

Indicators selected for inclusion in OECD Economic Surveys¹

CO₂ intensity

CO₂ intensity of GDP is calculated as kg of production-based CO₂ emissions per real GDP generated (kg/ USD). Included are CO₂ emissions from combustion of coal, oil, natural gas and other fuels. The emissions estimates are obtained from the IEA's database of CO₂ emissions from fuel combustion. Gross Domestic Product (GDP) is expressed at constant 2010 USD using PPP.

CO₂ intensity per capita is calculated using the *production-based* or the *demand-based* CO₂ emissions, expressed in tonnes of CO₂ per person. The difference between the production-based and the demand-based intensities determines whether the residents of a country are net importers or net exporters of CO₂. The estimates of *production-based CO₂ emissions* are obtained from the IEA's database of 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. The estimates of CO₂ emissions embodied in final domestic demand are obtained from the OECD dataset on *Carbon Dioxide Embodied in International Trade*, derived from the OECD Input-Output Database. Population series are compiled and revised from Census data. The source of population data is the *Historical population data and projections (1950-2060) dataset* of the *OECD Employment and Labour Market Statistics Database*.

Energy intensity

Energy intensity is calculated as ktOE of Total Primary Energy Supply per GDP (ktOE/USD). It reflects, at least partly, efforts to improve energy efficiency and to reduce emissions of greenhouse gases and air pollutants. TPES comprises production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes. Gross Domestic Product (GDP) is expressed at constant 2010 USD using PPP. Data on Total Primary Energy Supply (TPES) are obtained from the *World Energy Statistics Dataset* in the *IEA World Energy Statistics and Balances Database*.

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

Population exposure to air pollution

Population exposure to airborne fine particles (PM_{2.5}) has potentially the most significant adverse effects on health compared to other air pollutants. *Mean exposure to PM_{2.5}* is calculated as the mean annual outdoor PM_{2.5} concentration weighted by population residing in the relevant area. It is the concentration level, expressed in µg/m³, to which a typical resident is exposed throughout a year. PM_{2.5} concentrations are taken from van Donkelaar et al. (2016). They have been derived using satellite observations and a chemical transport model, calibrated to global ground-based measurements. Population data are taken from the Socioeconomic Data and Applications Center (SEDAC) at the NASA. For more details on the methodology see OECD (2017), *Air quality and health: Exposure to air pollution* dataset, *OECD Environment Statistics* (database).

¹ Note that these indicators draw on the OECD's work on Green Growth Indicators (OECD 2014, 2011). However, the exact definition of indicators used here might slightly differ.

To complement this indicator, a breakdown of population exposed to different levels of PM_{2.5} is also presented. The current WHO guidelines and interim targets for PM_{2.5} annual mean concentrations are used to present such breakdown of exposures. The guidelines and targets are summarized in the table below:

	PM _{2.5} (µg/m ³)	Basis for the selected level
Interim target-1 (IT-1)	35	These levels are associated with about a 15% higher long-term mortality risk relative to the AQG level.
Interim target-2 (IT-2)	25	In addition to other health benefits, these levels lower the risk of premature mortality by approximately 6% [2–11%] relative to the IT-1 level.
Interim target-3 (IT-3)	15	In addition to other health benefits, these levels reduce the mortality risk by approximately 6% [2-11%] relative to the IT-2 level.
Air quality guideline (AQG)	10	These are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to long-term exposure to PM _{2.5} .

Source: WHO (2006)²

Waste generation and recycling

Municipal waste is waste collected by or on behalf of municipalities. It includes 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. *Material recovery* includes recycling and composting. *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 for 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. Data are obtained from the *Municipal waste – Generation and Treatment dataset* of the *OECD Environment Database*.

Greening taxation

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) other environmentally related taxes (incl waste management – final disposal, packaging and other waste-related product taxes, ozone-depleting substances and other taxes). Tax data is obtained from the *Instruments used for environmental policy dataset* of the *OECD Environment Database*.

Tax rates of unleaded petrol and diesel are expressed in dollars per litre. Dollars are expressed in 2010 PPP USD, deflated using the Consumer Price Index. Data on tax rates are obtained from the *IEA Energy Prices and Taxes Statistics* databases.

² WHO (2006), WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide - Global update 2005 - Summary of risk assessment, World Health Organisation. http://www.who.int/phe/health_topics/outdoorair/outdoorair_aqg/en/.

Environment-related inventions

The *environment-related inventions per capita* are expressed per million residents (higher-value inventions/million persons).

The *percentage of environment-related technologies* is expressed as a percentage of all domestic inventions in all technologies. Changes in innovation in environment-related technologies 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 family³ 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.

Environmentally adjusted multifactor productivity (EAMFP)

The EAMFP framework extends the traditional productivity calculation, which accounts only for produced capital and labour inputs, and includes also the use of natural capital (14 types of fossil fuels and minerals: oil, gas, hard coal, soft coal, iron ore, bauxite, copper, lead, nickel, tin, zinc, gold, silver, phosphate) and the emission of pollutants as negative by-products (8 types of greenhouse gases and air pollutants: CO₂, CH₄, N₂O, SO_x, NO_x, NMVOC, CO, PM₁₀). The *Growth in environmentally adjusted multifactor productivity* (EAMFP) measures a country's ability to generate income from a given set of inputs, while accounting for the consumption of natural resources and production of undesirable environmental outputs. This allows the productivity performance to be assessed more accurately. The *growth contribution of natural capital* measures how much current income growth depends on natural resource use, and the *growth adjustment for pollution abatement* measures to what extent economic growth has been achieved at the expense of environmental quality. These indicators allow the sources of economic growth, and its long-run prospects, to be better assessed. For more details on the methodology and the underlying data sources see:

Cárdenas Rodríguez, M., I. Haščič and M. Souchier (2016), "Environmentally Adjusted Multifactor Productivity Growth: Methodology and Empirical Results for OECD and G20 Countries", *Green Growth Papers* No. 2016/04.

³ 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'