



Energy and Emissions per Value Added database

Users guide

International
Energy Agency



INTERNATIONAL ENERGY AGENCY

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This document provides information regarding the Energy and Emissions per Value Added database, developed by the International Energy Agency (IEA).

Last updated: March 2023

Please address your comments and inquiries to EnergyIndicators@iea.org. We are keen to receive user feedback in order to improve further editions of this database.

The sources for value added data are:

[OECD Annual National Accounts](#), Table 6A. Value added and its components by activity, ISIC rev4, 2023

[OECD Trade in Value Added](#) (TiVA) database, 2023

[UNSD National Accounts Official Country Data](#), Tables 2.4 and 2.5, 2023

The source for Energy consumption data is:

[IEA World Energy Balances](#), 2023 edition

The source of emissions data is:

[IEA Greenhouse Gas Emissions from Energy](#), 2023 edition

Acknowledgements, contributors and credits

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Energy and emissions statistics collected and compiled by other colleagues from the Energy Data Centre were instrumental for this database.

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Database overview

Value added data is the basis for analysing how economies are structured, and to develop sectoral energy intensity indicators – useful to monitor trends in the economic efficiency of various activities, as a complement to data based on physical indicators.

The IEA has developed the current database to provide the most complete coverage of sectoral value-added data, at current and constant prices, and associated energy efficiency indicators. This database merges value added data from three databases (OECD and UNSD National accounts, and OECD Trade in Value Added - TiVA) with IEA energy data.

The value-added data is published up to 2-digits for 99 ISIC (Internal Standard Industrial Classification of All Economic Activities) Rev.4 divisions and 34 aggregated divisions for all OECD countries, from year 2000 to year 2021, and will be updated at least once a year. The data also covers 100 non-OECD countries and 12 country groups, offering sub-sectoral data for 3 ISIC Rev.4 divisions (2-digits) for 64 non-OECD countries. For more aggregated data, the coverage increases to 88 countries and 20 of the 21 ISIC Rev.4 sections.

Why “value added”?

Value added is useful to analyse the structure of economies, and can be used as a proxy of activity data, homogeneously across all sectors. Value added data at sectoral level provide a more granular picture of economic activity compared to GDP.

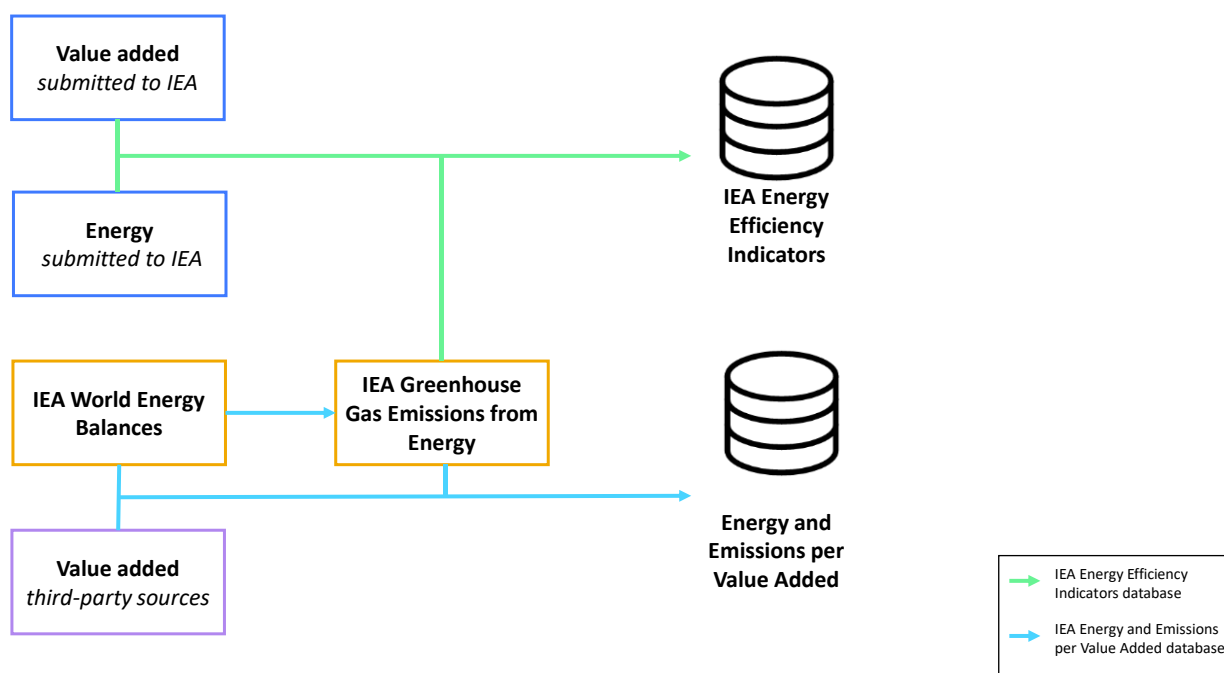
Coupled with energy consumption data, energy intensity indicators can be derived from value added, offering a better geographical coverage (global) compared to commodity data, and homogeneous indicators in terms of unit across all sectors. Value added is mostly consistent with energy balances in terms of sectoral boundaries, as both are defined following ISIC classification, except for few exceptions¹.

How this database compares with the Energy Efficiency Indicators database?

The IEA Energy Efficiency Indicators (EEI) database contains annual end use energy consumption by energy product, end use carbon emissions and associated indicators across four sectors of final consumption. In the EEI database a wide collection of indicators is available. Some indicators are computed by using key sectoral activity data, for example passenger-kilometer energy intensity for transport, others are computed using value-added energy intensity.

¹ Value added should be preferred over total sales as it excludes intermediary products consumption. The IEA World Energy Balances only account for energy consumption of fuel used within economic activity, excluding embedded energy at upstream level for producing intermediary goods. Value added has consequently a definition aligned with energy balances definitions, avoiding double counting of either energy or monetary flows.

There is therefore an overlap between the Energy and Emissions per Value Added database and the EEI database where indicators are calculated using value added as activity, but it is important to note that sources and coverage are different.



EEI value added and energy consumption data are compiled through direct submissions to IEA or through official submission to partner organizations, while for the present database value added data are extracted from third party sources (detailed in “[Data Sources](#)”), and energy and carbon data are derived from global IEA databases.

Although value added and energy data from those sources should mostly be consistent, some minor misalignments may persist and as a result discrepancies may exist between the two databases for overlapping indicators.

Description of the interactive Excel file

The interactive excel file offers a selection of value added and indicators time series to fit several analysis purposes. Three types of variables are included:

- ISIC section value added;
- ISIC division value added;
- Derived energy and carbon indicators.

For each type of variable data are available in tabular format in data tabs, and several visualization tabs are included.

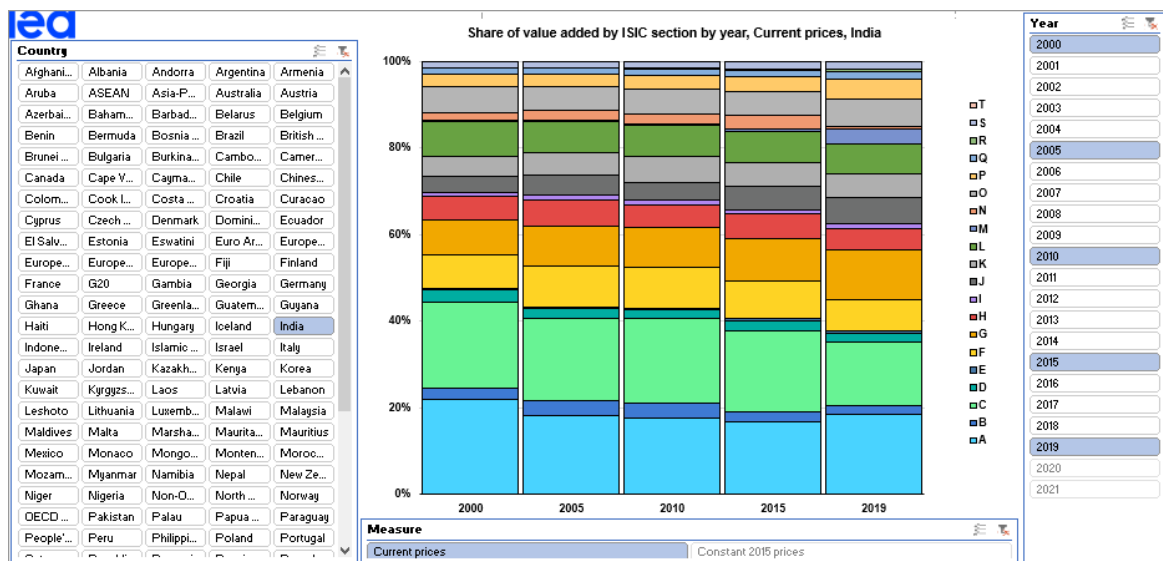
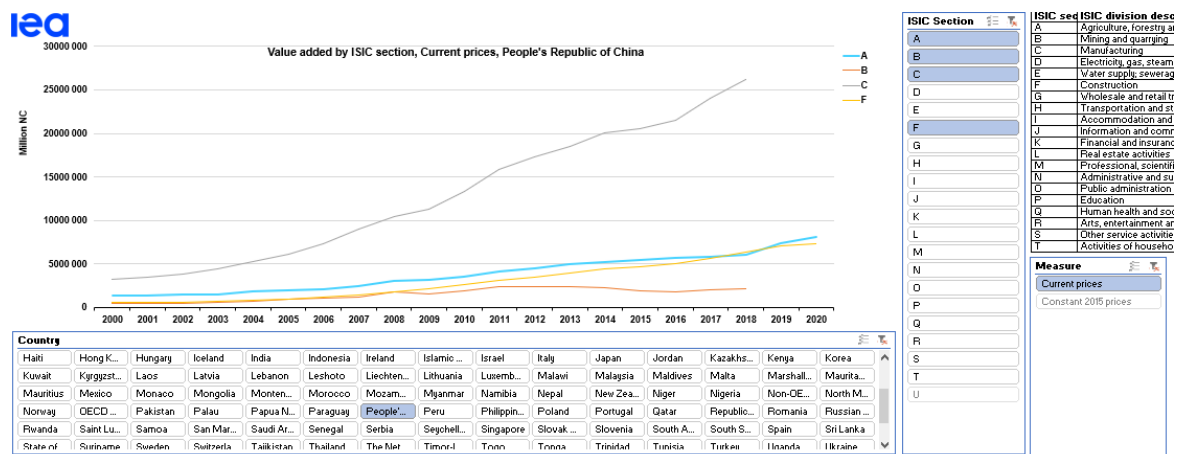
ISIC section level

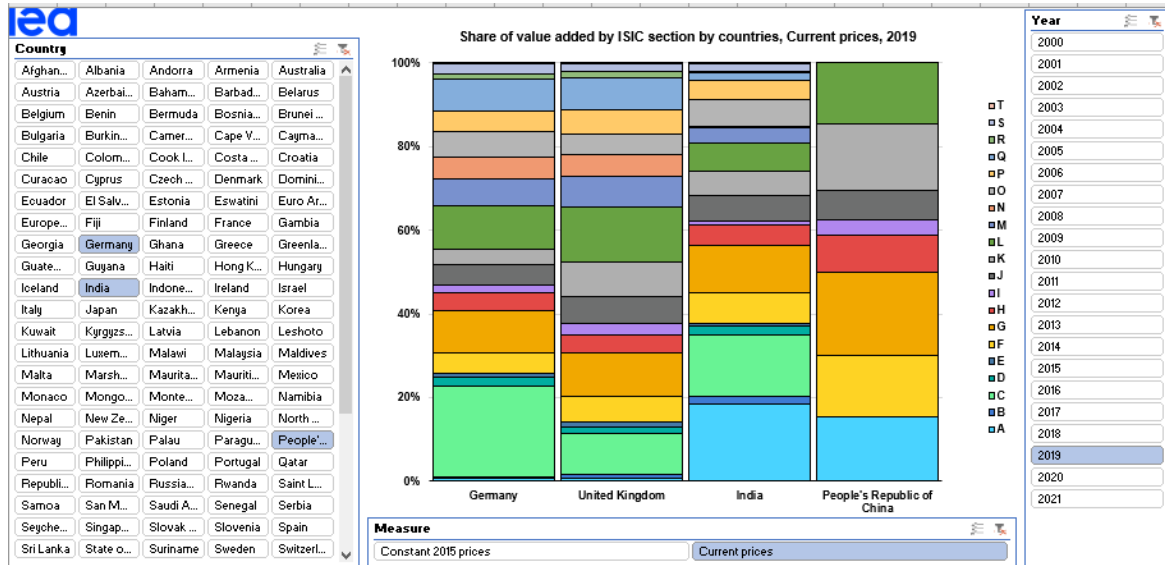
Value added data at ISIC section level are relevant for analysis of structure of country economies.

Three visualisation tabs are available:

- Time series: value added by ISIC section for selected country. This chart helps access and visualise absolute value-added data for selected years, as well as to compare their evolution across sectors over time.
- Structure by year: share of value added by ISIC section for selected country. Changes in the economy structure can be easily visualised, both between years close in time or over a longer period of time.
- Structure by country: share of value added by ISIC section for selected year. Countries can be compared with no limits to number of countries to include.

All charts can be plotted using either current prices (preferred for structural analysis), or constant prices.



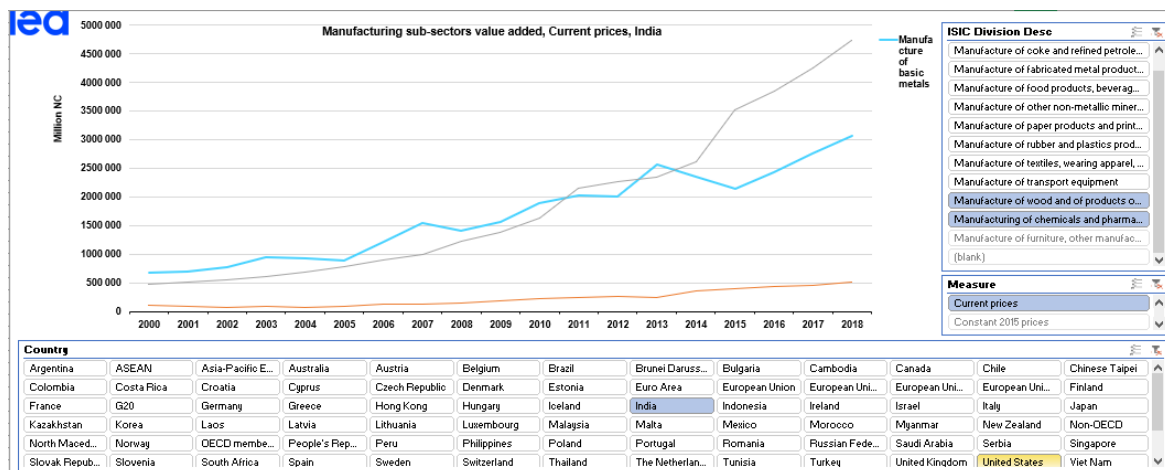


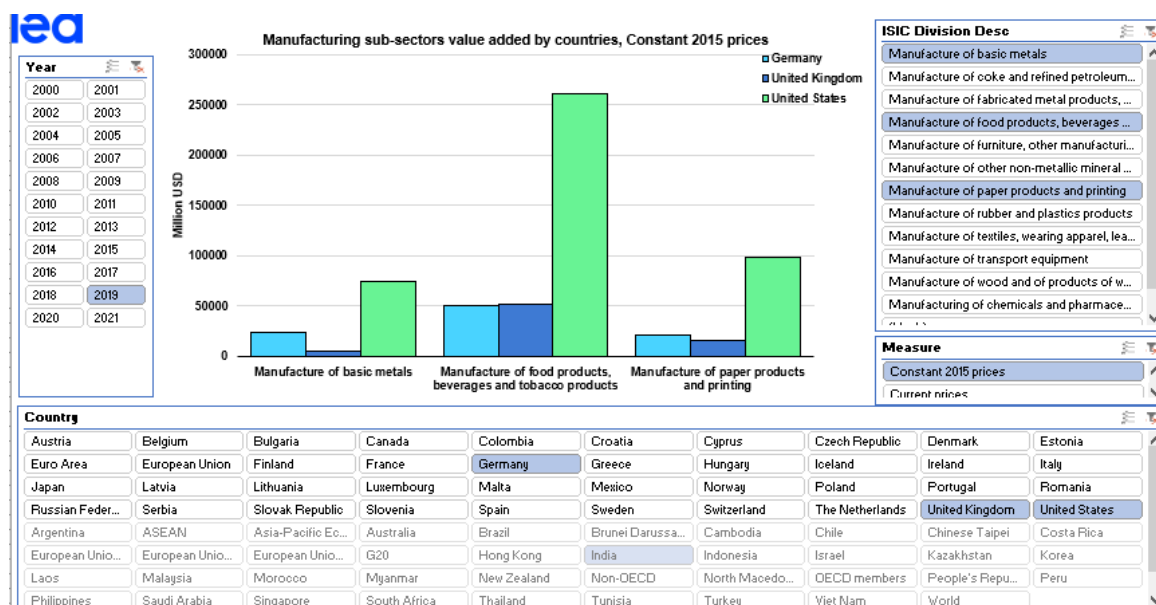
ISIC division level

Two visualisation tabs are available:

- Time series: value added by ISIC division for selected country. This chart helps to access and visualise absolute value-added data for selected years, as well as to compare their evolution across sectors over time.
- Manufacturing by country: manufacturing sub-sectors value added by countries.

All charts can be plotted using either current prices or constant prices.





Indicators

Two types of indicators are available:

- Per value added energy intensity, defined as energy per unit of value added (MJ/USD PPP 2015)
- Per value added carbon intensity, defined as carbon emissions per unit of value added (kgCO₂/USD PPP 2015)

Indicator

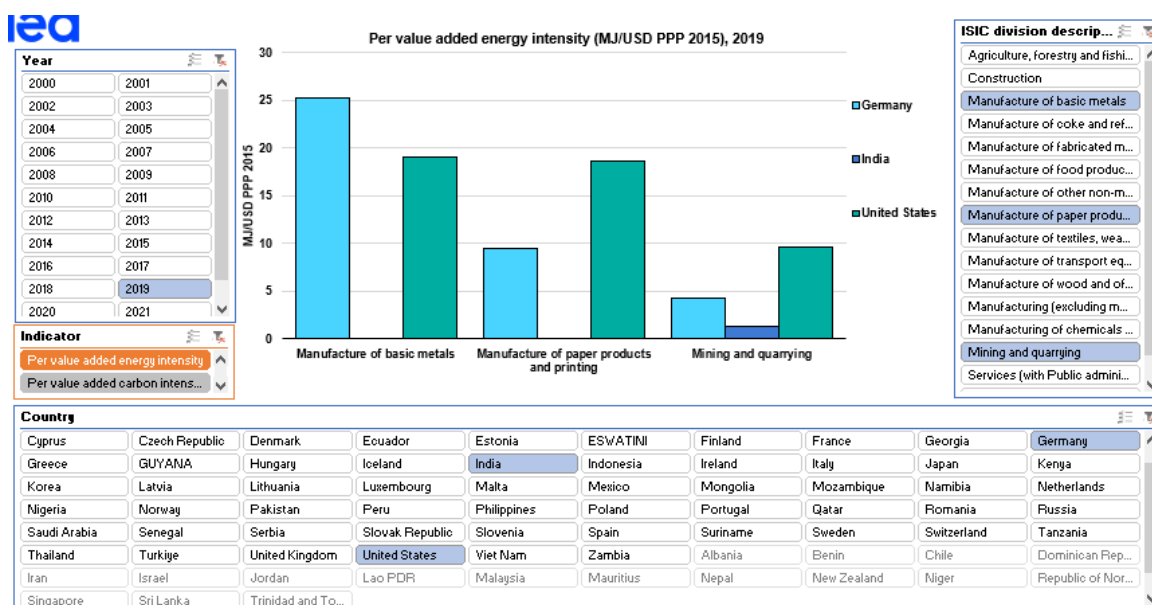
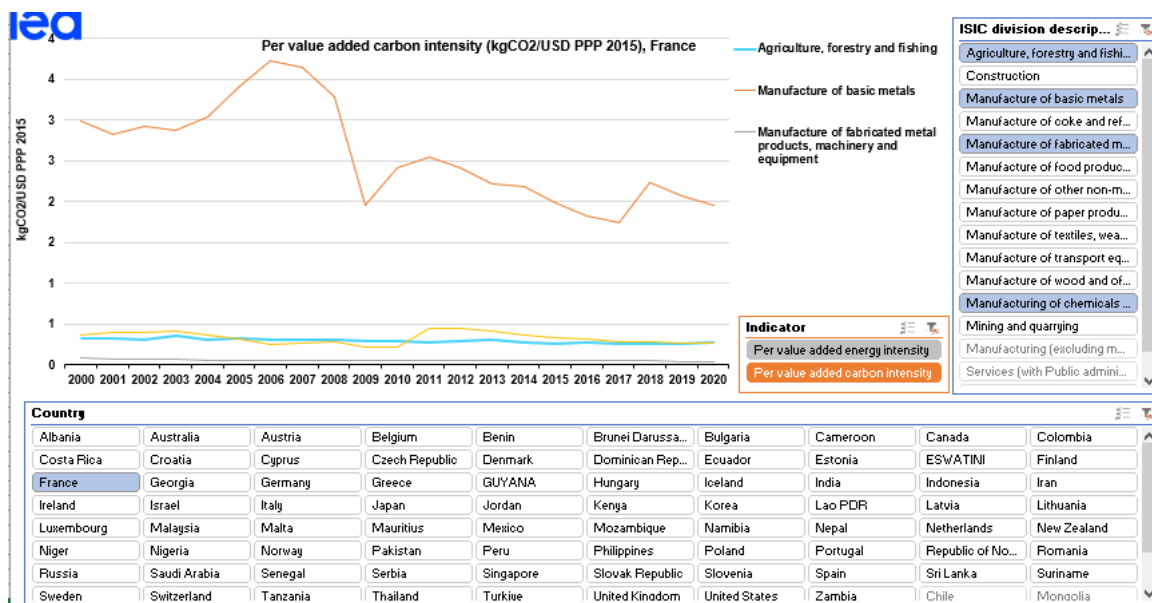
Per value added energy intensity

Per value added carbon intensity

Data are plotted in two visualisation tabs:

- Time series: per value added indicator over time for selected country
- Indicators by country: per value added indicator in selected year across countries and sub-sectors.

Value added is expressed using constant levels at 2015 prices and Power Purchase Parity (PPP).



Data sources

The value-added data uses the following three sources:

[Value-added and its components by activity, ISIC](#) published by the OECD within its annual national accounts data;

[Trade in Value Added \(TiVA\) database](#) published by the OECD;

[National accounts official country data](#) published by the UNSD.

Energy data sourced from [IEA World Energy Balances](#).

Emissions data are sources from [IEA Greenhouse Gas Emissions from Energy](#).

For further detailed regarding selection of sources, please refer to the appendix document.

OECD - Annual national accounts

The OECD National Accounts Statistics database includes annual and quarterly data of a wide range of areas, such as gross domestic product (GDP) with its three approaches: expenditure based, output based and income based; gross domestic product (GDP) per capita; disposable income; population and employment; PPPs and exchange rates; general government accounts; financial accounts flows and stocks and central government debt for OECD countries and non-member economies.

One of its datasets is "[Value-added and its components by activity, ISIC](#)". The data are compiled from statistics reported to the OECD by Member countries in their answers to annual national accounts questionnaire.

This source has been selected as first choice when data are available from other sources because of its very fine granularity.

The value-added data are expressed in national currency (millions), in current prices and constant prices (national base year, previous year prices and OECD base year i.e. 2015).

OECD - Trade in Value Added

The Trade in Value Added (TiVA) database is a collection of measures that can provide insights into global production networks and supply chains beyond what is possible with conventional trade statistics.

The [TiVA database](#) contains a selection of principal indicators that track the origins of value added in exports, imports and final demand. The 2018 edition covers 64 economies (including all OECD, EU and G20 countries and most East and Southeast Asian economies) as well as region aggregates. Indicators are available for 36 industries within a hierarchy based on ISIC Rev. 4.

For most OECD countries, value added by industry data are drawn from the SNA08 / ISIC Rev.4 version of the [OECD's STAN Database](#) or [SNA Database](#) adapted to the industry classification of the Inter-Country Input-Output (ICIO) system. For other countries, sources include UNSD SNA08 and Eurostat ESA 2010 databases as well as SNA data published by national statistical institutes.

Although TiVA database is meant to undertake some analysis related to trade, this has been selected as source for value added thanks to its very broad coverage, in part thanks to estimates, as well as the classification used, requiring minimal data manipulation. TiVA data complements OECD National Accounts when data are not available.

The value-added is expressed in millions U.S. dollars at current prices.

UNSD - National accounts official country data

The National Accounts Main Aggregates Database presents a series of analytical national accounts tables from 1970 onwards for more than 200 countries and areas of the world. It is the

product of a global cooperation effort between the Economic Statistics Branch of the United Nations Statistics Division, international statistical agencies and the national statistical services of these countries. The database is updated in December of each year with newly available national accounts data for all countries and areas.

If a full set of official data is not reported for a specific country, estimation procedures are employed to obtain estimates for the entire time series. For estimation purposes, other data sources are analysed to gather supplementary data on the national accounts of a country. The data gathered are then either used directly or estimation procedures are applied to obtain a complete and consistent set of time series of main national accounts aggregates and their related growth rates and indices. As official data are not always available for use in the database, the sources and methods used for estimations should be taken into consideration. Metadata for each country describing the methods and sources used for all data included in the database are available via the [Meta-Data](#) link.

Two tables from this database present value-added data:

Table 2.4: [Value added by industries at current prices \(ISIC Rev. 4\)](#)

Table 2.5: [Value added by industries at constant prices \(ISIC Rev. 4\)](#)

The data are published in local currency unit (LCU).

Date of latest extraction of the data

All the data from all sources were extracted on the 8th of September 2022.

Classification system

This database present data referring to the 4th revision of the official Internal Standard Industrial Classification of All Economic Activities (ISIC).

Detailed information on ISIC can be found in the [statistical paper](#) published by the UN.

Geographical coverage

This document is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. In this publication, 'country' refers to country or territory, as case may be.

Countries and territories

ISO 3-digits	Country/Territory	Methodology	Fiscal year
AFG	Afghanistan		
ALB	Albania	SNA 2008	Calendar year
AND	Andorra		
ARG	Argentina	Not available	Not available
ARM	Armenia		
ABW	Aruba		
AUS	Australia	SNA 2008	Fiscal year beginning on the 1st July
AUT	Austria	SNA 2008	Calendar year
AZE	Azerbaijan		
BHS	Bahamas		
BRB	Barbados		
BLR	Belarus		
BEL	Belgium	SNA 2008	Calendar year
BEN	Benin		
BMU	Bermuda		
BIH	Bosnia and Herzegovina		
BRA	Brazil	SNA 2008	Calendar year
VGB	British Virgin Islands		
BRN	Brunei Darussalam	Not available	Not available
BGR	Bulgaria	SNA 2008	Calendar year
BFA	Burkina Faso		
KHM	Cambodia	Not available	Not available
CMR	Cameroon		
CAN	Canada	SNA 2008	Calendar year
CPV	Cape Verde	SNA 1993	Calendar year
CYM	Cayman Islands		
CHL	Chile	SNA 2008	Calendar year
CHN	China	Not available	Not available
TWN	Chinese Taipei	Not available	Not available
COL	Colombia	SNA 2008	Calendar year
COK	Cook Islands		
CRI	Costa Rica	SNA 2008	Calendar year
HRV	Croatia	SNA 2008	Calendar year
CUW	Curacao		
CYP	Cyprus	SNA 2008	Calendar year
CZE	Czech Republic	SNA 2008	Calendar year
DNK	Denmark	SNA 2008	Calendar year
DOM	Dominican Republic		

ECU	Ecuador		
SLV	El Salvador		
EST	Estonia	SNA 2008	Calendar year
SWZ	Eswatini		
FJI	Fiji		
FIN	Finland	SNA 2008	Calendar year
FRA	France	SNA 2008	Calendar year
GMB	Gambia		
GEO	Georgia		
DEU	Germany	SNA 2008	Calendar year
GHA	Ghana		
GRC	Greece	SNA 2008	Calendar year
GRL	Greenland		
GTM	Guatemala		
GUY	Guyana		
HKG	Hong Kong	SNA 2008	Calendar year
HUN	Hungary	SNA 2008	Calendar year
ISL	Iceland	SNA 2008	Calendar year
IND	India	Not available	Not available
IDN	Indonesia	Not available	Not available
IRL	Ireland	SNA 2008	Calendar year
ISR	Israel	Not available	Not available
ITA	Italy	SNA 2008	Calendar year
JPN	Japan	SNA 2008	Calendar year
JOR	Jordan		
KAZ	Kazakhstan	Not available	Not available
KEN	Kenya		
KOR	Korea	SNA 2008	Calendar year
KGZ	Kyrgyzstan		
LAO	Laos	Not available	Not available
LVA	Latvia	SNA 2008	Calendar year
LBN	Lebanon		
LSO	Lesotho		
LIE	Liechtenstein		
LTU	Lithuania	SNA 2008	Calendar year
LUX	Luxembourg	SNA 2008	Calendar year
MWI	Malawi		
MYS	Malaysia	Not available	Not available
MDV	Maldives		
MLT	Malta	SNA 2008	Calendar year
MRT	Mauritania		
MUS	Mauritius		
MEX	Mexico	SNA 2008	Calendar year
MCO	Monaco		

MNG	Mongolia		
MNE	Montenegro		
MAR	Morocco	Not available	Not available
MOZ	Mozambique		
NAM	Namibia		
NZL	New Zealand	SNA 2008	Fiscal year beginning on the 1st April
NER	Niger		
NGA	Nigeria		
MKD	North Macedonia	SNA 2008	Calendar year
NOR	Norway	SNA 2008	Calendar year
PAK	Pakistan		
PLW	Palau		
PRY	Paraguay		
PER	Peru	SNA 2008	Calendar year
PHL	Philippines	Not available	Not available
POL	Poland	SNA 2008	Calendar year
PRT	Portugal	SNA 2008	Calendar year
QAT	Qatar		
MDA	Republic of Moldova		
ROU	Romania	SNA 2008	Calendar year
RUS	Russia	SNA 2008	Calendar year
RWA	Rwanda		
WSM	Samoa		
SMR	San Marino		
SAU	Saudi Arabia	Not available	Not available
SEN	Senegal		
SRB	Serbia	SNA 2008	Calendar year
SYC	Seychelles		
SGP	Singapore	Not available	Not available
SVK	Slovak Republic	SNA 2008	Calendar year
SVN	Slovenia	SNA 2008	Calendar year
ZAF	South Africa	Not available	Not available
SSD	South Sudan		
ESP	Spain	SNA 2008	Calendar year
LKA	Sri Lanka		
PSE	State of Palestine		
SWE	Sweden	SNA 2008	Calendar year
CHE	Switzerland	SNA 2008	Calendar year
TZA	Tanzania		
THA	Thailand	Not available	Not available
NLD	The Netherlands	SNA 2008	Calendar year
TLS	Timor-Leste		

TON	Tonga		
TTO	Trinidad and Tobago		
TUN	Tunisia	Not available	Not available
TUR	Turkey	SNA 2008	Calendar year
UGA	Uganda		
UKR	Ukraine		
GBR	United Kingdom	SNA 2008	Calendar year
USA	United States	SNA 2008	Calendar year
UZB	Uzbekistan		
VUT	Vanuatu		
VNM	Viet Nam	Not available	Not available
ZMB	Zambia	SNA 2008	Calendar year
	Zanzibar		

Aggregates

Aggregate
ASEAN
Asia-Pacific Economic Cooperation
Euro area
Euro area (12 countries)
European Union
European Union (13 countries)
European Union (15 countries)
European Union (28 countries)
G20
Non-OECD
OECD members
World

Methodology

Selection of ISIC level

Value added at ISIC section level (1-digit) has the best coverage and is necessary for basic economy structural analysis.

Value added at ISIC division level (2-digits) is required for deriving manufacturing sub-sectors energy efficiency indicators.

Value added at ISIC 3-digits and 4-digits levels are available in some of the sources but with very limited coverage (refer to detailed availability table), as a result 1 and 2 digits levels are included in the database.

Aggregation of the value-added data

To combine the value-added data with the energy data, the value-added data were aggregated to sectors that are comparable to those with available energy statistics (see below).

The defined aggregates are:

01-03	Agriculture, forestry and fishing
07-09	Mining and quarrying of non-energy producing products and mining support service activities
07-08	Mining and quarrying of non-energy producing products
10-18_20-32	Manufacturing (excluding manufacture of coke and refined petroleum products)
10-12	Manufacture of food products, beverages, tobacco products
13-15	Manufacture of textiles, wearing apparel, leather and related products
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
17-18	Paper & Printing
19	Manufacture of coke and refined petroleum products
20-21	Manufacture of chemicals and chemical products & basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastics products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25-28	Manufacture of fabricated metal products, machinery and equipment
29-30	Manufacture of motor vehicles, trailers, other transport equipment
31-32	Manufacture of furniture & Other manufacturing
35-36	Electricity, gas, steam, air conditioning, and water supply
41-43	Construction

33_36-39_45-47_52-53_55-56_58-66_68-75_77-82_84_85-88_90-96_99	Services (with Public administration and defense; compulsory social security - ISIC 84)
33_36-39_45-47_52-53_55-56_58-66_68-75_77-82_85-88_90-96_99	Services (without Public administration and defense; compulsory social security - ISIC 84)

The aggregates are calculated only if all the components from the aggregate are available.

Unit of measure

The value-added data published by the OECD in the national accounts and by the UNSD are published in national currency while the value-added data published by the OECD in the database TiVA is published in U.S. dollars. Thus, to harmonise the data, a conversion is needed.

All data points are converted in the database to be expressed in national currency, USD prices and prices using Purchasing Power Parities (PPP). Current prices values are converted using country and year specific conversion factors. Constant prices values are converted using country conversion factors for the reference year.

To allow comparison across countries, value-added data are converted into purchasing power parity (PPP), based on the same database as for the conversion in U.S. dollars for the OECD countries, i.e. "[PPPs and exchange rates](#)".

Exchange rates

Market exchange rates are extracted from OECD [Main Economic Indicators \(MEI\)](#) for OECD countries, and from IMF [International Finance Statistics \(IFS\)](#) for non-OECD countries.

Purchasing Power Parities (PPP)

Purchasing Power Parities (PPP) are the rates of currency conversion that equalize the purchasing power of different currencies by eliminating the differences in price levels between countries. In their simplest form, PPPs are simply price relatives that show the ratio of the prices in national currencies of the same good or service in different countries.²

Caution should be taken when analyzing prices using PPP rates, especially as those are rates estimated at GDP level in the framework of International Comparison Program (ICP)³, and used to do conversions to constant PPP unit (using industry specific deflators), as PPPs for individual industries are not available. Furthermore, those are estimated on the production side, instead of expenditure side. This methodology is however deemed to offer a better proxy of volumes output compared to using market exchange rates, not accounting for any adjustment.

PPP figures are derived from IMF [World Economic Outlook \(WEO\)](#) and [World Bank World Development Indicators \(WDI\)](#).

² <https://www.oecd.org/sdd/purchasingpowerparities-frequentlyaskedquestionsfaqs.htm>

³ [PPPs for policy making: a visual guide to using data from the ICP \(worldbank.org\)](#)

Reference period

The reference period for the value-added varies by source and country. However, the majority of the value-added data is based on the calendar year (about 77%), while the rest is based on a fiscal year.

Re-referencing of the reference year for constant prices

Reference years of value-added data at constant prices vary across data sources and within the same data source. Therefore, deflators are used to re-reference the data to 2015, in line with OECD reference year.

Deflators are extracted from the OECD database '[6A. Value added and its components by activity, ISIC rev4](#)'.

When deflators are not published, data are re-referenced when data for current and constant prices are available, using the following formula:

$$Deflator_{year=n}^{base\ year=y} = 100 * \frac{Current_n}{Constant_n^{base\ year=y}}$$

$$Constant_n^{2015} = Constant_n^{base\ year=y} * \frac{Deflator_{2015}^{base\ year=y}}{Deflator_y^{base\ year=y}}$$

$$Constant_n^{2015} = Constant_n^{base\ year=y} * \frac{Current_{2015}}{Constant_{2015}^{base\ year=y}}$$

For example, re-referencing India ISIC 01 division national currency value added in year 2019 from reference year 2011 to 2015:

$$Constant_{2019}^{2015} = Constant_{2019}^{2011} * \frac{Current_{2015}}{Constant_{2015}^{2011}} = 16773 * \frac{19104}{13890} = 23069\ bn\ INR$$

As summary, data in year n are converted as per below table:

	Current	Constant
National currency	$= NC_n$	$= NC_n * \frac{deflator_{ref_year}}{deflator_n}$
USD	$= \frac{NC_n}{Exchange_rate_n}$	$= \frac{NC_n}{Exchange_rate_{ref_year}} * \frac{deflator_{ref_year}}{deflator_n}$
PPP	$= \frac{NC_n}{PPP_rate_n}$	$= \frac{NC_n}{PPP_rate_{ref_year}} * \frac{deflator_{ref_year}}{deflator_n}$

Derivation of energy indicators

Following the framework set out in the IEA [Energy Efficiency Indicators Fundamentals on Statistics](#), energy intensity expressed in energy final consumption per unit of Value Added is a proxy of energy efficiency indicators, useful in the absence of physical efficiency indicators, and to compare inhomogeneous sectors across each other.

Figure 6.5 • Pyramid of industry indicators

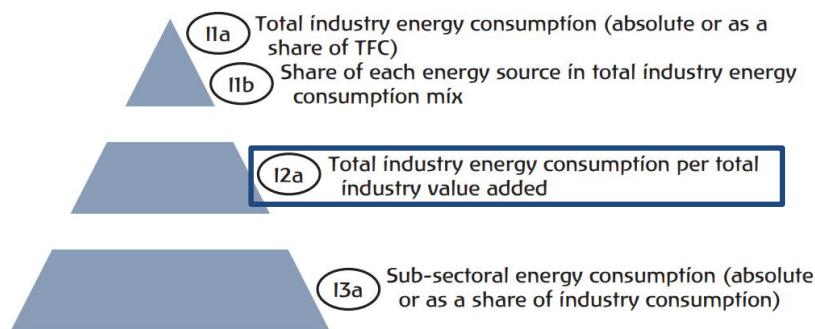
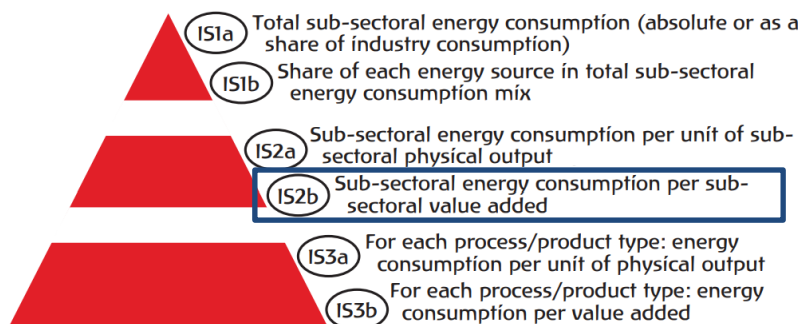


Figure 6.6 • Pyramid of industry sub-sectors indicators



Value added data from this database using unit constant prices with 2015 reference period are coupled with energy consumption data from [World Energy Balances](#).

The IEA World Energy Balances follows the [International Recommendations for Energy Statistics](#) classification, requiring some mapping to the ISIC rev.4 classification. The mapping used is defined below:

ISIC	Balances shortnames	Note
01-03	AGRICULT + FISHING	
05-09	MINING – EMINES – EOILGASEX	
10-12	FOODPRO	
10-18_20-32	CHEMICAL + IRONSTL – EBLASTFUR – ECOKEOVS + FOODPRO + MACHINE + NONFERR + NONMET + PAPERPRO – TBLASTFUR – TCOKEOVS + TEXTILES + TRANSEQ + WOODPRO	ISIC 31-32 is included in Balances INONSPEC flow.
13-15	TEXTILES	

16	WOODPRO	
17-18	PEPERPRO	
19	EREFINER	
20-21	CHEMICAL	
22_31-32	INONSPEC	Balances also includes non-specified/non-allocated industry consumption in INONSPEC.
23	NONMET	
24	IRONSTL – EBLASTFUR – ECOKEOVS – TBLASTFUR – TCOKEOVS	
25-28	MACHINE	
29-30	TRANSEQ	
Services (84)	COMMPUB	COMMPUB includes public administration (ISIC 84) except defence (ISIC 8422)
Services (w/ 84)	COMMPUB	COMMPUB includes public administration (ISIC 84) except defence (ISIC 8422)
41-43	CONSTRUC	

Derivation of emissions indicators

Similarly to energy indicators, emissions indicators are computed coupling value added data with emissions from [Greenhouse Gas Emissions from Energy](#) database. This database is based on and follow same structure as World Energy Balances.