Energy Technology RD&D Budgets

May 2022 Edition

Database documentation

International Energy Agency

INTERNATIONAL ENERGY AGENCY

The IEA examines the full spectrum of energy issues including oil, gas and coal supply and demand, renewable energy technologies, electricity markets, energy efficiency, access to energy, demand side management and much more. Through its work, the IEA advocates policies that will enhance the reliability, affordability and sustainability of energy in its 31 member countries, 10 association countries and beyond.

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Thailand

This publication and any map included herein are 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.

This document provides information regarding the 2022 edition of the IEA *Energy Technology RD&D Budgets* database. The data files and documentation are available at: https://www.iea.org/data-and-statistics/data-product/energy-technology-rd-and-d-budget-database-2

For more information about trends and data please visit: https://www.iea.org/reports/energy-technology-rdd-budgets-overview.

For visualization of country-level data through interactive menus, please visit: https://www.iea.org/articles/energy-technology-rd-and-d-budgets-data-explorer

Please address your comments and inquiries to RDD@iea.org.

Please note that all IEA data are subject to the following terms and conditions found on the IEA website: www.iea.org/t&c/.

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Changes from the last edition

Geographical coverage

Lithuania became an IEA member in February 2022, therefore it is included in the IEA aggregate for data starting in 1990 and for the entire time series.

Private RD&D data

The 2021 edition has also been expanded to include data for private RD&D spending for a selection of countries that have carried out surveys and submitted the results to the IEA. Details on the coverage of those surveys can be found in the relevant notes for each country. Such data are included across the outputs in different formats.

Database files

The published database now includes the output files in csv format.

Database structure

The database *Energy Technology RD&D Budgets* includes annual data for:

Countries: 31 IEA countries; 4 IEA regions; the European Union; Brazil. For availability of data by country, see section 4: *Geographical coverage and country notes*.

Years: 1974-2022 unless otherwise specified.

The database includes an Excel file with selected data, for fast access to the database (**IEA_Energy_RDD_selected_data.xlsm)**

And the followingfiles, all available in three different formats (ivt, txt and csv):

RDD_Country_Budgets

Detailed country RD&D budgets: 33 countries (32 individual countries + European Union), 8 products and 184 flows

RDD_Country_Budgets_ Summary

Summary country RD&D budgets: 33 countries (32 individual countries + European Union), 8 products and 11 flows (8 summary groups of energy technologies + Total + Memos: Low-carbon and Non-low-carbon).

RDD_Region_Budget

Estimated RD&D budgets by region: 4 regions, 3 products and 11 flows.

RDD_Indicators

RD&D indicators: 34 countries (32 individual countries + EU27 + EU28) and 4 indicators.

RDD_Per_GDP

RD&D budgets per GDP: 32 countries and 1 indicator.

RDD_Private_Sector

RD&D spendings in the private sector by country: 3 countries, 5 products and 11 flows (8 summary groups of energy technologies + Total + Memos: Low-carbon and Non-low-carbon).

Flow definitions

The *IEA Guide to Reporting Energy RD&D Budget/Expenditure Statistics*, which includes the detailed definitions, can be found in the same folder as this document and is also available for download here.

The following tables shows the complete set of technologies covered in the questionnaire. The different countries submit at various levels of disaggregation depending on availability at national level.

Flow

Long name	Short name
GROUP 1: ENERGY EFFICIENCY	EFFICIENCY
11 Industry	11EFFIND
111 Industrial techniques and processes	111INDTE
112 Industrial equipment and systems	112INDEQ
113 Other industry	113INDOT
119 Unallocated industry	119INDUN
12 Residential and commercial buildings, appliances and equipment	12EFFRCO
121 Building design and envelope	121BUDEE
1211 Building envelope technologies	1211ENVE
1212 Building design	1212DESI
1219 Unallocated building design and envelope	1219BUUN
122 Building operation and efficient building equipment	122OPERA
1221 Building management systems (including smart meters) and efficient internet and communication technologies	1221EMAN
1222 Lighting technologies and control systems	1222LTEC
1223 Heating, cooling and ventilation technologies	1223HEAT
1224 Other building operations and efficient building equipment	1224OTHE
1229 Unallocated building operations and equipment	1229OPUN
123 Appliances and other residential/commercial	123APPLI
1231 Appliances	1231APPL
1232 Batteries for portable devices	1232BATT

Long name	Short name
1233 Other residential/commercial	1233ORCO
1239 Unallocated appliances and other residential/commercial	1239APUN
129 Unallocated residential/commercial buildings, appliances and equipment	129EFFRUN
13 Transport	13TRANSP
131 On-road vehicles	131ORVEH
1311 Vehicle batteries/storage technologies	1311VBAT
1312 Advanced power electronics, motors, EV/HEV/FCV systems	1312ADVA
1313 Advanced combustion engines	1313ENGI
1314 Electric vehicle infrastructure (including smart chargers and grid communications)	1314INFR
1315 Fuel for on-road vehicles (excluding hydrogen)	1315UFUE
1316 Materials for on-road vehicles	1316MATE
1317 Other on-road transport	1317OTHE
1319 Unallocated on-road vehicles	1319ORUN
132 Off-road transport and transport systems	132OFFRO
133 Other transport	133OTRAN
139 Unallocated transport	139TRANUN
14 Other energy efficiency	14OEFFIC
141 Waste heat recovery and utilisation	141WASTE
142 Communities	142COMMU
143 Agriculture and forestry	143AGRIF
144 Heat pumps and chillers	144HEATP
145 Other energy efficiency	145OENEF
149 Unallocated other energy efficiency	149OEFUN
19 Unallocated energy efficiency	19EFFUN
GROUP 2: FOSSIL FUELS: OIL, GAS and COAL	FOSSILFUEL
21 Oil and gas	21OILGAS
211 Enhanced oil and gas production	211ENHAN
212 Refining, transport, storage of oil and gas	212REFIN
213 Non-conventional oil and gas production	213NONCO
214 Oil and gas combustion	214COMBU

Long name	Short name
215 Oil and gas conversion	215CONVE
216 Other oil and gas	216OTOIL
219 Unallocated oil and gas	219OGUN
22 Coal	22COAL
221 Coal production, preparation and transport	221CPROD
222 Coal combustion (including IGCC)	222CCOMB
223 Coal conversion (excluding IGCC)	223CCONV
224 Other coal	224OCOAL
229 Unallocated coal	229COALUN
23 CO2 capture and storage	23CO2CS
231 CO2 capture/separation	231CAPSE
232 CO2 transport	232CTRAN
233 CO2 storage	233CSTOR
239 Unallocated CO2 capture and storage	239CO2CSUN
29 Unallocated fossil fuels	29FOSFUN
GROUP 3: RENEWABLE ENERGY SOURCES	RENEWABLE
31 Solar energy	31SOLAR
311 Solar heating and cooling	311SHEAT
312 Photovoltaics	312PHOTOV
313 Solar thermal power and high-temp. applications	313THERMA
319 Unallocated solar energy	319SOLUN
32 Wind energy	32WIND
321 Onshore wind technologies	321WONSH
322 Offshore wind technologies (excluding low wind speed)	322WOFFS
323 Wind energy systems and other technologies	323WSYST
329 Unallocated wind energy	329WINDUN
33 Ocean energy	33OCEAN
331 Tidal energy	331TIDAL
332 Wave energy	332WAVE
333 Salinity gradient power	333SALIN
334 Other ocean energy	334OOTHE

Long name	Short name
339 Unallocated ocean energy	339OCEUN
34 Biofuels (including liquid biofuels, solid biofuels and biogases)	34BIOFUE
341 Production of liquid biofuels	341LPROD
3411 Gasoline substitutes (including ethanol)	3411GAS
3412 Diesel, kerosene and jet fuel substitutes	3412DIES
3413 Algal biofuels	3413ALG
3414 Other liquid fuel substitutes	3414LOTH
3419 Unallocated production of liquid biofuels	3419LPUN
342 Production of solid biofuels	342SPROD
343 Production of biogases	343GPROD
3431 Thermochemical	3431GTHE
3432 Biochemical (including anaerobic digestion)	3432GBIO
3433 Other biogases	3433GOTH
3439 Unallocated production of biogases	3439GPUN
344 Applications for heat and electricity	344BAPPL
345 Other biofuels	345BOTHE
349 Unallocated biofuels	349BIOUN
35 Geothermal energy	35GEOTHE
351 Geothermal energy from hydrothermal resources	351GEOHY
352 Geothermal energy from hot dry rock (HDR) resources	352GEHDR
353 Advanced drilling and exploration	353DRILL
354 Other geothermal energy (including low-temp. resources)	354GOTHE
359 Unallocated geothermal energy	359GEOUN
36 Hydroelectricity	36HYDROE
361 Large hydroelectricity (capacity of 10 MW and above)	361HLARG
362 Small hydroelectricity (capacity less than 10 MW)	362HSMAL
369 Unallocated hydroelectricity	369HYDRUN
37 Other renewable energy sources	37OTHREN
39 Unallocated renewable energy sources	39RENUN
GROUP 4: NUCLEAR	NUCLEAR
41 Nuclear fission	41FISSON

Long name	Short name
411 Light water reactors (LWRs)	411LWRS
412 Other converter reactors	412OTHNU
4121 Heavy water reactors (HWRs)	4121HWRS
4122 Other converter reactors	4122OTHE
4129 Unallocated other converter reactors	4129OTNUN
413 Fuel cycle	413FUCYC
4131 Fissile material recycling/reprocessing	4131RECY
4132 Nuclear waste management	4132WAST
4133 Other fuel cycle	4133OTCY
4139 Unallocated fuel cycle	4139FUCUN
414 Nuclear supporting technologies	414SUPTE
4141 Plant safety and integrity	4141SAFE
4142 Environmental protection	4142PROT
4143 Decommissioning	4143DECO
4144 Other nuclear supporting technologies	4144ONUC
4149 Unallocated nuclear supporting technologies	4149ONUN
415 Nuclear breeder	415BREED
416 Other nuclear fission	416OFISS
419 Unallocated nuclear fission	419FISUN
42 Nuclear fusion	42FUSION
421 Magnetic confinement	421MACON
422 Inertial confinement	422INCON
423 Other nuclear fusion	423OFUSI
429 Unallocated nuclear fusion	429FUSUN
49 Unallocated nuclear	49NUCUN
GROUP 5: HYDROGEN AND FUEL CELLS	HGENCELL
51 Hydrogen	51HYDROG
511 Hydrogen production	511HYPRO
512 Hydrogen storage	512HYSTO
513 Hydrogen transport and distribution	513HYTRA
514 Other infrastructure and systems	514HYINF

Long name	Short name
515 Hydrogen end-uses (including combustion; excluding fuel cells and vehicles)	515HYEND
519 Unallocated hydrogen	519HYDUN
52 Fuel cells	52FUELCE
521 Stationary applications	521FUSTA
522 Mobile applications	522FUMOB
523 Other applications	523FUOTH
529 Unallocated fuel cells	529FUELUN
59 Unallocated hydrogen and fuel cells	59HYFUUN
GROUP 6: OTHER POWER AND STORAGE TECHNOLOGIES	OTHERPANDS
61 Electric power generation	61POWCON
611 Power generation technologies	611GETEC
612 Power generation supporting technologies	612GESUP
613 Other electricity power generation	613GEOTH
619 Unallocated electric power generation	619POWUN
62 Electricity transmission and distribution	62TRADIS
621 Transmission and distribution technologies	621TDTEC
6211 Cables and conductors (superconducting, conventional, composite core)	6211CABL
6212 AC/DC conversion	6212ACDC
6213 Other transmission and distribution techs.	6213OTHE
6219 Unallocated transmission and distribution	6219TDTUN
622 Grid communication, control systems and integration	622GRIDC
6221 Load management (including renewable integration)	6221LOAD
6222 Control systems and monitoring	6222CONT
6223 Standards, interoperability and grid cyber security	6223STAN
6229 Unallocated grid communication, control systems and integration	6229GRIDUN
629 Unallocated electricity transmission and distribution	629TRANUN
63 Energy storage (non-transport applications)	63ENSTOR
631 Electrical storage	631ELSTO
6311 Batteries and other electrochemical storage (excluding vehicles and general public portable devices)	6311BATT
6312 Electromagnetic storage	6312ELMA

Long name	Short name
6313 Mechanical storage	6313MECH
6314 Other storage (excluding fuel cells)	6314OSTO
6319 Unallocated electrical storage	6319ELSUN
632 Thermal energy storage	632THEST
639 Unallocated energy storage	639ENSTUN
69 Unallocated other power and storage technologies	69OPOWUN
GROUP 7: OTHER CROSS-CUTTING TECHNOLOGIES AND RESEARCH	OTHERTECH
71 Energy system analysis	71SYSANA
72 Basic energy research that cannot be allocated to a specific category	72BASICUN
73 Other	73OTHER
GROUP 8: UNALLOCATED	UNALLOC
TOTAL BUDGET	TOTAL

Long name	Short name	Definition
Memo: Low-carbon	MEMOLC	Includes: energy efficiency, carbon capture and storage (CCS), renewable energy sources, nuclear, hydrogen and fuel cells, other power and storage, and other cross-cutting technologies and research. =EFFICIENCY+23CO2CS+RENEWABLE+ NUCLEAR+HGENCELL+OTHERPANDS+OTHERTECH+UNA LLOC
Memo: Non-low-carbon	MEMONLC	Includes: coal, gas, oil and other fossil fuel RD&D with the exception of CCS. =21OILGAS+22COAL+29FOSFUN

Product definitions

Products

Long name	Short name	Definition
Total RD&D in million USD (2021 prices and exchange rates)	RDDUSD	Total public RD&D expenditure data, converted from current prices in national currencies to US dollars in constant 2021 prices using GDP deflators and 2021 exchange rates.
Total RD&D in million USD (2021 prices and PPPs)	RDDUSDPPP	Total public RD&D expenditure data, converted from current prices in national currencies to US dollar PPPs in constant 2021 prices using GDP deflators and 2021 PPPs. Purchasing power parities (PPPs) are the rates of currency conversion that eliminate the differences in price levels between countries. For more information on PPP methodology, see www.oecd.org/std/prices-ppp.
Total RD&D in million EUR (2021 prices and exchange rates)	RDDEURO	Total public RD&D expenditure data, converted from current prices in national currencies to euros in constant 2021 prices using GDP deflators and 2021 exchange rates.
Total RD&D in million national currencies (2021 prices)	RDDNCREAL	Total public RD&D expenditure data in national currencies, deflated using country-specific GDP deflators.
Total RD&D in million national currencies (nominal)	RDDNC	Total public RD&D expenditure data, expressed in national currencies at current prices.
Government R&D in million national currencies (nominal)	GOVTRD	Government R&D expenditure data, expressed in national currencies at current prices.
Government Demonstration in million national currencies (nominal)	GOVTDEMO	Government Demonstration expenditure data, expressed in national currencies at current prices.
State-owned R&D in million national currencies (nominal)	STATERD	State-owned R&D expenditure data, expressed in national currencies at current prices.
State-owned Demonstration in million national currencies (nominal)	STATEDEMO	State-owned Demonstration expenditure data, expressed in national currencies at current prices.
Private sector RD&D in million national currencies (nominal)	PRIVATERDD	Private sector RD&D expenditure data, expressed in national currencies at current prices
Private sector RD&D in million national currencies (2021 prices)	PRDDNCREAL	Private sector RD&D expenditure data in national currencies deflated using country-specific GDP deflators.
Private sector RD&D in million USD (2021 prices and exchange rates)	PRDDUSD	Private sector RD&D expenditure data, converted from current prices in national currencies to US dollars in constant 2021 prices using GDP deflators and 2021 exchange rates.
Private sector RD&D in million USD (2021 prices and PPPs)	PRDDUSDPPP	Private sector RD&D expenditure data, converted from current prices in national currencies to US dollar PPPs in

		constant 2021 prices using GDP deflators and 2021 PPPs. Purchasing power parities (PPPs) are the rates of currency conversion that eliminate the differences in price levels between countries. For more information on PPP methodology, see www.oecd.org/std/prices-ppp.
Private sector RD&D in million EUR (2021 prices and exchange rates)	PRDDEURO	Private sector RD&D expenditure data, converted from current prices in national currencies to euros in constant 2021 prices using GDP deflators and 2021 exchange rates.

Energy RD&D Budgets per thousand units of GDP

Long name	Short name	Definition
RD&D per thousand units of GDP	RDD1000GDP	Total RD&D in nominal national currencies divided by GDP in nominal national currencies at market prices and volumes, expressed in thousand units of GDP.

RD&D Economic Indicators

Long name	Short name	Definition
U.S. dollar exchange rate	USEXRMEI	Source: OECD Main Economic Indicators for OECD Countries and European Union and IMF International Financial Statistics for Brazil.
Purchasing power parity (PPP)	PPP	Source: IMF World Economic Outlook[1], with gaps in data completed with World Bank World Development Indicators[2].
Nominal GDP in national currency (Millions)	GDPNC	Source: IMF World Economic Outlook, with gaps in data completed with World Bank World Development Indicators.
GDP deflator	GDPDEF	Source: IMF World Economic Outlook, with gaps in data completed with World Bank World Development Indicators.

Currency conversion

$$RDDNCREAL_{Y,C} = RDDNC_{Y,C} \times \frac{GDPDEF_{2021,C}}{GDPDEF_{Y,C}}$$

$$RDDUSD_{Y,C} = \frac{RDDNC_{Y,C}}{USERXMEI_{2021,C}} \times \frac{GDPDEF_{2021,C}}{GDPDEF_{Y,C}}$$

$$RDDUSDPPP_{Y,C} = \frac{RDDNC_{Y,C}}{PPP_{2021,C}} \times \frac{GDPDEF_{2021,C}}{GDPDEF_{Y,C}}$$

$$RDDEURO_{Y,C} = RDDUSD_{Y,C} \times USERXMEI_{2021,France}$$

Where:
C is the country
Y is the year

[1] - International Monetary Fund. 2021. World Economic Outlook: War Sets Back the Global Recovery. Washington, DC, October. (IMF WEO)

[2] - World Development Indicators. 2022. Washington, D.C. :The World Bank. (WB WDI)

Geographical coverage and country notes

Geographical coverage: countries

Long name	Short name
Australia	AUSTRALI
Austria	AUSTRIA
Belgium	BELGIUM
Brazil	BRAZIL
Canada	CANADA
Czech Republic	CZECH
Denmark	DENMARK
Estonia	ESTONIA
Finland	FINLAND
France	FRANCE
Germany	GERMANY
Greece	GREECE
Hungary	HUNGARY
Ireland	IRELAND
Italy	ITALY
Japan	JAPAN
Korea	KOREA
Lithuania	LITHUANIA
Luxembourg	LUXEMBOU
Mexico	MEXICO
Netherlands	NETHLAND
New Zealand	NZ
Norway	NORWAY
Poland	POLAND
Portugal	PORTUGAL

Slovak Republic	SLOVAKIA
Spain	SPAIN
Sweden	SWEDEN
Switzerland	SWITLAND
Turkey	TURKEY
United Kingdom	UK
United States	USA
European Union	EU

Geographical coverage: regions

IEA	**Short name:** IEATOT
Definition	Includes Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.
IEA Americas	**Short name:** IEAAM
Definition	Includes Canada, Mexico and the United States.
IEA Europe	**Short name:** IEAEUR
Definition	Includes Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey and the United Kingdom.
IEA Asia Oceania	**Short name:** IEAAO
Definition	Includes Australia, Japan, Korea and New Zealand.

Country notes

Australia	Short name: **AUSTRALI**

Definition

Source: Department of the Environment and Energy
Latest submission: 2021/2022
Latest available data: 2022

Funding institutions/programmes included in the submission

- Department of Industry, Science, Energy and Resources (DISER)
- Department of Agriculture, Water and Environment (DAWE)
- Australian Nuclear Science and Technology Organisation (ANSTO)
- Australian Renewable Energy Agency (ARENA)
- Australian Research Council (ARC)
- Commonwealth Science and Industrial Research Organisation (CSIRO)
- Cooperative Research Centres (CRCs)
- Bureau of Meteorology (BoM)

The submission also includes RD&D funding by some State Governments. Coverage across states and territories is not comprehensive.
2021 (fiscal year July 2021 to June 2022) data do not include budgetary outlays for the Australian Renewable Energy Agency (ARENA).

Budgetary stage information

All data refer to the financial year; for example, 2021 refers to 1 July 2021 to 30 June 2022.
Expenditure by individual institution can vary greatly from year to year, and an agency's proportion of total spending will also vary (e.g. completion or termination of projects, etc.). The budgetary stages would change over the years, considering the completion of various long-term funded projects. Thus, depending on the funding institution, the budgetary stage may be final budget appropriation or obligations.

Data coverage

Excludes overseas territories.
The submission does not include the Australian Government's direct funding for universities, administered through its research training and support programs, due to limitations in data reporting. Indirect funding for the higher-education sector through agencies such as the ARC, CRC, ARENA etc. is captured in the submission.
Data at the 3 and 4-digit levels are not available for all projects.

State-owned enterprises coverage

State-owned enterprises data is included starting from 2018.
The coverage for state-owned enterprises does not include all states and territories.

Private sector coverage

No data available

Time series changes

For cycle 2021/2022, the data starting from 2018 has been updated to increase the coverage to state/territory and state-owned enterprises.
From 1999 to 2003, only aggregate figures are available for nuclear fission/fusion.
Data for 2009, 2010 and 2011 have been estimated by the Australian administration, causing breaks in series between 2008 and 2009.
In 1993, figures for nuclear fuel cycle include nuclear supporting technology data.

Australia Definition (continued)	Prior to 1997, biofuels includes geothermal and other renewable energy not elsewhere classified. **Other information** N/A

Austria	**Short name:** AUSTRIA

Definition

Source: Austrian Energy Agency on behalf of the Austrian Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)

Latest submission: 2020/2021

Latest available data: 2020

Funding institutions/programmes included in the submission

- Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)
  - City of Tomorrow
  - IEA Research Cooperation
  - Smart Energy Systems
  - JPI Urban Europe
  - Mobility of Tomorrow
- Climate and Energy Fund
  - Energy Research Programme
  - Flagship Region Energy
  - Zero Emission Mobility
  - Smart Cities
  - Energy Transition 2050
- Austrian Research Promotion Agency
- General programme

Budgetary stage information

No details available

Data coverage

Government RD&D data cover federal and state units.

Financial flows from European programmes (Horizon 2020, Research Fund for Coal and Steel…) are excluded, national contributions on project level are included. Austrian contributions to the European Union budget are excluded. IEA TCPs (including common funds) are included.

Data are collected from a performer perspective as expenditures by using voluntary surveys for equity capital used by research organizations and universities, and identifying contracted funding with data provided by funding agencies.

Details on methodology and sample coverage are available at:

https://nachhaltigwirtschaften.at/resources/iea_pdf/events/20200708_webinar-energiewende/webinar-energiewende-energieforschung-indinger-katzenschlager-2020-07-08_en.pdf.

Estimated share of the sample of the total expenditure covered:

- Government >95%
- Higher education >80%

State-owned enterprises coverage

In Austria, state owned companies are covered in the R&D-surveys for the private sector. They are intentionally not covered in the detailed survey for IEA.

Austria Definition (continued)	**Private sector coverage** For every second year (2015, 2017, 2019,...) Austria provides a total annual sum for energy R&D for the whole private sector (including state owned) in the IEA questionnaire. Due to confidentiality and data protection, no individual technology figure is disclosed by the federal statistics authority. **Time series changes** N/A **Other information** N/A

Belgium	Short name: **BELGIUM**

Definition	**Source**: Belgium Federal Government
	Latest submission: 2021/2022
	Latest available data: 2022
	
	Funding institutions/programmes included in the submission
	
	Federal (nuclear)
	• Federal Public Service Economy (https://economie.fgov.be/en)
	  • NIRAS/ONDRAF
	  • IRE
	  • SCK CEN
	  • Waste treatment and dismantling techniques for decommissioning of legacy facilities
	  • BELSPO
	  • Royal Military School
	  • Energy Transition Fund grants
	Contributions to CERN are not included.
	
	Brussels-capital region
	• Bruxelles–Environnement (https://environnement.brussels/)
	• Innoviris (https://innoviris.brussels/) – until 2019
	
	Flemish region
	• Research Foundation Flanders (FWO) (https://www.fwo.be/en/).
	• Flanders Innovation & Entrepreneurship (VLAIO) (https://www.vlaio.be/nl/andere-doelgroepen/flanders-innovation-entrepreneurship)
	• Interuniveristy Micro-electronics Centre (Imec) (https://www.imec-int.com/en/home)
	• Flanders Make (https://www.flandersmake.be/en)
	• Flemish Institute for Technological Research (VITO) (https://vito.be/en)
	“VLAIO” and “Research Foundation – Flanders” are funding agencies for research. IMEC, VITO, Flanders Make are strategic research centres who yearly receive a public funding amount (dotation) from the Flemish government.
	
	Walloon region
	• Walloon Public Service Energy https://energie.wallonie.be/fr/recherche-et-developpement-en-energie.html?IDC=8180
	• Walloon Public Service Research https://recherche.wallonie.be/home.html
	
	Budgetary stage information
	
	Data provided are based on obligations (budgetary stage vi).

Belgium
Definition (continued)

Data coverage

Government RD&D data cover federal and regional units.

For 2022 estimates, only data for nuclear budgets are available.

Federal (nuclear)

Data are collected with a hybrid methodology by using voluntary surveys at the federal level.

Estimated share of the sample of the total expenditure covered:

- Government 100%
  - Information obtained from SCK CEN, IRE, NIRAS/ONDRAF, BELSPO and the Royal Military School
- Higher education 0%
- Business sector 0%

Brussels-capital region

For the Brussels region, data provided are based on the individual analysis of the projects themselves. The data include all the projects in which there is a regional co-funding involved.

Flemish region

Data are collected from a funder perspective as budgets. The data are derived from the budget.

The figures are composed from the survey of the funding agencies (VLAIO and FWO) and some public institutions which are financed by the government for the research activities.

Flemish data rely on the individual analysis of budgets of approved project proposals in the energy technology field, and only includes Flemish public RD&D expenditures (no European / international / private co-funding budget is included).

Walloon region

Data are collected from a funder perspective as budgets. The data are derived from the budget and on the individual analysis of the projects themselves. Only the national/regional public funding has been taken into account for projects which are co-financed by Europe.

State-owned enterprises coverage

There are no state-owned companies.

Private sector coverage

No data available

Time series changes

N/A

Other information

N/A

Brazil	**Short name:** BRAZIL

Definition

Source: Ministry of Mines and Energy
Latest submission: 2021/2022
Latest available data: 2020

Funding institutions/programmes included in the submission

- Financiadora de Estudos e Projetos (FINEP);
- Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (ANP);
- Agência Nacional de Energia Elétrica (ANEEL);
- Banco Nacional do Desenvolvimento (BNDES);
- Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq);
- Comissão Nacional de Energia Nuclear (CNEN)
- Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP).

Budgetary stage information

Data are based on final budget appropriations.

Data coverage

The demonstration budgets are included in the R&D section.

State-owned enterprises coverage

No data available

Private sector coverage

No data available

Time series changes

N/A

Other information

The dataset is the result of a project called Energy Big Push (EBP) that gathered the all the relevant actors active in the energy innovation scenario of Brazil, including the Brazilian Ministry of Mines and Energy and the Ministry of Science, Technology and Innovation.

EBP project analysed the RD&D spending data of the relevant federal institutions listed above and the state of São Paulo.

It is important to note that significant amount of resources are associated with contractual investment obligations, being considered public-oriented in this project. This is the case of all investments under regulated programs of the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP), and Brazilian Electricity Regulatory Agency (ANEEL).

The database of Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP) was not available at project level. In that case it was necessary to adopt the premise that almost all investment is made in oil and gas industry. This was a necessary simplification to report the data, but it is recognized that part of these resources may be invested in renewable energy.

For values associated with Brazilian National Development Bank (BNDES) the database contains the financing granted by the institution in energy RD&D area, considering BNDES loans and non-reimbursable funding.

Canada	Short name: **CANADA**

Definition

Source: Natural Resources Canada
Latest submission: 2020/2021
Latest available data: 2021

Funding institutions/programmes included in the submission

Figures are based on data from approximately 30 federal departments and agencies as well as all provincial and territorial governments. The Canadian process surveys all federal, provincial and territorial organizations funding energy RD&D related activities with the exception of municipalities. Government figures include combined data from federal departments and agencies and all of provinces and territories.

- Natural Resources Canada (NRCan)
  - Program of Energy Research & Development (PERD)
  - Energy Innovation Program (EIP)
  - Impact Canada Initiative – Clean Technology Challenges
  - Clean Growth Program (CGP)
  - Green Infrastructure (GI) – Smart Grid, Buildings, Electric Vehicles Infrastructure, Clean Energy for Rural & Remote Communities,
  - Canadian Emissions Reduction Innovation Network (CERIN)
  - Breakthrough Energy Solutions Canada (BESC)
- Natural Resources Canada (NRCan) – Atomic Energy of Canada Limited (AECL)
  - Revitalization of the Chalk River Laboratories
  - Federal Nuclear Science and Technology Work Plan
- Innovation, Science and Economic Development Canada (ISED) – Sustainable Development Technology Canada (SDTC)
  - SD Tech Fund
- Innovation, Science and Economic Development Canada (ISED) – National Research Council Canada (NRC)
  - R&D programs
  - Industrial Research Assistance Program (IRAP)
- Innovation, Science and Economic Development Canada (ISED) – Natural Sciences and Engineering Research Council of Canada (NSERC)
  - Discovery Research
  - Research Training and Talent Development
  - Research Partnerships

Of approx. 30 federal departments/agencies, five federal organizations are identified as major spenders. Federal organizations are not listed in any particular order (i.e. ranked by spending). Provincial and territorial governments were also surveyed but the details of their major programs are not provided here.

Budgetary stage information

All data refer to the fiscal year, for example, 2019 refers to April 1st 2019 to March 31st 2020.

Data up to and including 2019 refer to actual outlays. Data beyond 2019 are considered estimates based on the available data at the time of reporting. Each year, the data collection period starts in October and ends in March/April.

Data coverage

The data cover national projects, national contributions to international RD&D programmes or organizations such as the International Atomic Energy Agency (IAEA) and OECD Nuclear Energy Agency (NEA) and international RD&D efforts under the IEA Technology Collaboration Programmes.

Canada Definition (continued)

State-owned enterprises coverage

For Canada, State-Owned Enterprises (SOEs) are reported only from provincial and territorial governments. SOEs are considered Provincial or Territorial Crown Corporations, such as electric or gas utilities. Not all provincial and territorial governments reported relevant spending from SOEs.

2012-2013 fiscal year was the first year Canada started reporting SOEs separately.

Private sector coverage

Data on the private sector are available here: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2710034701.

Time series changes

N/A

Other information

The data are collected with a hybrid methodology by using voluntary surveys

Canada uses both funder and performer perspectives to collect energy RD&D data, as the investment flows externally outside the government (i.e. to private sector) and also internally within the government (i.e. national laboratories). NRCan, as a coordinator of the data, works with both performers and funders within the Government of Canada (GOC) to check and verify the data submitted. This particular process puts enhanced measures to ensure the accuracy of the data received including budgeted and estimated expenditures. GOC's internal performers do not often provide budgeted/estimated expenditures. In those cases, budgeted/estimated figures are provided by the program administrators.

For provinces and territories, each provincial/territorial government has its own coordinating ministry that is responsible for collecting the data, on behalf of its provincial/territorial government.

Czech Republic — Short name: CZECH

Definition

Source: Ministry of Industry and Trade of the Czech Republic
Latest submission: 2021/2022
Latest available data: 2022

Funding institutions/programmes included in the submission

No details available.

Budgetary stage information

No details available.

Data coverage

No details available.

State-owned enterprises coverage

No details available.

Private sector coverage

No details available.

Czech Republic	**Time series changes**
Definition (continued)	N/A

Other information

Publicly funded R&D projects can be searched through public databases and portals. These are mainly the ISVAV (https://www.rvvi.cz/) and the STARFOS portal (https://starfos.tacr.cz/cs). Based on individual code and project name, basic information can be found. These are mainly: the amount of eligible costs and the amount of public support (not for every year but only total amount), basic information about an institution carrying the research, project solution time, program of a concrete project, public tender number, R&D categories field, etc. Each specific project has an individual code that serves as a unique identifier. R&D projects data are collected by the Technology Agency of the Czech Republic (TA CR).

The above-mentioned public databases are managed by the Technology Agency of the Czech Republic (STARFOS), respectively by the Research, Development and Innovation Council (ISVAV). The Ministry of Industry and Trade with the help of the Technology Agency of the Czech Republic (TA CR), which has direct access to background data, such as eligible costs and public support for each individual year, searched specific energy projects in the Czech Republic within the STARFOS database. These projects were supplemented by already searched projects, as the search was carried out in 2015 while preparing one of the previous questionnaires. These projects were subsequently exported, including the key information necessary to complete the questionnaire.

Denmark	Short name: **DENMARK**
Definition	**Source**: Danish Energy Agency, Ministry of Energy, Utilities and Climate, Ministry of Higher Education and Science **Latest submission:** 2021/2022 **Latest available data:** 2021

Funding institutions/programmes included in the submission

- Ministry of Higher Education and Science
- Danish Innovation Fund
- Ministry of Climate, Energy and Utilities
- Energy Technology Development and Demonstration Program

Budgetary stage information

Data are based on obligations for 2020 and 2021 (budgetary stage vi).

Data coverage

Excludes Greenland and the Faroe Islands.

Figures included in the Danish submission consist exclusively of funding of project proposals directed towards Danish RD&D programs. Contributions to international organisations and programmes are not included.

State-owned enterprises coverage

Does not include data from state-owned companies in Denmark.

Private sector coverage

No data available

Denmark Definition (continued)	**Time series changes** N/A **Other information** N/A
Estonia	**Short name:** ESTONIA

Definition	**Source**: Ministry of Economic Affairs and Communications
	Latest submission: 2021/2022
	Latest available data: 2021
	
	Funding institutions/programmes included in the submission
	
	• Estonian Research Council (https://www.etag.ee/en/funding/programmes/)
	  ○ RITA, grant, personal funding
	• Ministry of Economic Affairs and Communications
	  ○ R&D programme for the National Development Plan of the Energy Sector until 2030
	• Research programmes are described here: https://www.hm.ee/en/activities/research-and-development/research-programmes
	
	Budgetary stage information
	
	No details available
	
	Data coverage
	
	Data are collected from a performer perspective as expenditures.
	All projects and other RD&D related activities by the evaluated institutions listed at: https://www.etis.ee/Portal/Institutions/Index?lang=ENG are registered at the Estonian Research Information System.
	
	State-owned enterprises coverage
	
	Data include state-owned energy companies belonging to the Republic of Estonia:
	• Eesti Energia (https://www.energia.ee/en/ettevottest)
	• Elering (https://elering.ee/en/about-company)
	
	Private sector coverage
	
	No details available
	
	Time series changes
	
	Data prior to 2011 are not available.
	The data from 2013 to 2016 have been revised to exclude EU fundings in the 2022 May release. The data for 2017 will be revised in the 2022 October release.
	
	Other information
	
	Data reported under the name of Coal actually correspond to oil shale.

Finland	Short name: **FINLAND**

Definition

Source: Statistics Finland on behalf of the Energy Department, Ministry of Economic Affairs and Employment

Latest submission: 2021/2022

Latest available data: 2020

Funding institutions/programmes included in the submission

- Ministry of Economic Affairs and Employment
- The Finnish State Nuclear Management Fund
- Tekes - Finnish Funding Agency for Innovation / Business Finland
- VTT Technical Research Centre of Finland
- Geological Survey of Finland
- The Finnish Academy
- Ministry of the Environment
- Finnvera
- Nordic Investment Bank
- Ministry of Agriculture and Forestry.

Budgetary stage information

No details available

Data coverage

R&D also includes demonstration budgets.

State-owned enterprises coverage

No data available

Private sector coverage

No data available

Time series information

N/A

Other

“Other coal” contains budgets allocated to peat research.
“Coal combustion” includes "Coal conversion".

France	**Short name:** FRANCE

Definition

Source: Service de la Donnée et des Etudes Statistiques, Ministère de la Transition Ecologique et Solidaire

Latest submission: 2021/2022

Latest available data: 2020

Funding institutions/programmes included in the submission

13 public scientific and technical institutions, industrial and commercial institutions, public interest groups or public funding programmes:

- Agence de l'environnement et de la maitrise de l'énergie (ADEME)
- Agence nationale pour la gestion des déchets radioactifs (ANDRA)
- Agence nationale de la recherche (ANR)
- Banque publique d'investissement (BPI)
- Bureau de Recherches Géologiques et Minières (BRGM)
- Centre national de la recherche scientifique (CNRS)
- Centre Scientifique et Technique du Bâtiment (CSTB)
- Commissariat à l'énergie atomique et aux énergies alternatives (CEA)
    - ITER, Jules Horowitz reactor project
- Institut français pétrole énergies nouvelles (IFPEN)
- Institut de radioprotection et de sûreté nucléaire (IRSN)
- Institut français de recherche pour l'exploitation de la mer (IFREMER)
- Institut national de la recherche pour agronomique (INRA)
- Institut français des sciences et technologies des transports, de l'aménagement et des réseaux (IFSTTAR)

Budgetary stage information

The French data submission is mostly based on actual budget outlays (budgetary stage vii), with a few French institutions reporting on obligations.

Data coverage

Government RD&D data cover central government units only.

It covers a combination of basic research/ applied research/ experimental development programmes as well as both energy related and fundamental research programmes.

French data include ITER contributions and exclude other EU or other international RD&D programmes and contributions to these programmes. Indirect funding related to the ITER project, via Euratom, is excluded from the submission.

Data are collected from a funder perspective as budget.

Includes Monaco, and excludes the following overseas departments and territories (Guadeloupe, Guyana, Martinique, New Caledonia, French Polynesia, Reunion, and Saint-Pierre and Miquelon).

State-owned enterprises coverage

SOEs are not included in the submission due to the business secrecy rules applicable in France.

Private sector coverage

No data available.

France	**Time series changes**
Definition (continued)	In 2010 the French Administration revised the RD&D budgets back to 2002. This results in a break in series between 2001 and 2002. In 2018, International Thermonuclear Experimental Reactor (ITER) funding (via the Commissariat à l'énergie atomique et aux énergies alternatives -CEA-, GOVT R&D budgets) was added ("Other nuclear fusion" item) with also data from 2002 to 2017. In 2017, a new structure (specialized in nuclear waste management) was added with data since 2002. No incidence on GOVT demonstration budgets: only GOVT R&D budgets was updated. In 2021, the data transmitted by the CNRS (Centre national de la recherche scientifique) have been revised from 2002 to improve the coverage. **Other information** N/A

Germany	Short name: **GERMANY**
Definition	**Source**: Federal Ministry for Economic Affairs and Energy **Latest submission:** 2021/2022 **Latest available data:** 2022 **Funding institutions/programmes included in the submission** • 7th Energy Research Programme of the Federal Government • Federal Ministry for Economic Affairs and Energy • Federal Ministry of Education and Research • Federal Ministry of Food and Agriculture **Budgetary stage information** 2020 estimated data are based on actual outlays (budgetary stage vii). **Data coverage** Government RD&D data cover federal and state units. Data include basic research and applied research projects. Data cover national projects and national contributions to international RD&D efforts under the IEA TCPs. Figures on international or European programmes are not included. **State-owned enterprises coverage** No data available. **Private sector coverage** No data available. **Time series changes** With the transition to the 7th Energy Research Programme, the data for 2019 onwards are based on a new categorization of energy research funding. Data do not include the new Laender of Germany prior to 1992.

Germany Definition (continued)	From 2003 onwards, the institutionally financed R&D activities of the Helmholtz centers are included. From 2018 onwards, the institutional funding for non-nuclear energy research is mainly allocated to category 8, “Unallocated”. **Other information** All government energy RD&D expenditures for project funding are managed with the electronic accounting system profile. The Federal Ministry for Economic Affairs and Energy uses a fine-grained categorisation system in order to match project expenditures to the categories of national and IEA energy RD&D reporting. The other ministries use similar systems. The sample coverage is 100%.
Greece	**Short name:** GREECE
Definition	**Source**: General Secretariat for Research and Technology **Latest submission:** 2010/2011 **Latest available data:** 2011 **Funding institutions/programmes included in the submission** No details available **Budgetary stage information** No details available **Data coverage** No details available **State-owned enterprises coverage** No data available **Private sector coverage** No data available **Time series changes** From 2000 onwards, Greece has provided only aggregated data until 2007. **Other information** N/A

Hungary	Short name: **HUNGARY**
Definition	**Source**: National Research, Development and Innovation Office (NRDI) **Latest submission:** 2021/2022 **Latest available data:** 2021 **Funding institutions/programmes included in the submission** • National Research, Development and Innovation Office • Ministry of Finance **Budgetary stage information** Data are based on obligations. **Data coverage** Data refer to projects supported by Hungarian budgetary funds (National research, development and Innovation Fund) and the projects co-financed by European Structural and Investment Funds (ESIF represented 75% of the total RD&D budget in 2017 and 80% in 2018). **State-owned enterprises coverage** No data available **Private sector coverage** No data available **Time series changes** Data for 1995, 1996, 1998 and 1999 are not complete. New data were received for the period 2013-2016 in cycle 2016/17, explaining the break in time series between 2012 and 2013. **Other information** In most of the cases in Hungary, RD&D funds are not allocated to a specific field of science but are assigned to different projects through tenders; thus, energy obligations may vary from year to year. Further details about Hungarian RD&D budget are available on the NRDI website.

Ireland	**Short name:** IRELAND
Definition	**Source**: Sustainable Energy Authority of Ireland **Latest submission:** 2020/2021 **Latest available data:** 2020 **Funding institutions/programmes included in the submission** • Sustainable Energy Authority of Ireland (SEAI) • National Research Funding Programme • Ocean Energy Prototype Development Fund • Department of Agriculture, Food and the Marine (DAFM) • Competitive Research Funding Programme • Department of Transport • National funding through departmental vote

Ireland

Definition (continued)

- Green Public Transport Fund
- Environmental Protection Agency (EPA)
- EPA Climate Call
- Enterprise Ireland
- Commercialisation Fund
- Geological Survey Ireland (GSI)
- Geothermica/GSI Research Programme
- Marine Institute
- Marine Institute's Marine Research Programme
- Marine Research Programme – Industry-led Awards
- Science Foundation Ireland (SFI)
- SFI Future Innovator Prize
- SFI Industry Fellowship
- SFI Frontiers for the Future Programme
- SFI Centres Programme
- Irish Research Council (IRC)
- Employment Based Postgraduate Programme
- EPS Postgraduate Application
- EPS Postdoctoral Application
- Ulysses
- Advanced Laureate Awards
- Government of Ireland Postgraduate Award
- Government of Ireland Postdoctoral Award

Budgetary stage information

Data from 2016 are based on awarded budgets (budgetary stage vi).

Data coverage

For transnational projects (e.g. ERANET), only the financial contribution from the Irish agencies was included (when this information was made available to SEAI). For such projects, in-kind contribution from Irish agencies was not accounted for in the reporting (when this information was made available to SEAI); Irish funder's contribution had to be estimated in some cases. The value of funding provided by International/European organisations (e.g. European Commission etc.) is not included in the data.

Transnational projects in which Irish public funding agencies are participating as a partner or a lead were not included (e.g. Interreg projects).

State-owned enterprises coverage

Ireland does not have any state-owned enterprises.

Private sector coverage

No data available

Time series information

Data prior to 2015 consist of funding of project proposals directed towards Irish energy RD&D programs and are based on reported "actual expenditures". Data include deployment prior to 2010. Data from 2016 onwards refer to a new data methodology based on a data collection run by SEAI with the main organisations, listed above, which disburse public funding.

Other

The data have been collected from a funder perspective as budgets.

Further information relating to energy RD&D projects funded in Ireland is available at the SEAI National Energy Database.

Italy	Short name: ITALY

Definition

Source: Department of Energy, Ministry of Economic Development
Latest submission: 2020/2021
Latest available data: 2019

Funding institutions/programmes included in the submission

No details available

Budgetary stage information

No details available

Data coverage

The Italian BES R&D survey is census-based, considering that the target population comprises all the active enterprises that potentially perform R&D, according to the information we received from other statistical or administrative sources. In 2018 the target population comprised over 37 000 enterprises.

Since 2016, ISTAT has implemented an imputation method to take into account the non-response units. This action solves the previous problem of “under-estimations” of Italian business R&D expenditures and personnel, and it improves the quality of the final results. It is a partial imputation of the non-response units because only the units in the previous two surveys that gave preliminary R&D data were considered in the imputation process. Specifically, in this process – based on a predictive regression imputation, applied to the two key variables (R&D expenditure and R&D personnel in FTE) – about 3 000 non-response enterprises were involved in the 2018 edition of the Italian BES R&D survey.

State-owned enterprises coverage

No data available

Private sector coverage

Business Sector: 70% of the performers (response rate for the A reference year 2018)

The target population comprises all the Italian active enterprises that could potentially perform R&D. The main statistical source used for defining the target population of R&D performers is the most updated release of the official Italian business Register, Asia 2018. Other sources of information were:

- the inventory of the enterprises claiming tax relief for R&D activities and projects (Dichiarazione Unico from the Italian Agency for fiscal revenues of the Ministry of Economy)
- the list of the enterprises reporting R&D activities in the two previous R&D surveys
- the list of the enterprises reporting intramural R&D activities in the previous CIS
- the register of the innovative start-ups included in the Business Register of the Italian Ministry of Economic Development
- the register of the contributors to international research programs (EU 7th Framework Program for Research and Technical Development for projects)
- the list of the enterprises operating in one of the Italian Scientific and Technological Parks
- the lists of R&D performing firms provided by some industrial associations, such as Federchimica and Assobiotech.

Time series information

N/A

Italy Definition (continued)	**Other** The Italian BES R&D survey is a web survey. The data collection made use of the Istat Business Statistical Portal, a single entry point for Istat web-based data collection from enterprises. ISTAT Business Statistical Portal implements a new approach for the organisation and management of data collection processes.

Japan	**Short name:** JAPAN

Definition

Source: Ministry of Economy, Trade and Industry
Latest submission: 2021/2022
Latest available data: 2021

Funding institutions/programmes included in the submission

- Ministry of Economy, Trade and Industry (METI)
- Ministry of Environment (MOE), from 2018 onwards
- Ministry of Education, Culture, Sports, Science and Technology (MEXT).

Budgetary stage information

Data provided are based on final budget appropriations (budgetary stage v).

Data coverage

Data provided do not include budgets related to international RD&D programmes.

State-owned enterprises coverage

No data available

Private sector coverage

No data available

Time series information

The items included in Conservation were expanded in 1994. Earlier budgetary data are not comparable.
Data for Japan cover budgets allocated by METI for all years and include the spending of MOE for the first time in 2018. In 2018 MOE represented 13% of the total national budget, which explains the break in time series between 2017 and 2018. This also affects the aggregates “IEA Total” and “IEA Asia Oceania”.

Other

N/A

Korea	Short name: **KOREA**
Definition	**Source**: Ministry of Trade, Industry, and Energy (MOTIE), Korea Institute Energy Technology Evaluation and Planning (KETEP) **Latest submission:** 2021/2022 **Latest available data:** 2021 **Funding institutions/programmes included in the submission** Korean Energy Technology Evaluation and Planning (KETEP) **Budgetary stage information** Data are based on actual outlays. **Data coverage** Data include RD&D budgets based on the technology development and international cooperation reflected in the Energy R&D Program of the MOTIE. **State-owned enterprises coverage** No data available **Private sector coverage** No data available **Time series information** N/A **Other** N/A

Lithuania	**Short name:** LITHUANIA
Definition	**Source**: Ministry of Energy of the Republic of Lithuania **Latest submission:** 2020/2021 **Latest available data:** 2021 **Funding institutions/programmes included in the submission** • Ministry of Economy and Innovation of the Republic of Lithuania • Ministry of Environment • Ministry of Transport and Communications • State research institute • Lithuanian energy institute • State owned utility companies • Universities **Budgetary stage information** Figures for the year 2021 are actual outlays and figures for the year 2022 are obligations.

Lithuania Definition (continued)	**Data coverage** Data from one more important RD&D funder in Lithuania – Research Council of Lithuania – are not available for the current submission, but they are planned to be included in following submissions. **State-owned enterprises coverage** State-owned utilities data are submitted separately in the SOE section. **Private sector coverage** No data available **Time series information** Data prior to 2019 are not available. **Other** In many cases, RD&D funds are not allocated specifically to energy-related technologies but are assigned to different projects through tenders.
Luxembourg	Short name: **LUXEMBOU**
Definition	**Source**: Ministère de l'Economie, Direction générale Recherche, propriété intellectuelle et nouvelles technologies **Latest submission:** 2013/2014 **Latest available data:** 2012 **Funding institutions/programmes included in the submission** • Luxembourg Government, conventions are double signed by both the Minister of Economy and Minister of Finance. **Budgetary stage information** Data provided are based on obligations (budgetary stage vi). **Data coverage** The figures provided do not show the split between R&D and Demonstration since the split is not available within current reporting scheme. **State-owned enterprises coverage** No data available **Private sector coverage** No data available **Time series information** Luxembourg has provided just partial information for 1991 to 2000.

Luxembourg	**Other**
Definition (continued)	N/A

Mexico	**Short name:** MEXICO

Definition

Source: Secretaría de Energía – Dirección General de Investigación, Desarrollo Tecnológico y Formación de Recursos Humanos
Latest submission: 2020/2021
Latest available data: 2020

Funding institutions/programmes included in the submission

- SENER – CONACYT
  - Fondo Sectorial de Hidrocarbos
  - Fonda Sectorial de Sustentabilidad Energética

Budgetary stage information

No details available

Data coverage

Data are collected from a funder perspective as budget.
The data cover government RD&D from central or federal government units.
The data cover national projects, national contributions to international RD&D efforts under the IEA Technology Collaboration Programmes. It includes contribution committed by the Energy Sustainability Fund for a project in collaboration with the European Commission.

State-owned enterprises coverage

There are two SOEs in Mexico:

- Petróleos Mexicanos (PEMEX)
- Comisión Federal de Electricidad (CFE)

They are not included in the submission.

Private sector coverage

No data available

Time series information

Data for Mexico are available starting in 2013.

Other

N/A

Netherlands	Short name: **NETHLAND**

Definition

Source: Netherlands Enterprise Agency (RVO.nl), Ministry of Economic Affairs and Climate Policy

Latest submission: 2020/2021

Latest available data: 2020

Funding institutions/programmes included in the submission

- The Ministry of Economic Affairs and Climate Policy (EZK)
- The Ministry of Education, Culture and Science
- The Ministry of the Interior and Kingdom Relations (IKR)

Budgetary stage information

Data submitted are based on obligations (budgetary stage vi).

Data coverage

R&D budgets and expenditures of universities, as well as funding from local governments programs, are not included in the submitted data.

Excludes the former Netherlands Antilles.

The Netherlands submission does not include EU or international RD&D programmes, nor the Dutch contributions to IAEA, ITER or CERN.

State-owned enterprises coverage

No data available

Private sector coverage

No data available

Time series information

N/A

Other

N/A

New Zealand	**Short name:** NZ

Definition

Source: Ministry of Business, Innovation and Employment

Latest submission: 2021/2022

Latest available data: 2020

Funding institutions/programmes included in the submission

- Ministry of Business, Innovation and Employment
  - Endeavour
  - Strategic Science Investment Fund Programmes
  - National Science Challenges and Partnerships
  - Provincial Development Unit

New Zealand

Definition (continued)

Budgetary stage information

The data provided are based on actual expenditures.
The data refer to the financial year; for example, 2021 refers to 1 July 2021 to 30 June 2022.

Data coverage

Government RD&D data cover central and state units.
Only national projects are covered in public energy RD&D.

State-owned enterprises coverage

State-owned companies are not included in the submission. There is one SOE, Transpower New Zealand Limited.

Private sector coverage

No data available

Time series information

For cycle 2021/2022, there was a reallocation of codes, as the ANZSRC codes used to classify research have been revised. This may have a small impact on categorisation for fiscal year 20/21. Previous years have not been revised.

Other information

Data are collected from a funder perspective as budgets.
The value for 2021 GOVT R&D in Unallocated corresponds to the spendings of one government agency which didn't provide updated data for the current cycle.

Norway

Short name: **NORWAY**

Definition

Source: Climate, Industry and Technology Department, Ministry of Petroleum and Energy
Latest submission: 2021/2021
Latest available data: 2022

Funding institutions/programmes included in the submission

- The Research Council of Norway
- Enova SF
- Innovation Norway;
- The Norwegian Water and Energy Directorate
- Gassnova SF.
- Statnett
- Statkraft

Budgetary stage information

The budgetary stage is different depending on the submitting institution. Some data are based on grants to individual projects while others are based on state budget allocation, depending on which funding scheme the data is collected from.

Data coverage

Includes the Svalbard archipelago (Spitsbergen).

Norway Definition (continued)	Allocations for International R&D programmes (e.g. Horizon 2020) are, in general, not included. However, support of Norwegian participation in ERA-NET Cofunds is included. In addition, some national programmes provide financial support to Norwegian actors that participate in international programmes. Such schemes are included in the Norwegian submission of the RD&D questionnaire. **State-owned enterprises coverage** Included: • Statnett • Statkraft Not included: • Statoil (only partially state-owned) **Private sector coverage** No data available **Time series changes** N/A **Other information** The Norwegian schemes for governmental RDD support are, for the most part, technology-neutral. The actual allocations each year to various energy fields and technologies are based on the quality of the projects responding to the calls, i.e. competition among researchers and projects proposals, where the best projects are funded within available budgets. Reporting on final budget appropriations is only possible for very broad fields such as petroleum, CCS and energy efficiency/ renewable energy/ energy system/ storage.
Poland	**Short name:** POLAND
Definition	**Source**: Department of Innovation and Development, Ministry of Science and Higher Education **Latest submission:** 2020/2021 **Latest available data:** 2021 **Funding institutions/programmes included in the submission** • Ministry of Science and Higher Education (MSHE) • National Centre for Research and Development (agency for applied research supervised by MSHE) • National Centre of Science (agency for basic research supervised by MSHE). **Budgetary stage information** Data are based on obligations. Data for 2021 are only initial estimation for on-going or planned projects. The final data for this period will vary and should be higher. **Data coverage** Not included: Other Polish ministries and institutes supervised by those ministries which may also fund some research projects (but marginally – the MSHE is the prime source of public funding for R&D via the two supervised agencies mentioned above). Only R&D projects are included in the submission. Demonstration projects are not included.

Poland

Definition (continued)

Data reported come from R&D projects funded or co-funded from public money. Financial means from EU structural funds are also included (Contributions from international organisations and EC framework programmes like H2020 are not included).

All projects funded from science budget, including “State-owned R&D” and “Government pilot projects”, are included in the submission.

Data reported in questionnaire do not include all funds on energy R&D from MSHE’s budget (may include even less than 50%). This is due to the structure of Polish science budget, which is divided into definite financing streams (on the basis of a legislative regulation). Approximately half of the science budget is appropriated on statutory tasks of scientific institutions and other tasks that means that it is not the government (MSHE) that decides the objective of the funds but R&D institutions, including academia. As a result, funds on statutory tasks – as far as division on definite economy sectors is concerned, e.g. renewable energy – is difficult to measure. These could only be estimated by each research unit and university faculty. They are not obliged to collect those data by the statistical Polish system.

State-owned enterprises coverage

No data available

Private sector coverage

No data available

Time series changes

The decrease in energy R&D fundings compared to the 2010-2015 period is caused by the schedule of priorities implementation in the National Research Program. Energy was one from seven main country R&D priorities. The largest R&D projects were launched in 2010 and ended in 2015. In the following years, projects from other priorities were carried out. However, in September 2021, the government has launched a new strategic R&D programme in the field of energy (the budget for 2021-2029 is 800 mln PLN).

In row “22.Coal” funds estimation for 2021 are 196 mln PLN (almost 10 times increase in funding compared to previous years). It is due to the launch of the new program ‘The Bloki 200+’ (Power Generation Units+) dedicated to mitigating the effects of shutting down coal-fired power plants and transforming the system towards renewable energy sources. The Bloki 200+ (Power Generation Units+) is an initiative designed to support research & development work in the area of energy. It aims to develop new technological, organisational and legal solutions to facilitate the adaptation of power generation units (which have to be operated for the next 15 years to ensure energy supply and security of the Polish energy system) to the changing operating conditions and new challenges associated with the national energy system, increasingly relying on wind and solar energy. The programme will contribute to limit GHG emission and enabling the implementation of new competing technologies based on renewable and other clean energy sources.

Other information

In Poland, the Ministry of Science and Higher Education is responsible for financing research (basic and applied research projects, experimental development and research infrastructure), while “sectoral” ministries (e.g. ministry for energy, climate, agriculture, environment, defence etc.) are responsible for the implementation of demonstration projects and for the deployment of new technologies in their respective areas.

Data reported in questionnaire are not official statistical data, but only estimations based on analysis carried out by MSHE and its supervised funding agencies. Data provided are based on obligations (Minister’s and its agencies programmes and projects) and on the individual analysis of the projects themselves.

The Polish Statistical Office delivers official statistical data for R&D in Poland. From 2013, the Polish Statistical Office presents government budget appropriations or outlays for R&D by socio-economic objectives (NABS), where energy is 1 of 13 these objectives (others are environment, agriculture, health, defence etc.). However those data are not detailed and divided into sub-areas as RES, fossil fuels, nuclear etc.).

Portugal	Short name: **PORTUGAL**

Definition

Source: Direção Geral de Energia e Geologia
Latest submission: 2020/2021
Latest available data: 2021

Funding institutions/programmes included in the submission

- National Foundation for Science and Technology
- MIT Portugal

Other institutions are also included in the submission.

Budgetary stage information

The data for 2020 are based on actual outlays The data for 2021 are based on forecast calculated based on the assumption that budgets grow at the same rate as GDP forecast published by the European Commission for Portugal.

Data coverage

Includes the Azores and Madeira Islands.
The financing budgets include expenditure on human resources related to the relevant energy projects.
Energy-related projects undertaken with the European Union or other countries (bilaterally or multilaterally) are included in the Portuguese energy RD&D data.

State-owned enterprises coverage

No data available

Private sector coverage

The Private-Sector energy R&D budget groups the expenditures of the Business and Enterprise and the PNP sector.

Time series changes

In 2013, the total budget triples because the figures include salaries and EU financing.
From 2016 onwards, data include funding from the Nation Foundation for Science and Technology and other funding agencies.

Other information

Information on the yearly survey are available here: https://www.dgeec.mec.pt/np4/206/
12.027 business enterprises were surveyed and 9.987 replied to the questionnaire (87%), of which 4.155 had RD&D expenses. 135 PNP organizations were surveyed and 134 replied to the questionnaire (99,3%), of which 74 had RD&D expenses.
The data for 2020 were sorted on the basis of replies to question 5 (Energy) of the Survey of the National Scientific and Technological Potential (IPCTN) provided by the universities/companies that perform RD&D. In this question, the nomenclature of socio-economic objectives (SEO) is based on the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007). For the 2020 survey, the IPCTN19 questionnaire form disaggregated the Energy objective in order to comply with the one-digit level of the IEA questionnaire. The IPCTN follows the internationally established guidelines (OECD, Frascati Manual, 2015) with four institutional sectors: Business and Enterprise (Empresas), Government (Estado), Higher Education (Ensino Superior) and Non-profit Private (Instituições privadas sem fins lucrativos).

Slovak Republic	**Short name:** SLOVAKIA

Definition

Source: Department of International Energy Relations, Ministry of Economy of The Slovak Republic

Latest submission: 2021/2022

Latest available data: 2022

Funding institutions/programmes included in the submission

- Ministry of Education, Science, Research and Sport of the Slovak Republic (MESRS SR) http://www.minedu.sk/about-the-ministry/
- Slovak Research and Development Agency – SRDA https://www.apvv.sk/?lang=en
- Scientific Grant Agency – VEGA http://www.minedu.sk/vedecka-grantova-agentura-msvvas-sr-a-sav-vega/
- Research Agency – RA http://www.vyskumnaagentura.sk/en/;
- Slovak Innovation and Energy Agency – SIEA http://www.siea.sk/.

Budgetary stage information

No details available

Data coverage

Financial means from EU structural funds are included in the indicated amounts.

Data concerning specific budgets for demonstration projects or any “seed-capital” budgets for R&D are not available.

State-owned enterprises coverage

No data available

Private sector coverage

No data available

Time series information

N/A

Other

The Ministry of Education, Science, Research and Sport of the Slovak Republic (MESRS SR) is the central body of the state administration of the Slovak Republic for elementary, secondary and higher education, educational facilities, lifelong learning, and science, and for the state's support for sports.

The R&D agenda belongs to competencies of MESRS SR and is supported from the state budget via grant agencies (Slovak Research and Development Agency – SRDA, Scientific Grant Agency – VEGA).

The use of structural funds of European Union for research and development are administered by dedicated agency Research agency (RA) or directly via relevant section of MESRS SR - EU Structural Funds Section.

Industries and private companies are co operating with academic institutions, but the funding for these activities is small.

Incentives for R&D – support from the state budget in SMEs and their co operation with academic institutions – is implemented through Law no. 185/2009 Coll. and Commission Regulation (EU) No. 651/2014 (until now, no. 800/2008).

Spain	Short name: **SPAIN**
Definition	**Source**: Subdirección General de Coordinación de la Innovación, Ministerio de Ciencia, Subdirección General de Prospectiva, Estrategia y Normativa en Materia de Energía, Ministerio para la Transición Ecológica y el Reto Demográfico **Latest submission:** 2021/2022 **Latest available data:** 2020 **Funding institutions/programmes included in the submission** • National Research Agency (AEI) • Centre for Industrial Technological Development (CDTI) **Budgetary stage information** No details available **Data coverage** Includes the Canary Islands and the Islas Baleares. **State-owned enterprises coverage** No data available **Private sector coverage** No data available **Time series changes** N/A **Other information** N/A
Sweden	**Short name:** SWEDEN
Definition	**Source**: Energy Analysis Department, Swedish Energy Agency **Latest submission:** 2021/2022 **Latest available data:** 2022 **Funding institutions/programmes included in the submission** • Swedish Energy Agency • VINNOVA – Sweden´s Innovation Agency • The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) • The Swedish Research Council (VR) **Budgetary stage information** Data are based on actual outlays (budgetary stage vii).

Sweden	**Data coverage**
Definition (continued)	International programmes such as ITER and expenditures to the IEA and the EU are included, but not the contribution for IEA and EU memberships. Data are collected from a funder perspective as budget. **State-owned enterprises coverage** State-owned enterprises exist but are not covered in the data. **Private sector coverage** No data available **Time series change** N/A **Other information** N/A

Switzerland	Short name: **SWITLAND**

Definition	**Source**: Swiss Federal Office of Energy, Energy Research & Cleantech
	Latest submission: 2021/2022
	Latest available data: 2021
	
	Funding institutions/programmes included in the submission
	
	• ETH domain
	• basic financing and internal competitive programmes of the federal technical universities and research organisations (ETHZ, EPFL, PSI, EMPA, EAWAG, WSL)
	• Swiss National Science Foundation (SNSF)
	• (Open) project funding (fundamental research)
	  • National Research Programmes
	• Swiss Innovation Agency (Innosuisse)
	• (Open) project funding (applied research)
	  • Energy Programme (SCCER)
	  • EUREKA
	  • COST
	• Swiss Federal Office of Energy (SFOE)
	• Energy Research Programmes (incl. SWEET/SOUR)
	• Pilot and Demonstration Programme
	• Swiss Federal Nuclear Safety Inspectorate (ENSI)
	• Nuclear Safety and Radioactive Waste Research Programme
	• State Secretariat for Education Research and Innovation (SERI)
	• Replacement measures for the European Framework Programmes
	• Cantons
	• basic financing of cantonal universities and universities of applied sciences
	
	Budgetary stage information
	
	The numbers up to 2020 correspond to the effective expenditures of R&D institutions. The values for 2021 and 2022 are estimated based on 2020. Since there is no specific budget for energy related R&D in Switzerland that there is a broad variety of national/regional funding bodies, the value is estimated from the year before.

Switzerland Definition (continued)

Data coverage

Estimated share of the sample of the total expenditure covered:

- Government 100%
- All the Swiss federal research organizations receive the survey. All the institutions dealing in energy research do respond and declare their data in a remarkable degree of detail.
- Higher education 100%
- All the Swiss universities and universities of applied sciences receive the survey. All the institutions dealing in energy research do respond and declare their data in a remarkable degree of detail.

State-owned enterprises coverage

No data available

Private sector coverage

No data available

Time series change

N/A

Other information

Data are collected with a hybrid methodology by using voluntary surveys.

The Swiss RD&D statistics are based on the real expenditures per project. Data about projects entirely or partially funded by the federal government are available from federal databases. However, federal research organisations, federal and cantonal universities, as well as cantonal universities of applied sciences, also run internal or third-party financed projects (cantonal/private, national/international). Data about these projects are declared by the performers annually on a detailed questionnaire (per project, including several classifications/categories). About 30% of the total expenditures are based on the survey.

Turkey — Short name: TURKEY

Definition

Source: The Scientific and Technological Research Council of Turkey (TÜBİTAK) and the Ministry of Energy and Natural Resources

Latest submission: 2017/2018

Latest available data: 2018

Funding institutions/programmes included in the submission

- Scientific and Technological Research Council of Turkey (TÜBİTAK) - Academic R&D Funding Directorate (ARDEB)
- Public Research Grant Committee (KAMAG)
- Technology and Innovation Grant Programs Directorate (TEYDEB)
- TÜBİTAK Marmara Research Center (MAM) Energy Institute, Chemistry Institute and Materials Institute

Budgetary stage information

Turkish data are allocated and realised budgets (final budget appropriations, budgetary stage v) for the years 2016 and 2017. Only the budgets for 2018 represent estimated values.

Turkey

Definition (continued)

Data coverage

The budget includes the public R&D funds that are provided to academic and private sector researchers, entrepreneurs, and/or research consortiums, including all related actors and public research institutes.

Based on the responsibility area of TÜBİTAK, all national values represent R&D budgets and not demonstration.

State-owned enterprises coverage

No data available

Private sector coverage

No data available

Time series change

Data for 2014-2018 include European R&D project financial resources allocated in the corresponding years. The total values are EUR 3.97 million in 2016 and EUR 8.48 million in 2017 that have been converted to national currency based on the annual average conversion rates.

Other information

N/A

United Kingdom

Short name: **UK**

Definition

Source: Department for Business, Energy and Industrial Strategy (BEIS)

Latest submission: 2020/2021

Latest available data: 2020

Funding institutions/programmes included in the submission

- Department for Business, Energy and Industrial Strategy (BEIS)
- Department for Transport (DfT)
- Department for Environment Food And Rural Affairs (DEFRA)
- Department for International Development (DfID)
- UK Research and Innovation Councils (UKRI), primarily:
  - Engineering and Physical Sciences Research Council (EPSRC)
  - Innovate UK
- Innovate UK
- Scottish Government
- Nuclear Decommissioning Authority (NDA)
- Office for Low Emission Vehicles.

Budgetary stage information

All data refer to the UK financial year; for example, the data year 2017 correspond starts April 1, 2017, and runs until March 31, 2018.

Data for year 2020 are estimates based on available information at the time of the submission to the IEA.

Data coverage

Includes the Channel Islands.

United Kingdom	Due to data coming from multiple sources in the UK government that provide differing degrees of detail, only certain sub-totals can be shown.
Definition (continued)	All programmes funded directly by the UK government, regardless of where they take place are included; whereas projects funded by EU institutions are not included. **State-owned enterprises coverage** No data available **Private sector coverage** No data available **Time series change** Amounts reported for 2017 data under GROUP 8: "Unallocated" include budgets from EPSRC for which a more detailed breakdown was not available. **Other information** N/A

United States	**Short name:** US
Definition	**Source**: U.S. Department of Energy, for the years 2012 to 2015. IEA estimates from public sources for earlier years and for 2016 onwards. **Latest submission:** 2016/2017 **Latest available data:** 2020 **Funding institutions/programmes included in the submission** • Department of Energy (DoE) • Department of Defense (DoD) • Department of Transport (DoT) • Department of Agriculture (USDA) • National Aeronautics and Space Agency (NASA) **Budgetary stage information** No details available **Data coverage** Includes Puerto Rico, Guam and the Virgin Islands and the Hawaiian Free Trade Zone. **State-owned enterprises coverage** No data available **Private sector coverage** No data available **Time series change**

United States

Definition (continued)

There is a large increase in RD&D spending observed in 2009 due to the increased expenditures associated with the American Recovery and Reinvestment Act of 2009 (stimulus) spending. This is a one-year appropriation (although actual expenditures may go into future years), and so 2010 saw a significant decrease.

For the year 2016 and onwards, data refer to the estimates made by the IEA Secretariat based on publicly available information on final budget appropriations (figures as voted by the parliament for the coming year, including additional votes during the year). IEA estimates include data for the following agencies/departments: Department of Energy (DoE), Department of Defense (DoD), National Aeronautics and Space Administration (NASA), U.S. Department of Agriculture (USDA) and Department of Transportation (DoT).

Other information

The item III.1.1 “Solar heating and cooling” is included under the item I.2 “Energy efficiency-residential and commercial” as it cannot be easily separated.

European Union

Short name: **EU**

Definition

Source: European Union Directorate-General for Research and Innovation, Directorate for Energy

Latest submission: 2020/2021

Latest available data: 2020

Funding institutions/programmes included in the submission

- Horizon 2020
- Innovation Fund (small-scale projects)

Budgetary stage information

Figures refer to the committed – not yet paid – EU contribution to projects. Budgets have been allocated to the year of the calls for proposals and are not spread across the duration of the project.

Data coverage

Only project grants are considered – financial instruments or contributions to other initiatives are not included.

Only projects including an explicit reference to energy R&D objectives have been included.

Projects have been classified according to their contribution to energy-related R&D objectives as either “fully”, “partially” or “not” contributing. The EU contribution to projects fully contributing was taken into account fully (100%), while for projects partially contributing, only 40% of the EU contribution has been taken into account in the figures.

Besides the Horizon 2020 Societal Challenge “Clean, secure and efficiency energy”, the following programme parts contribute substantially to energy-related R&D objectives: “Nanotechnologies, Advanced Materials, Biotechnology, and Advanced Manufacturing and Processing (NMBP)”, “Smart, Green and Integrated Transport”, “European Research Council”, “Marie Skłodowska-Curie Actions”, “Information and Communication Technologies”, and “Innovation in SMEs”.

State-owned enterprises coverage

Not applicable

Private sector coverage

Not applicable

European Union	**Time series change**
Definition (continued)	The European Union revised data back to 2018 with the 2020 submission, in order to improve the attribution of funding to the specific years and technology categories.
	Other information
	The EU provided substantial support to energy harvesting and the “Smart Cities and Communities” initiative. As there is no dedicated category in the current template for “Smart Cities and Communities” (SCC), which is a very substantial spending item for the EU Horizon 2020 programme, SCC is included under item 73 “Other cross-cutting technologies and research – Other” in the current figures. SCC is covering energy efficiency in buildings and transport as well as renewable energy and electricity transmission and distribution.

IEA Publications

International Energy Agency

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