HIGH-LEVEL POLITICAL FORUM ON SUSTAINABLE DEVELOPMENT

POLICY BRIEF #1

ACHIEVING UNIVERSAL ACCESS TO ELECTRICITY

Developed by:

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This document is a part of a series of Policy Briefs being developed to support SDG7 review at the UN High-Level Political Forum to be held in July 2018. The objective is to inform intergovernmental discussions by providing substantive inputs on SDG7 and its interlinkages with other SDGs prepared through inclusive multi-stakeholder consultation processes. The development of these Policy Briefs is coordinated under the auspices of the Ad Hoc Informal Multi-stakeholder Technical Group of Advisors on SDG7.

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KEY MESSAGES

Status of electricity access and progress towards achieving SDG 7.1

- The number of people without access to electricity fell to 1.1 billion in 2016 from 1.7 billion in 2000. The number of people gaining access to electricity each year is accelerating, thanks to strong successes in countries including Bangladesh, Ethiopia, India, Kenya and Tanzania, and increasingly coming from renewables as public programmes and private business models providing electricity access with off-grid solar are thriving and many countries are exploiting their renewable potential in the centralised electricity mix.
- However, having a source of electricity is not a guarantee of full access. Electricity needs to be available at the right time, at an affordable price, and without a reliable supply and appliances. As a consequence, households, schools, health centres and local enterprises with a connection may not have access to meaningful electricity services.
- Current progress is promising in many parts of Asia and some countries in sub-Saharan Africa, but they are not on track to achieve universal access by 2030. Based on recent trends and policies, the number of people without electricity access is on track to decline to below 680 million by 2030, 80% concentrated in rural areas of sub-Saharan Africa.

Priority actions

- Guarantee leadership, commitment and strategic planning: it is essential that governments elevate universal access to electricity high on the political agenda, backing commitments up with strategic planning, clear policies and dedicated institutions.
- Ensure dedicated institutions and enabling policy and regulatory frameworks: Virtually all successful public electrification programs have featured a specific leading institution. A dedicated public-sector “champion” can provide a strong framework for all actors. It is essential to make institutions strong, with a clear mandate, with the authority and resources to fulfil the mandate, and made to be held accountable for achieving that mandate.
- Enable private sector participation: To achieve the estimated $52 billion/year in investment necessary to deliver universal access, private investment needs to complement public spending. However, most investment in developing countries is driven by public grant/concessional funding and non-commercial equity.
- Integrate electrification of productive uses in access strategies: No country has gone from poverty to prosperity without making electricity affordable and available in bulk. Household electrification strategies should take into account other development goals and opportunities to use energy access to stimulate inclusive, climate resilient and sustainable economic activity.
- Support technology development and standards: Decentralised systems are benefitting from innovative systems for control and demand-side management. Electrification planning needs to take into account the dynamic and integrated nature of energy demand, and to ensure technical standards and energy efficiency in end-use appliances. Falling costs of energy storage will make access more affordable and achievable.
- Address affordability, which remains a critical barrier, by lowering upfront costs in providing targeted financing and subsidies, harnessing new business models such as the PAYG model, and creating sound policies and institutions.

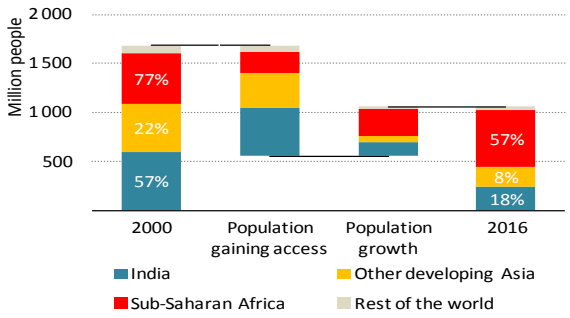
Electricity access and the Sustainable Development Goals

Energy has been long recognised as essential for humanity to develop and thrive, but the adoption in 2015 of new United Nations Sustainable Development Goals (SDGs) marked a new level of political recognition of the importance of energy to development. The SDGs include, for the first time, a target to ensure access to affordable, reliable, sustainable and modern energy for all. Electricity access is crucial to the achievement of many of the other SDGs. Providing connections to households, however, is not enough to ensure economic and social development. Electricity needs to be available reliably and affordably not only for households to access meaningful services but also for income generating activities and public services. Improvements and cost declines in decentralised technologies offer new opportunities for delivering universal electricity access, but many challenges remain, particularly for providing electricity access affordably for remote and poor households.

Current status of electricity access

Efforts to promote electricity access are having a positive impact in all regions, and the pace of progress has accelerated. The number of people without access to electricity fell below the 1.1 billion mark for the first time in 2016. Nearly 1.2 billion people have gained access since 2000, but population growth in areas with low access rates has offset some gains (see Figure 1). Where access to electricity is incomplete, it is characterized by a considerable urban-rural divide.

Figure 1: Change in population without access to electricity between 2000 and 2015



Note: Percentages within the graph indicates the share of population without electricity access.
Source: International Energy Agency

Most progress has been made in **developing Asia**, where 870 million people have gained access since 2000. India accounts for 500 million– one of the largest electrification success stories in history – while universal electrification was announced in China in 2015. Today about 89% of the population in the region has access and the absolute number of people without access has halved in the last ten years despite population growth. Based on current policies and trends, the region is on track to achieving universal access in the early 2030s.

There is for the first time a positive trend in **sub-Saharan Africa**, where the number of people without access peaked in 2013, led by Cote d'Ivoire, Ethiopia, Ghana, Kenya, Sudan and Tanzania. Since 2012, the pace of electrification has nearly tripled relative to 2000-2012. Some 80% of the 590 million people who remain without access live in rural areas, where the average electrification rate is less than 25%. Despite positive developments, population growth and uneven progress means that on the basis of current efforts, some 600 million will remain without access in 2030.

Over 95% of the global population without electricity access live in Asia and sub-Saharan Africa. While other world regions have reached near-universal access, there are several exceptions, including Yemen and Haiti where less than half the population has access.

Even in countries where access is universal, unplanned service disruptions and power outages can be common, there is no guarantee that supply is affordable, and many rural off- and mini-grid systems can supply only a few hours of electricity services per day. Consequently, even for many of those who have gained access, the absolute level of electricity consumption, and access to electricity services is low. There is no universally-accepted minimum threshold for what constitutes electricity access particularly in establishing policy targets[1].

Electrification solutions

Grid electrification has been the source of electricity access for an estimated 97% of people who have gained a connection since 2000 (IEA, 2017) and from a system perspective offers the lowest-cost path to household electrification when the option exists. Given the economies of scale associated with centralised power generation, grid extension and connection will likely remain the most favourable electrification option for many households, particularly those in more densely populated areas. IEA geospatial analysis suggests that to deliver universal access by 2030, grid extension is the lowest-cost option for around 40% of households that do not currently have access. The importance of centralised generation from renewables grows, to around half of generation for electricity access to 2030, an increase from a 30% share seen since 2000; coal's role is expected to decline in particular. One barrier, however, is the significant financial weakness of utilities in

[1] In the IEA's scenarios, a household initially gains access to enough electricity sufficient to power a basic level of energy services, growing over time so that by 2030, the average household has electricity to power four lightbulbs operating at five hours per day, one refrigerator, a fan operating 6 hours per day, a mobile phone charger and a television operating 4 hours per day. The Multi-Tier Framework (MTF), developed by ESMAP, is a complex metric of energy access going beyond whether a household has an electricity connection or not. MTF incorporates energy service attributes such as 'Capacity', 'Reliability', 'Quality', 'Legality', 'Safety' and 'Affordability' to determine five tiers (from Tier 0 as the lowest to Tier 5 as the highest rating) (IEA and World Bank, 2017).

many cases (Kojima & Trimble, 2016): in such cases, attending to the financial health of the domestic power sector, focusing on 'commercially-oriented' operation, is of great importance.

Grid extension is less favourable than **decentralised options**[2] under conditions of complex terrain, low population density, regulatory and institutional hurdles, or high investment and maintenance costs that may not be recoverable by utilities. The IEA estimates that to deliver universal electricity access by 2030, decentralised solutions are the least-cost option for 60% of people lacking access, with the role of grid expansion expected to increase with increasing power demand and economic activity. Currently, decentralised access solutions are small but accelerating: the IEA estimates that 33 million people have access to electricity with decentralised renewables (excluding pico solar, which IRENA estimate benefit 114 million users), with the rate of connection accelerating. IRENA estimates that globally, off-grid renewable electricity capacity for residential and commercial purposes is around 4,030 MW (IRENA, 2017c). Decentralized electricity systems can also have cobenefits for local job creation and economic growth. The dynamics of electrification solutions are not static: in western economies the network emerged from local systems (both private and municipal) and later interconnected; the same may be true for areas currently gaining access and power demand grows.

Several trends are converging to transform the energy access landscape in rural areas with decentralised options. Notably, these trends include the declining cost of renewables and storage (historically, most decentralised capacity has been oil-based), the emergence of new technologies enabling smart metering and mobile payments, the liberalisation of energy markets enabling more actors, including the private sector, to participate, as well as focus from international initiatives. Affordable financing models have been instrumental, two in particular. The **pay-as-you-go (PAYG)** model has emerged in recent years with considerable momentum: consumers use their phones to pay a fixed up-front cost for the device – usually a solar panel bundled with battery storage and appliances – and then pay for its use in instalments. Critically, the daily payments can be less than a household pays for poor-quality energy alternatives, such as kerosene for lighting. The model is well-established in East Africa, where mobile money is widely used, and has expanded to more than 30 countries, serving an estimated 700 000 households (REN21, 2017). The PAYG model is scalable with private sector capital; however, so far PAYG businesses have been almost exclusively reliant on international investors, exposing businesses to the risk of transaction costs and currency fluctuations, which can lead to price increases for consumers.

In Bangladesh, a successful **micro-credit** model has been in operation for more than a decade. There, the state-owned Infrastructure Development Company (IDCOL) channels international funding to micro-credit groups and installers, sets technical specifications and loan terms and certifies products and components for quality control purposes. While affordability has been key, household loan terms have moved from concessional towards commercial. A cumulative 4.1 million solar home systems have been installed (IDCOL, 2017) and more than 100 000 jobs have been generated. Replicable lessons include adaptation of equipment to local needs, enforcement of product standards, and workforce training. A designated "national champion" like IDCOL can be tasked with establishing an overall policy framework within which financing, product certification and other activities unfold.

The role of mini-grids, currently limited, is expected to increase, especially when access initiatives aim to provide electricity for productive and commercial activities as well as households. For sustainable mini-grid development and operation, an enabling environment is needed that covers dedicated policies and regulations, tailored financing mechanisms, enabling institutional frameworks, a focus on capacity building and adapted technology. Within such an enabling environment, suitable policies and regulations for mini-grids cover: a clear rural electrification strategy, a tailored licensing and permitting framework, a mechanism to address compensation/integration of mini-grids when the main grid arrives, clear rules for setting tariffs which incentivizes investment and enables sustainable operation, and measures to facilitate access to finance for both developers and end-users (IEA, 2017; IRENA, 2016). Anchoring mini-grid development to productive sectors, such as telecoms towers, agriculture (irrigation/processing) can provide important revenue to the supplier and increase the financial viability of the mini grid (as well as having benefits to the local economy). It is therefore important to promote productive uses sooner rather than later.

Investment to deliver universal electricity access

Providing electricity for all by 2030 would require an estimated annual investment of $52 billion per year in power generation and infrastructure, equal to 3.4% of average annual global energy sector investment over this timeframe. In the IEA *Energy for All* scenario, renewables make up around 90% of investment in new capacity. However, IEA projects that less than half of this needed investment is made under current trends and policies and that over 95% of the investment gap will affect countries in sub-Saharan Africa. There, under current trends 600 million people could still be without electricity by 2030 unless more investment is mobilised.

[2] "Decentralised" electricity generation here encompasses off-grid (standalone) systems powering individual households and mini-grids, powering a network of clustered homes and/or businesses.

Bundling very efficient appliances with off-grid renewable systems can reduce the overall cost by around one-third.

Interlinkages with other SDGs

Energy (including electricity) is not useful in itself: it is only useful to the extent that it provides useful services and drives actions. Therefore, while it is important to measure energy access directly, the true impact is on enabling the success of other SDGs. Modern energy access is an important factor to the achievement of virtually all development goals, but for some SDGs it is essential:

No poverty (SDG 1); Gender equality (SDG 5); Decent work & economic growth (SDG 8); Industry, innovation, & infrastructure (SDG 9): People deprived of modern energy are trapped in a reinforcing cycle with insufficient means to improve their living conditions and basic services, including lighting, education, health and fresh water to meet basic human needs. At the same time, poor households without access spend a significant share of their very limited income on expensive, unhealthy, unsafe and inefficient forms of energy. Modern, affordable energy is essential for breaking this cycle. Moreover, electricity access can improve livelihoods. This is especially the case for women, for whom the chance to work from home can create an. independent source of income With the development of local skills, the deployment of decentralised energy can create employment in assembling, distributing, installing and maintaining equipment and support rural economies, as well as potentially allowing for revenue generation. Electricity is also essential for economic sectors – agriculture, tourism, commerce, industry – to thrive and create income-generating opportunities, increase value added, and therefore revenues, in rural areas, and telecommunications improve access to markets and information.

Zero hunger (SDG 2); clean water and sanitation (SDG 6): Today energy inputs are limited throughout the agri-food chain in developing and least-developed countries, hindering efficient food production and threatening food security. Modern energy offers many benefits: Electricity for irrigation pumps can double the yield of croplands; refrigeration reduces spoilage, and providing energy for processing can vastly improve the efficiency of food production, increase the value of the products and generate economic and employment gains. Moreover, installing and operating water extraction, transport and treatment systems requires a considerable amount of energy: expanding these services to poorer population is dependent on a source of electricity.

Good health and wellbeing (SDG 3): At present, an estimated 4 million people die prematurely each year due to the use of polluting fuels and technologies in households for cooking, heating and lighting, without adequate ventilation. Women and children suffer most of the worst effects. Providing access to modern energy for all can lower the premature death toll by around 1.8 million people per year in 2030 (IEA, 2017). Thermal comfort (heating and cooling) and refrigeration are also key to good health and nutrition. Moreover, health care facilities require reliable electricity to function and power medical devices and good lighting is needed to provide essential services. Refrigerators used in health clinics with unreliable electricity cause significant failure of vaccines. Yet, an estimated 1 billion people globally are served by health facilities without electricity, of which 255 million people live in sub-Saharan Africa (Practical Action, 2013*)*. Access rates drop dramatically for rural clinics, and those with access often have an unreliable supply (WHO and World Bank, 2014). This lack of, or unreliable, access contributes to the immense health care challenge developing countries face.

Quality education (SDG 4): Ensuring electricity access can reinforce education goals. Well-lit, well-heated and well-cooled schools and households are essential for creating learning spaces for children and adults. Information and communication technologies, on which modern education is based, also require energy input. Conversely, quality education is an enabling factor in achieving SDG 7, given that knowledge and skills influence the feasibility of implementing access solutions from technical, financial and political perspectives.

Climate action (SDG 13): Despite electricity generation contributing a large share of global CO_2 emissions, there is no threat from delivering universal household electricity access to the achievement of the Paris Agreement. The growing importance of renewables for electricity access and the relatively low levels of electricity consumption of households in developing countries mean that delivering universal access increases global CO_2 emissions in 2030 by around 0.2% (70 million tonnes of CO_2) relative to the baseline (IEA, 2017). At the same time, reliable, modern energy access can improve the resilience of households and communities to a changing climate.

It is also important to note that there are interlinkages between the three SDG 7 targets themselves: For example, cost reductions in renewables, storage and energy efficiency as a result of deployment globally will facilitate rural electrification.

Policy recommendations

Guarantee leadership, commitment and strategic planning: To make progress in this area, it is essential that governments elevate universal access to electricity high on the political agenda, backing commitments up with strategic planning, clear policies and dedicated institutions. Policy uncertainty and a lack of transparency can create the perception of excessive risk, discouraging investment and halting progress. Governments should map a clear energy development scenario, charting the expansion of the grid and the integration of decentralized solutions into rural electrification strategies, and planning for people moving up the energy ladder. Electrification strategies should also ensure a sustainable and affordable supply, and plan for providing electricity to

productive sectors. To maximise socio-economic benefits, it is important to identify priority areas, such as the electrification of health centres, schools and productive sectors.

Ensure dedicated institutions and enabling policy and regulatory frameworks: Virtually all successful public electrification programs have featured a specific leading institution. A dedicated public-sector "champion" can provide a strong framework for all actors that addresses not only technical and market development issues, but also other critical dimensions such as quality control, training, and adaptation of solutions to local needs. There are a host of stakeholders with important roles to play: it is essential to make these institutions strong, with a clear mandate, with the authority and resources to fulfil the mandate, and made to be held accountable for achieving that mandate.

Enable private sector participation: The power sector is often represented by government-linked institutions, and most investment is driven by public grant/concessional funding and non-commercial equity in developing countries. To achieve the necessary scale-up to deliver electricity for all by 2030 (estimated by the IEA to be $52 billion per year), private investment needs to complement public investment. Policies, regulations and incentive structures can facilitate market development and ensure affordable financing for all electrification solutions. De-risking tools can help attract both downstream (end-user) and upstream (enterprise) capital into the off-grid sector. This also necessitates an adequate enabling policy framework, and facilitating access to commercial debt and equity (see Policy Brief on Finance for SDG 7).

Integrate electrification of productive uses in access strategies: No country has gone from poverty to prosperity without making electricity affordable and available in bulk. Household electrification strategies should take into account other development goals and opportunities to use energy access to stimulate inclusive, climate resilient and sustainable economic activity. Electrifying communities with grids or mini-grids can allow economies of scale by leveraging power demand from productive sectors where houses, businesses and public services are physically close to one another. Mini grids are more likely to be economical in more densely populated but remote areas. There is also an important development opportunity to use the provision of energy access to create local jobs, contingent on fostering local skills and competencies. Local entrepreneurs can play a fundamental role in extending electricity access with decentralised solutions. The Addis Ababa Action Agenda commits leaders to providing both public and private investment in energy infrastructure and clean energy technologies with the aim of delivering universal access.

Support technology development and standards: Innovative systems for control and demand-side management are gaining importance in the off-grid sector**.** Off-grid systems have proven to be effective at providing access to areas that are too expensive to electrify via the grid in the short or medium term. Moving beyond a basic level of electricity consumption is likely to make the case for mini-grid development or grid extension. Mini-grids themselves can be integrated into large networks, if they use compatible equipment. This underlines the need to recognise the dynamic and integrated nature of energy access development, and for co-ordinated planning which takes account of ways to upgrade existing systems and integrate decentralised systems into the grid if it arrives. Similarly, grid standards should vary depending on the connected load. There is also a role for governments in putting in place standards and labelling, ensuring quality assurance, and by controlling the import of less efficient goods. Low-quality goods and poor information can erode consumer confidence and spoil new markets.

Energy storage: Many stand-alone renewable solutions typically only offer 4 hours of limited service (light bulbs, mobile charging, small TV in the evening). To offer higher levels of services, greater generation requires more storage capacity, representing significant additional cost, particularly in a solar PV-battery system. It's a process then of moving up tiers of electrification over time, as end-users' ability to pay increases. At current prices, this makes the systems that include storage in most cases uncompetitive. However, a clear cost reduction trajectory, based on technology learning curve dynamics, is emerging for various storage technologies that is likely to continue making these solutions more affordable. Public subsidies for off-grid electrification can be targeted to address this to reduce the cost in the short term.

Harness to potential of energy efficiency, which has the potential to improve not only the economics of energy access, but also the reliability and performance of a system. Efficient appliances such as LEDs, low-power TVs, and various types of machinery enable access to energy services at lower levels of power consumption. However, developing countries are often the recipients of second-hand, inefficient appliances, which while more affordable in the near-term, limit the level of energy services a consumer can attain. Pairing off-grid systems with super-efficient appliances can substantially reduce the lifetime cost of a new connection; however, financing is needed to overcome the additional upfront cost burden. Many policies and programmes to improve energy access should broaden to focus on demand technologies and regulate the import of less efficient goods.

Addressing affordability, which remains a particularly critical barrier to scaling up these solutions. Even though people without electricity access often pay a lot for conventional energy sources, such as kerosene and candles the upfront costs for off-grid systems may still be higher than most consumers are willing or able to pay. As discussed, the IDCOL approach and the PAYG business models that bundle services and appliances offer scope for overcoming the upfront cost barriers. Governments can also help by lowering the cost for decentralised solutions by creating sound policies and institutions, discussed above. Governments may need to subsidise decentralised connections to ensure equity between

rural and urban households, as well as affordability. Targeted subsidies and financing could be aimed at lowering connection fees, or the upfront costs of equipment and appliances.

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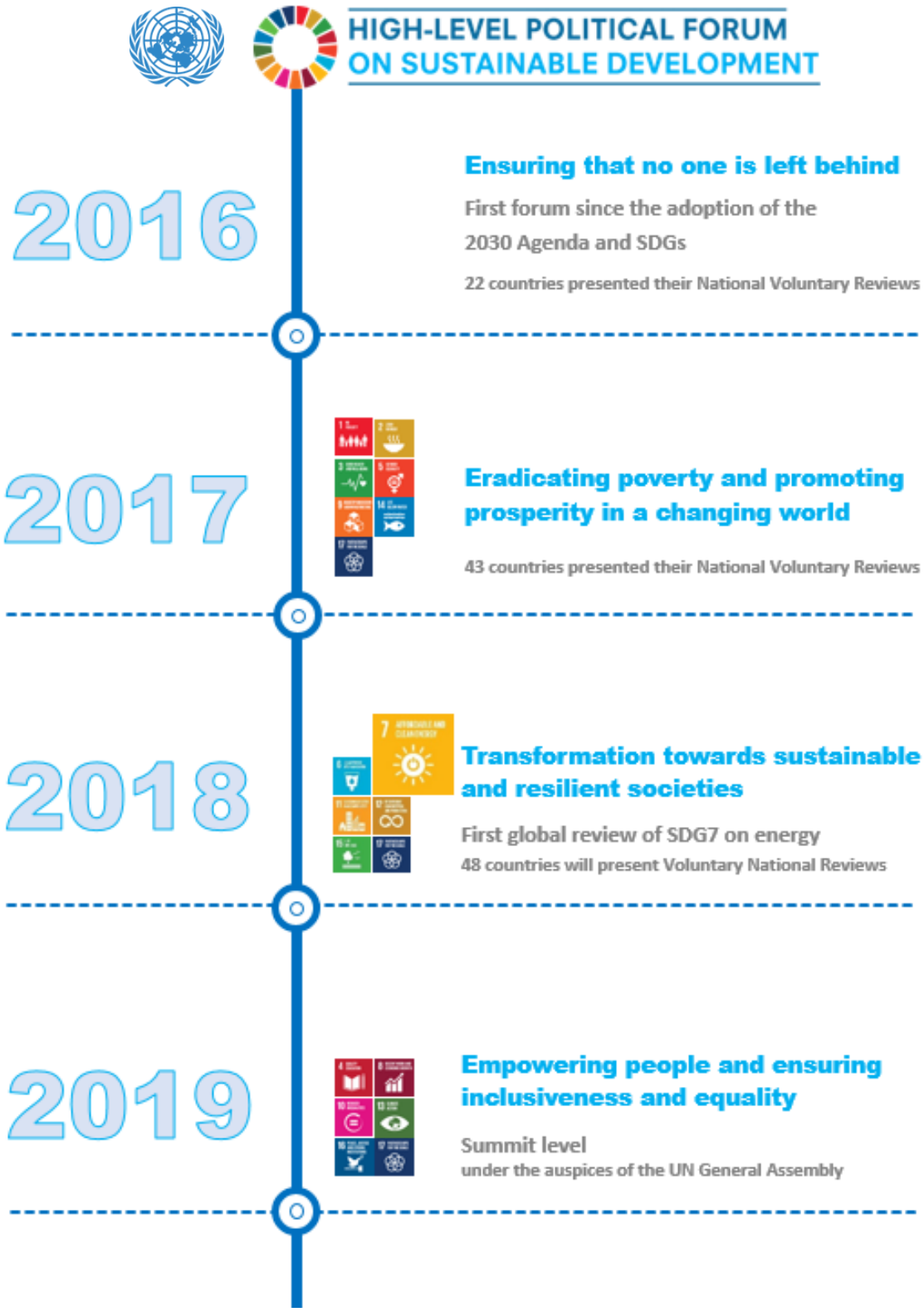

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