



POLICY BRIEF #9

WATER-ENERGY-FOOD NEXUS FOR THE REVIEW OF SDG 7

Developed by:

FAO

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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 and progress towards achieving the SDGs

- If we continue with business as usual, it will be impossible to meet the simultaneous huge increases in water, energy and food needs in the next decades. The Water-Energy-Food (WEF) Nexus builds on the close linkages between these sectors to manage tradeoffs and synergies in order to address this challenge;
- The importance of water, energy and food in sustainable development is evidenced by the fact that they have their specific SDGs. However these sectors also significantly contribute to several others, and to the implementation of the Paris Agreement;
- The WEF Nexus approach is increasingly used at project level and supported by some governments, civil society, international development partners, the private sector and research. Progress has been much slower in mainstreaming the Nexus approach in policy making, institutional set ups and planning;
- The implementation of the WEF Nexus approach faces several challenges which often vary depending on country situations of geographical coverage (e.g. transboundary river basin), and gender. However, governance issues are very common, including lack of policy coherence, institutional coordination and information, as well as stakeholder power differences and politics at different levels;
- Despite a strong gender dimension in the WEF sectors, gender aspects are often overlooked in the use of the WEF Nexus approach;
- At the same time there exist several opportunities to support the adoption of the WEF Nexus approach, including the use of well-proven WEF Nexus technologies, Nexus tools and practices, operators' interest when it reduces costs and risks and financial support in that respect; opportunities for stakeholder dialogues and public awareness, and increased WEF Nexus investments;

Given the challenges in mainstreaming the use of the WEF Nexus in policies and programmes, actions to that end should adopt a stepwise process through practical approaches might be better than striving for the 'ideal'.

Priority actions over the next four years

- Document, advertise and further support practical cases where the use of the WEF Nexus approach has led to successful outcomes;
- Fill knowledge gaps, in particular through support to knowledge platforms and the improvement of data collection relevant to the WEF sectors;
- Strengthen gender perspectives and financial support to SMEs that embrace the WEF Nexus approach;
- Keep fostering multi-stakeholder stakeholder dialogue at all levels and with a wide variety of partners, including the private sector; and
- Prioritise capacity development of decentralised levels as basis for WEF Nexus based decision making on actions related to the WEF sectors.

Priority actions towards 2030

- Strengthen participatory approaches and address power differences, in particular regarding the implementation of WEF-related interventions at local level;
- Strengthen capacity of national decision makers relevant to the WEF sectors, building in as much as possible on but not necessarily limited to existing structures and mechanisms; and
- Promote horizontal and vertical coordination.

Introduction

Agriculture is the largest user of the world's freshwater resources, accounting for 70% of total global water withdrawals (FAO, 2011a), while the energy sector (primary energy production and electricity generation) accounts for 10% of water withdrawals and 3% of total global water consumption (IEA 2016). An estimated

30 % of global energy consumption occurs along food supply chains (FAO 2011b), and the water sector accounts for 4% of total global electricity consumption (IEA 2016). However, without adequate water and energy agriculture global food needs cannot be met. At the same time, cities and industry sectors, too, claim increasingly more water, energy, food and land resources. The challenge of managing simultaneous demand and supply in the water, energy and food sectors is will be exacerbated in the near future if we continue with 'business-as usual': Feeding a global population, expected to reach 9.8 billion people by 2050, will require a 60% increase in food production (compared to 2012 levels) and substantial avoidance of food loss along the value chains. Global energy consumption is projected to grow by almost 30% between 2016 and 2040 according to IEA's New Policies Scenario (IEA 2017); the total global water withdrawals for irrigation are projected to increase by 10 percent by 2050 (FAO 2011a), and by 2% by 2040 for the energy sector from 2014 (IEA 2016).

An integrated approach is required to account for the close links between water, energy and food in addressing the daunting challenge of fulfilling their simultaneous demands in a sustainable manner. The Water-Energy-Food (WEF) Nexus approach fulfils this need as a means inform sector planning, policy and technology decisions by identifying potential tradeoffs and exploring synergies in their production and use in the context of finite and often stressed natural resources assets, and the challenges of climate change. More broadly, it addresses some of the key development challenges of our age: Meeting growing demands for goods and services related to population growth, rapid urbanization, changing diets and economic development through equitable and sound management of resources within planetary boundaries and in the context of climate change.

Links between the Water-Energy-Food Nexus, the Sustainable Development Goals and the Paris Agreement

The above explains why water, energy, and food security are recognized as SDGs in their own right. However, progress towards the majority of the SDGs is directly related to the sustainable use of resources such as land, food, water, and energy. In that line, WEF Nexus knowledge platforms and stakeholder dialogue fora can act as a "Bridging Institutions" for different stakeholders in achieving the SDGs (in particular

SDG 17). The WEF Nexus is therefore a central pillar of Agenda 2030, as an enabler of sustainable development in its three dimensions.

More specifically, the WEF Nexus approach can help in the implementation of the SDGs, in at least three ways:

- Identify potential trade-offs at the policy design stage (e.g., targets related to food security, bioenergy, thermal power capacity additions);
- Support the identification and development of solutions that positively benefit multiple-SDGs (e.g., decentralised renewables in agri-food);
- Better link SDGs in their implementation through a process which avoids the 'silo' approach that prevailed with the MDGs;

There are in particular close inter-linkages between the WEF Nexus and climate change – hence with the implementation of the Paris Agreement (SEI, 2011):

- On the one hand, energy and food/agricultural production are major drivers of climate change; on the other hand, agriculture and water are among the most climate-vulnerable sectors;
- Climate policies themselves may also affect water, energy and food security. They can improve water, energy and food security e.g. on afforestation, soil carbon sequestration and renewable energy. But they can impact or be impacted by WEF resources. For instance, the promotion of renewable energy that consumes water might lead to CO2 reduction but to an increase in water footprint. Similarly, the amount of available water might limit renewable energy aspects of the climate strategy a location can pursue;
- At the same time, policies and practices related to the WEF sectors – such as those included in climate-smart agriculture, and smarter energy solutions resulting from digitization, are part of the solutions to climate change mitigation and adaptation;
- Finally, in large parts of rural developing economies (South Asia and Sub-Saharan Africa) the switch in cooking energy from solid biomass (wood, agricultural residue, animal dung) to clean fuels is a part of the solution to reduce carbon emissions, increase carbon retention in trees and also increase the organic content of soils.

The WEF Nexus approach can therefore help in aligning the implementation of the 2030 Agenda and the Paris Agreement.

The inclusion of gender concerns in the WEF Nexus nexus shows us how demand on women's work and time in agriculture, enterprises, and household facilitates access to water and energy, and in turn women's increased access to water and energy leads to their participation in production of food and manifestation of their agency. Such an analysis of the

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roles and contributions of women and men to the water, energy and food sectors helps in understanding the complex interrelationship between women food producers, with their large scale role in agriculture and collection of water and fuel, yet at the same time their exclusion from access to ownership and control rights to critical factors of production (Kelkar et al, 2017), and the need for gender sensitivity in the design and management of WEF action, in particular in development transitions.

Status of Implementation of the WEF-Nexus Approach

Due to its importance in achieving both the SDGs and the Paris Agreement, the WEF Nexus approach has recently received increasing attention in international initiatives (e.g. SE4All, World Economic Forum) as well as support from the research/academic sector (e.g. IFPRI, DIE, SEI), governments (e.g. German Development Cooperation), the private sector (e.g. WBCSD, AB InBev, Royal Dutch Shell, Coca Cola), and international development partners (e.g. WWF, REEEP, IUCN, OFID, IRENA, UNESCWA, FAO, EC, UNECE).

- Food producers (i.e. farmers and/or agrifood companies) are used to manage their production according to the availability of water and energy. However, the increased risks of resource scarcity, associated with the realities of climate change, require 'to change gear' in addressing these challenges. Indeed, the use of the WEF Nexus approach can increasingly be found at project level, often with support from international development partners and the private sector;
- Inadequate attention is paid to reducing gender imbalances in household decision related to WEF matters (e.g. agricultural practices, water use, cooking fuel) (Nathan et al, 2018, forthcoming).
- To date, there are very few examples of its mainstreaming in national policies, programmes and institutions - exceptions being for instance Austria, Germany, Mauritius and Qatar. This is explained by some of the governance challenges which are discussed in turn.

Challenges and Opportunities

While the trends that give impetus to adopting a WEF Nexus approach are global in nature, the implications and challenges vary according to different contexts (OFID, 2017):

- For low-income countries, the highest priority is to close simultaneously the large energy, water and food security gaps. Access to technologies, knowledge, and finance are key for setting up viable business models and develop integrated nexus solutions - particularly in agriculture — and can help accelerate progress toward sustainable development and poverty reduction;
- Emerging economies have witnessed rapid growth. This also means increased consumption of goods and services

per capita, including regarding the WEF sectors. A focus on resource use efficiency and good governance will ensure adequate, inclusive and sustainable supply of water, energy and food under these circumstances;

- Industrialized countries have higher per capita resource demands and large external resource footprints that put pressure on resources. In this case, the challenge is to substantially reduce their footprint while ensuring adequate economic growth.

Given the nature of the WEF Nexus, i.e. cross sectoral and focused on key resources for people's livelihoods, ensuring policy coherence and good governance are crucial for its sound and fair implementation. Until very recently, implementation focused primarily on technical solutions; whereas governance have not received much consideration, particularly in the context of the institutions and politics governing the WEF sectors. Recent research in that respect points out the following realities and challenges in WEF Nexus decision making:

- Limited information undermines evidence-based decision-making. This is due to the frequent lack of reliable and up-to-date on the status of the WEF sectors at local level but also often at national level, in particular in developing countries;
- Insufficient awareness of the benefits of using the WEF Nexus approach by relevant sector players;
- Inadequate account of externalities due to low or no pricing of water and energy use, in particular in developing countries;
- Lack of motivation to coordinate by relevant sectorial bodies, because the transaction costs of coordination are perceived higher than the benefits. Therefore, besides awareness of the benefits, incentives to collaborate are also needed. Fragmentation is sometimes compounded by international and bilateral development support; and different priorities of the sectors (line ministries) often hinder collaboration with other sectors and long-term planning. Ministries/institutions with an overarching mandate (Bridging Institutions) like transboundary river commissions or planning ministries/environmental ministries are sometimes in a better position to take up/promote the WEF Nexus approach;
- Many companies offering WEF Nexus solutions to the medium and small players in the agro-food value chains are mostly innovative and early-phase enterprises with one distinct and common problem: access to adequate finance, mostly experienced due to market imperfections on the supply side of funds. In order to attract investment and enlarge their business or 'build scale', these entities need de-risking mechanisms and enablers of access to further significant finance; and
- WEF Nexus decisions are more based on political than technical factors (Scott, 2017; Weitz et al, 2017). This is because the current reality of combined increased resource

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demand and resource scarcity as well as climate change impacts, means that decisions on the production and use of WEF resources entail tradeoffs- hence winners and losers. For these reasons, aspects related to stakeholder differences in knowledge/information and, ultimately, power, often prevail in WEF nexus decision making. Therefore, one has to go beyond tradeoffs and synergies of WEF nexus issues, and better understand the nature of stakeholder interaction in dealing with these issues.

The management of international transboundary river basins present specific challenges. These concern diversity of scales and perspectives, importance of state actors and importance of politics. Applying the WEF Nexus approach can help to address such challenges through new resources and a more integrated and inclusive approach that can alter existing actor dynamics and portray a richer picture of their relationships (Keskinen et al, 2016).

At the same time, interesting opportunities exist that address the challenges related to the WEF-Nexus:

- There are several ways to reduce the energy footprint in the water sector. This would concern in particular improved energy efficiency e.g. in irrigation, and energy neutrality (e.g. in waste water treatment; which can also produce energy). One can add the potential for the energy sector to provide the agricultural sector its produced water after treatment such as is being seen by some oil/gas companies in the US;
- Farmers and private sector companies are usually interested in water and/or energy saving practices that do not only reduce their operational expenses, but also contribute to de-risking their operations where these resources are or might become more scarce (REEEP, 2014);
- Several efforts are also being taken to integrated water in energy planning (IRENA, 2017). The World Bank's Thirsty energy work in South Africa is an example of this World Bank, 2017).
- Some financial support mechanisms to WEF small and medium enterprises – such as the OFID-REEEP WEF Nexus Revolving Capital Pool (OFID, 2016), are emerging;
- Carbon and water footprints are useful tools for measuring and monitoring but also valuable assets in marketing products (UNESCO, 2012);
- The use of renewable energy can, depending on the technology used and local conditions, have significant positive effects on both optimizing water use while ensuring enough food production. However, this can also face several constraints, as shown by the cost-benefit analysis (both monetized and non-monetized) of introducing renewable energy in selected food value chains recently undertaken by FAO (FAO 2017 a and b). In particular, non-monetized costs of women's labour, whether in cultivation or cooking, are ignored in cost-benefit calculations, leading to an overuse of both

women's labour and the biomass extracted with it (Nathan et al, 2018, forthcoming);

- WEF Nexus-related investments contribute substantially to achieving all SDGs, and these investments are promoted in the agendas of both national governments and development finance institutions. For example, OFID's Corporate Plan 2016-2025 expresses the institution's readiness to mobilize resources to tackle energy, water and food security in an integrated way (OFID, 2017). Indeed, over the coming decade, OFID will commit 70 percent of its funding to the WEF sectors, plus transportation as an enabling component;
- Inclusive governance in the WEF sectors can contribute to address power imbalances between different actors as well as levels of government. This includes stakeholder dialogue on the WEF Nexus at different levels. In that respect, recent interesting experience at regional level concern the EU/BMZ-funded WEF Nexus Regional Dialogue Programme, as well as ESCWA's Water-Energy Nexus (ESCWA 2016) and Water-Food Nexus Project Nexus Projects in the Arab Region, and the 'Integrating Approach' used in Colombia provides a good example at national level; and
- Gender considerations are beginning to be systematically included in the WEF Nexus work of some organisations – e.g. CSIRO (CSIRO, 2017).

Recommendations on scaling up the use of the WEF Nexus Approach

Whilst several projects follow the WEF Nexus approach, key factors to go beyond anecdotal evidence and scale up successful WEF nexus experience would require a major paradigm shift in the fragmented way programmes are currently usually implemented in the WEF sectors. This will not be easy and will not happen overnight. From a pragmatic point of view, this means that developing a stepwise process through practical approaches might be better than striving for the 'ideal' (Scott, 2015).

The following recommendations in that direction are proposed:

- a. As regards *political/institutional aspects*:
 - Take into consideration the political economy of solutions put forward: Make the analysis of political systems, stakeholders and power relations an integral part of all suggestions/solutions for WEF-nexus issues. Solutions should be formulated that promote policy coherence as well as an enabling environment (access to information, rule of law etc.);
 - Build effective, accountable and inclusive institutions at all levels: Integrate the building and/or strengthening of institutions into policy-making for and implementation of WEF-nexus approaches. Effective, accountable and inclusive institutions as well as rule-based regulatory/legal environments are crucial in promoting a

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- participatory and citizen-oriented implementation of actions related to the WEF sectors;
- Strengthen local NGOs, given their close links with local populations - hence their key role in raising awareness and facilitating implementation of development actions (UN ESCWA, 2013);
 - Prioritise capacity strengthening of decentralized government institutions Indeed, it is decision-making at the local level that will largely determine how trade-offs and synergies in the WEF nexus are implemented; when promoting the WEF Nexus approach with governmental institutions. Emphasize the efficiency gains and the conflict prevention potential of the Nexus approach, despite higher upfront/capex costs of inter-sectoral coordination and planning. Enable broad stakeholder-involvement, not only at governmental level, but also for citizens, in order to allow for bottom-up solutions, knowledge sharing and conflict mitigation;
 - Support both horizontal and vertical coordination: While important, in practice both types of coordination will often be met with resistance. Progress regarding the above-mentioned interventions, in particular those related to stakeholder processes and capacity building, have proven to strengthen such coordination in an unforced, somewhat 'organic' way.
- b. As regards *knowledge management*:
- Document and advertise successful WEF Nexus management cases because these help raise interest and provide the arguments for scaling up Nexus;
 - Improve the knowledge basis regarding WEF Nexus current and future status. IRENA (2015) has reviewed the most common WEF Nexus tools. Whilst most of them concern scenarios based on modeling, FAO proposes two tools that are based on existing situations: the nexus assessment methodology (FAO 2014), and the cost-benefit analysis of clean energy technologies in agrifood chains (FAO, 2017 a and b);
 - Fill knowledge gaps, and collect and make available data, including on water and energy use and needs at all stages of agrifood chains, environmental impacts on the use of water, energy and land in food production besides GHG emissions as well as social impacts (employment, gender, etc), and link these gaps to gender considerations;
 - Support interregional/international exchange of experiences on the use the Nexus Approach in planning and policymaking. Provide case studies/good practices; which can be transferred to other national/regional contexts. Knowledge platforms such as [the Germany/EU-funded Nexus Resource Platform](#) and the [energypedia/Powering Agriculture portal](#) are good examples about sharing nexus experience and information.
- c. As regards *appropriate technologies and good practices*:
- Promote well-proven technologies in the WEF sectors. Social acceptance, risks, work load and opportunity costs have to be sufficiently taken into account when promoting these technologies;
 - Where possible, co-locate water and energy infrastructure, allowing the waste stream of one to be utilized by the other (or by the agricultural sector), allowing for a reduction in by-products, minimization of transportation costs and lower energy and water requirements.
 - Strengthen capacities of WEF resource users: Making WEF sector stakeholders aware of the risks associated with inappropriate use of water and energy, and then enable them to employ efficient clean energy as well as energy and water use efficient technologies and practices. The capacity of direct resource users to assess options, take informed decisions on investment, handle technologies and access finance, is key for scaling up the Nexus approach. Awareness and Information of consumers on sustainable energy use is also important in order to create a demand to buy these products. Concrete examples of capacity development include the [GIZ/FAO Toolbox on Solar Powered Irrigation Systems](#) to strengthen skills in Nexus technology, and the The OFID-REEEP WEF Nexus Revolving Capital Pool regarding financial support mechanisms (OFID, 2016);
- d. As regards *stakeholder processes*:
- Foster stakeholder dialogue at different levels (e.g. especially private- public- sector engagement): An interesting experience at regional level concerns [the EU/BMZ-funded WEF Nexus Regional Dialogue Programme](#), and the '[Integrating Approach](#)' used in [Colombia](#) to implement SDGs provides a good example of fruitful and inclusive dialogue at national level; and
 - Strengthen participatory approaches and address power differences, including about gender, as these are often crucial in achieving sustainable and equitable implementation of actions related to the WEF sectors. The WEF Nexus approach adds to the typical stakeholder processes an element of equality between sectors, which helps in addressing power differences. IIED has developed one of the few compilation on Power tools, which are also relevant to WEF Nexus implementation (IIED 2001).

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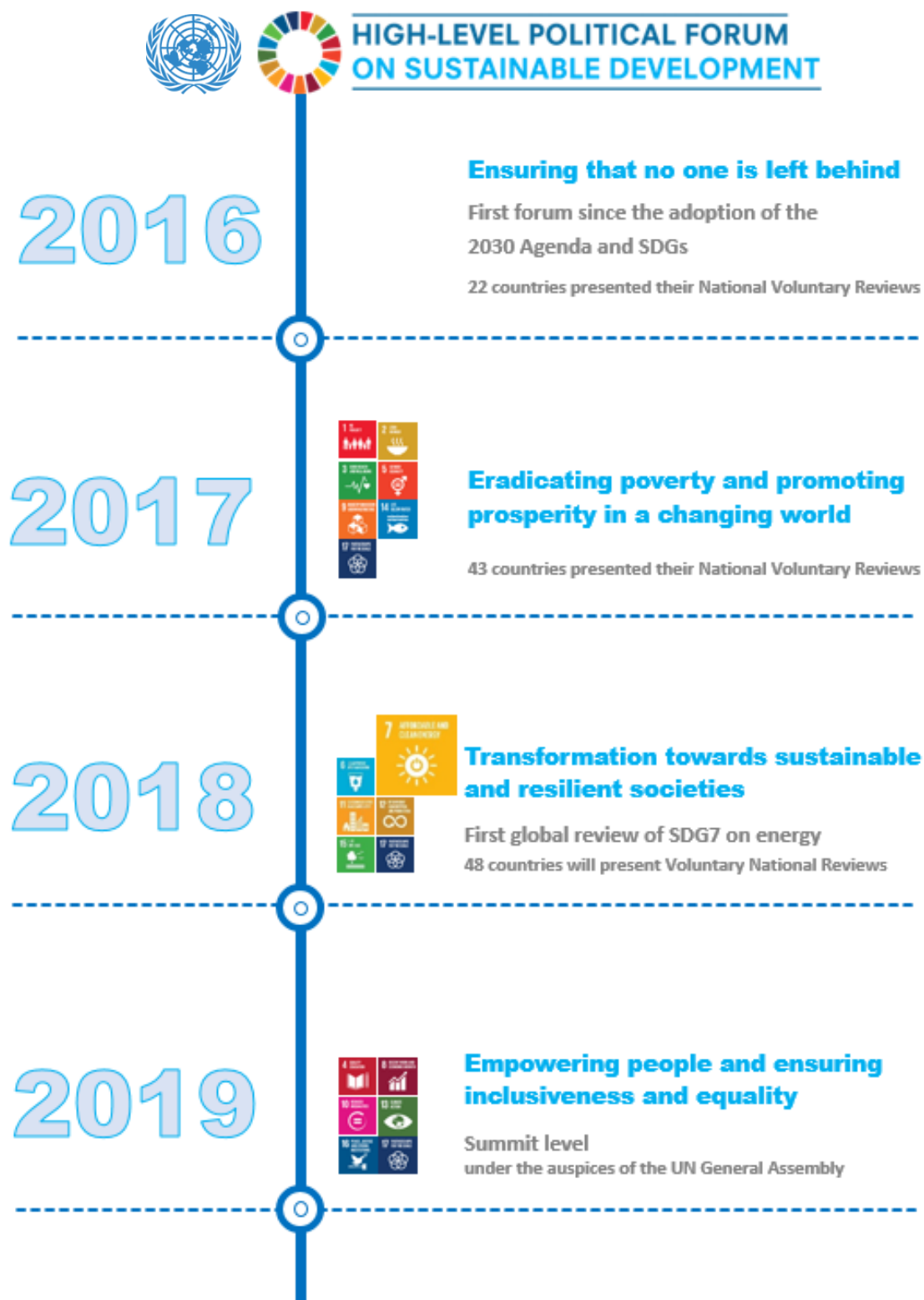
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