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World Energy Investment 2019: Methodology Annex

Comments and questions are welcome and should be addressed to:
Energy Supply and Investment Outlook Division, International Energy Agency
31-35 rue de la Fédération, 75739 Paris Cedex 15, France
Telephone: (33-1) 40 57 65 12; Email: investment@iea.org

Introduction

The way investment is measured across the energy spectrum varies, largely because of differences in the availability of data and the nature of expenditures. This document explains in greater detail the methodology used to ensure that the estimates are consistent and comparable across sectors in *World Energy Investment 2019 (WEI 2019)*. The definition of investment changed from the previous editions of WEI where investment was defined as overnight capital expenditure. In *WEI 2019*, investment is defined as ongoing capital spending on assets. For some sectors, such as power generation, this investment is spread out evenly from the year in which a new plant or upgrade of an existing one begins its construction to the year in which it becomes operational. For other sources, such as upstream oil and gas and liquefied natural gas (LNG) projects, investment reflects the capital spending incurred over time as production from a new source ramps up or to maintain output from an existing asset.

For energy efficiency, the measurement task is more complex and much of the expenditure is by consumers for whom purchases of more efficient goods are not investments *per se*. In *WEI 2019*, as in *WEI 2018* and other recent IEA reports, investment in energy efficiency includes incremental spending by companies, governments and individuals to acquire equipment that consumes less energy than that which they would otherwise have bought. Due to the different possible methodologies available, this estimate of energy efficiency investment is not definitive but still included to provide a comparison with the scale of investment in energy supply. Fossil fuel and power sector investments are those that raise or replace energy supply, while energy efficiency investments are counted as those that reduce energy demand.

Investment estimates are derived from International Energy Agency (IEA) data for energy demand, supply and trade, and estimates of unit capacity costs, analysis of which benefits from extensive interaction with industry. By default, investment data are given in year 2018

US dollars, adjusted using country-level gross domestic product (GDP) deflators and 2018 exchange rates. Unless otherwise stated in *WEI 2019*, all time series and historical comparisons are presented in real dollar terms, adjusted for inflation.

Overall, this approach to investment represents an approximation of real-world practice and is aligned with the concept of capital expenditure in finance and accounting. In reality, varying time lags and spending patterns characterise the period between the final investment decision and the operation of an energy project. As such, where available, estimates of and financing activity are also provided to give a more complete picture of the turnover of the energy asset base as well as decisions to commit new capital. While other areas of spending – including operating and maintenance expenditures, research and development, financing costs, mergers and acquisitions or public markets transactions – remain important for energy sector development, and are analysed on a standalone basis, they are not included in the investment calculations of *World Energy Investment 2019*.

Measuring investment in energy efficiency

Defining and measuring investment in energy efficiency is far less straightforward than for investment in energy supply. The IEA defines an energy efficiency investment as the incremental spending to acquire equipment that consumes less energy than would otherwise have been used to provide the service, such as lighting, heating or mobility, had the consumer not bought a more efficient option (i.e. the baseline). The additional cost of a more efficient alternative can represent but a small share of the total spending on a particular energy-related good or service. Furthermore, investment and spending is carried out by many millions of households and firms, often without external financing. As much as possible, a bottom-up analysis using sales and investment data on sales of efficient goods is used.

In the buildings sector, the incremental investment for new or renovated buildings is the change in cost for services (design, delivery, installation) and products (lighting, appliances, equipment and materials) that achieve increased energy efficiency performance beyond the investment required for the minimum performance legally allowed. Thus, in principle, the full cost of a renovation that is associated with energy efficiency improvements is included. For building types and products that have legal requirements on the performance of buildings, buildings services or building products, this cost is the incremental spending beyond that needed to achieve the minimum energy performance standards, energy efficiency regulations or building energy codes. For building types and products that do not have energy requirements, this cost is the incremental spending on energy-efficient services and products beyond what would have otherwise been spent, which in some cases is no spending. For the incremental investment in buildings achieved due to the improvement in energy efficiency policies, this cost is the incremental spending required to achieve the new energy performance requirements beyond the previous level to which the market had already adapted. Building sector spending for residential and commercial

buildings is compiled from published national reports, for example spending reports of various public institutions. If not counted elsewhere in the buildings sector estimate, energy efficiency obligations, loans and funds established by policy are considered to be incremental spending. It also draws upon industry sources, in particular Navigant Research Energy Efficient Buildings and construction-sector indices.

For the industry sector and freight transport sectors, the incremental investment is calculated based on the average technology efficiency in a recent base year. The result is modelled on a regional basis and based on the realised level of energy savings in a sector and energy saving cost curves in the World Energy Model (IEA, 2018a). Added to this is published data on investment in industrial energy management systems that improve system-wide efficiencies in manufacturing and heavy industry.

The baselines that are used to represent the likely alternative investment option, i.e. had the more efficient good not be purchased, are specific to each sector and sub-sector (Table 1).

Table 1 Approaches to setting the baselines above which incremental investment in energy efficiency is estimated in different sub-sectors		
Sector	Sub-sector	Baseline
Buildings	Building envelope, HVAC (heating, ventilation, and air conditioning) and controls	Minimum energy performance standards for new construction, incorporated into the baseline with a time lag of several years to reflect adoption of the standard into the value chain. For retrofits of existing buildings, all spending is incremental.
	Appliances and lighting	Minimum energy performance standards, incorporated into the baseline with a time lag of several years
Industry	Energy-intensive industry	Sector average technology efficiency in prior year and no energy management system spending
	Other industry	Sector average technology efficiency in prior year and no energy management system spending
Transport	Light-duty vehicles	Average efficiency of new vehicle sales, per size and power class
	Freight vehicles and other transport	Average intensity of different modes in 2017

In the light duty vehicles sector, spending is taken to be the additional price of each efficient vehicle (defined as those in the top 25% for fuel economy in their size and power class) sold compared to the average price of vehicles in eight size and eight power classes in each country in that year. Different size and power classes are considered to take into account expressed consumer preferences and to maintain the principle of reduced energy

demand for the same level of energy service provided. Underlying data is derived from IHS Markit (2018) and supplemented with public data sources, according to the general methodology of the Global Fuel Economy Initiative (GFEI, 2019) as well as Marklines (2019). Improved data quality for the analysis for *WEI 2019* led to a downward revision of the historical data series for light duty vehicle energy efficiency spending without a change to the methodology employed. This price-based approach differs from cost-based approaches that estimate the total cost of the improving efficiency of the car fleet rather than the incremental consumer spending only. Cost-based approaches are commonly used in modelling exercises and aim to quantify the additional costs associated with improved fuel economy in future years, such as those incurred by manufacturers.

Measuring investment in oil, gas, and coal

In line with capital spending in the other energy sectors, the investment estimates for oil, gas and coal represent spending, i.e. the total amount of investment costs incurred in any given year. They are derived from IEA data for demand, supply and trade, plus industry data on investment costs, where available. In the case of upstream oil and gas investment, global spending estimates are based on the announced spending of over 70 leading oil and gas companies representing 75% of global oil and gas production has been surveyed and adjusted to represent the global spending. For the oil refining sector, spending estimates are calculated based on project-level information on new refineries, and upgrading projects. The investment estimates for the downstream sectors such as oil and gas pipelines and shipping transport were made to correspond to the IEA data for demand, supply and trade for oil and gas products. This follows the new methodology of the World Energy Model, used to produce the projections in the IEA's annual World Energy Outlook.

The investment in LNG liquefaction terminals is based on reported or estimated annual spending for over 50 projects that reached final investment decision between 2000 and 2018. Analyses rely on a wide range of publicly available sources. IEA estimates have been made where detailed information is not available, such as disaggregated spending by type of activity and capital spending plans by unlisted companies.

IEA Upstream Investment Cost Index (UICI)

The IEA Upstream Investment Cost Index or UICI is an indicator that the IEA developed to monitor cost trends in the upstream sector. The index measures the annual change of capital costs for exploration and development experienced by operating companies for the entire upstream sector, averaged across all regions and assets. The index is a composite indicator that reflects prices for cement, steel and other construction materials and equipment, as well as the cost of sector specific labour, drilling rigs and oilfield services. The UICI is calculated by weighting the average capital spending of two separate exploration and production indices on the basis of disaggregated historical data for the different key components within these two activities. The index captures the yearly

evolution of costs related to the acquisition of seismic data, project management, drilling services and the construction of production facilities, as well as the costs of labour, materials and equipment that are incorporated into charges for drilling, related services and facilities.

IEA Upstream Shale Investment Cost Index (USICI)

The IEA Upstream Shale Investment Cost Index or USICI aims to assess trends in underlying costs incurred directly by operating companies. This index tracks the inflation rate of capital costs associated with the drilling and completion of wells, as well as the construction of required facilities for production across the US shale industry. USICI is built as the weighted average of representative components for each of these key activities, including drilling, completion and field facilities. IEA USICI is therefore a blended indicator that takes into account time evolution of rig rates, cost of fuel, steel and other raw materials, fracking equipment rates, chemicals as well as changes to costs related to a specialised workforce required for the different services.

Measuring investment in power

The estimates of electricity investment presented in *WEI 2019* correspond to annual capital spending on new power plants and network assets, or the replacement of old assets; i.e., investment outlays are spread evenly from the year that an asset begins its construction until the year it becomes operational. Thus, the investment for 2018 actually reflects spending carried out in assets that will become operational in the future, too. The historical construction period is estimated from reported primary financing data, sanctioning dates, and operational dates at project-level by technology and by region in a given year.

Investment estimates reflect IEA analysis on annual capacity additions and unit investment costs, derived in part from surveys with industry, IEA (2018a), Platts (2019), BNEF (2019a), IEA Technology Collaboration Programmes,¹ IRENA (2019) and other organisations; and a new investment modelling tool that allocates evenly the annual capital spending that correspond to each asset during its construction phase. The estimates are shown in 2018 US dollar prices, adjusted using GDP deflators and 2018 exchange rates. Investment does not include operating and maintenance expenditures, financing costs, research and development spending, mergers and acquisitions or debt and equity market transactions.

¹ See <https://www.iea.org/tcp/> for further details.

The new methodology is the same as the one that will be employed in forward-looking IEA analysis. It represents an approximation of real-world practice. In reality, capital outlays on new plants will be also spread over the years preceding installation.

Nuclear power presents particular challenges given the long lead times and spending patterns associated with plant development. For new nuclear power plants, spending also corresponds to the evenly allocation from the year in which the unit takes final investment decision, to the year in which the unit is connected to the grid. *WEI 2019* includes estimates for upgrades to existing nuclear plants to extend lifetime operation. Investment in existing plants is estimated by reviewing plants reaching a 40-year lifetime in a given year and assessing their reported operational plans going forward. In the absence of specific information about the timing of upgrades, investments are also calculated on a capital spending basis at the 40-year mark with cost assumptions from OECD/NEA (2012) and assume a construction time of approximately two years.

Investment in electricity networks includes transmission, distribution and EV charging stations. The data corresponds to the capital spending methodology and reflects three key drivers: investment in new infrastructure to accommodate new demand, investment to replace ageing infrastructure and the investment required to integrate renewables in the power system. Networks investment to accommodate new demand is calculated based on the commissioning of new transmission and distribution lines and on the analysis of data provided by the *NRG Expert Transmission and Distribution Database* (NRG, 2018). The applied unit investment costs are based on past capital expenditures and data from industry surveys. Investment in asset replacement assumes an average lifetime of 40 years for assets already in operation. Unit replacement costs are derived from costs of new infrastructure. Investment costs of transmission and distribution networks required for renewables integration are derived from renewable integration costs based on literature reviews. The analysis of investments in the digitalisation of the electricity grid is based on analysis of NRG (2018), BNEF (2019b). EV charging stations investment is based on combining estimates of public and private charger installations with prevailing cost information, based on IEA (2019a).

Additionally, investment in grid-scale battery storage and behind-the-meter storage is based on the capacity deployment reflected in the *US Department of Energy Global Energy Storage Database* (US DOE, 2019), the *Clean Horizon Project Database* (Clean Horizon, 2019), the analysis of data from the *China Energy Storage Alliance Global Energy Storage Market Analysis* (CNESA, 2019), and data provided by governments. Investment in pumped-hydro storage, the largest component of global storage investment, is included in the hydropower data of *WEI 2019*. Behind-the-meter storage is derived from BNEF (2019c) and data provided by governments.

Finally, data on financing flows and information about investment decisions, where available, are also shown to give a more complete picture of the turnover of the capital stock. *WEI 2019* has undertaken an analysis of final investment decisions for power generation, based on awarded equipment contracts from data provided by McCoy Power

Reports (2019) (including coal power, gas power and hydropower) and reported construction starts (nuclear) based on data from the International Atomic Energy Agency, *Power Reactor Information Systems (PRIS)* (2019). These data may not capture smaller projects below 5 MW (below 10 MW for hydropower). However, *WEI 2019* has made estimates for investments and final investment decisions (treated as the same) in small-scale generator sets, based on Global Data (2018a, 2018b).

Financing and funding trends

WEI 2019 features analysis on trends in the sources of finance – the structure of financing arrangements used to directly finance assets and their geographic location – for the power sector investments presented in the report.

By financing mechanism

WEI 2019 broadly categorises the sources of finance for new energy assets into balance-sheet financing and project financing. To estimate project-financed investment on a spending basis, reported primary financing data, financial close date as proxy of the sanctioned date as well as actual or estimated operational date at project-level are combined in a given year. Only new financing is included, i.e. project finance for refinancing and merger and acquisition are excluded from our analysis. In some but not many cases where a project is confirmed ongoing but a reported operational date is unavailable, assumptions about construction times are used by technology and by region. For example, an onshore wind-power project in North Africa, for which a primary financing transaction occurred in 2015 but the commissioning date is unknown, is counted as investment spreading from 2015 for two years based on the assumption. The main data sources are IJGlobal (2019), WindEurope (2019), and US DOE (2018). Balance sheet financing is estimated as the residual of the total investment less the contribution from project finance. Given the difficulties in synthesising complex data, which are not always complete or transparent, the results should be seen as providing a broad indication of trends.

Green bonds

In *WEI 2019*, as in *WEI2018*, green bonds cover corporate bonds; ABS; supranational, sub-sovereign and agency bonds; municipal bonds; project bonds; sovereign bonds; and financial sector bonds. In this report, only green bonds labelled to provide transparency to investors are discussed and unlabelled climate-aligned bonds are excluded. Additionally, some regions have or are developing their own standards. For example, China has a separate standard that does not always align with international green bond standards.

While it can be difficult to assess the percentage of a green bond's proceeds that will be dedicated to energy efficiency, our analysis follows the Climate Bonds Initiative conventions for allocation by energy end use. Green bonds for which the use of proceeds is allocated to energy

efficiency include those that specifically target energy efficiency applications in accordance with the Climate Bonds Standard, as well as green bonds for all Property Assessed Clean Energy (PACE) ABS, rooftop solar PV ABS (which reduce energy imports to a building), and issuances from corporate and public entities in the utilities, property and transport infrastructure sectors.

Research and Development

The approach taken is a bottom-up tracking exercise based on publicly reported data. While it is acknowledged that definitions can vary, especially between the public and private sectors in terms of how capitalised assets are included, the numbers are generally taken at face value. No attempts have been made to extrapolate from this dataset to fill known gaps in particular sectors or countries.

The main breakdowns and sources of data are presented in Table 2.

Funding type	Region/country	Source
Public	IEA member governments	Data submitted annually to IEA, broken down by technology area. See IEA (2019b, 2011)
	China	Statistics Yearbook on Science and Technology Activities of Industrial Enterprises; China Statistical Yearbook on Science and Technology; Annual company disclosures of listed companies in sectors not separately covered by NBS statistics and their estimated receipt of government funding; MI (2018)
	India	Research budgets of energy-related ministries
	Brazil	CT ENERG, CT PETRO budgets, plus ANEEL project-by-project costs
	Mexico	Data submitted to the IEA
	Indonesia	MEMR Strategic plans
	Russia	Survey data and news coverage
	South Africa	Research budgets of the Department of Energy and SANEDI
Private sector	Corporate	Reported R&D spending in annual company disclosures, allocated per energy sub-sector according to share of revenue from that activity unless otherwise stated by the company
	China	Statistics Yearbook on Science and Technology Activities of Industrial Enterprises; Annual company disclosures of listed companies in sectors not separately covered by NBS statistics
	Venture capital	Series A, series B and seed funding by technology area from the Cleantech Group i3 database.

Corporate financial reports of over 1 900 companies active in energy sector industry classifications are included in the sample. These classifications include: fossil fuel extraction, transport, conversion and services; electricity generation, including production, equipment manufacture and services; electricity, gas and district heating utilities; electricity and gas networks and smart grids; electric mobility; LEDs; insulation; electricity storage; non-electricity renewable energy, including production and equipment manufacture. R&D

budgets of companies that are active in multiple sub-sectors are allocated on the basis of interviews with major companies or split in line with the share of revenue in these sectors (including non-energy sectors). For automotive companies, a share of R&D that is relevant to improving fuel efficiency, alternative fuels and alternative drivetrains is allocated based on interviews. These attempts to capture only energy-relevant R&D budgets are particularly important in the case of companies whose primary sectoral classification is not well-aligned with the full extent of their market and innovation activities.

One notable caveat is that this methodology makes it challenging to capture corporate research into efficient buildings, appliances and industry. Such R&D is undertaken within the R&D activities of these other sectors for which energy efficiency cannot be separated from their other research activities. We know that energy research in other sectors is substantial (IEA, 2018b). Furthermore, non-listed companies comprise a non-trivial component of total energy R&D spending and these are not captured by our methodology.

Low-carbon energy technology spending is separated wherever possible to include all technologies (for the public sector and venture capital) and all industry sub-sectors (for the corporate sector) related to: renewables; nuclear; CCUS; smart grids; electric mobility; LEDs; electricity storage, insulation.

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Abbreviations and acronyms

ABS	asset-backed security	ICT	information and communication technology
AT&C	aggregate technical and commercial losses	IMO	International Maritime Organization
BEV	battery-electric vehicle	IOU	investor-owned utility
Capex	capital expenditure	IPO	initial public offering
CCGT	combined-cycle gas turbine	IPP	independent power producer
CCUS	carbon capture, utilisation and storage	IRR	internal rate of return
CfD	contract-for-difference	LCOE	levelised cost of energy
CO ₂	carbon dioxide	LDV	light-duty vehicle
CO ₂ -EOR	enhanced oil recovery	LED	light-emitting diode
CSP	concentrating solar power	LFP	lithium iron phosphate
CVC	corporate venture capital	Li-ion	lithium-ion
DER	distributed energy resource	LMO	lithium manganese oxide
DUC	drilled but uncompleted well	LNG	liquefied natural gas
EBITDA	earnings before interest, taxes, depreciation and amortisation	LPG	liquefied petroleum gas
ECA	export credit agency	M&A	mergers and acquisitions
EPC	energy performance contract	MDB	multilateral development bank
ESCO	energy service company	NCA	nickel cobalt aluminium
ESI	energy savings insurance	NGL	natural gas liquids
EV	electric vehicle	NMC	nickel manganese cobalt
FCEV	fuel-cell electric vehicle	NOC	national oil company
FID	final investment decision	NPA	non-performing asset
FiT	feed-in tariff	NPS	New Policies Scenario
FLNG	floating liquefied natural gas	NPV	net present value
FSRU	floating storage regasification unit	OCGT	open-cycle gas turbine
GDP	gross domestic product	OCTG	oil country tubular goods
GHG	greenhouse gas	PACE	property-assessed clean energy
HVAC	heating, ventilation and cooling, or	PCI	project of common interest
HVAC	high-voltage alternating current	PEM	proton-exchange membrane (also called polymer electrolyte membrane)
HVDC	high-voltage direct current	PFI	public financial institution
		PHEV	plug-in hybrid
		PPA	power purchase agreement

PSM	payment security mechanism	TSOs	transmission system operators
PSP	pump-hydro storage power	UHVDC	ultra-high-voltage direct current
PV	photovoltaic	UICI	Upstream Investment Cost Index
R&D	research and development	USICI	Upstream Shale Investment Cost Index
RD&D	research, development and demonstration	VC	venture capital
ROE	return on equity	VIU	vertically integrated utility
RoI	return on investment	VRE	variable renewable energy
ROIC	return on invested capital	WACC	weighted average cost of capital
RT&H	renewable transport and heat	WLTP	Worldwide Harmonised Light Vehicles Test Procedure
SDS	Sustainable Development Scenario	WTI	West Texas Intermediate
SOE	state-owned enterprise	YTD	year to date
SOEC	solid oxide electrolyser cell	YoY	year-on-year
T&D	transmission and distribution		

Units of measurement

Energy

boe	barrels of oil equivalent
kboe/d	thousand barrels of oil equivalent per day
MBtu	million British thermal units
GJ	gigajoules
toe	tonne of oil equivalent
ktoe	thousand tonnes of oil equivalent
Mtoe	million tonnes of oil equivalent
kWh	kilowatt hours
MWh	megawatt hour
GWh	gigawatt hour
TWh	terawatt hour

Power

MW	megawatt
GW	gigawatt

Electricity

kV	kilovolt
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Energy density

kWh/kg	kilowatt hours per kilogramme
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Gas

bcm	billion cubic metres
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Oil

kb/d	thousand barrels per day
mb/d	million barrels per day

Mass

kg	kilogramme
Mt	million tonnes
Bt	billion tonnes

Distance

km	kilometre
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Advanced biofuels: Sustainable fuels produced from non-food crop feedstocks that are capable of significantly reducing lifecycle greenhouse gas emissions compared with fossil fuel alternatives, and that do not directly compete with food and feed crops for agricultural land or cause adverse sustainability impacts.

Balance sheet finance: Involves the explicit financing of assets on a company's balance sheet using retained earnings from business activities, including those with regulated revenues, as well as corporate debt and equity issuance in capital markets. To some extent, it measures the degree to which a company self-finances its assets, though balance sheets also serve as intermediaries for raising capital from external sources.

Capital costs: Costs to develop and construct a fixed asset such as a power plant and grid infrastructure or execute a project, excluding financing costs. For power generation assets, capital costs include refurbishment and decommissioning costs.

Dispatchable power generation: Refers to technologies whose power output can be readily controlled – increased to maximum rated capacity or decreased to zero – in order to match supply with demand.

Energy Research and development (R&D): Covers research and development related to the production, storage, transportation, distribution and rational use of all forms of energy. WEI 2019 estimates corporate R&D spending in energy-related sectors based on publicly reported information R&D expenses.

Energy Research, development and demonstration (RD&D): Covers research, development and demonstration related to the production, storage, transportation, distribution and rational use of all forms of energy. WEI 2019 assesses energy RD&D spending by governments that includes basic research clearly oriented towards the development of energy-related technologies, applied research, experimental development and demonstration.

Free cash flow: The cash flow available to the company's investors (e.g. shareholders and bondholders) after all operation expenses are paid and investments are made. It is calculated by subtracting capital expenditure from operating cash flow.

Internal rate of return (IRR): The discount rate that makes the present value of investment cost (cash outflow) equal to that of benefits (cash inflow), whereby making the net present value of the project equal to 0.

Investment: In WEI 2019, all investment data and projections reflect actual spending across the life cycle of a project, i.e. the capital spent is assigned to the year when it is incurred. Investments for oil, gas and coal include production, transformation and transportation; those for the power sector include refurbishments, uprates, new builds and replacements for all fuels and technologies for on-grid, mini-grid and off-grid generation, as well as investment in transmission and distribution, and battery storage. Investment data are presented in real terms in year 2018 US dollars unless otherwise stated.

Note that the definition is new and our methodology to assess investment changed from the previous versions of WEI. Previously, the investment data reflected "overnight investment", i.e. the capital spent is generally assigned to the year production (or trade) is started, rather than the year when it is incurred.

Lead times: The amount of time from the start of a project to its commissioning. In WEI 2019, lead times refer to the time between the final investment decision and the start-up for oil and gas projects and construction time for power generation assets.

Mission Innovation (MI): A global initiative of over 20 countries to accelerate clean energy innovation. Initiative members aim to double their government and/or state-directed clean energy RD&D investment over five years from 2015 to 2020, among other goals. See the MI website for details.

New Policy Scenario: An IEA scenario that provides a measured assessment of where today's policy frameworks and ambitions, together with the continued evolution of known technologies, might take the energy sector in the coming decades. The policy ambitions include those that have been announced and incorporate the commitments made in

the Nationally Determined Contributions under the Paris Agreement, but do not speculate as to further evolution of these positions.

Paris Agreement: An agreement with the United Nations Framework Convention on Climate Change ratified by almost 190 countries to tackle climate change. It aims to strengthen the global response to keep a global temperature rise this century well below 2 °C above pre-industrial levels. All Parties to the Agreement are required to put forward their best efforts through Nationally Determined Contributions and to strengthen the efforts in the years ahead.

Payback period: Refers to the period of time required to recover the amount invested in a project from its benefits (cash inflows).

Project finance: Involves external lenders – including commercial banks, development banks and infrastructure funds – sharing risks with the sponsor of the project. It can also involve fundraising from the debt capital markets with asset-backed project bonds. They often involve non-recourse or limited-recourse loans where lenders provide funding on a project's future cash flow and have no or limited recourse to liability of the project parent companies.

Return on Invested Capital (ROIC): A profitability ratio expressed as operating income adjusted for taxes divided by invested capital. The ratio measures the ability of a company's core business investments to generate profits. For the ROIC/WACC analysis in WEI 2019, invested capital is calculated by subtracting cash and cash equivalent, other long-term assets than property/plant/equipment, good will and intangibles, and current liabilities from total assets.

Seed, series A and series B: generally the first three venture capital fundraising rounds involving external investors in a start-up. The values generally increase from up to USD 2 million for a seed round, to USD 10 million or more for a series B round, but can be smaller or much larger.

Sustainable Development Scenario: An IEA scenario that shows how the energy sector can achieve the objectives of the UN Sustainable Development Goals (SDGs) most closely related to energy, namely, those goals related to energy access, air pollution emissions and climate change (SDGs 3, 6, 7, and 13). It is aligned with the Paris Agreement's goal holding the increase in the global average temperature to well below 2 °C.

Weighted-average cost of capital (WACC): The weighted average cost of capital is expressed in nominal terms and measures the company's required return on equity and the after-tax cost of debt issuance, weighted according to its capital structure.

White certificate: A tradable asset which proves that a certain percentage of energy savings has been achieved relative to an established baseline. In most applications, white certificates are combined with energy company obligation schemes that are designed to achieve a certain target of energy savings, thereby creating a market for energy efficiency.