

REFERENCE DATA SERIES No. 1  
2013 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**

2013 Edition

INTERNATIONAL ATOMIC ENERGY AGENCY  
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# Introduction

Reference Data Series No. 1 (RDS-1) is an annual publication — currently in its thirty-third 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 2012. 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). However, energy and electricity data for 2012 are estimated, as the latest information available from the United Nations Department of Economic and Social Affairs is for 2010 only. Population data originate from the World Population Prospects (2010 revision), published by the Population Division of the United Nations Department of Economic and Social Affairs. The 2012 values again are estimates.

As in previous editions, projections of future energy and electricity demand and the role of 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.

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 publication are based on a compromise between:

- 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 future 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 experts consider all the operating reactors, possible licence renewals, planned shutdowns and plausible construction projects foreseen for the next several decades. They build the projections project by project by assessing the plausibility of each in light of, first, the low projection's assumptions and, second, the high projection's assumptions.

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 market, technology and resource trends continue and there are few additional changes in explicit laws, policies and regulations affecting nuclear power. This case was explicitly designed to produce a 'conservative but plausible' set of projections. Additionally, the low case does not automatically assume that targets for nuclear power growth in a particular country will 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 current rates of economic and electricity demand growth, especially in the Far East, continue. Changes in country policies toward climate change are also included in the high case.

Over the short term, the low price of natural gas and the impact of increasing capacities of subsidized renewable energy sources are expected to impact nuclear growth prospects in some regions of the developed world. These low natural gas prices are partly due to low demand as a result of macroeconomic conditions as well as technological advances. Moreover, the ongoing financial crisis continues to present challenges for capital intensive projects such as nuclear power. The assumption adopted by the expert group was that the above mentioned challenges, in addition to the accident at the Fukushima Daiichi nuclear power plant, are expected to temporarily delay deployment of some nuclear power plants. In the longer run, the underlying fundamentals of population growth and demand for electricity in the developing world, as well as climate change concerns, security of energy supply and price volatility for other fuels, continue to point to nuclear generating capacity playing an important role in the energy mix.

Over the past year, most countries have finalized their nuclear safety reviews, providing greater clarity with respect to nuclear power development. Nevertheless, challenges remain, given that policy responses to the Fukushima Daiichi accident are still evolving in some key regions. Once greater certainty about the policy and regulatory responses is established, these projections will likely need to be refined.

Compared with the 2012 projections to 2030, the 2013 projections were reduced by about 20 GW(e)<sup>1</sup> in both the low and high cases. These reductions continue to reflect responses to the Fukushima Daiichi accident and factors noted above, although the decline this year is less than in the two previous years. Some of the effects of the Fukushima Daiichi accident have included earlier than anticipated retirements, delayed or possibly cancelled new build, and increased costs owing to changing regulatory requirements. Nevertheless, interest in nuclear power remains strong in some regions, particularly in the developing world.

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<sup>1</sup> It should be kept in mind that there is a distinction between available capacity (supplying electricity to the grid) and installed nominal capacity not supplying electricity that may not be recognized in the published data.



With respect to projections to 2050, assumptions were made about the general rate of development and retirements. Given all the uncertainties, these estimates should be considered as suggestive of the actual outcomes.

The data on electricity produced by nuclear power plants are converted to joules based on the average efficiency of a nuclear power plant (i.e. 33%); data on electricity generated by geothermal heat are 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 other non-thermal sources such as wind, tide and solar is based on the energy content of the electricity generated (the equivalent of assuming 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 =  $10^9$  kW·h =  $3.6 \times 10^{-3}$  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 Haiti\*  
Antigua and Barbuda Honduras\*  
Argentina\* Jamaica\*  
Aruba Martinique  
Bahamas Mexico\*  
Barbados Montserrat  
Belize\* Netherlands Antilles  
Bermuda Nicaragua\*  
Bolivia\* Panama\*  
Brazil\* Paraguay\*  
Cayman Islands Peru\*  
Chile\* Puerto Rico  
Colombia\* S. Georgia & S. Sandwich Islands  
Costa Rica\* Saint Kitts and Nevis  
Cuba\* Saint Lucia  
Dominica\* Saint Pierre and Miquelon  
Dominican Republic\* Saint Vincent & the Grenadines  
Ecuador\* Suriname  
El Salvador\* Trinidad and Tobago\*  
Grenada Turks and Caicos Islands  
Guadeloupe Uruguay\*  
Guatemala\* Venezuela\*  
Guyana

### Western Europe

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

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

## **South East Asia and the Pacific**

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

## **Far East**

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

TABLE 1. NUCLEAR POWER REACTORS IN THE WORLD (end of 2012)

Group and Country	In Operation		Long-term Shut Down Reactors		Under Construction		Electricity Supplied by Nuclear Power Reactors in 2012	
	Number of Units	Total MW(e)	Number of Units	Total MW(e)	Number of Units	Total MW(e)	TWh	Percent of Total Electricity
<b>North America</b>								
Canada	19	13500					89.1	15.3
United States of America	104	102136			1	1165	770.7	19.0
<b>Latin America</b>								
Argentina	2	935			1	692	5.9	4.7
Brazil	2	1884			1	1245	15.2	3.1
Mexico	2	1530					8.4	4.7
<b>Western Europe</b>								
Belgium	7	5927					38.5	51.0
Finland	4	2752			1	1600	22.1	32.6
France	58	63130			1	1600	407.4	74.8
Germany	9	12068					94.1	16.1
Netherlands	1	482					3.7	4.4
Spain	8	7560					58.7	20.5
Sweden	10	9395					61.5	38.1
Switzerland	5	3278					24.4	35.9
United Kingdom	16	9231					64.0	18.1
<b>Eastern Europe</b>								
Armenia	1	375					2.1	26.6
Bulgaria	2	1906					14.9	31.6
Czech Republic	6	3804					28.6	35.3
Hungary	4	1889					14.8	45.9

**TABLE 1. NUCLEAR POWER REACTORS IN THE WORLD (end of 2012)**

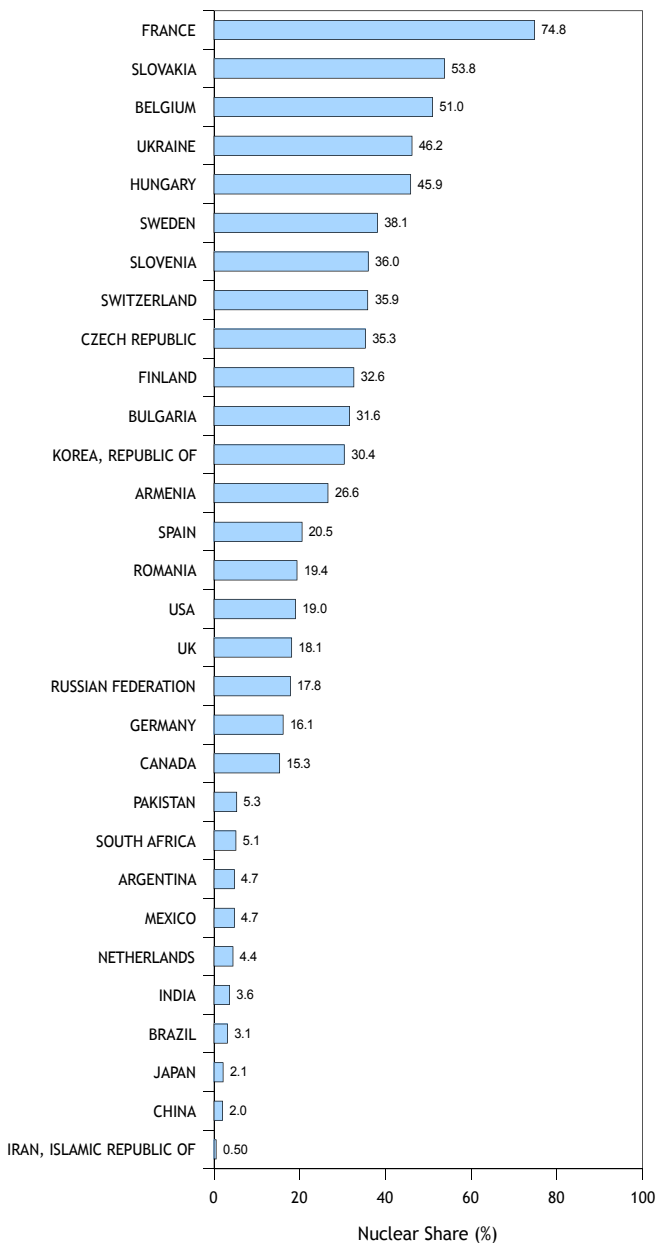
Group and Country	In Operation		Long-term Shut Down Reactors		Under Construction		Electricity Supplied by Nuclear Power Reactors in 2012	
	Number of Units	Total MW(e)	Number of Units	Total MW(e)	Number of Units	Total MW(e)	TWh	Percent of Total Electricity
Romania	2	1300					10.6	19.4
Russian Federation	33	23643			10	8382	166.3	17.8
Slovakia	4	1816			2	880	14.4	53.8
Slovenia	1	688					5.2	36.0
Ukraine	15	13107			2	1900	84.9	46.2
<b>Africa</b>								
South Africa	2	1860					12.4	5.1
<b>Middle East and South Asia</b>								
India	20	4391			7	4824	29.7	3.6
Iran, Islamic Republic of	1	915					1.3	0.5
Pakistan	3	725			2	630	5.3	5.3
United Arab Emirates					1	1345		
<b>Far East</b>								
China	17	12860			29	28844	92.7	2.0
Japan	50	44215	1	246	2	2650	17.2	2.1
Korea, Republic of	23	20739			4	4980	143.5	30.4
<b>World Total (*)</b>	<b>437</b>	<b>373069</b>	<b>1</b>	<b>246</b>	<b>66</b>	<b>63337</b>	<b>2346.3</b>	<b>11.3</b>

Notes:

(\*) Including the following data in Taiwan, China:

– 6 units in operation with total capacity of 5018 MW(e); 2 units under construction with total capacity of 2600 MW(e);

– 38.7 TWh of nuclear electricity generation, representing 18.4% of the total electricity generated.



**FIGURE 1. NUCLEAR SHARE OF TOTAL ELECTRICITY GENERATION IN 2012**

Note: the nuclear share of electricity generation in Taiwan, China was 18.4%.

**TABLE 2. NUMBER OF COUNTRIES WITH NUCLEAR POWER REACTORS IN OPERATION OR UNDER CONSTRUCTION (end of 2012)**

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	2
Latin America	45	3		2	3
Western Europe	29	9		2	9
Eastern Europe	27	9		3	9
Africa	57	1			1
Middle East and South Asia	25	3		3	4
South East Asia and the Pacific	29				
Far East	11	3	1	3	3
<b>World Total</b>	<b>225</b>	<b>30</b>	<b>1</b>	<b>14</b>	<b>31</b>

**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.



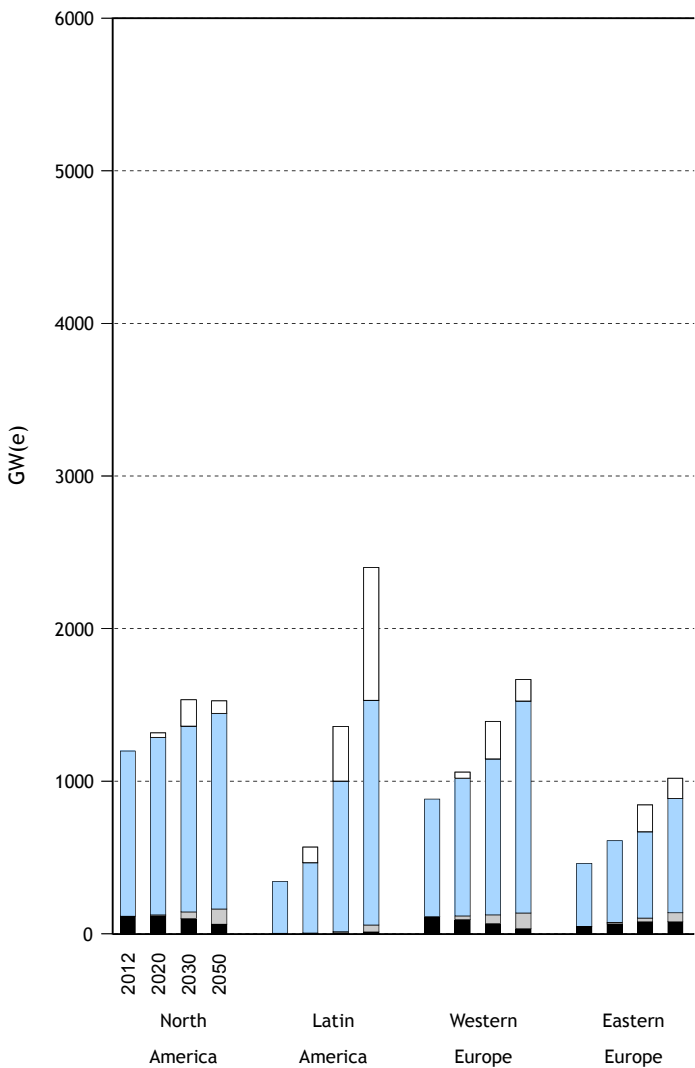


**TABLE 3. ESTIMATES OF TOTAL AND NUCLEAR ELECTRICAL GENERATING CAPACITY**

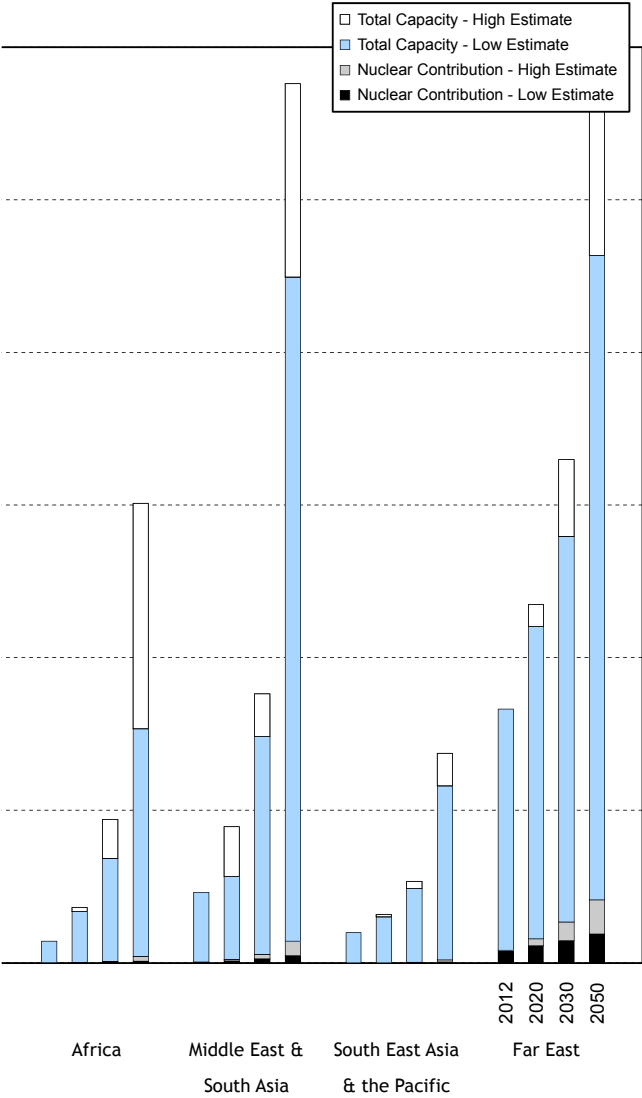
Country Group	2012		2020 (a)		2030 (a)		2050 (a)(b)				
	Total Elect. GW(e)	Nuclear % GW(e)	Total Elect. GW(e)	Nuclear % GW(e)	Total Elect. GW(e)	Nuclear % GW(e)	Total Elect. GW(e)	Nuclear % GW(e)			
North America	1198	115.6 9.7	1286 1316	118 124	9.2 9.4	1359 1533	101 143	7.4 9.3	1485	64 163	4.3 11.0
Latin America	344	4.3 1.3	465 568	5 6	1.0 1.1	1000 1359	7 15	0.7 1.1	1964	13 59	0.7 3.0
Western Europe	883	113.8 12.9	1019 1059	94 117	9.2 11.0	1145 1391	68 124	6.0 8.9	1596	33 137	2.1 8.6
Eastern Europe	461	48.5 10.5	611 611	64 75	10.5 12.2	668 844	79 104	11.9 12.3	953	79 138	8.3 14.5
Africa	141	1.9 1.3	335 362	1.9 1.9	0.6 0.5	683 939	5 10	0.7 1.1	2272	10 42	0.4 1.9
Middle East and South Asia	461	6.0 1.3	564 892	13 22	2.3 2.4	1482 1763	27 54	1.8 3.1	5127	47 142	0.9 2.8
South East Asia and the Pacific	198		301 317			486 533	0 4	0.0 0.8	1266	5 20	0.4 1.6
Far East	1663	82.8 5.0	2202 2348	112 158	5.1 6.7	2793 3298	147 268	5.3 8.1	5124	189 412	3.7 8.0
World Total	5348	373.1 7.0	6783 7473	407 503	6.0 6.7	9617 11660	435 722	4.5 6.2	19787	440 1113	2.2 5.6

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**





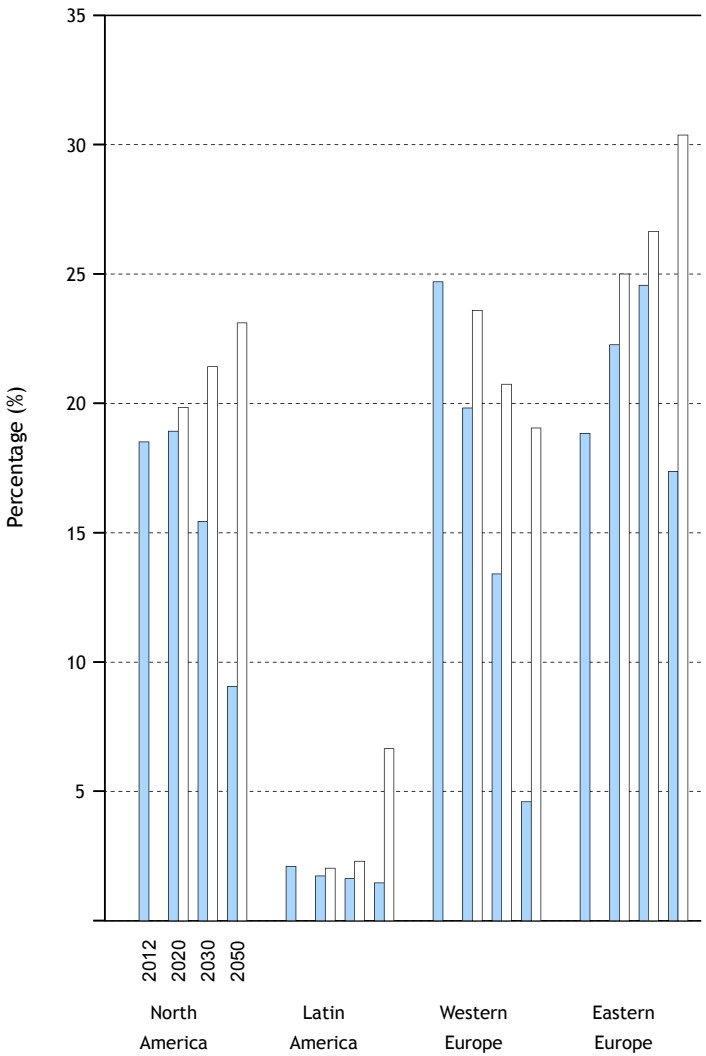
**TABLE 4. ESTIMATES OF TOTAL ELECTRICITY GENERATION AND CONTRIBUTION BY NUCLEAR POWER (\*)**

Country Group	2012				2020				2030				2050 (a)			
	Total Elect.		Nuclear		Total Elect.		Nuclear		Total Elect.		Nuclear		Total Elect.		Nuclear	
	TWh	%	TWh	%	TWh	%	TWh	%	TWh	%	TWh	%	TWh	%	TWh	%
North America	4645	859.8	18.5	4904	928	18.9	5144	794	15.4	5675	514	9.1	1312	23.1		
				4934	979	19.8	5254	1125	21.4							
Latin America	1404	29.5	2.1	2046	35	1.7	3410	56	1.6	7134	105	1.5	475	6.7		
				2219	45	2.0	5017	115	2.3							
Western Europe	3135	774.4	24.7	3532	700	19.8	4006	537	13.4	5804	267	4.6	1106	19.1		
				3681	869	23.6	4721	979	20.7							
Eastern Europe	1813	341.8	18.8	2152	479	22.3	2543	625	24.6	3665	637	17.4	1113	30.4		
				2222	556	25.0	3063	816	26.7							
Africa	688	12.4	1.8	1193	14	1.2	2332	40	1.7	8476	82	1.0	342	4.0		
				1380	14	1.0	3233	78	2.4							
Middle East and South Asia	1927	36.3	1.9	2462	91	3.7	5425	215	4.0	19207	377	2.0	1142	5.9		
				3076	152	4.9	6352	429	6.8							
South East Asia and the Pacific	827			1062			1689	0	0.0	4449	40	0.9	161	3.6		
				1102			1943	32	1.6							
Far East	6417	292.1	4.6	7516	830	11.0	9910	1160	11.7	20023	1525	7.6	3319	16.6		
				8596	1176	13.7	12704	2115	16.6							
World Total	20855	2346.3	11.3	24867	3078	12.4	34458	3426	9.9	74433	3548	4.8	8971	12.1		
	Low Estimate			27210	3790	13.9	42287	5689	13.5							
	High Estimate															

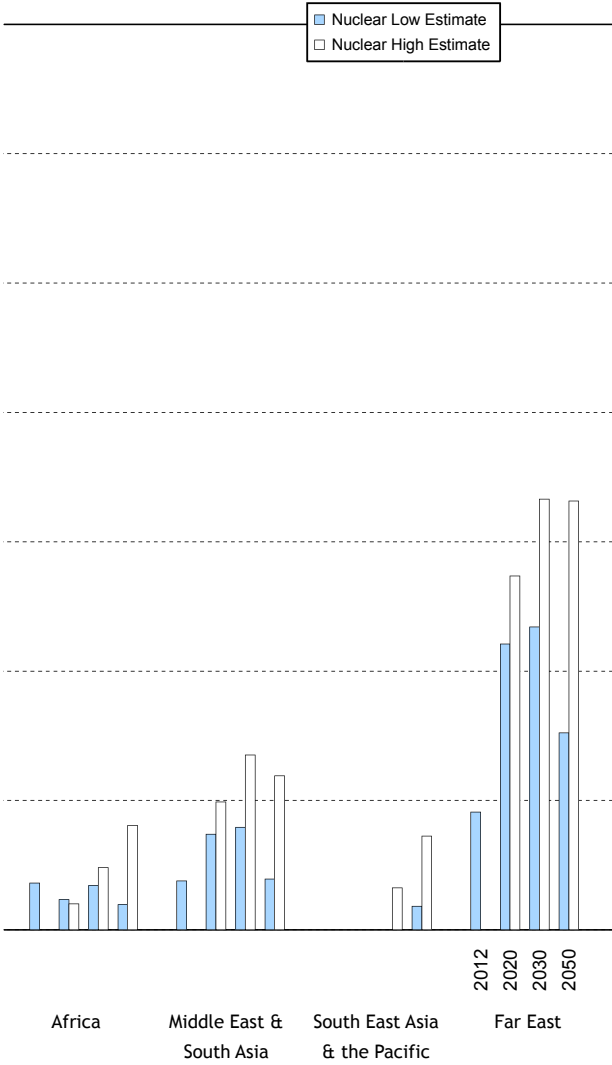
Notes:

(\*) 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 year-end capacity 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 POWER**







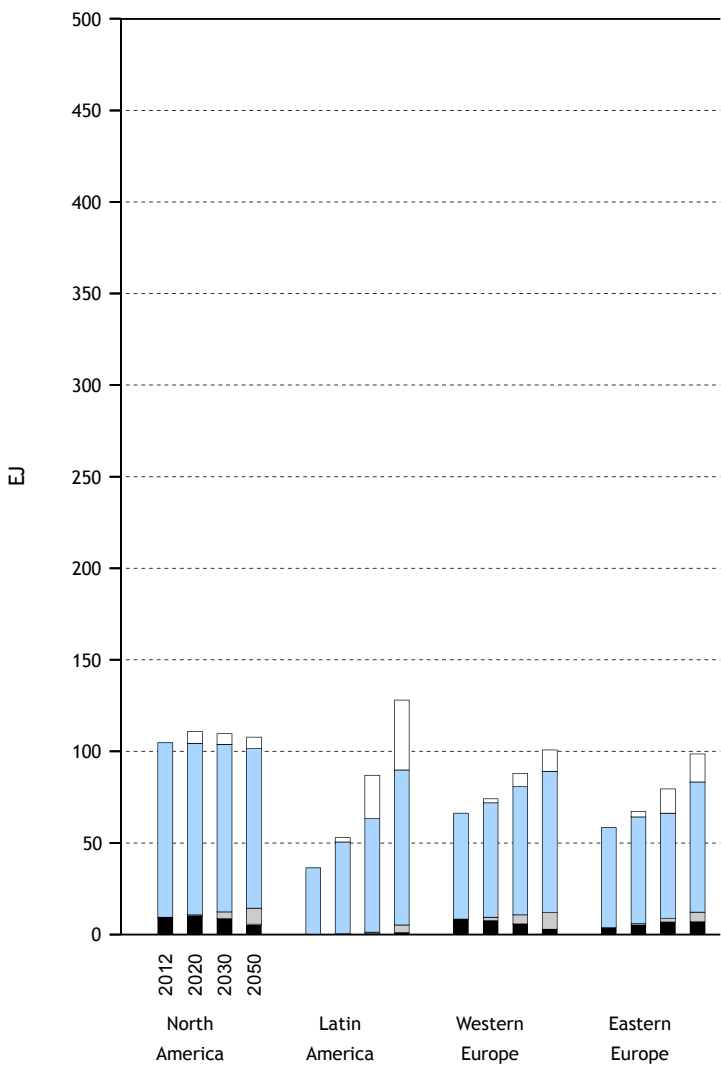
**TABLE 5. ESTIMATES OF TOTAL ENERGY REQUIREMENT (EJ), PERCENTAGE USED FOR ELECTRICITY GENERATION, AND PERCENTAGE SUPPLIED BY NUCLEAR ENERGY (\*)**

Country Group	2012			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	104.7	41.1	9.0	104	44	9.7	104	46	8.3	105	50	5.5
				111	41	9.6	110	45	11.2			13.3
Latin America	36.3	25.5	0.9	51	27	0.8	63	36	1.0	109	43	1.3
				53	28	0.9	87	38	1.4			4.0
Western Europe	66.2	38.5	12.8	72	39	10.6	81	38	7.3	95	47	3.3
				74	40	12.8	88	43	12.1			12.0
Eastern Europe	58.4	38.6	6.4	64	41	8.2	66	47	10.3	91	50	8.3
				67	41	9.0	80	47	11.2			12.3
Africa	31.8	21.8	0.4	36	33	0.4	56	42	0.8	203	42	0.7
				40	35	0.4	97	34	0.9			1.4
Middle East and South Asia	75.6	33.2	0.5	94	34	1.1	160	44	1.5	493	51	0.9
				110	36	1.5	183	45	2.6			2.3
South East Asia and the Pacific	26.7	32.0		30	36		41	43	0.0	100	46	0.5
				32	35		42	47	0.8			1.7
Far East	152.1	40.8	2.1	183	40	5.0	232	42	5.5	400	49	4.7
				199	42	6.5	294	42	7.8			8.1
World Total	551.8	36.8	4.6	635	38	5.3	803	42	4.7	1595	48	2.7
High Estimate				686	39	6.0	980	43	6.3			5.6

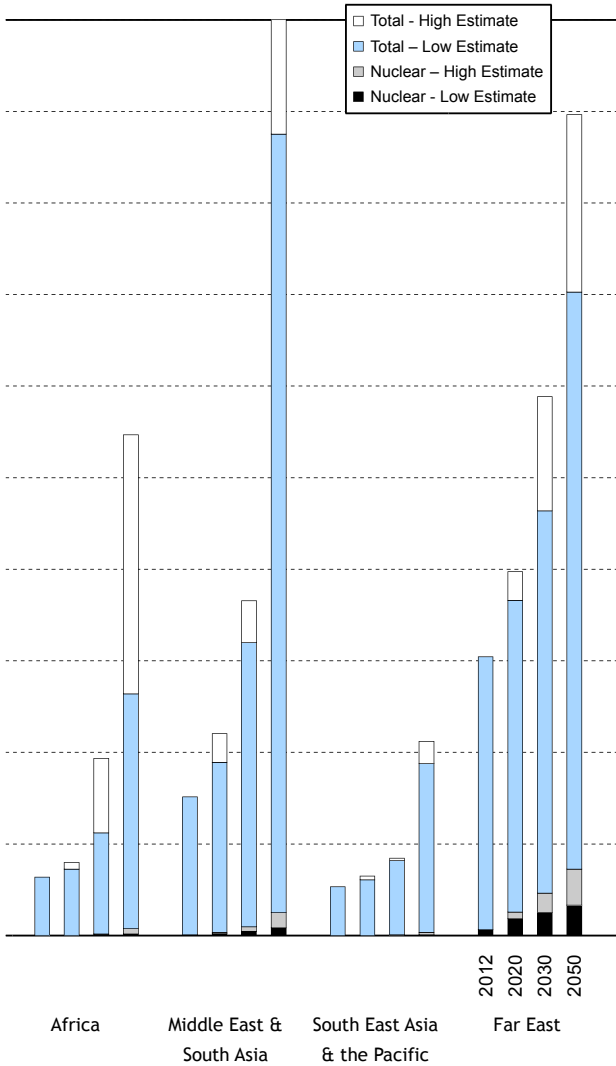
Notes:

(\*) 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 TOTAL ENERGY REQUIREMENT**





**TABLE 6. TOTAL ENERGY REQUIREMENT (EJ) BY TYPE OF FUEL IN 2012 (\*)**

Country Group	Solids (a)	Liquids	Gases	Biofuels (b)	Hydro	Nuclear	Renewables (c)	Total
North America	19.03	34.99	31.86	5.86	2.47	9.38	1.12	104.71
Latin America	1.68	16.38	9.11	5.66	2.74	0.32	0.45	36.34
Western Europe	9.67	21.65	18.17	4.74	2.10	8.45	1.44	66.21
Eastern Europe	11.94	12.32	27.94	1.41	1.00	3.73	0.04	58.38
Africa	4.89	8.54	4.68	13.05	0.42	0.14	0.12	31.83
Middle East and South Asia	19.16	24.69	20.25	10.33	0.66	0.40	0.11	75.61
South East Asia and the Pacific	6.15	9.25	6.27	4.27	0.26		0.46	26.66
Far East	89.60	36.39	14.04	4.29	3.74	3.19	0.84	152.09
<b>World Total</b>	<b>162.12</b>	<b>164.22</b>	<b>132.32</b>	<b>49.60</b>	<b>13.40</b>	<b>25.60</b>	<b>4.57</b>	<b>551.83</b>

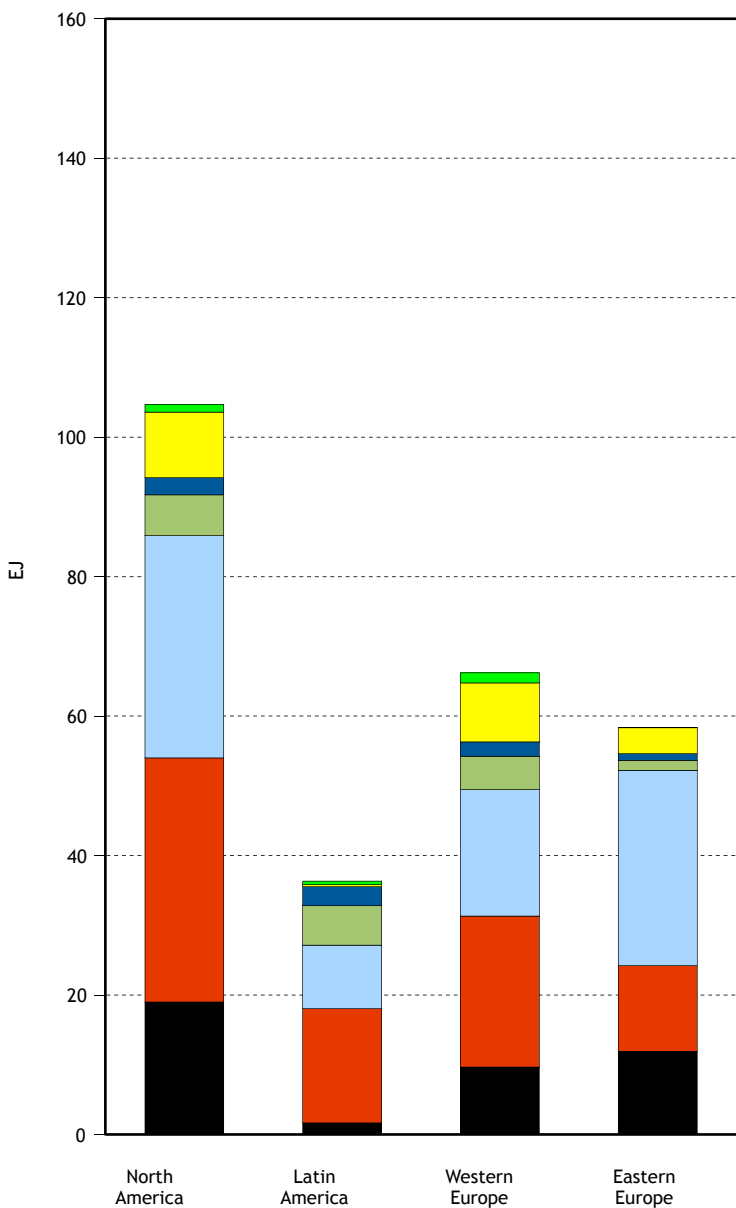
**Notes:**

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

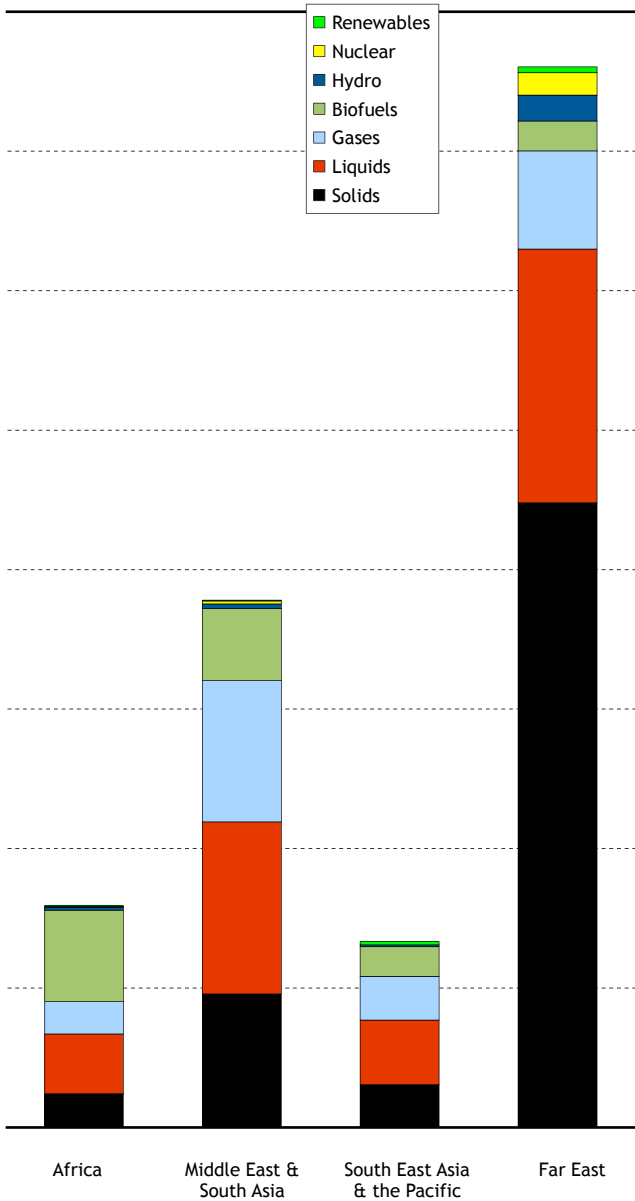
(a) Solids do not include commercial wood.

(b) The column headed 'Biofuels' includes commercial wood, charcoal, combustible renewables, waste and other energy products derived directly or indirectly from biomass.

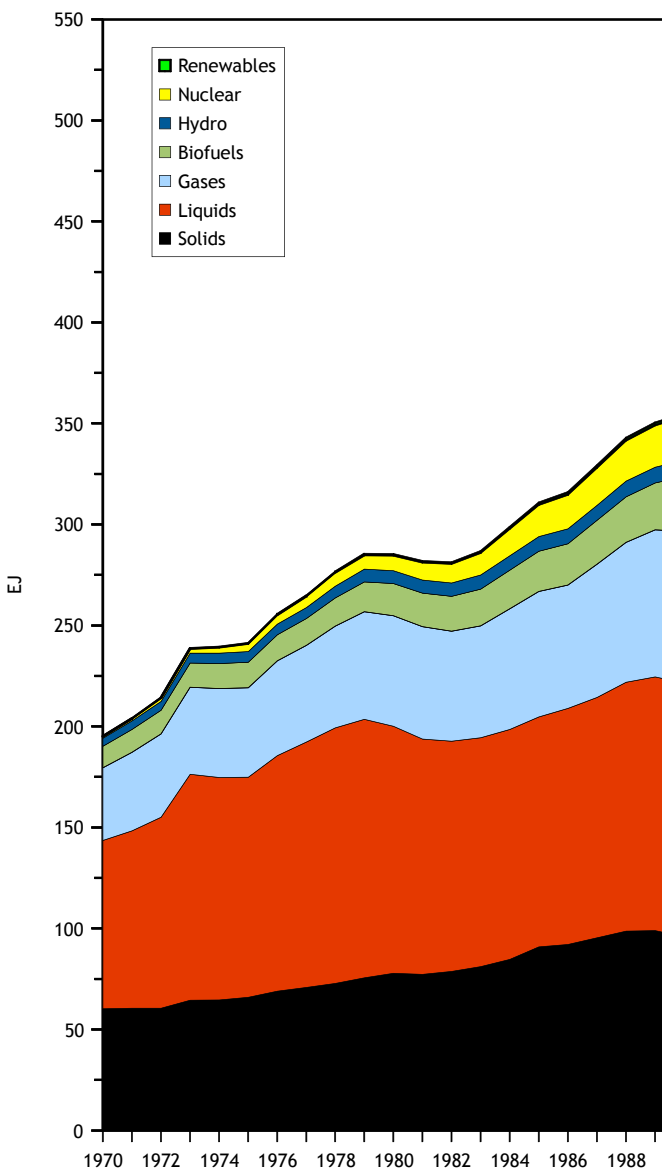
(c) The column headed 'Renewables' includes geothermal, wind, solar, tide energy and net electricity trade.



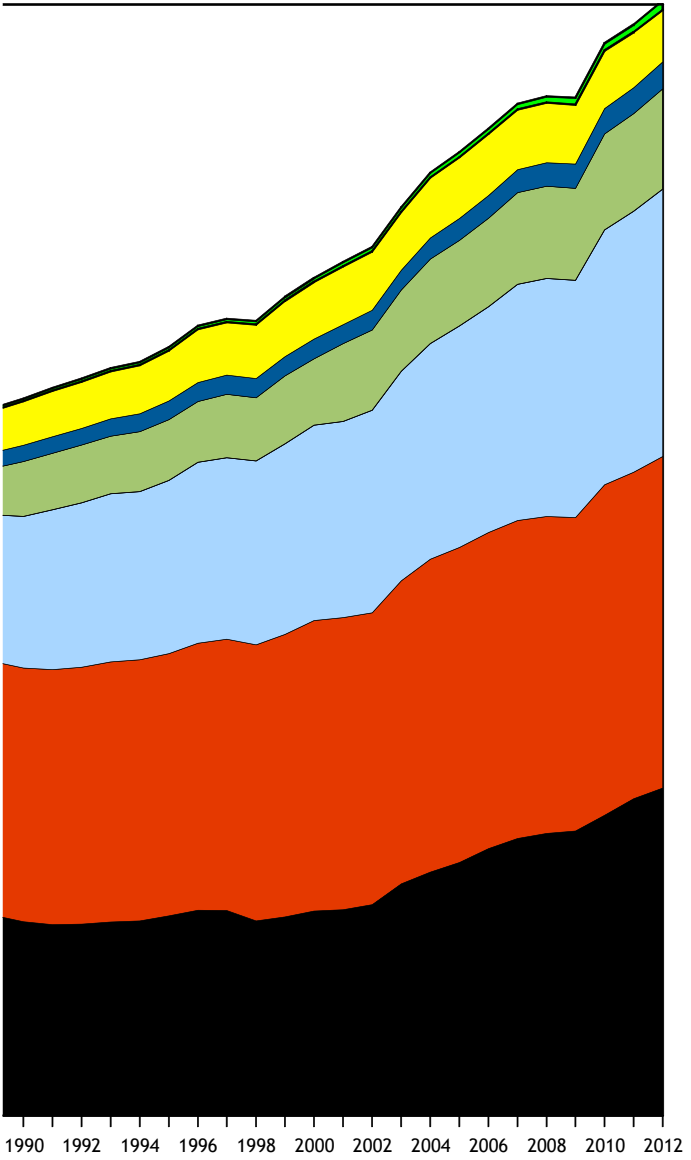
**FIGURE 5. TOTAL ENERGY REQUIREMENT BY FUEL TYPE IN 2012**







**FIGURE 6. BREAKDOWN OF WORLD TOTAL ENERGY REQUIREMENT DURING THE PERIOD 1970 – 2012**



Year



**TABLE 7. FUEL SHARES (%) OF TOTAL ENERGY REQUIREMENT IN 2012 (\*)**

Country Group	Solids (a)	Liquids	Gases	Biofuels (b)	Hydro	Nuclear	Renewables (c)	Total
North America	18.2	33.4	30.4	5.6	2.4	9.0	1.1	100.0
Latin America	4.6	45.1	25.1	15.6	7.5	0.9	1.2	100.0
Western Europe	14.6	32.7	27.4	7.2	3.2	12.8	2.2	100.0
Eastern Europe	20.4	21.1	47.8	2.4	1.7	6.4	0.1	100.0
Africa	15.4	26.8	14.7	41.0	1.3	0.4	0.4	100.0
Middle East and South Asia	25.3	32.7	26.8	13.7	0.9	0.5	0.1	100.0
South East Asia and the Pacific	23.1	34.7	23.5	16.0	1.0		1.7	100.0
Far East	58.9	23.9	9.2	2.8	2.5	2.1	0.6	100.0
<b>World Total</b>	<b>29.4</b>	<b>29.8</b>	<b>24.0</b>	<b>9.0</b>	<b>2.4</b>	<b>4.6</b>	<b>0.8</b>	<b>100.0</b>

**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 'Biofuels' includes commercial wood, charcoal, combustible renewables, waste and other energy products derived directly or indirectly from biomass.

(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 2012

Country Group	Thermal (a)	Hydro	Nuclear	Renewables (b)	Total
North America	30.11	2.47	9.38	1.03	42.99
Latin America	5.81	2.74	0.32	0.40	9.28
Western Europe	13.64	2.10	8.45	1.29	25.48
Eastern Europe	17.75	1.00	3.73	0.04	22.52
Africa	6.29	0.42	0.14	0.10	6.95
Middle East and South Asia	23.96	0.66	0.40	0.10	25.12
South East Asia and the Pacific	7.84	0.26		0.43	8.54
Far East	54.40	3.74	3.19	0.78	62.11
<b>World Total</b>	<b>159.80</b>	<b>13.40</b>	<b>25.60</b>	<b>4.18</b>	<b>202.98</b>

**Notes:**

(a) The column headed 'Thermal' is the total for solids, liquids, gases, biofuels 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 2012**

Country Group	Thermal (a)	Hydro	Nuclear	Renewables (b)	Total
North America	64.0	14.8	18.5	2.7	100.0
Latin America	42.7	54.3	2.1	0.9	100.0
Western Europe	49.5	18.6	24.7	7.2	100.0
Eastern Europe	65.5	15.4	18.8	0.3	100.0
Africa	80.4	16.9	1.8	0.9	100.0
Middle East and South Asia	87.4	9.6	1.9	1.2	100.0
South East Asia and the Pacific	88.8	8.8		2.3	100.0
Far East	78.0	16.2	4.6	1.2	100.0
<b>World Total</b>	<b>68.5</b>	<b>17.8</b>	<b>11.3</b>	<b>2.4</b>	<b>100.0</b>

**Notes:**

(a) The column headed 'Thermal' is the total for solids, liquids, gases, biofuels and waste.

(b) The column headed 'Renewables' includes geothermal, wind, solar and tide energy.

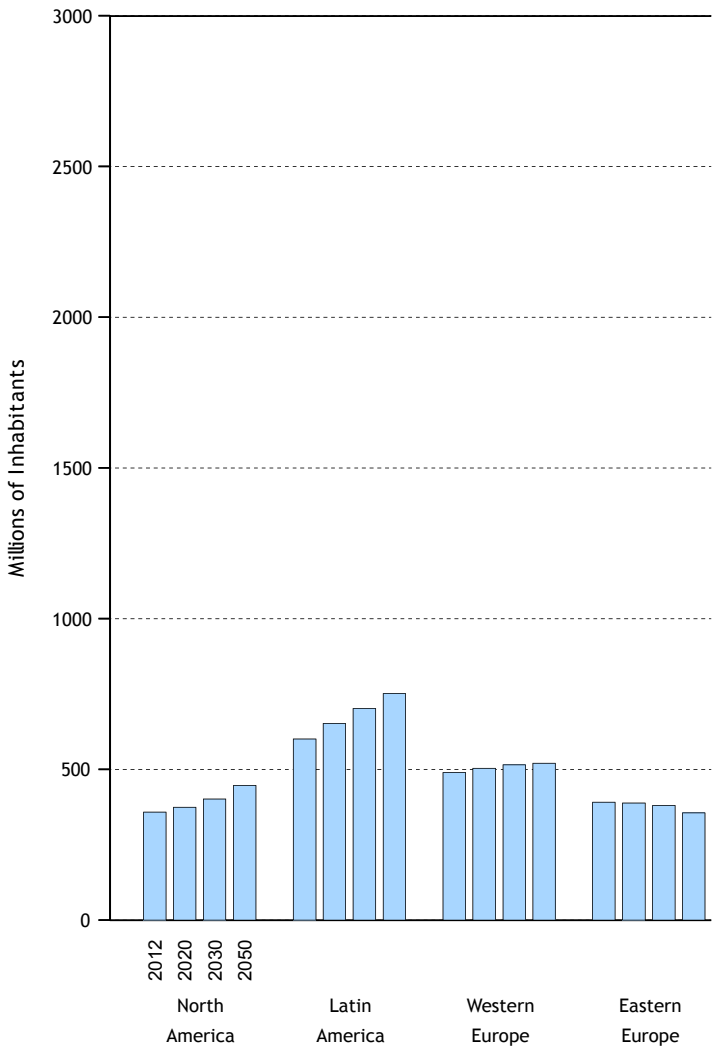


**TABLE 10. ESTIMATES OF POPULATION GROWTH BY REGION (\*)**

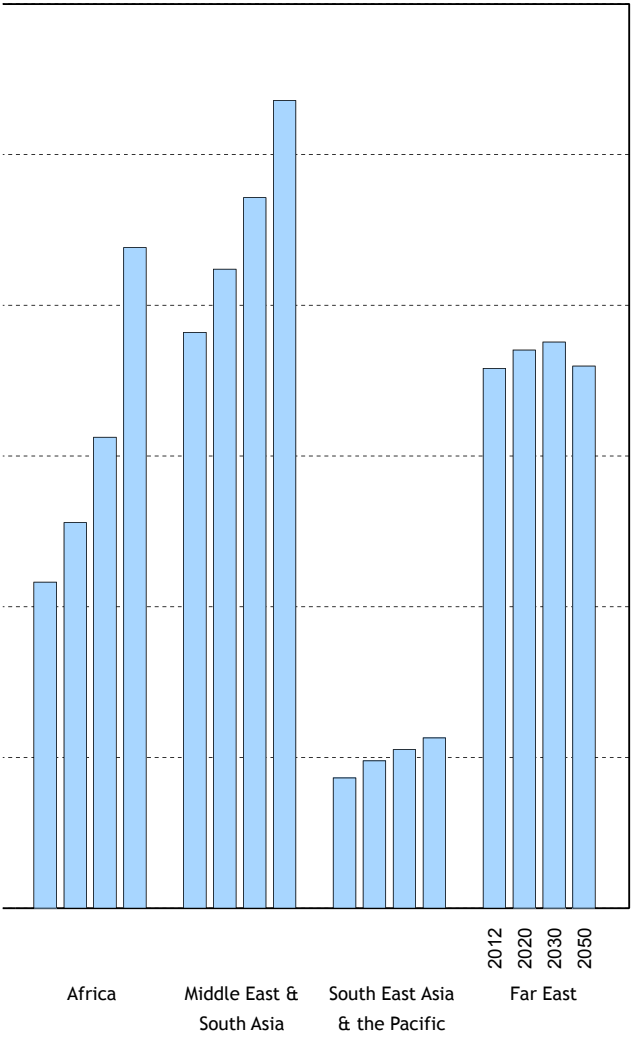
Country Group	2012		2020		2030		2050	
	Million Inhabitants	Growth Rate (%/a) 2000 – 2012	Million Inhabitants	Growth Rate (%/a) 2012 – 2020	Million Inhabitants	Growth Rate (%/a) 2020 – 2030	Million Inhabitants	Growth Rate (%/a) 2030 – 2050
North America	358	1.13	374	0.56	402	0.71	447	0.53
Latin America	601	1.24	652	1.03	702	0.73	751	0.34
Western Europe	489	0.54	504	0.37	515	0.21	520	0.05
Eastern Europe	391	-0.38	389	-0.07	381	-0.21	356	-0.34
Africa	1081	2.69	1278	2.12	1562	2.03	2192	1.71
Middle East and South Asia	1910	1.96	2119	1.31	2357	1.07	2679	0.64
South East Asia and the Pacific	431	1.07	488	1.56	526	0.75	564	0.35
Far East	1791	0.63	1852	0.42	1878	0.14	1798	-0.22
<b>World Total</b>	<b>7052</b>	<b>1.42</b>	<b>7657</b>	<b>1.03</b>	<b>8321</b>	<b>0.84</b>	<b>9306</b>	<b>0.56</b>

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





**FIGURE 7. POPULATION ESTIMATES**



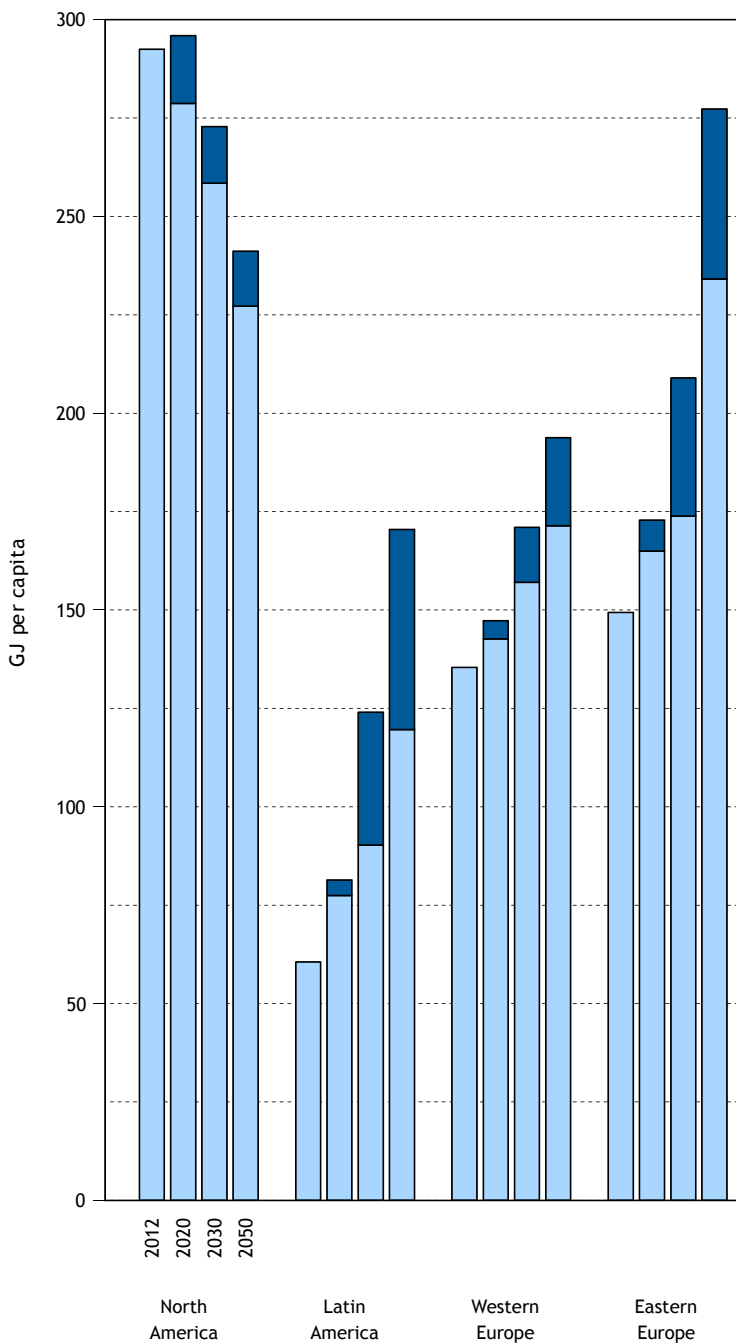


**TABLE 11. ESTIMATES OF TOTAL ENERGY AND ELECTRICITY REQUIREMENT PER CAPITA**

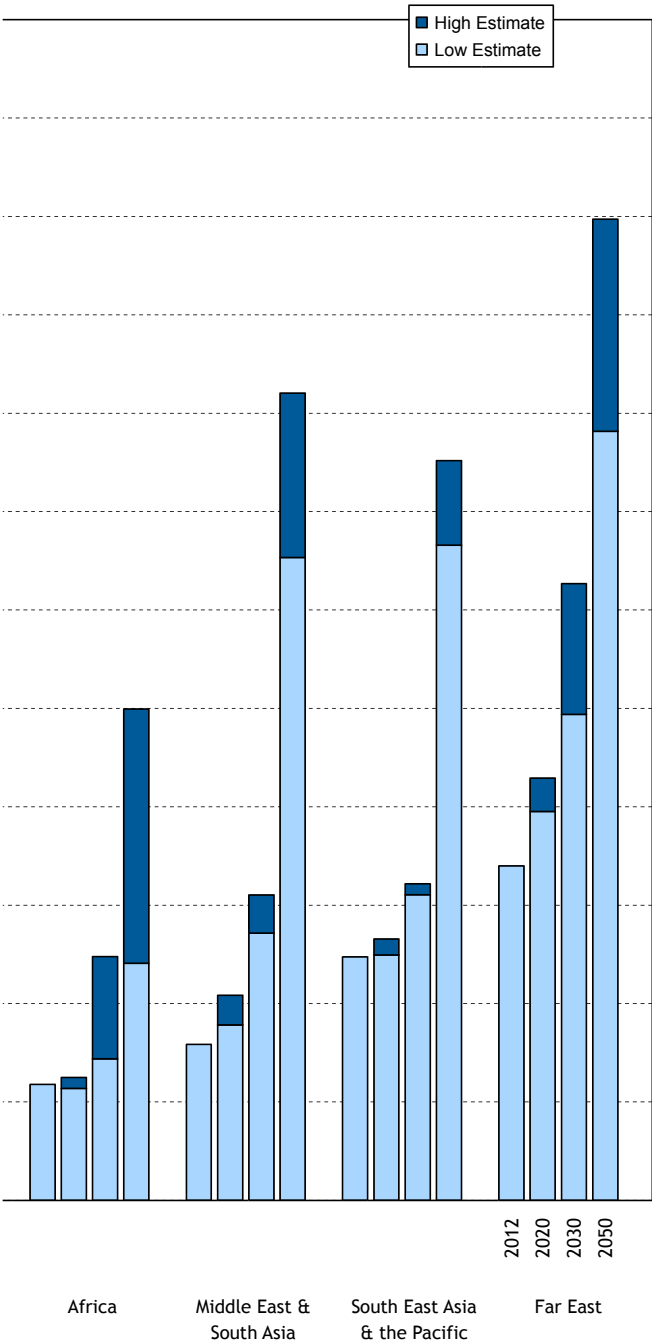
Country Group	2012		2020		2030		2050 (*)	
	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MWh/cap)	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MWh/cap)	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MWh/cap)	Energy Requirement per Capita (GJ/cap)	Electricity Requirement per Capita (MWh/cap)
North America	292	13.0	279 – 296	13.1 – 13.2	258 – 273	12.8 – 13.1	234 ± 7	12.7 ± 0.3
Latin America	61	2.3	77 – 81	3.1 – 3.4	90 – 124	4.9 – 7.2	145 ± 25	9.5 ± 2.0
Western Europe	135	6.4	143 – 147	7.0 – 7.3	157 – 171	7.8 – 9.2	183 ± 11	11.2 ± 1.1
Eastern Europe	149	4.6	165 – 173	5.5 – 5.7	174 – 209	6.7 – 8.0	256 ± 22	10.3 ± 1.1
Africa	29	0.6	28 – 31	0.9 – 1.1	36 – 62	1.5 – 2.1	92 ± 32	3.9 ± 1.4
Middle East and South Asia	40	1.0	45 – 52	1.2 – 1.5	68 – 78	2.3 – 2.7	184 ± 21	7.2 ± 0.8
South East Asia and the Pacific	62	1.9	62 – 66	2.2 – 2.3	78 – 80	3.2 – 3.7	177 ± 11	7.9 ± 0.8
Far East	85	3.6	99 – 107	4.1 – 4.6	123 – 157	5.3 – 6.8	222 ± 27	11.1 ± 1.6
World Average	78	3.0	83 – 90	3.2 – 3.6	96 – 118	4.1 – 5.1	171 ± 23	8.0 ± 1.2

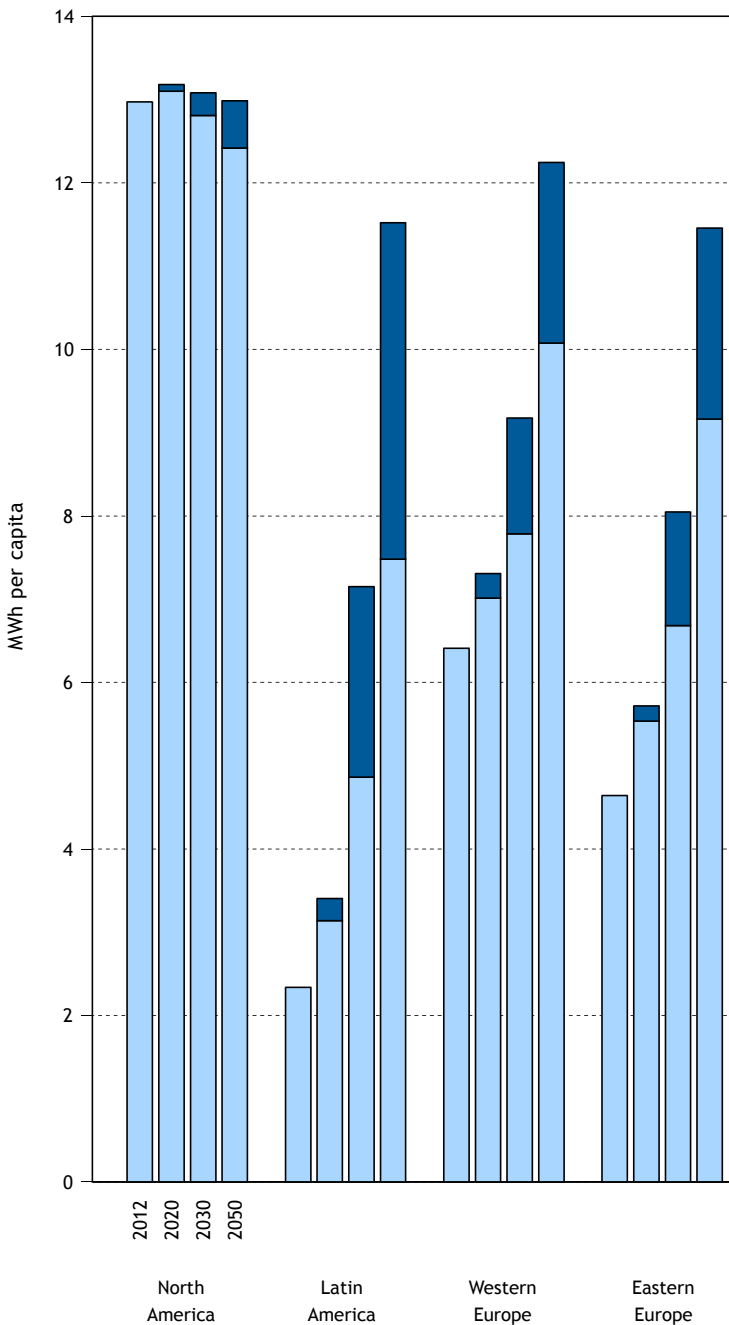
Note:

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

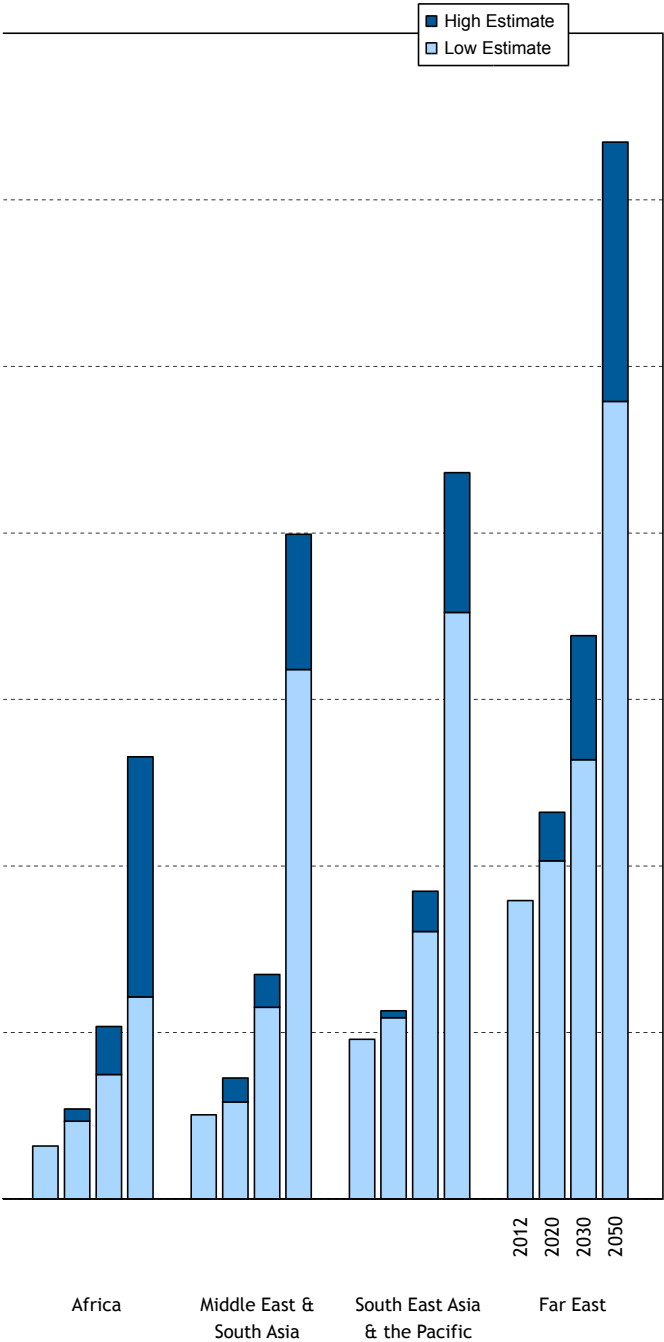


**FIGURE 8. TOTAL ENERGY REQUIREMENT PER CAPITA**





**FIGURE 9. TOTAL ELECTRICITY REQUIREMENT PER CAPITA**

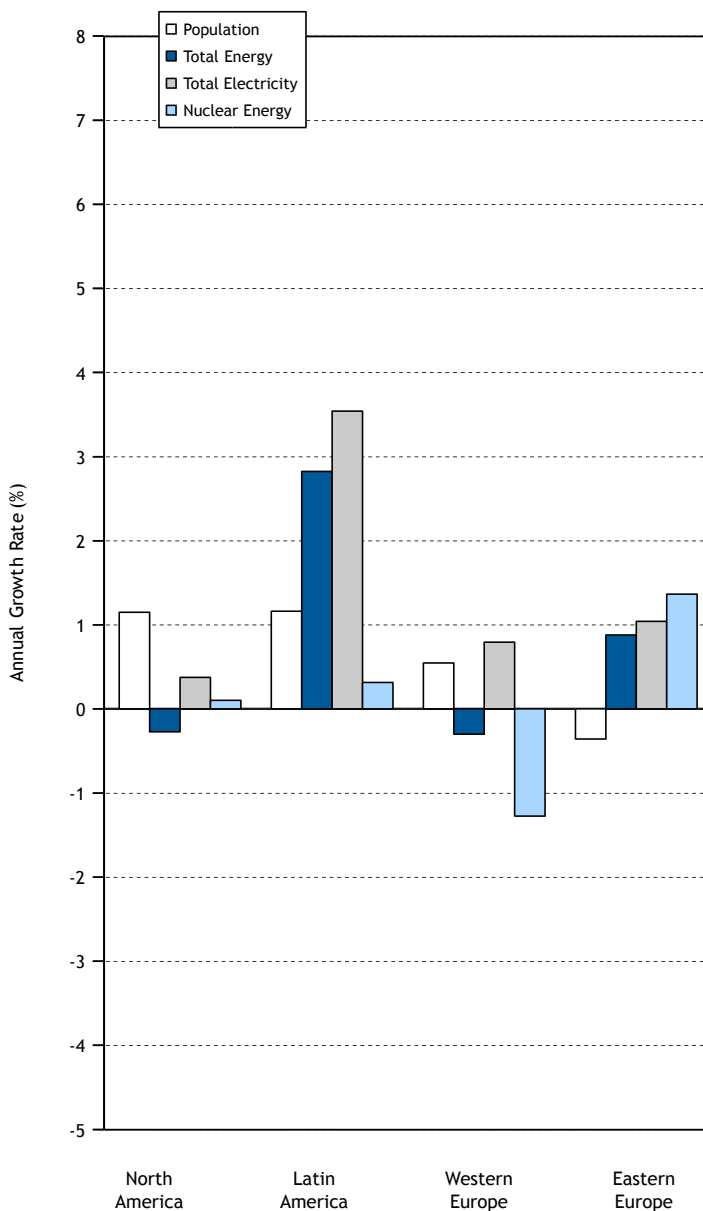




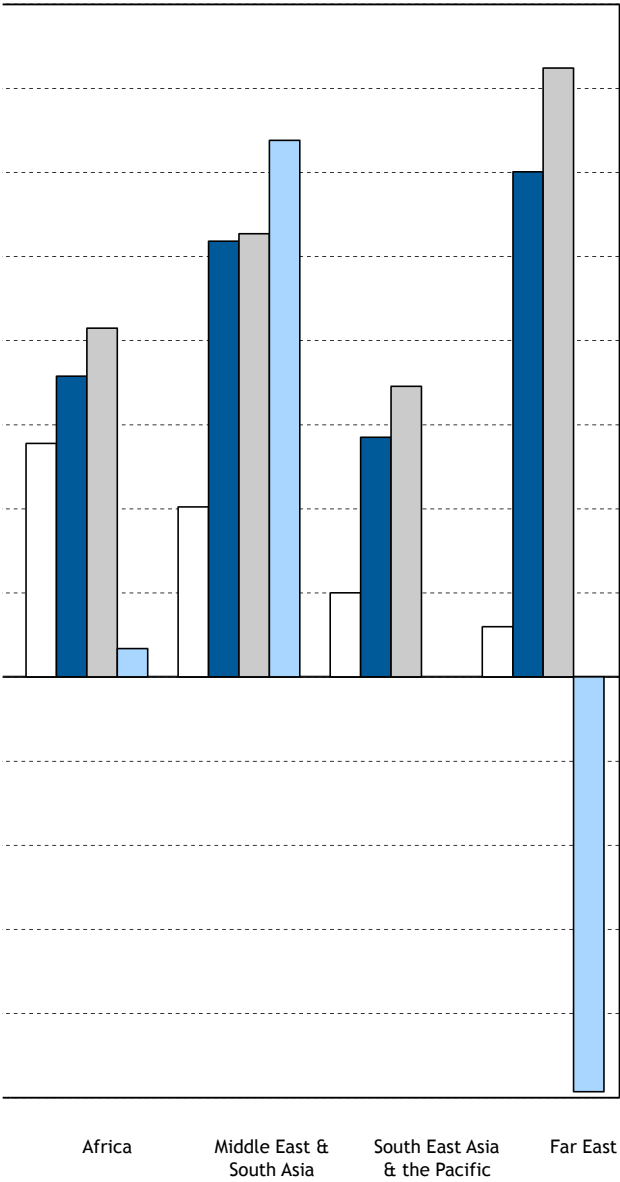


**TABLE 12. AVERAGE ANNUAL GROWTH RATES DURING THE PERIOD 2002–2012 (%)**

Country Group	Population	Total Energy	Total Electricity	Nuclear Energy	Nuclear Capacity
North America	1.2	-0.3	0.4	0.1	0.7
Latin America	1.2	2.8	3.5	0.3	0.4
Western Europe	0.5	-0.3	0.8	-1.3	-1.0
Eastern Europe	-0.4	0.9	1.0	1.4	0.4
Africa	2.8	3.6	4.1	0.3	0.0
Middle East and South Asia	2.0	5.2	5.3	6.4	7.5
South East Asia and the Pacific	1.0	2.8	3.5		
Far East	0.6	6.0	7.2	-4.9	1.8
World Average	1.3	2.5	3.1	-0.9	0.4



**FIGURE 10. AVERAGE ANNUAL GROWTH RATES DURING THE PERIOD 2002 – 2012**





**TABLE 13. ESTIMATES OF AVERAGE ANNUAL GROWTH RATES DURING THE PERIOD 2012–2030 (%)**

Country Group	Population	Total Energy	Total Electricity	Nuclear Energy	Nuclear Capacity
North America	0.6	0.0 – 0.3	0.6 – 0.7	-0.4 – 1.5	-0.8 – 1.2
Latin America	0.9	3.1 – 5.0	5.1 – 7.3	3.6 – 7.9	2.7 – 7.0
Western Europe	0.3	1.1 – 1.6	1.4 – 2.3	-2.0 – 1.3	-2.8 – 0.5
Eastern Europe	-0.1	0.7 – 1.7	1.9 – 3.0	3.4 – 5.0	2.8 – 4.3
Africa	2.1	3.2 – 6.4	7.0 – 9.0	6.7 – 10.7	5.7 – 9.7
Middle East and South Asia	1.2	4.3 – 5.0	5.9 – 6.9	10.4 – 14.7	8.7 – 13.0
South East Asia and the Pacific	1.1	2.4 – 2.6	4.0 – 4.9		
Far East	0.3	2.4 – 3.7	2.4 – 3.9	8.0 – 11.6	3.2 – 6.7
World Average	0.9	2.1 – 3.2	2.8 – 4.0	2.1 – 5.0	0.9 – 3.7





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