OECD Green Growth Indicators

Database documentation

The OECD Green Growth database contains selected indicators for monitoring progress towards green growth to support policy making and inform the public at large. The database synthesises data and indicators across a wide range of domains. It draws on a range of OECD databases as well as external data sources. The database covers OECD member and accession countries, key partners (including Brazil, China, India, Indonesia and South Africa) and other selected non-OECD countries.

The indicators have been selected according to well-specified criteria and embedded in a conceptual framework, which is structured around four groups to capture the main features of green growth:

- **Environmental and resource productivity**: indicate whether economic growth is becoming greener with more efficient use of natural capital and to capture aspects of production which are rarely quantified in economic models and accounting frameworks;

- **The natural asset base**: indicate the risks to growth from a declining natural asset base;

- **Environmental dimension of quality of life**: indicate how environmental conditions affect the quality of life and wellbeing of people;

- **Economic opportunities and policy responses**: indicate the effectiveness of policies in delivering green growth and describe the societal responses needed to secure business and employment opportunities.

For further details on the methodology, please consult:

OECD (2017), Green Growth Indicators 2017

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OECD Green Growth Indicators

Environmental and resource productivity

CO₂ productivity

Production-based CO₂ productivity, GDP per unit of energy-related CO₂ emissions

Production-based CO₂ intensity, energy-related CO₂ per capita

Production-based CO₂ emissions

Demand-based CO₂ productivity, GDP per unit of energy-related CO₂ emissions

Demand-based CO₂ intensity, energy-related CO₂ emissions per capita

Demand-based CO₂ emissions

Demand-based CO₂ productivity, disposable income per unit of energy-related CO₂ emissions

CO₂ emissions from air transport per unit of GDP

CO₂ emissions from air transport per capita

CO₂ intensity of GDP, CO₂ per unit of GDP

Energy productivity

Energy productivity, GDP per unit of TPES

Energy intensity, TPES per capita

Total primary energy supply

Renewable energy supply, % TPES

Renewable energy supply (excluding solid biofuels), % TPES

Renewable electricity, % total electricity generation

Energy consumption in agriculture, % total energy consumption

Energy consumption in services, % total energy consumption

Energy consumption in transport, % total energy consumption

Energy consumption in industry, % total energy consumption

Energy consumption in other sectors, % total energy consumption

Non-energy material productivity

Non-energy material productivity, GDP per unit of DMC

Biomass, % of DMC

Non-metallic minerals, % of DMC

Metals, % of DMC

Municipal waste generated, kg per capita

Municipal waste recycled or composted, % waste treated

Municipal waste incinerated, % waste treated

Municipal waste disposed to landfills, % waste treated

Nitrogen balance per hectare

Phosphorus balance per hectare

Environmentally adjusted multifactor productivity

Environmentally adjusted multifactor productivity (EAMFP) growth

Contribution of natural capital

Adjustment for pollution abatement

Natural asset base

Land resources

Irrigated land, % agricultural land

Natural and semi-natural vegetated land, % total

Bare land, % total

Cropland, % total

Artificial surfaces, % total

Water, % total
Loss of natural and semi-natural vegetated land, % since reference year ______________ 22
Gain of natural and semi-natural vegetated land, % since reference year ______________ 22
Conversion from natural and semi-natural land to cropland, % since 1992 ______________ 22
Conversion from natural and semi-natural land to artificial surfaces, % since 1992 ______________ 22
Conversion from cropland to artificial surfaces, % since 1992 ______________ 23
Built-up area, % total land ______________ 23
Built-up area per capita ______________ 23
New built-up area, % since reference year ______________ 24
Forest resources
Forest resource stocks ______________ 25
Intensity of use of forest resources ______________ 25
Forest with a long-term management plan, % total forest area ______________ 25
Naturally regenerating forests, % total forest area ______________ 25
Intact forest landscape, km2 ______________ 26
Intact forest landscape loss, % since 2000 ______________ 26
Water resources
Total renewable freshwater per capita ______________ 27
Total freshwater abstraction per capita ______________ 27
Water stress, total freshwater abstraction as % total available renewable resources ______________ 27
Water stress, total freshwater abstraction as % total internal renewable resources ______________ 28
Permanent surface water, % total area ______________ 29
Seasonal surface water, % total area ______________ 29
Conversion of permanent water to not-water surface, % permanent water, since 1984 ______________ 29
Conversion of permanent to seasonal water, % permanent water, since 1984 ______________ 29
Conversion of not-water to permanent water, % permanent water, since 1984 ______________ 30
Conversion of seasonal to permanent water, % permanent water, since 1984 ______________ 30
Wildlife resources
Threatened mammal species, % total known species ______________ 31
Threatened bird species, % total known species ______________ 31
Threatened vascular plant species, % total known species ______________ 31
Farmland Birds Index, 2000=100 ______________ 32
Forest Birds Index, 2000=100 ______________ 32
Sales of pesticides per unit of agricultural land ______________ 32
Atmosphere and climate
Annual surface temperature, change since 1951-1980 ______________ 34
Environmental dimension of quality of life ______________ 35
Exposure to environmental risks
Mean population exposure to PM$_{2.5}$ ______________ 35
Percentage of population exposed to more than 10 µg/m$^3$ ______________ 35
Percentage of population exposed to more than 35 µg/m$^3$ ______________ 35
Mortality from exposure to ambient PM$_{2.5}$ ______________ 35
Welfare cost of premature deaths from exposure to ambient PM$_{2.5}$, GDP equivalent ______________ 36
Mortality from exposure to ambient ozone ______________ 36
Welfare cost of premature deaths from exposure to ambient ozone, GDP equivalent ______________ 36
Mortality from exposure to lead ______________ 37
Welfare cost of premature deaths from exposure to lead, GDP equivalent ______________ 37
Mortality from exposure to residential radon ______________ 38
Welfare cost of premature deaths from exposure to residential radon, GDP equivalent ______________ 38
Access to drinking water and sewage treatment ______________ 40
Population with access to improved drinking water sources, % total population ______________ 40
Population with access to improved sanitation, % total population ______________ 40
Population connected to public sewerage, % total population ______________ 40
Population connected to sewerage with primary treatment, % total population _________ 40
Population connected to sewerage with secondary treatment, % total population ________ 41
Population connected to sewerage with tertiary treatment, % total population __________ 41

**Economic opportunities and policy responses** 42

Technology and innovation: R&D

- Environment-related government R&D budget, % total government R&D __________ 42
- Environment-related R&D expenditure, % GDP ____________________________42
- Renewable energy public RD&D budget, % total energy public RD&D __________43
- Fossil fuel public RD&D budget, % total energy public RD&D _______________43
- Energy RD&D public budget, % GDP ______________________________44

Technology and innovation: Patents

- Development of environment-related technologies, % all technologies __________ 46
- Relative advantage in environment-related technologies ________________________ 46
- Development of environment-related technologies, % inventions worldwide ________ 46
- Development of environment-related technologies, inventions per capita ____________ 47

Environmental goods and services

- National expenditure on environmental protection, % GDP ________________ 48

International financial flows: Official Development Assistance

- Environmentally related ODA, % total ODA ________________ 49
- ODA – all sectors – biodiversity, % total ODA _________________________ 49
- ODA – all sectors – climate change mitigation, % total ODA _______________ 50
- ODA – all sectors – climate change adaptation, % total ODA ________________ 50
- ODA – all sectors – desertification, % total ODA _____________ 50
- ODA – environment sector, % total allocable ODA ________________ 51
- ODA – renewable energy sector, % total allocable ODA ________________ 51
- ODA – water supply and sanitation sector, % total allocable ODA __________ 51
- Net ODA provided, % GNI _________________________ 52

Environmental taxes and transfers

- Environmentally related tax revenue, % GDP ______________________________ 53
- Environmentally related tax revenue, % total tax revenue _____________________ 53
- Energy-related tax revenue, % total environmental tax revenue _____________ 53
- Road transport-related tax revenue, % total environmental tax revenue _______ 53
- Emissions priced above EUR 30 per tonne of CO₂, % total emissions ____________ 54
- Emissions priced above EUR 60 per tonne of CO₂, % total emissions ____________ 54
- Petrol tax, USD per litre ____________________________ 55
- Petrol end-user price, USD per litre ___________________________________ 55
- Diesel tax, USD per litre _____________________________________________ 55
- Diesel end-user price, USD per litre ___________________________________ 55
- Residential electricity price, USD per kWh _______________________________ 55
- Industry electricity price, USD per kWh _________________________________ 55
- Mean feed-in tariffs for solar PV electricity generation, USD per kWh __________ 56
- Mean feed-in tariffs for wind electricity generation, USD per kWh ___________ 56
- Fossil fuel consumer support, % energy-related tax revenue _______________ 56
- Fossil fuel consumer support, % total tax revenue _________________________ 57
- Fossil fuel consumer support, % total fossil fuel support ___________________ 57
- Fossil fuel producer support, % total fossil fuel support ___________________ 58
- Fossil fuel general services support, % total fossil fuel support _____________ 59
- Petroleum support, % total fossil fuel support ___________________________ 59
- Coal support, % total fossil fuel support ________________________________ 60
- Gas support, % total fossil fuel support _________________________________ 61
- Electricity support, % total fossil fuel support ____________________________ 61
- Total fossil fuel support, % total tax revenue _____________________________ 62
Environmental and resource productivity

CO₂ productivity

Production-based CO₂ productivity, GDP per unit of energy-related CO₂ emissions

Production-based CO₂ productivity is calculated as real GDP generated per unit of CO₂ emitted (USD/kg). Included are CO₂ emissions from combustion of coal, oil, natural gas and other fuels.

The estimates of CO₂ emissions are obtained from the IEA’s database of CO₂ emissions from fuel combustion. Default methods and emission factors are given in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

Gross Domestic Product (GDP) is expressed at constant 2015 USD using PPP. For more details on the underlying GDP data, see the metadata for Real GDP.

Production-based CO₂ intensity, energy-related CO₂ per capita

Production-based CO₂ intensity is calculated as CO₂ emissions per capita (tonnes/person). Included are CO₂ emissions from combustion of coal, oil, natural gas and other fuels.

The estimates of CO₂ emissions are obtained from the IEA’s database of CO₂ emissions from fuel combustion. Default methods and emission factors are given in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the World Population Prospects database from the United Nations, complemented with data from the World Development Indicators of the World Bank.

Production-based CO₂ emissions

Production-based CO₂ emissions are expressed in million metric tonnes. Production-based CO₂ emissions are also expressed as an index with values in 2000 normalised to equal 100. Included are CO₂ emissions from combustion of coal, oil, natural gas and other fuels.

The estimates of CO₂ emissions are obtained from the IEA’s database of CO₂ emissions from fuel combustion. Default methods and emission factors are given in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

Demand-based CO₂ productivity, GDP per unit of energy-related CO₂ emissions

Demand-based CO₂ productivity is calculated as GDP generated per unit of CO₂ emitted from final demand (USD/kg).

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1 Published also on OECD.stat > Energy > CO₂ > CO₂ emissions from fuel combustion
2 Published also on OECD.stat > Energy > CO₂ > CO₂ emissions from fuel combustion
3 Published also on OECD.stat > Energy > CO₂ > CO₂ emissions from fuel combustion
Demand-based emissions reflect the CO₂ from energy use emitted during the various stages of production of goods and services consumed in domestic final demand, irrespective of where the stages of production occurred. Trends in emissions on this basis thus complement the more conventional production-based measures.

Gross Domestic Product (GDP) is expressed at constant 2015 USD using PPP. For more details on the underlying GDP data, see the metadata for Real GDP.

The estimates of CO₂ emissions embodied in final domestic demand are obtained from the OECD dataset on Carbon Dioxide Embodied in International Trade (2019 edition), derived from the OECD Input-Output Database. The estimates are calculated for 64 countries (with an input-output table modelled for the “rest of the world”) using IEA data on “CO₂ emissions from fuel combustion” (2018) complemented with data on the use of international bunker fuels and the OECD Inter-Country Input-Output (ICIO) system (Edition 2019). The calculated emission-intensities of production for each industry in each country are then combined with the Leontief inverse of the ICIO system to get emission multipliers for final demand. This can be used to allocate the flows of CO₂ emitted in producing a product; irrespective of how many intermediate processes and countries the product passes through before arriving to its final purchaser. For a more detailed description of the methodology please consult: http://www.oecd.org/sti/ind/carbon dioxide emission embodied in international trade.htm

Demand-based CO₂ intensity, energy-related CO₂ emissions per capita

Demand-based CO₂ intensity is expressed as CO₂ emissions per capita (tonnes/person). Demand-based emissions reflect the CO₂ from energy use emitted during the various stages of production of goods and services consumed in domestic final demand, irrespective of where the stages of production occurred. Trends in emissions on this basis thus complement the more conventional production-based measures.

The estimates of CO₂ emissions embodied in final domestic demand are obtained from the OECD dataset on Carbon Dioxide Embodied in International Trade (2019 edition), derived from the OECD Input-Output Database. The estimates are calculated for 64 countries (with an input-output table modelled for the “rest of the world”) using IEA data on “CO₂ emissions from fuel combustion” (2018) complemented with data on the use of international bunker fuels and the OECD Inter-Country Input-Output (ICIO) system (Edition 2019). The calculated emission-intensities of production for each industry in each country are then combined with the Leontief inverse of the ICIO system to get emission multipliers for final demand. This can be used to allocate the flows of CO₂ emitted in producing a product; irrespective of how many intermediate processes and countries the product passes through before arriving to its final purchaser. For a more detailed description of the methodology please consult: http://www.oecd.org/sti/ind/carbon dioxide emission embodied in international trade.htm

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4 Published also on OECD.stat > Industry and Services > Structural Analysis (STAN) Databases > Input Output Database > Carbon Dioxide Emissions embodied in International Trade
5 Note that the demand-based CO₂ emission estimates are therefore not directly comparable to the production-based CO₂ estimates (which exclude bunker fuels).
6 Published also on OECD.stat > Industry and Services > Structural Analysis (STAN) Databases > Input Output Database > Carbon Dioxide Emissions embodied in International Trade
7 Note that the demand-based CO₂ emission estimates are therefore not directly comparable to the production-based CO₂ estimates (which exclude bunker fuels).
arriving to its final purchaser. For a more detailed description of the methodology please consult: http://www.oecd.org/sti/ind/carbondioxideemissionsembodiedininternationaltrade.htm

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the World Population Prospects database from the United Nations, complemented with data from the World Development Indicators of the World Bank.

Demand-based CO2 emissions

Demand-based CO2 emissions are expressed in million metric tonnes. Demand-based emissions reflect the CO2 from energy use emitted during the various stages of production of goods and services consumed in domestic final demand, irrespective of where the stages of production occurred. Trends in emissions on this basis thus complement the more conventional production-based measures.

The estimates of CO2 emissions embodied in final domestic demand are obtained from the OECD dataset on Carbon Dioxide Embodied in International Trade (2019 edition), derived from the OECD Input-Output Database. The estimates are calculated for 64 countries (with an input-output table modelled for the “rest of the world”) using IEA data on “CO2 emissions from fuel combustion” (2018) complemented with data on the use of international bunker fuels and the OECD Inter-Country Input-Output (ICIO) system (Edition 2019). The calculated emission-intensities of production for each industry in each country are then combined with the Leontief inverse of the ICIO system to get emission multipliers for final demand. This can be used to allocate the flows of CO2 emitted in producing a product; irrespective of how many intermediate processes and countries the product passes through before arriving to its final purchaser. For a more detailed description of the methodology please consult: http://www.oecd.org/sti/ind/carbondioxideemissionsembodiedininternationaltrade.htm

Demand-based CO2 productivity, disposable income per unit of energy-related CO2 emissions

Demand-based CO2 productivity is calculated as the Net National Disposable Income available per unit of CO2 emitted from final demand (USD/kg).

Demand-based emissions reflect the CO2 from energy use emitted during the various stages of production of goods and services consumed in domestic final demand, irrespective of where the stages of production occurred. Trends in emissions on this basis thus complement the more conventional production-based measures.

Net National Disposable Income (NNDI) is expressed in real terms at constant 2015 USD using PPP, and is obtained from the Disposable income and net lending/borrowing dataset of Aggregate National Accounts of the OECD.

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8 Published also on OECD.stat > Industry and Services > Structural Analysis (STAN) Databases > Input Output Database > Carbon Dioxide Emissions embodied in International Trade.

9 Note that the demand-based CO2 emission estimates are therefore not directly comparable to the production-based CO2 estimates (which exclude bunker fuels).
National Accounts Statistics Database. National disposable income includes the national income plus international transfers concerning taxes, social contributions and benefits from and to the rest of the world. National income includes international transfers associated with the compensation of employees, taxes on production and imports, subsidies on products and production, and property income. National disposable income is presented in net terms (i.e. net of depreciation).

The estimates of CO₂ emissions embodied in final domestic demand are obtained from the OECD dataset on Carbon Dioxide Embodied in International Trade (2019 edition), derived from the OECD Input-Output Database. The estimates are calculated for 64 countries (with an input-output table modelled for the “rest of the world”) using IEA data on “CO₂ emissions from fuel combustion” (2018) complemented with data on the use of international bunker fuels and the OECD Inter-Country Input-Output (ICIO) system (Edition 2019). The calculated emission-intensities of production for each industry in each country are then combined with the Leontief inverse of the ICIO system to get emission multipliers for final demand. This can be used to allocate the flows of CO₂ emitted in producing a product; irrespective of how many intermediate processes and countries the product passes through before arriving to its final purchaser. For a more detailed description of the methodology please consult: [http://www.oecd.org/sti/ind/carbondioxideemissionsembodiedininternationaltrade.htm](http://www.oecd.org/sti/ind/carbondioxideemissionsembodiedininternationaltrade.htm)

CO₂ emissions from air transport per unit of GDP

Air transport CO₂ intensity of GDP is calculated as CO₂ emitted per unit of real GDP generated (kg/USD). Included are CO₂ emissions from all commercial passenger and freight flight schedules around the world.

Emissions are attributed to a country on a residence basis (i.e. the approach used to measure GDP) using the national aviation authority granting the official air operator’s certificate. The level of emissions is estimated using aircraft characteristics and distance to travel. For a more detailed description of the methodology please consult the metadata of the source dataset.

CO₂ emissions are obtained from the OECD Air Transport CO₂ emissions from fuel combustion database. Gross Domestic Product (GDP) is expressed at constant 2015 USD using PPP. For more details on the underlying GDP data, see the metadata for Real GDP.

CO₂ emissions from air transport per capita

This indicator is calculated as CO₂ emissions per capita (tonnes/person). Included are CO₂ emissions from all commercial passenger and freight flight schedules around the world.

10 Published also on OECD.stat > National Accounts > Annual national accounts > Disposable income and net lending – net borrowing
11 Published also on OECD.stat > Industry and Services > Structural Analysis (STAN) Databases > Input Output Database > Carbon Dioxide Emissions embodied in International Trade
12 Note that the demand-based CO₂ emission estimates are therefore not directly comparable to the production-based CO₂ estimates (which exclude bunker fuels).
13 Published also on OECD.stat > Environment > Air and Climate > Air Transport CO₂ Emissions
Emissions are attributed to a country on a residence basis (i.e. the approach used to measure GDP) using the national aviation authority granting the official air operator’s certificate. The level of emissions is estimated using aircraft characteristics and distance to travel. For a more detailed description of the methodology please consult the metadata of the source dataset.

The estimates of CO₂ emissions are obtained from the OECD Air Transport CO₂ emissions from fuel combustion database. Population is the de facto population in a country, area or region as of 1st July of the year indicated. The main source of population data is the World Population Prospects database from the United Nations, complemented with data from the World Development Indicators of the World Bank.

**CO₂ intensity of GDP, CO₂ per unit of GDP**

CO₂ intensity of GDP is calculated as kilograms of production-based CO₂ emissions per real GDP (kg/USD). Included are CO₂ emissions from combustion of coal, oil, natural gas and other fuels.

The estimates of CO₂ emissions are obtained from the IEA’s database of CO₂ emissions from fuel combustion. Default methods and emission factors are given in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

Gross Domestic Product (GDP) is expressed at constant 2015 USD using PPP. For more details on the underlying GDP data, see the metadata for Real GDP.

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14 Published also on OECD.stat > Environment > Air and Climate > Air Transport CO₂ Emissions
15 Published also on OECD.stat > Energy > CO₂ > CO₂ emissions from fuel combustion
Energy productivity

Energy productivity, GDP per unit of TPES

Energy productivity is calculated as GDP per unit of TPES (USD/toe). It reflects, at least partly, efforts to improve energy efficiency and to reduce carbon and other atmospheric emissions. Together with energy intensity, these indicators also reflect structural and climatic factors.

TPES comprises production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes.

Gross Domestic Product (GDP) is expressed at constant 2015 USD using PPP. For more details on the underlying GDP data, see the metadata for Real GDP.

Data on Total Primary Energy Supply (TPES) are obtained from the World Energy Statistics Dataset in the IEA World Energy Statistics and Balances Database.16

Energy intensity, TPES per capita

Energy intensity is calculated as TPES per capita (toe/person). It reflects, at least partly, efforts to improve energy efficiency and to reduce carbon and other atmospheric emissions. Together with Energy productivity, these indicators also reflect structural and climatic factors.

TPES comprises production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes.

Data on Total Primary Energy Supply (TPES) are obtained from the World Energy Statistics Dataset in the IEA World Energy Statistics and Balances Database.17

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the World Population Prospects database from the United Nations, complemented with data from the World Development Indicators of the World Bank.

Total primary energy supply

Total primary energy supply (TPES) is expressed in million tonnes of oil equivalent. TPES is also expressed as an index with values in 2000 normalised to equal 100. TPES comprises production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes.

Data on Total Primary Energy Supply (TPES) are obtained from the World Energy Statistics Dataset in the IEA World Energy Statistics and Balances Database.18
Renewable energy supply, % TPES

*Renewable energy supply* is calculated as a share of renewable sources in TPES (expressed as percentage).

Renewables include hydro, geothermal, solar (thermal and PV), wind and tide/wave/ocean energy, as well as combustible renewables (solid biomass, liquid biomass, biogas) and waste (renewable municipal waste).

TPES comprises production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes.

The underlying data on “renewables and waste energy supply (ktoe)” are obtained from the *World - Renewable and Waste Energy Statistics dataset* of the *IEA Renewables Information Statistics Database*.\(^{19}\) Data on Total Primary Energy Supply (TPES) are obtained from the IEA database on *World Energy Statistics and Balances*.\(^{20}\)

Renewable energy supply (excluding solid biofuels), % TPES

*Renewable energy supply* is calculated as a share of renewable sources excluding solid biofuels in TPES (expressed as percentage).

Renewables include hydro, geothermal, solar (thermal and PV), wind and tide/wave/ocean energy, as well as combustible renewables (liquid biomass, biogas) and waste (renewable municipal waste). The indicator excludes solid biomass (primary solid biofuels and charcoal) to avoid distortions due to the traditional use of biomass for cooking, and due to the potential environmental risks associated to its unsustainable sourcing.

TPES comprises production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes.

The underlying data on “renewables and waste energy supply (ktoe)” are obtained from the *World - Renewable and Waste Energy Statistics dataset* of the *IEA Renewables Information Statistics Database*.\(^{21}\) Data on Total Primary Energy Supply (TPES) are obtained from the IEA database on *World Energy Statistics and Balances*.\(^{22}\)

Renewable electricity, % total electricity generation

*Renewable electricity* is calculated as a share of renewables in electricity production (%).

Renewables include hydro, geothermal, solar (thermal and PV), wind and tide/wave/ocean energy, as well as combustible renewables (solid biomass, liquid biomass, biogas) and waste (renewable municipal waste).

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\(^{19}\) Published also on *OECD.stat > Energy > Renewables Information*

\(^{20}\) Published also on *OECD.stat > Energy > World Energy Balances*

\(^{21}\) Published also on *OECD.stat > Energy > Renewables Information*

\(^{22}\) Published also on *OECD.stat > Energy > World Energy Balances*
The underlying data on renewable electricity and total electricity generation are obtained from the *World - Renewable and Waste Energy Statistics Dataset* in the *IEA Renewables Information Statistics Database*.23

**Energy consumption in agriculture, % total energy consumption**

Energy consumption in agriculture is expressed as a share of total energy consumption (%). Final consumption reflects for the most part deliveries to consumers. It excludes energy used for transformation processes and for own use of the energy-producing industries.

Energy consumption in agriculture includes deliveries to users classified as agriculture, hunting and forestry by the International Standard Industrial Classification (ISIC). Therefore, it includes energy consumed by such users whether for traction (excluding agricultural highway use), power or heating (agricultural and domestic) [ISIC Rev.4 Divisions 01 and 02].

The underlying data on energy consumption are obtained the *World Energy Statistics Dataset* in the *IEA World Energy Statistics and Balances Database*.24

**Energy consumption in services, % total energy consumption**

Energy consumption in services is expressed as a share of total energy consumption (%). Final consumption reflects for the most part deliveries to consumers. It excludes energy used for transformation processes and for own use of the energy-producing industries.

Energy consumption in services includes both commercial and public services [ISIC Rev.4 Divisions 33, 36-39, 45-47, 52, 53, 55-56, 58-66, 68-75, 77-82, 84 (excluding Class 8422), 85-88, 90-96 and 99].

The underlying data on energy consumption are obtained the *World Energy Statistics Dataset* in the *IEA World Energy Statistics and Balances Database*.25

**Energy consumption in transport, % total energy consumption**

Energy consumption in transport is expressed as a share of total energy consumption (%). Final consumption reflects for the most part deliveries to consumers. It excludes energy used for transformation processes and for own use of the energy-producing industries.

Energy consumption in transport covers all transport activity (in mobile engines) regardless of the economic sector to which it is contributing [ISIC Rev.4 Divisions 49 to 51].

The underlying data on energy consumption are obtained the *World Energy Statistics Dataset* in the *IEA World Energy Statistics and Balances Database*.26

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23 Published also on [OECD.stat > Energy > Renewables Information](https://www.oecd.org/energy/)

24 Published also on [OECD.stat > Energy > World Energy Balances](https://www.oecd.org/energy/)

25 Published also on [OECD.stat > Energy > World Energy Balances](https://www.oecd.org/energy/)

26 Published also on [OECD.stat > Energy > World Energy Balances](https://www.oecd.org/energy/)
Energy consumption in industry, % total energy consumption

Energy consumption in industry is expressed as a share of total energy consumption (%). Final consumption reflects for the most part deliveries to consumers. It excludes energy used for transformation processes and for own use of the energy-producing industries.

Energy consumption in industry includes the following sub-sectors: iron and steel, chemical and petrochemical, non-ferrous metals, non-metallic minerals, transport equipment, machinery, mining and quarrying, food and tobacco, paper, pulp and print, wood and wood products, construction, textile and leather together with any manufacturing industry not included above.

The underlying data on energy consumption are obtained the World Energy Statistics Dataset in the IEA World Energy Statistics and Balances Database. ²⁷

Energy consumption in other sectors, % total energy consumption

Energy consumption in other sectors is expressed as a share of total energy consumption (%). Final consumption reflects for the most part deliveries to consumers. It excludes energy used for transformation processes and for own use of the energy-producing industries.

Energy consumption in other sectors includes residential consumption and all fuel use not elsewhere specified.

The underlying data on energy consumption are obtained the World Energy Statistics Dataset in the IEA World Energy Statistics and Balances Database. ²⁸

²⁷ Published also on OECD.stat > Energy > World Energy Balances
²⁸ Published also on OECD.stat > Energy > World Energy Balances
Non-energy material productivity

Non-energy material productivity, GDP per unit of DMC

*Non-energy material productivity* is calculated as GDP generated per unit of materials consumed (USD/kg).

Domestic Material Consumption (DMC) refers to the apparent consumption of materials; it is calculated as the sum of domestic consumption of biomass for food and feed, construction minerals, industrial minerals, metals and wood. Data on DMC are obtained from the Material Resources dataset included in the [OECD Environment Database](https://www.oecd.org).  

Gross Domestic Product (GDP) is expressed at constant 2015 USD using PPP. For more details on the underlying GDP data, see the metadata for [Real GDP](https://www.oecd.org).

Biomass, % of DMC

Consumption of Biomass is expressed as a percentage of Domestic Material Consumption (DMC). Biomass materials include biomass for food and wood. Food materials include crops (e.g. cereals, roots, sugar and oil bearing crops, fruits, vegetables), fodder crops (including grazing), wild animals (essentially marine catches), small amounts of non-edible biomass (e.g. fibres, rubber), and related products including livestock. Wood includes harvested wood and traded products made of wood (e.g. paper, furniture, etc.)

Total domestic material consumption refers to the apparent consumption of materials; it is calculated as the sum of domestic consumption of biomass for food and feed, construction minerals, industrial minerals, metals and wood. Data on DMC are obtained from the Material Resources dataset included in the [OECD Environment Database](https://www.oecd.org).

Non-metallic minerals, % of DMC

Consumption of non-metallic materials is expressed as a percentage of Domestic Material Consumption (DMC). Non-metallic minerals include construction and industrial minerals. Construction minerals include primary (e.g. sand, gravel, stones, limestone, excavated soil if used) or processed (e.g. glass, cement, concrete) minerals. Industrial minerals include primary or processed non-metallic minerals (e.g. salts, arsenic, potash, phosphate rocks, sulphates and asbestos).

Total domestic material consumption refers to the apparent consumption of materials; it is calculated as the sum of domestic consumption of biomass for food and feed, construction minerals, industrial minerals, metals and wood. Data on DMC are obtained from the Material Resources dataset included in the [OECD Environment Database](https://www.oecd.org).

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29 Published also on [OECD.stat > Environment > Material Resources](https://www.oecd.org)
30 Published also on [OECD.stat > Environment > Material Resources](https://www.oecd.org)
31 Published also on [OECD.stat > Environment > Material Resources](https://www.oecd.org)
Metals, % of DMC

Consumption of metals is expressed as a percentage of Domestic Material Consumption (DMC). Metals include metal ores, metals and products made of metals.

Total domestic material consumption refers to the apparent consumption of materials; it is calculated as the sum of domestic consumption of biomass for food and feed, construction minerals, industrial minerals, metals and wood. Data on DMC are obtained from the Material Resources dataset included in the OECD Environment Database.

Municipal waste generated, kg per capita

Municipal waste generated is expressed in kg per person. Municipal waste is waste collected by or on behalf of municipalities. It includes household waste originating from households (i.e. waste generated by the domestic activity of households) and similar waste from small commercial activities, office buildings, institutions such as schools and government buildings, and small businesses that treat or dispose of waste at the same facilities used for municipally collected waste.

Municipal waste data are obtained from the Municipal waste – Generation and Treatment dataset of OECD Environment Database.

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the World Population Prospects database from the United Nations, complemented with data from the World Development Indicators of the World Bank.

Municipal waste recycled or composted, % waste treated

Municipal waste recycled or composted is expressed as a percentage of all waste treated. Recycling is defined as any reprocessing of material in a production process that diverts it from the waste stream, except reuse as fuel. Both reprocessing as the same type of product, and for different purposes are included. Direct recycling within industrial plants at the place of generation is excluded. Composting is defined as a biological process that submits biodegradable waste to anaerobic or aerobic decomposition, and that results in a product that is recovered. Waste treated includes recycling, composting, incineration and landfill disposal.

Waste treatment data are obtained from the Municipal waste – Generation and Treatment dataset of OECD Environment Database.

32 Published also on OECD.stat > Environment > Material Resources
33 Published also on OECD.stat > Environment > Waste > Municipal waste – Generation and Treatment
34 Published also on OECD.stat > Environment > Waste > Municipal waste – Generation and Treatment
Municipal waste incinerated, % waste treated

Municipal waste incinerated is expressed as a percentage of all waste treated. Incineration with and without energy recovery is included. Waste treated includes recycling, composting, incineration and landfill disposal.

Waste treatment data are obtained from the Municipal waste – Generation and Treatment dataset of OECD Environment Database. 35

Municipal waste disposed to landfills, % waste treated

Municipal waste disposed to landfills is expressed as a percentage of all waste treated. Landfill is defined as a deposit of waste into or onto land, including specially engineered landfill, and temporary storage of over one year on permanent sites. The definition covers both landfill in internal sites (i.e. where a generator of waste is carrying out its own waste disposal at the place of generation) and in external sites. Waste treated includes recycling, composting, incineration and landfill disposal.

Waste treatment data are obtained from the Municipal waste – Generation and Treatment dataset of OECD Environment Database. 36

Nitrogen balance per hectare

Nitrogen balance is calculated as the difference between the total quantity of nitrogen inputs entering an agricultural system (mainly fertilisers, livestock manure), and the quantity of nitrogen outputs leaving the system (mainly uptake of nutrients by crops and grassland). Gross nitrogen balances are expressed in kg of nutrient surplus (when positive) or deficit (when negative) per hectare of agricultural land. This calculation can be used as a proxy to reveal the status of environmental pressures, such as declining soil fertility in the case of a nutrient deficit, or the risk of polluting soil, water and air in the case of a nutrient surplus.

Nutrient balances are obtained from the Agri-Environmental indicators: Nutrients balance dataset of OECD Agriculture and Fisheries Database. 37

Phosphorus balance per hectare

Phosphorus balance is calculated as the difference between the total quantity of phosphorus inputs entering an agricultural system (mainly fertilisers, livestock manure), and the quantity of phosphorus outputs leaving the system (mainly uptake of nutrients by crops and grassland). Gross phosphorus balances are expressed in kg of nutrient surplus (when positive) or deficit (when negative) per hectare of agricultural land. This calculation can be used as a proxy to reveal the status of environmental pressures, such as declining...
soil fertility in the case of a nutrient deficit, or the risk of polluting soil, water and air in the case of a nutrient surplus.

Nutrient balances are obtained from the Agri-Environmental indicators: Nutrients balance dataset of the OECD Agriculture and Fisheries Database. ³⁸

³⁸ Published also on OECD.stat > Agriculture and Fisheries > Environmental indicators for agriculture > Agri-environmental indicators: Nutrients balance.
Environmentally adjusted multifactor productivity

Environmentally adjusted multifactor productivity (EAMFP) growth

EAMFP growth measures the change in productivity at the macroeconomic (country) level encompassing e.g. technological change, institutional and organisational improvements. EAMFP growth is presented in percentage points of output growth. It is calculated using a growth accounting approach as the residual growth in the joint production of both the desirable and the undesirable outputs that cannot be explained by changes in the consumption of factor inputs (including labour, produced capital and natural capital). Therefore, for a given growth of input use, EAMFP increases when GDP increases or when pollution decreases.

EAMFP data are obtained from the Environmentally adjusted multifactor productivity dataset of OECD Environment Database. For further details on the methodology please consult: Environmentally adjusted multifactor productivity: methodology and results for OECD and G20 and oe.cd/eamfp

Contribution of natural capital

The contribution of natural capital to output growth is presented in percentage points. It measures to what extent a country's growth in output is attributable to natural resource use.

Data are obtained from the Environmentally adjusted multifactor productivity dataset of OECD Environment Database. For further details on the methodology please consult: Environmentally adjusted multifactor productivity: methodology and results for OECD and G20 and oe.cd/eamfp

Adjustment for pollution abatement

The adjustment of output growth for pollution abatement is presented in percentage points. It measures to what extent a country's GDP growth should be scaled up or down reflecting its pollution abatement efforts, adding what has been undervalued due to resources being diverted to pollution abatement, or deducing the ‘excess’ growth which is generated at the expense of environmental quality.

Data are obtained from the Environmentally adjusted multifactor productivity dataset of OECD Environment Database. For further details on the methodology please consult: Environmentally adjusted multifactor productivity: methodology and results for OECD and G20 and oe.cd/eamfp

39 Published also on OECD.stat > Environment > Environmentally adjusted multifactor productivity
40 Published also on OECD.stat > Environment > Environmentally adjusted multifactor productivity
41 Published also on OECD.stat > Environment > Environmentally adjusted multifactor productivity
Natural asset base

Land resources

Irrigated land, % agricultural land

*Irrigated land is expressed as a share of total agricultural land* (%)… Irrigation management plays an important role in achieving water resource sustainability. Higher shares of irrigated agricultural land can contribute to national water stress. For a detailed discussion of the trends of agricultural water abstraction and changes in irrigated areas, please consult: *OECD (2019), Trends and Drivers of Agri-environmental Performance in OECD Countries, OECD Publishing, Paris.*

Data are obtained from the dataset on *Environmental performances of agriculture - indicators* from the *OECD Agriculture and Fisheries Database.*

Natural and semi-natural vegetated land, % total

*Natural and semi-natural vegetated land* is expressed as a percentage of total area (natural and semi-natural vegetated land + bare land + cropland + artificial surfaces + inland water).

Natural and semi-natural vegetated land comprises tree-covered areas, grassland, wetland shrubland and sparse vegetation. It designates land covered by natural or semi-natural vegetation, with limited anthropogenic footprint, as a proxy for land important for maintaining biodiversity and provides higher-value ecosystem services at the global scale. This definition includes “semi-natural” vegetation due to the difficulty of reliably identifying the degree of ‘naturalness’ of some land cover types. The ecological value of these lands may vary with their use (e.g. natural forests vs planted forests; grasslands as wild meadows versus those used as pasture) however this use is difficult to discern from the methodology adopted for the computation of this indicator.

Land cover data are obtained from the *Land cover in countries and regions dataset* of *OECD Environment Database.* For further details on the methodology please consult *Land cover change and conversions: methodology and results for OECD and G20.*

Bare land, % total

*Bare land* is expressed as a percentage of total area (natural and semi-natural vegetated land + bare land + cropland + artificial surfaces + inland water).

Bare areas comprise deserts, permanent snow and ice.

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*Published also on* *OECD.stat > Agriculture and Fisheries > Environmental indicators for agriculture > Agri-environmental other indicators*

*Published also on* *OECD.stat > Environment > Land resources > Land cover > Land cover in countries and regions*
Land cover data are obtained from the *Land cover in countries and regions dataset* of *OECD Environment Database*. For further details on the methodology, please consult *Land cover change and conversions: methodology and results for OECD and G20*.

**Cropland, % total**

*Cropland* is expressed as a percentage of total area (natural and semi-natural vegetated land + bare land + cropland + artificial surfaces + inland water).

Cropland comprises rainfed, irrigated and mosaic cropland.

Land cover data are obtained from the *Land cover in countries and regions dataset* of *OECD Environment Database*. For further details on the methodology, please consult *Land cover change and conversions: methodology and results for OECD and G20*.

**Artificial surfaces, % total**

*Artificial surfaces* are expressed as a percentage of total area (natural and semi-natural vegetated land + bare land + cropland + artificial surfaces + inland water).

Land cover data are obtained from the *Land cover in countries and regions dataset* of *OECD Environment Database*. For further details on the methodology, please consult *Land cover change and conversions: methodology and results for OECD and G20*.

For users interested specifically in urbanisation, there are indicators based on higher-resolution datasets of built-up area that are likely to be more suitable for focused applications. See variables on built-up area at the end of this section.

**Water, % total**

*Water* is expressed as a percentage of total area (natural and semi-natural vegetated land + bare land + cropland + artificial surfaces + inland water).

Land cover data are obtained from the *Land cover in countries and regions dataset* of *OECD Environment Database*. For further details on the methodology, please consult *Land cover change and conversions: methodology and results for OECD and G20*.

For users interested specifically in surface water changes, there are indicators based on higher-resolution datasets of surface water that are likely to be more suitable for focused applications. See variables on water surface at the end of the section on water resources.

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44 Published also on [OECD.stat > Environment > Land resources > Land cover > Land cover in countries and regions](https://stats.oecd.org)
45 Published also on [OECD.stat > Environment > Land resources > Land cover > Land cover in countries and regions](https://stats.oecd.org)
46 Published also on [OECD.stat > Environment > Land resources > Land cover > Land cover in countries and regions](https://stats.oecd.org)
47 Published also on [OECD.stat > Environment > Land resources > Land cover > Land cover in countries and regions](https://stats.oecd.org)
Loss of natural and semi-natural vegetated land, % since reference year

Loss of natural and semi-natural vegetated land is presented as a proxy for pressures on biodiversity and ecosystems. The indicator is defined as the percentage of tree cover, grassland, wetland, shrubland and sparse vegetation converted to any other land cover type. The denominator used is the ‘stock’ of natural and semi-natural land at the start of the period. The indicator is presented for the starting reference years of 1992 and 2004.

Land cover change data are obtained from the Land cover change in countries and regions dataset of OECD Environment Database. For further details on the methodology, please consult Land cover change and conversions: methodology and results for OECD and G20.

Gain of natural and semi-natural vegetated land, % since reference year

Gain of natural and semi-natural vegetated land are conversions from bare land, cropland, artificial surfaces and water into natural and semi-natural land. The denominator used is the ‘stock’ of natural and semi-natural land at the start of the period. The indicator is presented for the starting reference years of 1992 and 2004.

Land cover change data are obtained from the Land cover change in countries and regions dataset of OECD Environment Database. For further details on the methodology, please consult Land cover change and conversions: methodology and results for OECD and G20.

Conversion from natural and semi-natural land to cropland, % since 1992

Conversion of natural and semi-natural vegetated land to cropland is defined as the percentage of tree cover, grassland, wetland, shrubland and sparse vegetation converted to cropland. The denominator used is the ‘stock’ of natural and semi-natural land in 1992.

Land cover change data are obtained from the Land cover change in countries and regions dataset of OECD Environment Database. For further details on the methodology, please consult Land cover change and conversions: methodology and results for OECD and G20.

Conversion from natural and semi-natural land to artificial surfaces, % since 1992

Conversion of natural and semi-natural vegetated land to artificial surfaces is defined as the percentage of tree cover, grassland, wetland, shrubland and sparse vegetation converted to artificial surfaces. The denominator used is the ‘stock’ of natural and semi-natural land in 1992.

Land cover change data are obtained from the Land cover change in countries and regions dataset of OECD Environment Database. For further details on
Conversion from cropland to artificial surfaces, % since 1992

Conversion of cropland to artificial surfaces is defined as the percentage of cropland converted to artificial surfaces. The denominator used is the 'stock' of cropland in 1992.

Land cover change data are obtained from the Land cover change in countries and regions dataset of OECD Environment Database. For further details on the methodology, please consult Land cover change and conversions: methodology and results for OECD and G20.

Built-up area, % total land

Built-up area is expressed as a percentage of total land area.

Built-up is defined as the presence of buildings (roofed structures). This definition excludes other parts of urban environments and the human footprint such as paved surfaces (roads, parking lots), commercial and industrial sites (ports, landfills, quarries, runways) and urban green spaces (parks, gardens). Consequently, such built-up area may be quite different from other urban area data that use alternative definitions. Total land area is the area of the country excluding inland water.

Built-up area data are obtained from the Built-up area and built-up area change in countries and regions of the OECD Environment Database. For further details on the methodology please consult Land cover change and conversions: methodology and results for OECD and G20.

Built-up area per capita

Built-up area per capita is the number of square meters of built-up area per inhabitant (m²/person).

Built-up is defined as the presence of buildings (roofed structures). This definition excludes other parts of urban environments and the human footprint such as paved surfaces (roads, parking lots), commercial and industrial sites (ports, landfills, quarries, runways) and urban green spaces (parks, gardens). Consequently, such built-up area may be quite different from other urban area data that use alternative definitions.

Built-up area data are obtained from the Built-up area and built-up area change in countries and regions of the OECD Environment Database. For further details on the methodology please consult Land cover change and conversions: methodology and results for OECD and G20.

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52 Published also on OECD.stat > Environment > Land resources > Land cover > Land cover change in countries and regions
53 Published also on OECD.stat > Environment > Land resources > Land cover > Built-up area and built-up area change in countries and regions
54 Published also on OECD.stat > Environment > Land resources > Land cover > Built-up area and built-up area change in countries and regions
Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the World Population Prospects database from the United Nations, complemented with data from the World Development Indicators of the World Bank.

New built-up area, % since reference year

*New built-up area* are the conversions from non-built-up to built-up area, expressed percentage increase. The denominator used is the built-up area at the start of the period. The indicator is presented for the starting reference years of 1990 and 2000.

Built-up is defined as the presence of buildings (roofed structures). This definition largely excludes other parts of urban environments and the human footprint such as paved surfaces (roads, parking lots), commercial and industrial sites (ports, landfills, quarries, runways) and urban green spaces (parks, gardens). Consequently, such built-up area may be quite different from other urban area data that use alternative definitions.

Built-up area data are obtained from the Built-up area and built-up area change in countries and regions of the OECD Environment Database. For further details on the methodology please consult [Land cover change and conversions: methodology and results for OECD and G20](#).

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55 Published also on OECD.stat > Environment > Land resources > Land cover > Built-up area and built-up area change in countries and regions
Forest resources

Forest resource stocks

*Forest resource stocks* are expressed in million m³. Stocks are measured as the growing stock of standing trees. It is defined as the volume over bark of all living trees with a minimum diameter of 10 cm at breast height and including the stem from ground level up to a top diameter of 0 cm (excluding branches).

Data are obtained from the *Global Forest Resource Assessment 2020* of the *Food and Agricultural Organisation*.56

Intensity of use of forest resources

*Intensity of use of forest resources* is measured as the ratio of actual fellings over annual productive capacity (i.e. gross increment).

Comparing resource abstraction to renewal of stocks is a central question concerning sustainable forest resource management. This indicator gives insights into the quantitative aspects of forest resources; however, no account is taken of the quality of the resource, moreover, national averages can conceal important variations among forests.

Data are obtained from the *Forest resources dataset* of the *OECD Environment statistics database*.57

Forest with a long-term management plan, % total forest area

The share of forest area with a long-term management plan is expressed as percentage of total forest area. This indicator includes management plans of 20-40 years (or more), which are documented and revised every 5-10 years. Long-term management plans are an indicator of the intention to sustainably manage forest resources.

Data are obtained from the *Global Forest Resource Assessment 2020* of the *Food and Agricultural Organisation*.58

Naturally regenerating forests, % total forest area

The share of naturally regenerating forest is expressed as percentage of total forest area. This indicator includes forest areas where human activities have been of such low impact that the ecological processes have not been visibly disturbed. This includes activities where the structure and species composition are different from the original intact forest (i.e. primary forest), but all major goods and services are maintained. Total forest area is the sum of naturally regenerating forests and planted forests.

Data are obtained from the *Global Forest Resource Assessment 2020* of the *Food and Agricultural Organisation*.59

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57 Published also on *OECD.stat > Environment > Forest*
Intact forest landscape, km²

*Intact forest landscape extent* is measured in squared kilometres. Intact forest landscape is defined as the forest areas that are larger than 500km², wider than 10km, free of settlements or infrastructure and unaffected by industrial activity, agricultural clearing or other anthropogenic disturbance in the last 70 years. Treeless areas within forests such as lakes, ice or patches of grassland are included.

Data are obtained from the *Intact Forest Landscapes dataset* of the [OECD Environment statistics database](https://oecd.org). For further details on the methodology, consult the metadata of the source dataset.

Intact forest landscape loss, % since 2000

*Intact forest landscape loss* is expressed as the percentage of intact forest in 2000 that no longer meets the conditions of an intact forest landscape. Intact forest landscape is defined as the forest areas that are larger than 500km², wider than 10km, free of settlements or infrastructure and unaffected by industrial activity, agricultural clearing or other anthropogenic disturbance in the last 70 years. Treeless areas within forests such as lakes, ice or patches of grassland are included.

Data are obtained from the *Intact Forest Landscapes dataset* of the [OECD Environment statistics database](https://oecd.org). For further details on the methodology, consult the metadata of the source dataset.

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60 Published also on [OECD.stat > Environment > Land resources > Land cover > Intact forest landscapes](https://oecd.stat)

61 Published also on [OECD.stat > Environment > Land resources > Land cover > Intact forest landscapes](https://oecd.stat)
**Water resources**

Total renewable freshwater per capita

*Total renewable freshwater per capita* refers to the available stocks per capita (m³/person). Total available renewable freshwater resources comprise total internal flows and actual external inflows. Internal flow is the total volume of river run-off and groundwater generated, in natural conditions, exclusively by precipitation into a territory. The internal flow is equal to precipitation less actual evapotranspiration and can be calculated or measured. If the river run-off and groundwater generation are measured separately, transfers between surface and groundwater should be netted out to avoid double counting. Actual external inflow is the total volume of actual flow of rivers and groundwater, coming from neighbouring territories. Whereas this indicator shows data for year 2015, the data refer to the long-term average availability for every country.

Data on freshwater resources are obtained from the *Freshwater resources Dataset* of the *OECD Environment Database*.  

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the *World Population Prospects database* from the *United Nations*, complemented with data from the World Development Indicators of the World Bank.

Total freshwater abstraction per capita

*Total freshwater abstraction per capita* is calculated as gross freshwater abstraction per capita (m³/person). Freshwater abstraction – particularly for public water supply, irrigation, industrial processes, and for cooling in electric power plants – exerts enormous pressure on the quantity and quality of freshwater resources.

Data on freshwater abstraction are obtained from the *Freshwater Abstractions Dataset* of the *OECD Environment Database*. Note that data for the United Kingdom include freshwater abstractions only in England and Wales.

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the *World Population Prospects database* from the *United Nations*, complemented with data from the World Development Indicators of the World Bank.

Water stress, total freshwater abstraction as % total available renewable resources

*Water stress from available resources* measures the total gross abstractions of freshwater expressed as a percentage of total available renewable freshwater resources (including inflows from neighbouring countries).

Water stress can be categorised as:

- low (less than 10%): generally no major stress on the available resources
- moderate (10-20%): water availability is becoming a constraint on development and significant investment is needed to provide adequate supplies

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62 Published also on *OECD.stat > Environment > Water*
63 Published also on *OECD.stat > Environment > Water*
• medium-high (20-40%): implies management of both supply and demand, and a need for conflict resolution among competing uses of water.
• high (more than 40%): indicates serious scarcity and usually shows unsustainable water use, which can become a limiting factor in social and economic development.

Data on freshwater abstractions are obtained from the Freshwater Abstractions Dataset from the OECD Environment Database.\textsuperscript{64} Note that data for the United Kingdom include freshwater abstractions only in England and Wales.

Water stress, total freshwater abstraction as % total internal renewable resources

*Water stress from internal resources* measures the total gross abstractions of freshwater expressed as a percentage of total internal renewable freshwater resources (precipitation net of evapotranspiration).

Water stress can be categorised as:

• low (less than 10%): generally no major stress on the available resources
• moderate (10-20%): water availability is becoming a constraint on development and significant investment is needed to provide adequate supplies
• medium-high (20-40%): implies management of both supply and demand, and a need for conflict resolution among competing uses of water.
• high (more than 40%): indicates serious scarcity and usually shows unsustainable water use, which can become a limiting factor in social and economic development.

Data on freshwater abstractions are obtained from the Freshwater Abstractions Dataset from the OECD Environment Database.\textsuperscript{65} Note that data for the United Kingdom include freshwater abstractions only in England and Wales.

\textsuperscript{64} Published also on [OECD.stat > Environment > Water](http://www.oecd.org)
\textsuperscript{65} Published also on [OECD.stat > Environment > Water](http://www.oecd.org)
Permanent surface water, % total area

*Permanent surface water* is expressed as a percentage of total country area. *Permanent surface water* is defined as areas that were water for every month of the reference year. Note that these data refer only to water surface, they do not account for the volume of water. Total area refers to land and inland water bodies (including permanent and seasonal water).

Surface water data are obtained from the *Surface water and surface water change dataset* of [OECD Environment Database]. For further details on the methodology, please consult [Land cover change and conversions: methodology and results for OECD and G20](https://doi.org/10.1787/5b22361f-en).

Seasonal surface water, % total area

*Seasonal surface water* is expressed as a percentage of total country area.

*Seasonal surface water* is defined as areas that were water for 1 to 11 months of the reference year. Note that these data refer only to water surface, they do not account for the volume of water. Total area refers to land and inland water bodies (including permanent and seasonal water).

Surface water data are obtained from the *Surface water and surface water change dataset* of [OECD Environment Database]. For further details on the methodology, please consult [Land cover change and conversions: methodology and results for OECD and G20](https://doi.org/10.1787/5b22361f-en).

Conversion of permanent water to not-water surface, % permanent water, since 1984

*Conversion of permanent water to not-water surface* is defined as the percentage of permanent water area lost. The denominator used is the available permanent water surface in 1984.

*Permanent surface water* is defined as areas that were water for every month of the reference year. Note that these data refer only to water surface, they do not account for the volume of water.

Surface water data are obtained from the *Surface water and surface water change dataset* of [OECD Environment Database]. For further details on the methodology, please consult [Land cover change and conversions: methodology and results for OECD and G20](https://doi.org/10.1787/5b22361f-en).

Conversion of permanent to seasonal water, % permanent water, since 1984

*Conversion of permanent to seasonal water* is defined as the percentage of permanent water area that became seasonal water. The denominator used is the available permanent water surface in 1984.
**Permanent surface water** is defined as areas that were water for every month of the reference year. **Seasonal surface water** is defined as areas that were water for 1 to 11 months of the reference year. Note that these data refer only to water surface, they do not account for the volume of water.

Surface water data are obtained from the *Surface water and surface water change dataset* of [OECD Environment Database](https://www.oecd.org/environment/landresources/landcover/surfacewaterandsurfacewaterchange/). For further details on the methodology, please consult [Land cover change and conversions: methodology and results for OECD and G20](https://www.oecd.org/environment/landresources/landcover/surfacewaterandsurfacewaterchange/).

**Conversion of not-water to permanent water, % permanent water, since 1984**

Conversion of not-water to permanent water measures how much land was inundated since 1984, expressed as percentage of permanent water. The denominator used is the available permanent water surface in 1984.

**Permanent surface water** is defined as areas that were water for every month of the reference year. Note that these data refer only to water surface, they do not account for the volume of water.

Surface water data are obtained from the *Surface water and surface water change dataset* of [OECD Environment Database](https://www.oecd.org/environment/landresources/landcover/surfacewaterandsurfacewaterchange/). For further details on the methodology, please consult [Land cover change and conversions: methodology and results for OECD and G20](https://www.oecd.org/environment/landresources/landcover/surfacewaterandsurfacewaterchange/).

**Conversion of seasonal to permanent water, % permanent water, since 1984**

This variable measures how much permanent water was gained due to changes from seasonal waters. The denominator used is the available permanent water surface in 1984.

**Seasonal surface water** is defined as areas that were water for 1 to 11 months of the reference year. **Permanent surface water** is defined as areas that were water for every month of the reference year. Note that these data refer only to water surface, they do not account for the volume of water.

Surface water data are obtained from the *Surface water and surface water change dataset* of [OECD Environment Database](https://www.oecd.org/environment/landresources/landcover/surfacewaterandsurfacewaterchange/). For further details on the methodology, please consult [Land cover change and conversions: methodology and results for OECD and G20](https://www.oecd.org/environment/landresources/landcover/surfacewaterandsurfacewaterchange/).
**Wildlife resources**

**Threatened mammal species, % total known species**

Number of threatened mammal species expressed as percentage of total known species.

The *threatened* category refers to critically endangered, endangered and vulnerable species, that is those plants and animals that are in danger of extinction or likely soon to be (for further information, see the *IUCN Red List Categories and Criteria: Version 3.1, Second edition*).

Whereas this indicator shows data for year 2015, the data refer to the latest information available for every country. Note that due to measurement difficulties national data on threatened species mostly reflect averages over long periods of time.

Data on threatened species are obtained from the *Threatened Species Dataset* in the *OECD Environment Database*. Country-specific information is available in the *Countries metadata* document of this dataset.

**Threatened bird species, % total known species**

Number of threatened bird species expressed as percentage of total known species.

The *threatened* category refers to critically endangered, endangered and vulnerable species, that is those plants and animals that are in danger of extinction or likely soon to be (for further information, see the *IUCN Red List Categories and Criteria: Version 3.1, Second edition*).

Whereas this indicator shows data for year 2015, the data refer to the latest information available for every country. Note that due to measurement difficulties national data on threatened species mostly reflect averages over long periods of time.

Data on threatened species are obtained from the *Threatened Species Dataset* in the *OECD Environment Database*. Country-specific information is available in the *Countries metadata* document of this dataset.

**Threatened vascular plant species, % total known species**

Number of threatened vascular plant species expressed as percentage of total known species.

The *threatened* category refers to critically endangered, endangered and vulnerable species, that is those plants and animals that are in danger of extinction or soon likely to be (for further information, see the *IUCN Red List Categories and Criteria: Version 3.1, Second edition*).

Whereas this indicator shows data for year 2015, the data refer to the latest information available for every country. Note that due to measurement difficulties national data on threatened species mostly reflect averages over long periods of time.
difficulties national data on threatened species mostly reflect averages over long periods of time.

Data on threatened species are obtained from the Threatened Species Dataset in the OECD Environment Database. Country-specific information is available in the Countries metadata document of this dataset.

**Farmland Birds Index, 2000=100**

The farmland bird index is an aggregated index, with values in 2000 normalised to equal 100, of population trend estimates of a selected group of breeding bird species that are dependent on agricultural land for nesting or breeding. Indices are first calculated for each species independently at the national level, then national-level indices are aggregated to generate a single index. These national indices vary significantly in the number and type of species they include (ranging from 8 to 39 bird species), to reflect varying national situations. A decrease of the index means that the population abundance of bird species is declining, representing biodiversity loss. For a detailed discussion of the index, please consult: OECD (2019), Trends and Drivers of Agri-environmental Performance in OECD Countries, OECD Publishing, Paris.

Data are obtained from the dataset on Environmental performances of agriculture - indicators from the OECD Agriculture and Fisheries Database.

**Forest Birds Index, 2000=100**

The forest bird index is an aggregated index, with values in 2000 normalised to equal 100, of population trend estimates of a selected group of breeding bird species that are dependent on forest lands for nesting or breeding. Indices are first calculated for each species independently at the national level, then national-level indices are aggregated to generate a single index. These national indices vary significantly in the number and type of species they include (ranging from 8 to 39 bird species), to reflect varying national situations. A decrease of the index means that the population abundance of bird species is declining, representing biodiversity loss. For a detailed discussion of the index, please consult the metadata of the source dataset.

Data are obtained from the dataset on Environmental performances of agriculture - indicators from the OECD Agriculture and Fisheries Database.

**Sales of pesticides per unit of agricultural land**

Sales of pesticides per unit of agricultural land is calculated as the ratio of kilograms of pesticides sold in a given year per hectare of agricultural land (kg/ha).
Pesticides include primarily fungicides, herbicides, insecticides, and to a lower extent molluscicides and other substances. From a biodiversity-conservation perspective, the use of pesticides is considered a key driver in the decline of farmland bird populations, a common indicator which suggests negative impacts on farmland biodiversity more broadly; of particular concern is the use of insecticides and herbicides. For a detailed discussion of the interactions between pesticide use and biodiversity, please consult: OECD (2019), Trends and Drivers of Agri-environmental Performance in OECD Countries, OECD Publishing, Paris.

Data are obtained from the dataset on Environmental performances of agriculture - indicators from the OECD Agriculture and Fisheries Database.

77 Published also on OECD.stat > Agriculture and Fisheries > Environmental indicators for agriculture > Agri-environmental other indicators
Atmosphere and climate

Annual surface temperature, change since 1951-1980

Annual surface temperature change is measured in Celsius degrees (°C). It is calculated as the difference between the annual average temperature (in a given year) and the average annual temperature of the 1951-1980 period.

Data are obtained from the FAOSTAT Temperature Change dataset of the Food and Agriculture Organization of the United Nations. Data are based on the publicly available GISTEMP data, the Global Surface Temperature Change data distributed by the National Aeronautics and Space Administration Goddard Institute for Space Studies (NASA-GISS).
Environmental dimension of quality of life

Exposure to environmental risks

Mean population exposure to PM$_{2.5}$

Mean population exposure to fine particulate matter is calculated as the mean annual outdoor PM$_{2.5}$ concentration weighted by population living in the area. It is the concentration level, expressed in micrograms per cubic meter (µg/m$^3$), to which a typical resident is exposed throughout a year.

Data on exposure to air pollution are obtained from the Exposure to PM$_{2.5}$ – countries and regions dataset from the OECD Environment Database. Detailed information on the methodology and underlying data sources used to compute exposure to air pollution is in the associated metadata.

Percentage of population exposed to more than 10 µg/m$^3$

Proportion of people living in areas with annual concentrations exceeding the WHO Air Quality Guideline (AQG) value of 10 micrograms per cubic meter.

Data on exposure to air pollution are obtained from the Exposure to PM$_{2.5}$ – countries and regions dataset from the OECD Environment Database. Detailed information on the methodology and underlying data sources used to compute exposure to air pollution is in the associated metadata.

Percentage of population exposed to more than 35 µg/m$^3$

Proportion of people living in areas with annual concentrations exceeding the WHO Interim Target value of 35 micrograms per cubic meter.

Data on exposure to air pollution are obtained from the Exposure to PM$_{2.5}$ – countries and regions dataset from the OECD Environment Database. Detailed information on the methodology and underlying data sources used to compute exposure to air pollution is in the associated metadata.

Mortality from exposure to ambient PM$_{2.5}$

Mortality from exposure to ambient PM$_{2.5}$ is expressed in deaths per million inhabitants.

According to the World Health Organisation (WHO), exposure to fine particulate matter (PM$_{2.5}$) has potentially the most significant adverse effects on health compared to other air pollutants. Particulate matter (PM$_{2.5}$) can be inhaled and cause serious health problems including both respiratory and cardiovascular disease, having its most severe effects on children and elderly people.

Data and further details on the methodology can be obtained from GBD (2017), Global Burden of Disease Study 2017 Results, and the dataset of Mortality and...
Welfare cost of premature deaths from exposure to environmental risks are compared to GDP as percentage points of GDP equivalent.

Cost estimates represent only the cost of premature mortalities. They are calculated using estimates of the “Value of a Statistical Life” (VSL) and the number of premature deaths attributable to each environmental risk. They exclude any morbidity impacts (labour productivity losses, treatment costs and willingness to pay to avoid pain and suffering from illness). They also exclude impacts other than those on human health (e.g. on built structures, agricultural productivity, ecosystem health). The social cost of the exposure to these environmental risks is thus greater than the cost of mortalities presented here.

Yet the available evidence suggests that mortality costs account for the bulk of the total costs to society. Finally, VSL also captures non-market values that are unrelated to expenditures and therefore not an integral part of the calculation of GDP. Consequently, the cost estimates are compared with GDP only for illustration.

Data and further details on the methodology can be obtained from GBD (2017), Global Burden of Disease Study 2017 Results, and the dataset of Mortality and welfare cost from exposure to environmental risks from the OECD Environment Database.

Mortality from exposure to ambient ozone

Mortality from exposure to ambient ozone is expressed in deaths per million inhabitants.

Ambient (or ground-level) ozone (O3) has serious consequences for human health, contributing to, or triggering, respiratory diseases. These include breathing problems, asthma and reduced lung function (WHO). Ozone exposure is highest in emission-dense countries with warm and sunny summers. The most important determinants are background atmospheric chemistry, climate, anthropogenic and biogenic emissions of ozone precursors such as volatile organic compounds, and the ratios between different emitted chemicals.

Data and further details on the methodology can be obtained from GBD (2017), Global Burden of Disease Study 2017 Results, and the dataset of Mortality and welfare cost from exposure to environmental risks from the OECD Environment Database.

Welfare cost of premature deaths from exposure to ambient ozone, GDP equivalent

Welfare costs of premature deaths from exposure to ambient ozone are compared to GDP as percentage points of GDP equivalent.
Cost estimates represent only the cost of premature mortalities. They are calculated using estimates of the “Value of a Statistical Life” (VSL) and the number of premature deaths attributable to each environmental risk. They exclude any morbidity impacts (labour productivity losses, treatment costs and willingness to pay to avoid pain and suffering from illness). They also exclude impacts other than those on human health (e.g. on built structures, agricultural productivity, ecosystem health). The social cost of the exposure to these environmental risks is thus greater than the cost of mortalities presented here. Yet the available evidence suggests that mortality costs account for the bulk of the total costs to society. Finally, VSL also captures non-market values that are unrelated to expenditures and therefore not an integral part of the calculation of GDP. Consequently, the cost estimates are compared with GDP only for illustration.

Data on premature deaths can be obtained from GBD (2017), Global Burden of Disease Study 2017 Results. Data and further details on the methodology to derive the VSL estimates can be obtained from the dataset of Mortality and welfare cost from exposure to environmental risks from the OECD Environment Database.84

Mortality from exposure to lead

Mortality from exposure to lead is expressed in deaths per million inhabitants.

Lead (Pb) is a toxic metal found in the Earth’s crust. Its widespread use has resulted in extensive environmental contamination, human exposure and significant public health problems in many parts of the world. Important sources of environmental contamination include mining, smelting, manufacturing and recycling activities, and, in some countries, the continued use of leaded paint, leaded gasoline, and leaded aviation fuel.

Data and further details on the methodology to derive premature deaths from exposure to lead can be obtained from GBD (2017), Global Burden of Disease Study 2017 Results, and the dataset of Mortality and welfare cost from exposure to environmental risks from the OECD Environment Database.85

Welfare cost of premature deaths from exposure to lead, GDP equivalent

Welfare costs of premature deaths from exposure to lead are compared to GDP as percentage points of GDP equivalent.

Cost estimates represent only the cost of premature mortalities. They are calculated using estimates of the “Value of a Statistical Life” (VSL) and the number of premature deaths attributable to each environmental risk. They exclude any morbidity impacts (labour productivity losses, treatment costs and willingness to pay to avoid pain and suffering from illness). They also exclude impacts other than those on human health (e.g. on built structures, agricultural productivity, ecosystem health). The social cost of the exposure to these environmental risks is thus greater than the cost of mortalities presented here. Yet the available evidence suggests that mortality costs account for the bulk of the total costs to society. Finally, VSL also captures non-market values that are unrelated to expenditures and therefore not an integral part of the calculation.

84 Published also on OECD.stat > Environment > Environmental risks and health
85 Published also on OECD.stat > Environment > Environmental risks and health
of GDP. Consequently, the cost estimates are compared with GDP only for illustration.

Data on premature deaths can be obtained from **GBD (2017), Global Burden of Disease Study 2017 Results**. Data and further details on the methodology to derive the VSL estimates can be obtained from the dataset of **Mortality and welfare cost from exposure to environmental risks** from the **OECD Environment Database**.

**Mortality from exposure to residential radon**

Mortality from exposure to residential radon is expressed in deaths per million inhabitants.

Radon (Rn) is a radioactive gas that arises as a by-product of the decay chain of uranium, occurring naturally within the Earth’s crust. Some fraction of this natural radon escapes into the atmosphere, where it forms at low concentration unless build-up is caused by enclosed spaces like homes, mines or caves. Soil gas infiltration is recognized as the most important source of residential radon. Other sources, including building materials and water extracted from wells, are of less importance in most circumstances. Radon is a major contributor to the ionizing radiation dose received by the general population, and is the second cause of lung cancer, after smoking. Epidemiological studies have provided convincing evidence of an association between indoor radon exposure and lung cancer, even at the relatively low radon levels commonly found in residential buildings.

Data and further details on the methodology to derive premature deaths from exposure to residential radon can be obtained from **GBD (2017), Global Burden of Disease Study 2017 Results**, and the dataset of **Mortality and welfare cost from exposure to environmental risks** from the **OECD Environment Database**.

**Welfare cost of premature deaths from exposure to residential radon, GDP equivalent**

Welfare costs of premature deaths from exposure to residential radon are compared to GDP as percentage points of GDP equivalent.

Cost estimates represent only the cost of premature mortalities. They are calculated using estimates of the “Value of a Statistical Life” (VSL) and the number of premature deaths attributable to each environmental risk. They exclude any morbidity impacts (labour productivity losses, treatment costs and willingness to pay to avoid pain and suffering from illness). They also exclude impacts other than those on human health (e.g. on built structures, agricultural productivity, ecosystem health). The social cost of the exposure to these environmental risks is thus greater than the cost of mortalities presented here. Yet the available evidence suggests that mortality costs account for the bulk of the total costs to society. Finally, VSL also captures non-market values that are unrelated to expenditures and therefore not an integral part of the calculation of GDP. Consequently, the cost estimates are compared with GDP only for illustration.

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86 Published also on [OECD.stat > Environment > Environmental risks and health](https://stats.oecd.org)
87 Published also on [OECD.stat > Environment > Environmental risks and health](https://stats.oecd.org)
Data on premature deaths can be obtained from GBD (2017), *Global Burden of Disease Study 2017 Results*. Data and further details on the methodology to derive the VSL estimates can be obtained from the dataset of *Mortality and welfare cost from exposure to environmental risks* from the *OECD Environment Database*.88

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88 Published also on *OECD.stat > Environment > Environmental risks and health*
Access to drinking water and sewage treatment

Population with access to improved drinking water sources, % total population

Percentage of population using improved drinking water sources. Improved sources of drinking water include: piped water into dwelling, yard or plot, public taps or standpipes, boreholes or tubewells, protected dug wells, protected springs, packaged water, delivered water and rainwater. Improved water sources should be located on premises and available when needed and free of faecal (and priority chemical) contamination.

Data on access to improved drinking water sources are obtained from the Sustainable Development Goals indicators dataset from the United Nations.

Population with access to improved sanitation, % total population

Percentage of population using improved sanitation and a basic handwashing facility. Improved sanitation facilities include: flush or pour flush toilets to sewer systems, septic tanks or pit latrines, ventilated improved pit latrines, pit latrines with a slab, and composting toilets. Sanitation facilities should not be shared with other households and where excreta is safely disposed in situ or treated off-site. Population with a basic handwashing facility: a device to contain, transport or regulate the flow of water to facilitate handwashing with soap and water in the household.

Data on access to improved sanitation are obtained from the Sustainable Development Goals indicators dataset from the United Nations.

Population connected to public sewerage, % total population

Percentage of the national resident population connected to an urban wastewater collecting system. “Connected” means physically connected to a wastewater treatment plant through a public sewerage network (incl. primary, secondary, tertiary or other treatment). Individual private treatment facilities such as septic tanks are not covered.

Data on access to public sewerage are obtained from the Wastewater Treatment Dataset from the OECD Environment Database.\(^8^9\) Note that data for the United Kingdom include only England and Wales.

Population connected to sewerage with primary treatment, % total population

Percentage of the national resident population connected to public sewerage with primary treatment.

“Primary treatment” refers to a physical and/or chemical process involving settlement of suspended solids, or other process in which the BOD5 (the amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter) of the incoming wastewater is reduced by at least 20% before discharge and the total suspended solids are reduced by at least 50%.

\(^{89}\) Published also on OECD.stat > Environment > Water
Data on access to public sewerage are obtained from the *Wastewater Treatment Dataset* from the *OECD Environment Database*.\(^90\) Note that data for the United Kingdom include only England and Wales.

**Population connected to sewerage with secondary treatment, % total population**

Percentage of the national resident population connected to public sewerage with secondary treatment.

“Secondary treatment” refers to a process generally involving biological treatment with secondary settlement or another process, resulting in reductions in biochemical oxygen demand of at least 70% and chemical oxygen demand of at least 75%.

Data on access to public sewerage are obtained from the *Wastewater Treatment Dataset* from the *OECD Environment Database*.\(^91\) Note that data for the United Kingdom include only England and Wales.

**Population connected to sewerage with tertiary treatment, % total population**

Percentage of the national resident population connected to public sewerage with tertiary treatment.

“Tertiary treatment” refers to treatment of nitrogen and/or phosphorus and/or any other pollutant affecting the quality or specific use of water; microbiological pollution, colour, etc.

Data on access to public sewerage are obtained from the *Wastewater treatment Dataset* from the *OECD Environment Database*.\(^92\) Note that data for the United Kingdom include only England and Wales.

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\(^90\) Published also on [OECD.stat > Environment > Water](https://stats.oecd.org/

\(^91\) Published also on [OECD.stat > Environment > Water](https://stats.oecd.org/

\(^92\) Published also on [OECD.stat > Environment > Water](https://stats.oecd.org/)
Economic opportunities and policy responses

Technology and innovation: R&D

Environment-related government R&D budget, % total government R&D

Government budget for R&D refers to Government Budget Appropriations or Outlays for Research and Development (GBAORD), that measure the funds that government allocate to R&D to meet various socio-economic objectives. These objectives are defined using the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007) classification. Estimates of environment-related government RD&D are reported from the funder perspective as budget (rather than as expenditure from the performer perspective). This indicator is based on the socio-economic objective “environment” which includes research directed at the control of pollution and on developing monitoring facilities to measure, eliminate and prevent pollution. It is expressed as a percentage of all-purpose GBAORD.

Data on government expenditure regarding environment-related R&D are obtained from the Government budget appropriations or outlays for R&D (GBAORD) Dataset of the OECD Science, Technology and R&D Statistics Database. Additional information on the methodology for internationally harmonised collection and use of R&D statistics can be found in the Frascati Manual.

Environment-related R&D expenditure, % GDP

R&D expenditure refers to Gross domestic Expenditure on Research and Development (GERD) measured as total intramural (= business enterprise + government + higher education + private non-profit) R&D expenditure in various socio-economic objectives. These objectives are defined using the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007) classification. Estimates of R&D are reported from the performer perspective as expenditure (rather than as budget from the funder perspective). This indicator is based on the socio-economic objective “environment” which includes research directed at the control of pollution and on developing monitoring facilities to measure, eliminate and prevent pollution. It is expressed as percentage of GDP.

Data on environment-related R&D expenditure is obtained from the Gross domestic expenditure on R-D by sector of performance and socio-economic objective dataset of the OECD Science, Technology and R&D Statistics Database. Additional information on the methodology for internationally

93 Estimated budgets and actual expenditures by governments often differ because projected amounts of R&D at the appropriations stage vary from what is actually measured by the performers. It may also be due to an imprecision in the budget appropriations impeding separate identification of appropriations that are specifically targeted to R&D.

94 Published also on OECD.stat > Science, Technology and Patents > Research and Development Statistics > GBAORD

95 Estimated budgets and actual expenditures by governments often differ because projected amounts of R&D at the appropriations stage vary from what is actually measured by the performers. It may also be due to imprecise budget appropriations impeding separate identification of appropriations that are specifically targeted to R&D.

96 Published also on OECD.stat > Science, Technology and Patents > Research and Development Statistics > Expenditure
harmonised collection and use of R&D statistics can be found in the Frascati Manual.

For more details on the underlying GDP data, see the metadata for Real GDP.

Renewable energy public RD&D budget, % total energy public RD&D

Public budget directed at research, development and demonstration (RD&D) related to renewable energy, including hydro, geothermal, solar (thermal and PV), wind and tide/wave/ocean energy, as well as combustible renewables (solid biomass, liquid biomass, biogas) and other renewable energy technologies (all supporting measuring, monitoring and verifying technologies in renewable energies). It is expressed as a percentage of total energy RD&D public budget (directed at all forms of energy).

RD&D budgets of public entities (government, public agencies and state-owned enterprises, as defined by the IEA) cover research, development and demonstration related to the production, storage, transportation, distribution and rational use of all forms of energy. This covers basic research (oriented towards the development of energy-related technologies), applied research, experimental development and demonstration. Deployment is excluded from IEA Energy RD&D. Estimates of RD&D are reported from the funder perspective as budget (rather than as expenditure from the performer perspective).97

Public energy RD&D includes all programmes that focus on: (i) sourcing energy; (ii) transporting energy; (iii) using energy; and (iv) enhancing energy efficiency. As collected by the IEA, these programmes concern one of the following seven main branches of energy-related developments: (i) energy efficiency; (ii) fossil fuels (oil, gas and coal); (iii) renewables; (iv) nuclear fission and fusion; (v) hydrogen and fuel cells; (vi) other power and storage techniques; and (vii) other cross-cutting technologies or research.

Data on public RD&D are obtained from the RD&D Budget Dataset from the IEA Energy Technology RD&D Statistics Database.98

The energy RD&D data collected by the IEA should not be confused with the data on government budget appropriations or outlays on R&D (GBAORD) collected by the OECD Directorate for Science, Technology and Industry for the socio-economic objective “Production, distribution and rational utilisation of energy”, as defined in the Frascati Manual, which is a narrower concept.

Fossil fuel public RD&D budget, % total energy public RD&D

Public budget directed at research, development and demonstration (RD&D) related to fossil fuels, including oil, gas and coal and excluding RD&D related to CO₂ capture and storage (CCS). They are expressed as a percentage of total energy RD&D public budgets (directed at all forms of energy).

97 Estimated budgets and actual expenditures by governments often differ because projected amounts of RD&D at the appropriations stage are different than what is actually measured by the performers. It may also be due to imprecise budget appropriations impeding separate identification of appropriations that are specifically targeted to RD&D.

98 Published also on OECD.stat > Energy > Energy Technology R and D
RD&D budgets of public entities (government, public agencies and state-owned enterprises, as defined by the IEA) cover research, development and demonstration related to the production, storage, transportation, distribution and rational use of all forms of energy. This covers basic research (oriented towards the development of energy-related technologies), applied research, experimental development and demonstration. Deployment is excluded from IEA Energy RD&D. Estimates of RD&D are reported from the funder perspective as budget (rather than as expenditure from the performer perspective).  

Public energy RD&D includes all programmes that focus on: (i) sourcing energy; (ii) transporting energy; (iii) using energy; and (iv) enhancing energy efficiency. As collected by the IEA, these programmes concern one of the following seven main branches of energy-related developments: (i) energy efficiency; (ii) fossil fuels (oil, gas and coal); (iii) renewables; (iv) nuclear fission and fusion; (v) hydrogen and fuel cells; (vi) other power and storage techniques; and (vii) other cross-cutting technologies or research.

Data on public RD&D are obtained from the RD&D Budget Dataset from the IEA Energy Technology RD&D Statistics Database.

The energy RD&D data collected by the IEA should not be confused with the data on government budget appropriations or outlays on R&D (GBAORD) collected by the OECD Directorate for Science, Technology and Industry for the socio-economic objective “Production, distribution and rational utilisation of energy”, as defined in the Frascati Manual, which is a narrower concept.

### Energy RD&D public budget, % GDP

Energy RD&D public budget is expressed as a percentage of GDP. This indicator allows the Renewable energy public RD&D budget (see above) to be put into a broader context.

IEA Energy RD&D from public bodies (government, public agencies and state-owned enterprises, as defined by the IEA) covers research, development and demonstration related to the production, storage, transportation, distribution and rational use of all forms of energy. It covers basic research (oriented towards the development of energy-related technologies), applied research, experimental development and demonstration. Deployment is excluded from IEA Energy RD&D. It is expressed as percentage of total (all energy-related developments) public RD&D. Estimates of RD&D are reported from the funder perspective as budget (rather than as expenditure from the performer perspective).

Energy RD&D includes all programmes that focus on: (i) sourcing energy; (ii) transporting energy; (iii) using energy; and (iv) enhancing energy efficiency. As collected by the IEA, these programmes concern one of the following seven branches:

- Energy efficiency
- Fossil fuels
- Renewables
- Nuclear fission and fusion
- Hydrogen and fuel cells
- Other power and storage techniques
- Other cross-cutting technologies or research

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99 Estimated budgets and actual expenditures by governments often differ because projected amounts of RD&D at the appropriations stage are different than what is actually measured by the performers. It may also be due to imprecise budget appropriations impeding separate identification of appropriations that are specifically targeted to RD&D.

100 Published also on OECD.stat > Energy > Energy Technology R and D

101 Estimated budgets and actual expenditures by governments often differ because projected amounts of RD&D at the appropriations stage are different than what is actually measured by the performers. It may also be due to imprecise budget appropriations that impede separate identification of appropriations that are specifically targeted to RD&D.
The main branches of energy-related developments: (i) energy efficiency; (ii) fossil fuels (oil, gas and coal); (iii) renewables; (iv) nuclear fission and fusion; (v) hydrogen and fuel cells; (vi) other power and storage techniques; and (vii) other cross-cutting technologies or research.

The energy RD&D data collected by the IEA should not be confused with the data on government budget appropriations or outlays on R&D (GBAORD) collected by the OECD Directorate for Science, Technology and Industry for the socio-economic objective “Production, distribution and rational utilisation of energy”, as defined in the Frascati Manual, which is a narrower concept.

Data on energy public RD&D budget are obtained from the RD&D Budget Dataset from the IEA Energy Technology RD&D Statistics Database.¹⁰²

For more details on the underlying GDP data, see the metadata for Real GDP.

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¹⁰² Published also on OECD.stat > Energy > Energy Technology R and D.
Technology and innovation: Patents

Development of environment-related technologies, % all technologies

The number of environment-related inventions is expressed as a percentage of all domestic inventions (in all technologies). Changes in ‘environmental’ technological innovation can then be interpreted in relation to innovation in general.

Indicators of technology development are constructed by measuring inventive activity using patent data across a wide range of environment-related technological domains (ENVTECH), including environmental management, water-related adaptation, and climate change mitigation technologies. The counts used here include only higher-value inventions (with patent family size ≥ 2).

Data are obtained from the Patents: Technology development dataset of the OECD Environment Database. Detailed information on the methodology used to compute the patent counts is in the associated metadata.

Relative advantage in environment-related technologies

The relative advantage in environment-related technologies is an index of the specialisation in environmental innovation of a given country relative to the world average. It is calculated as the ratio of 1) the share of environment-related inventions on all inventions (in all technologies) at home and 2) the share of environment-related inventions on all inventions (in all technologies) in the world. Hence, an index equal to one means that a country innovates as much in ‘green’ technologies as the world on average; an index above 1 indicates a relative technological advantage (RTA), or specialisation, in environment-related technologies compared to the world average.

Indicators of technology development are constructed by measuring inventive activity using patent data across a wide range of environment-related technological domains (ENVTECH), including environmental management, water-related adaptation, and climate change mitigation technologies. The counts used here include only higher-value inventions (with patent family size ≥ 2).

Data are obtained from the Patents: Technology development dataset of the OECD Environment Database. Detailed information on the methodology used to compute the patent counts is in the associated metadata.

Development of environment-related technologies, % inventions worldwide

The number of environment-related inventions is expressed as a percentage of environment-related inventions worldwide. This indicator allows the

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103 A patent family is defined as the set of all patent applications protecting the same ‘priority’ (as defined by the Paris Convention), also referred to as ‘simple patent family’ (see Martinez 2010).
104 Published also on OECD.stat > Environment > Patents > Technology development
105 A patent family is defined as the set of all patent applications protecting the same ‘priority’ (as defined by the Paris Convention), also referred to as ‘simple patent family’ (see Martinez 2010).
106 Published also on OECD.stat > Environment > Patents > Technology development
importance of inventive activity in a given country to be assessed in terms of its contribution to the global pool of inventions.

Indicators of technology development are constructed by measuring inventive activity using patent data across a wide range of environment-related technological domains (ENVTECH), including environmental management, water-related adaptation, and climate change mitigation technologies. The counts used here include only higher-value inventions (with patent family size ≥ 2).

Data are obtained from the Patents: Technology development dataset of the OECD Environment Database. Detailed information on the methodology used to compute the patent counts is in the associated metadata.

**Development of environment-related technologies, inventions per capita**

The number of environment-related inventions is expressed per million residents (higher-value inventions/million persons).

Indicators of technology development are constructed by measuring inventive activity using patent data across a wide range of environment-related technological domains (ENVTECH), including environmental management, water-related adaptation, and climate change mitigation technologies. The counts used here include only higher-value inventions (with patent family size ≥ 2).

Data are obtained from the Patents: Technology development dataset of the OECD Environment Database. Detailed information on the methodology used to compute the patent counts is in the associated metadata.

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108 Published also on OECD.stat > Environment > Patents > Technology development

109 A patent family is defined as the set of all patent applications protecting the same ‘priority’ (as defined by the Paris Convention), also referred to as ‘simple patent family’ (see Martinez 2010).

110 Published also on OECD.stat > Environment > Patents > Technology development
Environmental goods and services

National expenditure on environmental protection, % GDP

*National expenditure on environmental protection* is expressed as a percentage of Gross Domestic Product. Environmental Protection (EP) includes all activities and actions which have as their main purpose the prevention, reduction and elimination of pollution as well as any other degradation of the environment. The scope of environmental protection expenditure is defined according to the Classification of Environmental Protection Activities (CEPA 2000). The expenditure accounts presented here are in accordance with the System of Environmental-Economic Accounting (SEEA). National expenditure on EP covers the expenditure on EP products by resident units, expenditure related to the production of EP products (including the gross capital formation), and transactions related to the financing of EP expenditure.

Data and further details can be obtained from the *EPEA (Environmental Protection Expenditure Accounts)* dataset of the *OECD Environment Database.*

For more details on the underlying GDP data, see the metadata for *Real GDP.*

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111 Published also on [OECD.stat > Environment > Environmental Expenditures and Revenues](http://www.oecd.stat)
International financial flows: Official Development Assistance

Environmentally related ODA, % total ODA

Environmentally related Official Development Assistance (ODA) is expressed as a percentage of total ODA. Environmentally related ODA is identified using marker "Environment" and the set of “Rio Markers”. The Rio Markers specifically screen for policy objectives of a cross-sectorial nature, including climate change, biodiversity and desertification. This variable includes only data on bilateral commitments and is calculated by aggregating up from the level of the individual projects in order to avoid double-counting.

ODA commitments identified using the "Environment" marker (principal or significant objective) include activities that are intended to produce an improvement in the physical and/or biological environment of the recipient country, area or target group concerned or include specific action to integrate environmental concerns with a range of development objectives through institution building and/or capacity development. The “Environment” marker was introduced in 1992.

ODA commitments identified using the “Rio markers” (principal or significant objective) include:

- **Biodiversity-related aid** is defined as activities that promote conservation of biodiversity, sustainable use of its components, or fair and equitable sharing of the benefits of the use of genetic resources. The biodiversity marker was introduced in 1998.
- **Desertification-related aid** is defined as activities that tackle desertification or mitigate the effects of drought. The desertification marker was introduced in 1998.
- **Climate change mitigation-related aid** is defined as activities that strengthen the resilience of countries to climate change and that contribute to stabilisation of GHG concentrations by promoting reduction of emissions or enhancement of GHG sequestration. The climate change mitigation marker was introduced in 1998.
- **Climate change adaptation-related aid**, approved by OECD-DAC members in December 2009, is defined as aid in support of climate change adaptation and complements the climate change mitigation marker, thus allowing presentation of a more complete picture of aid in support of developing countries’ efforts to address climate change. The climate change adaptation marker was introduced in 2010.

Total ODA comprises both screened and non-screened ODA bilateral commitments. ODA data are obtained from the Aid Activities Targeting Global Environmental Objectives dataset of the Creditor Reporting System of the OECD International Development Statistics Database.

ODA – all sectors – biodiversity, % total ODA

Official Development Assistance (ODA) targeting biodiversity is expressed as a percentage of total ODA. ODA targeting the objectives of the Rio conventions is identified using the “Rio Markers” (principal or significant objective), which

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Notes:

112 Click [here](#) for more information on the ODA methodology.
113 Published also on [OECD.stat > Development > Flows based on individual aid projects (CRS)](#)
screen for policy objectives of a cross-sectoral nature, including climate change, biodiversity and desertification (see Environmentally related ODA, % total ODA for more details on the Rio Markers).

Total ODA comprises both screened and non-screened ODA bilateral commitments.\textsuperscript{114} ODA data are obtained from the Aid Activities Targeting Global Environmental Objectives dataset of the Creditor Reporting System of the OECD International Development Statistics Database.\textsuperscript{115}

ODA – all sectors – climate change mitigation, % total ODA

Official Development Assistance (ODA) targeting climate change mitigation is expressed as a percentage of total ODA. ODA targeting the objectives of the Rio conventions is identified using the “Rio Markers” (principal + significant objective), which screen for policy objectives of a cross-sectoral nature, including climate change, biodiversity and desertification (see Environmentally related ODA, % total ODA for more details on the Rio Markers).

Total ODA comprises both screened and non-screened ODA bilateral commitments.\textsuperscript{116} ODA data are obtained from the Aid Activities Targeting Global Environmental Objectives dataset of the Creditor Reporting System of the OECD International Development Statistics Database.\textsuperscript{117}

ODA – all sectors – climate change adaptation, % total ODA

Official Development Assistance (ODA) targeting climate change adaptation is expressed as a percentage of total ODA. ODA targeting the objectives of the Rio conventions is identified using the “Rio Markers” (principal + significant objective), which screen for policy objectives of a cross-sectoral nature, including climate change, biodiversity and desertification (see Environmentally related ODA, % total ODA for more details on the Rio Markers).

Total ODA comprises both screened and non-screened ODA bilateral commitments.\textsuperscript{118} ODA data are obtained from the Aid Activities Targeting Global Environmental Objectives dataset of the Creditor Reporting System of the OECD International Development Statistics Database.\textsuperscript{119}

ODA – all sectors – desertification, % total ODA

Official Development Assistance (ODA) targeting desertification is expressed as a percentage of total ODA. ODA targeting the objectives of the Rio conventions is identified using the “Rio Markers” (principal + significant objective), which screen for policy objectives of a cross-sectoral nature, including climate change, biodiversity and desertification (see Environmentally related ODA, % total ODA for more details on the Rio Markers).

\textsuperscript{114} Click here for more information on ODA methodology.
\textsuperscript{115} Published also on OECD.stat > Development > Flows based on individual aid projects (CRS)
\textsuperscript{116} Click here for more information on ODA methodology.
\textsuperscript{117} Published also on OECD.stat > Development > Flows based on individual aid projects (CRS)
\textsuperscript{118} Click here for more information on ODA methodology.
\textsuperscript{119} Published also on OECD.stat > Development > Flows based on individual aid projects (CRS)
Total ODA comprises both screened and non-screened ODA bilateral commitments.\(^{120}\) ODA data are obtained from the *Aid Activities Targeting Global Environmental Objectives* dataset of the *Creditor Reporting System* of the *OECD International Development Statistics Database*.\(^{121}\)

**ODA – environment sector, % total allocable ODA**

Official Development Assistance allocated to environmental protection activities is expressed as a percentage of total sector-allocable ODA. Environment sector refers to general environmental protection activities, i.e. environmental policy and administrative management, biosphere protection, biodiversity, site preservation, flood prevention/control, environmental education/training and environmental research. This indicator is based on commitment data (not actual disbursements), which best reflect current policies by donors.

Sector-allocable ODA comprises aid directed to social infrastructure and services, economic infrastructure and services, production sectors and multi-sector/cross cutting aid.\(^{122}\)

ODA data are obtained from the *Aid Activities Targeting Global Environmental Objectives* dataset of the *Creditor Reporting System* of the *OECD International Development Statistics Database*.\(^{123}\)

**ODA – renewable energy sector, % total allocable ODA**

Official Development Assistance allocated to renewable energy is expressed as a percentage of total sector-allocable ODA. Renewable energy-related aid is defined as activities that promote the development and deployment of energy generation facilities with reduced pressure on the environment. The renewable energy sector includes hydro-electric power plants, geothermal energy, solar energy, wind power, ocean power and biomass. This indicator is based on commitment data (not actual disbursements), which best reflect current policies by donors. OECD aggregate refers to OECD-DAC Members (25 countries).

Sector-allocable ODA comprises aid directed to social infrastructure and services, economic infrastructure and services, production sectors and multi-sector/cross cutting aid.\(^{124}\)

ODA data are obtained from the *Aid Activities Targeting Global Environmental Objectives* dataset of the *Creditor Reporting System* of the *OECD International Development Statistics Database*.\(^{125}\)

**ODA – water supply and sanitation sector, % total allocable ODA**

Official Development Assistance allocated to the water supply and sanitation sector is expressed as a percentage of total sector-allocable ODA. The water supply and sanitation sector refers to water sector policy and administrative

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\(^{120}\) Click [here](#) for more information on ODA methodology.

\(^{121}\) Published also on [OECD.stat > Development > Flows based on individual aid projects (CRS)](https://doi.org/10.1787/oaee-en)

\(^{122}\) Click [here](#) for more information on ODA methodology.

\(^{123}\) Published also on [OECD.stat > Development > Individual aid projects (CRS)](https://doi.org/10.1787/oaee-en)

\(^{124}\) Click [here](#) for more information on ODA methodology.

\(^{125}\) Published also on [OECD.stat > Development > Individual aid projects (CRS)](https://doi.org/10.1787/oaee-en)
management, water resources conservation, water supply and sanitation, basic
drinking water supply and basic sanitation, river basin' development, waste
management / disposal, education and training in water supply and sanitation.
This indicator is based on commitment data (not actual disbursements), which
best reflect current policies by donors. OECD aggregate refers to OECD-DAC
Members (25 countries).

Sector-allocable ODA comprises aid directed to social infrastructure and
services, economic infrastructure and services, production sectors and multi-
sector/cross cutting aid.\textsuperscript{126}

ODA data are obtained from the \textit{Aid Activities Targeting Global
Environmental Objectives dataset} of the \textit{Creditor Reporting System} of the
\textit{OECD International Development Statistics Database}.\textsuperscript{127}

Net ODA provided, \% GNI

Net official development assistance (ODA) provided is expressed as a
percentage of Gross National Income.

Official development assistance (ODA) is defined as government aid designed
to promote the economic development and welfare of developing countries.
Loans and credits for military purposes are excluded. The OECD maintains a
list of developing countries and territories; only aid to these countries counts
as ODA.

Net ODA provided consists of disbursements of loans made on concessional
terms (net of repayments of principal) and grants by official agencies of the
members of the Development Assistance Committee (DAC), and by non-DAC
countries to promote economic development and welfare in countries and
territories in the DAC list of ODA recipients. It includes loans with a grant
element of at least 25 percent (calculated at a rate of discount of 10 percent).

A long-standing ODA target is that developed countries should devote 0.7\% of
their gross national income to ODA. This indicator is measured as a percentage
of gross national income.

Net ODA disbursements as percentage of GNI are obtained from the \textit{Total
flows by donor (ODA + OOF + Private) dataset} of the \textit{OECD International
Development Statistics Database}\textsuperscript{128} and complemented with data taken from
the World Development Indicators of the World Bank.

\textsuperscript{126} Click \url{here} for more information on ODA methodology.

\textsuperscript{127} Published also on \url{OECD.stat > Development > Individual aid projects (CRS)}

\textsuperscript{128} Published also on \url{OECD.stat > Development > Flows by provider > Total flows by donor
(ODA+OOF+Private) (DAC)}
Environmental taxes and transfers

Environmentally related tax revenue, % GDP

Environmentally related tax revenue is expressed as a percentage of GDP. Environmentally related taxes include (i) energy products for transport purposes (petrol and diesel) and for stationary purposes (fossil fuels and electricity); (ii) motor vehicles and transport (one-off import or sales taxes, recurrent taxes on registration or road use and other transport taxes); (iii) waste management (final disposal, packaging and other waste-related product taxes); (iv) ozone-depleting substances and (v) other environmentally related taxes.

Tax data is obtained from the Instruments used for environmental policy dataset of the OECD Environment Database.¹²⁹

For more details on the underlying GDP data, see the metadata for Real GDP.

Environmentally related tax revenue, % total tax revenue

Environmentally related tax revenue is expressed as a percentage of total tax revenue. Environmentally related taxes include taxes to (i) energy products for transport purposes (petrol and diesel) and for stationary purposes (fossil fuels and electricity); (ii) motor vehicles and transport (one-off import or sales taxes, recurrent taxes on registration or road use and other transport taxes); (iii) waste management (final disposal, packaging and other waste-related product taxes); (iv) ozone-depleting substances and (v) other environmentally related taxes.

Tax data is obtained from the Instruments used for environmental policy dataset of the OECD Environment Database.³³⁰

Total tax revenue data is obtained from the Detailed Tax Revenue Tables of individual countries in the OECD Tax statistics Database, complemented with information from the Main National Accounts Tax Aggregates dataset from EUROSTAT, the Government Finance indicators of the Asian Development Bank, and the International Financial Statistics dataset from the International Monetary Fund.

Energy-related tax revenue, % total environmental tax revenue

Energy related tax revenue is expressed as a percentage of environmentally related tax revenue. Environmentally related taxes include (i) energy products for transport purposes (petrol and diesel) and for stationary purposes (fossil fuels and electricity); (ii) motor vehicles and transport (one-off import or sales taxes, recurrent taxes on registration or road use and other transport taxes); (iii) waste management (final disposal, packaging and other waste-related product taxes); (iv) ozone-depleting substances and (v) other environmentally related taxes.

¹²⁹ Published also on OECD.stat > Environment > Instruments used for environmental policy
³³⁰ Published also on OECD.stat > Environment > Instruments used for environmental policy
³³¹ Published also at OECD.stat > Public Sector, Taxation and Market Regulation > Taxation
Road transport-related tax revenue, % total environmental tax revenue

Tax revenue related to motor vehicles used in road transport is expressed as a percentage of all environmentally related tax revenue. Environmentally related taxes include (i) energy products for transport purposes (petrol and diesel) and for stationary purposes (fossil fuels and electricity); (ii) motor vehicles and transport (one-off import or sales taxes, recurrent taxes on registration or road use and other transport taxes); (iii) waste management (final disposal, packaging and other waste-related product taxes); (iv) ozone-depleting substances and (v) other environmentally related taxes.

Tax data is obtained from the Instruments used for environmental policy dataset of the OECD Environment Database.

Emissions priced above EUR 30 per tonne of CO₂, % total emissions

Emissions priced above EUR 30 per tonne of CO₂ are expressed as a percentage of total CO₂ emissions. The complement of this share shows the pricing gap, a summary measure of the difference between the actual and the benchmark rate of EUR 30. The actual (or effective) rates on CO₂ include carbon taxes, specific taxes on energy use (primarily excise taxes), and tradable emission permit prices (regardless of the permit allocation method).

The benchmark rate of EUR 30 is a low-end estimate of the damage that carbon emissions currently cause. Pricing emissions above EUR 30 does not guarantee that polluters pay for the full damage they cause, or that prices are sufficiently high to decarbonise economies. A price below EUR 30 does mean, however, that emitters are not directly confronted with the cost of emissions to society and that incentives for cost-effective abatement are too weak. For a more detailed description of the methodology please consult: http://oe.cd/ECR2018 and http://oe.cd/TEU2019


Emissions priced above EUR 60 per tonne of CO₂, % total emissions

Emissions priced above EUR 60 per tonne of CO₂ are expressed as a percentage of total CO₂ emissions. The complement of this share shows the pricing gap, a summary measure of the difference between the actual and the benchmark rate of EUR 60. The actual (or effective) rates on CO₂ include carbon taxes, specific taxes on energy use (primarily excise taxes), and tradable emission permit prices (regardless of the permit allocation method).

EUR 60 per tonne of CO₂ is a midpoint estimate of carbon costs in 2020, as well as a forward-looking low-end estimate of carbon costs in 2030. Rising benchmark values over time for carbon costs reflect that the marginal damage caused by one tonne of CO₂ increases with the accumulation of CO₂ in the atmosphere.

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132 Published also on OECD.stat > Environment > Instruments used for environmental policy
133 Published also on OECD.stat > Environment > Instruments used for environmental policy


**Petrol tax, USD per litre**

Tax rates per litre of petrol are expressed at constant 2015 USD using PPP. They are calculated as the arithmetic average of the household excise tax for the unleaded premium 95, unleaded premium 98, and unleaded regular petrol, and are deflated using the Consumer Price Index.

Data on tax rates are obtained from the *End-Use Prices datasets* of the [IEA Energy Prices and Taxes Statistics database](https://www.iea.org/statistics/database/).

**Petrol end-user price, USD per litre**

Household end-user price per litre of petrol is expressed at constant 2015 USD using PPP. It is calculated as the arithmetic average of the household end-user price for the unleaded premium 95, unleaded premium 98, and unleaded regular petrol, and is deflated using the Consumer Price Index.

Data on end-user prices are obtained from the *World Energy Prices in Transport dataset* of the [IEA World Energy Prices database](https://www.iea.org/statistics/database/).

**Diesel tax, USD per litre**

Tax rates per litre of diesel fuel are expressed at constant 2015 USD using PPP. They are the excise tax rates for households deflated by the Consumer Price Index.

Data on tax rates are obtained from the *End-Use Prices dataset* of the [IEA Energy Prices and Taxes Statistics database](https://www.iea.org/statistics/database/).

**Diesel end-user price, USD per litre**

Household end-user price per litre of diesel is expressed at constant 2015 USD using PPP. It is deflated using the Consumer Price Index.

Data on end-user prices are obtained from the *World Energy Prices in Transport dataset* of the [IEA World Energy Prices database](https://www.iea.org/statistics/database/).

**Residential electricity price, USD per kWh**

Residential electricity prices are expressed at constant 2015 USD using PPP per kilowatt-hour. They are the annual average of end-user prices for households. The price is deflated by the GDP deflator to facilitate comparison with the industry electricity price.

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134 Published also on [OECD.stat > Energy > Energy Prices and Taxes > End-Use Prices](https://www.oecd.org/statistics/database/)

135 Published also on [OECD.stat > Energy > Energy Prices and Taxes > End-Use Prices](https://www.oecd.org/statistics/database/)
Data on end-user prices are obtained from the *World Energy Prices Electricity dataset* of the *IEA World Energy Prices database*.

**Industry electricity price, USD per kWh**

Industry electricity prices are expressed at constant 2015 USD using PPP per kilowatt-hour. To ensure better comparability with data on residential prices, the price is deflated by the GDP deflator and includes VAT.

Data on end-user prices are obtained from the *World Energy Prices Electricity dataset* of the *IEA World Energy Prices database*.

**Mean feed-in tariffs for solar PV electricity generation, USD per kWh**

Feed-in tariffs (FITs) for solar photovoltaic are expressed at current USD per kWh.

Feed-in tariffs (FITs) are prevalent support policies for scaling up renewable electricity capacity. They are market-based economic instruments, which typically offer long-term contracts that guarantee a price to be paid to a producer of a pre-determined source of electricity per kWh fed into the electricity grid. The country-level values presented here are often aggregated at the sub-sector level as a mean value over many data points. For further details on this aggregation, please consult the source dataset metadata.

Data on feed-in tariffs are obtained from the *Renewable energy feed-in tariffs dataset* of the *OECD Environment database*.

**Mean feed-in tariffs for wind electricity generation, USD per kWh**

Feed-in tariffs (FITs) for wind are expressed at current USD per kWh.

Feed-in tariffs (FITs) are prevalent support policies for scaling up renewable electricity capacity. They are market-based economic instruments, which typically offer long-term contracts that guarantee a price to be paid to a producer of a pre-determined source of electricity per kWh fed into the electricity grid. The country-level values presented here are often aggregated at the sub-sector level as a mean value over many data points. For further details on this aggregation, please consult the source dataset metadata.

Data on feed-in tariffs are obtained from the *Renewable energy feed-in tariffs dataset* of the *OECD Environment database*.

**Fossil fuel consumer support, % energy-related tax revenue**

Support for the consumption of fossil fuels is expressed as a percentage of energy-related tax revenue. The consumer support estimate (CSE) includes both direct budgetary transfers and tax expenditure that provide a benefit or preference for fossil fuel consumption relative to other alternatives. This broad definition encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level. The information is collected from official government documents (e.g. budget statements, public accounts,......

Energy-related tax revenue refers to the revenue derived from taxes on energy products used for transport purposes (gasoline and diesel fuel) and for stationary purposes (e.g. power generation). Energy-tax revenue data are obtained from the Environmentally related tax revenue dataset of the OECD Environment Statistics database139.

Fossil fuel consumer support, % total tax revenue

Support for the consumption of fossil fuels is expressed as a percentage of total tax revenue. The consumer support estimate (CSE) includes both direct budgetary transfers and tax expenditure that provide a benefit or preference for fossil fuel consumption relative to other alternatives. This broad definition encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level. The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the Inventory of Support Measures for Fossil Fuels Database140. For further information, see: OECD (2018) OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018. The OECD weighted average excludes Iceland.

Total tax revenue data is obtained from the Detailed Tax Revenue Tables of individual countries in the OECD Tax statistics Database141, complemented with information from the Main National Accounts Tax Aggregates dataset from EUROSTAT, the Government Finance indicators of the Asian Development Bank, and the International Financial Statistics dataset from the International Monetary Fund.

Fossil fuel consumer support, % total fossil fuel support

Support for the consumption of fossil fuels is expressed as a percentage of total fossil fuel support. The consumer support estimate (CSE) includes both direct budgetary transfers and tax expenditure that provide a benefit or preference for fossil fuel consumption relative to other alternatives.

Total fossil fuel support comprises: Consumer Support Estimates (CSE), Producer Support Estimates (PSE) and General Services Support Estimate (GSSE), for petroleum, coal, natural gas and electricity. Support benefitting

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138 Inventory published on OECD.stat > Environment >Environmental policy > OECD Inventory of Support Measures for Fossil Fuels
139 See https://oe.cd/pine. Published also on OECD.stat > Environment > Environmental policy > Instruments used for environmental policy
140 Inventory published on OECD.stat > Environment >Environmental policy > OECD Inventory of Support Measures for Fossil Fuels
141 Published also at OECD.stat > Public Sector, Taxation and Market Regulation > Taxation
electricity is derived from the fossil-fuel component of measures providing electricity tariffs below cost recovery or annual average-cost pricing for electricity end-users. Support amounts benefitting fossil fuels as power generation inputs are aggregated under their respective fuel type, i.e. petroleum, coal or natural gas.

Measures that benefit individual producers are classified under the PSE, while those that benefit individual consumers are classified under the CSE. Measures benefitting producers or consumers collectively are classified under the GSSE, as are measures that do not increase current production or consumption of fossil fuels but that may do so in the future. The definition of support encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level.

The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the Inventory of Support Measures for Fossil Fuels Database. For further information, see: OECD (2018) OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018. The OECD weighted average excludes Iceland.

Fossil fuel producer support, % total fossil fuel support

Support for the production of fossil fuels is expressed as a percentage of total fossil fuel support. The producer support estimate (PSE) includes both direct budgetary transfers and tax expenditure that provide a benefit or preference to individual producers for fossil fuel production relative to other alternatives.

Total fossil fuel support comprises: Consumer Support Estimates (CSE), Producer Support Estimates (PSE) and General Services Support Estimate (GSSE), for petroleum, coal, natural gas and electricity. Support benefitting electricity is derived from the fossil-fuel component of measures providing electricity tariffs below cost recovery or annual average-cost pricing for electricity end-users. Support amounts benefitting fossil fuels as power generation inputs are aggregated under their respective fuel type, i.e. petroleum, coal or natural gas.

Measures that benefit individual producers are classified under the PSE, while those that benefit individual consumers are classified under the CSE. Measures benefitting producers or consumers collectively are classified under the GSSE, as are measures that do not increase current production or consumption of fossil fuels but that may do so in the future. The definition of support encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level.

The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the Inventory of Support Measures for Fossil Fuels.

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142 Inventory published on OECD.stat > Environment > Environmental policy > OECD Inventory of Support Measures for Fossil Fuels

Fossil fuel general services support, % total fossil fuel support

General services support is expressed as a percentage of total fossil fuel support. The general services support estimate (GSSE) includes both direct budgetary transfers and tax expenditure that provide a benefit or preference that benefit collectively producers and consumers, and other measures that do not increase current production or consumption relative to other alternatives, but that may do so in the future (i.e. public support for the construction of coal or natural-gas terminals, and government funding for sector-wide R&D in relation to fossil-fuel exploration and transformation).

Total fossil fuel support comprises: Consumer Support Estimates (CSE), Producer Support Estimates (PSE) and General Services Support Estimate (GSSE), for petroleum, coal, natural gas and electricity. Support benefitting electricity is derived from the fossil-fuel component of measures providing electricity tariffs below cost recovery or annual average-cost pricing for electricity end-users. Support amounts benefitting fossil fuels as power generation inputs are aggregated under their respective fuel type, i.e. petroleum, coal or natural gas.

Measures that benefit individual producers are classified under the PSE, while those that benefit individual consumers are classified under the CSE. Measures benefitting producers or consumers collectively are classified under the GSSE, as are measures that do not increase current production or consumption of fossil fuels but that may do so in the future. The definition of support encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level.

The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the Inventory of Support Measures for Fossil Fuels Database. For further information, see: OECD (2018) OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018. The OECD weighted average excludes Iceland.

Petroleum support, % total fossil fuel support

Petroleum support is expressed as a percentage of total fossil fuel support.

Total fossil fuel support comprises: Consumer Support Estimates (CSE), Producer Support Estimates (PSE) and General Services Support Estimate (GSSE), for petroleum, coal, natural gas and electricity. Support benefitting...
electricity is derived from the fossil-fuel component of measures providing electricity tariffs below cost recovery or annual average-cost pricing for electricity end-users. Support amounts benefitting fossil fuels as power generation inputs are aggregated under their respective fuel type, i.e. petroleum, coal or natural gas.

Measures that benefit individual producers are classified under the PSE, while those that benefit individual consumers are classified under the CSE. Measures benefitting producers or consumers collectively are classified under the GSSE, as are measures that do not increase current production or consumption of fossil fuels but that may do so in the future. The definition of support encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level.

The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the Inventory of Support Measures for Fossil Fuels Database\textsuperscript{145}. For further information, see: OECD (2018) OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018. The OECD weighted average excludes Iceland.

Coal support, % total fossil fuel support

Coal support is expressed as a percentage of total fossil fuel support.

Total fossil fuel support comprises: Consumer Support Estimates (CSE), Producer Support Estimates (PSE) and General Services Support Estimate (GSSE), for petroleum, coal, natural gas and electricity. Support benefitting electricity is derived from the fossil-fuel component of measures providing electricity tariffs below cost recovery or annual average-cost pricing for electricity end-users. Support amounts benefitting fossil fuels as power generation inputs are aggregated under their respective fuel type, i.e. petroleum, coal or natural gas.

Measures that benefit individual producers are classified under the PSE, while those that benefit individual consumers are classified under the CSE. Measures benefitting producers or consumers collectively are classified under the GSSE, as are measures that do not increase current production or consumption of fossil fuels but that may do so in the future. The definition of support encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level.

The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the Inventory of Support Measures for Fossil Fuels Database\textsuperscript{146}. For further information, see: OECD

\textsuperscript{145} Inventory published on OECD.stat > Environment >Environmental policy > OECD Inventory of Support Measures for Fossil Fuels

\textsuperscript{146} Inventory published on OECD.stat > Environment >Environmental policy > OECD Inventory of Support Measures for Fossil Fuels
Gas support, % total fossil fuel support

Natural gas support is expressed as a percentage of total fossil fuel support.

Total fossil fuel support comprises: Consumer Support Estimates (CSE), Producer Support Estimates (PSE) and General Services Support Estimate (GSSE), for petroleum, coal, natural gas and electricity. Support benefitting electricity is derived from the fossil-fuel component of measures providing electricity tariffs below cost recovery or annual average-cost pricing for electricity end-users. Support amounts benefitting fossil fuels as power generation inputs are aggregated under their respective fuel type, i.e. petroleum, coal or natural gas.

Measures that benefit individual producers are classified under the PSE, while those that benefit individual consumers are classified under the CSE. Measures benefitting producers or consumers collectively are classified under the GSSE, as are measures that do not increase current production or consumption of fossil fuels but that may do so in the future. The definition of support encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level.

The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the Inventory of Support Measures for Fossil Fuels Database. For further information, see: OECD (2018) OECD Companion to the Inventory of Support Measures for Fossil Fuels. The OECD weighted average excludes Iceland.

Electricity support, % total fossil fuel support

Electricity support is expressed as a percentage of total fossil fuel support.

Total fossil fuel support comprises: Consumer Support Estimates (CSE), Producer Support Estimates (PSE) and General Services Support Estimate (GSSE), for petroleum, coal, natural gas and electricity. Support benefitting electricity is derived from the fossil-fuel component of measures providing electricity tariffs below cost recovery or annual average-cost pricing for electricity end-users. Support amounts benefitting fossil fuels as power generation inputs are aggregated under their respective fuel type, i.e. petroleum, coal or natural gas.

Measures that benefit individual producers are classified under the PSE, while those that benefit individual consumers are classified under the CSE. Measures benefitting producers or consumers collectively are classified under the GSSE, as are measures that do not increase current production or consumption of fossil fuels but that may do so in the future. The definition of support encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level.

The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the Inventory of Support Measures for Fossil Fuels Database. For further information, see: OECD (2018) OECD Companion to the Inventory of Support Measures for Fossil Fuels. The OECD weighted average excludes Iceland.
fossil fuels but that may do so in the future. The definition of support encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level.

The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the *Inventory of Support Measures for Fossil Fuels Database*. For further information, see: OECD (2018) *OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018*. The OECD weighted average excludes Iceland.

**Total fossil fuel support, % total tax revenue**

Total fossil fuel support is expressed as percentage of total tax revenue.

Total fossil fuel support comprises: Consumer Support Estimates (CSE), Producer Support Estimates (PSE) and General Services Support Estimate (GSSE), for petroleum, coal and natural gas. Measures that benefit individual producers are classified under the PSE, while those that benefit individual consumers are classified under the CSE. Measures benefitting producers or consumers collectively are classified under the GSSE, as are measures that do not increase current production or consumption of fossil fuels but that may do so in the future. The definition of support encompasses policies that can induce changes in the relative prices of fossil fuels in the support estimate level.

The information is collected from official government documents (e.g. budget statements, public accounts, budget statistics, programme announcements or official government web sites) and compiled in the *Inventory of Support Measures for Fossil Fuels Database*. For further information, see: OECD (2018) *OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018*. The OECD weighted average excludes Iceland.

Total tax revenue data is obtained from the *Detailed Tax Revenue Tables* of individual countries in the *OECD Tax statistics Database*, complemented with information from the *Main National Accounts Tax Aggregates* dataset from EUROSTAT, the Government Finance indicators of the Asian Development Bank, and the *International Financial Statistics* dataset from the International Monetary Fund.

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148 Inventory published on [OECD.stat > Environment > Environmental policy > OECD Inventory of Support Measures for Fossil Fuels](http://www.oecd.org)
149 Inventory published on [OECD.stat > Environment > Environmental policy > OECD Inventory of Support Measures for Fossil Fuels](http://www.oecd.org)
150 Published also at [OECD.stat > Public Sector, Taxation and Market Regulation > Taxation](http://www.oecd.org)
Regulations and management

Terrestrial protected area, % land area

*Terrestrial protected area* is expressed as a percentage of total land area. Protected areas include all areas with a management category by the International Union for Conservation of Nature (IUCN). Areas with overlapping management categories are only included once to avoid double-counting. However, some countries report some protected areas as points (i.e. without the properly georeferenced location details), in these cases the overlaps cannot be identified or resolved. The total protected area presented here includes these areas reported as points. For further details on the methodology please consult *Indicators on Terrestrial and Marine Protected Areas: Methodology and Results for OECD and G20 countries.*

Data on protected areas are obtained from the *Protected Areas* dataset in the *OECD Environment Database.*

Marine protected area, % total exclusive economic zone

*Marine protected area* is expressed as a percentage of total exclusive economic zone. Protected areas include all areas with a management category by the International Union for Conservation of Nature (IUCN). Areas with overlapping management categories are only included once to avoid double-counting. However, some countries report some protected areas as points (i.e. without the properly georeferenced location details), in these cases the overlaps cannot be identified or resolved. The total protected area presented here includes these areas reported as points. The exclusive economic zone (EEZ) of a country includes, under the 1982 UN Convention on the Law of the Sea, 200 nautical miles from the coastline, or to the mid-point between coastlines where the EEZ of different countries would otherwise overlap. Some marine areas are shared between countries in joint regimes or there are unresolved overlapping claims to an area. In these cases, the entire relevant area (and protected areas therein) are attributed to all countries concerned. For further details on the methodology please consult *Indicators on Terrestrial and Marine Protected Areas: Methodology and Results for OECD and G20 countries.*

Data on protected areas are obtained from the *Protected Areas* dataset in the *OECD Environment Database.*

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151 Published also on OECD.stat > Environment > Biodiversity.
152 Published also on OECD.stat > Environment > Biodiversity.
Socio-economic context

Economic context

Real GDP, index 2000=100

The Gross Domestic Product is expressed as an index 2000=100. GDP measures market and government production and the associated economic activity. However, as a 'gross' measure, no account is taken of the depreciation neither of produced assets nor of the depletion of natural assets.

The main source for the GDP series is the Gross domestic product dataset of Aggregate National Accounts of the OECD National Accounts Statistics Database. Data for the Slovak Republic (prior to 1992) are estimated using the GDP growth rates from the latest OECD Economic Outlook. Data for Estonia (prior to 1992), Hungary (1990), Latvia (prior to 1995) and Russia (prior to 1995) are estimated based on the GDP growth rates taken from the World Bank. Data for Brazil are taken from the OECD Economic Outlook; data on Brazil prior to 1996 are estimated based on the GDP growth rates taken from the World Development Indicators of the World Bank.

Value added in agriculture, % of total value added

Value added in agriculture is expressed as a percentage of total value added. Agriculture corresponds to ISIC v3 divisions 1-5 and includes forestry, hunting as well as cultivation of crops and livestock production.

The main source for the value added series is the Gross domestic product dataset of Aggregate National Accounts of the OECD National Accounts Statistics Database. OECD Data are complemented using the value added data taken from the World Development Indicators of the World Bank.

Value added in industry, % of total value added

Value added in industry is expressed as a percentage of total value added. Industry corresponds to ISIC v3 divisions 10-45 and includes value added in mining, manufacturing, construction, electricity, water, and gas.

The main source for the value added series is the Gross domestic product dataset of Aggregate National Accounts of the OECD National Accounts Statistics Database. OECD Data are complemented using the value added data taken from the World Development Indicators of the World Bank.

Value added in services, % of total value added

Value added in services is expressed as a percentage of total value added. Services correspond to ISIC v3 divisions 50-99 and includes value added in...
wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, real estate services as well as financial intermediation.

The main source for the value added series is the *Gross domestic product dataset* of Aggregate National Accounts of the *OECD National Accounts Statistics Database*. OECD Data are complemented using the value added data taken from the World Development Indicators of the World Bank.

**Real GDP per capita**

The Gross Domestic Product per capita (USD/person) is expressed at constant 2015 USD PPP prices. GDP per capita measures a country’s economic wealth of the population of a nation. However, as a mean value it does not reflect income distribution. Moreover, it is a ‘gross’ measure of income and no account is taken of the depreciation neither of produced assets nor of the depletion of natural assets.

For more details on the underlying GDP data, see the metadata (above) for *Real GDP*.

**Population**

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the *World Population Prospects database* from the *United Nations*, complemented with data from the World Development Indicators of the World Bank.

**Labour tax revenue, % GDP**

Labour tax revenues are expressed as a percentage of GDP. Labour tax revenues include total (i.e. supranational + federal/central government + state/regional + local government) revenue from taxes on (i) income, profits and capital gains of individuals, (ii) social security contributions (i.e. taxes to employees, employers, self-employed or non-employed and other social security contributions that could not be allocated among these fields) and (iii) taxes on payroll and workforce.

Tax revenue data is obtained from the *Detailed Tax Revenue Tables* of individual countries in the *OECD Tax statistics Database*, complemented with information from the *Main National Accounts Tax Aggregates* dataset from EUROSTAT, and the *International Financial Statistics* dataset from the International Monetary Fund.

For more details on the underlying GDP data, see the metadata for *Real GDP*.

**Labour tax revenue, % total tax revenue**

Labour tax revenues are expressed as a percentage of total tax revenue. Labour tax revenues include total (i.e. supranational + federal/central government + state/regional + local government) revenue from taxes on (i) income, profits and capital gains of individuals, (ii) social security contributions (i.e. taxes to employees, employers, self-employed or non-employed and other social...
security contributions that could not be allocated among these fields) and (iii) taxes on payroll and workforce.

Tax revenue data is obtained from the Detailed Tax Revenue Tables of individual countries in the OECD Tax statistics Database\(^{159}\), complemented with information from the Main National Accounts Tax Aggregates dataset from EUROSTAT, and the International Financial Statistics dataset from the International Monetary Fund.

### Social context

#### Population

Population is expressed in thousand inhabitants. Population is defined here as all nationals present in or temporarily absent from a country, and foreign nationals permanently settled in the country.

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the World Population Prospects database from the United Nations, complemented with data from the World Development Indicators of the World Bank.

#### Population by age-groups, % total

Population is presented by the age groups 0-14, 15-64 and 65+, as a percentage of total population. Population is defined here as all nationals present in or temporarily absent from a country, and foreign nationals permanently settled in the country.

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the World Population Prospects database from the United Nations, complemented with data from the World Development Indicators of the World Bank.

#### Women, % total population

This indicator refers to the percentage of women from total population. Population is defined here as all nationals present in or temporarily absent from a country, and foreign nationals permanently settled in the country. Total population is the sum of men and women.

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the World Population Prospects database from the United Nations, complemented with data from the World Development Indicators of the World Bank.

#### Total fertility rate, children per woman

Total fertility rate is expressed as live births per woman. It represents the average number of live births a hypothetical cohort of women would have at the end of their reproductive period if they were subject during their whole lives to

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\(^{159}\) Published also at OECD.stat > Public Sector, Taxation and Market Regulation > Taxation
the fertility rates of a given period and if they were not subject to premature mortality.

The main data source is the *World Population Prospects database* from the *United Nations*, complemented with World Bank data.

**Life expectancy at birth**

Life expectancy at birth is expressed in years. It represents the average number of years of life expected by a hypothetical cohort of individuals who would be subject during all their lives to the mortality rates of a given period.

The main data source is the *World Population Prospects database* from the *United Nations*, complemented with World Bank data.

**Net migration**

Net migration is expressed in thousand individuals. It represents the number of immigrants minus the number of emigrants.

The data source is the *World Population Prospects database* from the *United Nations*.

**Population density, inhabitants per km²**

Population density is the number of inhabitants per square kilometre of total country area (persons/km²). Population is defined here as all nationals present in or temporarily absent from a country, and foreign nationals permanently settled in the country.

Population is the de facto population in a country, area or region as of 1 July of the year indicated. The main source of population data is the *World Population Prospects database* from the *United Nations*, complemented with data from the World Development Indicators of the World Bank.

Total area data are obtained from the *Land Resources dataset of the OECD Environment Database*. "Pub. 160" Published also on *OECD.stat > Environment > Land Resources*
Flags

B: Break in series
C: Confidential
E: Estimated
I: Incomplete
n: National estimate