ENERGY TECHNOLOGY RD&D BUDGETS 2019 EDITION

DATABASE DOCUMENTATION

This document provides information regarding the 2019 edition of the Energy technology RD&D budgets database. This document can be found online at http://wds.iea.org/wds/pdf/RDD_Documentation.pdf.

For more information about trends and data please visit https://www.iea.org/statistics/rdd/.

Please address your inquiries to RDD@iea.org.

Please note that all IEA data is subject to the following Terms and Conditions found on the IEA's website: www.iea.org/t&c/

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1. DATABASE STRUCTURE

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

- countries: 30 IEA countries, 4 IEA regions, and the European Union
  (see section 5: *Geographical coverage and country notes* for availability of data by country);
- years: 1974-2018 unless otherwise specified.

The database includes the following five files:

RDD_Country Budgets.IVT	**Detailed country RD&D budgets** 31 countries (30 individual countries + European Union), 8 products and 184 flows
RDD_Country Budgets_Summary.IVT	**Summary country RD&D budgets** 31 countries (30 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.IVT	**Estimated RD&D budgets by region** 4 regions, 3 products and 11 flows
RDD_Indicators.IVT	**RD&D indicators** 30 countries and 4 indicators
RDD_Per_GDP.IVT	**RD&D budgets per GDP** 30 countries and 1 indicator

2. FLOW DEFINITIONS

The IEA Guide to Reporting Energy RD&D Budget/Expenditure Statistics with the detailed definitions can be found in the same folder as this document and is also available for download at https://www.iea.org/stats/RDD%20Manual.pdf .

Energy RD&D budgets	
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

Energy RD&D budgets	
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
215 Oil and gas conversion	215CONVE
216 Other oil and gas	216OTOIL

Energy RD&D budgets	
Long name	**Short name**
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
339 Unallocated ocean energy	339OCEUN
34 Biofuels (including liquid biofuels, solid biofuels and biogases)	34BIOFUE
341 Production of liquid biofuels	341LPROD

Energy RD&D budgets	
Long name	**Short name**
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
411 Light water reactors (LWRs)	411LWRS
412 Other converter reactors	412OTHNU
4121 Heavy water reactors (HWRs)	4121HWRS
4122 Other converter reactors	4122OTHE

Energy RD&D budgets	
Long name	**Short name**
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
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

Energy RD&D budgets	
Long name	**Short name**
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 conversion	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
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

Energy RD&D budgets	
Long name	**Short name**
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
Memo: Low-carbon	MEMOLC
Memo: Non-low-carbon	MEMONLC

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+U NALLOC
Memo: Non-low-carbon	MEMONLC	Includes: coal, gas, oil and other fossil fuel RD&D with the exception of CCS. =21OILGAS+22COAL+29FOSFUN

3. PRODUCT DEFINITIONS

Energy RD&D Budgets		
Long name	**Short name**	**Definition**
Total RD&D in million USD (2018 prices and exchange rates)	RDDUSD	Total RD&D expenditure data, converted from current prices in national currencies to US dollars in constant 2018 prices using GDP deflators and 2018 exchange rates.
Total RD&D in million USD (2018 prices and PPPs)	RDDUSDPPP	Total RD&D expenditure data, converted from current prices in national currencies to US dollar PPPs in constant 2018 prices using GDP deflators and 2018 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 (2018 prices and exchange rates)	RDDEURO	Total RD&D expenditure data, converted from current prices in national currencies to euros in constant 2018 prices using GDP deflators and the euro 2018 exchange rates.
Total RD&D in million national currencies (2018 prices)	RDDNCREAL	Total RD&D expenditure data in national currencies, deflated using country-specific GDP deflators.
Total RD&D in million national currencies (nominal)	RDDNC	Total 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	Total R&D expenditure data, expressed in national currencies at current prices.

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: Main Economic Indicators (OECD).
Purchasing Power Parity (PPP)	PPP	Source: National Accounts (OECD).
Nominal GDP in national currency (Millions)	GDPNCN	Source: National Accounts (OECD).
GDP Deflator	GDPDEF	Source: National Accounts (OECD).

4. GEOGRAPHICAL COVERAGE AND COUNTRY NOTES

Countries and Regions		
Country	**Short name**	**Definition**
Estimated IEA Total	IEAEST	The International Energy Agency (IEA) includes Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, Mexico (starting with 2013 data), the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.
Estimated IEA Americas	IEAAMEST	Includes Canada, Mexico (starting with 2013 data) and the United States.
Estimated IEA Europe	IEAEUREST	Includes Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey and the United Kingdom.
Estimated IEA Asia Oceania	IEAAOEST	Includes Australia, Japan, Korea and New Zealand.

Countries and Regions		
Country	**Short name**	**Definition**
Australia	AUSTRALI	**Source**: Department of the Environment and Energy **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: • AusIndustry; • 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); • Department of Education and Training (DoET); • Department of Industry, Innovation and Science (DIIS); • National Energy Resources Australia (NERA). **Country note**: Excludes overseas territories. All data refer to the financial year, for example 2018 refers to 1 July 2018 to 30 June 2019. No data is reported under state-owned companies as there is no relevant expenditure in that section in Australia. The decrease in spending that occurred in Government R&D between 2013 and 2014 was mainly due to completion of major programs supporting CCS, solar energy and energy efficiency. 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. 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. Prior to 1997, biofuels includes geothermal and other renewable energy not elsewhere classified.

Countries and Regions		
Country	**Short name**	**Definition**
Austria	AUSTRIA	**Source**: Austrian Energy Agency on behalf of the Federal Ministry of Transport, Innovation and Technology **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: All funding institutions on federal level. The most important ones are: • The Austrian Research Promotion Agency (FFG): www.ffg.at; • Climate and Energy Fund: https://www.klimafonds.gv.at/home-en-US/; • Austrian Science Fund (FWF): http://www.fwf.ac.at/en/; • Kommunalkredit Public Consulting (KPC): http://www.publicconsulting.at/kpc/en/home; • Austria Wirtschaftsservice Gesellschaft mbH (aws), the Austrian federal promotional bank.www.awsg.at. The Climate and Energy Fund makes use of the other funding agencies for calls, contracting etc. Funding Agencies of provinces (if any) covered via the administrations of provinces. A full publication of this survey can be found at: http://www.nachhaltigwirtschaften.at/iea/results.html/id7664. **Country note**: In general, direct expenditures through co-financing in energy-related projects undertaken with the European Union (EU, especially Horizon 2020) or other countries are included in Austrian RD&D data only if there is a contract with a national funding institution. According to the guidelines, contributions to the EU energy RD&D budget are not included, and also not the return from EU/H2020 projects (only the national funding is covered, if any, as mentioned above). Austrian data do not include contributions to the common funds of international organizations (e.g. ITER or CERN), but cover the national funding of energy-specific projects in the framework of these organizations. Data cover all costs of Austrian activities in IEA TCPs, excluding the common funds. State owned R&D-budgets are not covered. R&D from “state owned enterprises” plays a minor role in the energy sector (this might not be the case in other sectors like transportation etc.). Funding of (more or less) state owned or influenced research infrastructure is covered, but that is not sector companies/enterprises. 2018 data are based on obligations (money actually committed during the year). Budget forecasts are not available for estimated years.

Countries and Regions		
Country	**Short name**	**Definition**
Belgium	BELGIUM	**Source**: Belgium Federal Government **Latest submission:** 2018/2019 **Latest available data:** 2017 **Funding institutions included in the submission**: **Flemish region:** The list of included institutions in the figures for Flanders: • Flanders Innovation & Entrepreneurship (VLAIO)(https://www.vlaio.be/nl/andere-doelgroepen/flanders-innovation-entrepreneurship); • Imec (https://www.imec-int.com/en/home); • Flanders Make (https://www.flandersmake.be/en); • VITO (https://vito.be/en); • "Research Foundation – Flanders (FWO)" (https://www.fwo.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 (https://spw.wallonie.be/) **Brussels-capital region:** Bruxelles-Environnement (https://environnement.brussels/) and Innoviris (https://innoviris.brussels/) **Federal (nuclear):** Federal Public Service Economy (https://economie.fgov.be/en) and BELSPO (https://www.belspo.be/belspo/index_en.stm) **Country note**: Figures include data for the three regions (Flanders, Walloon and Brussels). For the Flemish region, data are based on final budget appropriations. 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). For the Walloon region, data provided are based on obligations, 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. For the Brussels region, data provided are based on obligations (budgetary stage vi), and on the individual analysis of the projects themselves. The data includes all the projects in which there is a regional co-funding involved. There are no state owned companies. For 2018 estimated, only data for nuclear budgets are available.

Countries and Regions		
Country	**Short name**	**Definition**
Canada	CANADA	**Source**: Natural Resources Canada (NRCan), Government of Canada **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: Figures are based on data from 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. **Country note**: All data refer to the fiscal year, for example, 2017 refers to April 1st 2017 to March 31st 2018. Government figures include combined data from Federal Departments and Agencies and all of Provinces and Territories. Data up to and including 2017 refer to actual outlays. Data beyond 2017 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. Data include contributions to the following international RD&D programmes/organizations: • International Atomic Energy Agency (IAEA) • OECD Nuclear Energy Agency (NEA) • Center for Energy Advancement through Technological Innovation (CEATI) 2012-2013 fiscal year was the first year Canada started reporting state-owned entities separately.

Countries and Regions		
Country	**Short name**	**Definition**
Czech Republic	CZECH	**Source**: Ministry of Industry and Trade of the Czech Republic **Latest submission:** 2015/2016 **Latest available data:** 2016 **Funding institutions included in the submission**: No detail available. **Country note**: Prior to the 2009/10 cycle data were collected by the Ministry of Industry & Trade, and only included large projects. From 2009/10 onwards, data include almost all Czech ministries involved in energy research. When the proposed Technology Agency starts work, comprehensive data are expected to be available. Revisions to historical data reported with the 2015/16 submission correspond to the application of an improved methodology for data collection. Data reported in the questionnaire now come from an aggregation of data collected from a database listing all R&D projects funded or co-funded with public money. For 2015 data, budget forecasts are based only on currently on-going projects with long-term schedules. This can result in a budget decrease between 2014 and 2015 that will not reflect the actual budgets once data become available.
Denmark	DENMARK	**Source**: Danish Energy Agency, Ministry of Energy, Utilities and Climate **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: • Energiteknologisk Udviklings- og Demonstrationsprogram (EUDP) - primarily an D&D program but including some support to research activities • ELFORSK – RD&D for efficient use of electricity, emphasis om R&D • The Danish Innovation Fund – primarily supports research activities. **Country note**: Excludes Greenland and the Danish Faroes. Figures included in the Danish submission consist exclusively of funding of project proposals directed towards Danish RD&D programs. Contributions to international organizations and programmes are not included. Danish data are based on obligations for 2016 and 2017 (budgetary stage vi) and on final budget appropriations for 2018 (budgetary stage v).

Countries and Regions		
Country	**Short name**	**Definition**
Estonia	ESTONIA	**Source**: Ministry of Economic Affairs and Communications **Latest submission:** 2017/2018 **Latest available data:** 2017 **Funding institutions included in the submission**: • Environmental investment Centre; • KredEx; • Information from Universities regarding their own financing of energy R&D projects (state budget/ EU funding); • Energy companies. **Country note**: Data prior to 2011 are not available. Data reported under the name of Coal actually correspond to oil shale.
Finland	FINLAND	**Source**: Statistics Finland **Submitted by:** Energy Department, Ministry of Economic Affairs and Employment **Latest submission:** 2018/2019 **Latest available data:** 2017 **Funding institutions 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. **Country note**: “Other coal” contains budgets allocated to peat research. “Coal combustion” includes "Coal conversion".

Countries and Regions		
Country	**Short name**	**Definition**
France	FRANCE	**Source**: Service de la Donnée et des Etudes Statistiques, Ministère de la Transition Ecologique et Solidaire **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: 14 public scientific and technical institutions, industrial and commercial institutions, public interest groups or public funding programs. 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) ; • 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); • Fonds unique interministériel (FUI). **Country note**: Includes Monaco, and excludes the following overseas departments and territories (Guadeloupe, Guyana, Martinique, New Caledonia, French Polynesia, Reunion, and Saint-Pierre and Miquelon). In 2010 the French Administration revised the RD&D budgets back to 2002. This results in a break in series between 2001 and 2002. The French data submission is mostly based on actual budget outlays (budgetary stage vii), with a few French institutions reporting on obligations. 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, nor contributions to these programmes.

Countries and Regions		
Country	**Short name**	**Definition**
Germany	GERMANY	**Source**: Federal Ministry for Economic Affairs and Energy **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: The funding reported is the funding within the 6th Energy Research Programme of the Federal Government. Funding institutions are the Federal Ministry for Economic Affairs and Energy, the Federal Ministry of Education and Research and the Federal Ministry of Food and Agriculture. **Country note**: Data do not include expenditures by regional governments. Data do not include the new Laender of Germany prior to 1992. Data include basic research and applied research projects. From 2003 onwards, the institutionally financed R&D activities of the Helmholtz centers are included. The figures submitted to IEA are based on the 6th energy research programme. The "total budget" data are identical to figures reported in the yearly updated "2019 Federal Government Report on Energy Research" available online. Figures on international or European programmes are not included. 2018 estimated data are based on actual outlays (budgetary stage vii). A report about German RD&D budget is available at: https://www.bmwi.de/Redaktion/EN/Publikationen/Energie/federal-government-report-on-energy-research-2019.html.
Greece	GREECE	**Source**: General Secretariat for Research and Technology **Latest submission:** 2010/2011 **Latest available data:** 2011 **Funding institutions included in the submission**: No detail available. **Country note**: From 2000 onwards, Greece has provided only aggregated data until 2007.

Countries and Regions		
Country	**Short name**	**Definition**
Hungary	HUNGARY	**Source**: National Research, Development and Innovation Office (NRDI) **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: National Research, Development and Innovation Office and Ministry of Finance. **Country note**: 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. Data refer to obligations for 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 2017). 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	IRELAND	**Source**: Sustainable Energy Authority of Ireland **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: • Sustainable Energy Authority of Ireland (SEAI); • Department of Agriculture, Food and the Marine (DAFM); • Department of Transport, Tourism and Sport (DTTAS); • Environmental Protection Agency (EPA). • Enterprise Ireland; • Geological Survey Ireland (GSI); • Marine Institute; • Science Foundation Ireland (SFI). **Country note**: 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. Data for this period are based on obligations (budgetary stage vi). Further information relating to energy RD&D projects funded in Ireland is available at the SEAI National Energy Database.

Countries and Regions		
Country	**Short name**	**Definition**
Italy	ITALY	**Source**: Department of Energy, Ministry of Economic Development **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: No detail available. **Country note**: Includes only RD&D performed on the Italian territory. RD&D by Italian entities abroad is not included, but RD&D by foreign entities on Italian territory is included. RD&D of entities granted extraterritorial status in Italy (embassies, EU research institutions, etc.) is not included. In 2015, Italy changed their methodology on RD&D statistics and revised time series back to 2010. Data reported are now based on surveys performed by the National Statistical Office (ISTAT). R&D budget for 2010-2015 are based on actual outlays. Demonstration budgets for 2010-2015 are based on obligations. Data for 2016 and 2017 have been estimated by Italy based on ISTAT preliminary estimates on R&D for the various institutional sectors. As such, the new methodology used for 2016 and 2017 data differs from the one for previous years.
Japan	JAPAN	**Source**: Ministry of Economy, Trade and Industry **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: • Ministry of Economy, Trade and Industry (METI); • Ministry of Environment (MOE). **Country note**: The items included in Conservation were expanded in 1994. Earlier budgetary data are not comparable. "State-owned R&D" budgets are not covered in the "Government R&D" totals. Data provided are based on final budget appropriations (budgetary stage v), and does not include budgets related to international RD&D programmes. 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 the 13% of the total national budget, this explains the break in time series between 2017 and 2018. This has also effects on the aggregates IEA Total and IEA Asia Oceania.

Countries and Regions		
Country	**Short name**	**Definition**
Korea	KOREA	**Sources**: Ministry of Trade, Industry, and Energy (MOTIE), Korea Institute Energy Technology Evaluation and Planning (KETEP), Korea Energy Economics Institute (KEEI) **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: No detail available. **Country note**: Data include RD&D budgets based on the technology development and international cooperation reflected in the Energy R&D Program of the MOTIE.
Luxembourg	LUXEMBOU	**Source**: Ministère de l'Economie, Direction générale Recherche, propriété intellectuelle et nouvelles technologies **Latest submission:** 2013/2014 **Latest available data:** 2012 **Funding institutions included in the submission**: Luxembourg Government, conventions are double signed by both the Minister of Economy and Minister of Finance. **Country note**: Luxembourg has provided just partial information for 1991 to 2000. The figures provided do not show the split between R&D and Demonstration as the split is not available within current reporting scheme. Data provided are based on obligations (budgetary stage vi).
Mexico	MEXICO	**Source**: Secretaría de Energía (SENER), Gobierno de México **Latest submission:** 2017/2018 **Latest available data:** 2018 **Funding institutions included in the submission**: No details available at this moment. **Country note**: Mexico became an IEA member in February 2018 and as such is now included in the list of IEA member countries, starting with the 2018 edition of this publication. Data for Mexico are available starting in 2013.

Countries and Regions		
Country	**Short name**	**Definition**
Netherlands	NETHLAND	**Source**: Netherlands Enterprise Agency (RVO.nl), Ministry of Economic Affairs and Climate Policy **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions 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). R&D budgets and expenditures of universities, as well as funding from local governments programs, are not included in the submitted data. **Country note**: 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. Data submitted are based on obligations (budgetary stage vi).
New Zealand	NZ	**Source**: Ministry of Business, Innovation & Employment **Latest submission:** 2016/2017 **Latest available data:** 2017 **Funding institutions included in the submission**: • Ministry of Business, Innovation and Employment; • Statistics New Zealand; • Callaghan Innovation.

Countries and Regions		
Country	**Short name**	**Definition**
Norway	NORWAY	**Source**: Climate, Industry and Technology Department, Ministry of Petroleum and Energy **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: a) Government R&D/Demo: i. The Research Council of Norway ii. Enova SF iii. Transnova SF iv. Innovation Norway v. The Norwegian Water and Energy Directorate vi. Gassnova SF b) State-owned enterprises R&D/Demo: i. Statnett ii. Statkraft Not included: Statoil (only partially state-owned) **Country note**: Includes the Svalbard archipelago (Spitsbergen). Data reported for 2015 are based on actual outlays (budgetary stage vii). 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. 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.

Countries and Regions		
Country	**Short name**	**Definition**
Poland	POLAND	**Source**: Department of Innovation and Development, Ministry of Science and Higher Education **Latest submission:** 2017/2018 **Latest available data:** 2017 **Funding institutions 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). *Not included*: Other Polish ministries and institutes supervised by those ministries which may also fund some research projects (but marginally – the MSHE is responsible for science policy and funding research from public budget). **Country note**: Only R&D projects are included in the submission. Demonstration projects are not included. Data reported by Poland are estimations based on analysis carried out by the Ministry and its supervised funding agencies. All projects, funded from science budget including "State-owned R&D" and "Government pilot projects" are included in the submission. Funding from EU's Horizon 2020 is not included. Financial means from EU structural funds are included (flowing directly via national budget). Data for 2017 and 2018 are initial estimations for on-going or planned projects. The final data for this period will vary and should be higher. In Poland, a small number of state-owned energy companies (supervised by the Ministry of Energy) may perform RD&D as additional activities next to their statutory tasks. Data do not include such RD&D activities at the moment.

Countries and Regions		
Country	**Short name**	**Definition**
Portugal	PORTUGAL	**Source**: Direção Geral de Energia e Geologia **Latest submission:** 2015/2016 **Latest available data:** 2015 **Funding institutions included in the submission**: • National Foundation for Science and Technology • MIT Portugal **Country note**: Includes the Azores and Madeira Islands. The financing budgets include expenditure on human resources related to the relevant energy projects. Only 8 out of 15 entities replied to the questionnaire, so the list of funding institutions referred above is a sample and do not represent the national situation. Energy-related projects undertaken with the European Union (EU) or other countries (bilaterally or multilaterally) are included in the Portuguese energy RD&D data. 2013 Total Budget triples and this is because the figures include salaries and EU financing.

Countries and Regions		
Country	**Short name**	**Definition**
Slovak Republic	SLOVAKIA	**Source**: Department of International Energy Relations, Ministry of Economy of The Slovak Republic **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions 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/. 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, science and for the state's support for sports. 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. Financial means from EU structural funds are included in indicated amounts. Industries and private companies are cooperating with academic institutions, but the funding of these activities is small. Incentives for R&D - support from the state budget in SMEs and their cooperation with academic institutions is implemented through Law no. 185/2009 Coll. and Commission Regulation (EU) No. 651/2014 (till now no. 800/2008). **Country note**: Data concerning specific budgets for demonstration projects or any "seed-capital" budgets for R&D are not available.

Countries and Regions		
Country	**Short name**	**Definition**
Spain	SPAIN	**Source**: Secretaría de Estado de Investigación, Desarrollo e Innovación, MINECO. Subdirección General de Planificación Energética y Seguimiento, MINETUR **Latest submission:** 2018/2019 **Latest available data:** 2017 **Funding institutions included in the submission**: • National Research Agency (AEI); • Centre for Industrial Technological Development (CDTI). **Country note**: Includes the Canary Islands and the Islas Baleares.
Sweden	SWEDEN	**Source**: Energy Analysis Department, Swedish Energy Agency **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions 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). **Country note**: State-owned R&D exists but is not included. Swedish data are based on actual outlays annually presented to the IEA (budgetary stage vii). 2016 estimated data are based on forecasts (estimates of funding before beginning of budget discussion). International programmes like ITER and expenditure to the IEA and the EU are included, but not contribution for IEA and EU memberships.

Countries and Regions		
Country	**Short name**	**Definition**
Switzerland	SWITLAND	**Source**: Swiss Federal Office of Energy, Federal Department of the Environment, Transport, Energy and Communications **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions included in the submission**: • ETH domain; • Swiss National Science Foundation SNSF; • CTI (since 1.1.2018: Innosuisse); • Swiss Federal Office of Energy SFOE; • Swiss Federal Nuclear Safety Inspectorate ENSI; • State Secretariat for Education Research and Innovation SERI; • Other federal offices and institutes; • European Commission; • Cantons. **Country note**: The scope of the Swiss RD&D data submission includes all the energy-relevant, governmental funding institutions at federal, regional (cantonal), and European level. The statistics are mainly based on the energy-related projects listed in the official databases of the funding institutions (www.aramis.admin.ch, p3.snf.ch, cordis.europa.eu), on self-declarations by the research institutions, as well as on information provided by the Swiss Federal Statistical Office. The activities cover the entire innovation chain from basic research (mainly financed by the SNSF), applied research, and pilot & demonstration. The data include institutional (mainly ETH domain and Cantons, i.e., cantonal universities and universities of applied sciences), project, and career funding. Furthermore, they include overheads and project related investments. The European RD&D programmes – such as, e.g., Horizon 2020, Euratom, or EMPIR – co-financed by the Swiss government, are considered as well. The submission for Switzerland is based on even more detailed statistics (per topic, funding institution, research institute, and type of research) published on www.energy-research.ch. Swiss data are based on actual outlays for 2017 and on budget forecasts for 2018 estimates.

Countries and Regions		
Country	**Short name**	**Definition**
Turkey	TURKEY	**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 **Country note**: Data for 2014-2018 include the funding programs of the Scientific and Technological Research Council of Turkey (TÜBİTAK) under the Academic R&D Funding Directorate (ARDEB), the Public Research Grant Committee (KAMAG), as well as the Technology and Innovation Grant Programs Directorate (TEYDEB), and the research activities of the TÜBİTAK Marmara Research Center (MAM) Energy Institute, Chemistry Institute and Materials Institute that are funded from other public sources. 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. Turkish data are allocated and realized budgets (final budget appropriations, budgetary stage v) for the years 2016 and 2017. Only the budgets for 2018 represent estimated values. 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.

Countries and Regions		
Country	**Short name**	**Definition**
United Kingdom	UK	**Source**: Department for Business, Energy and Industrial Strategy (BEIS) **Latest submission:** 2018/2019 **Latest available data:** 2018 **Funding institutions 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); • Engineering and Physical Sciences Research Council (EPSRC); • Innovate UK; • Scottish Government; • Nuclear Decommissioning Authority (NDA); • Office for Low Emission Vehicles. **Country note**: Includes the Channel Islands. Due to data coming from multiple sources in the UK government which provide differing degrees of detail, only certain sub-totals can be shown. All data refer to the UK financial year, for example the data year 2017 corresponds starts April 1, 2017, and runs until March 31, 2018. Amounts reported for 2017 data under GROUP 8: "Unallocated" include budgets from EPSRC for which a more detailed breakdown was not available. 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.

Countries and Regions		
Country	**Short name**	**Definition**
United States	USA	**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:** 2018 **Country note**: Includes Puerto Rico, Guam and the Virgin Islands and the Hawaiian Free Trade Zone. All data refer to the fiscal year, for example 2016 refers to October 2016 to September 2017. 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. 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. 2012 data include both R&D and Demonstration budgets under the one heading of "R&D". For the years 2016 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).

Countries and Regions		
Country	**Short name**	**Definition**
European Union	EU	**Source**: European Union Directorate-General for Research and Innovation, Directorate for Energy **Latest submission:** 2018/2019 **Latest available data:** 2018 **Country note**: The figures include all relevant Horizon 2020 projects funded under calls for proposals in the years 2014, 2015, 2016, 2017 and 2018 (cut-off date for data was 1 April 2019). The figures for 2018 refer to concrete projects signed under the 2018 calls; however not all projects to be funded under the 2018 calls are already signed (figures will therefore be revised in the next data submission). Only project grants are considered – financial instruments or contributions to other initiatives are not included. 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. 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[1]. 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'. The European Union revised data back to 2014 with the 2018/19 submission, in order to improve the attribution of funding to the specific years and technology categories. 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. [1] See also RIO markers on climate related actions.