

	Electricity production		Access to electricity	Sources of electricity ^a									
	billion kwh			% of population	% of total								
	1990	2002	2000		Hydropower		Coal		Oil		Gas		Nuclear power
	1990	2002	2000	1990	2002	1990	2002	1990	2002	1990	2002	1990	2002
Afghanistan	..	..	6.0	..	..	..	..	..	..	..	..	..	..
Albania	3.2	3.7	..	89.1	95.3	..	..	10.9	4.7	..	..	..	..
Algeria	16.1	27.6	98.0	0.8	0.2	..	..	5.4	2.2	93.7	97.6	..	..
Angola	0.8	1.8	12.0	86.2	64.3	..	..	13.8	35.7	..	..	..	..
Argentina	51.0	84.5	94.6	35.6	42.5	1.3	1.4	9.7	1.8	39.0	45.9	14.3	6.9
Armenia	10.4	5.5	..	15.0	30.0	..	..	85.0	..	..	28.6	..	41.3
Australia	154.3	222.0	..	9.2	7.1	77.1	78.3	2.7	1.7	10.6	11.6	..	..
Austria	49.3	60.4	..	63.9	66.1	14.2	12.3	3.8	2.6	15.7	15.5	..	..
Azerbaijan	23.2	19.5	..	3.0	10.3	..	..	..	22.5	97.0	67.1	..	..
Bangladesh	7.7	18.4	32.5	11.4	6.0	..	..	4.3	8.5	84.3	85.5	..	..
Belarus	39.5	26.5	..	0.1	0.1	..	..	99.9	5.7	..	94.2	..	..
Belgium	70.3	80.9	..	0.4	0.4	28.2	15.6	1.9	1.2	7.7	22.1	60.8	58.5
Benin	0.0	0.1	22.0	..	3.2	..	..	100.0	96.8	..	..	..	..
Bolivia	2.1	4.2	60.4	55.3	53.1	..	..	5.3	17.5	37.6	27.3	..	..
Bosnia and Herzegovina	6.5	10.8	..	52.2	48.8	47.8	49.9	..	1.3	..	..	..	..
Botswana	..	..	22.0	..	..	..	..	..	..	..	..	..	..
Brazil	222.8	344.6	94.9	92.8	82.7	2.1	2.4	2.5	3.8	0.0	3.8	1.0	4.0
Bulgaria	42.1	42.2	..	4.5	5.2	35.4	41.2	4.7	2.0	20.6	3.6	34.8	48.0
Burkina Faso	..	..	13.0	..	..	..	..	..	..	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	..	..	..	..	..
Cambodia	..	..	15.8	..	..	..	..	..	..	..	..	..	..
Cameroon	2.7	3.3	20.0	98.5	96.4	..	..	1.5	3.6	..	..	..	..
Canada	481.9	601.4	..	61.6	58.2	17.1	19.5	3.4	2.4	2.0	5.8	15.1	12.6
Central African Republic	..	..	..	..	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..	..
Chile	18.4	45.5	99.0	55.3	51.0	34.3	19.0	7.7	1.1	1.3	25.3	..	..
China	621.2	1,640.5	98.6	20.4	17.6	71.2	77.5	7.9	3.0	0.5	0.3	..	1.5
Hong Kong, China	28.9	34.3	..	..	..	98.3	63.8	1.7	0.4	..	35.8	..	..
Colombia	36.2	45.2	81.0	76.0	75.1	9.8	6.7	1.0	0.2	12.4	16.8	..	..
Congo, Dem. Rep.	5.6	5.9	6.7	99.6	99.7	..	..	0.4	0.3	..	..	..	..
Congo, Rep.	0.5	0.4	20.9	99.4	99.7	..	..	0.6	0.3	..	..	..	..
Costa Rica	3.5	7.5	95.7	97.5	79.2	..	..	2.5	1.6	..	..	..	..
Côte d'Ivoire	2.0	5.3	50.0	66.7	32.7	..	..	33.3	0.2	..	67.1	..	..
Croatia	8.9	12.2	..	48.8	43.9	..	17.3	35.8	18.2	15.4	20.7	..	..
Cuba	15.0	15.7	97.0	0.6	0.7	..	..	91.5	94.3	0.2	0.0	..	..
Czech Republic	62.6	76.0	..	2.3	3.3	71.8	66.8	4.8	0.5	1.0	3.9	20.1	24.7
Denmark	26.0	39.2	..	0.1	0.1	90.3	46.5	3.7	10.2	2.7	24.4	..	..
Dominican Republic	3.7	11.5	66.8	9.4	7.6	1.2	5.5	88.6	86.6	..	..	..	..
Ecuador	6.3	11.9	80.0	78.5	63.3	..	..	21.5	33.6	..	3.1	..	..
Egypt, Arab Rep.	42.3	86.1	93.8	23.5	16.3	..	..	36.9	7.5	39.6	76.0	..	..
El Salvador	2.2	4.1	70.8	73.5	27.8	..	..	6.9	47.5	..	..	..	..
Eritrea	..	..	17.0	..	..	..	..	..	..	..	..	..	..
Estonia	17.2	8.5	..	0.0	0.1	86.8	90.9	8.4	0.3	4.8	8.4	..	..
Ethiopia	1.2	2.0	4.7	88.4	98.9	..	..	11.6	1.0	..	..	..	..
Finland	54.4	74.9	..	20.0	14.4	33.0	26.3	3.1	0.8	8.6	15.1	35.3	29.8
France	416.7	554.8	..	12.8	10.9	8.5	4.5	2.1	0.8	0.7	4.2	75.4	78.7
Gabon	1.0	1.4	31.0	72.1	65.5	..	..	11.2	16.6	16.4	17.4	..	..
Gambia, The	..	..	..	..	..	..	..	..	..	..	..	..	..
Georgia	14.2	7.3	..	52.8	93.2	..	..	26.1	0.4	21.1	6.3	..	..
Germany	547.7	566.9	..	3.2	4.1	58.8	51.4	1.9	0.8	7.4	9.5	27.8	29.1
Ghana	5.7	7.3	45.0	100.0	69.0	..	..	..	31.0	..	..	..	..
Greece	34.8	53.9	..	5.1	5.2	72.4	64.1	22.3	16.0	0.3	13.1	..	..
Guatemala	2.3	6.2	66.7	76.0	27.5	..	15.7	9.0	43.1	..	..	..	..
Guinea	..	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	0.6	0.6	34.0	76.5	47.6	..	..	20.6	52.4	..	..	..	..

Sources of electricity

	Electricity production		Access to electricity % of population 2000	Sources of electricity ^a									
	billion kwh 1990	2002		Hydropower		Coal		Oil		Gas		Nuclear power	
			1990	2002	1990	2002	1990	2002	1990	2002	1990	2002	
Honduras	2.3	4.2	54.5	98.3	57.8	..	..	1.7	40.1	..	..	..	..
Hungary	28.4	36.2	..	0.6	0.5	30.5	25.1	4.8	5.9	15.7	29.7	48.3	38.6
India	289.4	596.5	43.0	24.8	10.7	65.3	70.1	4.3	4.7	3.4	10.5	2.1	3.3
Indonesia	33.3	108.2	53.4	20.2	9.2	31.5	39.7	42.7	23.3	2.3	22.1	..	..
Iran, Islamic Rep.	59.1	140.8	97.9	10.3	5.7	..	..	37.3	17.8	52.5	76.4	..	..
Iraq	24.0	31.2	95.0	10.8	2.0	..	..	89.2	98.0	..	..	..	..
Ireland	14.2	24.8	..	4.9	3.7	57.4	35.8	10.0	15.0	27.7	43.6	..	..
Israel	20.9	45.4	100.0	0.0	0.0	50.1	77.4	49.9	22.5	..	0.1	..	..
Italy	213.1	277.5	..	14.8	14.2	16.8	14.6	48.2	31.6	18.6	35.8	..	..
Jamaica	2.5	6.9	90.0	3.6	1.4	..	..	92.4	97.2	..	..	..	..
Japan	850.7	1,087.7	..	10.5	7.6	14.6	26.8	29.9	13.4	19.1	22.5	23.8	27.1
Jordan	3.6	8.1	95.0	0.3	0.7	..	..	87.8	90.9	11.9	8.4	..	..
Kazakhstan	87.4	58.3	..	8.4	15.2	..	69.9	91.6	4.2	..	10.6	0.6	..
Kenya	3.0	4.5	7.9	81.6	68.9	..	..	7.6	22.6	..	..	..	..
Korea, Dem. Rep.	27.7	19.8	20.0	56.3	53.7	40.1	41.2	3.6	5.1	..	..	..	..
Korea, Rep.	105.4	326.9	..	6.0	1.0	16.8	39.9	17.9	9.6	9.1	12.8	50.2	36.4
Kuwait	18.5	36.9	100.0	..	..	..	..	17.1	78.9	82.9	21.1	..	..
Kyrgyz Republic	13.4	11.9	..	67.3	90.5	..	4.8	32.7	..	..	4.8	..	..
Lao PDR	..	..	..	..	..	..	..	..	..	..	..	..	..
Latvia	6.6	4.0	..	67.7	62.0	..	1.0	32.3	3.4	..	33.1	..	..
Lebanon	1.5	9.7	95.0	33.3	7.0	..	..	66.7	93.0	..	..	..	..
Lesotho	..	..	5.0	..	..	..	..	..	..	..	..	..	..
Liberia	..	..	..	..	..	..	..	..	..	..	..	..	..
Libya	10.2	15.3	99.8	..	..	..	..	100.0	77.8	..	22.2	..	..
Lithuania	28.4	17.3	..	1.5	2.0	..	..	38.6	4.3	..	11.1	60.0	81.8
Macedonia, FYR	..	..	..	..	..	..	..	..	..	..	..	..	..
Madagascar	..	..	8.0	..	..	..	..	..	..	..	..	..	..
Malawi	..	..	5.0	..	..	..	..	..	..	..	..	..	..
Malaysia	23.0	74.2	96.9	17.3	7.1	4.8	6.0	55.9	9.3	22.0	77.5	..	..
Mali	..	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	..	..	100.0	..	..	..	..	..	..	..	..	..	..
Mexico	122.7	215.2	..	19.1	11.6	6.3	12.1	57.3	36.9	10.6	32.1	2.4	4.5
Moldova	15.5	3.2	..	1.7	3.7	32.3	3.8	26.6	0.7	39.5	91.8	..	..
Mongolia	..	..	90.0	..	..	..	..	..	..	..	..	..	..
Morocco	9.6	17.2	71.1	12.7	4.9	23.0	70.1	64.4	23.9	..	..	..	..
Mozambique	0.5	12.7	7.2	62.6	99.7	13.9	..	23.6	0.3	0.2	0.0	..	..
Myanmar	2.5	6.6	5.0	48.1	33.7	1.6	..	10.9	9.3	39.3	57.0	..	..
Namibia	1.4	1.5	34.0	95.2	96.8	1.5	0.4	3.3	2.8	..	..	..	..
Nepal	0.9	2.1	15.4	99.9	99.8	..	..	0.1	0.2	..	..	..	..
Netherlands	71.9	96.0	..	0.1	0.1	38.3	28.0	4.3	2.9	50.9	59.4	4.9	4.1
New Zealand	32.3	40.3	..	72.3	60.7	1.5	4.0	0.0	..	17.6	25.1	..	..
Nicaragua	1.4	2.7	48.0	28.8	11.4	..	..	39.8	78.8	..	..	..	..
Niger	..	..	..	..	..	..	..	..	..	..	..	..	..
Nigeria	13.5	15.3	40.0	32.6	46.2	0.1	..	13.7	9.8	53.7	44.0	..	..
Norway	121.6	130.1	..	99.6	99.3	0.2	0.2	0.0	0.0	..	0.2	..	..
Oman	4.5	10.3	94.0	..	..	..	..	18.4	18.0	81.6	82.0	..	..
Pakistan	37.7	75.7	52.9	44.9	29.5	0.1	0.3	20.6	32.2	33.6	35.7	0.8	2.3
Panama	2.7	5.3	76.1	83.2	64.3	..	..	14.7	35.4	..	..	..	..
Papua New Guinea	..	..	..	..	..	..	..	..	..	..	..	..	..
Paraguay	27.2	48.2	74.7	99.9	100.0	..	..	0.0	..	..	..	..	..
Peru	13.8	22.0	73.0	75.8	82.1	..	2.3	21.5	10.3	1.7	4.5	..	..
Philippines	25.2	48.5	87.4	24.0	14.5	7.7	33.3	46.7	13.0	..	18.1	..	..
Poland	134.4	142.5	..	1.1	1.6	97.5	94.5	1.2	1.7	0.1	1.5	..	..
Portugal	28.4	45.7	..	32.3	17.1	32.1	33.3	33.1	25.0	..	19.8	..	..
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..	..	..



3.9

Sources of electricity

	Electricity production		Access to electricity	Sources of electricity ^a									
	billion kwh			% of population 2000	% of total								
	1990	2002	1990		2002	Hydropower		Coal		Oil		Gas		Nuclear power
Romania	64.3	54.9	..	17.7	29.2	28.8	37.6	18.4	6.5	35.1	16.7	..	10.0
Russian Federation	1,082.2	889.3	..	15.4	18.2	5.2	19.2	68.0	3.1	..	43.3	10.8	15.9
Rwanda	..	..	..	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	64.9	145.6	97.7	..	..	..	..	61.5	65.9	38.5	34.1	..	..
Senegal	0.9	1.5	30.1	..	..	..	..	98.0	100.0	2.0	0.1	..	..
Serbia and Montenegro	36.5	33.2	..	31.1	31.5	65.4	66.1	1.9	0.7	1.6	1.6	..	..
Sierra Leone	..	..	..	..	..	..	..	..	..	..	..	..	..
Singapore	15.7	35.4	100.0	..	..	..	..	100.0	39.6	..	58.3	..	..
Slovak Republic	23.4	32.2	..	8.0	16.4	32.2	17.3	3.4	2.2	4.9	7.8	51.4	55.7
Slovenia	12.1	14.7	..	28.2	23.2	36.2	36.1	2.5	0.4	0.2	2.0	32.9	37.6
Somalia	..	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	165.4	218.4	66.1	0.6	1.3	94.3	93.1	..	..	..	..	5.1	5.5
Spain	151.2	242.7	..	16.8	9.5	40.1	34.0	5.7	11.8	1.0	13.3	35.9	26.0
Sri Lanka	3.2	7.0	62.0	99.8	38.7	..	..	0.2	61.2	..	..	..	..
Sudan	1.5	2.9	30.0	63.2	44.4	..	..	36.8	55.6	..	..	..	..
Swaziland	..	..	..	..	..	..	..	..	..	..	..	..	..
Sweden	146.0	146.0	..	49.7	45.6	1.2	2.6	0.8	2.0	0.3	0.4	46.7	46.3
Switzerland	54.6	64.9	..	54.6	54.2	0.1	..	0.5	0.1	0.6	1.4	43.3	41.9
Syrian Arab Republic	11.6	26.9	85.9	48.6	39.7	..	..	32.4	25.2	18.9	35.2	..	..
Tajikistan	18.1	15.2	..	90.9	97.7	..	..	9.1	..	6.7	2.3	..	..
Tanzania	1.6	3.0	10.5	95.1	91.4	..	3.5	4.9	5.1	..	..	..	..
Thailand	44.2	109.0	82.1	11.3	6.9	25.0	16.5	23.5	2.6	40.2	72.2	..	..
Togo	0.1	0.1	9.0	4.6	5.7	..	..	95.4	94.3	..	..	..	..
Trinidad and Tobago	3.6	6.1	99.0	..	..	..	..	0.1	0.0	99.0	99.5	..	..
Tunisia	5.8	11.8	94.6	0.8	0.6	..	..	35.5	10.2	63.7	89.0	..	..
Turkey	57.5	129.4	..	40.2	26.0	35.1	24.8	6.9	8.3	17.7	40.6	..	..
Turkmenistan	14.6	11.2	..	4.8	0.0	..	..	..	..	95.2	100.0	..	..
Uganda	..	..	3.7	..	..	..	..	..	..	..	..	..	..
Ukraine	298.8	173.7	..	3.6	5.6	27.6	17.2	14.9	0.7	28.4	31.6	25.5	44.9
United Arab Emirates	17.1	42.2	96.0	..	..	..	..	3.7	7.9	96.3	92.1	..	..
United Kingdom	317.8	384.5	..	1.6	1.2	65.0	32.8	10.9	1.8	1.6	39.6	20.7	22.9
United States	3,202.8	3,992.7	..	8.5	5.8	53.1	51.3	4.1	2.5	11.9	17.8	19.1	20.1
Uruguay	7.4	9.6	98.0	94.2	99.3	..	..	5.1	0.4	..	..	..	..
Uzbekistan	56.3	49.6	..	11.8	12.8	..	4.0	88.2	11.4	..	71.8	..	..
Venezuela, RB	59.3	87.4	94.0	62.3	66.2	..	..	11.5	11.6	26.2	22.2	..	..
Vietnam	8.7	35.8	75.8	61.8	50.8	23.1	13.6	15.0	12.3	0.1	23.3	..	..
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	1.7	3.8	50.0	..	..	..	..	100.0	100.0	..	..	..	..
Zambia	8.0	9.1	12.0	99.2	99.5	0.5	0.2	0.3	0.4	..	..	..	..
Zimbabwe	9.4	8.6	39.7	40.5	44.5	59.5	55.1	..	0.3	..	..	..	..
World	11,708.5 s	16,014.1 s	.. w	18.1 w	16.2 w	37.9 w	39.1 w	11.2 w	7.1 w	13.9 w	19.1 w	17.2 w	16.6 w
Low income	535.9	925.9	35.8	34.3	23.0	41.0	47.4	7.3	8.7	14.5	18.1	1.2	2.3
Middle income	3,817.1	5,519.5	90.4	21.2	21.8	34.4	39.2	15.8	9.2	20.3	21.9	7.5	6.9
Lower middle income	3,156.7	4,473.0	90.2	22.1	22.7	34.5	42.8	14.0	6.3	21.5	20.6	7.0	6.7
Upper middle income	660.5	1,046.5	..	17.3	17.8	34.0	23.9	24.3	21.8	14.4	27.6	9.6	7.7
Low & middle income	4,353.0	6,445.4	65.0	22.8	22.0	35.2	40.4	14.7	9.1	19.6	21.4	6.7	6.2
East Asia & Pacific	785.8	2,042.5	87.3	21.7	17.1	61.1	66.8	12.8	4.7	3.5	9.1	..	1.2
Europe & Central Asia	2,143.0	1,874.4	..	12.9	16.7	31.6	29.4	12.7	3.6	29.5	33.4	12.3	16.7
Latin America & Carib.	607.0	989.2	86.6	63.7	56.9	3.8	5.0	19.0	15.6	9.5	17.0	2.1	3.0
Middle East & N. Africa	254.9	534.5	90.4	10.3	6.6	0.9	2.3	50.5	38.3	38.4	52.8	..	..
South Asia	338.9	699.8	40.8	27.6	13.2	55.8	59.8	6.1	8.3	8.6	15.1	1.9	3.0
Sub-Saharan Africa	223.4	305.0	24.7	18.2	21.1	72.3	68.2	2.2	3.1	3.3	3.5	3.8	3.9
High income	7,355.4	9,568.7	..	15.3	12.2	39.6	38.2	9.2	5.8	10.6	17.6	23.3	23.6
Europe EMU	1,652.6	2,081.4	..	11.0	10.0	34.4	27.1	9.5	7.4	8.7	16.1	35.5	35.5

a. Shares may not sum to 100 percent because some sources of generated electricity are not shown.

About the data

Use of energy in general, and access to electricity in particular, are important in improving people's standard of living. But electricity generation also can damage the environment. Whether such damage occurs depends largely on how electricity is generated. For example, burning coal releases twice as much carbon dioxide—a major contributor to global warming—as does burning an equivalent amount of natural gas (see About the data for table 3.8). Nuclear energy does not generate carbon dioxide emissions, but it produces other dangerous waste products. The table provides information on electricity production by source. Shares may not sum to 100 percent because some sources of generated

electricity (such as wind, solar, and geothermal) are not shown.

The International Energy Agency (IEA) compiles data on energy inputs used to generate electricity. IEA data for countries that are not members of the Organisation for Economic Co-operation and Development (OECD) are based on national energy data adjusted to conform to annual questionnaires completed by OECD member governments. In addition, estimates are sometimes made to complete major aggregates from which key data are missing, and adjustments are made to compensate for differences in definitions.

The IEA makes these estimates in consultation with national statistical offices, oil companies, elec-

tricity utilities, and national energy experts. The IEA occasionally revises its time series to reflect political changes. Since 1990, for example, it has constructed energy statistics for countries of the former Soviet Union. In addition, energy statistics for other countries have undergone continuous changes in coverage or methodology as more detailed energy accounts have become available in recent years. Breaks in series are therefore unavoidable.

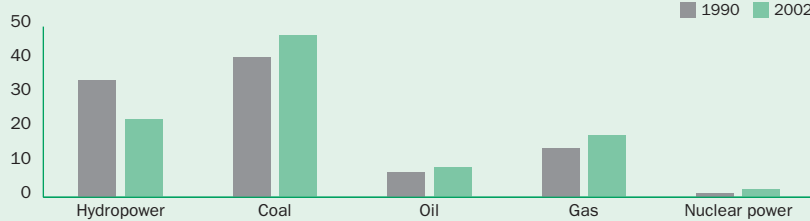
There is no single internationally accepted definition for access to electricity. The definition used here covers access at the household level—that is, the number of people who have electricity in their home. It includes commercially sold electricity, both on-grid and off-grid. For countries where access to electricity has been assessed through surveys by government agencies, the definition also includes self-generated electricity. The data do not capture unauthorized connections.

3.9a

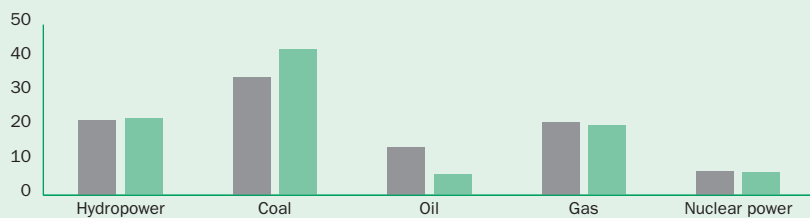
Sources of electricity generation have shifted differently in different income groups

Sources of electricity generation, by income group (% of total production)

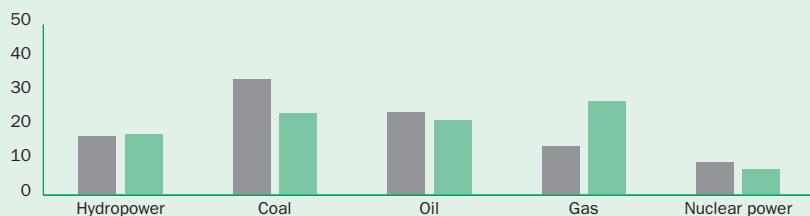
Low-income countries



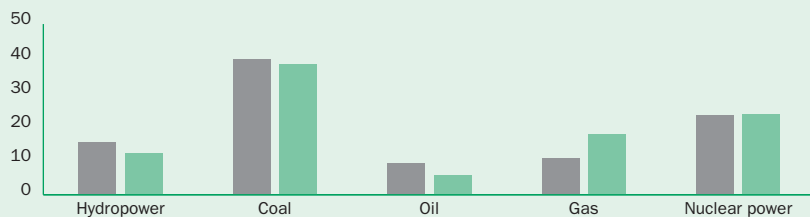
Lower-middle-income countries



Upper-middle-income countries



High-income countries



Source: Table 3.9.

Definitions

- Electricity production is measured at the terminals of all alternator sets in a station. In addition to hydropower, coal, oil, gas, and nuclear power generation, it covers generation by geothermal, solar, wind, and tide and wave energy as well as that from combustible renewables and waste. Production includes the output of electricity plants designed to produce electricity only, as well as that of combined heat and power plants.
- Access to electricity refers to the number of people with access to electricity (both on-grid and off-grid) as a percentage of the total population (see table 2.1).
- Sources of electricity refer to the inputs used to generate electricity: hydropower, coal, oil, gas, and nuclear power.
- Hydropower refers to electricity produced by hydroelectric power plants.
- Oil refers to crude oil and petroleum products.
- Gas refers to natural gas but not to natural gas liquids.
- Nuclear power refers to electricity produced by nuclear power plants.

Data sources

The data on electricity production are from the IEA's electronic files and its annual publications Energy Statistics and Balances of Non-OECD Countries, Energy Statistics of OECD Countries, and Energy Balances of OECD Countries. Data on access to electricity are from the IEA's World Energy Outlook 2002: Energy and Poverty.