

INTERNATIONAL ENERGY AGENCY



RENEWABLES IN GLOBAL ENERGY SUPPLY

An IEA Fact Sheet

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RENEWABLES IN GLOBAL ENERGY SUPPLY

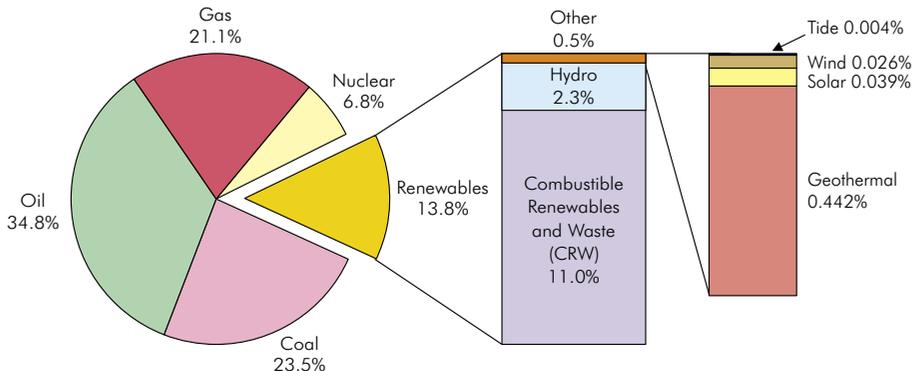
An IEA Fact Sheet

Renewables were at the centre of the energy discussion at the World Summit on Sustainable Development in Johannesburg (26 August – 4 September 2002). Differences in definition and lack of adequate data complicated the discussion between participants on this key issue. The International Energy Agency believes that this fact sheet can be of use to all in order to facilitate the debate on the past, current and future place and role of renewables in total energy supply.

This pamphlet presents as objectively as possible the main elements of the current renewables energy situation. The definitions and coverage of national statistics vary between countries and organisations. In this leaflet, we define renewables to include combustible renewables and waste (CRW), hydro, geothermal, solar, wind, tide, wave energy (see definitions page 6).

The pie-chart below represents the main fuels in the world total primary energy supply, with a disaggregation of the share of the main renewables categories. In 2000, renewables accounted for 13.8% of the 9958 Mtoe of World Total Primary Energy Supply (TPES)*. Combustible renewables and waste (97% of which is biomass, both commercial and non-commercial) represented almost 80% of total renewables followed by hydro (16.5%).

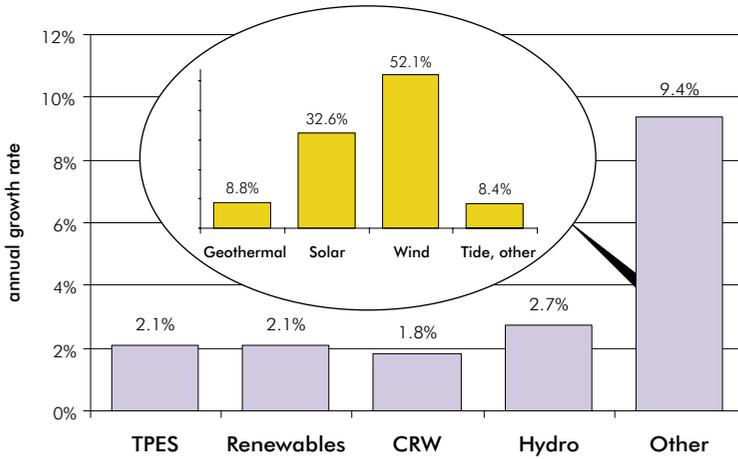
2000 Fuel Shares of World Total Primary Energy Supply*



* TPES is calculated using the IEA conventions (physical energy content methodology). It includes international marine bunkers and excludes electricity/heat trade. The figures include both commercial and non-commercial energy; this explains the small differences with the figures presented in the *World Energy Outlook 2002 Edition* (WEO) where non-commercial biomass in Non-OECD countries is treated separately. The chapter of the WEO on Energy and Poverty as well as tables at the end of the book include non-commercial energy together with commercial energy sources.

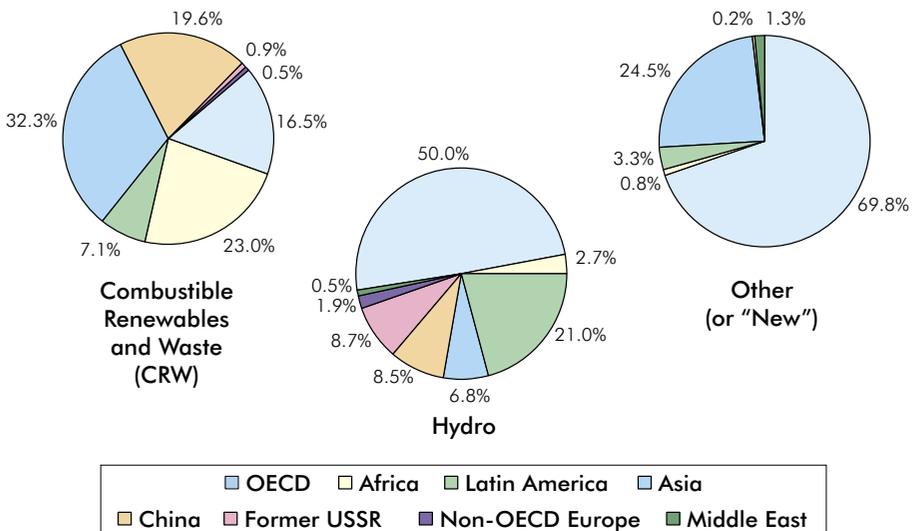
Source: IEA Energy Statistics

Annual Growth of Renewables Supply from 1971 to 2000



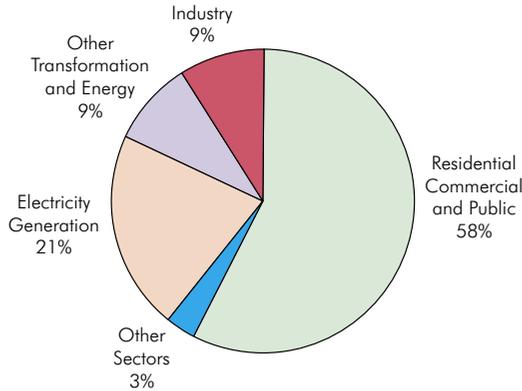
Total renewables supply experienced an annual growth of 2% over the last 30 years, almost identical to the annual growth in TPES. However, the "other" category in the chart above (also referred to as "new" renewables and including geothermal, solar, wind, etc.) recorded a much higher annual growth of 9%. Due to a very low base in 1971 and to recent fast growing development, wind experienced the highest increase (+52% p.a.) followed by solar (+32% p.a.).

2000 Regional Shares in Renewables Supply



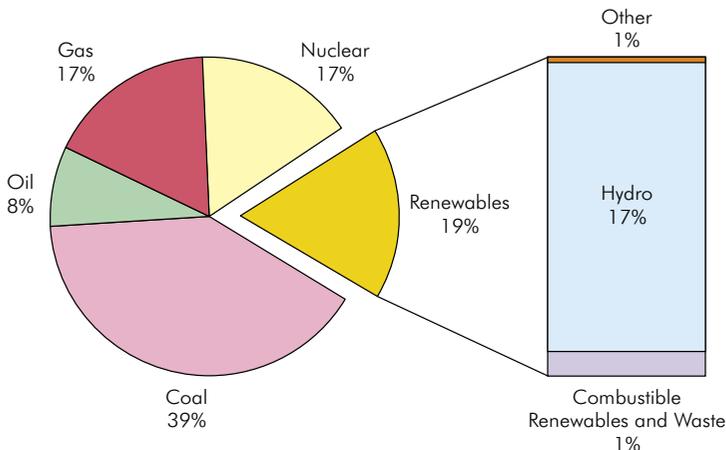
Due to the high share of biomass in total renewables, non-OECD regions like Asia, Latin America and Africa emerge as the main renewables users. The bulk of the consumption occurs in the residential sector for cooking and heating purposes. When looking at hydro and other (or “new”) renewables (solar, wind), OECD accounts for most of the use with, respectively, 50% and 70% in 2000.

2000 Global Sectorial Consumption of Renewables



Renewables are the second largest contributor to global electricity production. They accounted for 19% of production in 2000, after coal (39%) but ahead of nuclear (17%), natural gas (17%) and oil (8%). Most of the electricity generated from renewables comes from hydro power plants (92%) followed by combustible renewables and waste (5%). Although fast growing, geothermal, solar and wind accounted for less than 3% in 2000.

Renewables in Electricity Production

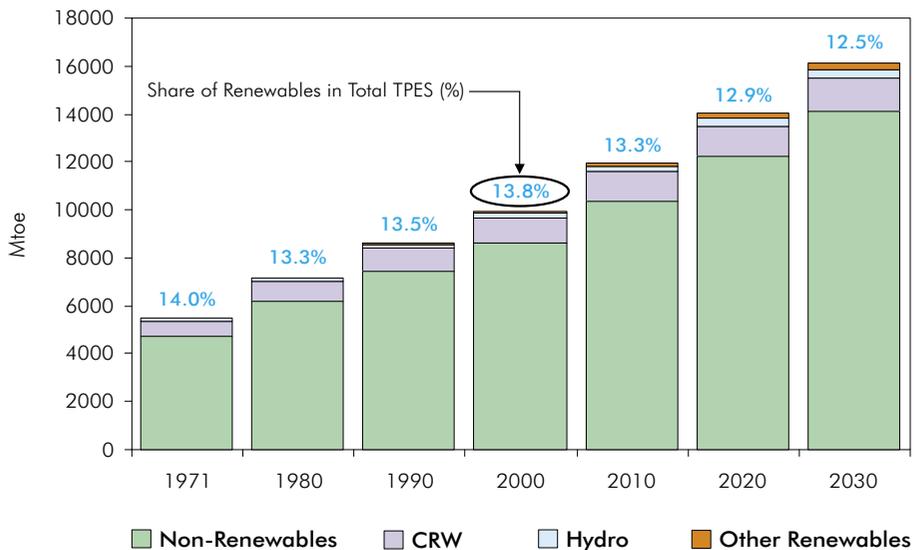


RENEWABLES OUTLOOK*

Global Development: Including Combustible Renewables and Waste (CRW), in a *Reference Scenario* assuming the continuation of present government policies and no major breakthrough in technologies, renewables would grow by 1.3% per year (below the 1.7% overall growth of the total energy demand) over the next 30 years.

In this scenario, the world share of renewable energy would decline from 13.8% in 2000 to 12.5% in 2030. This is principally due to a slowdown in the growth of CRW (to 0.8% p. a.), caused by the shift from traditional biomass to modern forms of energy in developing countries, and some reduction in the growth of hydropower (to 1.6% p. a.). Other (or “new”) renewables will grow the fastest (at 4.1% p. a.), but because they start from a very low base they will still be the smallest component of renewable energy in 2030.

World Total Primary Energy Supply



Regional Differences: The decrease in the world share of renewables comes principally from the developing countries which at present account for 73% of world renewables. In these countries, CRW growth will slow down (0.6% p. a. growth over the next three decades) as people get richer and switch to more “modern” fuels, usually fossil fuels for residential use.

* Figures presented here are based on IEA's latest projections of the *World Energy Outlook 2002*.

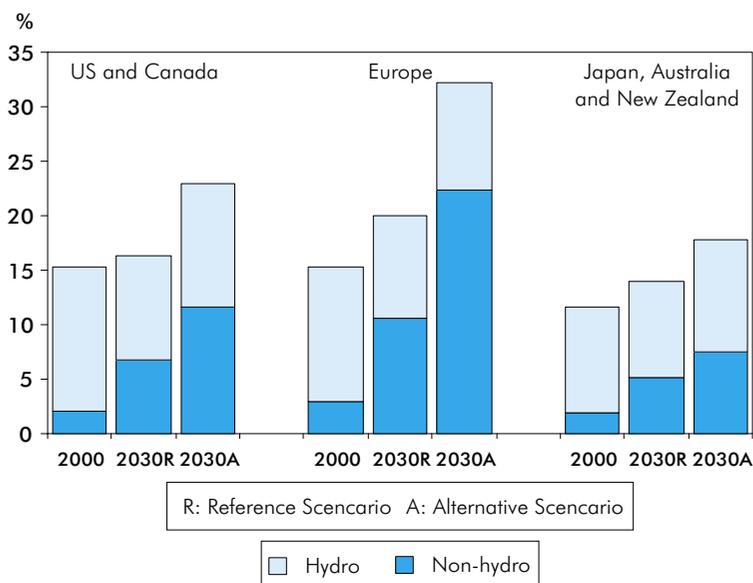
In 2030, 2.6 billion people will continue to rely on traditional biomass for cooking and heating; in developing countries, use of renewables will still represent 60% of residential energy consumption at the end of the outlook period, compared to 72% today.

In the OECD, the share of renewables has and will continue to increase from 6.4% in 2000 to a projected 8% in 2030. Most renewables will be used for power generation (72% in 2000, 75% in 2030).

A second scenario, the *Alternative Policy Scenario*, considers the impact of implementation of a range of new energy and environment policies now under consideration in OECD countries. In this scenario, non-hydro renewables are projected to grow by some 4% per annum between 2000 and 2030, compared to 2.7% p. a. in the *Reference Scenario*.

This means an additional 166 Mtoe of primary renewable energy, or 40% more than in the reference scenario, in 2030. The share of renewables, including hydropower in electricity generation, increases substantially from 14.7% in 2000, to 17.6% in 2010 and 25.4% in 2030.

Share of Renewables in OECD Regions' Electricity Generation



The substantial difference between the *Reference Scenario* and the *Alternative Policy Scenario* highlights the potential impact of new government policies on the future mix of primary energy.

DEFINITIONS

Renewables include the following categories:

■ **Combustible Renewables and Waste* (CRW):**

◆ **Solid Biomass and Animal Products:** Biomass is defined as any plant matter used directly as fuel or converted into other forms before combustion. Included are wood, vegetal waste (including wood waste and crops used for energy production), animal materials/wastes, sulphite lyes, also known as “black liquor”, and other solid biomass. It also includes charcoal produced from solid biomass.

◆ **Gas/Liquids from Biomass:** Biogas is derived principally from the anaerobic fermentation of biomass and solid wastes and combusted to produce heat and/or power.

◆ **Municipal Waste:*** Municipal waste consists of products that are combusted directly to produce heat and/or power and comprises wastes produced by the residential, commercial and public services sectors that are collected by local authorities for disposal in a central location. Hospital waste is included in this category.

◆ **Industrial Waste:*** Industrial waste consists of solid and liquid products (e.g. tyres) combusted directly, usually in specialised plants, to produce heat and/or power and that are not reported in the category solid biomass.

■ **Hydro Power:** potential and kinetic energy of water converted into electricity in hydroelectric plants. It includes large as well as small hydro, regardless of the size of the plants.

■ **Geothermal Energy:** Energy available as heat emitted from within the earth’s crust, usually in the form of hot water or steam. It is exploited at suitable sites for electricity generation after transformation or directly as heat for district heating, agriculture, etc.

■ **Solar Energy:** Solar radiation exploited for hot water production and electricity generation.

■ **Wind Energy:** Kinetic energy of wind exploited for electricity generation in wind turbines.

■ **Tide/Wave/Ocean Energy:** Mechanical energy derived from tidal movement or wave motion and exploited for electricity generation.

* Some of the waste (the non-biodegradable part of the waste) is not considered renewables as such. However, proper breakdown between renewables and non-renewables is often not available.

Key Regional Renewables Indicators for 2000

	TPES*	Of which Total Renewables	Share of Total Renewables in TPES	Share of the Main Fuel Categories in Total Renewables		
				Hydro	Geothermal, Solar, Wind, etc.	Combustible Renewables and Waste
	Mtoe	Mtoe	%	%	%	%
Africa	508	259	50.9	2.3	0.2	97.5
Latin America	456	127	27.9	37.3	1.3	61.3
Asia**	1 123	382	34.0	4.0	3.3	92.7
China***	1 158	234	20.2	8.2	0.0	91.8
Non-OECD Europe	95	9	9.9	46.1	0.9	53.0
Former USSR	921	30	3.3	65.5	0.2	34.3
Middle East	380	3	0.8	41.3	22.7	35.9
OECD	5 317	329	6.2	34.4	10.8	54.8
World	9 958	1 372	13.8	16.5	3.7	79.8

* Total Primary Energy Supply calculated using the physical energy content methodology.

** Asia excludes China

*** China includes People's Republic of China and Hong Kong, China

A Few Words of Caution on the Use of Data on Renewables

Definitions

Statistical information on renewables varies from country to country and from organisation to organisation. Time horizon, subsidies or taxation, sustainability and environment are some elements which might lead to some differences in coverage for policy or practical reasons. For example, large hydro is sometimes excluded from renewables, while peat is sometimes included. The figures and data presented in this leaflet are based on the coverage and definitions given on page 6.

Data Quality

Data on biomass, more specifically on "non-commercial" biomass, are often available only from secondary sources, due to the difficulty countries have in accurately monitoring the supply and consumption of biomass. As a consequence, the quality and reliability of the data may be limited, which makes comparison between countries difficult. The data on remote solar and wind installations are also difficult for national administrations to collect.

In order to improve the quality, the IEA has developed a specific "Renewables and Waste" questionnaire in 1999. This has led to a major improvement in the quality of the data reported by OECD Member countries.

Based on information collected from various sources worldwide, and with the words of caution on page 7, the following table gives an idea of the contribution of renewables (with and without combustible renewables and waste) to total primary energy supply for over 140 countries and regions.

Selected Renewables Indicators by Country for 2000

	TPES* (Mtoe)	Share of Renewables in TPES	
		A	B
		(%)	(%)
Albania	1.6	29.3	25.7
Algeria	29.1	0.3	0
Angola	7.7	74.6	1
Argentina	61.5	8.8	4
Armenia	2.1	5.3	5.3
Australia	110.2	6.3	1.4
Austria	28.6	23.8	12.9
Azerbaijan	11.7	1.2	1.1
Bahrain	6.4	0	0
Bangladesh	18.7	41.2	0.4
Belarus	24.3	4.1	0
Belgium	59.2	1.3	0.1
Benin	2.4	75.5	0
Bolivia	4.9	18.1	3.4
Bosnia & Herz.	4.4	14.2	10
Brazil	183.2	37.7	14.3
Brunei	2	0.9	0
Bulgaria	18.8	4.3	1.2
Cameroon	6.4	83.1	4.7
Canada	251	16.8	12.3
Chile	24.4	24.1	6.7
People's Rep. of China	1142	20.4	1.7
Chinese Taipei	83	0.9	0.9
Colombia	28.8	27.9	9.6
Congo	0.9	68.5	2.9
Cote d'Ivoire	6.9	63.1	2.2
Croatia	7.8	11.3	6.5
Cuba	13.2	22.2	0.1
Cyprus	2.4	1.9	1.5
Czech Rep.	40.4	1.9	0.4
Denmark	19.5	11.3	2.5
Dominican Rep.	7.8	18.2	0.8
Ecuador	8.2	16.5	8

	TPES* (Mtoe)	Share of Renewables in TPES	
		A	B
		(%)	(%)
Egypt	46.4	5.4	2.6
El Salvador	4.1	53	19
Eritrea	0.7	70.9	0
Estonia	4.5	11.1	0
Ethiopia	18.7	93.9	0.8
Finland	33.1	24.2	3.8
France	257.1	6.8	2.3
Gabon	1.6	63.1	3.9
Georgia	2.9	20.1	17.6
Germany	339.6	3.3	0.8
Ghana	7.7	76.2	7.4
Gibraltar	0.2	0	0
Greece	27.8	5.3	1.6
Guatemala	7.1	57.3	2.8
Haiti	2	75.6	1.2
Honduras	3	50.5	6.5
Hong Kong (China)	15.5	0.3	0
Hungary	24.8	1.6	0.1
Iceland	3.4	72.6	72.6
India	501.9	41.5	1.3
Indonesia	145.6	34.7	2.1
Islamic Rep. of Iran	112.7	1	0.3
Iraq	27.7	0.3	0.2
Ireland	14.6	1.8	0.6
Israel	20.2	3	3
Italy	171.6	5.3	4
Jamaica	3.9	12.4	0.3
Japan	524.7	3.3	2.2
Jordan	5.2	1.4	1.3
Kazakhstan	39.1	1.8	1.7
Kenya	15.5	79.2	3.1
Korea	193.6	1.3	0.2
DPR of Korea	46.1	6.2	4

A: Share of total renewables in TPES

B: Share of renewables **excluding combustible renewables and waste** in TPES

* Total Primary Energy Supply calculated using the physical energy content methodology.

Selected Renewables Indicators by Country for 2000 (cont.)

	TPES* (Mtoe)	Share of Renewables in TPES	
		A	B
		(%)	(%)
Kuwait	20.9	0	0
Kyrgyzstan	2.4	48.3	48.1
Latvia	3.7	29	6.6
Lebanon	5.1	3.4	0.9
Libya	16.4	0.8	0
Lithuania	7.1	9.2	0.5
Luxembourg	3.7	1.5	0.3
FYR of Macedonia	2.8	12.5	4.8
Malaysia	49.5	6.3	1.2
Malta	0.8	0	0
Mexico	153.5	10.4	5.2
Rep. of Moldova	2.9	2.2	0.2
Morocco	10.3	4.9	0.6
Mozambique**	7.1	101.1	8.4
Myanmar	12.5	74.6	1.3
Namibia	1	28.3	11.5
Nepal	7.9	87	1.8
Netherlands	75.8	2.5	0.2
Netherlands Antilles	1.1	0	0
New Zealand	18.6	33.5	27
Nicaragua	2.7	56.5	4.9
Nigeria	90.2	80.8	0.6
Norway	25.6	52.8	47.5
Oman	9.8	0	0
Pakistan	64	39.9	2.3
Panama	2.5	28.7	10.6
Paraguay**	3.9	175.2	117
Peru	12.7	29	11.4
Philippines	42.4	47.6	25.1
Poland	90	4.7	0.2
Portugal	24.6	12.7	4.4
Qatar	15.7	0	0
Romania	36.3	11.4	3.5
Russia	614	3.4	2.3
Saudi Arabia	105.3	0	0
Senegal	3.1	55.8	0
Singapore	24.6	0.3	0.3
Slovak Republic	17.5	2.8	2.3

	TPES* (Mtoe)	Share of Renewables in TPES	
		A	B
		(%)	(%)
Slovenia	6.5	12	5
South Africa	107.6	11.7	0.1
Spain	124.9	5.9	2.3
Sri Lanka	8.1	56.2	3.4
Sudan	16.2	87.5	0.6
Sweden	47.5	31.9	14.4
Switzerland	26.6	18.3	12.3
Syria	18.4	4.4	4.3
Tajikistan	2.9	41	41
United Rep. of Tanzania	15.4	94.9	1.3
Thailand	73.6	20.1	0.7
Togo	1.5	67.7	0
Trinidad and Tobago	8.7	0.4	0
Tunisia	7.9	15.8	0.1
Turkey	77.1	12.5	4.1
Turkmenistan	13.9	0	0
Ukraine	139.6	0.9	0.7
United Arab Emirates	29.6	0.1	0
United Kingdom	232.6	1.1	0.2
United States	2300	5	1.6
Uruguay	3.1	33.4	19.7
Uzbekistan	50.2	1	1
Venezuela	59.3	10	9.1
Vietnam	37	64.6	3.4
Yemen	3.5	2.2	0
FR of Yugoslavia	13.7	9.4	7.6
Former Yugoslavia	35.1	11.1	7
Zambia	6.2	92.9	10.7
Zimbabwe	10.2	57.5	2.7
Africa	507,8	50,9	1,3
Latin America	455,5	27,9	10,8
Asia	1122,6	34	2,5
China	1157,9	20,2	1,7
Non-OECD Europe	95,3	9,9	4,6
Former USSR	921,1	3,3	2,1
Middle East	380,3	0,8	0,5
OECD	5316,9	6,2	2,8
World	9957,5	13,8	2,8

A: Share of total renewables in TPES

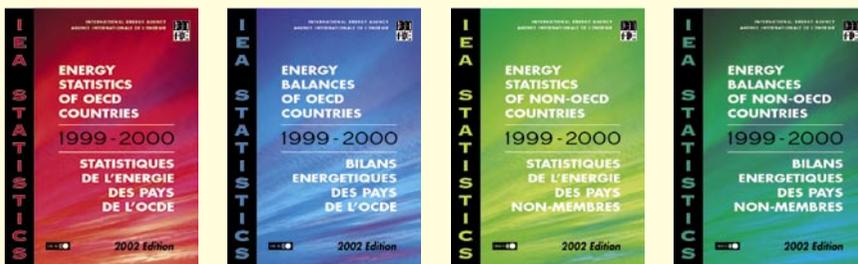
B: Share of renewables **excluding combustible renewables and waste** in TPES

* Total Primary Energy Supply calculated using the physical energy content methodology.

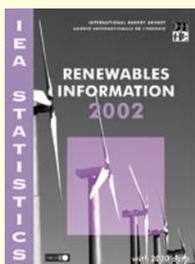
** Share above 100% is due to the way electricity exports are accounted for.

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Detailed historical data on renewables and other energy fuels are published in several annual IEA statistics books:

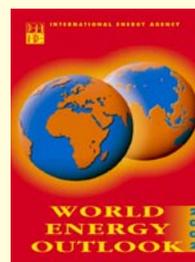


The full time series are available on CD Roms as well as on the internet.



In December 2002, the IEA will publish for the first time a statistics publication entirely dedicated to data on renewables in the 30 OECD Member countries. *Renewables Information* gives extensive figures on electricity production from renewable energy in the OECD region.

The *World Energy Outlook, 2002 Edition* provides data for a forecast of the global energy situation, including renewables up to the year 2030.



Moreover, the IEA publishes a wide range of information on renewables, including information on the most recent technology on renewables energy on its web site. The web site can be accessed at

www.iea.org