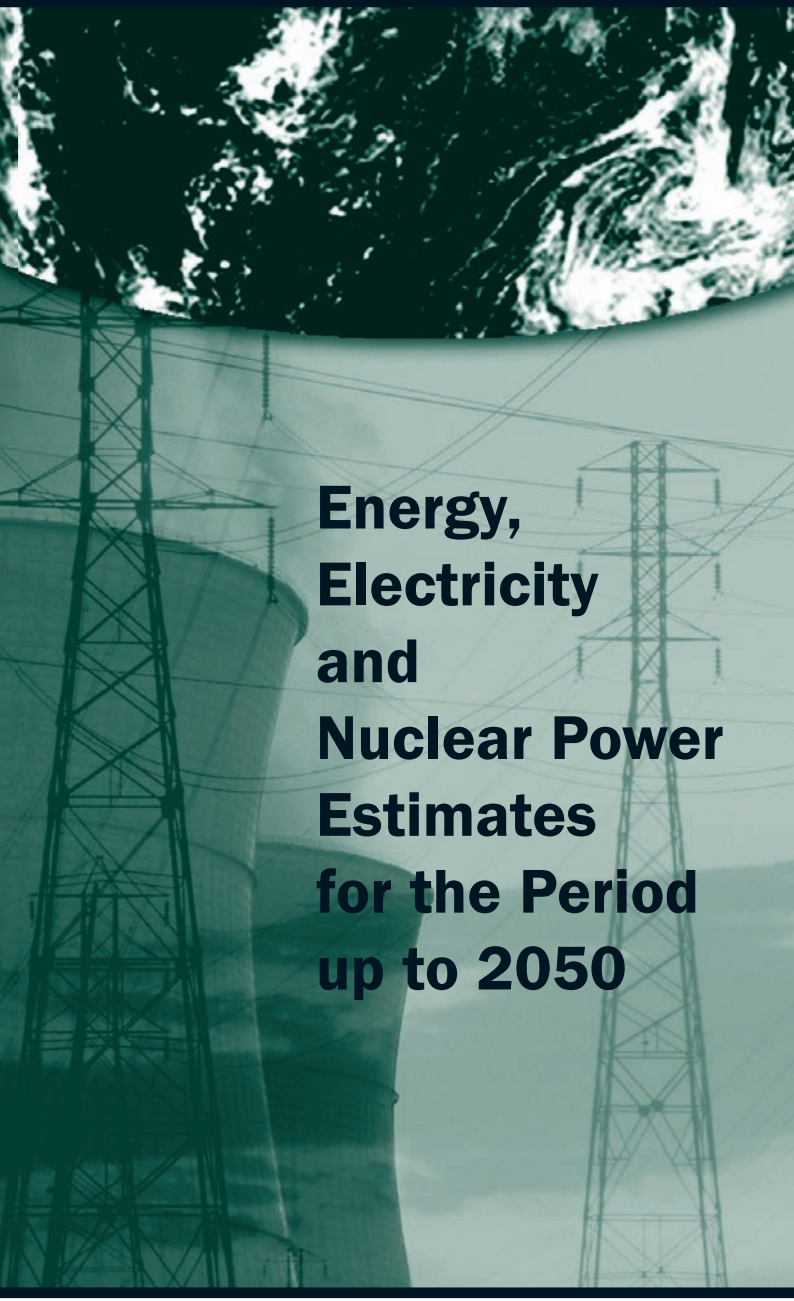
REFERENCE DATA SERIES No. 1 2010 Edition



Energy, Electricity and Nuclear Power Estimates for the Period up to 2050

IAEA
International Atomic Energy Agency

REFERENCE DATA SERIES No. 1

ENERGY, ELECTRICITY AND NUCLEAR POWER ESTIMATES FOR THE PERIOD UP TO 2050

2010 Edition

INTERNATIONAL ATOMIC ENERGY AGENCY
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INTRODUCTION

Reference Data Series No. 1 (RDS-1) is an annual publication — currently in its thirtieth edition — containing estimates of energy, electricity and nuclear power trends up to the year 2050.

RDS-1 starts with a summary of the situation of nuclear power in IAEA Member States as of the end of 2009. The data on nuclear power presented in Tables 1 and 2 are based on actual statistical data collected by the IAEA's Power Reactor Information System (PRIS). Energy and electricity data for 2009, however, are estimated, since the latest available information from the United Nations Department of Economic and Social Affairs is for 2007. Population data originate from the World Population Prospects (2008 revision), published by the Population Division of the United Nations Department of Economic and Social Affairs, and the 2009 values again are estimates.

As in the past, projections of future needs of energy, electricity and nuclear power are presented as low and high estimates encompassing the inherent uncertainties involved in projecting trends. The RDS-1 estimates should be viewed as very general growth trends whose validity must be constantly subjected to critical review.

Beginning with the 30th edition of this publication, however, the end-point of the estimates is extended up to the year 2050 (instead of 2030). Looking beyond 2030 is prompted by the interest expressed by numerous Member States currently without nuclear power in adding nuclear energy to their future national energy supply mixes. Given the lead times in planning and implementing nuclear power programmes, a fair share of these are likely to result in actual plant commissioning and grid connection after 2030.

Many international, national and private organizations routinely engage in energy demand and supply projections, including nuclear power. These projections are based on a multitude of different assumptions and aggregating procedures, which make a straightforward comparison and synthesis very difficult. The basic differences refer to such fundamental input assumptions as:

- Economic growth;
- Correlation of economic growth and energy use;
- Technology performance and costs;
- Energy resource availability and future fuel prices;
- Energy policy and physical, environmental and economic constraints.

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;
- Global and regional energy, electricity and nuclear power projections made by other international organizations.

More specifically, the estimates of nuclear generating capacity 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 stringent policies globally targeted at mitigating climate change.

In the presence of the current financial and economic crises, developing the 2009 and 2010 nuclear power projections posed a considerable challenge. The 2010 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 and/or 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%; data on electricity generated by geothermal heat is converted to joules based on the average efficiency of a geothermal power plant, i.e. 10%. 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% 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 (electrical)
1 GW(e) = 1000 MW(e) = 10^9 watts (electrical)
1 GJ = 1 gigajoule = 10^9 joules
1 EJ = 1 exajoule = 10^{18} joules
1 EJ = 23.9 megatonnes of oil equivalent (Mtoe)
1 TW·h = 1 terawatt-hour = 109 kW·h = 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 2009)

Group and Country	In Operation		Long-term Shut Down Reactors		Under Construction		Electricity Supplied by Nuclear Power Reactors in 2009	
	Number of Units	Total MW(e)	Number of Units	Total MW(e)	Number of Units	Total MW(e)	TW·h	Per cent of Total Electricity
North America								
Canada	18	12569	4	2726			85.1	14.8
United States of America	104	100747			1	1165	796.9	20.2
Latin America								
Argentina	2	935			1	692	7.6	6.9
Brazil	2	1884					12.2	2.9
Mexico	2	1300					10.1	4.8
Western Europe								
Belgium	7	5902					45.0	51.7
Finland	4	2696			1	1600	22.6	32.9
France	59	63260			1	1600	391.8	75.2
Germany	17	20480					127.7	26.1
Netherlands	1	487					4.0	3.7
Spain	8	7450					50.6	17.5
Sweden	10	9036					50.0	37.4
Switzerland	5	3238					26.3	39.5
United Kingdom	19	10137					62.9	17.9
Eastern Europe								
Armenia	1	375					2.3	44.9
Bulgaria	2	1906			2	1906	14.2	35.9
Czech Republic	6	3678					25.7	33.8
Hungary	4	1889					14.3	43.0

TABLE 1. NUCLEAR POWER REACTORS IN THE WORLD (end of 2009)

Group and Country	In Operation		Long-term Shut Down Reactors		Under Construction		Electricity Supplied by Nuclear Power Reactors in 2009	
	Number of Units	Total MW(e)	Number of Units	Total MW(e)	Number of Units	Total MW(e)	TW·h	Per cent of Total Electricity
Lithuania (a)	1	1185					10.0	76.2
Romania	2	1300					10.8	20.6
Russian Federation	31	21743			9	6996	152.8	17.8
Slovakia	4	1762			2	782	13.1	53.5
Slovenia	1	666					5.5	37.8
Ukraine	15	13107			2	1900	78.0	48.6
Africa								
South Africa	2	1800					11.6	4.8
Middle East and South Asia								
India	18	3987			5	2708	14.8	2.2
Iran, Islamic Republic of					1	915		
Pakistan	2	425			1	300	2.6	2.7
Far East								
China	11	8438			20	19920	65.7	1.9
Japan	54	46823	1	246	1	1325	263.1	28.9
Korea, Republic of	20	17705			6	6520	141.1	34.8
World Total (b)	438	371890	5	2972	55	50929	2558.1	13.8

Notes:

(a) Last unit was shut down on 31 December 2009;

(b) Including the following data on Taiwan, China:

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

— 39.9 TW·h of nuclear electricity generation, representing 20.65% of the total electricity generated.

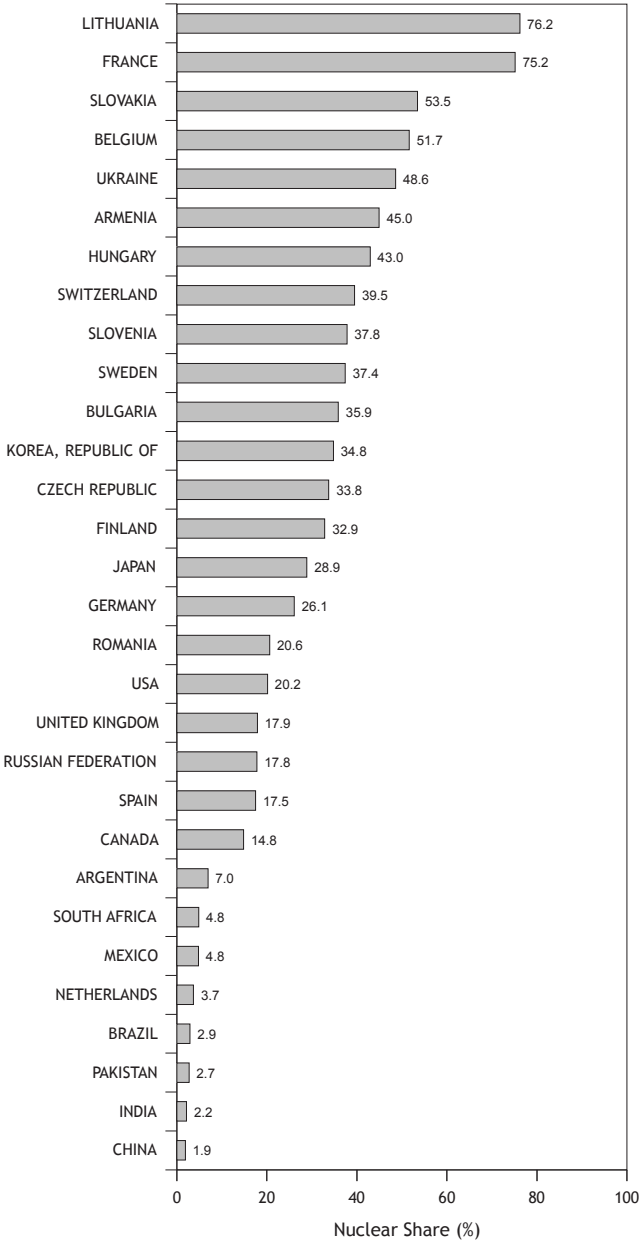


FIGURE 1. NUCLEAR SHARE OF TOTAL ELECTRICITY GENERATION IN 2009

Note: the nuclear share of electricity generation in Taiwan, China was 20.7%.

TABLE 2. NUMBER OF COUNTRIES WITH NUCLEAR POWER REACTORS IN OPERATION OR UNDER CONSTRUCTION (end of 2009)

Country Group	Number of Countries in Group	Countries with Nuclear Power Reactors			
		In Operation	Long term Shutdown	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	2009			2020 (a)			2030 (a)			2050 (a)(b)		
	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	1251	113.3	9.1	1082 1157	122 128	11.3 11.1	1058 1127	128 166	12.1 14.7	1001	130 260	13.0 26.0
Latin America	296	4.1	1.4	365 381	7.1 7.1	1.9 1.9	520 573	11 23	2.2 4.1	985	15 60	1.5 6.1
Western Europe	800	122.7	15.3	734 728	93 129	12.6 17.7	787 794	86 158	11.0 19.9	827	80 270	9.7 32.7
Eastern Europe	471	47.6	10.1	440 469	67 81	15.3 17.2	471 517	84 111	17.9 21.5	526	80 160	15.2 30.4
Africa	126	1.8	1.4	179 264	1.8 3.0	1.0 1.1	337 647	6.1 15	1.8 2.4	1934	10 48	0.5 2.5
Middle East and South Asia	385	4.4	1.1	539 662	14 23	2.6 3.5	910 1377	32 56	3.5 4.1	3143	50 140	1.6 4.5
South East Asia and the Pacific	174			227 242			349 404	1.0 6.0	0.3 1.5	758	5.0 27	0.7 3.6
Far East	1412	77.9	5.5	1734 1853	148 179	8.5 9.7	2026 2309	197 267	9.7 11.6	2689	220 450	8.2 16.7
World Total Low Estimate	4914	371.9	7.6	5301	453	8.5	6458	546	8.5	11864	590	5.0
World Total High Estimate				5757	550	9.6	7747	803	10.4		1415	11.9

Notes:

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

(b) Projection figures for total electric generating capacities are the arithmetic average between low and high estimates.

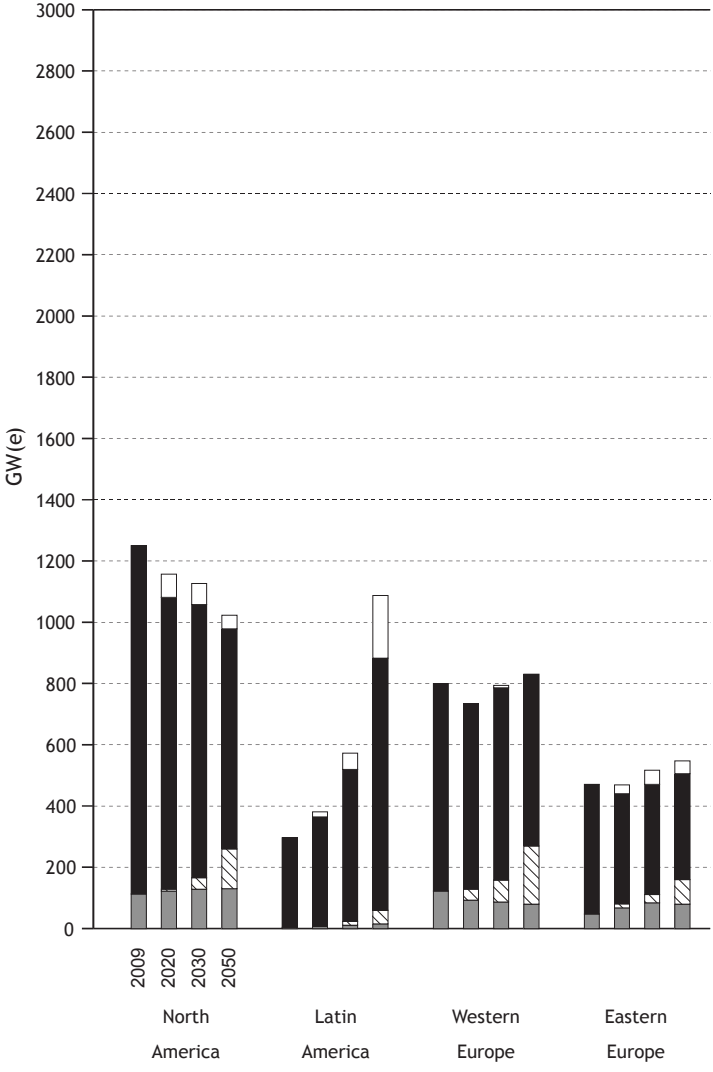


FIGURE 2. TOTAL AND NUCLEAR ELECTRICAL GENERATING CAPACITY

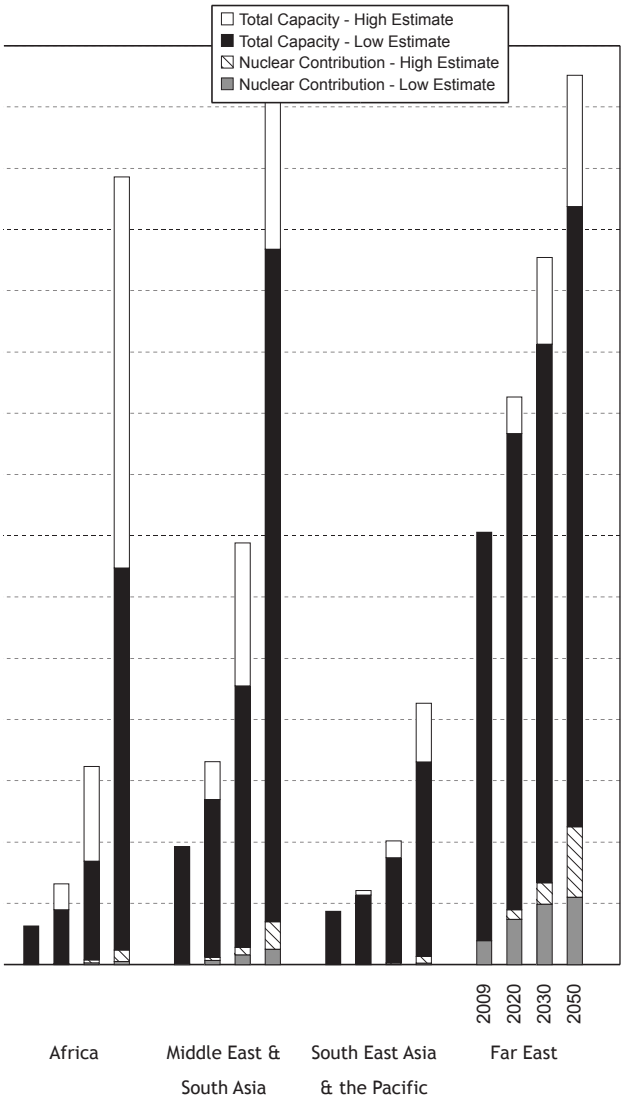

Total Capacity - High Estimate
Total Capacity - Low Estimate
Nuclear Contribution - High Estimate
Nuclear Contribution - Low Estimate
2009
2020
2030
2050
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

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

Country Group	2009			2020			2030			2050 (a)		
	Total Elect. TW·h	Nuclear		Total Elect. TW·h	Nuclear		Total Elect. TW·h	Nuclear		Total Elect. TW·h	Nuclear	
		TW·h	%		TW·h	%		TW·h	%		TW·h	%
North America	4525	882.0	19.5	4676 4994	984 1035	21.0 20.7	4819 5249	1034 1339	21.5 25.5	5245	1048 2095	20.0 40.0
Latin America	1220	29.9	2.5	1618 1689	53 53	3.3 3.1	2442 2725	86 178	3.5 6.5	5267	114 457	2.2 8.7
Western Europe	2967	780.8	26.3	3169 3274	699 968	22.0 29.6	3466 3763	666 1218	19.2 32.4	4204	617 2081	14.7 49.5
Eastern Europe	1720	326.6	19.0	1898 2048	455 544	24.0 26.6	2182 2448	592 778	27.1 31.8	2799	561 1121	20.0 40.1
Africa	628	11.6	1.8	907 1335	15 24	1.6 1.8	1734 3338	50 126	2.9 3.8	10250	82 391	0.8 3.8
Middle East and South Asia	1573	17.4	1.1	2297 2836	86 144	3.7 5.1	4037 6122	205 363	5.1 5.9	15303	324 908	2.1 5.9
South East Asia and the Pacific	729			977 1042			1547 1797	6 39	0.4 2.2	3685	35 189	1.0 5.1
Far East	5195	509.8	9.8	7191 7748	1024 1238	14.2 16.0	9027 10412	1399 1898	15.5 18.2	14752	1561 3193	10.6 21.6
World Total Low Estimate	18558	2558.1	13.8	22735	3314	14.6	29254	4040	13.8	61503	4342	7.1
World Total High Estimate				24965	4006	16.0	35854	5938	16.6		10436	17.0

Notes:

(*) 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 capacity at the end of the year and not the effective capacity average over the year.

(a) Projection figures for total electricity generation are the arithmetic average between low and high estimates.

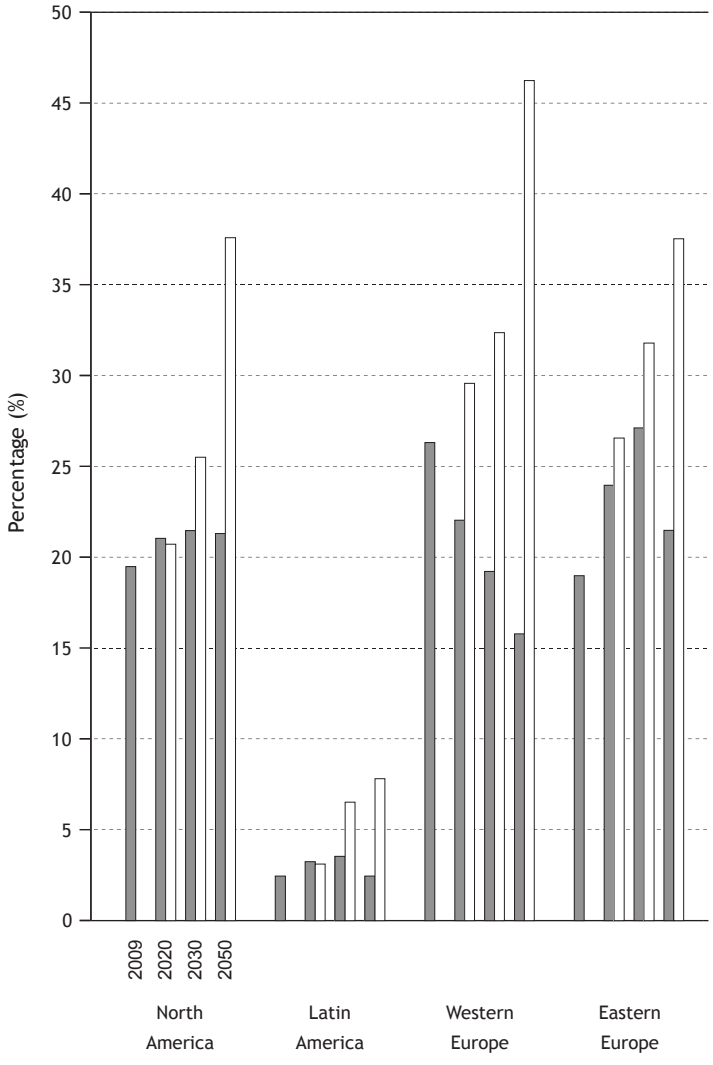
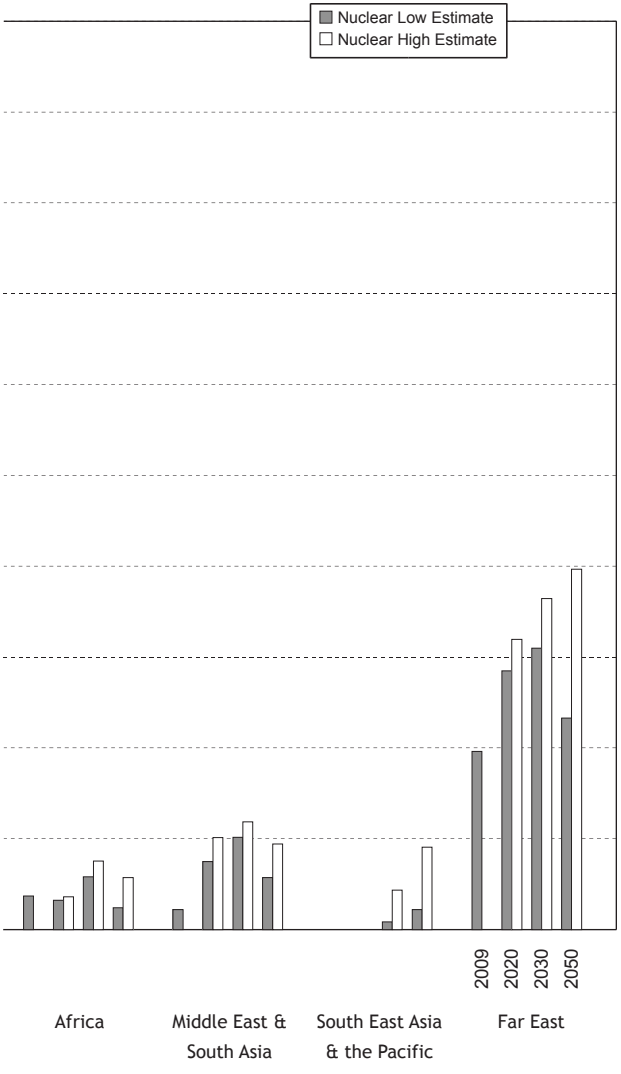


FIGURE 3. PERCENTAGE OF ELECTRICITY SUPPLIED BY NUCLEAR


Nuclear Low Estimate
Nuclear High Estimate
2009
2020
2030
2050
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

POWER

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

Country Group	2009			2020			2030			2050 (a)		
	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	104.5	37.2	9.2	104 109	39 39	10.3 10.3	103 114	40 40	10.9 12.9	111	42	11.3 19.0
Latin America	32.8	27.9	1.0	40 43	30 30	1.4 1.3	53 59	35 35	1.8 3.3	87	46	1.6 5.3
Western Europe	65.3	39.0	13.0	64 67	42 43	11.9 15.8	61 68	47 48	11.8 19.5	67	55	11.0 31.4
Eastern Europe	53.8	39.6	6.6	56 59	41 43	8.8 10.1	58 62	46 48	11.1 13.8	61	56	10.8 19.0
Africa	29.0	21.7	0.4	39 50	23 27	0.4 0.5	66 92	26 37	0.8 1.5	182	55	0.6 2.0
Middle East and South Asia	63.8	33.5	0.3	81 92	38 42	1.2 1.7	119 156	46 53	1.9 2.5	255	55	1.7 3.3
South East Asia and the Pacific	24.3	29.2		30 31	32 33		39 42	38 42	0.2 1.0	64	56	0.6 3.0
Far East	136.1	42.9	4.1	171 184	47 47	6.5 7.3	199 220	51 53	7.7 9.4	254	65	7.5 12.4
World Total Low Estimate	509.6	36.9	5.5	586	40	6.2	698	44	6.3	1080	55	4.9
World Total High Estimate				635	41	6.9	812	47	8.0			9.6

Notes:

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

(a) Projection figures for total energy requirement and percentage used for electricity generation are the arithmetic average between low and high estimates.

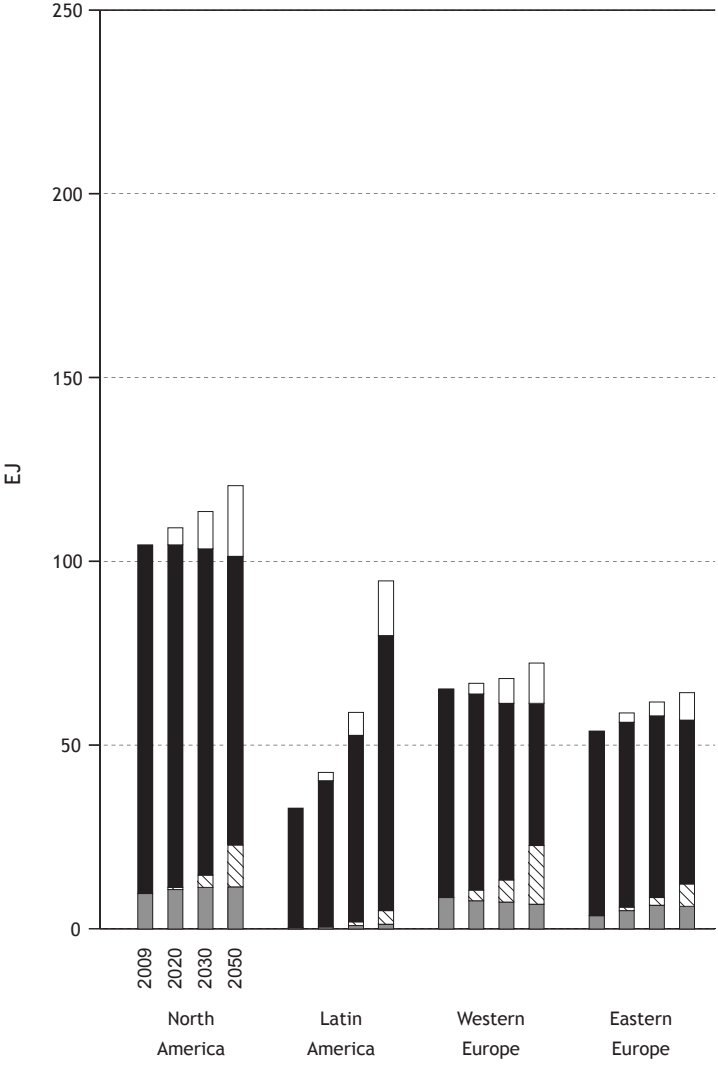


FIGURE 4. ESTIMATES OF ENERGY REQUIREMENT

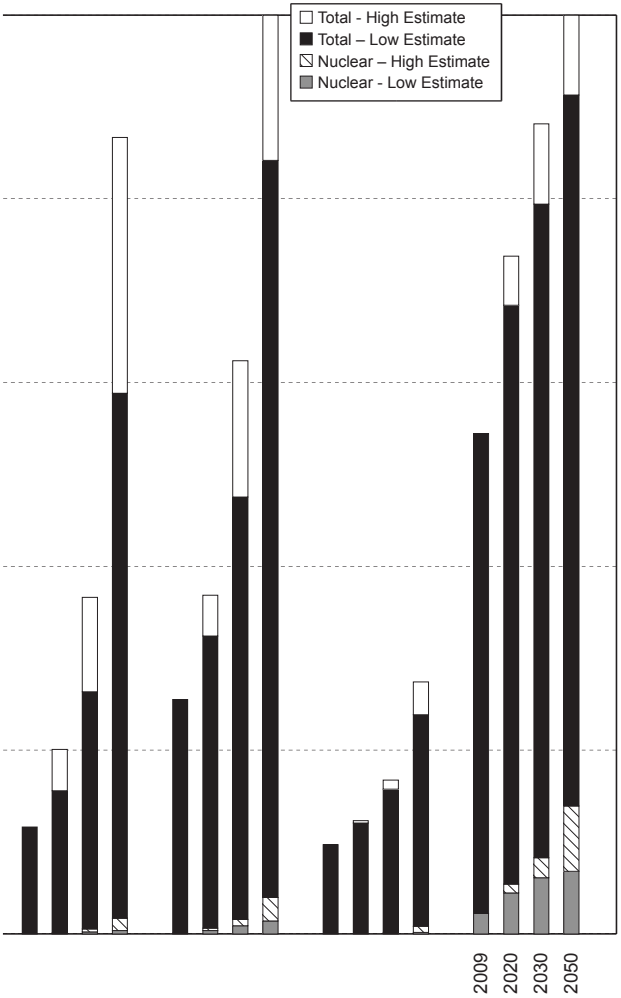

Total - High Estimate
Total – Low Estimate
Nuclear – High Estimate
Nuclear - Low Estimate
2009
2020
2030
2050
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

TABLE 6. TOTAL ENERGY REQUIREMENT (EJ) BY TYPE OF FUEL IN 2009 (*)

Country Group	Solids (a)	Liquids	Gases	Biomass (b)	Hydro	Nuclear	Renewables (c)	Total
North America	21.19	35.71	28.41	6.15	2.52	9.62	0.85	104.46
Latin America	1.26	15.13	7.54	5.52	2.59	0.33	0.42	32.80
Western Europe	8.46	22.72	18.52	4.28	1.91	8.52	0.93	65.33
Eastern Europe	10.88	11.56	25.35	1.45	1.12	3.56	-0.12	53.81
Africa	4.58	7.75	4.33	11.83	0.36	0.13	0.06	29.04
Middle East and South Asia	15.50	21.42	16.28	9.84	0.57	0.19	> 0.01	63.80
South East Asia and the Pacific	4.74	8.55	6.38	3.92	0.25		0.42	24.26
Far East	81.44	31.75	9.82	4.24	2.83	5.56	0.49	136.12
World Total	148.07	154.58	116.64	47.23	12.15	27.91	3.06	509.64

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.

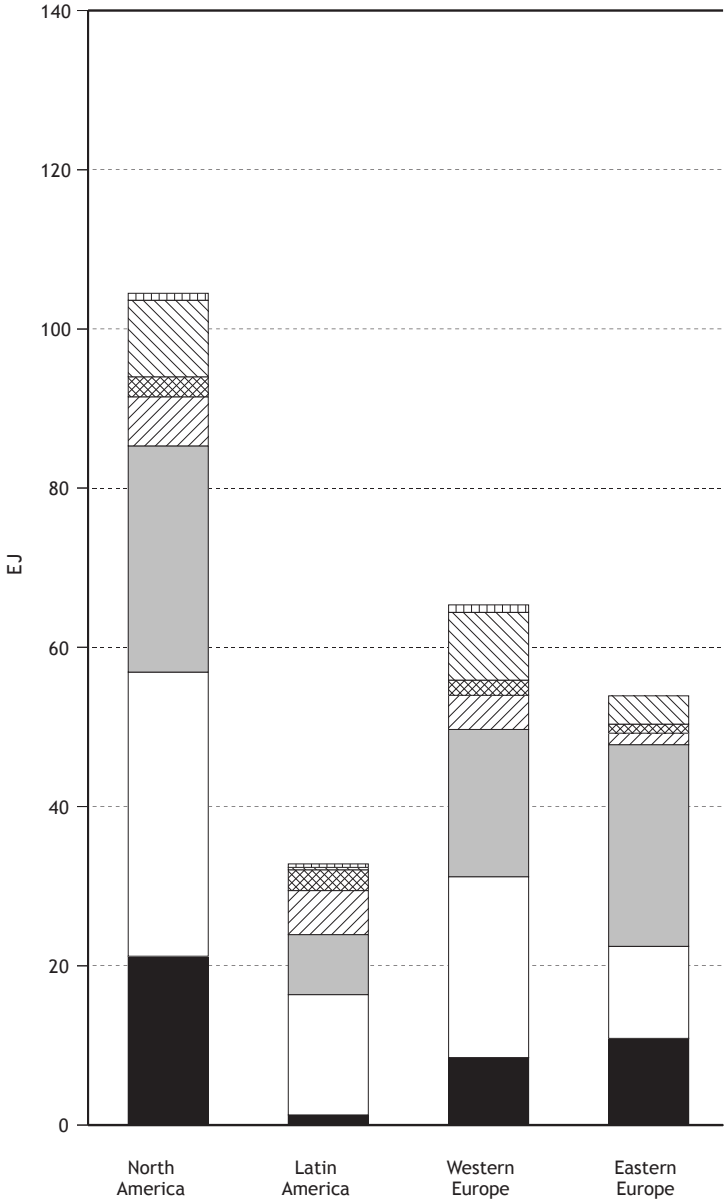
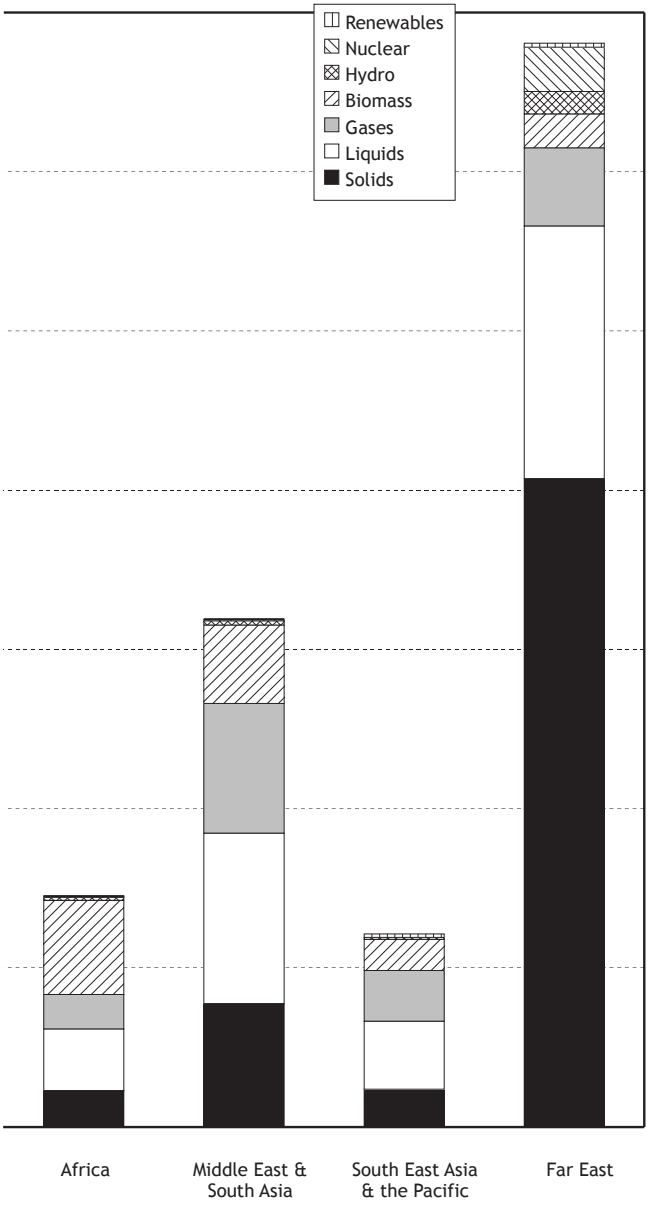


FIGURE 5. TOTAL ENERGY REQUIREMENT BY FUEL TYPE IN 2009


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

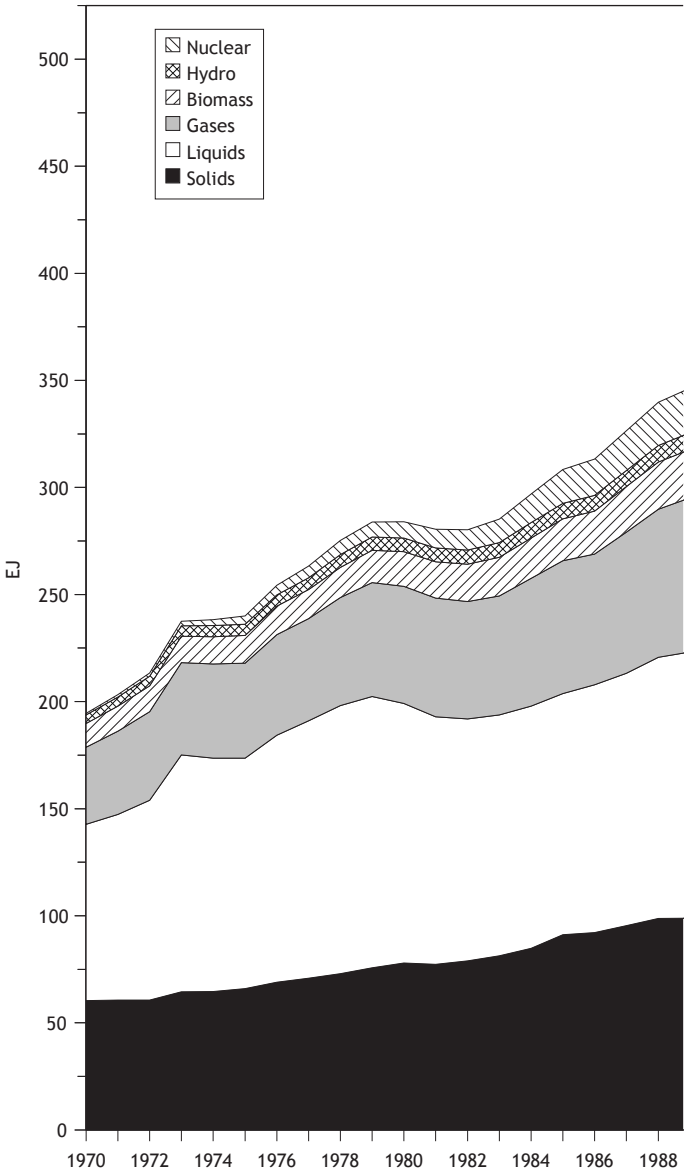


FIGURE 6. BREAKDOWN OF WORLD TOTAL ENERGY REQUIREMENT DURING THE PERIOD 1970 — 2009

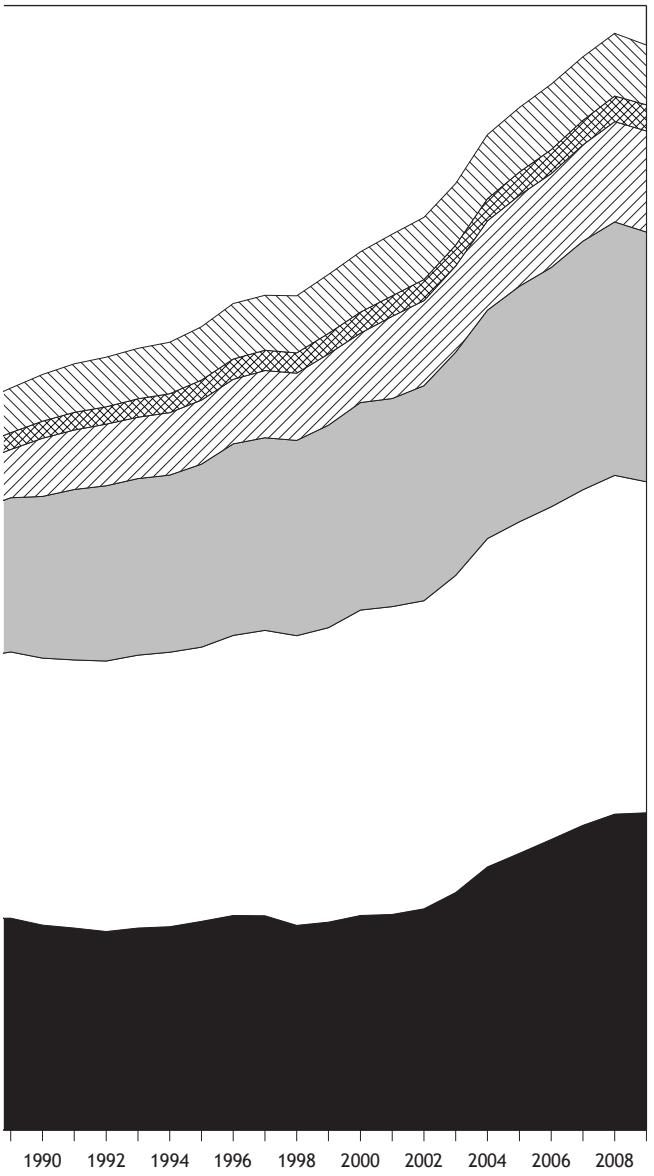

1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Year

TABLE 7. FUEL SHARES (%) OF ENERGY REQUIREMENT IN 2009 (*)

Country Group	Solids (a)	Liquids	Gases	Biomass (b)	Hydro	Nuclear	Renewables (c)	Total
North America	20.29	34.18	27.20	5.89	2.41	9.21	0.81	100.00
Latin America	3.84	46.13	22.99	16.84	7.91	1.00	1.29	100.00
Western Europe	12.95	34.77	28.35	6.55	2.92	13.04	1.43	100.00
Eastern Europe	20.22	21.48	47.11	2.70	2.08	6.62	-0.22	100.00
Africa	15.78	26.68	14.92	40.72	1.25	0.43	0.22	100.00
Middle East and South Asia	24.30	33.57	25.51	15.42	0.89	0.30	> 0.01	100.00
South East Asia and the Pacific	19.54	35.23	26.32	16.15	1.03		1.73	100.00
Far East	59.83	23.32	7.21	3.11	2.08	4.09	0.36	100.00
World Total	29.05	30.33	22.89	9.27	2.38	5.48	0.60	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 2009

Country Group	Thermal (a)	Hydro	Nuclear	Renewables (b)	Total
North America	28.89	2.52	9.62	0.83	41.87
Latin America	5.91	2.59	0.33	0.40	9.23
Western Europe	15.81	1.91	8.52	0.85	27.08
Eastern Europe	18.06	1.12	3.56	0.03	22.76
Africa	5.89	0.36	0.13	0.05	6.42
Middle East and South Asia	20.32	0.57	0.19	> 0.01	21.08
South East Asia and the Pacific	6.82	0.25		0.42	7.48
Far East	52.43	2.83	5.56	0.50	61.31
World Total	154.11	12.15	27.91	3.07	197.24

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 2009

Country Group	Thermal (a)	Hydro	Nuclear	Renewables (b)	Total
North America	63.58	15.48	19.49	1.45	100.00
Latin America	37.55	59.03	2.45	0.96	100.00
Western Europe	51.01	17.83	26.32	4.84	100.00
Eastern Europe	62.80	18.11	18.99	0.10	100.00
Africa	81.69	16.05	1.84	0.42	100.00
Middle East and South Asia	88.83	10.05	1.11	0.01	100.00
South East Asia and the Pacific	88.34	9.54		2.12	100.00
Far East	74.73	15.11	9.81	0.35	100.00
World Total	66.63	18.19	13.78	1.40	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	2009		2020		2030		2050	
	Million Inhabitants	Growth Rate (%/a) 1999 – 2009	Million Inhabitants	Growth Rate (%/a) 2009 – 2020	Million Inhabitants	Growth Rate (%/a) 2020 – 2030	Million Inhabitants	Growth Rate (%/a) 2030 – 2050
North America	345	1.09	379	0.87	407	0.71	448	0.48
Latin America	587	1.43	659	1.05	711	0.76	729	0.13
Western Europe	474	0.37	484	0.19	488	0.09	520	0.32
Eastern Europe	403	-0.13	393	-0.22	380	-0.35	356	-0.33
Africa	965	2.34	1188	1.91	1398	1.64	1998	1.80
Middle East and South Asia	1788	1.87	2091	1.43	2325	1.07	2660	0.68
South East Asia and the Pacific	424	1.18	469	0.92	500	0.64	529	0.28
Far East	1767	0.69	1872	0.53	1914	0.22	1892	-0.06
World Total	6752	1.40	7535	1.00	8123	0.75	9133	1.18

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

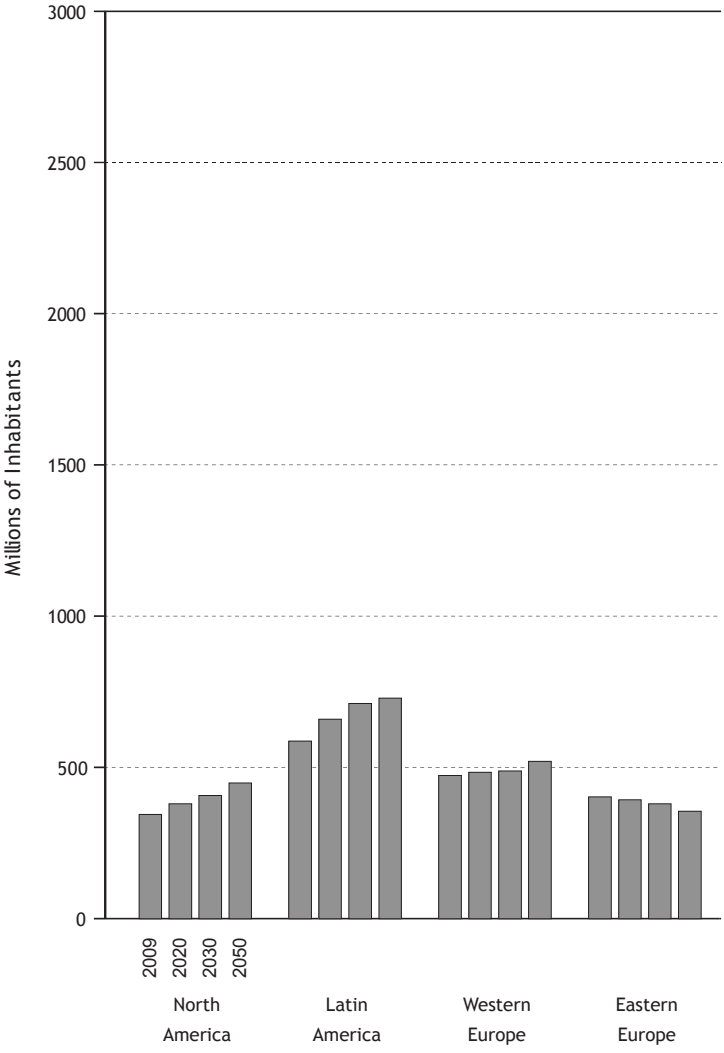


FIGURE 7. POPULATION ESTIMATES

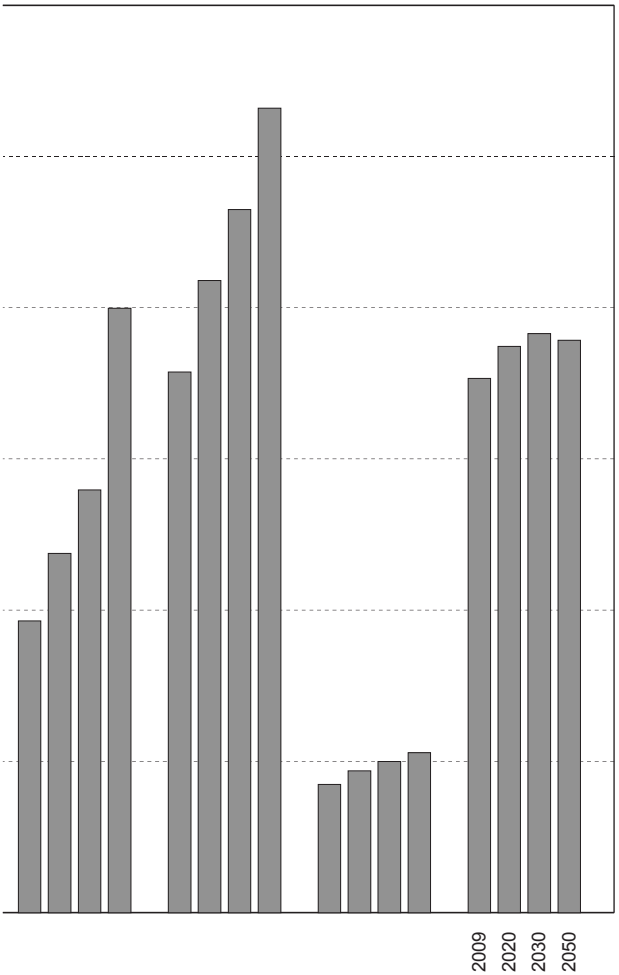

2009
2020
2030
2050
Africa
Middle East &
South Asia
South East Asia
& the Pacific
Far East

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

Country Group	2009		2020		2030		2050 (*)	
	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MW·h/cap)	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MW·h/cap)	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MW·h/cap)	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MW·h/cap)
North America	303	13.1	275 – 288	12.3 – 13.2	254 – 279	11.8 – 12.9	248 ± 21	11.7 ± 0.7
Latin America	56	2.1	61 – 65	2.5 – 2.6	74 – 83	3.4 – 3.8	120 ± 10	7.2 ± 0.8
Western Europe	138	6.3	132 – 138	6.6 – 6.8	126 – 140	7.1 – 7.7	129 ± 11	8.1 ± 0.6
Eastern Europe	134	4.3	143 – 149	4.8 – 5.2	153 – 163	5.7 – 6.4	170 ± 11	7.9 ± 0.5
Africa	30	0.7	33 – 42	0.8 – 1.1	47 – 66	1.2 – 2.4	91 ± 17	5.1 ± 1.7
Middle East and South Asia	36	0.9	39 – 44	1.1 – 1.4	51 – 67	1.7 – 2.6	96 ± 17	5.8 ± 1.5
South East Asia and the Pacific	57	1.7	64 – 66	2.1 – 2.2	79 – 84	3.1 – 3.6	121 ± 8	7.0 ± 0.9
Far East	77	2.9	91 – 99	3.8 – 4.1	104 – 115	4.7 – 5.4	134 ± 14	7.8 ± 0.7
World Average	75	2.7	78 – 84	3.0 – 3.3	86 – 100	3.6 – 4.4	118 ± 15	6.7 ± 1.2

Note:
(*) Projection figures are the arithmetic average between low and high estimates with indicated range.

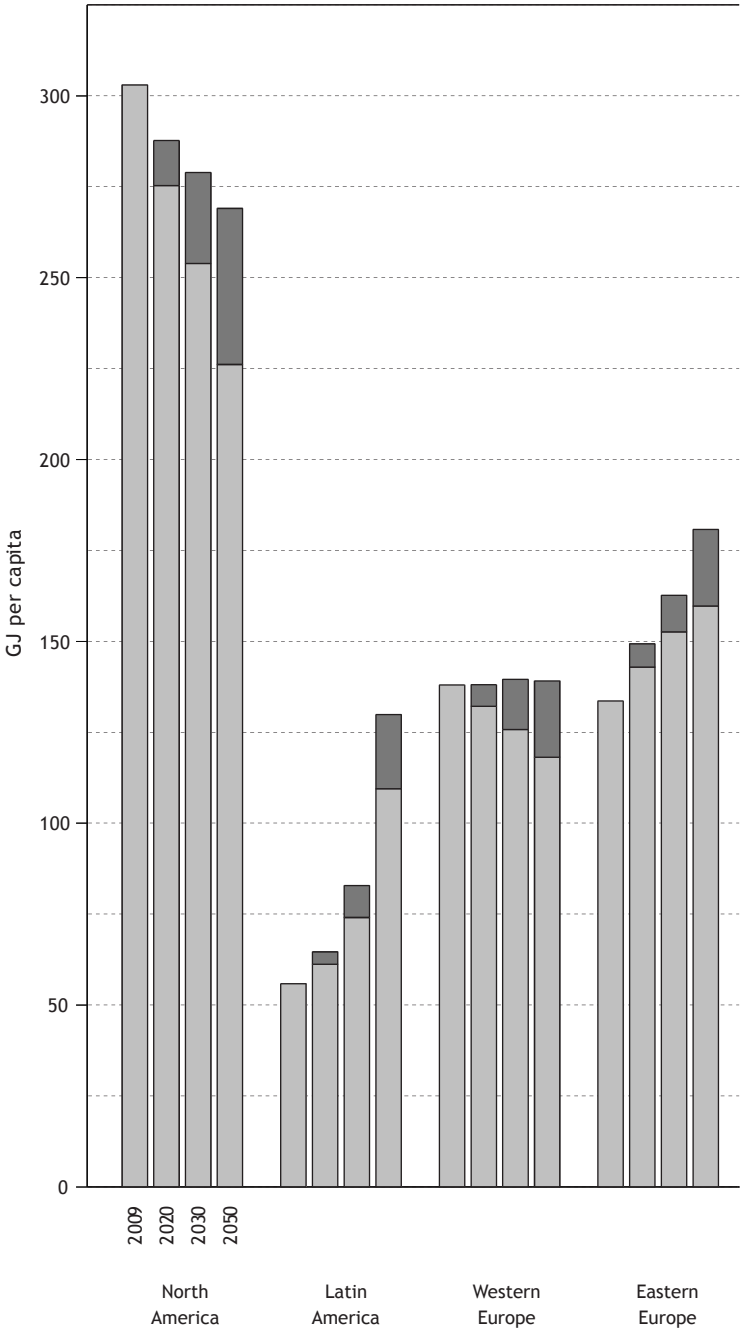
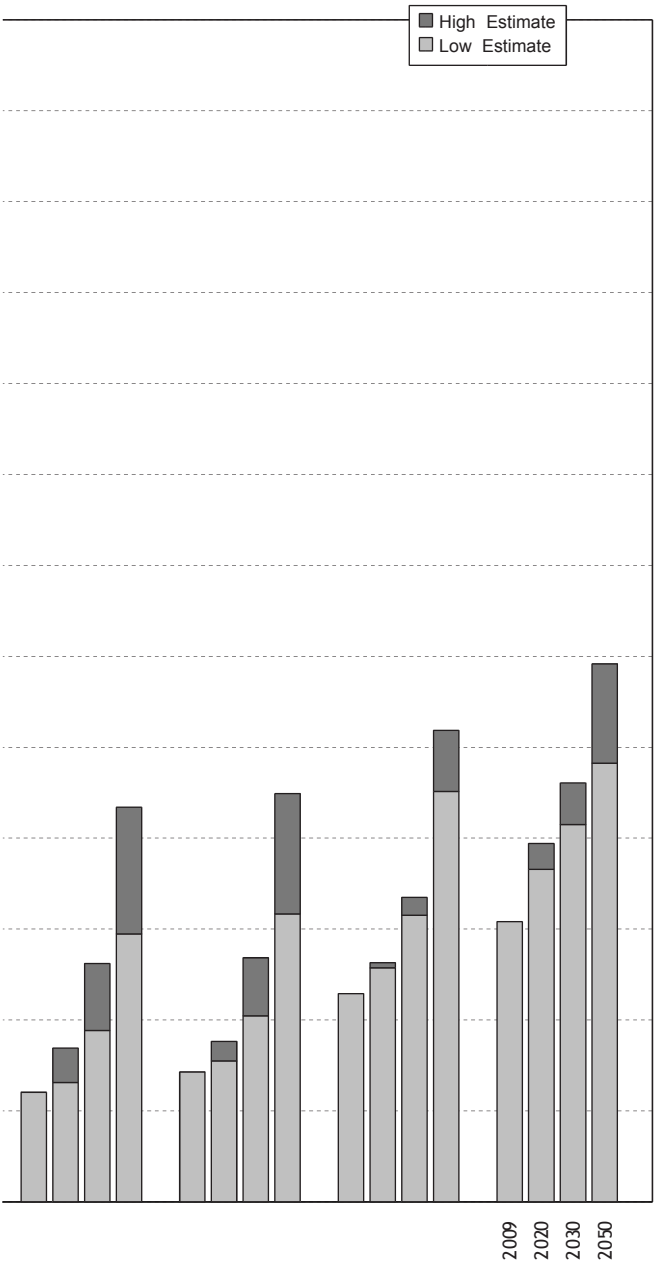


FIGURE 8. TOTAL ENERGY REQUIREMENT PER CAPITA


High Estimate
Low Estimate
2009
2020
2030
2050
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

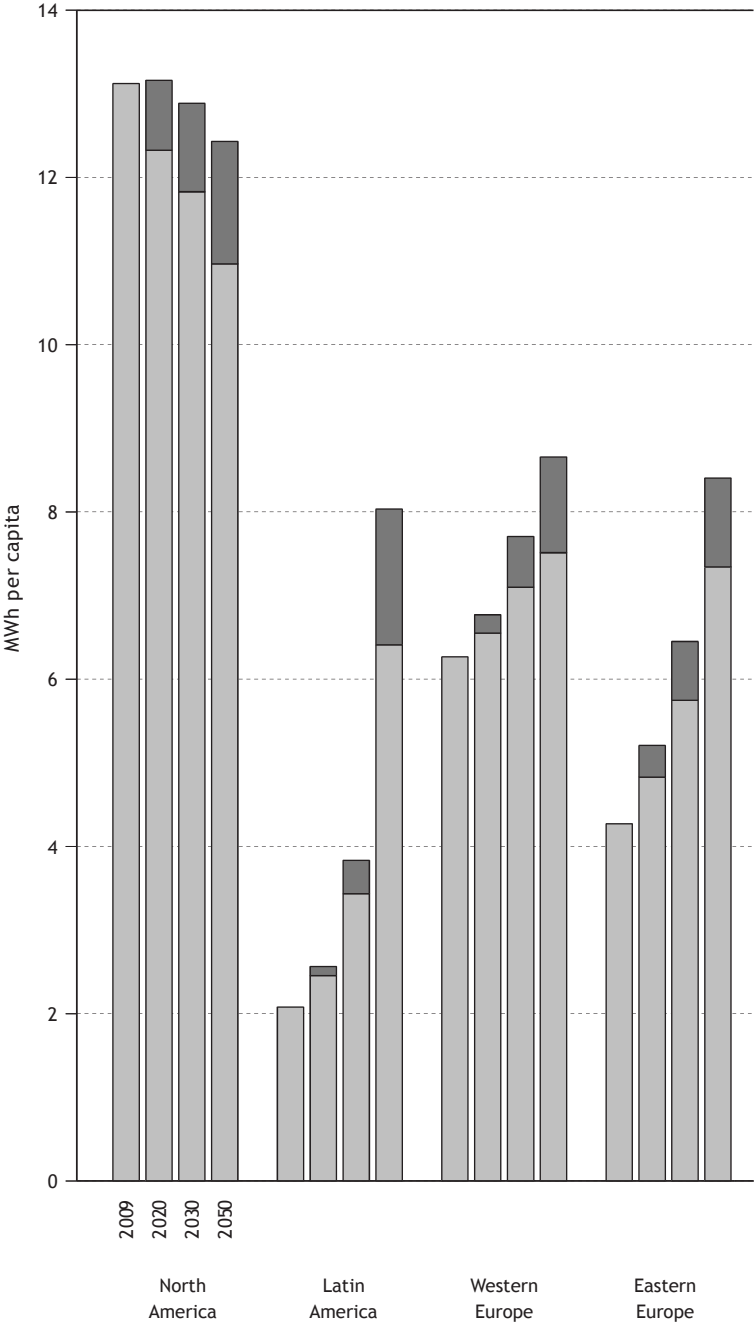


FIGURE 9. TOTAL ELECTRICITY REQUIREMENT PER CAPITA

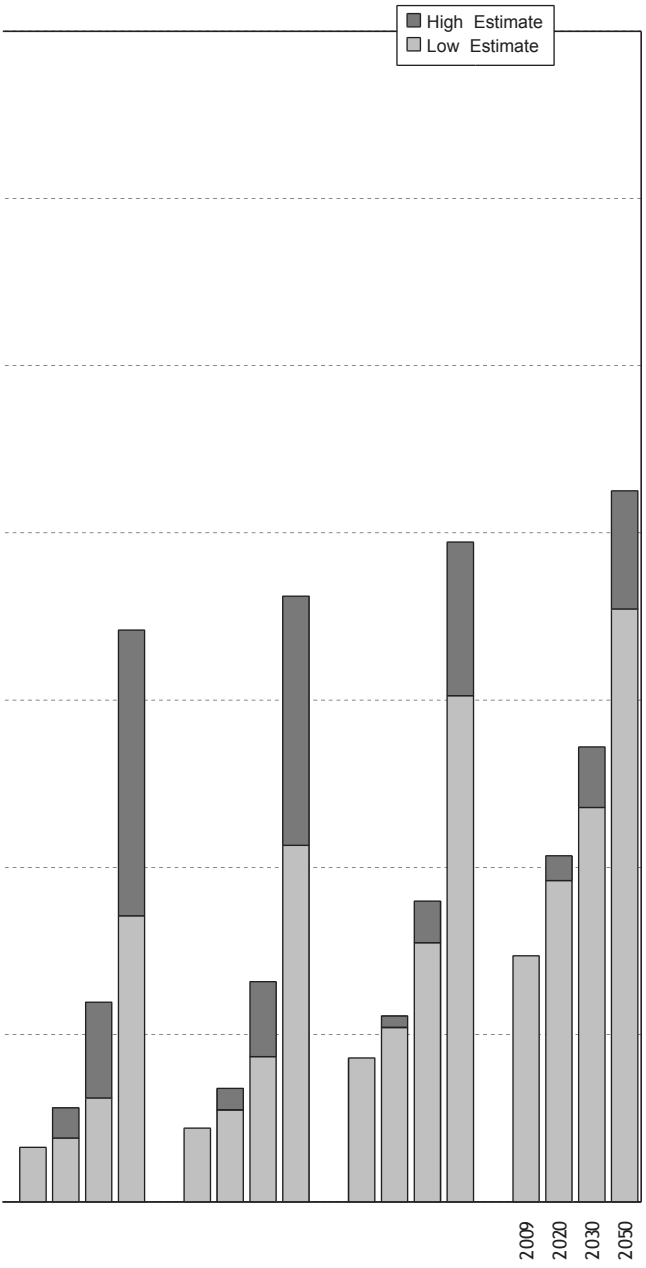

High Estimate
Low Estimate
2009
2020
2030
2050
Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

TABLE 12. AVERAGE ANNUAL GROWTH RATES DURING THE PERIOD 1999—2009 (%)

Country Group	Population	Total Energy	Total Electricity	Nuclear Energy	Nuclear Capacity
North America	1.1	0.0	0.7	1.0	0.6
Latin America	1.4	2.2	2.7	3.8	3.5
Western Europe	0.4	0.0	0.9	-0.8	-0.3
Eastern Europe	-0.1	0.6	1.1	2.5	0.5
Africa	2.3	2.6	4.7	-1.5	0.0
Middle East and South Asia	1.9	5.9	4.6	4.2	8.1
South East Asia and the Pacific	1.2	3.8	3.5		
Far East	0.7	5.7	6.9	1.2	2.0
World Average	1.3	2.4	2.8	0.6	0.6

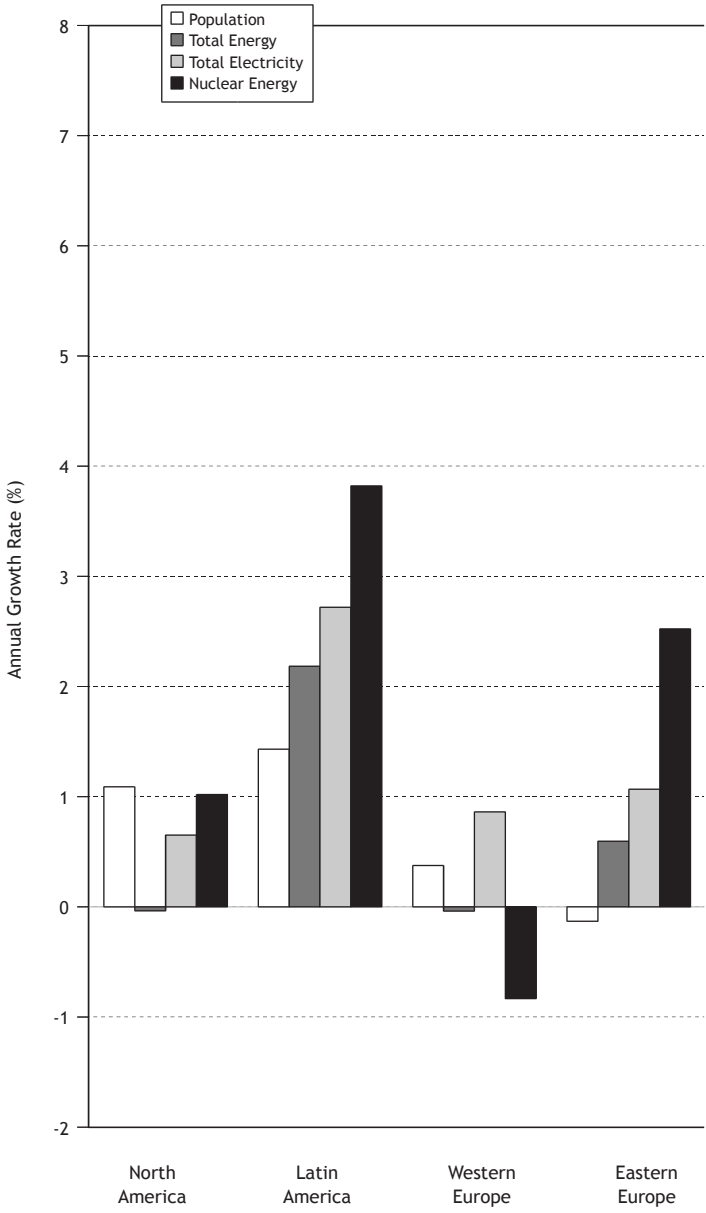


FIGURE 10. AVERAGE ANNUAL GROWTH RATES DURING THE PERIOD 1999 — 2009

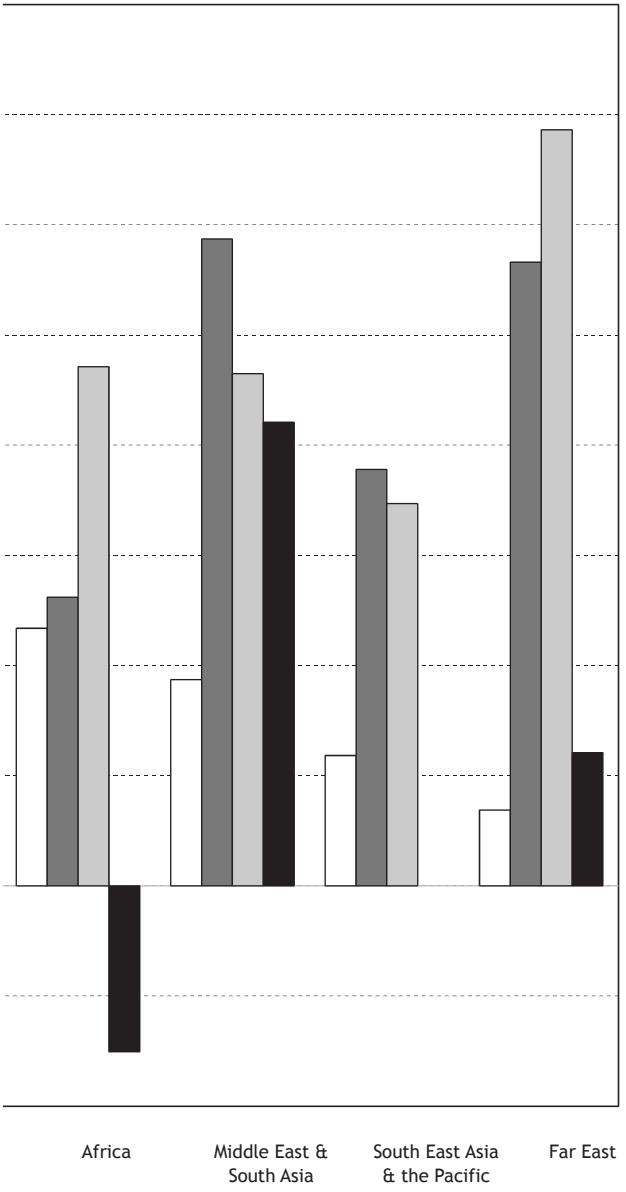

Africa
Middle East & South Asia
South East Asia & the Pacific
Far East

TABLE 13. ESTIMATES OF AVERAGE ANNUAL GROWTH RATES DURING THE PERIOD 2009—2030 (%)

Country Group	Population	Total Energy	Total Electricity	Nuclear Energy	Nuclear Capacity
North America	0.8	0.0 – 0.4	0.3 – 0.7	0.8 – 2.0	0.6 – 1.8
Latin America	0.9	2.3 – 2.8	3.4 – 3.9	5.2 – 8.9	4.9 – 8.6
Western Europe	0.1	-0.3 – 0.2	0.7 – 1.1	-0.8 – 2.1	-1.7 – 1.2
Eastern Europe	-0.3	0.4 – 0.7	1.1 – 1.7	2.9 – 4.2	2.8 – 4.1
Africa	1.8	4.0 – 5.6	5.0 – 8.3	7.3 – 12.0	6.0 – 10.7
Middle East and South Asia	1.3	3.0 – 4.3	4.6 – 6.7	12.5 – 15.6	9.8 – 12.9
South East Asia and the Pacific	0.8	2.3 – 2.6	3.6 – 4.4		
Far East	0.4	1.8 – 2.3	2.7 – 3.4	4.9 – 6.5	4.5 – 6.0
World Average	0.9	1.5 – 2.2	2.2 – 3.2	2.2 – 4.1	1.8 – 3.7

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