Regional Observatory on Sustainable Energies - ROSE

Handbook for SDG 7 indicators

UNITED NATIONS

ECLAC

REGIONAL OBSERVATORY ON SUSTAINABLE ENERGY

ROSE

Index

Introduction to the Regional Observatory on Sustainable Energies and the SDG7

In 2015 the United Nations adopted a new Global Agenda for Sustainable Development "as a universal call to end poverty, protect the planet and ensure that by 2030 all people enjoy peace and prosperity"[1]. The 17 Sustainable Development Goals (SDGs), which are part of this agenda, have been identified in an integrated manner and pursue a development model that can harmonize economic growth, social inclusion and environmental protection. Building on from the Millennium Development Goals (MDGs), the new Goals are universal and cover more ground; they recognize as well that tackling climate change is essential for sustainable development and poverty eradication. Thus, for the first time, the issue of energy was deemed as a fundamental component for sustainable development as it address a major root cause of poverty, and so the seventh goal was dedicated "to ensure access to affordable, secure, sustainable and modern energy for all[2].

The Sustainable Development Goal 7 (SDG 7) aims to ensure universal access to affordable, reliable and modern energy services by 2030; increase the share of renewable energy in the global energy mix; and double the global rate of improvement in energy efficiency. It also seeks to increase international cooperation to facilitate access to clean energy research, as well as the improvement of infrastructure and technological progress. The inclusion in the 2030 Global Agenda of a target focused on sustainable energy triggered new efforts in terms of international energy statistics for tracking and monitoring progress on SDG 7 indicators.

In the face of the problem of inefficient use of energy resources, the Latin America and Caribbean (LAC) region needs new tools to help government officials make accurate and timely policy decisions for the achievement of SDG 7 targets. There is no progress without innovation, and no innovation without research; thus the availability, reliability, quality and systematic collection of energy data are imperative to the

[1]For further information please refer to: https://www.undp.org/sustainable-development-goals
[2]For further information please refer to: https://www.un.org/sustainabledevelopment/energy/

research process. More detailed, timely and transparent information from the energy sector is needed for the development of a new tool, a set of integrated indicators, to help Latin American and Caribbean policy makers guide efforts towards a sustainable development horizon. Such indicators, based on transparent, accurate and timely data, have the potential to provide policy tools at the national level that would facilitate strategic decision-making by policymakers in the region.

Accordingly, this new set of energy indicators aim at encouraging countries to make the necessary changes in their national energy programs and strategic energy objectives in order to follow a more sustainable and efficient path. Furthermore, this energy program addresses energy poverty that is paramount to achieve equity and social inclusion. Additionally, working with evidence-based energy policy can foster structural change, as it has the capacity to impact productivity and social welfare. A pertinent example was the "Big Environmental Push[3]", a main focus within the 2018-2020 cooperation programme ECLAC-BMZ/giz[4], executed in nine pilot countries to support the implementation of the 2030 Agenda and the Paris Agreement in a coherent, intersectoral and holistic fashion. In summary, all the efforts directed toward the implementation of these energy indicators seek to improve national statistical capacity to collect and process energy data and improve data acquisition and dissemination in the LAC region.

The COVID-19 crisis has been tragic at a global scale. In the words of the UN Secretary General, "the pandemic has demonstrated the fragility of our world[5]". Fragilities that have a root cause among others on structural inequalities and environmental degradation that impacted the hardest the already most vulnerable. "Entire regions that were making progress on eradicating poverty and narrowing inequality have been set back years, in a matter of months"[6].

The disastrous effects of the pandemic in the Latin American and Caribbean region made it necessary to take health protection measures that produced a drastic decrease in economic activity from the decree of the mandatory confinement of people in their homes in most of the countries in the region[7]. The energy and transport sectors, as well as the improvement initiatives related to them, were negatively impacted, falling back in years of effort. As a result, though the world continues to advance towards sustainable energy targets, "efforts are not of the scale required to achieve Goal 7 by 2030[8]".

More than ever, the importance of access to electricity and clean cooking has become paramount. This is because access to electricity keeps people connected, protects vulnerable populations, powers vital health facilities and saves lives. On the other hand, access to clean cooking solutions and the reduction in indoor air pollution means less vulnerability to COVID-19 and the other risks associated with traditional biomass. Thus, recognizing the critical role energy plays in combatting the pandemic and catalyzing an economic recovery means that in order to provide a sound global COVID-19, adjustment to existing programs and new initiatives need to take place[9].

After carefully analyzing all the challenges faced by the Latin American and Caribbean countries to successfully achieve SDG 7, on October 31th of 2018, the Economic Commission for Latin America and the Caribbean (ECLAC) launched the "Regional Observatory on Sustainable Energy (ROSE)" for the LAC region. The objective of this observatory is to accelerate the progress of the countries in the region towards the achievement of SDG 7 and providing them with a comprehensive tool to follow this process. All of the related initiatives will have to take in consideration al of the challenges posed by the Covid pandemic. Six

[3] For further information please refer to: https://www.cepal.org/en/cooperation-topic/big-environmental-push
[4] For further information please refer to: https://www.cepal.org/en/programa-cooperacion-cepal-bmzgiz/2018-2020-programme
[5] Secretary-General's Nelson Mandela Lecture: "Tackling the Inequality Pandemic: A New Social Contract for a New Era" [as delivered]: https://www.un.org/sg/en/content/sg/statement/2020-07-18/secretary-generals-nelson-mandela-lecture-%E2%80%9Ctackling-the-inequality-pandemic-new-social-contract-for-new-era%E2%80%9D-delivered
[6] Idem.
[7] For further information please refer to: http://biblioteca.olade.org/opac-tmpl/Documentos/old0452.pdf
[8] Please refer to page 38 of the following report: https://unstats.un.org/sdgs/report/2020/The-Sustainable-Development-Goals-Report-2020.pdf
[9] For further information on energy Covid-19 response please visit: https://www.seforall.org/covid-19-response

countries were chosen as main beneficiaries: Panama, Uruguay, Bolivia, Argentina, Cuba and Guyana. Thus, ROSE will work in close collaboration with the national focal points of these countries.

The main partners of the ROSE project are the International Renewable Energy Agency (IRENA) and the Latin American Energy Organization (OLADE), the Regional Energy Integration Commission (CIER), the Inter-American Development Bank (IADB) the German Cooperation Agency (GIZ), the World Bank (WB), as well as the Economic Commission for Europe (ECE), the Economic and Social Commission for Western Asia (ESCWA), the Economic Commission for Africa (ECA), the Economic and Social Commission for Asia and the Pacific (ESCAP). These agencies will play a role of knowledge and information contributors.

ROSE Objectives

General Objective

To strengthen the national capacities of all Member States in Latin America and the Caribbean to design, implement and monitor energy programs and policies for a sustainable country development.

Specific objectives

1. To strengthen the technical capacities of beneficiary countries to produce relevant and comprehensive data sets necessary to create energy indicators to track countries progress towards the accomplishment of SDG7.
2. To enhance the capacity of beneficiary countries to design and implement evidence-based policies and action plans oriented towards the accomplishment of the SDG7.

Technical objectives

1. To enhance the statistical reporting in the countries and propose ways to improve data acquisition in order to create a basis for an institutional change at the national level.
2. To improve the communication and collaboration between different government institutions involved in collecting and reporting data.
3. To create synergies between government institutions and relevant NGOs, industries, associations, academia, and other pertinent stakeholders, emphasizing the importance of such collaboration especially in terms of data sharing and knowledge exchange.

Aim of the Handbook

This handbook is intended to be a detailed guide for data collection, processing and indicator development for the SDG 7, made available to all users of the ROSE database. This database is currently being implemented by CEPAL STAT.

In this Handbook you will find a description of the SDG 7 indicators and general overlook of the methodologies used by the Custodian agencies for the development of each indicator. Thus, the aim of Handbook is to facilitate the understanding of the SDG 7 indicators to an audience of policy makers and non-statisticians.

Technical Note: Data Source for the SDG7 indicators

Taking in consideration that the energy access indicators are based on nationally representative surveys and that many data points are estimated using multi-level non-parametric models, we will not be displaying the exact calculation of the indicators, but an effort has been made to identify some of the precise data sources by country. Furthermore, the profiles for each SDG 7 indicators in this handbook have been constructed taking as a main reference the SDG Indicators Metadata repository of the Statistics Division of the Department of Economic and Social Affairs of the United Nations[10]. More complete data sources and methodological references are found in:

- Global Tracking Framework 2013 Report[11]
- Global Tracking Framework 2015 Report[12]
- Global Tracking Framework 2017 Report[13]
- Tracking SDG7 2018: The Energy Progress Report[14]
- Tracking SDG 7 2019: The Energy Progress Report[15]
- Tracking SDG 7 2020: The Energy Progress Report[16]
- Tracking SDG 7 2021: The Energy Progress Report[17]

[10] The metadata available in this repository is a work in progress. It reflects the latest reference metadata information provided by the UN System and other international organizations on data and statistics for the Tier I and II indicators in the global indicator framework. The information is updated as of September 2021. For further information please refer to: https://unstats.un.org/sdgs/metadata/?Text=&Goal=7&Target
[11] To access the full report, please refer to: https://trackingsdg7.esmap.org/data/files/download-documents/gtf-2013-full-report.pdf
[12] To access the full report, please refer to: https://trackingsdg7.esmap.org/data/files/download-documents/gtf-2105-full-report.pdf
[13] To access the full report, please refer to: https://trackingsdg7.esmap.org/data/files/download-documents/eegp17-01_gtf_full_report_for_web_0516.pdf
[14] To access the full report, please refer to: https://trackingsdg7.esmap.org/data/files/download-documents/tracking_sdg7-the_energy_progress_report_full_report.pdf
[15] To access the full report, please refer to: https://trackingsdg7.esmap.org/data/files/download-documents/2019-tracking_sdg7-complete-rev030320.pdf
[16] To access the full report, please refer to: https://trackingsdg7.esmap.org/data/files/download-documents/tracking_sdg_7_2020-full_report_-_web_0.pdf
[17] To access the full report, please refer to: https://trackingsdg7.esmap.org/data/files/download-documents/2021_tracking_sdg7_report.pdf

Tracking Energy Development in the LAC Region

In declaring 2012 the "International Year of Sustainable Energy for All"[18], the UN General Assembly (2011) established—at the personal initiative of the UN Secretary General—three global objectives to be accomplished by 2030. Those goals were: (i) to ensure universal access to modern energy services (including electricity and clean, modern cooking solutions); (ii) to double the global rate of improvement in energy efficiency; and (iii) to double the share of renewable energy in the global energy mix[19]. Moreover, with the United Nations Sustainable Development Goals (SDGs) it was explicitly recognized affordable and clean energy as a goal and a key factor in development, alongside education and poverty alleviation[20].

Energy indicators are not simply data. They are a combination of detailed energy statistics coupled with relevant information that has the potential to provide a deeper understanding of social, environmental and economic challenges posed by energy supply and use, as well as the capacity to highlight important relationships that would not otherwise be evident. In this context, indicators can play an important role in communicating energy issues related to sustainable development to policymakers and society at large.

The inclusion of energy as an SDG acts as a catalyst for countries and international organizations to redouble their efforts to collect statistics and develop indicators to track progress towards achieving affordable and clean energy for all. Some key challenges include: furthering the capacity-building to incorporate the SDG 7 core indicators and underlying data collection into national statistical programs; methodological improvements to current indicators; the adoption by countries of a broader set of indicators to better reflect the complexity of the national and regional energy context; and the development of new indicators to track the nexus between SDG 7 and the other SDGs. The development of reliable energy indicators to track progress on sustainable development is possible only if adequate statistics are available at the national level.

[18] Resolution 65/151 of December the 20th, 2010, [https://undocs.org/A/RES/65/151].
[19] To access the full report, please refer to: https://trackingsdg7.esmap.org/data/files/download-documents/gtf-2013-full-report.pdf
[20]To access the full report, please refer to: https://publications.iadb.org/publications/english/document/Meeting-Challenges-Measuring-Progress-The-Benefits-of-Sustainable-Energy-Access-in-Latin-America-and-the-Caribbean.pdf

Role of International Organizations

The role of international organizations in data collection is essential. If a country does not possess the statistical capacity to monitor SDG 7, it can resort to this external support from international organizations. The global monitoring efforts carried out by international organizations are made available to every country along with their technical capacity and specialized databases. As well, a harmonization effort is put in place to address the problem of inconsistencies between national and international estimates that tend to undermine the national statistics of different countries. Moreover, it is common practice for developing countries to rely on global data rather than national data for their own decision making and resource allocation (AbouZahr et al., 2007). The statistical and analytical work of international organizations is used to set priorities for external support and official development assistance.

Currently, there are many statistical harmonization initiatives at the global level. Regarding energy in particular, the Inter-Secretariat Working Group on Energy Statistics (InterEnerStat[21]) brings together more than 20 international organizations to work on improving the availability and quality of international energy statistics, including their use in energy indicators (Taylor et al., 2017). Some of the organizations participating in Interenerstat are OLADE and the Oslo Group. The Oslo Group was established by the United Nations Statistical Commission to address methodological issues related to energy statistics and to contribute to improving international standards and methods for official energy statistics. The International Recommendations for Energy Statistics (IRES), a recent milestone of the Oslo Group with Interenerstat, provides data compilers with a comprehensive set of recommendations covering all aspects of the statistical production process, from basic concepts, definitions, and classifications to data sources, compilation strategies, energy balances, data quality, and statistical dissemination[22].

Role of OLADE

OLADE has a significant role in the economic and social development of the Latin American and Caribbean countries supporting the regional energy integration process, the protection and conservation of energy sources, as well as the rational use of energy. OLADE is officially mandated to collect data from its 27 member countries by sending detailed energy questionnaires to national counterparts (e.g., national government officials of the respective Ministries of Energy, Ministries of Environment, National Statistical Office, etc.). As a result, OLADE has positioned itself as the main source of comprehensive international statistics on energy and energy balances in the LAC region.

In 2018, OLADE together with the International Energy Agency (IEA) initiated a process of harmonization of energy balances in the region according to the methodology presented by the IRES[23]. The harmonization process aims to increase the quality and optimize the dissemination of energy information in the region, promoting the availability of harmonized energy statistics, with international standards, facilitating comparability with other countries in the world.

OLADE has become an energy data hub for the LAC countries, thanks to the good relations with its national counterparts that has enabled data collection, processing and dissemination. Similarly, OLADE plays a crucial role in SDG 7 reporting. The compilation of energy balances makes it possible to monitor progress towards achieving SDG 7.2 target (substantially increase the share of renewable energy in the global energy mix by 2030). Moreover, given that IEA uses OLADE data to generate global electrification rates, we can say that OLADE contributes directly to the monitoring of international access to electricity, which responds to the indicator 7.1.1 of SDG 7.

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[21] For further information please refer to: http://www.interenerstat.org/index.asp
[22] To access the full report, please refer to: https://unstats.un.org/unsd/energystats/methodology/ires/
[23] For further information please refer to: http://www.olade.org/en/noticias/olade-seeks-to-increase-the-quality-and-optimize-the-dissemination-of-energy-information-in-the-region/

Role of ECLAC

ECLAC also plays an important role in monitoring the production of SDG indicators in the LAC region. In 2016, the "National statistical capabilities questionnaire for the production of SDG indicators" was implemented for the first time, as part of the activities of the Statistical Coordination Group for the 2030 Agenda in Latin America and the Caribbean. The Group was established within the scope of SCA-ECLAC and develops its activities in accordance with the work of the Inter-institutional Group of Experts on the Indicators of Sustainable Development Goals (IAEG-SDG) and with the activities and decisions of the High-level Group for Partnership, Coordination and Capacity-Building for Statistics for the 2030 Agenda for Sustainable Development (HLG-PCCB)[24]. The questionnaire was conducted by the Statistics Division in the 43 members and associate members of ECLAC. The instrument was developed with the aim of gathering a wide range of information, with the perspective that it would continuously and permanently improved, completed and updated. The positive results of have motivated the repetition of the survey in 2017[25], 2018[26] and 2019[27], as well as the update of the assessment of countries' statistical capacity.

In the Quadrennial report on regional progress and challenges (2019) findings show that the production percentages by SDG vary, reflecting the different degrees of statistical development in the sectors involved in the 2030 Agenda. For SDG 7 a 43% of the indicators are produced in the surveyed countries[28]; 12% reported that they do not produce said indicator, but it can be derived from existing data sources; 14% responded that some data was available, but further refinement or supplementary information is required to produce indicator; 19% stated that data was not available; and finally 12% did not provide answer. The overall results of the updated assessment continue to show the urgent need to build interinstitutional mechanisms for statistical monitoring of the SDG indicators, and for technical assistance and horizontal cooperation accompanied by stable sources of financing that structurally improve the production of official statistics.

The work of ECLAC on access to energy data

The challenges of our current context need to be addressed with sound, evidence-based policies, but there are factors that significantly undermine these efforts, particularly information gaps, which vary among the different countries of the LAC region; non-harmonized statistics and indicators; and data deficits (the most important barrier). Thus, not having the necessary analytical tools to understand the interface between socio-ecological and socio-technical systems can jeopardize energy security in the region. Access to energy data thus becomes a policy and policymaking priority, so that a baseline can be established to quantify progress, compare across countries, and cooperate through the exchange of experiences to respond and adapt to current crises[29].

ECLAC articulates different initiatives to provide access to energy data that can lay the groundwork for a timely information system on energy and its main subsectors. In addition, the preparation of reports offers a complementary approach to energy issues and the structural factors that condition human development and social welfare. Among some of the data access initiatives we can mention the Regional Statistical Profile

[24] For further information please refer to: https://www.cepal.org/en/subsidiary-bodies/statistical-conference-americas/statistical-coordination-group-2030-agenda-latin-america-and-caribbean

[25] To access the full report, please refer to: https://repositorio.cepal.org/bitstream/handle/11362/41189/S1700474_en.pdf?sequence=7&isAllowed=y

[26] To access the full report, please refer to: https://repositorio.cepal.org/bitstream/handle/11362/43439/5/S1800379_en.pdf

[27] To access the full report, please refer to: https://repositorio.cepal.org/bitstream/handle/11362/44552/S1900432_en.pdf?sequence=7&isAllowed=y

[28] The 25 countries are: Antigua and Barbuda, Argentina, Barbados, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, Saint Vincent and the Grenadines, Suriname, Uruguay and Venezuela (Bolivarian Republic of).

[29] For further information please refer to: *Informe de Pobreza Hídrica y Energética: Propuesta Conceptual para la Región,* July, 2020.

of SDG 7[30], the Household Survey Data Bank (BADEHOG)[31], as well as publications such as various specialized thematic publications[32].

The work of ECLAC on energy efficiency

Aware of the importance of quality statistics to support policy decisions and recognizing that in the LAC region there is a deficiency of information related to national energy efficiency programs, ECLAC has created the Database for Energy Efficiency Indicators Program (BIEE for its acronym in Spanish)[33]. The main objective of the BIEE project is to monitor trends in energy consumption and energy efficiency through a set of harmonized indicators covering 16 countries for the moment[34]. The project is an adaptation of the ODYSSEE Program, developed by the European Commission and managed by the French Ecological Transition Agency (ADEME)[35].

The energy efficiency indicators have been developed for the 7 sectors considered by the project: Macro/Energy Balance (Global Indicators), Households, Industry, Services, Agriculture, Transport and Energy. The ministries involved in the project have collected all the data needed to calculate the indicators using specific templates developed for BIEE data collection. The quality of the data and the reporting process has been improved through capacity building workshops.

Prioritize SDG 7 targets in the regional context

In Latin American and the Caribbean, the regional bodies that play a key role in monitoring the SDGs are organized within the framework of the Forum of the Countries of Latin American and Caribbean on Sustainable Development[36]. The Forum should provide useful peer learning opportunities, through means such as voluntary examinations, the exchange of good practices and the discussion of common goals. Furthermore, the Statistical coordination group for the 2030 Agenda in Latin America and the Caribbean[37] was established to coordinate the process of preparation and implementation of regional indicators and the development of capacities. The framework for the institutional basis for statistical activities is the Statistical Conference of the Americas[38] of ECLAC.

All countries that are members of ECLAC are members of the Conference. That is to say that the 33 countries of Latin America and the Caribbean, together with several Asian, European and North American nations that have historical, economic and cultural ties with the region, comprise the 44 Member States of ECLAC. Thirteen non-independent territories in the Caribbean are Associate Members of the Commission.

[30]Prepared by ECLAC using the global database of the United Nations for Monitoring the SDGs. For further information please refer to: https://agenda2030lac.org/estadisticas/regional-sdg-statistical-profiles-target-1.html?lang=en&target_id=14.5

[31] BADEHOG is a statistical repository of ECLAC, made up of a set of sample household surveys conducted by Latin American and Caribbean countries since the 1990s. It is used in statistical development activities in the region, as well as for the production of institutional and research documents. With the available databases, a set of harmonized variables is built, used for the calculation of socioeconomic indicators, seeking the highest degree of comparability possible. For further information please refer to: https://repositorio.cepal.org/handle/11362/31828

[32] An example is the "Social Panorama of Latin America", a publication in which ECLAC has successfully contributed to the construction of a diagnosis of the processes facing the region, providing insight into the treatment of phenomena such as poverty, income distribution, employment, demographic dynamics, gender gaps, health, education, social policies and programs, among others. For further information please refer to: https://www.cepal.org/en/publicaciones/ps

[33] https://biee-cepal.enerdata.net/en/

[34] The data base is under development and only some countries are presently covered (other countries coming soon). Data is available for the following countries: Argentina, Bolivia, Brasil, Chile, Costa Rica, Ecuador, El Salvador, Guyana, Honduras, México, Nicaragua, Panamá, Paraguay, Perú, Uruguay. For the consultation of indicators please refer to: https://biee-cepal.enerdata.net/es/medidas

[35] For further information please refer to: https://www.ademe.fr/

[36] For further information please refer to: https://foroalc2030.cepal.org/2021/en

[37] For further information please refer to: https://www.cepal.org/en/subsidiary-bodies/statistical-conference-americas/statistical-coordination-group-2030-agenda-latin-america-and-caribbean

[38] The Statistical Conference of the Americas of the Economic Commission for Latin America and the Caribbean is a subsidiary body of the Commission that contributes to the progress of policies on statistics and statistical activities in the countries of the region. For further information please refer to: https://www.cepal.org/en/subsidiary-bodies/statistical-conference-americas

However, the Statistical Coordination Group consists of 10 countries, five of representatives of the national statistical systems of the countries comprising the InterAgency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDG) and five of High-level Group for Partnership, Coordination and Capacity-Building for Statistics for the 2030 Agenda for Sustainable Development (HLG-PCCB), ensuring the representation of subregional groupings. For the 2019-2021 period the member of the statistical coordination group are: Argentina, Ecuador, Mexico, Saint Kitts and Nevis, Saint Vicente and the Grenadines as HLG-PCCB; and Brazil, Colombia, Granada, Dominican Republic and Trinidad and Tobago as IAEG-SDG. The ECLAC Statistics Division serves as technical secretariat.

Since its creation, the Statistical Coordination Group has focused on coordinating capacity-building activities based on the specific needs of the region. To this end, and with the objective of identifying inputs for the formulation of a specific regional strategy, the Group decided to prepare an assessment of national statistical capacities to produce global indicators and define a core set of priority indicators for the region[39].

In 2018, the Statistical Coordination Group reviewed the Proposal on a Regional Framework of Indicators for Monitoring the Sustainable Development Goals in LAC[40] for a Framework of Indicators for the Regional Monitoring of the Sustainable Development Goals and Targets of ECLAC's Agenda 2030. The Proposal was prepared in accordance with the request made by member states at the ninth meeting of the Statistical Conference of the Americas[41]. The member countries of the Statistical Coordination Group reviewed the Proposal and revised the indicators of the global framework not included in the Proposal, in order to agree on a core set of priority indicators for monitoring the 2030 Agenda from a regional perspective, which would (i) take into account regional specificities, thus complementing the global indicator framework for the MDGs; and (ii) contribute to prioritizing measurement activities and effectively coordinating horizontal, regional and international cooperation activities to close statistical capacity gaps. The outcome of the review was the prioritization and inclusion of additional indicators based on the regional relevance of the indicator (see Table 1)[42] . The findings of the prioritization show that SDG indicator 7.1.2 (share of population relying mainly on clean fuels and technologies) is not among the first-order priority indicators.

Current Developments in the LAC region

The Covid-19 pandemic has introduced major uncertainties for the energy sector. With heterogeneous government responses to the crises, the impact of the pandemic in the region is still inestimable. There are many questions to consider, like the duration of the pandemic, the adequacy of the government's response, the resources to deploy for the recovery, among others. But it is clear that energy and sustainability should be central pillars of current and future strategies to be adopted by the governments of the regions[43].

Current development in energy access

With data from 2016, the SDG 7 indicators report on energy sustainability in LAC[44] observes that the region had a successful performance in moving towards universal access to electricity services. At the time, reporting a deficit of around 0.5% of access at the urban level, the 2019 report concludes that universal access could be highly likely by 2030. On the other hand, in 2016 the deficit at the rural level was reported at 5.6%, but experts estimated that said deficit could be counteracted thanks to the support of initiatives to incorporate renewable energies in integration and inclusive projects. Another dimension of measuring

[39] To access the full report, please refer to: https://repositorio.cepal.org/handle/11362/44552
[40] To access the full report, please refer to: https://repositorio.cepal.org/handle/11362/42397
[41] To access the full report, please refer to: https://repositorio.cepal.org/handle/11362/43367
[42] To access the full report, please refer to: https://repositorio.cepal.org/handle/11362/44552
[43] To access the full report, please refer to: https://www.iea.org/reports/world-energy-outlook-2020/an-energy-world-in-lockdown#abstract
[44] To access the full report, please refer to: https://repositorio.cepal.org/handle/11362/44686

access to energy is the use of clean cooking fuels and technologies (CFT), in Latin America, access remained stable (around 88% [85, 90]) between 2016 and 2017, with an average annual increase of 0.4 percentage points between 2010 and 2017[45].

Current development in share of renewable energy

The final consumption of renewable energies covered 27.6% of total consumption in the LAC region in 2015; this downward trend is possibly caused by the incorporation of modern fuels to the energy matrix (such as gas and biofuels)[46]. On the other hand, according to data compiled by IRENA, the region has an installed renewable energy capacity of 218.2 GW in 2017. Thus, capacity expansion rates show significant increases from 2014, the same period expressing annual increases greater than 5%. This trend is expected to continue thanks to the policies that have been incorporated by countries in the LAC region as part of the effort to increase the share of renewable energies.

Current development in energy efficiency

The primary energy intensity indicator (the total energy required to produce one unit of GDP) has been the indicator established to monitor efficiency in energy use. Thus, the LAC region has the best energy intensity indexes in the world, but at the same time the lowest rates of improvement (0.5% annualized) [47]. Between 1990 and 2015, energy intensity decreased from 4.38 in 1990 to 3.82 in 2015 (MJ/GDP in USD according to 2011 PPP). Thus, energy efficiency improvements are due to the replacement of more efficient sources such as gas. Achieving the 2030 energy efficiency target (doubling the rate of energy efficiency improvement over 2015 indicators) can be met by accelerating the rates of energy intensity decrease and through additional joint efforts.

[45] For further information please refer to the selected chapter: https://trackingsdg7.esmap.org/data/files/download-documents/chapter_2_access_to_clean_fuels_and_technologies_for_cooking.pdf
[46] It should be noted that the renewable energy participation indicator is highly composed of the preponderance of hydroelectric projects (Data from the report of the SDG 7 indicators, on energy sustainability in LAC, August 2019).
[47] Reported in the report of the SDG 7 indicators, on energy sustainability in LAC, with the UN High Political Forum - Accelerating SDG Achievement.

Table 1

Prioritization of the regional SDG 7 indicators based on the regional relevance

Target	Dimension	Proposed regional indicator	Framework of global indicators	Proxy indicator of the global indicator	Complementary indicator	No. of countries with information in the Global SDG Indicators Database	No. of countries that produce the indicator
7.1	Social/ Environmental	7.1.1 Proportion of population with access to electricity	X			19 (Latin America) 13 (the Caribbean)	23
7.1	Social/ Environmental	Electricity production per capita			X[48]		
7.2	Environmental/ Economic	Proportion of primary renewable energy produced, by combustible and non-combustible energy source		X[49] (7.2.1)			
7.3	Environmental/ Economic	7.3.1 Energy intensity measured in terms of primary energy and GDP	X			19 (Latin America) 13 (the Caribbean)	15
7.b	Environmental/ Economic	Carbon dioxide (CO_2) emissions from the energy sector			X[50]		
7.b	Environmental/ Economic	7.b.1 Investments in energy efficiency as a proportion of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services	X			0 (Latin America) 0 (the Caribbean)	5

Source: ECLAC[51].

[48] From an environmental perspective, information on energy production is more suitable than that on energy consumption for measuring the composition and trends in the energy mix, the transition towards greater energy efficiency and the environmental impact.

[49] Disaggregation by combustible or non-combustible renewable energy source is crucial to differentiating between polluting and non-polluting energy sources. Moreover, in some of the region's countries, a substantial portion of current renewable energy production derives from the use of wood and coal by households, which may be associated with unsustainable forestry practices.

[50] Carbon dioxide emissions from the energy sector are increasing in importance in the region. The contribution of the energy sector to these emissions is on a level with that of deforestation.

[51] Proposal on a Regional Framework of Indicators for Monitoring the Sustainable Development Goals in Latin America and the Caribbean, document prepared by the technical secretariat for the Statistical Coordination Group for the 2030 Agenda in Latin America and the Caribbean.

SDG7 - Ensure access to affordable, reliable, sustainable and modern energy for all

The objective of this handbook is to facilitate the understanding of the SDG 7 indicators for policy makers and non-statisticians; therefore this section will presents SDG 7 from a broad perspective. The aim is to understand the relationship between indicators, variable and data that are needed to derive, monitor and discuss the SDG 7 energy indicators. Accordingly, the following sections will present a description of the SDG 7 indicators and a summary of the methodologies used by the Custodian Agencies[52]. The presentation of each indicator will encompass the definition and concepts; data source type and data collection method; and other methodological considerations.

Key definitions

Clean cooking fuels and technologies: They are electricity, liquid petroleum gas [LPG], natural gas, biogas, solar, and alcohol fuels.

Clean cooking solutions: Fuel-stove combinations that achieve emissions performance measurements of Tier 4 or higher following ISO/TR 19867-3:2018 Voluntary Performance Targets (VPTs), which refer to the World Health Organization's 2014 guidelines for indoor air quality.

Electrification rate: share of households with access to electricity.

Energy balance: It is a matrix that shows physical flows where energy is produced, transformed and consumed in a country, in a determined time (normally, a year). The energy balance contains the accounting related to energy supply, transformation processes and consumption, including foreign trade. Indicators 7.2.1 and 7.2.2 are based on detailed balances compiled according to IRES.

[52] For further information please refer to: https://unstats.un.org/sdgs/metadata/

Final energy intensity: Ratio final energy consumption and GDP. The difference between the primary and final intensity is explained by the consumption used in energy transformations. It can be expressed at exchange rates or at purchasing power parities (ppp).

Improved cooking services: Refers to a household context that has met at least Tier 2 standards of the MTF across all six measurements attributes but not all for Tier 4 or higher. Household contexts with a status of MTF Tier 2 or Tier 3 are considered in Transition.

International Recommendations for Energy Statistics (IRES): It is a complete set of recommendations covering all aspects of the statistical production process, from basic concepts, definitions and classifications (including Standard International Energy Product Classification (SIEC)) to data sources, data compilation strategies, energy balances, data quality and statistical dissemination.

Modern Energy Cooking Services (MECS): Refers to a household context that has met the standards of Tier 4 or higher across all six measurement attributes of the Multi-Tier Framework: convenience, (fuel) availability (a proxy for reliability), safety, affordability, efficiency, and exposure (a proxy for health related to exposure to pollutants from cooking activities).

Multi-Tier Framework (MTF) for cooking: Multidimensional, tiered approach to measuring household access to cooking solutions across six technical and contextual attributes with detailed indicators and six thresholds of access, ranging from Tier 0 (no access) to Tier 5 (full access). The aggregate MTF tier is the lowest tier rating across the six attributes.

Primary energy intensity: Ratio between the total energy consumption of a country and the GDP at constant price. It measures the total amount of energy necessary to generate one unit of GDP. It can be expressed at exchange rates if national currencies are converted in $ on the basis of exchange rates or at purchasing power parities (ppp) if national currencies are converted in $ on the basis of purchasing power parities. As GDP is expressed at constant price of a reference year (e.g. 2010), only the exchange rates or purchasing power parities of that reference year (e.g. 2010) is needed. The purchasing power parities are similar to exchange rates but accounts for differences in the cost of living between countries.

Share of renewables in final energy consumption: share of the direct and indirect consumption of renewables in the final consumption; the direct consumption of renewables is the sum of the consumption of renewables directly used by final consumers (mainly biomass and solar); the indirect consumption of renewables corresponds to the consumption of electricity by final consumers that is supplied from renewables, which in turn is calculated from the share of renewables in the gross electricity consumption (ratio electricity production from renewables/ gross electricity consumption).

Share of renewables in gross electricity consumption: ratio of electricity production from renewables in gross electricity consumption (i.e. power production plus power imports minus power exports).

Share of renewables in primary supply: ratio of primary consumption of biomass and renewable primary electricity (i.e. hydro, wind, solar and geothermal) and total primary energy supply.

Total final energy consumption (TFEC): The sum of the final energy consumption in the transport, industry, residential, services and other sectors (also equivalent to the total final consumption minus non-energy use).

Understanding Access for SGD7

From the release of the first edition of Global Tracking Framework report (2013), the principal challenges in measuring access to energy have remained the same:

1. absence of universally agreed definition of "access";
2. difficulty of measuring any definition in a precise manner.

Access to electricity is usually equated with the *availability of an electricity connection* at home or the use of electricity for lighting. Similarly, access to energy for cooking is usually equated with the *use of non-solid fuels* as the primary energy source for cooking. These *binary metrics*, however, fail to capture the multifaceted, multi-tier nature of energy access and do not go beyond a household focus to include productive and community applications of energy. Since the publication of the first edition of the Global Monitoring Framework report (2013), the main challenges for measuring access to energy have remained the same.

Table 2

SDG 7 target and indicators

SDG 7. Ensure access to affordable, reliable, sustainable and modern energy for all
Target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services. • Indicator 7.1.1: Proportion of population with access to electricity. • Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology.
Target 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix. • Indicator 7.2.1: Renewable energy share in the total final energy consumption.
Target 7.3: By 2030, double the global rate of improvement in energy efficiency. • Indicator 7.3.1: Energy intensity measured in terms of primary energy and GDP.
Target 7.a: By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology. • Indicator 7.a.1: International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems.
Target 7.b: By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support. • Indicator 7.b.1: Installed renewable energy-generating capacity in developing countries (in watts per capita).

Source: UN.

The World Bank's Global Electrification Database and the World Health Organization's Global Household Energy Database

The very first estimates (for 1990-2010) of access to energy (data on electrification and primary fuel use) were based on the two global databases: World Bank's Global Electrification Database[53] and the World Health Organization's Global Household Energy Database[54].

The first two global datasets of estimates (for 1990-2010) of access to energy used in the Global Tracking Framework were developed in two steps. Firstly, data on low- and middle-income countries were compiled from *nationally representative household surveys*. For electrification, this included 126 countries and encompassed 96 percent of the world's population; for cooking, the coverage was 142 countries and 97 percent of the world's population. Countries classified as developed countries according to the regional

[53] For further information please refer to the World Bank Data Bank: https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS
[54] For further information please refer to: https://www.who.int/data/gho/data/themes/air-pollution/who-household-energy-db

aggregation of the United Nations[55] are assumed to have achieved a 100 percent rate of access to electricity and non-solid fuel[56,57].

Nationally representative household survey data sources include:

- The Demographic and Health Surveys of the U.S. Agency for International Development (DHS - USAID);
- Living Standards Measurement Surveys (LSMS);
- United Nations Children's Fund (UNICEF) Multiple Indicator Cluster Surveys (MICS);
- World Health Survey of the World Health Organization (WHO);
- other studies developed and implemented at the national level;
- various government agencies (e.g., ministries of energy and public utilities).

At a second step a simple modeling approach was adopted to fill in the missing data points – around 1990, around 2000, and around 2010.The model kept the original observation if data was available for any of the time periods. This modeling approach[58] allowed the estimation of access rates for 212 countries over these three time periods. For the WHO Global Household Energy Database, a mixed model[59] was used to obtain a set of annual *access rates to non-solid fuel* for each country between 1990 and 2010. This model derived solid fuel use estimates for 193 countries.

Household survey versus utility data

Although household survey is a consistent and standardized source of information, it presents a number of challenges. Surveys such as the DHS or the LSMS/income-expenditure surveys are typically conducted every 3–4 years, while most censuses are held every 10 years. Therefore, a number of countries have gaps in available data. Moreover, different surveys may provide different types of data because of differences in questions posed to respondents. For example, the question "*Does your household have an electricity connection?*" may bring out a different perspective on the household's electrification status than would another question, such as "*What is the primary source of lighting?*" This is especially the case for people who do not use electrical lighting despite having a connection—owing to an unaffordability of electricity connection, a lack of supply during evening hours or the need to use what little electricity is available for other activities. Furthermore, most nationally representative surveys on household energy use fail to capture parallel use of various kinds of stoves and fuels. Data collected are typically limited to primary cooking fuel. In some cases, inconsistencies may arise purely from sampling error or from the different sampling methodologies of the underlying surveys.

While utility data are a valuable complement to household survey data, it provides a different perspective on access and cannot be expected to yield the same results. In particular, utility data may fail to capture (i) highly decentralized forms of electrification in rural areas and (ii) illegal access to electricity in urban areas. But it is collected on a regular basis.

The figures of OLADE are generally lower than World Bank's estimates. OLADE uses both survey and electricity company data to calculate the rates of electrification for each country. This method differs from

[55] For further information please refer to: https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2019_BOOK-ANNEX-en.pdf

[56] For further information please refer to page 76 of the following report: http://seforall.org/sites/default/files/2019-04/SE4ALL_Global-Tracking-Framework-2013_report-red.pdf

[57] The International Energy Agency (IEA) also publishes energy access databases, with broad country coverage (on electricity access and on the traditional use of bio mass for cooking) and collates these in its annual World Energy Outlook (WEO). The World Bank and IEA electricity access databases are consistent for most countries but, in some cases, differences in methodology mean that they rely on differing sources.

[58] For further information please refer to model on p 127, http://seforall.org/sites/default/files/2019-04/SE4ALL_Global-Tracking-Framework-2013_report-red.pdf

[59] For further information please refer to model on p 128, http://seforall.org/sites/default/files/2019-04/SE4ALL_Global-Tracking-Framework-2013_report-red.pdf

the World Bank, which based rates mainly on census and household surveys. Utility records can sometimes be inaccurate due to reporting errors and lack of information on household electrification from renewable energy sources, including purchased solar home systems (SHSs)[60].

LAC countries have the same survey limitations as the rest of the world - most national surveys include only a few questions related to energy access (e.g., whether a household has electricity, the type of lighting used, and the main type of cooking fuel). The lack of standardized national surveys with more detailed questions on energy access, especially for poor communities, hinders the development of sound measures of energy access and energy poverty. One of the solutions proposed so far is Multi-tier framework for measuring access which will be further discussed in the pertinent indicator.

Table 3

Comparing OLADE and World Bank data

Electricity coverage,%	OLADE				World Bank			
	2016	**2017**	**2018**	**2019**	**2016**	**2017**	**2018**	**2019**
Argentina	98,79	98,79	98,79	98,79	99.96	100.00	100.00	100.00
Bolivia	90,28	90,70	93,06	87.54	91.80	91.80	92.80	96.30
Cuba	99,60	99,70	100,00	100,00	98.95	99.24	99.53	99.80
Guyana	90,12	90,44	90,76	91,09	89.25	90.34	91.24	92.02
Panamá	92,40	92,87	93,35	93.84	93.17	93.70	94.94	95.83
Uruguay	99,70	99,80	99,80	99.81	99.70	99.80	99.80	99.90

Source: sieLAC-OLADE

Note: Data present access to electricity provided by the grid-based system.

Source: World Bank

Note: Data is based on national surveys and censuses

The World Bank Data versus IEA Data

The World Bank and IEA each maintain a database of global electricity access rates. The World Bank Global Electrification Database derives estimates from standardized household surveys that are conducted in most countries every two to three years, along with a multilevel nonparametric model used to extrapolate data for the missing years. The IEA Energy Access Database[61] sources data, where possible, from government-reported values for household electrification (usually based on utility connections).

The two different approaches can lead to estimates that differ for some countries. Access levels based on household surveys are moderately higher than those based on energy sector data (as is typical) because they capture off-grid access, illegal connection and self-supply. Administrative data on electrification reported by the ministry of energy in each country show the electrification status from the perspective of supply-side data on utility connections. These kinds of data offer two principal advantages. First, administrative data are often available on an annual basis and, for this reason, may be more up to date than surveys, which are typically updated only every two to three years, requiring model estimates in missing years. Second, administrative data are not subject to the challenges that can arise when implementing surveys in the field as some household surveys may suffer from sampling errors, particularly in remote rural areas, which could lead to an underestimation of the access deficit[62].

[60] To access the full report, please refer to: https://publications.iadb.org/publications/english/document/Meeting-Challenges-Measuring-Progress-The-Benefits-of-Sustainable-Energy-Access-in-Latin-America-and-the-Caribbean.pdf

[61] For LAC countries IEA uses OLADE data.

[62] For further information please refer to page 35 of the following report: https://trackingsdg7.esmap.org/data/files/download-documents/2019-Tracking%20SDG7-Full%20Report.pdf.

ECLAC Data

The Household Survey Data Bank (BADEHOG) is an ECLAC repository, made up of a set of sample household surveys conducted by Latin American and Caribbean countries since the 1990s. These surveys are implemented by the National Statistics Offices or other public agencies of the respective countries, and are the source of information officially used to measure poverty, inequality and various social indicators. They are shared with ECLAC by the countries for use in statistical development activities in the region, as well as for the production of institutional and research documents. The available databases are used to construct a set of harmonized variables used for the calculation of socioeconomic indicators, seeking the highest degree of comparability possible.

BIEE program in Latin America[63]

As it was already mentioned in the Role of ECLAC, following the technical-political process and the operating logic of the most successful energy efficiency and analysis program in the world, the ODYSSEE Programme[64], developed by the European Commission and managed by the French Agency ADEME with the aim of producing a series of specific and methodologically consistent indicators that allow the evolution of national energy efficiency programs to be measured, analyzed in real time and —consequently— for appropriate policy decisions to be made.

The BIEE program in Latin America and the Caribbean provides a database to assess policies and programs on energy efficiency (EE) in participant countries, by promoting capacity building on EE indicators, motivating the implementation of EE policies and programs based on monitoring, measure and standardization, promoting the regional comparability of the sector, and enhancing regional coordination on EE issues in the regional and global agenda.

In 2018 ECLAC, with the support of ADEME and ENERDATA, launched the Energy Efficiency Policy Database for Latin America and the Caribbean[65]. The database for LAC countries has been adapted from the MURE Energy Efficiency Policy Database for Europe[66]. The objective of the database is to access all existing energy efficiency measures in Latin America.

[63] To access the full report, please refer to: https://repositorio.cepal.org/handle/11362/40809.
[64] For further information please refer to: http://www.odyssee-mure.eu/.
[65] For further information please refer to: https://biee-cepal-measures.enerdata.net/energy-efficiency-policies-database.html#/.
[66] For further information please refer to: https://www.measures.odyssee-mure.eu/

Indicator 7.1.1: Proportion of population with access to electricity[67]

Indicator information

Goal:

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

Target:

Target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services

Indicator:

Indicator 7.1.1: Proportion of population with access to electricity

International organization(s) responsible for global monitoring:

World Bank Group

Definition and concepts

Definition

Proportion of population with access to electricity is the percentage of population with access to electricity.

[67] To access the full metadata sheet, please refer to: https://unstats.un.org/sdgs/metadata/files/Metadata-07-01-01.pdf

This is expressed in percentage figures and is disaggregated by total, urban and rural access rates per country, as well as by UN regional and global classifications.

Concepts

Electricity access in this scenario refers to the proportion of population in the considered area (country, region or global context) that has access to consistent sources of electricity. The World Bank's Global Electrification Database compiles nationally representative household survey data as well as census data from 1990 to 2019. For Latin America and the Caribbean it also incorporates data from the Socio-Economic Database (SEDLAC)[68]. This database includes statistics on poverty and other distributional and social variables from all Latin American and some Caribbean countries, based on microdata from households' surveys.

Unit of measure

Percent (%)

Data source type and data collection method

Data source[69]

The World Bank is the agency that has taken responsibility for compiling a meta-database of statistics on electricity access harvested from the full global body of household surveys. The World Bank Electrification Database covers more than 220 countries for the period 1990-2019 and is updated regularly.

Data for access to electricity is collected from household surveys and censuses, tapping into a wide number of different household survey types including:

- Multi-tier Framework (MTF);
- Demographic and Health Surveys (DHS) and Living Standards Measurement Surveys (LSMS);
- Multi-Indicator Cluster Surveys (MICS);
- the World Health Survey (WHS);
- other nationally developed and implemented surveys, including those by various government agencies (for example, ministries of energy and utilities).

Reports produced by international agencies such as the UN, World Bank, USAID, National Statistics Offices, as well as country censuses are used to collect data. Though some of the reports might not directly focus on energy access, they tend to include questions regarding access to electricity. Also, for the sake of consistency in methodology across countries, government and utility data are not considered.

Data collection method

If data sources have any information on electricity access, it is collected and analyzed in line with the previous trends and future projections of each country. Data validation is conducted by checking that the

[68] For further information please refer to: http://www.cedlas.econo.unlp.edu.ar/wp/en/estadisticas/sedlac/

[69] For more information on compiling access to energy data see Chapter 2, Annex 2, page 127-129 of the Global Tracking Framework 2013 report.

figures are reflective of the ground level scenario as well as are in line with country populations, income levels and electrification programs.

Table 4

Overview of data sources for access to electricity

Name	Statistical agency	Number of countries	Number of surveys	Question(s) on electrification standardized across countries
Censuses	National statistical agencies	65	125 (12%)	Is the household connected to an electricity supply? Does the household have electricity?
Demographic and Health Survey	Funded by the United States Agency for International Development (USAID); implemented by ICF International	87	275 (27%)	Does your household have electricity?
Living Standards Measurement Survey	National statistical agencies supported by the World Bank	19	26 (3%)	
Income expenditure survey, or other national surveys	National statistical agencies, supported by the World Bank	96	446 (44%)	Is the house connected to an electricity supply? What is your primary source of lighting?
Multi Indicator Cluster Survey	United Nations Children's Fund (UNICEF)	64	103 (10%)	Does your household have electricity?
World Health Survey	World Health Organization	8	8 (<1%)	
Multi-Tier Framework	World Bank	8	8 (<1%)	
Other		12	15 (1.5%)	

Source: World Bank (in the "Tracking SDG7, 2019 Report")

Data providers

It varies according to the country and its context. Data is collected from national statistics agencies/offices as well as international agencies such as the UN and World Bank.

Data compilers

World Bank Group

Data reporter

World Bank Group

Data availability

Data is currently collected for 139 countries from 1990 to 2019, excluding "Developed" countries classified by the United Nations.

Time series

Data for countries have been compiled for the 1990-2019 period, though there are gaps in accurate data availability.

Disaggregation

Electricity access rates are disaggregated by geographic location into total, urban and rural rates. Countries that are classified as "Developed" or "High Income" are assumed to have 100 percent from the first year it was added to the category. Disaggregation of access to electricity by rural or urban place of residence is possible for all countries.

Sources of discrepancies

The World Bank database compiles electricity usage data, while many international agencies and national ministries report electricity production data. This is the main cause for data discrepancies. The quality and accuracy of population data can also lead to differences in assessing electrification.

Other methodological considerations

Rationale

Access to electricity addresses major critical issues in all the dimensions of sustainable development. The target has a wide range of social and economic impacts, including facilitating development of income generating activities and lightening the burden of household tasks.

Under the global target of equal access to energy, SDG7.1.1 focuses specifically on electricity access available to the global population. In order to gain a clear picture, access rates are only considered if the primary source of lighting is the local electricity provider, solar systems, mini-grids and stand-alone systems. Sources such as generators, candles, batteries, etc., are not considered due to their limited working capacities and since they are usually kept as backup sources for lighting.

Maintaining reliable and secure electricity services while seeking to rapidly decarbonize power systems is a key challenge for countries throughout the world. More and more countries are becoming increasingly dependent on reliable and secure electricity supplies to underpin economic growth and community prosperity. Access to electricity is particularly crucial to human development as electricity is, in practice, indispensable for certain basic activities, such as lighting, refrigeration and the running of household appliances, and cannot easily be replaced by other forms of energy. Individuals' access to electricity is one of the most clear and undistorted indication of a country's energy poverty status[70].

Comment and limitations[71]

The World Bank aims to estimate demand side access rates in order to better understand the access levels experienced by the population. This is different from the supply side access rates usually provided by governments, ministries, etc. The data collected is compiled from national household surveys and censuses. But since these are carried out infrequently, it is difficult to understand the ground level trends for short term periods. Collecting data for rural areas as well as last-mile connectivity problems also cause errors in data collection that could skew results.

While the existing global household survey evidence base provides a good starting point for tracking household energy access, it also presents several limitations that will need to be addressed over time. In many parts of the world, the presence of an electricity connection in the household does not necessarily guarantee that the energy supplied is adequate in quality and reliability or affordable in cost and it would be desirable to have fuller information about these critical attributes of the service, which has been highlighted in SDG7.

Substantial progress has already been made toward developing and piloting a new methodology known as the Multi-Tier Framework for Measuring Energy Access (World Bank) which is able to capture these broader dimensions of service quality and would make it possible to go beyond a simple yes/no measure of energy

[70] For further information please refer to: https://databank.worldbank.org/reports.aspx?source=2&type=metadata&series=EG.ELC.ACCS.ZS
[71] Methodological challenges associated with the measurement of energy access are more fully described the Global Tracking Framework (2013) (Chapter 2, Section 1, page 75-82), and in the ESMAP (2015) Report "Beyond Connections: Energy Access Redefined".

access to a more refined approach that recognizes different levels of energy access, and also takes into account the affordability and reliability of energy access explicitly referenced in the language of SDG7.

Method of computation

The World Bank's Global Electrification Database compiles nationally representative household survey data as well as census data from 1990 to 2019. It also incorporates data from the Socio-Economic Database for Latin America and the Caribbean, the Middle East and North Africa Poverty Database, and the Europe and Central Asia Poverty Database, all of which are based on similar surveys. At the time of this analysis, the Global Electrification Database contained 1,282 surveys from 139 countries, excluding surveys from high income countries as classified by the United Nations.

For missing years, it derives estimates from a suite of standardized household surveys that are conducted in most countries every two to three years, along with a multilevel nonparametric model used to extrapolate data. The Electrification Database conveys therefore a user-centric perspective on electrification, capturing what the households report (both formal and informal connections, all technologies, urban rural disaggregation). The rural access rate is based on the back calculation of rural population with access so that urban and rural populations with access do in fact add up to the total population with access:

- Rural population with access = (total population with access - urban population with access)/rural population.

Countries considered "Developed" by the United Nations and classified as "High Income" are assumed to have electrification rates of 100 percent from the first year the country joined the category.

Estimating missing values

The typical frequency of surveys is every two to three years, but in some countries and regions; surveys can be irregular in timing and much less frequent. To estimate values, a multilevel nonparametric modelling approach—developed by the World Health Organization to estimate clean fuel usage—was adapted to predict electricity access and used to fill in the missing data points for the time period between 1990 and 2019. Where data is available, access estimates are weighted by population. Multilevel nonparametric modelling considers the hierarchical structure of data (country and regional levels), using the regional classification of the United Nations.

The model is applied for all countries with at least one data point. In order to use as much real data as possible, results based on real survey data are reported in their original form for all years available. The statistical model is used to fill in data only for years where they are missing and to conduct global and regional analyses. In the absence of survey data for a given year, information from regional trends was borrowed. The difference between real data points and estimated values is clearly identified in the database. To avoid having electrification trends from 1990 to 2010 overshadow electrification efforts since 2010, the model was run twice[72]:

- With survey data + assumptions from 1990–2019 for model estimates from 1990–2019
- With survey data + assumptions from 2010–2019 for model estimates from 2010–2019

Given the low frequency and the regional distribution of some surveys, several countries have gaps in available data. To develop the historical evolution and starting point of electrification rates, a simple modelling approach was adopted to fill in the missing data points. This modelling approach allowed the estimation of electrification rates for 220 countries over these time periods. The SE4ALL Global Tracking

[72] For further information please refer to page 35 of the following report: https://trackingsdg7.esmap.org/data/files/download-documents/2019-Tracking%20SDG7-Full%20Report.pdf

Framework Report (2013) previously referenced provides more details on the suggested methodology for tracking access to energy[73].

Measuring access to electricity through off-grid sources

In 2017 International Renewable Energy Agency released a new methodology *Measurement and estimation of off-grid solar, hydro and biogas energy*[74] that comprises off-grid database covering developing countries (excluding China). The database sources data from large databases, including the global association for the off-grid solar energy industry (GOGLA), country, and regional databases, along with significant data from off-grid plants.

Current work on alternative to binary metrics: Multi-Tier Framework for Measuring Energy Access[75]

Countries generally use internationally accepted methods of conducting censuses and national surveys. There is some level of disparity between countries and regional methodologies, but the efforts to harmonize data are improving. The Multi-Tier Framework (MTF) by the World Bank is one such method being used to increase accuracy of data collection.

The multitier approach expands the binary definition (and measurement) of energy access to the ability to obtain energy that is adequate, available when needed, reliable, of good quality, affordable, legal, convenient, healthy, and safe for all required energy applications across households, productive engagements, and community facilities. In the multitier approach to measuring energy access, tiers are essentially levels of access reflecting the added dimensions of this expanded definition. They are defined according to a combination of attributes to rate the performance of the energy accessed from tier 0 (no or very low level of access) to tier 5 (very high level of access) (see Table 5). Progressively higher attributes appear in higher tiers, each tier marking the ability of the energy accessed to serve more energy applications. Such a metric allows different energy solutions (which can possess varying energy attributes, depending on technological capabilities) to be assessed on the performance of the energy they deliver.

The adoption of this methodology will allow – over time – the more refined measurement of energy access, making it possible to report more disaggregated information regarding the type of electricity supply (grid or off-grid), the capacity of electricity supply provided (in Watts), the duration of service (daily hours and evening hours), the reliability of service (in terms of number and length of unplanned service interruptions), the quality of service (in terms of voltage fluctuations), as well as affordability and legality of service.

Another advantage of this approach is that they can be applied not only to measuring energy access at the household level, but also its availability to support enterprises and deliver critical community services, such as health and education.

To compile the information captured by the multitier framework for any locale in a given geographic area into a single number, a simple index can be calculated by taking the average tier rating of users and adjusting it to a base of 100 using the following formula:

$$\text{Index of energy access} = \sum_{k=0}^{5} (20 * P_k * k),$$

Where k is the tier number and P_k is the proportion of households at k^{th} tier

[73] For further information please refer to Chapter 2, Section 1, page 82-87 of the Global Tracking Framework Report of 2013.
[74] To access the full report, please refer to: https://www.irena.org/publications/2018/Dec/Measurement-and-estimation-of-off-grid-solar-hydro-and-biogas-energy
[75] To access the full report, please refer to: http://seforall.org/sites/default/files/GTF-2105-Full-Report.pdf

Table 5

Multi-tier matrix for measuring access to household electricity supply

			TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
ATTRIBUTES	**1. Peak Capacity**	Power capacity ratings* (in W or daily Wh)		Min 3 W	Min 50 W	Min 200 W	Min 800 W	Min 2 kW
				Min 12 Wh	Min 200 Wh	Min 1.0 kWh	Min 3.4 kWh	Min 8.2 kWh
		OR Services		Lighting of 1,000 lmhr/ day	Electrical lighting, air circulation, television, and phone charging are possible			
	2. Availability (Duration)	Hours per day		Min 4 hrs	Min 4 hrs	Min 8 hrs	Min 16 hrs	Min 23 hrs
		Hours per evening		Min 1 hr	Min 2 hr	Min 3 hr	Min 4 hr	Min 4 hr
	3. Reliability						Max 14 disruptions per week	Max 3 disruptions per week of total duration <2 hrs
	4.Quality						Voltage problems do not affect the use of desired appliances	
	5. Affordability					Cost of a standard consumption package of 365 kWh/year < 5% of household income		
	6. Legality						Bill is paid to the utility, prepaid card seller, or authorized representative	
	7. Health & Safety						Absence of past accidents and perception of high risk in the future	

Note: *This aggregation method is used by the Multi-Dimensional Energy Poverty Index (Nussbaumer et al. 2012).
Source: ESMAP (taken from the "Beyond Connections, Energy Access Redefined" 2015 Report).

Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology [76]

Indicator Information

Goal:

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

Target:

Target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services

Indicator:

Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology

International organization(s) responsible for global monitoring:

World Health Organization (WHO)

Definition and concepts

Definition

Proportion of population with primary reliance on clean fuels and technology is calculated as the number of people using clean fuels and technologies for cooking, heating and lighting divided by total population

[76] To access the full metadata sheet, please refer to: https://unstats.un.org/sdgs/metadata/files/Metadata-07-01-02.pdf.

reporting that any cooking, heating or lighting, expressed as percentage. "Clean" is defined by the emission rate targets and specific fuel recommendations (i.e. against unprocessed coal and kerosene) included in the normative guidance WHO guidelines for indoor air quality: household fuel combustion (WHO guidelines)[77].

Concepts

Current global data collection focuses on the primary fuel used for cooking, categorized as solid or non-solid fuels, where solid fuels are considered polluting and non-modern, while non-solid fuels are considered clean. This single measure captures a good part of the lack of access to clean cooking fuels but fails to collect data on type of device or technology is used for cooking, and also fails to capture other polluting forms of energy use in the home such as those used for lighting and heating.

WHO guidelines

New evidence-based normative guidance from the WHO (i.e. WHO Guidelines for indoor air quality guidelines: household fuel combustion), highlights the importance of addressing both fuel and the technology for adequately protecting public health. These guidelines provide technical recommendations in the form of emissions targets for as to what fuels and technology (stove, lamp, and so on) combinations in the home are clean. These guidelines also recommend against the use of unprocessed coal and discourage the use kerosene (a non-solid but highly polluting fuel) in the home. They also recommend that all major household energy end uses (e.g. cooking, space heating, lighting) use efficient fuels and technology combinations to ensure health benefits

For this reason, the technical recommendations in the WHO guidelines, access to modern cooking solution in the home will be defined as "access to clean fuels and technologies" rather than "access to non-solid fuels." This shift will help ensure that health and other "nexus" benefits are better counted, and thus realized.

Unit of measure

Percent (%)

Data source type and data collection method

Data sources

Primary household fuels and technologies, particularly for cooking, are routinely collected at the national levels in most countries using censuses and surveys. Household surveys used include: United States Agency for International Development (USAID)-supported Demographic and Health Surveys (DHS); United Nations Children's Fund (UNICEF)-supported Multiple Indicator Cluster Surveys (MICS); WHO-supported World Health Surveys (WHS); and other reliable and nationally representative country surveys.

The World Health Organization is the agency that has taken responsibility for compiling a database of statistics on access to clean and polluting fuels and technologies harvested from the full global body of household surveys for cooking, heating and lighting. Currently, the WHO Database covers cooking energy for 170 countries and one territory for the period 1960-2020 and is updated regularly and publicly available.

[77] To access the full report, please refer to: https://www.who.int/airpollution/guidelines/household-fuel-combustion/IAQ_HHFC_guidelines.pdf

For lighting, the WHO database includes data for 125 countries for the period 1963-2019. For heating, the WHO database includes data for 71 countries for the period 1977-2020.

Presently WHO is working with national surveying agencies, country statistical offices and other stakeholders (e.g. researchers) to enhance multipurpose household survey instruments to gather data on the fuels and technologies used for heating and lighting.

In 2020, as a result of a survey enhancement process, data collection for the cooking database included main cooking fuel, exhaust systems (chimney or fan), cooking technology and cooking location. Lighting data collection focused on main lighting fuel. Data collection for the heating database included main heating fuel as well as heating technology.

The World Health Organization's Household Energy Database[78], which is a collection of regularly updated nationally representative household survey data from various sources (see Table 6), was used as input for the model (see method of computation below).

The current database is a repository for 1249 surveys from 168 countries (including high-income countries) between 1970 and 2017. Twenty-five percent of the surveys cover the years from 2012 to 2017 and 121 new surveys cover the period from 2015 to 2017. Modelled estimates for low- and middle-income countries are provided only if there is underlying survey data on cooking fuels. Population data from the United Nations Population Division were also used[79].

Table 6

Overview of data sources for clean fuels and technology

Name	Statistical agency	Number of countries	Number of surveys	Question(s) on electrification standardized across countries
Censuses	National statistical agencies	104	18.09%	What is the main source of cooking fuel in your household?
Demographic and Health Survey (DHS)	Funded by the United States Agency for International Development (USAID); implemented by ICF International	77	16.57%	What type of fuel does your household mainly use for cooking?
Living Standards Measurement Survey, income expenditure survey, or other national surveys	National statistical agencies supported by the World Bank	21	2.88%	Which is the main source of energy for cooking?
Multi Indicator Cluster Survey	United Nations Children's Fund (UNICEF)	78	10.65%	What type of fuel does your household mainly use for cooking?
Survey on global AGEING (SAGE)	WHO	6	0.48%	
World Health Survey	WHO	49	3.92%	
National Survey		100	36.99%	
Other		78	10.89%	

Source: World Bank (in the "Tracking SDG7, 2019 Report")

Data collection method

Surveys collected are nationally representative and contain data at household or population level. Typical cooking survey questions include:

- Major fuel used for cooking?
- What is the main source of cooking fuel in your household?
- What type of fuel does your household mainly use for cooing?
- Which is the main source of energy for cooking?
- In your household, what type of cook stove is mainly used for cooking?

[78] For further information please refer to: http://apps.who.int/gho/data/node.main.SDGFUELS712?lang=en
[79] For further information please refer to: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/2019-Tracking-SDG7-Report.pdf

Typical heating survey questions include:

- Main fuel used for heating
- What type of fuel and energy source is used in the heater?
- What does your household mainly use for space heating when needed?

Typical lighting survey questions include:

- Main fuel use for lighting
- At night, what does your household mainly use to light the household?

Data providers

National Statistical Offices or any national providers of household surveys and censuses.

Data compiler

WHO, Environment, Climate Change and Health Department (ECH).

Data reporter

World Health Organization (WHO)

Data availability

- For cooking fuels, coverage of 170 countries is available through the WHO Global Household Energy Database.
- For lighting fuels, the WHO database includes data for 125 countries.
- For heating fuels, the WHO database includes data for 71 countries.

The current database is a repository for 1249 surveys from 168 countries (including high-income countries, HICs) between 1970 and 2017. Twenty-five percent of the surveys cover the years from 2012 to 2017 and 121 new surveys cover the period from 2015 to 2017.

Time series

From 1960 to 2019.

Disaggregation

Disaggregated estimates for different end-uses (i.e. cooking, heating and lighting; with expected improvements in household surveys, this will be possible for heating and lighting for all countries.

- Disaggregation of access to clean fuel and technologies for cooking by rural or urban place of residence is possible for all countries with survey data.
- Gender disaggregation by main user (i.e. cook) of cooking energy will be available with expected improvements in household surveys.
- Gender disaggregation of head of household for cooking, lighting and heating is available Energy is a service provided at the household, rather than individual level.

Sources of discrepancies

There may be discrepancies between internationally reported and nationally reported figures. The reasons are the following:

- Modelled estimates versus survey data point.
- Use of different definitions of polluting (or previously solid) fuels (wood only or wood and any other biomass, e.g. dung residues; kerosene included or not as polluting fuels).
- Use of different total population estimate.
- Estimates are expressed as percentage of population using polluting (or solid) fuels (as per SDG indicator) as compared to percentage of household using polluting (or solid) fuels (as assessed by surveys such as DHS or MICS).
- In the estimates presented here, values above 95% polluting fuel use are reported as ">95", and values below 5% as "<5".

As well as changes in modelling methodology[80]:

Other methodological considerations

Rationale

Cooking, lighting and heating represent a large share of household energy use across the low- and middle-income countries. For cooking and heating, households typically rely on solid fuels (such as wood, charcoal, biomass) or kerosene paired with inefficient technologies (e.g. open fires, stoves, space heaters or lamps). It is well known that reliance on such inefficient energy for cooking, heating and lighting is associated with high levels of household (indoor) air pollution. The use of inefficient fuels for cooking alone is estimated to cause over 4 million deaths annually, mainly among women and children. These adverse health impacts can be avoided by adopting clean fuels and technologies for all main household energy end-or in some circumstances by adopting advanced combustion cook stoves (i.e. those which achieve the emission rates targets provided by the WHO guidelines) and adopting strict protocols for their safe use.

Given the importance of clean and safe household energy use as a human development issue, universal access to energy among the technical practitioner community is currently taken to mean access to both electricity and clean fuels and technologies for cooking, heating and lighting. For this reason, clean cooking forms part of the universal access objective under the UN Secretary General's Sustainable Energy for All initiative.

Comments and limitations

While the existing global household survey evidence base provides a good starting point for tracking household energy access for cooking fuel, it also presents a number of limitations that will need to be addressed over time.

- Current global data collection focuses on the primary fuel used for cooking, categorized as solid or non-solid fuels[81], where solid fuels are considered polluting and non-modern, while non-solid fuels are considered clean. This single measure captures a good part of the lack of access to clean cooking

[80] For further information refer to the metadata sheet of the indicator previously indicated.

[81] Non-solid fuels include (i) liquid fuels (for example, kerosene, ethanol, or other biofuels), (ii) gaseous fuels (such as natural gas, liquefied petroleum gas [LPG], and biogas), and (iii) electricity. Solid fuels include (i) traditional biomass (for example, wood, charcoal, agricultural residues, and dung), (ii) processed biomass (such as pellets, and briquettes); and (iii) other solid fuels (such as coal and lignite).

fuels but fails to collect data on type of device or technology is used for cooking, and also fails to capture other polluting forms of energy use in the home such as those used for lighting and heating (e.g. kerosene).

- The indicator uses the type of primary fuels and technologies used for cooking, heating, and lighting as a practical surrogate for estimating human exposure to household (indoor) air pollution and its related disease burden, but it is not currently possible to obtain nationally representative samples of indoor concentrations of criteria pollutants.
- The indicator is based on the main type of fuel and technology used for cooking as cooking occupies the largest share of overall household energy needs. However, many households use more than one type of fuel and stove for cooking and, depending on climatic and geographical conditions, heating with polluting fuels can also be a contributor to household (indoor) air pollution levels.
- Currently there is a limited amount of available data capturing the type of fuel and devices used in the home for heating and lighting.

Substantial progress has already been made toward developing and piloting a new methodology known as the Multi-Tier Framework for Measuring Energy Access (World Bank) which is able to capture the affordability and reliability of energy access (and going beyond traditional binary measures) explicitly referenced in the language of SDG7 and harnesses the normative guidance in the WHO guidelines to benchmark tiers of energy access.

Method of computation

The indicator is modelled with household survey data compiled by the WHO. The information on cooking fuel use and cooking practices comes from about 1440 nationally representative survey and censuses. Survey sources include Demographic and Health Surveys (DHS) and Living Standards Measurement Surveys (LSMS), Multi-Indicator Cluster Surveys (MICS), the World Health Survey (WHS), and other nationally developed and implemented surveys.

Estimates of primary cooking energy for the total, urban and rural population for a given country and year are obtained together using a single multivariate hierarchical model. Using household survey data as inputs, the model jointly estimates primary reliance on 6 specific fuel types: 1. unprocessed biomass (e.g. wood), 2. charcoal, 3. coal, 4. kerosene, 5. gaseous fuels (e.g. LPG), and 6. electricity; and a final category including other clean fuels (e.g. alcohol). Estimates of the proportion of the population with primary reliance on clean fuels and technology (SDG indicator 7.1.2) are then derived by aggregating the estimates for primary reliance on clean fuel types from the model[82].

As household surveys are conducted irregularly and reported heterogeneously, a multilevel nonparametric modeling approach developed by WHO (Bonjour et al. 2013)[83] and recently updated by Stoner et al. (2019) was adopted to estimate a complete set of values in between surveys. Multilevel nonparametric modeling takes into account the hierarchical structure of the data: survey points are correlated within countries, which are then clustered within regions.

Estimating missing values

At country level:

- Missing values for individual fuels within a survey are automatically imputed by the model (Stoner et al. 2019). For surveys where fuel use is only reported for the whole population (i.e. with no urban or

[82] Details on the model are published in Stoner, et al., "Global Household Energy Model."
[83] For further information please refer to page 128 of the following report: https://openknowledge.worldbank.org/handle/10986/16537.

rural disaggregation), the urban and rural values are automatically imputed by the model (Stoner et al. 2019).

At regional and global levels:

- Low- and middle-income countries with no data were excluded from regional and global aggregations, and values of 100% clean fuel and technology use were used for High income countries for regional and global calculations

Table 7

Multi-Tier Framework for Measuring Access to Cooking Solutions

ATTRIBUTES		TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Cooking exposure	ISO's voluntary performance targets (Default Ventilation)						
	PM2.5 (MG/MJd)	>1030	≤1030	≤481	≤218	≤62	≤5
	CO (g/MJd)	>18.3	≤18.3	≤11.5	≤7.2	≤4.4	≤3.0
	High Ventilation						
	PM2.5 (MG/MJd)	>1489	≤1489	≤733	≤321	≤92	≤7
	CO (g/MJd)	>26.9	≤26.9	≤16.0	≤10.3	≤6.2	≤4.4
	Low Ventilation						
	PM2.5 (MG/MJd)	>550	≤505	≤252	≤115	≤32	≤2
	CO (g/MJd)	>9.9	≤9.9	≤5.5	≤3.7	≤2.2	≤1.4
Cookstove Efficiency	ISO's voluntary performance targets	≤10%	>10%	>20%	>30%	>40%	>50%
Convenience	Fuel acquisition and preparation time (hours per week)	≥7		<7	<3	<1.5	<0.5
	Stove preparation time (minutes per meal)	≥15		<15	<10	<5	<2
Safety		Serious accident over the 12 months				No serious accident over the past year	
Affordability		Fuel cost ≥ 5% of household expenditure (income)				Fuel cost <5% of household expenditure (income)	
Fuel Availability		Primary fuel available less than 80% of the year				Available 80% of the year	Readily available throughout the year

Source: Adapted from Bhatia and Angelou 2015. (The Multi-Tier Framework initiative).

Multi-Tier Framework for Measuring Access to Cooking Solutions[84]

The Multi-Tier Framework (MTF) initiative redefines the way energy access is measured, going beyond the traditional binary measure of "connected or not connected" for electricity access, and "solid vs nonsolid fuels" for cooking. The MTF captures specific data that allows governments to identify and understand energy access gaps and develop potential solutions to improve energy services. The MTF identifies and analyzes the main reasons why households are not using electricity, or why their usage is limited (i.e. by

[84] For further information please refer to: https://mtfenergyaccess.esmap.org/methodology/cooking

capacity, reliability or affordability issues), and then recommends a set of measures to remove such constraints. MTF, therefore, not only allows for a nuanced tracking of SDG 7 targets, but also helps governments fine-tune their policies and approaches for reaching them.

Within the Multi-Tier Framework for Measuring Access to Cooking Solutions, Access to modern energy cooking solutions is measured based on six attributes: Cooking Exposure, Cookstove Efficiency, Convenience, Safety of Primary Cookstove, Affordability, and Fuel Availability, (see table 7).

- Cooking Exposure assesses personal exposure to pollutants from cooking activities, which depends on stove emissions, ventilation structure (which includes cooking location and kitchen volume) and contact time (time spent in the cooking environment).
- Cookstove Efficiency assesses the performance of the stove in regard to its thermal efficiency.
- Convenience measures the time spent acquiring (through collection or purchase) fuel and preparing fuel and the stove for cooking.
- Safety of Primary Cookstove assesses the safety in using the most used cookstove within the household.
- Affordability assesses a household's ability to pay for both the cookstove and fuel.
- Fuel Availability assesses the availability of fuel when needed for cooking purposes.

Table 8

Data sources of indicators 7.1.1 and 7.1.2 as of time of data release and per country

Country	Access to electricity/ Source of data for 1990, 2020 and 2010	Access to non-solid fuel/ Source of data for 1990, 2000 and 2010	Access to electricity/ Source of data for 2012	Access to non-solid fuel/ Source of data for 2012	Access to electricity/ Source of data for 2014	Access to non-solid fuel/ Source of data for 2014
Antigua and Barbuda	Estimate	Other 2007	Estimate	Assumption	NA	WHO
Argentina	Estimate	Other 2001	Estimate	WHO	NA	WHO
Bahamas	Estimate	Estimate	Estimate	Assumption	100	WHO
Barbados	Estimate	NatCen 2000	Estimate	WHO	100	WHO
Belize	Estimate	NatCen 2010	Estimate	WHO	NA	WHO
Bolivia, Plurinational State of	DHS 2008	DHS 2008	2012 SEDLAC	WHO	SEDLAC	WHO
Brazil	NatCen 2009	WHS 2003	2012 SEDLAC	WHO	SEDLAC	WHO
Chile	ENEMDU 2010	NatCen 2002	2011 SEDLAC	WHO	NA	WHO
Colombia	NatCen 2010	DHS 2010	2012 GEIH-National	WHO	SEDLAC	WHO
Costa Rica	ENCOVI 2010	NatSur 2009	2012 ENAHO	WHO	SEDLAC	WHO
Cuba	Estimate	Other 2008	Estimate	WHO	NA	WHO
Dominica	Estimate	NatCen 2001	Estimate	WHO	NA	WHO
Dominican Republic	NatCen 2010	DHS 2007	Estimate	WHO	SEDLAC	WHO
Ecuador	NatCen 2010	NatCen 2006	2012 ENEMDU	WHO	SEDLAC	WHO
El Salvador	INE 2010	NatSur 2007	2012 Census	WHO	SEDLAC	WHO
Grenada	Estimate	NatCen 2001	Estimate	WHO	NA	WHO
Guatemala	NatCen 2006	WHS 2003	2011 ENCOVI	WHO	SEDLAC	WHO
Guyana	DHS 2009	DHS 2009	Estimate	WHO	MICS	WHO
Haiti	DHS 2006	DHS 2005	2012 DHS	WHO	NA	WHO
Honduras	NatCen 2010	DHS 2005	2011 INE	WHO	SEDLAC	WHO
Jamaica	Ministry of Energy 2008	NatCen 2001	Estimate	WHO	NA	WHO
Mexico	NatCen 2010	NatCen 2010	2012 SEDLAC	WHO	SEDLAC	WHO
Nicaragua	ENAHO 3 2005	NatSur 2006	2009 SEDLAC	WHO	SEDLAC	WHO
Panama	Estimate	LSMS 2008	Estimate	WHO	NA	WHO
Paraguay	NatCen 2010	NatSur 2009	2011 Census	WHO	SEDLAC	WHO
Peru	NatCen 2010	NatSur 2010	2012 DHS	WHO	SEDLAC	WHO
Saint Lucia	Estimate	Estimate	Estimate	WHO	NA	WHO
Suriname	Estimate	MICS 2006	Estimate	WHO	NA	WHO
Trinidad and Tobago	Other HH 2009	MICS 2006	Estimate	Assumption	100	WHO
Uruguay	SEDLAC 2009	NatSur 2006	2012 Census	WHO	100	WHO
Venezuela, Bolivarian Rep. of	SEDLAC 2010	NatCen 2001	Estimate	WHO	NA	WHO

Source: Self-elaborated with observations from GTF 2013, 2015, 2017 and the Tracking SDG 7 report 2018, 2019 and 2020.

Notes: The source field gives either the name or date of the household survey from which the figure is taken; or indicates that the figure is an estimate based on the statistical model described in Computation method. Developed countries are considered to have access rates to electricity of 100 percent.

DHS = Demographic and Health Survey; WHS=World Health Survey; LSMS = Living Standard Measurement Survey; MICS=Multiple Indicators Cluster Survey; SEDLAC=Socio-Economic Database for Latin America and the Caribbean; NatCen=National Census; NatSur=National Survey; ENEMDU= La Encuesta Nacional de Empleo, Desempleo y Subempleo; INE= Instituto Nacional de Estadística, ENCOVI= La Encuesta Nacional de Condiciones de Vida; ENAHO= Encuesta Nacional de Hogares; Other/NA=Source is not non-specified; Other HH=Other household survey; GEIH=Gran Encuesta Integrada de Hogares..

Indicator 7.2.1: Renewable energy share in the total final energy consumption[85]

Indicator Information

Goal:

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

Target:

Target 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix

Indicator:

Indicator 7.2.1: Renewable energy share in the total final energy consumption

International organization(s) responsible for global monitoring:

International Energy Agency (IEA)

United Nations Statistics Division (UNSD)

International Renewable Energy Agency (IRENA)

[85] To access the full metadata sheet, please refer to: https://unstats.un.org/sdgs/metadata/files/Metadata-07-02-01.pdf

Definition and concepts

Definition

The renewable energy share in total final energy consumption (TFEC) is the percentage of final consumption of energy that is derived from renewable resources.

- Total final energy consumption (TFEC) is defined as the sum of the final energy consumption in the transport, industry and other sectors (also equivalent to the total final consumption minus non-energy use).

Concepts

Renewable energy consumption includes consumption of energy derived from: hydro, wind, solar, solid biofuels, liquid biofuels, biogas, geothermal, marine and renewable waste. Total final energy consumption is calculated from balances as total final consumption minus non-energy use.

Comments with regard to specific renewable energy sources:

- Solar energy includes solar PV and solar thermal.
- Liquid biofuels include biogasoline, biodiesels and other liquid biofuels.
- Solid biofuels include fuelwood, animal waste, vegetable waste, black liquor, bagasse and charcoal.
- Renewable waste energy covers energy from renewable municipal waste.

Unit of measure

The renewable energy share in the total final energy consumption is expressed as a percentage (%) and has no unit of measurement.

Data source type and data collection method

Data sources

Data on renewable energy consumption are available through national energy balances compiled based on data collected by the International Energy Agency (for around 150 countries) and the United Nations Statistics Division (UNSD) for all countries. The energy balances make it possible to trace all the different sources and uses of energy at the national level.

Some technical assistance may be needed to improve these statistics, particularly in the case of renewable energy sources. Specialized industry surveys (e.g. on bioenergy use) or household surveys (in combination with the measurement of other indicators) would be feasible approaches to filling in data gaps (e.g. for use of firewood, off-grid solar energy).

Data collection method

The IEA collects energy data at the national level according to harmonized international definitions and questionnaires, as described in the UN International Recommendations for Energy Statistics[86] . UNSD also collects energy statistics from countries according to the same harmonized methodology.

Data provider

National administrations[87].

Data compiler

The International Energy Agency (IEA) and United Nations Statistics Division (UNSD) are the primary compilers of energy statistics across countries and develop internationally comparable energy balances based on internationally agreed methodologies. Aggregates are based on analysis merging of IEA and UNSD data.

Data reporter

International Energy Agency (IEA)

United Nations Statistics Division (UNSD)

International Renewable Energy Agency (IRENA)

Data availability

Between the various existing data sources, primarily the IEA World Energy Balances and the UN Energy Statistics Database, annual total and renewable energy consumption for every country and area can be collected[88]. The Tracking SDG7: The Energy Progress Report (formerly Sustainable Energy for All Global Tracking Framework) is reporting this indicator at a global level between 1990 and 2030.

Time series

2000 – present.

Disaggregation

Disaggregation of the data on consumption of renewable energy, e.g. by resource and end-use sector, could provide insights into other dimensions of the goal, such as affordability and reliability. For solar energy, it may also be of interest to disaggregate between on grid and off-grid capacity.

Data on consumption of renewable energy can be disaggregated:

- By resource, e.g. share of solid biofuels in the TFEC

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[86] To access the full report, please refer to: https://unstats.un.org/unsd/energystats/methodology/ires/

[87] Documentation on sources for IEA and UNSD can be found on the following sites and reports: http://wds.iea.org/wds/pdf/WORLDBAL_Documentation.pdf and https://unstats.un.org/unsd/energystats/data

[88] For further information please refer to: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/2019-Tracking-SDG7-Report.pdf

- By end-use, referring to the energy service for which the energy is consumed: electricity, heat, and transport.

Regional aggregates

Aggregates are calculated, whether by region or global, using final energy consumption as weights.

Sources of discrepancies

The IEA World energy balances and the UN Energy Statistics Database, which provide the underlying data for calculating this indicator, are global databases obtained following harmonized definitions and comparable methodologies across countries. However, they do not represent an official source for national submissions of the indicator 7.2.1 on renewable energy. Due to possible deviations from IRES in national methodologies, national indicators may differ from the internationally comparable ones. Difference may arise due to different sources of official energy data, dissimilarities in the underlying methodologies, adjustments and estimations.

Other methodological considerations

Rationale

The target "By 2030, increase substantially the share of renewable energy in the global energy mix" impacts all three dimensions of sustainable development. Renewable energy technologies represent a major element in strategies for greening economies everywhere in the world and for tackling the critical global problem of climate change. A number of definitions of renewable energy exist; what they have in common is highlighting as renewable all forms of energy that their consumption does not deplete their availability in the future. These include solar, wind, ocean, hydropower, geothermal sources, and bioenergy (in the case of bioenergy, which can be depleted, sources of bioenergy can be replaced within a short to medium-term frame). Importantly, this indicator focuses on the amount of renewable energy actually consumed rather than the capacity for renewable energy production, which cannot always be fully utilized. By focusing on consumption by the end user, it avoids the distortions caused by the fact that conventional energy sources are subject to significant energy losses along the production chain.

Renewable energy consumption includes consumption of energy derived from: hydro, solid biofuels, wind, solar, liquid biofuels, biogas, geothermal, marine and waste. Total final energy consumption is calculated from national balances and energy statistics as total final consumption minus non-energy use.

Comments regarding specific renewable energy resources:

- Solar energy consumption includes solar PV and solar thermal.
- Liquid biofuel energy consumption includes biogasoline, biodiesels and other liquid biofuels.
- Solid biofuel consumption includes fuelwood, animal waste, vegetable waste, black liquor, bagasse and charcoal[89].
- Waste energy covers energy from renewable municipal waste[90].
- Biogas.

[89] IRENA distinguish more products.
[90] IRENA distinguishes renewable municipal waste and renewable industrial waste.

The rationale of choosing final energy consumption instead of primary energy production[91]

Primary energy accounting

Many energy production statistics (e.g. IEA, Eurostat, EIA) are based on a physical energy content or primary energy accounting method. In these systems, energy is accounted for in the form in which it first appears. For fossil fuels and bioenergy, the energy content in the fuels before conversion is used as the measure. For nuclear and renewable energy, the primary energy content is calculated based on a number of different conventions.

The comparison between the roles of renewables and other sources is obscured by assumptions about the efficiencies of the various processes in these conventions (the physical energy content method, the partial substitution method, etc.). Wherever high efficiencies are used, *the share of renewables in the overall system is underrepresented in terms of the useful energy produced*.

Final energy accounting

Within the TFEC figures, heat and electricity are reported directly in the form ready for consumption. Although other primary energy sources (for example, fossil fuels and bioenergy used for heating in the residential sector) are still reported in terms of their fuel content, this methodology comes closer to representing the energy in the forms useful to users. To establish the contribution of each technology, the aggregated figures for electricity and commercial heat have to be allocated to the relevant technology. This can be done based on the proportions exhibited in production data, attributing the losses proportionally. The advantage of using TFEC as the basis for monitoring is that it allows a straight comparison (in GWh) of electricity producing renewables (or nuclear sources) as well as of commercial heat—and gets closer to measuring useful energy.

Comments and limitations[92]

There are a series of limitations that we can observed while working with existing renewable energy statistics:

- Renewable energy statistics are not able to distinguish whether renewable energy is being sustainably produced. For example, a substantial share of today's renewable energy consumption comes from the use of wood and charcoal by households in the developing world, which sometimes may be associated with unsustainable forestry practices. There are efforts underway to improve the ability to measure the sustainability of bioenergy, although this remains a significant challenge.
- Off-grid renewables data are limited and not sufficiently captured in the energy statistics.
- The method of allocation of renewable energy consumption from electricity and heat output assumes that the shares of transmission and distribution losses are the same between all technologies. However, this is not always true because renewables are usually located in more remote areas from consumption centers and may incur larger losses.
- Likewise, imports and exports of electricity and heat are assumed to follow the share of renewability of electricity and heat generation, respectively. This is a simplification that in many cases will not affect the indicator too much, but that might do so in some cases, for example, when a country only

[91] For further information please refer to: http://prdrse4all.spc.int/system/files/gtf-2013-full-report_0.pdf

[92] Methodological challenges associated with defining and measuring renewable energy are more fully described in Chapter 4, Section 1, pages 194-200 of the2013 Global Tracking Framework.

generates electricity from fossil fuels but imports a great share of the electricity it uses from a neighboring country's hydroelectric power plant.

- Data for traditional use of solid biofuels are generally scarce globally, and developing capacity in tracking such energy use, including developing national-level surveys, is essential for sound global energy tracking.

IEA assumes that the use of bioenergy in the residential sector of non-OECD countries is made up of "traditional biomass," whereas in the OECD countries it counts as modern bioenergy. This is obviously a simplification given the fact that informal use of wood fuels in low-efficiency appliances also occurs in many OECD countries, and has been widely questioned by other international organizations.

The major issue affecting the contribution from renewable energy to the global energy mix relates to the use of biomass for heating and cooking. In many countries this is an informal sector, and data availability and accuracy are acknowledged to be poor and subject to large errors.

Method of computation[93]

This indicator is based on the development of comprehensive energy statistics across supply and demand for all energy sources – statistics used to produce the energy balance. Internationally agreed methodologies for energy statistics are described in the "International Recommendations for Energy Statistics" (IRES)[94], adopted by the UN Statistical Commission.

Once an energy balance is developed, the indicator can be calculated by dividing final energy consumption from all renewable sources by total final energy consumption. Renewable energy consumption is derived as the sum of direct final consumption of renewable sources plus the components of electricity and heat consumption estimated to be derived from renewable sources based on generation shares.

Data from the International Energy Agency (IEA) and United Nations Statistics Division (UNSD) energy balances are used to calculate the indicator according to the following formula[95], where the variables are derived from the energy balance flows and their subscripts correspond to the energy balance products:

$$\%\,TFEC_{RES} = \frac{TFEC_{RES} + \left(TFEC_{ELE} \times \frac{ELE_{RES}}{ELE_{TOTAL}}\right) + \left(TFEC_{HEAT} \times \frac{HEAT_{RES}}{HEAT_{TOTAL}}\right)}{TFEC_{TOTAL}}$$

- TFEC = total final energy consumption,
- ELE = gross electricity production,
- HEAT = gross heat production,

The denominator is the total final energy consumption of all energy products; while the numerator, the renewable energy consumption, is a series of calculations defined as: the direct consumption of renewable energy sources plus the final consumption of gross electricity and heat that is estimated to have come from renewable sources. This estimation allocates the amount of electricity and heat consumption to renewable sources based on the share of renewables in gross production in order to perform the calculation at the final energy level.

[93] The Global Tracking Framework Report (IEA and World Bank, 2013) provides more details on the suggested methodology for defining and measuring renewable energy (Chapter 4, Section 1, page 201-202).
[94] For further information please refer to: https://unstats.un.org/unsd/energystats/methodology/documents/IRES-web.pdf.
[95] For further information please refer to: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/May/SDG7Tracking_Energy_Progress_2020.pdf

Estimating missing values

At country level:

The IEA has attempted to provide all the elements of energy balances down to the level of final consumption, for over 150 countries. Providing all the elements of supply, as well as all inputs and outputs of the main transformation activities and final consumption has often required estimations. Estimations have been generally made after consultation with national statistical offices, energy companies, utilities and national energy experts.

Likewise, UNSD attempts to provide full energy balances for the 225 countries and areas it covers, including the 75 or so it covers for SDG reporting. This may require searching for national official publications, data from other international organizations and expert estimation based on reputable sources and other publicly available information. Generally speaking, data on the supply side is more widely available than transformation activities and final consumption

At regional and global levels:

In addition to estimates at a country level, adjustments addressing differences in definitions alongside estimations for informal and/or confidential trade, production or consumption of energy products are sometimes required to complete major aggregates, when key statistics are missing. Such estimations and adjustments implemented by IEA have been generally made after consultation with national statistical offices, energy companies, utilities and national energy experts.

Indicator 7.3.1: Energy intensity measured in terms of primary energy and GDP[96]

Indicator Information

Goal:

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

Target:

Target 7.3: By 2030, double the global rate of improvement in energy efficiency

Indicator:

Indicator 7.3.1: Energy intensity measured in terms of primary energy and GDP

International organization(s) responsible for global monitoring:

International Energy Agency (IEA)

United Nations Statistics Division (UNSD)

Definition and concepts

Definition

Energy intensity is defined as the energy supplied to the economy per unit value of economic output.

[96] To access the full metadata sheet, please refer to: https://unstats.un.org/sdgs/metadata/files/Metadata-07-03-01.pdf

Concepts

Total energy supply, as defined by the International Recommendations for Energy Statistics (IRES), is made up of production plus net imports minus international marine and aviation bunkers plus-stock changes. Gross Domestic Product (GDP) is the measure of economic output. For international comparison purposes, GDP is measured in constant terms at purchasing power parity.

Unit of measure

The energy intensity level of primary energy is expressed in mega-joules of total energy supply per unit of purchasing power parity GDP in constant 2017 USD figures.

Data source type and data collection method

Data source

National energy balance and energy statistics.

Total energy supply is typically calculated in the making of energy balances. Energy balances are compiled based on data collected for around 150 economies from the International Energy Agency (IEA) and for all countries in the world from the United Nations Statistics Division (UNSD).

GDP data are taken mainly from the World Bank – World Development Indicator database.

Data collection method

The IEA collects energy data at the national level according to harmonized international definitions and questionnaires, as described in the UN International Recommendations for Energy Statistics[97].

UNSD also collects energy statistics from countries according to the same harmonized methodology. The most recent GDP estimates published by the World Bank with reference year of 2017 have been used when calculating this indicator. Additionally, missing years for countries with at least one data point for GDP reported by the World Bank have been estimated using National Accounts – Analysis of Main Aggregates (AMA) growth rates.

Data providers

National administrations[98].

Data compilers

The International Energy Agency (IEA) and United Nations Statistics Division (UNSD) are the primary compilers of energy statistics from across countries and develop internationally comparable energy balances based on internationally agreed methodologies. Aggregates are based on a merging between IEA and UNSD data.

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[97] To access the full report, please refer to: https://unstats.un.org/unsd/energystats/methodology/ires/
[98] Documentation on sources for IEA and UNSD can be found on the following sites and reports: http://wds.iea.org/wds/pdf/WORLDBAL_Documentation.pdf and https://unstats.un.org/unsd/energystats/data.

Data reporter

International Energy Agency (IEA)

United Nations Statistics Division (UNSD)

Data availability

IEA and UN Energy Balances combined provide total energy supply data for all countries on an annual basis. GDP data are available for most countries on an annual basis.

Time series

2000 – present.

Disaggregation

Disaggregation of energy intensity, e.g. by final consumption sectors or end-uses, could provide further insights into progress towards energy efficiency. At present it is only feasible to calculate such sector disaggregation for the following sectors – industry, residential, transport, agriculture, households – as reported in the Tracking SDG7: The Energy Progress Report[99]. It would be desirable, over time, to develop more refined sectoral level energy intensity indicators that make it possible to look at energy intensity by industry (e.g. cement, steel) or by type of vehicle (e.g. cars, trucks), for example.

Sources of discrepancies

The IEA World energy balances and the UN Energy Statistics Database, which provide the underlying data for calculating this indicator, are global databases obtained following harmonized definitions and comparable methodologies across countries. However, they do not represent an official source for national submissions of the indicator 7.3.1 on energy efficiency. Due to possible deviations from IRES in national methodologies, national indicators may differ from the internationally comparable ones. Difference may arise due to different sources of official energy data, dissimilarities in the underlying methodologies, adjustments and estimations.

Other methodological considerations

Rationale

Energy intensity is an indication of how much energy is used to produce one unit of economic output. It is an inverse proxy of the efficiency with which an economy is able to use energy to produce economic output. A lower ratio indicates that less energy is used to produce one unit of output, so decreasing trends indicate progress.

[99] Formerly Sustainable Energy for All Global Tracking Framework.

Comment and limitations

Energy intensity is only an imperfect proxy for energy efficiency. It can be affected by a number of factors, such as climate, structure of the economy, nature of economic activities etc. that are not necessarily linked to pure efficiency. For better assessment of energy efficiency progress, more disaggregated data are needed, such as those at the sectoral and end-use level.

Method of computation

This indicator is based on the development of comprehensive energy statistics across supply and demand for all energy sources – statistics used to produce the energy balance. Internationally agreed methodologies for energy statistics are described in the International Recommendations for Energy Statistics, adopted by the UN Statistical Commission. Once the energy balance is developed, the indicator can be obtained by dividing total energy supply over GDP:

$$Primary\ Energy\ Intensity = \frac{TPES}{GDP}$$

- Ratio of TPES to GDP measured in MJ per USD 2011 PPP. Energy intensity indicates how much energy is used to produce one unit of economic output. A lower ratio indicates that less energy is used to produce one unit of economic output.
- Energy intensity is an imperfect indicator of energy efficiency as changes are impacted by other factors, particularly changes in the structure of economic activity.

Estimating missing values

At country level:

The IEA has attempted to provide all the elements of energy balances, for over 150 countries. Providing all the elements of energy supply, has often required estimations. Estimations have been generally made after consultation with national statistical offices, energy companies, utilities and national energy experts.

Likewise, UNSD attempts to provide full energy balances for the 225 countries and areas it covers, including the 75 or so it covers for SDG reporting. This may require searching for national official publications, data from other international organizations and expert estimation based on reputable sources and other publicly available information. Generally speaking, data on the supply side is more widely available than transformation activities and final consumption.

At regional and global levels:

In addition to estimates at a country level, adjustments addressing differences in definitions alongside estimations for informal and/or confidential trade, production or stock changes of energy products are sometimes required to complete major aggregates, when key statistics are missing. Such estimations and adjustments implemented by IEA have been generally made after consultation with national statistical offices, energy companies, utilities and national energy experts.

Indicator 7.a.1: International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems[100]

Indicator information

Goal:

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

Target:

Target: 7.a. By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

Indicator:

Indicator: 7.a.1: International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems

International organization(s) responsible for global monitoring:

Organization for Economic Co-operation and Development (OECD) and International Renewable Energy Agency (IRENA)

[100] To access the full metadata sheet, please refer to: https://unstats.un.org/sdgs/metadata/files/Metadata-07-0a-01.pdf

Definition and concepts

Definition

The flows are covered through two complementary sources.

- OECD: The flows covered by the OECD are defined as all official loans, grants and equity investments received by countries on the Development Assistance Committee (DAC) List of Official development assistance (ODA) Recipients from foreign governments and multilateral agencies, for the purpose of clean energy research and development and renewable energy production, including in hybrid systems extracted from the OECD/DAC Creditor Reporting System (CRS).
- IRENA: The flows covered by IRENA are defined as all additional loans, grants and equity investments received by developing countries[101] from all foreign governments, multilateral agencies and additional development finance institutions (including export credits, where available) for the purpose of clean energy research and development and renewable energy production, including in hybrid systems. These additional flows cover the same technologies and other activities (research and development, technical assistance, etc.) as listed above and exclude all flows extracted from the OECD/DAC Creditor Reporting System (CRS).

Unit of measure

Million United States Dollars (USD) at 2018 prices and exchange rates (using donor country deflators and 2018 exchange rate).

Data source type and data collection method

Data sources and data collection method

The OECD/DAC has been collecting data on official and private resource flows from 1960 at an aggregate level and 1973 at an activity level through the Creditor Reporting System[102]. Data are reported on an annual calendar year basis by statistical reporters in national administrations (aid agencies, Ministries of Foreign Affairs or Finance, etc.).

IRENA's data on financial flows from public sources in support of renewable energy are available in IRENA's Public Renewable Energy Investment Database. IRENA collects this data from a wide range of publicly available sources, including the databases and annual reports of all of the main development finance institutions and 20 other bilateral and multilateral agencies investing in renewable energy. The database is updated annually and (at end-2016) covers public renewable energy investment flowing to 29 developed countries and 104 developing countries, for the period 2000-2015. As new publicly-funded financial institutions start investing in renewable energy, the IRENA database will expand to include these new investors over time.

Data providers

Statistical reporters in national administrations.

[101] Defined as countries in developing regions, as listed in the UN M49 composition of regions.
[102] CRS data are considered complete from 1995 for commitments at an activity level and 2002 for disbursements.

Data compilers

Organization for Economic Co-operation and Development (OECD) and International Renewable Energy Agency (IRENA).

Data reporter

Organization for Economic Co-operation and Development (OECD) and International Renewable Energy Agency (IRENA).

Data availability

The CRS contains flows to all DAC recipient countries. Global and regional figures are based on the sum of ODA and Other official flows (OOF) to the renewable energy projects. IRENA currently includes data about renewable energy projects in 29 developed countries and 104 developing countries (133 countries overall).

Time series:

- OECD: annual data from 1960 onwards.
- IRENA: annual data from 2000 onwards.

Disaggregation

Data in the CRS contain markers which reflect whether a policy objective is attained through the activity. Measuring gender equality is included in the CRS. Data from the CRS are reported at the project level and can be disaggregated by type of flow (ODA or OOF), by donor, recipient country, type of finance, type of aid (project, agriculture sub-sector, etc.).

Data in IRENA are stored by country (source and recipient) at the project-level, allowing disaggregation of the data in several dimensions. For example, financial flows can be divided by technologies (i.e. bioenergy, geothermal energy, hydropower, ocean energy, solar energy, and wind energy) and subtechnologies (e.g. onshore and offshore wind), by geography (both at the country and regional level), by financial instrument and by type of recipient.

Sources of discrepancies

Neither OECD nor IRENA make estimates of these figures. The data all come from national sources reported to OECD or, in the case of IRENA, from officially published statistics.

Other methodological considerations

Rationale

Total ODA and OOF flows to developing countries quantify the public financial effort (excluding export credits) that donors provide to developing countries for renewable energies. The additional flows (from the IRENA database) capture the flows to non-ODA Recipients in developing regions, flows from countries and institutions not currently reporting to the DAC and certain other types of flows, such as export credits.

Energy access is a major development constraint in many developing countries and, while starting from a relatively low base, energy demand is expected to grow very rapidly in many of these countries in the future. This presents an opportunity for developing countries to utilize clean and renewable technologies to meet their future energy needs if they can gain access to the appropriate technologies and expertise. This indicator provides a suitable measure of the international support given to developing countries to access these technologies.

Comment and limitations

Data in the Creditor Reporting System are available from 1973. However, the data coverage is considered complete since 1995 for commitments at an activity level and 2002 for disbursements. At present, flows to clean energy research and development are only partially covered by the database and a few other areas (e.g. off-grid electricity supply, investments in improved cookstove projects) may be covered only partially.

The IRENA database currently only covers financial institutions that have invested a total of USD 400 million or more in renewable energy. The process of continuous improvement of the database includes verifying the data against data produced by the multilateral development banks for climate finance reporting and by comparing the data with other independent reporting by international development finance agencies.

Method of computation

The OECD flows are calculated by taking the total official flows (ODA and OOF) from DAC member countries, multilateral organizations and other providers of development assistance to the sectors listed above. The IRENA (additional) flows are calculated by taking the total public investment flows from IRENA's Public Renewable Energy Investment Database and excluding: domestic financial flows; international flows to countries outside developing regions; and flows reported by OECD. The flows are commitments measured in current United States Dollars (USD).

Estimating missing values

Not applicable - there is no imputation of missing values.

Indicator 7.b.1: Installed renewable energy-generating capacity in developing countries (in watts per capita) [103]

Indicator information

Goal:

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all

Target:

Target: 7.b. By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing states and landlocked developing countries, in accordance with their respective programmes of support.

Indicator:

Indicator: 7.a.1: International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems

International organization(s) responsible for global monitoring:

International Renewable Energy Agency (IRENA)

[103] To access the full metadata sheet, please refer to:: https://unstats.un.org/sdgs/metadata/files/Metadata-07-0b-01.pdf.

Definition and concepts

Definition

The indicator is defined as the installed capacity of power plants that generate electricity from renewable energy sources divided by the total population of a country. Capacity is defined as the net maximum electrical capacity installed at the year-end and renewable energy sources are as defined in the IRENA Statute.

Concepts

Electricity capacity is defined in the International Recommendations for Energy Statistics as the maximum active power that can be supplied continuously (i.e., throughout a prolonged period in a day with the whole plant running) at the point of outlet (i.e., after taking the power supplies for the station auxiliaries and allowing for the losses in those transformers considered integral to the station). This assumes no restriction of interconnection to the network. It does not include overload capacity that can only be sustained for a short period of time (e.g., internal combustion engines momentarily running above their rated capacity).

The IRENA Statute defines renewable energy to include energy from the following sources: hydropower; marine energy (ocean, tidal and wave energy); wind energy; solar energy (photovoltaic and thermal energy); bioenergy; and geothermal energy.

Unit of measure

Watts per capita

Data source type and data collection method

Data sources

IRENA's electricity capacity database contains information about the electricity generating capacity installed at the year-end, measured in MW. The dataset covers all countries and areas from the year 2000 onwards. The dataset also records whether the capacity is on-grid or off-grid and is split into 36 different renewable energy types that can be aggregated into the six main sources of renewable energy.

For the population part of this indicator, IRENA uses population data from the United Nations World Population Prospects[104]. The population data reflects the residents in a country or area regardless of legal status or citizenship. The values are midyear estimates.

Data collection method

The capacity data is collected as part of IRENA's annual questionnaire cycle. Questionnaires are sent to countries at the start of a year asking for renewable energy data for two years previously (i.e. at the start of 2019, questionnaires ask for data for the year 2017). The data is then validated and checked with countries and published in the IRENA Renewable Energy Statistics Yearbook at the end of June. To minimize reporting

[104] The United Nations Department of Economic and Social Affairs published information about their methodology on the link below: https://population.un.org/wpp/Methodology/

burden, the questionnaires for some countries are pre-filled with data collected by other agencies (e.g. Eurostat) and are sent to countries for them to complete any additional details requested by IRENA.

At the same time as this, preliminary estimates of capacity for the previous year are also collected from official sources where available (e.g. national statistics, data from electricity grid operators) and from other unofficial sources (mostly industry associations for the different renewable energy sectors). These are published at the end of March.

Data providers

Renewable energy generating capacity: National Statistical Offices and National Energy Agencies of Ministries (the authority to collect this data varies between countries). Data for preliminary estimates may also be collected from industry associations, national utility companies or grid operators.

Population: United Nations Population Division. World Population Prospects.

Data compilers

International Renewable Energy Agency (IRENA).

Data reporter

International Renewable Energy Agency (IRENA).

Data availability

The total number of capacity records in the database (all developing countries/areas, all years since 2000, all technologies) is 11,000. In terms of numbers of records, 3,120 (28%) are estimates and 740 (7%) are from unofficial sources. The remaining records (65%) are all from returned questionnaires or official data sources.

However, in terms of the amount of capacity covered in the database, the shares of data from estimated and unofficial sources are only 5% and 1% respectively. The large difference between these measures is due to the inclusion of off-grid capacity figures in the database. The amount of off-grid generating capacity in a country is frequently estimated by IRENA but the amount of off-grid capacity recorded in each case is often relatively small.

Time series

Renewable generating capacity data is available from 2000 onwards.

Disaggregation

IRENA's renewable capacity data is available for every country and area in the world from the year 2000 onwards. These figures can also be disaggregated by technology (solar, hydro, wind, etc.) and by on-grid and off-grid capacity

Sources of discrepancies:

The main source of discrepancies between different sources of electricity capacity data are likely to be due to the under-reporting or non-reporting of off-grid capacity data or slight variations in the definition of installed capacity. IRENA uses the IRES definition of capacity agreed by the Oslo Group on Energy Statistics, while some countries and institutions may use slightly different definitions of capacity to reflect local circumstances.

Other methodological considerations

Rationale

The infrastructure and technologies required to supply modern and sustainable energy services cover a wide range of equipment and devices that are used across numerous economic sectors. There is no readily available mechanism to collect, aggregate and measure the contribution of this disparate group of products to the delivery of modern and sustainable energy services. However, one major part of the energy supply chain that can be readily measured is the infrastructure used to produce electricity.

Renewables are considered a sustainable form of energy supply, as their current use does not usually deplete their availability to be used in the future. The focus of this indicator on electricity reflects the emphasis in the target on modern sources of energy and is particularly relevant for developing countries where the demand for electricity is often high and its availability is constrained. Furthermore, the focus on renewables reflects the fact that the technologies used to produce renewable electricity are generally modern and more sustainable than non-renewables, particularly in the fastest growing sub-sectors of electricity generation from wind and solar energy.

The division of renewable electricity capacity by population (to produce a measure of Watts per capita) is proposed to scale the capacity data to account for the large variation in needs between countries. It uses population rather than GDP to scale the data, because this is the most basic indicator of the demand for modern and sustainable energy services in a country.

This indicator should also complement indicators 7.1.1 and 7.2. With respect to electricity access, it will provide additional information to the proportion of people with electricity access by showing how much infrastructure is available to deliver that access (in terms of the amount of capacity per person). The focus on renewable capacity will also add-value to the existing renewables indicator (7.2) by showing how much renewable energy is contributing to the need for improved electricity access.

Comment and limitations

At present, electricity only accounts for about one-quarter of total energy use in the World and an even lower share of energy use in most developing countries. The focus of this indicator on electricity capacity does not capture any trends in the modernization of technologies used to produce heat or provide energy for transport.

However, with the growing trend towards electrification of energy end-uses, the focus here on electricity may become less of a weakness in the future and may also serve as a general indicator of the progress towards greater electrification in developing counties. That, in itself, should be seen as a shift towards the use of more modern technology to deliver sustainable energy services.

Furthermore, as reflected in many national policies, plans and targets, increasing the production of electricity and, in particular, renewable electricity, is seen by many countries as a first priority in their transition to the delivery of more modern and sustainable energy services. Thus, this indicator is a useful first-step towards measuring overall progress on this target that reflects country priorities and can be used until other additional or better indicators can be developed.

Method of computation

For each country and year, the renewable electricity generating capacity at the end of the year is divided by the total population of the country as of mid-year (July 1st).

Estimating missing values

At the country level, electricity capacity data is sometimes missing for two reasons:

- Delays in responding to IRENA questionnaires or publication of official data. In such cases, estimates are made so that global and regional totals can be calculated. The most basic treatment is to repeat the value of capacity from the previous year.
- Off-grid capacity data is frequently missing from national energy statistics, or is presented in nonstandard units (e.g. numbers of mini-hydro plants in a country rather than their capacity in MW). Where official data is not available, off-grid capacity figures are collected by IRENA from a wide variety of other official and unofficial sources in countries (e.g. development agencies, government departments, NGOs, project developers and industry associations) and this information is added to the capacity database to give a more complete picture of developments in the renewable energy sector in a country.

Regional and global totals are only estimated to the extent that figures for some countries may be estimated in each year.

Conclusions

Goal 7 (SDG 7) aims to ensure universal access to affordable, reliable and modern energy services by 2030; increase the share of renewable energy in the global energy mix; and double the global rate of improvement in energy efficiency. Likewise, it seeks to increase international cooperation to facilitate access to research, as well as the improvement of infrastructure and technological progress. The inclusion of a target in the 2030 Global Agenda focused on sustainable energy triggered new developments in terms of international energy statistics for tracking and monitoring progress on SDG 7 indicators.

The Covid-19 global pandemic impacted the world's economy in an unprecedented way. It exposed structural problems of our society and our economic and productive system, like the deep inequalities not only between developed and developing countries, but also within the most developed countries. Regarding SDG 7, the pandemic slowed global progress in reaching universal access to electricity and clean cooking. In terms of access to electricity the pandemic has slowed the rate of both new grid and off-grid connections. For clean cooking, the pandemic increased the number of people without access by 30 million between 2019 and 2021, a rise of 1%. The Covid-19 pandemic has both decreased the flow of new investments and increased the cost of capital in developing economies[105].

- Setting national plans with clear and monitored targets, and creating institutions to fulfil those objectives, are important first steps to answer to the challenges posed by the on-going crisis. Holistic national access plans that consider other sustainable development goals as well as climate mitigation and adaptation needs can combine the many priorities in developing countries. The need for action becomes more urgent each year that progress stalls or slows down, making it even harder to realize the goal of universal access in 2030. The world must maintain its focus on achieving access for all, and international support is more critical than ever as progress continues to deteriorate in the wake of the pandemic.

[105] For further information please refer to: https://www.iea.org/commentaries/the-pandemic-continues-to-slow-progress-towards-universal-energy-access.

- More detailed, timely and transparent information from the energy sector is needed for the development of a new tool, a set of integrated indicators, to help Latin American and Caribbean policymakers guide efforts towards a sustainable development horizon. Such indicators, based on transparent, accurate and timely data, have the potential to provide policy tools at the national level that would facilitate strategic decision making by policy makers in the region.
- Currently, there are many statistical harmonization initiatives at the global level. Specifically for energy, the Inter-Secretariat Working Group on Energy Statistics (InterEnerStat) brings together more than 20 international organizations to work on improving the availability and quality of international energy statistics, and their use in energy indicators (Taylor et al., 2017) .
- Access to electricity is often equated with the availability of an electrical connection in the home or the use of electricity for lighting. Similarly, access to energy for cooking is often equated with the use of non-solid fuels as a primary energy source for cooking. However, not only do these binary measures fail to capture the multifaceted and multilevel nature of energy access, they do not go beyond a household focus and do not include productive and community applications of energy.
- Different surveys may provide different types of data due to differences in the questions asked of respondents.
- LAC countries have the same survey limitations as the rest of the world; most national surveys include only a few questions related to energy access (e.g., whether a household has electricity, the type of lighting used, and the main type of cooking fuel). The lack of standardized national surveys with more detailed questions on energy access, especially for poor communities, makes it difficult to develop robust measures of energy access and energy poverty. One of the solutions proposed so far is a multilevel framework for measuring access (discussed below).
- While the existing global household survey evidence base provided a good starting point for tracking household energy access, it also presented a number of limitations that still need to be addressed. In many parts of the world, the presence of a household electricity connection does not necessarily guarantee that the energy supplied is adequate in quality and reliability or affordable in cost, and more complete information on these critical attributes of service would be desirable.
- Renewable energy technologies represent an important element in strategies to green economies around the world and to address the critical global problem of climate change. There are various definitions of renewable energy; what they have in common is that their consumption does not exhaust their availability in the future.
- A limitation of existing renewable energy statistics is that they are unable to distinguish whether renewable energy is being produced sustainably. For example, a substantial portion of current renewable energy consumption comes from the use of fuelwood and charcoal by households in the developing world, which can sometimes be associated with unsustainable forestry practices.
- The BIEE program in Latin America and the Caribbean provides an evidence base for assessing energy efficiency (EE) policies and programs in participating countries, promoting capacity building on EE indicators, motivating the implementation of EE policies and programs based on monitoring, measurement and standardization, promoting regional comparability of the sector, and improving regional coordination on EE issues on the regional and global agenda.

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