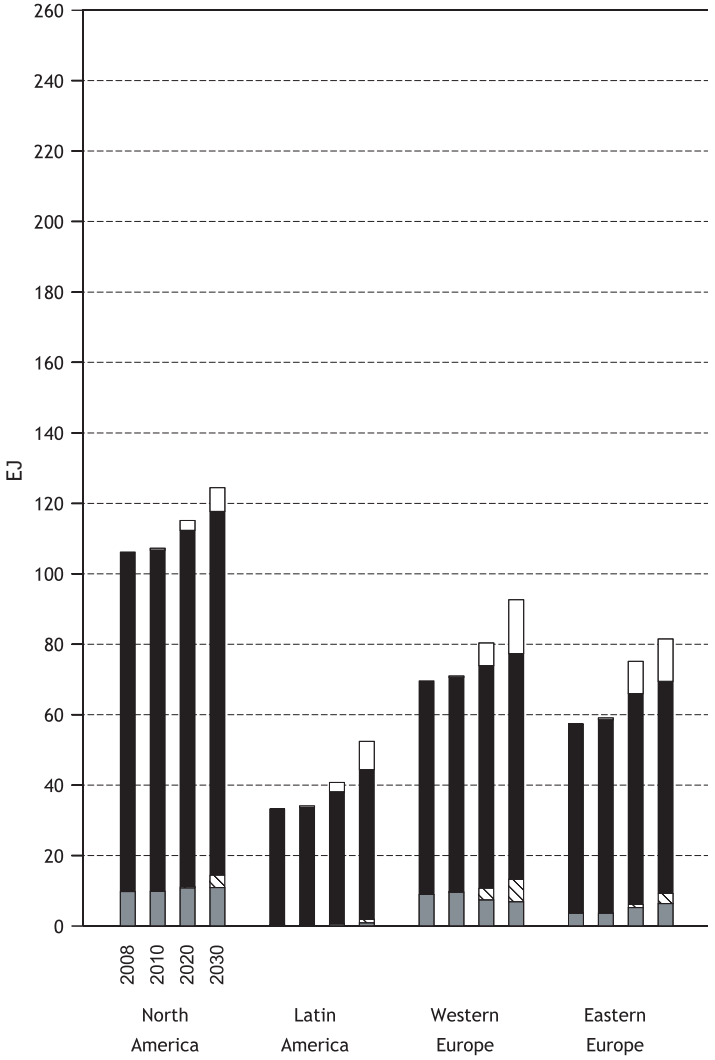


FIGURE 4. ESTIMATES OF ENERGY REQUIREMENT

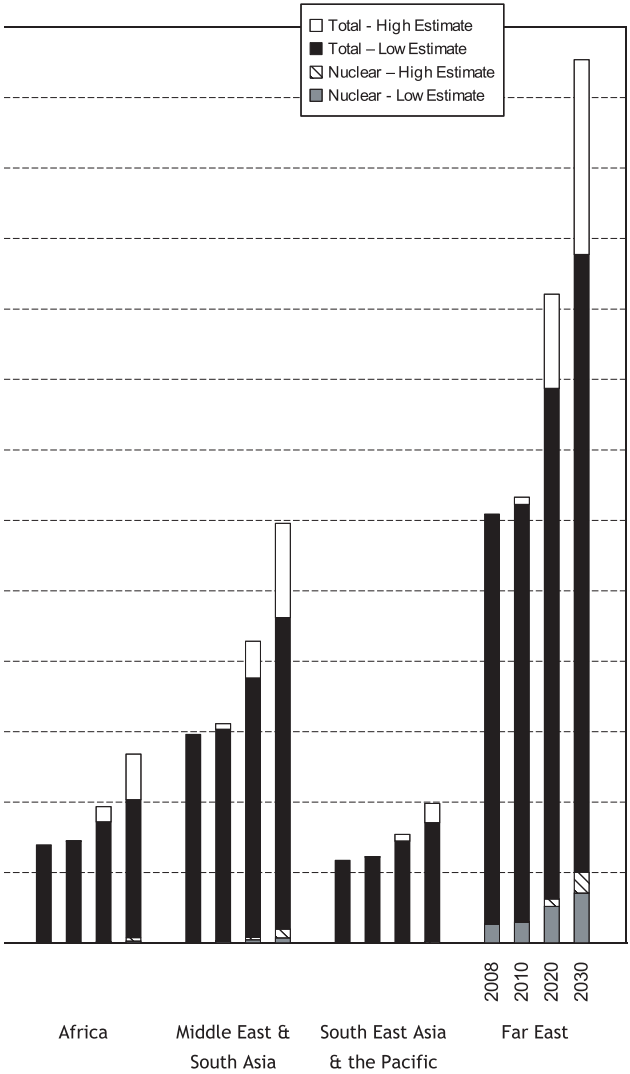

Total - High Estimate
Total – Low Estimate
Nuclear – High Estimate
Nuclear - Low Estimate
2008
2010
2020
2030
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

TABLE 6. TOTAL ENERGY REQUIREMENT (EJ) BY TYPE OF FUEL IN 2008 (*)

Country Group	Solids (a)	Liquids	Gases	Biomass (b)	Hydro	Nuclear	Renewables (c)	Total
North America	20.68	38.03	28.98	5.68	2.32	9.76	0.75	106.21
Latin America	1.33	15.89	7.72	5.04	2.56	0.32	0.40	33.27
Western Europe	9.86	24.40	19.67	3.97	1.89	8.97	0.86	69.62
Eastern Europe	12.20	11.77	27.36	1.48	1.12	3.64	-0.18	57.38
Africa	4.73	7.61	3.94	11.05	0.37	0.14	0.06	27.88
Middle East and South Asia	14.56	20.29	14.83	8.76	0.62	0.16	0.01	59.23
South East Asia and the Pacific	4.26	8.65	6.08	3.87	0.25		0.39	23.51
Far East	68.98	31.34	9.32	3.64	2.65	5.35	0.48	121.76
World Total	136.60	157.99	117.91	43.48	11.77	28.34	2.77	498.86

Notes:

(*) Total energy requirement is estimated as production of primary energy plus net trade (import - export) minus international bunkers and stock changes.

(a) Solids do not include commercial wood.

(b) The column headed 'Biomass' includes commercial wood, combustible renewables, waste and other biomass products.

(c) The column headed 'Renewables' includes geothermal, wind, solar, tide energy and net electricity trade.

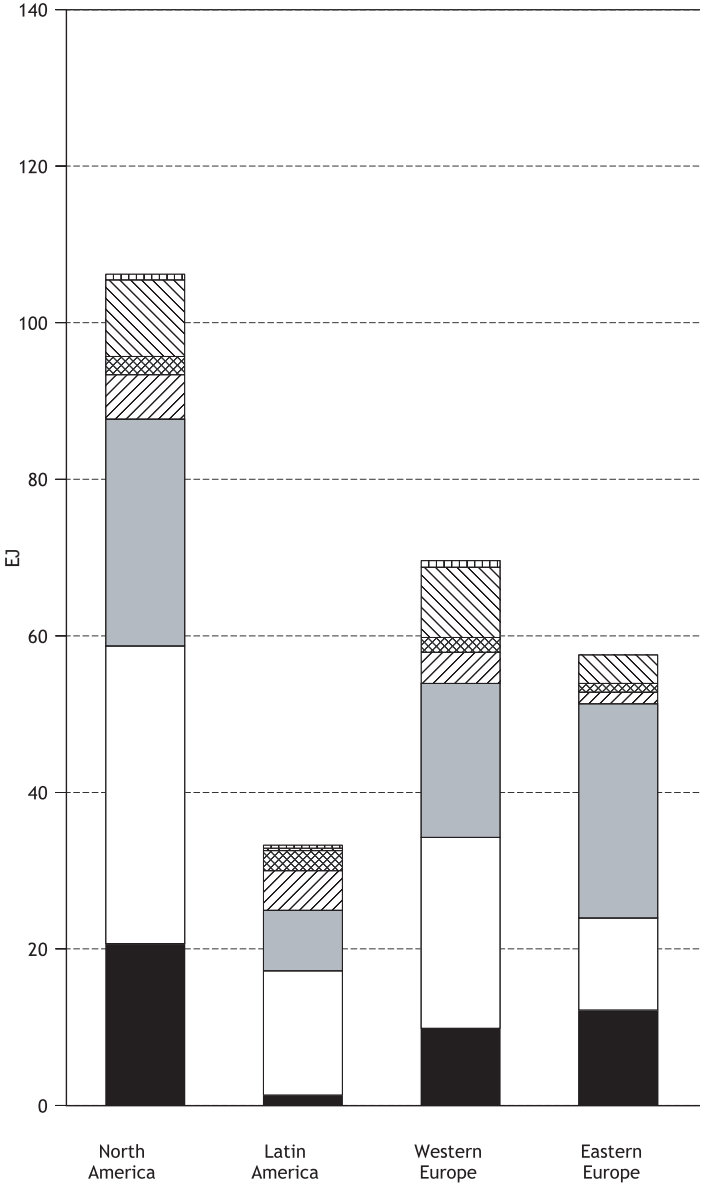
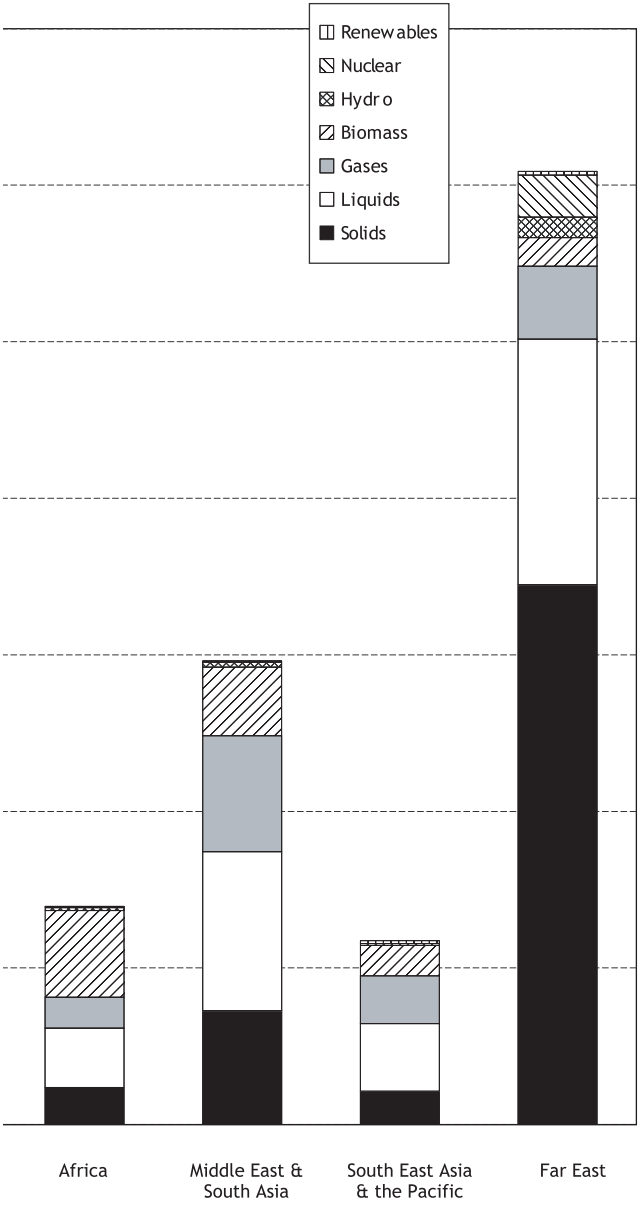


FIGURE 5. TOTAL ENERGY REQUIREMENT BY FUEL TYPE IN 2008


Renewables
Nuclear
Hydro
Biomass
Gases
Liquids
Solids
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

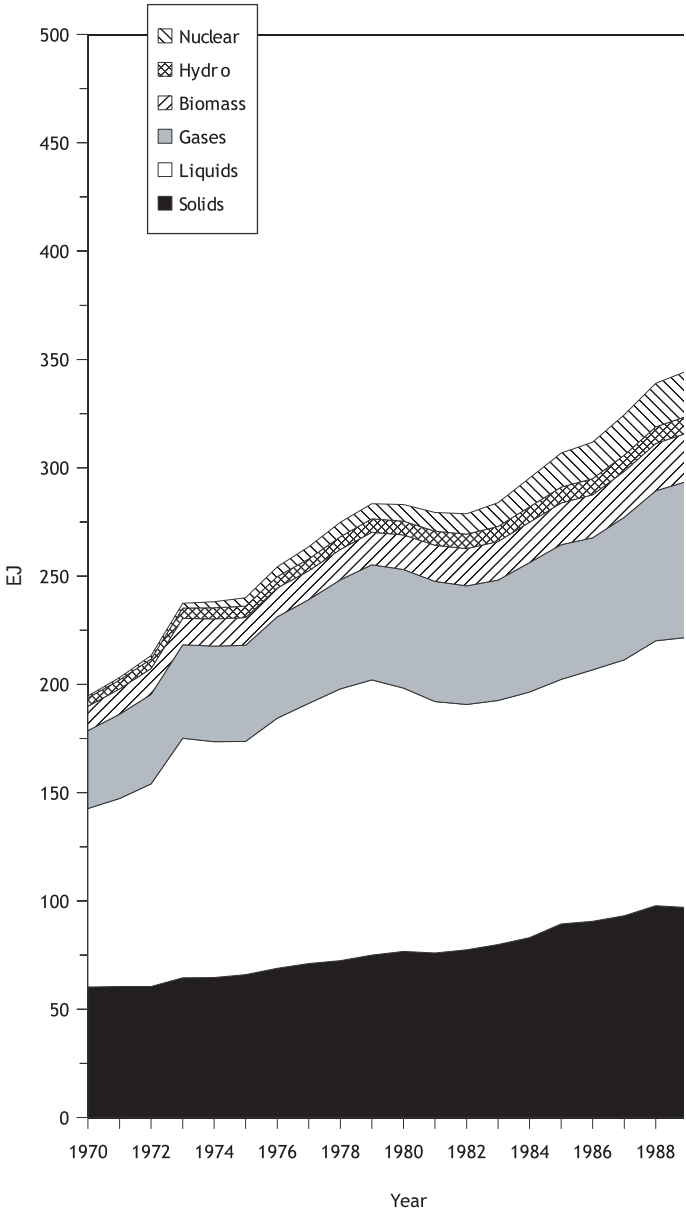


FIGURE 6. BREAKDOWN OF WORLD TOTAL ENERGY REQUIREMENT DURING THE PERIOD 1970 — 2008

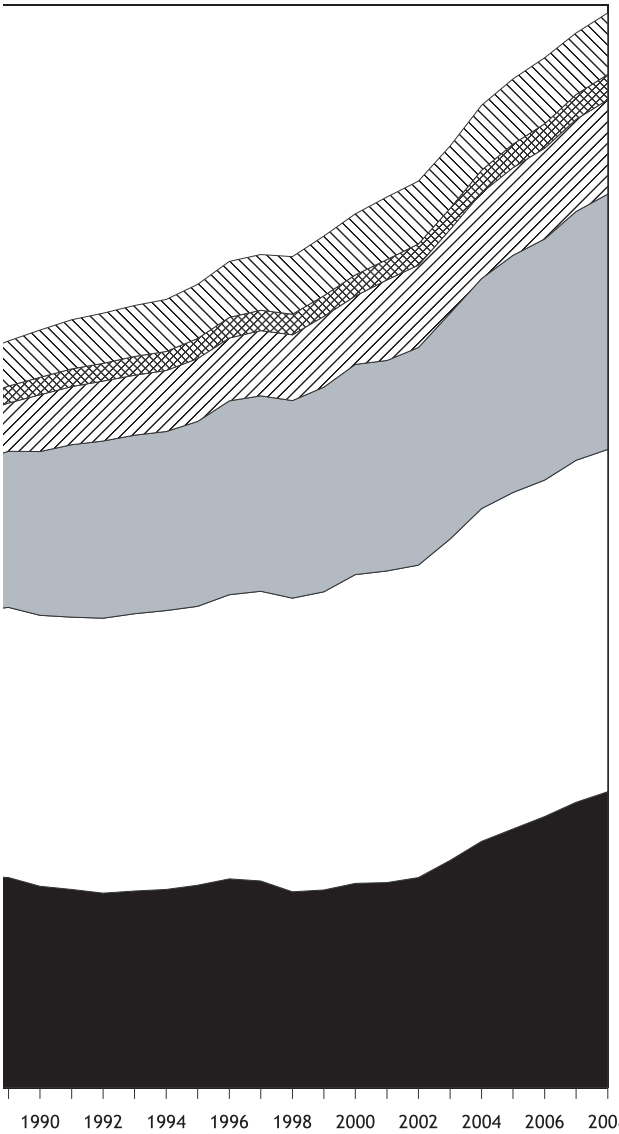

1990
1992
1994
1996
1998
2000
2002
2004
2006
2008

TABLE 7. FUEL SHARES (%) OF ENERGY REQUIREMENT IN 2008 (*)

Country Group	Solids (a)	Liquids	Gases	Biomass (b)	Hydro	Nuclear	Renewables (c)	Total
North America	19.47	35.81	27.28	5.35	2.18	9.19	0.71	100.00
Latin America	3.99	47.77	23.22	15.15	7.70	0.96	1.21	100.00
Western Europe	14.16	35.05	28.26	5.70	2.72	12.88	1.23	100.00
Eastern Europe	21.27	20.51	47.68	2.57	1.95	6.34	-0.31	100.00
Africa	16.95	27.27	14.14	39.62	1.32	0.50	0.20	100.00
Middle East and South Asia	24.58	34.26	25.03	14.78	1.05	0.27	0.02	100.00
South East Asia and the Pacific	18.12	36.80	25.88	16.48	1.06		1.67	100.00
Far East	56.65	25.74	7.65	2.99	2.17	4.39	0.40	100.00
World Total	27.38	31.67	23.64	8.72	2.36	5.68	0.56	100.00

Notes:

(*) Total energy requirement is estimated as production of primary energy plus net trade (import - export) minus international bunkers and stock changes.

(a) Solids do not include commercial wood.

(b) The column headed 'Biomass' includes commercial wood, combustible renewables, waste and other biomass products.

(c) The column headed 'Renewables' includes geothermal, wind, solar, tide energy and net electricity trade.

TABLE 8. FUEL USE (EJ) FOR ELECTRICITY GENERATION BY TYPE OF FUEL IN 2008

Country Group	Thermal (a)	Hydro	Nuclear	Renewables (b)	Total
North America	25.13	2.32	9.76	0.76	37.98
Latin America	5.14	2.56	0.32	0.39	8.41
Western Europe	16.06	1.89	8.97	0.72	27.64
Eastern Europe	18.18	1.12	3.64	0.03	22.96
Africa	5.73	0.37	0.14	0.05	6.29
Middle East and South Asia	19.09	0.62	0.16	0.00	19.87
South East Asia and the Pacific	6.78	0.25		0.39	7.41
Far East	43.46	2.65	5.35	0.49	51.95
World Total	139.57	11.77	28.34	2.83	182.51

Notes:
(a) The column headed 'Thermal' is the total for solids, liquids, gases, biomass and waste.
(b) The column headed 'Renewables' includes geothermal, wind, solar and tide energy.

TABLE 9. PERCENTAGE CONTRIBUTION OF EACH FUEL TYPE TO ELECTRICITY GENERATION IN 2008

Country Group	Thermal (a)	Hydro	Nuclear	Renewables (b)	Total
North America	66.15	13.72	19.04	1.09	100.00
Latin America	39.15	57.54	2.38	0.93	100.00
Western Europe	52.45	17.06	26.68	3.81	100.00
Eastern Europe	64.59	17.04	18.30	0.07	100.00
Africa	80.51	16.95	2.11	0.43	100.00
Middle East and South Asia	87.54	11.47	0.99	0.00	100.00
South East Asia and the Pacific	88.92	9.29		1.79	100.00
Far East	74.27	15.23	10.15	0.35	100.00
World Total	67.15	17.66	14.03	1.16	100.00

Notes:
(a) The column headed 'Thermal' is the total for solids, liquids, gases, biomass and waste.
(b) The column headed 'Renewables' includes geothermal, wind, solar and tide energy.

TABLE 10. ESTIMATES OF POPULATION GROWTH BY REGION (*)

Country Group	2008		2010		2020		2030	
	Million Inhabitants	Growth Rate (%/a) 1998 — 2008	Million Inhabitants	Growth Rate (%/a) 2008 — 2010	Million Inhabitants	Growth Rate (%/a) 2010 — 2020	Million Inhabitants	Growth Rate (%/a) 2020 — 2030
North America	341	1.09	352	1.49	383	0.87	410	0.68
Latin America	576	1.38	589	1.13	646	0.93	690	0.67
Western Europe	480	0.56	485	0.51	504	0.38	515	0.21
Eastern Europe	398	-0.30	391	-0.82	389	-0.06	381	-0.21
Africa	975	2.70	1033	2.95	1276	2.14	1524	1.79
Middle East and South Asia	1765	1.97	1854	2.50	2126	1.38	2354	1.02
South East Asia and the Pacific	417	1.17	423	0.68	463	0.91	495	0.67
Far East	1752	0.70	1768	0.46	1873	0.58	1925	0.27
World Total	6704	1.33	6895	1.42	7660	1.06	8293	0.80

(*) Projection figures are the arithmetic average between low and high estimates.

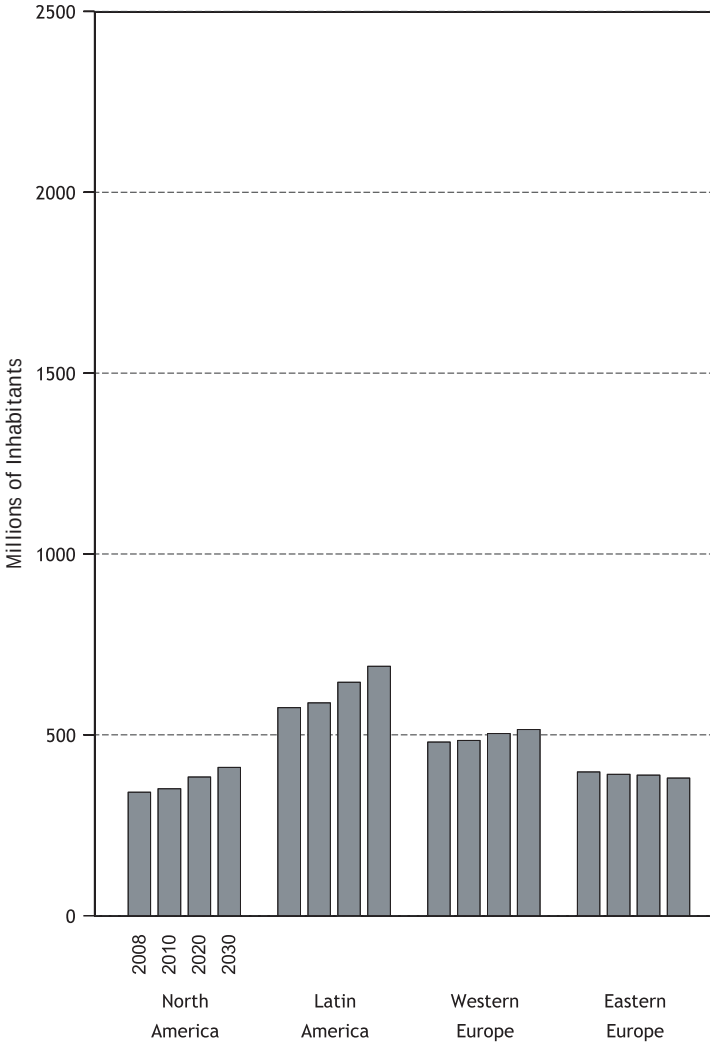


FIGURE 7. POPULATION ESTIMATES

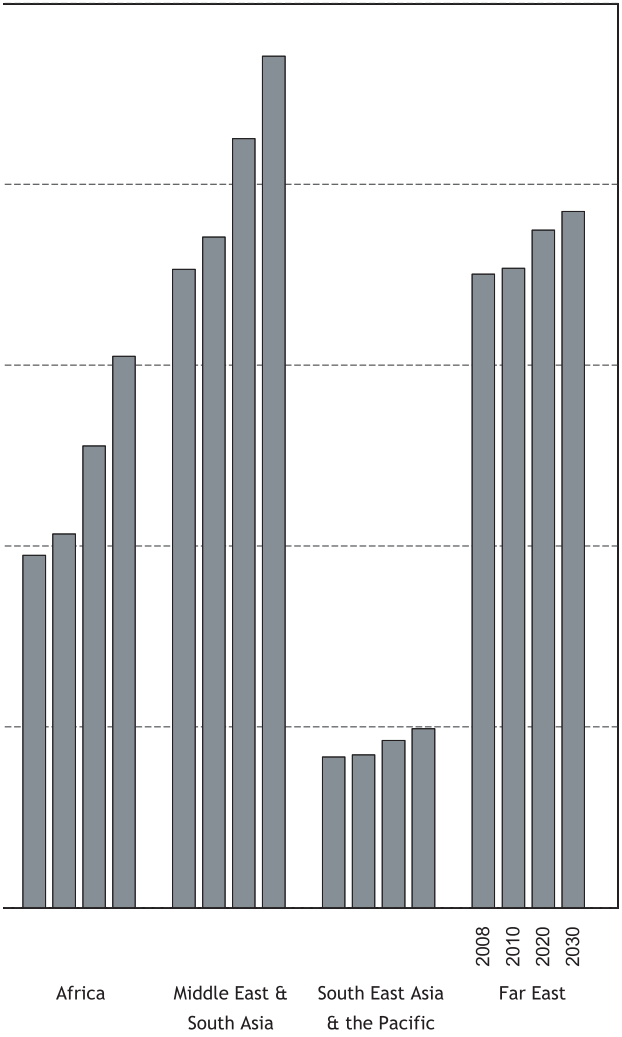

2008
2010
2020
2030
Africa
Middle East &
South Asia
South East Asia
& the Pacific
Far East

TABLE 11. ESTIMATES OF TOTAL ENERGY AND ELECTRICITY REQUIREMENT PER CAPITA

Country Group	2008		2010		2020		2030	
	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MWh/cap)	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MWh/cap)	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MWh/cap)	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MWh/cap)
North America	311	13.8	304 – 305	13.7 – 13.8	293 – 300	14.6 – 15.7	287 – 303	15.6 – 18.0
Latin America	58	2.1	57 – 58	2.1 – 2.2	59 – 63	2.5 – 2.8	64 – 76	2.9 – 3.9
Western Europe	145	6.4	146 – 146	6.5 – 6.5	147 – 159	7.0 – 7.6	150 – 180	7.8 – 9.3
Eastern Europe	144	4.6	150 – 151	4.7 – 4.7	170 – 193	5.9 – 6.0	182 – 214	7.3 – 8.3
Africa	29	0.6	28 – 28	0.6 – 0.6	27 – 30	0.6 – 0.8	27 – 35	0.7 – 1.0
Middle East and South Asia	34	0.9	33 – 34	0.8 – 0.9	35 – 40	1.1 – 1.3	39 – 51	1.3 – 1.8
South East Asia and the Pacific	56	1.8	58 – 58	2.0 – 2.0	63 – 67	2.3 – 2.6	69 – 80	2.7 – 3.5
Far East	69	2.8	70 – 72	2.8 – 2.9	84 – 98	3.7 – 4.4	102 – 130	4.8 – 6.2
World Average	74	2.8	74 – 75	2.8 – 2.8	77 – 85	3.1 – 3.5	81 – 98	3.6 – 4.5

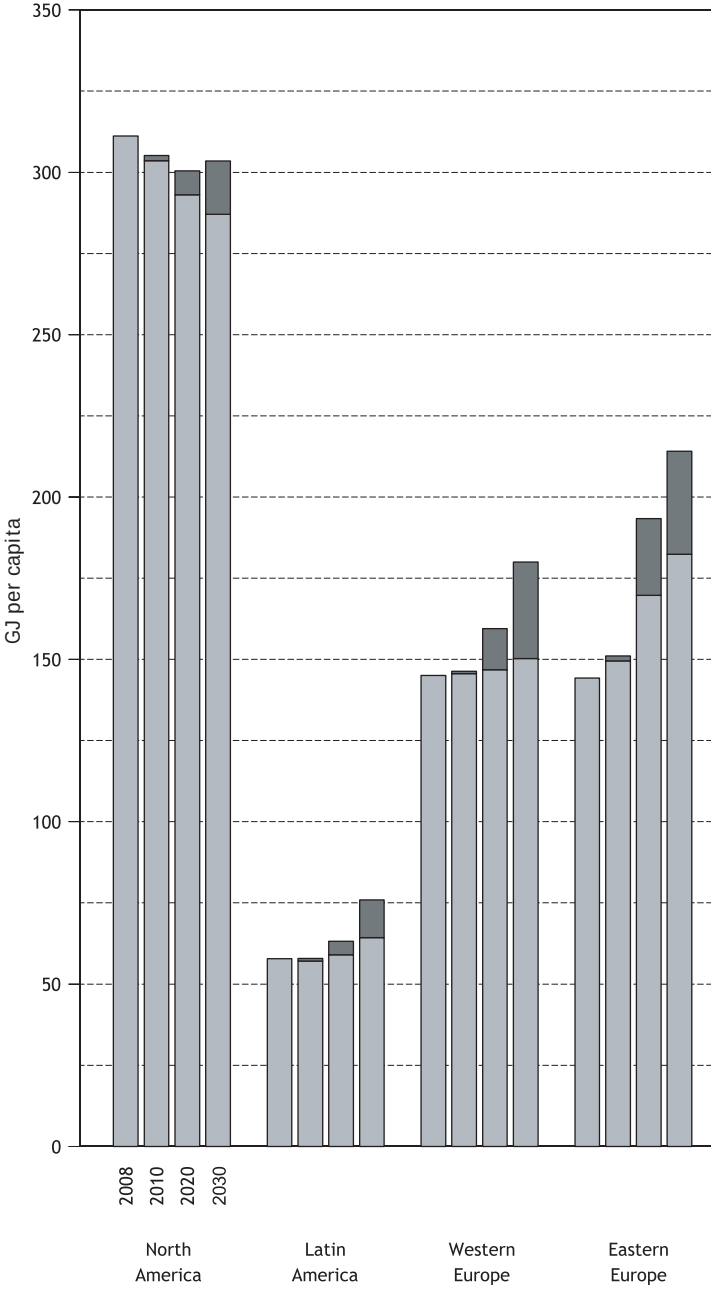
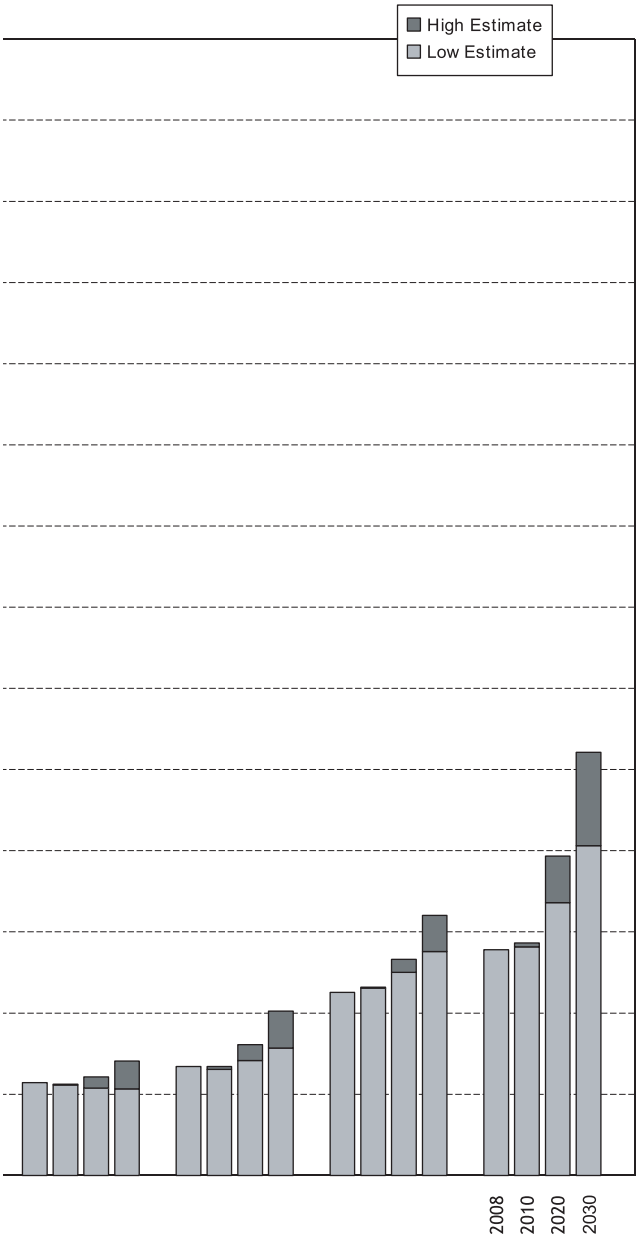


FIGURE 8. TOTAL ENERGY REQUIREMENT PER CAPITA


High Estimate
Low Estimate
2008
2010
2020
2030
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

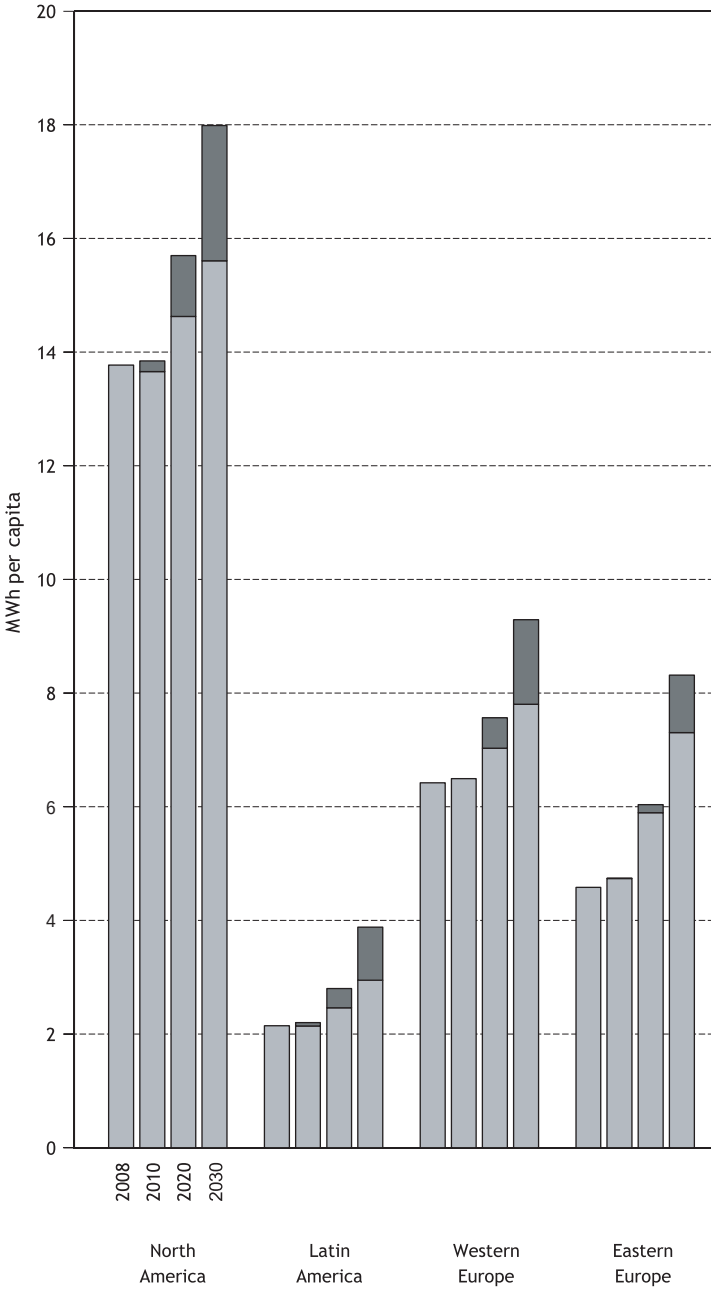


FIGURE 9. TOTAL ELECTRICITY REQUIREMENT PER CAPITA

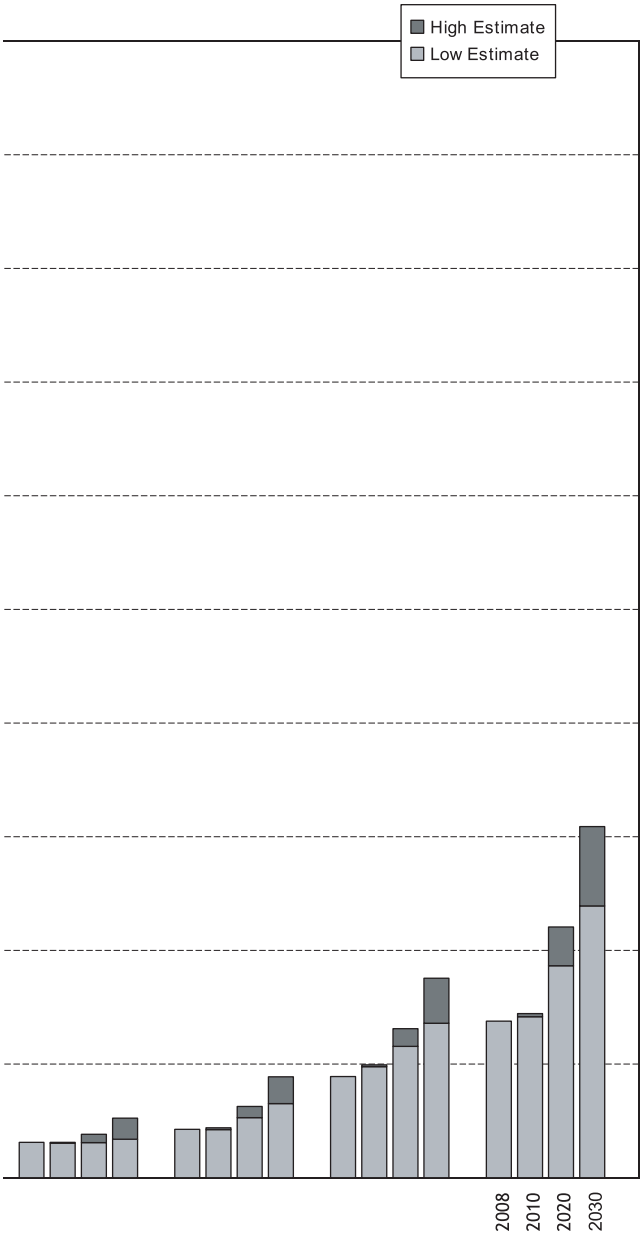

High Estimate
Low Estimate
2008
2010
2020
2030
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

TABLE 12. AVERAGE ANNUAL GROWTH RATES DURING THE PERIOD 1998—2008 (%)

Country Group	Population	Total Energy	Total Electricity	Nuclear Energy	Nuclear Capacity
North America	1.1	0.6	1.3	1.9	0.6
Latin America	1.4	2.5	3.2	4.5	3.4
Western Europe	0.6	0.7	1.4	-0.1	-0.3
Eastern Europe	-0.3	1.3	1.7	3.3	0.2
Africa	2.7	2.7	4.6	—	—
Middle East and South Asia	2.0	5.5	4.9	3.6	8.7
South East Asia and the Pacific	1.2	4.1	4.5		
Far East	0.7	5.3	6.6	1.1	2.2
World Average	1.3	2.6	3.1	1.3	0.6

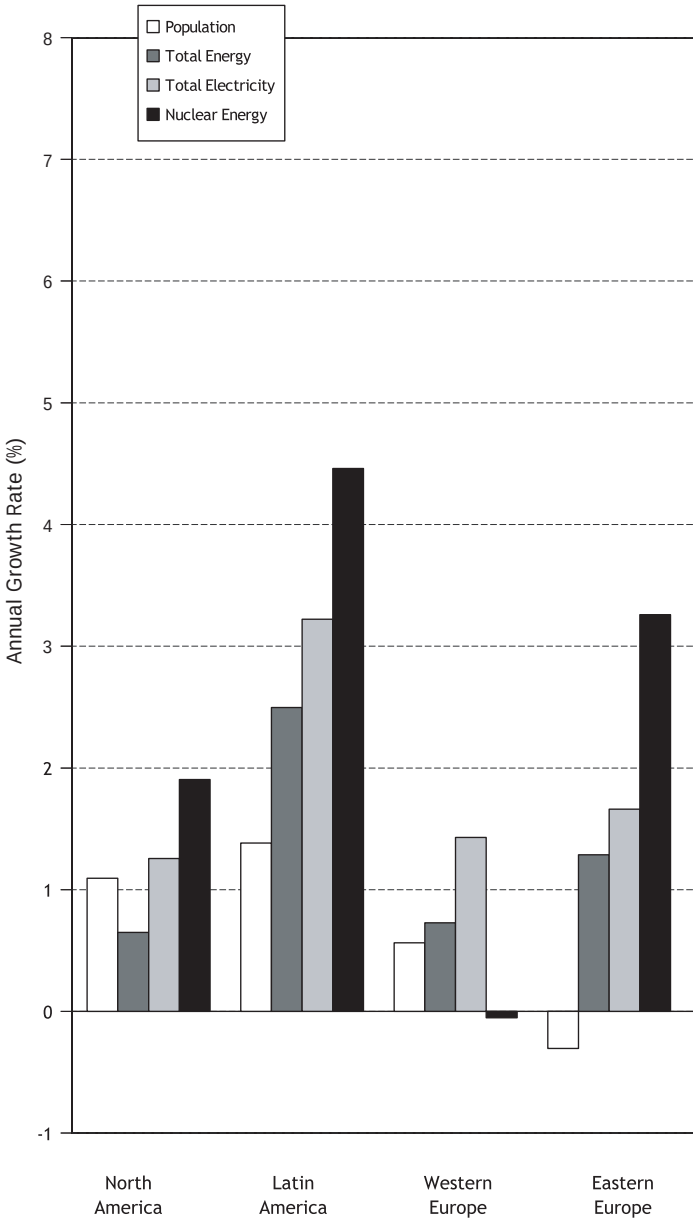


FIGURE 10. AVERAGE ANNUAL GROWTH RATES DURING THE PERIOD 1998 — 2008

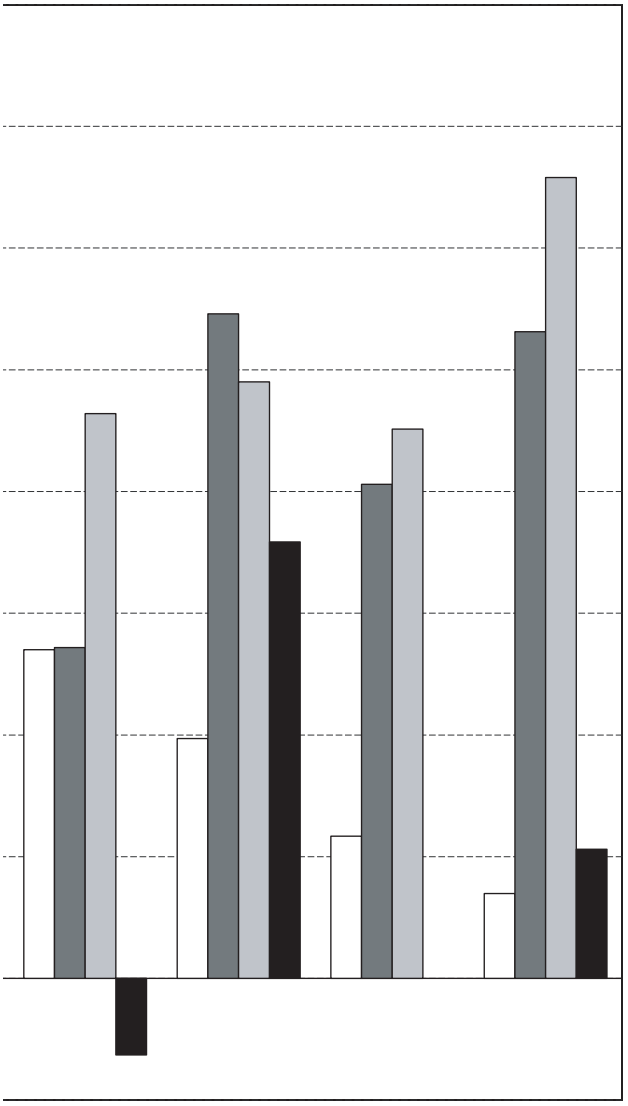

Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

TABLE 13. ESTIMATES OF AVERAGE ANNUAL GROWTH RATES DURING THE PERIOD 2008—2030 (%)

Country Group	Population	Total Energy	Total Electricity	Nuclear Energy	Nuclear Capacity
North America	0.8	0.5 — 0.7	1.4 — 2.1	0.5 — 1.8	0.5 — 1.8
Latin America	0.8	1.3 — 2.1	2.3 — 3.6	4.8 — 8.4	4.6 — 8.2
Western Europe	0.3	0.5 — 1.3	1.2 — 2.0	-1.5 — 1.4	-1.8 — 1.2
Eastern Europe	-0.2	1.1 — 2.6	1.9 — 2.5	2.6 — 4.3	2.6 — 4.3
Africa	2.1	1.7 — 3.0	2.5 — 4.5	5.7 — 10.8	5.7 — 10.8
Middle East and South Asia	1.3	2.0 — 3.2	3.3 — 4.8	7.9 — 13.1	7.3 — 12.5
South East Asia and the Pacific	0.8	1.7 — 2.4	2.7 — 3.9		
Far East	0.4	2.2 — 3.3	3.0 — 4.2	4.2 — 5.8	3.9 — 5.6
World Average	1.0	1.4 — 2.4	2.2 — 3.2	1.5 — 3.6	1.5 — 3.6

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