

KEY RENEWABLES TRENDS Excerpt from:

RENEWABLES INFORMATION

2015

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The following analysis is an excerpt from the publication *Renewables Information* (2015 edition).

Please note that we strongly advise users to read definitions, detailed methodology and country specific notes which can be found online under *References* at www.iea.org/statistics/topics/renewables/.

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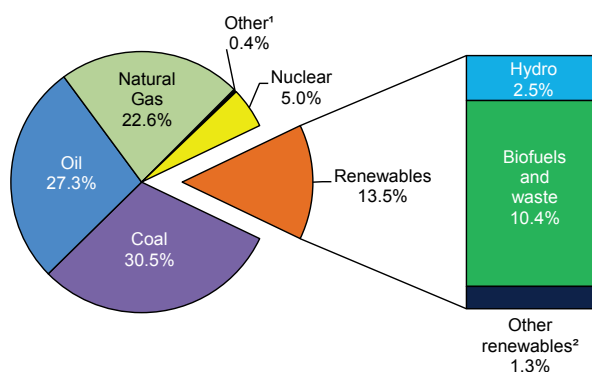
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RENEWABLES MARKET OVERVIEW

DEVELOPMENT OF RENEWABLES AND WASTE IN THE WORLD

In 2013, world total primary energy supply (TPES) was 13 555 million tonnes of oil equivalent (Mtoe) of which 13.5%, or 1 829 Mtoe, was produced from renewable energy sources (Figure 1).

Figure 1: 2013 fuel shares in world total primary energy supply



1. Includes electricity from energy sources not defined above, such as non-renewable wastes, peat, oil shale and chemical heat.

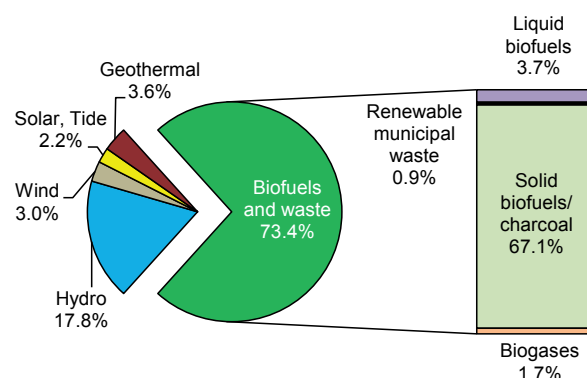
2. Includes geothermal, wind, solar, tide.

Note: Totals in graphs might not add up due to rounding.

Due to its widespread non-commercial use (i.e. residential heating and cooking) in developing countries, solid biofuels (excluding wastes) is by far the largest renewable energy source, representing 10.4% of world TPES and 73.4% of global renewables supply (Figure 2). The second-largest source is hydroelectric power, which provides 2.5% of world TPES and 17.8% of renewables. Geothermal, liquid biofuels, biogases, solar, wind, and tide each hold a smaller share and make up the rest of the renewables energy supply.

Since 1990, renewable energy sources have grown at an average annual rate of 2.2%, which is slightly higher than the growth rate of world TPES, 1.9%

Figure 2: 2013 product shares in world renewable energy supply



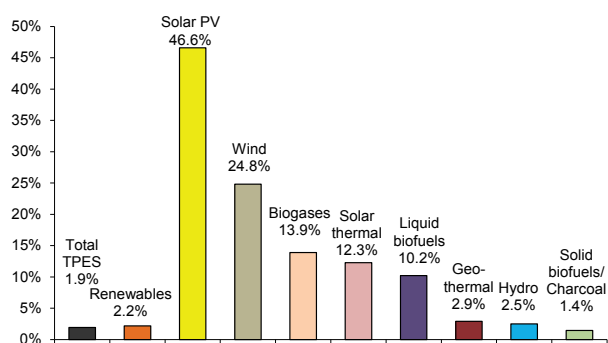
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(Figure 3). Growth has been especially high for solar photovoltaic and wind power, which grew at average annual rates of 46.6% and 24.8%, respectively. However, this is due to their very low bases in 1990, and production remains small. OECD countries account for most of the world production and growth of solar and wind energy. Biogases had the third-highest annual growth rate, at 13.9%, followed by solar thermal, at 12.3%, and liquid biofuels, at 10.2%. But again, all started from low bases.

Hydro experienced one of the slowest growth rates among the renewable energy sources, at 2.5% per annum since 1990. It was immediately followed by solid biofuels and charcoal which had an even lower growth rate of only 1.4%.

The average annual growth rate of hydro in non-OECD countries, 4.4% from 1990 to 2013, was larger than in OECD countries, which was only 0.8%. Growth was particularly strong in Viet Nam (10.8%), China (8.9%) and Myanmar (9.1%) in the Asia region,

Figure 3: Annual growth rates of world renewables supply from 1990 to 2013

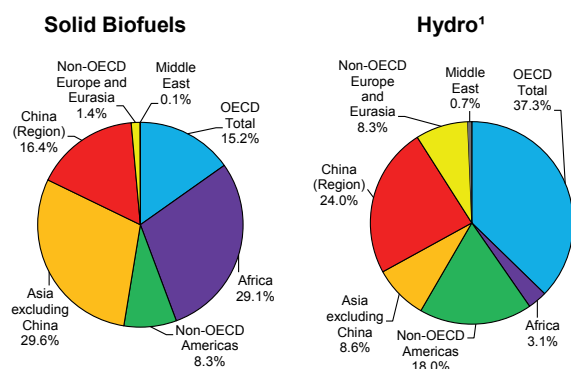


in the Dominican Republic (8.6%) in Non-OECD Americas region, in Mozambique (18.7%), Sudan (9.9%) and Ethiopia (9.4%) in the African region, and Jordan (7.2%) in the Middle East region.

In 2013, non-OECD countries' share of hydro reached 62.7%, and any further increase is likely to be from these countries, as most of the remaining hydro potential resides in these countries.

Non-OECD countries account for most of the production of solid biofuels, but its growth since 1990 is comparable for OECD and non-OECD countries. In 2013, 85.7% of solid biofuels was produced and consumed in non-OECD countries, where developing countries, situated mainly in South Asia and sub-Saharan Africa, use non-commercial biomass for residential cooking and heating (Figure 4). Africa, which accounted for only 5.5% of global TPES in 2013, accounted for 29.3% of the world's solid biofuels supply.

Figure 4: 2013 regional shares in renewables supply



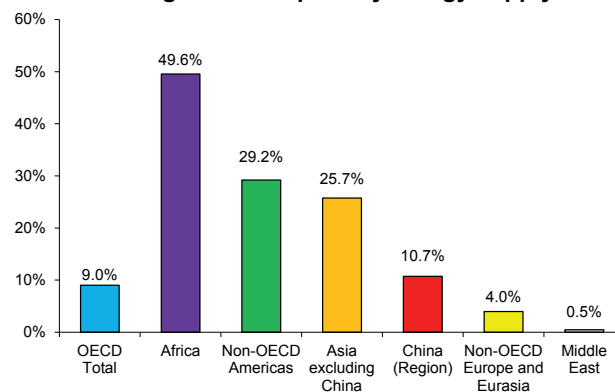
1. Excludes pump storage generation.

Note: Totals in graphs might not add up due to rounding.

Because of their non-commercial use of solid biofuels, non-OECD countries are the principal renewable energy users, accounting for 73.9% of world total renewables

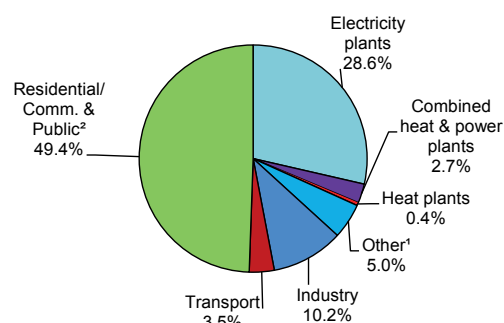
supply. On the other hand, while OECD countries supply only 26.1% of world renewables, they constitute 39.1% of global TPES. Consequently, in OECD countries the share of renewables in total energy supply is only 9.0% compared to 49.6% in Africa, 29.2% in Non-OECD Americas, 25.7% in Non-OECD Asia and 10.7% in China (Figure 5). However, the OECD countries play a major role when looking at "new" renewables, supplying 66.1% of world energy from solar, wind, tide, renewable municipal waste, biogases and liquid biofuels in 2013.

Figure 5: 2013 shares of renewables of regional total primary energy supply



While about half of the renewable primary energy supply in OECD countries is used in the transformation sector to generate electricity and sold heat, on a global level a majority of renewables is consumed in the residential, commercial and public services sectors. Again, this is a consequence of widespread solid biofuels use in the residential sector of developing countries. In fact, only 31.8% of renewables are used for electricity production and heat production worldwide, while 49.4% are used in the residential, commercial and public sectors (Figure 6).

Figure 6: 2013 world sectoral consumption of renewables



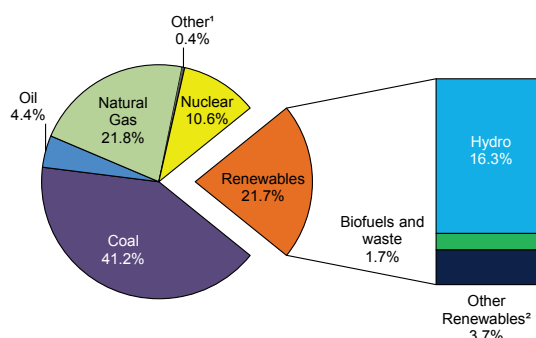
1. Other transformation, energy industry own use, losses.

2. Includes the agriculture/ forestry, fishing and non-specified industries.

Note: Totals in graphs might not add up due to rounding.

Renewables are the third-largest contributor to global electricity production. They accounted for 21.6% of world generation in 2013, after coal (41.2%) and slightly behind gas (21.8%), but ahead of nuclear (10.6%) and oil (4.4%). Hydro supplies the vast majority of renewable electricity, generating 16.3% of world electricity and 75.1% of total renewable electricity. Biofuels and waste, including solid biofuels, play a minor role in electricity generation, supplying 1.7% of world electricity. Although growing rapidly, geothermal, solar and wind energies accounted for only 3.7% of world electricity production in 2013.

Figure 7: Fuel shares in world electricity production in 2013



1. Includes electricity from energy sources not defined above such as non-renewable wastes, peat, oil shale, and chemical heat.

2. Includes geothermal, wind, solar, tide.

Note: Totals in graphs might not add up due to rounding.

Worldwide, since 1990, renewable electricity generation grew on average by 3.5% per annum, which is slightly faster than the total electricity generation growth rate (3.0%). So while 19.5% of global electricity in 1990 was produced from renewable sources, this share rose to 21.6% in 2013. This slight increase was held back by slow growth of the main renewable source, hydroelectric power, with its share of total world electricity production falling from 18.1% in 1990 to 16.3% in 2013. Taking out hydro from renewables, the share of the remaining renewable sources used to produce electricity grew from 1.3% in 1990 to 5.4% in 2013.

Since 1990 renewable electricity grew at an average annual average rate of 2.4% in OECD countries, while it grew by 4.6% in non-OECD countries. However, in non-OECD countries, renewable electricity grew slower than the total electricity growth (4.6% versus 4.9%). In all non-OECD regions, excluding Non-OECD Europe and Eurasia, electricity growth has been faster than in the OECD. These regions include developing economies, such as those in Asia and Africa, where population growth is much higher. In addition, as income increases, people switch from fuel wood and charcoal to kerosene and liquefied petroleum gases for cooking, and have better access to electricity through electrification programmes. As a consequence, future electricity growth, including renewable electricity growth, is expected to remain higher in non-OECD countries than in OECD countries.

DEVELOPMENT OF RENEWABLES AND WASTE IN OECD COUNTRIES

In the 2014 provisional data, the share of renewables in total primary energy supply reached 9.2%, the highest share since the IEA time series began in 1990 but only a marginal increase on the 9.0% share of 2013 (Figure 8). The slower growth is partly explained by unusually high hydro production in OECD Europe in 2013, which caused a percentage growth of only 0.3 point to 13.1% of TPES in 2014. This growth was similar to what was seen in OECD Asia but above OECD Americas.

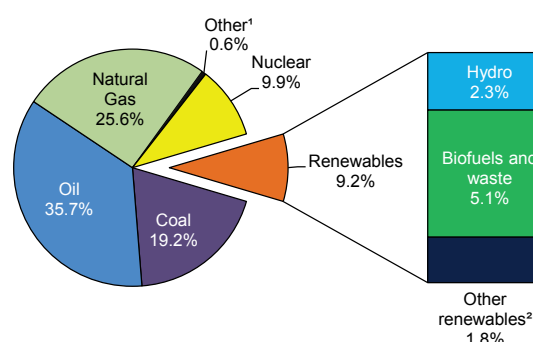
Primary energy supply

Summary: 1990 – 2014 provisional

In OECD countries, total primary energy supply (TPES) from renewable sources increased from 268 Mtoe in 1990 to 480 Mtoe in 2014, yielding an average annual growth of 2.5%. By comparison, the growth of TPES for conventional energy sources (including coal, oil, gas and nuclear) in OECD countries from 1990 to 2014 was 0.5%. Over this period, renewables' contribution to total OECD primary energy supply grew from 5.9% to 9.2%.

The largest proportion of renewable primary energy supply in OECD countries came from biofuels and waste, with a 55.2% share of the renewable supply (Figure 9). Of these biofuels, solid biofuels, including wood, wood wastes, other solid wastes and charcoal, constitutes the largest share, at 37.9% of the supply. The second-largest renewable energy source is hydro-electric power, providing 25.0% of renewable primary energy. With a 9.9% share, liquid biofuels is the third-largest renewable energy source, followed by geothermal, at 6.9%.

Figure 8: 2014 fuel shares in OECD total primary energy supply

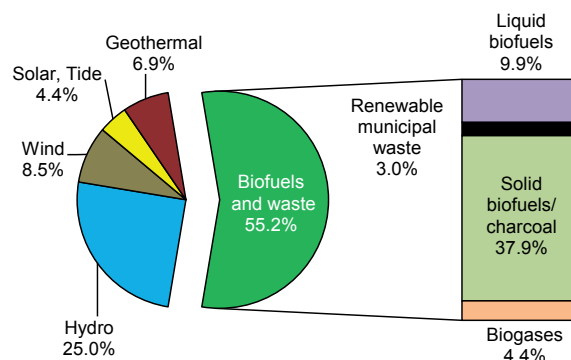


1. Includes energy sources not classified elsewhere such as non-renewable combustible wastes, ambient air for pumps, fuel cells, hydrogen, etc.

2. Includes geothermal, wind, solar, tide.

Note: Totals in graphs might not add up due to rounding.

Figure 9: 2014 product shares in OECD renewable energy supply

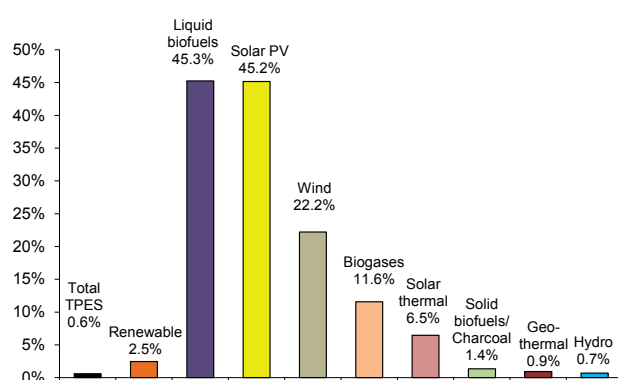


Note: Totals in graphs might not add up due to rounding.

While these four renewable energy sources constituted 79.7% of the total OECD primary renewable energy in 2014, their combined average annual growth rate has been 1.8% since 1990. This is lower than the

average annual growth rate of total renewable energies, 2.5%, for the OECD region over the same period. This difference can be attributed to the slow growth of hydroelectric power, with average annual growth of only 0.7%, only slightly higher than the 0.6% growth rate of total TPES over the period (Figure 10). Because hydroelectric capacity is mature in most OECD member states, it is increasingly difficult to locate suitable environmentally acceptable sites to expand this energy form. Therefore, little new growth is to be expected for this sector. Solid biofuels and geothermal energy also grew slower than total renewables, at 1.4% and 0.9% per annum since 1990.

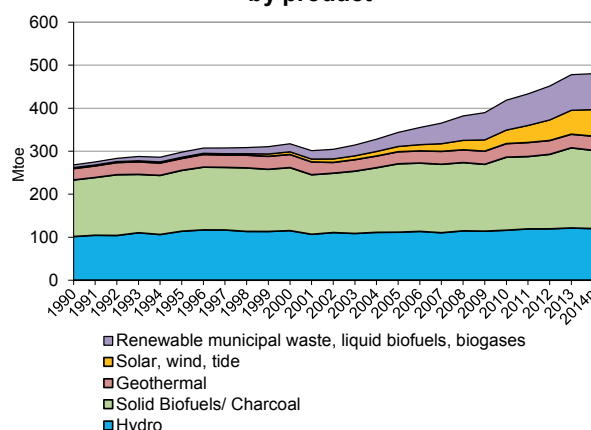
Figure 10: Annual growth rates of renewable supply from 1990 to 2014 in OECD total



These major sources influenced much of the growth of total renewables from 1990 to 2001 (Figure 11). However, since 2001, the majority of renewables growth can be attributed to “new” renewables, a loosely defined term used to delineate between traditional and more recent technologies used to produce renewable energy. Technologies that utilise solar energy, wind, tide, liquid biofuels, and biogases penetrated the supply and were responsible for the growth in renewable energy from 2001 to 2014 (Figure 11). For example, liquid biofuels experienced the highest growth among the renewables, averaging 45.3% over the period. Also experiencing growth rates well above other renewables over the period were solar photovoltaic, at 45.2% per annum, and wind, at 22.2%, the second- and third-highest growth rates respectively. Biogases increased much more rapidly than solid biofuels, with an average annual growth rate of 11.6%.

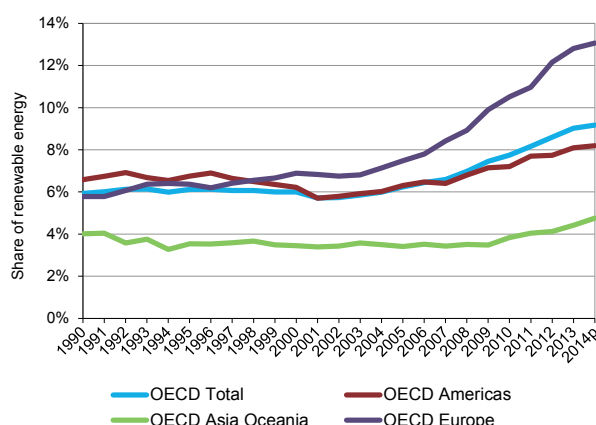
However, despite these significant growth rates, the contribution of such “new” renewables to the total

Figure 11: OECD renewable primary energy supply by product



energy supply is still minor. Wind, solar, tide, renewable municipal waste, liquid biofuels and biogases combined still represented only 2.8% of total primary energy supply in 2014. Nevertheless, their growing contribution to the renewable energy supply should be noted as they increased from 3.2% in 1990 to 30.2% in 2014.

Figure 12: OECD regional shares in renewable energy supply



Among the different OECD regions, OECD Europe recorded the highest share of primary energy supply from renewable sources, with 13.1% in 2014 (Figure 12). It is also the OECD area that has experienced the largest increase (from 5.8%) in its renewable share since 1990. The increase of the renewable share in OECD Europe is the result of the implementation of strong policies supporting renewable energy in the late 1990s and early 2000s, in particular the European Union’s directive to increase the share of renewable energy to 20% by 2020, which includes targets for individual countries. The share of renewables in OECD Americas reached 8.2% in 2014. In OECD Asia Oceania the share

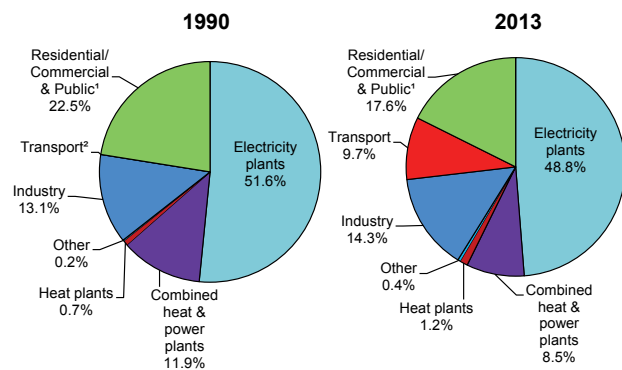
of renewable primary energy supply grew only slightly, from 4.0% in 1990 to 4.8% in 2014.

As a result of this diversification in the use of renewable, the overall renewable share in electricity generation has fallen. In 1990, 51.6% of renewable energy was used in electricity-only plants for electricity production. However, this share declined to 48.8% in 2013 (Figure 13).

The majority of the growth of renewable energy has taken place in the final consumption sectors, such as the residential, commercial, industry, and most significantly, transport sectors. In 2013, half of renewable primary energy was used in places other than electricity-only plants. This trend is underpinned by the strong presence of biofuels which are used for heat production and consumption directly on-site in these sectors. The most significant trend is the growth of biofuels used for transport. In 2013, liquid biofuels and biogases used for transport constituted 9.2% of

the consumption of renewables. Compared to 1990, this sector's consumption of renewable energy increased the most.

Figure 13: OECD sectoral consumption of renewables



1. Includes the Agriculture/forestry, fishing and non-specified industries.

2. Represents less than 0.05%.

Note: Totals in graphs might not add up due to rounding.