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Trade-offs and opportunities with water resources and the environment

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Executive Summary

Renewable energy will increasingly drive the transformation of the energy sector and spread across the territory. What will be their impact? What will be their broad benefits? Global energy demand is foreseen to almost double until 2050, , and in the meantime the energy sector will undergo major, structural transformations, like decarbonization, electrification, and decentralization of production. Electrical power produced from renewable energy has a crucial role to play in this transition, also thanks to declining cost of technologies– notably, solar photovoltaic and wind – that are making renewable projects more viable, often competitive with conventional alternatives. Despite variations across countries and fluctuations over time, renewable energy markets are expanding, and policy makers are called to facilitate investments through appropriate instruments and regulations. At the same time, they face the complex challenge of maximizing the impact of renewable energy as a catalyst for development while ensuring that their deployment is sustainable.

Renewable energy can drive sustainable development in the agricultural and water sectors, provided that synergies and trade-offs in the Water-Food-Energy-Ecosystem Nexus are appropriately addressed. The 17 Sustainable Development Goals (SDGs) adopted in 2015 by the United Nations member States span across the economic, social and environmental dimensions of sustainability. In the SDG framework, progress towards each one of the goals is intertwined with the others in a complex network, through linkages that are positive (synergies, reinforcing each other's progress) or negative (trade-offs, hampering each other's progress). Renewable energy technologies can be used to improve access to water and to increase food production, but their deployment can also compete with other needs, bring unintended cross-sectoral impacts, including on biodiversity and ecosystems. These considerations highlight the crucial importance of considering intersectoral impacts and sustainability priorities as early as possible in the renewable energy planning process, and to consistently address them through well-integrated, sustainable renewable energy projects.

This approach requires the effective implementation of a multi-stakeholder, cross-sectoral dialogue along three parallel "tracks": strategic planning, policy design, and project development. This report suggests a non-comprehensive "tool-kit" for policy makers to identify, evaluate, and act upon the synergies and trade-offs brought by the deployment of renewable energy. Their aim is to upscale renewable energy while at the same time facilitate (or at least safeguard), progress in the other sectors, with a special focus on water, agriculture, and environment. Crucially, this must happen at all levels of decision making: strategic planning, policy development, and project development. The tool-kit includes step-by-step guidance to operationalize the identification of key cross-sectoral linkages and sustainability issues at these three levels and proposes tools and methods to address them in practice. Therefore, the tool-kit is designed to support a multi-stakeholder, cross-sectoral dialogue process that helps policy makers uncovering the commonly context-specific synergies and trade-offs.

Transboundary cooperation and coordination are necessary to exploit regional synergies and to ensure sustainability of renewable energy deployment. There are significant advantages to cooperate on renewable energy across national borders, notably the opportunity of exploiting resource complementarities and pursuing common objectives and interests. Furthermore, because of the transboundary impact that can come with renewable energy projects, effective coordination is crucial to prevent tensions and to appropriately coordinate at the level of basin planning. Regional cooperation platforms like international river basin organizations can play a major role in facilitating this dialogue.

The multi-stakeholder dialogue should involve policy-makers from relevant sectors as well as key actors from civil society, industry, and investment groups. While energy policy-makers can be regarded as the primary owners of the process of sustainable renewable energy planning, the approach proposed in this publication emphasizes the importance of coherent planning across sectors and calls for all concerned policy makers to act in synergy. Areas where policy needs to be coherent with renewable energy are: water, agro-forestry, environment, as well as cross-sectoral areas such as climate change, health, employment, tourism, and rural development. This multi-stakeholder dialogue must also include civil society organizations, renewable energy industry representatives, and bankers and financiers. This heterogeneity aims at giving the many aspects of renewable energy due consideration: from public interest, ownership, and awareness, to technical feasibility, bankability, and eligibility for developmental or impact financing.

Strategic planning of renewable energy must go beyond the assessment of the different technologies' potentials and must consider other sectors' priorities. The sustainability of renewable energy deployment starts from resource assessment, spatial planning, and target-setting. These should account for geographic, technological, as well as cross-sectoral aspects and "nexus priorities" in the strategic planning process. To this end, the report suggests the mapping of three types of scenarios resulting from intersectoral linkages: "*win-win*" situations - where renewable energy potential is high and synergies with other sectors are also high - "*lose-lose*" - where renewable energy potential is low and negative impacts are high - and mixed situations - where there are intersectoral tradeoffs to be well-understood and addressed.

Renewable energy policies can be vetted to effectively tackle intersectoral synergies and trade-offs, as proposed through the Sustainability Assessment Matrix. To ensure sustainability, policy makers need to make sure that intersectoral linkages are adequately reflected into renewable energy policy, as well as into water, agriculture, and environment related policies. Synergies should be supported and encouraged, and trade-offs should be systematically assessed, transparently discussed, mitigated and, as appropriate, compensated. The report proposes a step-by-step process to map cross-sectoral policy interlinkages, identify potential gaps and barriers, and clarify what needs to be done to address them. This can be used for evaluating existing renewable energy policies as well as for designing new ones.

Policy makers should actively engage private actors and ensure that they are committed to develop sustainable projects. The priorities of private actors involved in project development (project owners, developers, equipment manufacturers, Engineering, Procurement and Construction (EPC) contractors but also bankers and financiers) should be aligned with those of policy makers. To help achieve this alignment, policy makers should create an enabling environment that facilitates compliance with the relevant standards, including through incentives. They should also ensure that energy projects have value beyond energy generation and that they are in line with the government's social, economic and environmental priorities, and the States´ rules and regulations.

1. Introduction - Integrating sustainability into renewable energy investment and deployment through a “nexus” approach

1.1 Sustainable Development Goals and the water–food–energy-ecosystems nexus

In order to achieve economic, social and environmental sustainability and to improve quality of life, the United Nations Member States adopted in 2015 the document “Transforming Our World: The 2030 Agenda for Sustainable Development”. The Agenda proposes 17 Sustainable Development Goals (SDGs) as stimulants for action in areas of critical importance. The SDGs cover a broad spectrum of human activities and establish clear objectives to achieve a sustainable future for world population in each activity.

Itis widely acknowledged that the SDGs and, specifically the ones that refer to food security (SDG-2), water and sanitation (SDG-6) and clean energy (SDG-7), are closely interlinked. Simply, they all rely to a significant extent on the exploitation of common, finite, and increasingly degraded water and land resources.Hence, policy and measures put in place to meet the targets established under each one of these goals may compromise the achievement of the targets under the other two. The inseparable links between these three SDGs form a “nexus” between energy, water, and food[1].Other SGDs are also deeply affected by the increasing exploitation natural resources, for instance the ones calling for climate action (SDG-13) and for the protection of life on land (SDG-15). It should be noted that, due to our dependence on ecosystem services for resource provisioning, the well-being of ecosystems is simply a prerequisite for a truly sustainable development of “nexus sectors”[2].

SDG-7 focuses on ensuring access to affordable, reliable, sustainable and modern energy for all. Energy demand is expected to increase by 80 percent until 2050 due expanding global population as well as social, economic, and technological developments[3]. In the same period, as the world’s population will hit 10 billion food demand will grow by some 50% (compared to 2013, in a scenario of modest economic growth[4]) and global water demand will rise by 55%, reaching 5.500 km^3 (from about 3.500 km^3 in 2000) with manufacturing (+400%), electricity production (+140%) and domestic use (+130%), increasingly in competition with the largest water consumer: irrigation[5].

As these demands drive nexus sectors to higher productions, intersectoral competition for available resources (see Figure 1) will simply increase due to the natural constraints of natural resources availability and the degradation of common resources. This competitive approach could result in unmet demands, and increasing struggle towards the achievement of clean energy, safe water and sanitation, and food security for all, with serious consequences on health and justice. Considering that

[1] Fader et al (2018), “Toward an Understanding of Synergies and Trade-Offs Between Water, Energy, and Food SDG Targets”, Front. Environ. Sci. Vol. 6 art. 112

[2] In this report “nexus sectors” refers to those that play a role in the management of energy, water, agriculture, and forestryresourcesforestry resources, as well as environment protection.

[3] International Renewable Energy Agency IRENA (2015), “Renewable Energy in the Water, Energy & Food Nexus” (https://www.irena.org/publications/2015/Jan/Renewable-Energy-in-the-Water-Energy--Food-Nexus)

[4] Food and Agriculture Organization (FAO) (2017), “The future of food and agriculture, Trends and challenges” (http://www.fao.org/publications/fofa/en/)

[5] OECD (2012), “Environmental Outlook to 2050, The Consequences of Inaction”. (https://www.oecd.org/g20/topics/energy-environment-green-growth/oecdenvironmentaloutlookto2050theconsequencesofinaction.htm)

there is no set hierarchy or primacy between SDGs, achieving any one of the three Sustainable Development Goals at the expense of the others simply results in a net social loss.

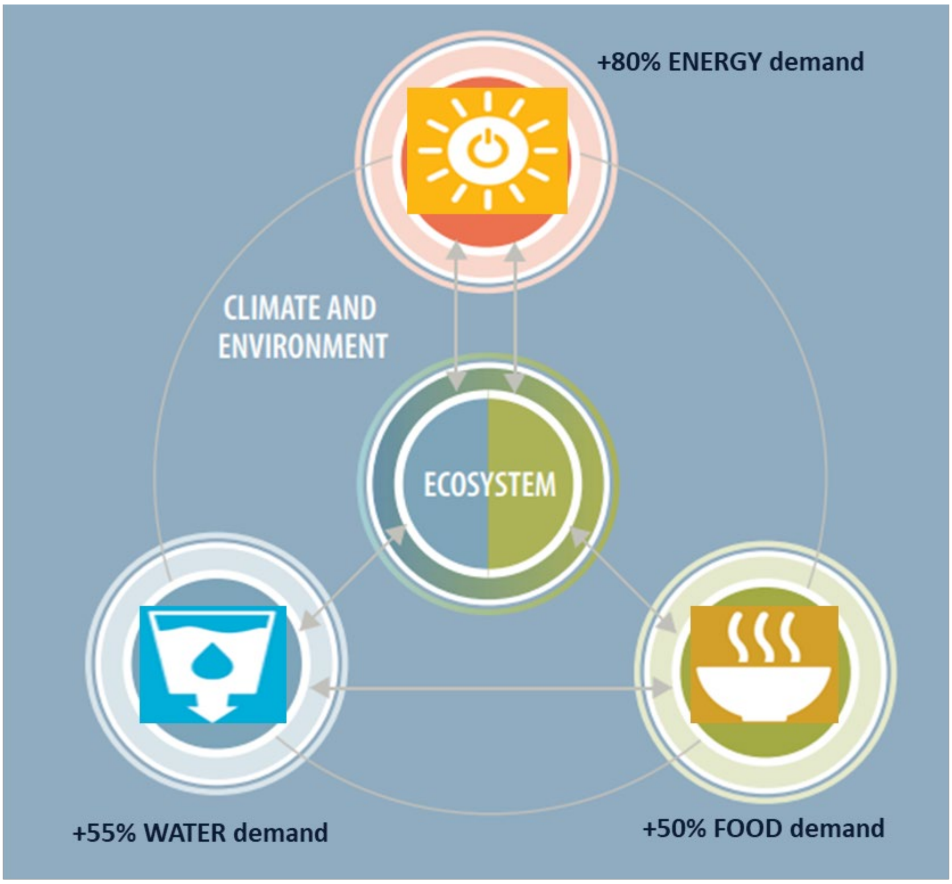

Figure 1: Increasing demand of resources by 2050 projected in some major global studies (section 1.1) and the water-energy-food-ecosystem nexus

1.2 Renewable energy and the nexus

The energy sector is undergoing a profound transformation. The decarbonization of the energy sector has become a primary concern for Governments who are called to address the effects of climate change across society and the economy. The electrification of sectors traditionally dominated by fossil fuel-based energy (such as the transport sector) is expected to dramatically increase demand for clean electricity. Decentralization is also affecting the historical patterns of energy production and consumption, especially regarding electricity, with a discernible trend toward smaller power generation units located closer to demand and self-generation, both for residential and for industrial usage. This is foreseen to induce significant and structural changes in the energy and nexus sectors[6].

Beyond the well-established benefits from decarbonization, electrification, and decentralization, it is the constantly decreasing cost of technology that makes renewable energy more and more

[6] International Energy Agency (IEA) (2019), "Renewables 2019, Analysis and forecast to 2024 - Executive Summary", p. 4. (https://www.iea.org/renewables2019/).

economically viable, and increasingly competitive with fossil fuel options[7].Hence renewable energy will play an increasingly central role in the energy systems of the future, as one of the most practical solutions to tackle climate change.

In the last five years, new investments in power generation capacity from renewable energy have consistently surpassed those in fossil fuel-based generation. Still, the current level of investments is lower than what would be required to limit global temperature rise, and a significant reallocation of investment capital towards renewable energy is needed in order to meet the sustainable development goals as a whole[8,9,10]. This is confirmed by the projections of the International Energy Agency's (IEA): to reach sustainability goals (Sustainable Development Scenario), power generation from wind and solar photovoltaic sources must jump from the 1,5 thousand TWh globally produced in 2017, to over 14 TWh by 2040[11].

Due to the interlinkages between the three nexus sectors, the required increase in renewable energy investment will potentially have a positive impact on the other nexus sectors using the water, food, and environmental resources but the problem is that, as of today, most renewable energy policies and projects are not explicitly designed to exploit them. Furthermore, just like more conventional energy technologies, renewables also use natural resources (water and land) and as such their deployment can enter in competition and affect progress in another nexus sector[12]. Resource constraints that exist between renewables on one hand and agricultural production and water on the other can result in painful trade-offs.

Therefore, increasing the environmental, social, and economic sustainability passes through the systematic exploitation of synergies and reduction of trade-offs across the deeply interconnected nexus sectors. The processes of planning and deploying renewable energy should be designed to account for all these cross-sectoral impacts, setting a higher ambition of multiplying the benefits of renewable energy across sectors, as well avoiding unnecessary competition for resources that could slow down the development in each sector. As nexus sectors depend on the same natural resources and ecosystems, prioritizing the sustainable utilization of resources to preserve them more effectively becomes a common interest of investors and policy makers across all sectors.

It is worth underlining the economic argument behind the idea of "doing more with less" that is intrinsic in the Agenda 2030 and in the nexus approach. Energy demand growth will need new energy investments. Renewable energy sources will continuously become more widespread since they are the overall preferable way to meet that demand while also achieving the goal to limit global warming

[7] IRENA (2019), "Renewable Power Generation Costs in 2018". (https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Renewable-Power-Generations-Costs-in-2018.pdf); IRENA (2016), "The Power to Change: Solar and Wind Cost Reduction Potential to 2025". (https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA_Power_to_Change_2016.pdf)

[8] Renewable Energy Policy Network for the 21st Century (REN21) (2019), "Global Status Report 2019", Chapter 1 Figure 3. (https://www.ren21.net/gsr-2019/).

[9] For 2019, net new generating capacity by renewable energy sources is estimated to increase by 12% compared to the previous year, exhibiting the largest growth comparable with the record-setting year 2015

[10] IEA (2019), "World Energy Investment 2019". (https://webstore.iea.org/world-energy-investment-2019).

[11] IEA (2018), "World Energy Outlook 2018". (https://www.iea.org/weo2018/).

[12] This report only focuses on water and land resources and does not discuss the broader impact of renewable energy deployment on global resources and throughout the life cycle of equipment (mining, manufacturing, decommissioning, etc.).

to below 1.5°C relative to pre-industrial levels. Financing is commonly also sectoral and hence investors in all sectors need to cooperate more closely to contribute to actually achieving simultaneously a multiplicity of goals. The case of renewable energy deployment is particularly evident, given the massive effort that will require financing new investments.

1.3 Integrating sustainability across sectors and across countries

The sustainability of renewable energy must be appropriately integrated throughout the planning and deployment processes to ensure that proliferation of renewables does not impede progress in neighboring sectors and countries. This should lead to renewable energy strategies, policies and projects that are sustainable and compatible with other sectoral plans, and that multiply the social, environmental, and also economic benefits of renewable energy deployment.

Several processes and methods from international best practices attempt to introduce sustainability concerns in the decision-making processes, either directly or indirectly. For example, the need for assessment of environmental and social impacts of new renewable projects is well understood and many countries have introduced requirements for project developers. Similarly, the consultation of multiple stakeholders (including from other sectors) before the adoption of new policy measures – or the associated laws – has become an accepted principle of good governance and transparent decision-making related to renewable energy projects.

However, in practice the introduction of sustainability variables throughout the process is not integrated enough to guarantee that sustainability and cross-sectoral concerns will be systematically considered. The need for a more comprehensive approach is evident. The renewable energy decision-making process should integrate the assessment of nexus considerations at every relevant step, and this integration needs to be organic (decision-makers need to internalize the assessment of cross-sectoral and environmental concerns and not view it as something foreign, irrelevant or hostile to the progress of their sector), and systemic (it should form a system of continuous planning, monitoring and evaluation of impacts, and it should permeate all processes that lead to decisions) (Figure 2).

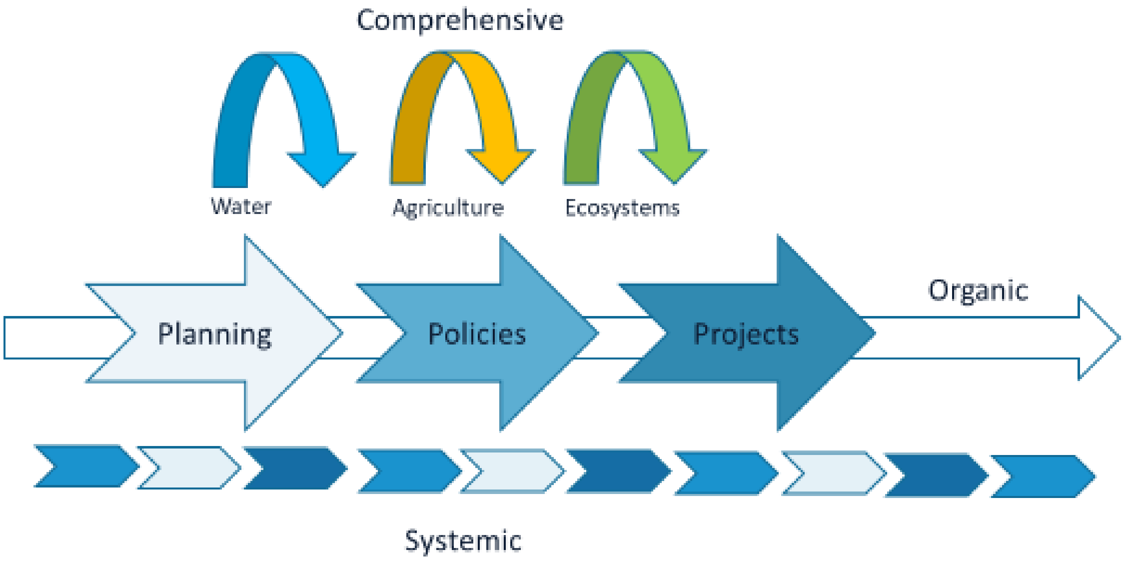

Figure 2: Addressing Sustainability of Renewable Energy in a comprehensive, organic, and systemic manner

Notably, the need for a more holistic impact assessment becomes urgent in the case of renewable energy deployment initiatives that carry an impact across national boundaries, for example through water resources. Considering that 60% of global water resources are internationally shared, managing transboundary impact is a necessity for many countries and settings. Large hydropower development and reservoir operations are among the most common causes of transboundary tensions, as they directly affect water availability and flow management. However, as renewable energy investment proliferates(beyond hydropower) other and unexpected issues start to arise. This is the case of small hydropower that can have a significant cumulative impact on the environment, biomass consumption that starts driving forest degradation and increasing flood risk[13], the cultivation of thirsty bioenergy crops that add on water demand, and even the deployment of large solar and wind farms, which could bring significant changes to land use.

The exploitation of shared resources for renewable energy deployment can create regional tensions in many ways, making helpful such dedicated regional and transboundary dialogues. In fact, more collaboration among countries would help not only mitigating trade-offs, but also better exploiting transboundary synergies and complementarities, acting upon shared interests, and broaden regional cooperation.

[13]This can have an impact on water through the "forest-water nexus".", as described in FAO (2019), "Advancing the Forest and Water Nexus" (http://www.fao.org/3/ca6483en/CA6483EN.pdf).

2. A tool-kit to manage cross-sectoral and transboundary impact

2.1 The need for practical tool-kit to policy-makers

The need to consider nexus sectors in renewable energy planning was first pointed out in a 2015 report by the International Renewable Energy Agency(IRENA) titled "Renewable Energy in the Water, Energy and Food Nexus"[14].The report explored various synergies and trade-offs between renewable energy, water, and food production, calling for the development of a practical assessment tool to identify, quantify and assess the impact of energy policy choices in the energy-water-food-ecosystems nexus and conceptualizing the introduction of sustainability concerns into renewable energy deployment. In the same year, the United Nations Economic Commission for Europe (UNECE) published the methodology for assessing nexus issues in transboundary basins[15] and the first applications presented then already demonstrated the important role of renewable energy.

In 2017, the UNECE published a brochure[16]to explore good practices and policies for intersectoral synergies and sustainability of renewable energy deployment. The report provides examples of synergies between renewable energy and the energy-water-food-ecosystems nexus and proposes tools to identify, explore and exploit those synergies. In this way, the value of renewable energy would be maximized and positive impacts to the interlinked nexus sectors would be amplified. Going beyond a strictly national approach, the report also gives a transboundary dimension to the assessment of synergies between renewables and the nexus sectors. By advocating collaboration and coordination between riparian countries in renewable energy planning and deployment, it showcases that a variety of benefits can be found in regional cross-sectoral coordination and cooperation on renewable energy development and calls for the development of an "energy-specific nexus assessment tool" to assess renewable energy initiatives from a nexus perspective (Figure 3).

A similar call for stronger cooperation on sustainable renewable energy at the level of policy comes from the global environment community. In 2019, the World Wildlife Fund and The Nature Conservancy published the report "Connected and Flowing"[17], which illustrates the importance of protecting river ecosystems and the well-being of local communities by adopting a truly sustainable mix of renewable energy. The idea is to reduce the bias towards hydropower as the most convenient renewable energy technology and plan for renewables at the level of power-system (considering all technologies) and regional cooperation (valuing complementarity of resources). The report summarizes the challenge that policy-makers face with the development of a power system that is low-carbon, low-cost, and low-impact (in terms of negative social and environmental costs).

The next step is to operationalize a tool-kit for policy makers to produce strategic plans and sustainable policies and projects, through:

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[14] International Renewable Energy Agency IRENA (2015), "Renewable Energy in the Water, Energy & Food Nexus" (https://www.irena.org/publications/2015/Jan/Renewable-Energy-in-the-Water-Energy--Food-Nexus)

[15] UNECE (2015), "Reconciling resource uses in transboundary basins: assessment of the water-food-energy-ecosystems nexus", United Nations.

[16]UNECE (2017), "Deployment of renewable energy: The water-energy-food-ecosystems nexus approach to support the Sustainable Development Goals"

[17] Opperman, J., Hartmann, M. Lambrides et al. (2019), "Connected and flowing: a renewable future for rivers, climate and people", WWF and The Nature Conservancy, Washington, DC. (nature.org/content/dam/tnc/nature/en/documents/TNC_ConnectedFlowing_Report_WebSpreads.pdf)

- systematic identification of cross-sectoral synergies and tradeoffs
- definition of appropriate policy response to maximize or minimize them, respectively
- enhancement of transboundary coordination and cooperation

Because of this, the toolkit proposed in this report it mainly targets policy makers, placing a strong emphasis on the opportunities, not to be missed, of maximizing the positive impact of renewable energy development, across-sectors and across countries. The toolkit also helps to navigate the various trade-offs.

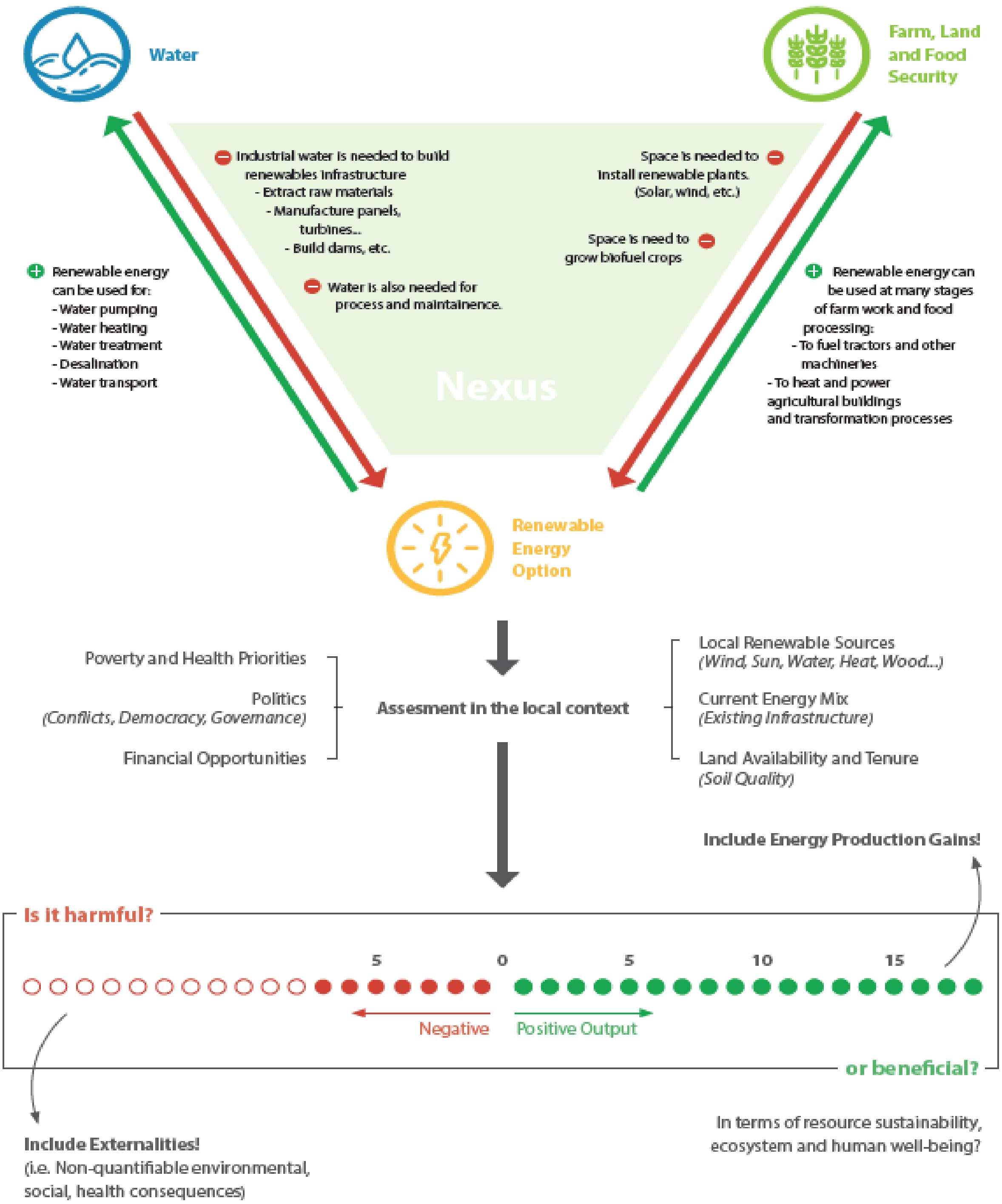

Figure 3: Proposed framework to develop an "energy-specific nexus assessment tool" for renewable energy development[18]

2.2 Synergies and Trade-offs between renewable energy and nexus sectors

Synergies exist where, due to the interrelations across various nexus components, the most beneficial option for one of the sectors also provides benefits in at least one other nexus sector. This creates a "win-win" scenario for the nexus sectors involved. In the case of renewable energy policy choices,

[18] UNECE (2017), "Deployment of renewable energy: The water-energy-food-ecosystems nexus approach to support the Sustainable Development Goals"".

once cross-sectoral synergies between renewable energy and the agricultural production or the water sectors are identified and exploited, the net social benefit of renewable energy is compounded and distributed across other sectors, making an already attractive proposition (i.e. renewables as a clean energy source) an even higher policy priority.

Trade-offs exist where the positive outcomes in one sector brings negative outcomes in another. It is often the case that the impact of renewable energy is preferable to a non-renewable alternative. In fact, assuming a certain increase in energy demand that must be met by increasing energy generation (though this may not be the case: see Box 1), renewable energy will often come out ahead, since its environmental footprint is typically lower than that of conventional options, such as coal-fired plants. However, there can also be trade-offs that call for careful consideration of alternatives, also in renewable energy planning. For instance, as pointed out in the IRENA 2015 Report[19], some renewable energy technologies (such as Wind and Solar PV) are much less water intensive than fossil fuel-based technologies (such as coal-fired electricity plants), but others (such as Concentrated Solar Power (CSP) or Bioenergy) have a substantial water footprint that is particularly important to consider where water is scarce. Trade-offs correspond to "win-lose" scenarios.

Policy makers should be able to navigate the impact of their possible choices across different sectors, to systematically identify "win-win" and "win-lose" scenarios and to decide how to act in both cases. Once the trade-offs are identified, the quantification of all effects, positive and negative, across the different nexus sectors can give policy-makers clear indications of the overall, cross-sectoral value of a given choice and set the basis for an informed discussion on trade-offs using the "avoid, mitigate, compensate" approach.

Box 1 – The "Energy Efficiency First" Principle

From a system perspective, the addition of new renewable energy capacity should also be compared with the impact of energy efficiency measures. The "Energy efficiency first" (EE1st) is a key principle of energy security and sustainability and it has been adopted and actively promoted, among others, mainly by the European Union.

On 30 November 2016, the European Commission presented the Clean Energy for all Europeans package of proposals (Clean Energy Package – CEP)[20], with the aim of bringing EU energy legislation into line with the new 2030 climate and energy targets and contributing to the 2015 Energy Union goals[21]. The CEP with amendments finally evolved into a set of Regulations and Directives which implement the strategic approach of the European Union on Energy, namely to lead the clean energy transition by adopting three main goals: putting energy efficiency first, achieving global leadership in renewable energies and providing a fair deal for consumers. The "energy efficiency

[19] UNECE (2017), op. cit. fn.2, p. 13 fig. 4

[20] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, Clean Energy For All Europeans, COM/2016/0860 final.

[21] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy, COM/20150080 final.

first” principle, the main goal of the EU transition to clean energy, intended to ensure secure, sustainable, competitive and affordable energy supply in the EU.

“Energy efficiency first” applies to all policy-making and investment decisions and it ensures that energy saving solutions are not overlooked or undervalued, that benefits from energy efficiency are valued accurately and in the long-term and that policies which will prioritize investment in energy efficiency will be actively pursued. In the process of assessing policies that aim to increase investment in new renewable energy, policies to increase RE investments should be compared to a scenario where investment in energy efficiency could bring about the same energy sector policy goals as new investments in RE.

The “energy efficiency first” principle can also be considered through a nexus approach, where there are multiple benefits and/or cross-sectoral synergies from energy efficiency investments. This is the case of municipal water utilities, whose role in providing clean water will be increasingly crucial, and where a joint “water-energy efficiency” approach is needed to tackle the problems of water losses while at the same time reducing the costs of operations (typically, energy is the highest expenditure for water utilities) and wastewater treatment (through energy recovery from sludge valorization)[22].

In order to capitalize on synergies and address or mitigate trade-offs, the first step is to identify and understand them. Subsequently, appropriate methodologies must be applied to assess the benefit across the sectors, also to look beyond the evident synergies for possible hidden trade-offs in less obvious areas. In promoting cross-sectoral nexus synergies[23], research has shown[24] that, although positive interactions can be identified between almost all secondary targets under the respective SDGs of the nexus (SDGs 2, 6 and 7), no pair of targets under any of the three SDGs shows only synergies without also showing some trade-offs as well. It is therefore crucial to examine and assess interlinkages thoroughly before planning deployment of renewable energy, in order to understand how it will affect the nexus sectors as a system.

It is important to stress that the synergies and trade-offs between renewable energy and other nexus sectors needs is very often context-specific. A thorough analysis of the particularities of each renewable energy policy initiative and its possible interactions with other nexus sectors must precede any conclusion on where synergies and trade-offs can be found. Once synergies and tradeoffs are identified, policy makers can take more informed decisions on the specific measures and incentives that should be adopted to encourage the promotion of identified synergies or the mitigation of possible trade-offs. They can examine planned policies and adjust the ones already in place with a clearer understanding of the overall net social value those measures aim to create.

Furthermore, the multiple benefits provided by renewable energy, and the reduction of their negative impact on the environment and local communities, can make the difference when it comes to reducing the political risks of investments. The ability of policy makers to systematically exploit synergies and

[22] See IEA on Energy and Water https://www.iea.org/weo/water/

[23] A review and quantitative analysis of 37 projects related to the energy-water-food nexus can be found at: Endo et al. (2015), “A review of the current state of research on the water, energy, and food nexus”, Journal of Hydrology: Regional Studies 11 (2017) 20–30.

[24] Fader et al (2018), op. cit. fn.1, p. 6.

timely identify and mitigate trade-offs related to renewable energy can therefore increase social acceptance and interest from investors at the same time.

2.2.1 Renewables and Water

The relation of water and energy is well understood. In most energy production processes, water is a key input: Most thermal power plants require water for cooling, water produces energy via small and large hydropower plants, and it also an important factor in extraction of fossil fuels. Only wind and solar PV put close to insignificant pressure on water demand (with the exception of solar-powered irrigation, which can indirectly increase water withdrawals)[25]. On the other hand, energy is needed to sustain and improve water services, by making water more easily availably (pumping, conveying, distributing) and cleaner (treating wastewater, desalinizing brackish water)[26].

An important aspect of the linkages between water and renewable energy is the possibility to increase access to both energy and water by adopting a synergistic approach. Renewable energy-based desalination, pumping or water treatment technologies can provide low energy intensity solutions for increased access to water to cover different uses. The ability to deploy these renewable-based solutions in a distributed, stand-alone and small-scale manner can also make such solutions ideal for areas where access to energy (as well as water) is limited (for example, islands or remote farming locations). Other synergies are to be found in the maximization of benefits from existing infrastructure: "floating solar" PV on hydropower reservoirs increases the energy output of existing infrastructure with no added pressure on water or land, although it may result in increased variability locally.

2.2.2 Renewables and Agriculture (food), Forestry and Rural Development

Energy and food are intrinsically linked, since energy is required to grow, transport, process and store food. At the same time, agricultural products can be used as fuel for energy production. One of the key cross-sections between energy and agricultural production (food, feed, fibre) is land use. Intersectoral competition for land availability mainly revolves around land for biomass (energy crops) versus land for food production, but potential conflicts with solar PV siting and wind power also exists. Although land use is traditionally considered as a trade-off between the two sectors, some approaches treat it as a synergy (as in the case of "agrovoltaics" or "solar sharing", see Box 2)[27].

Overall, distributed and integrated renewable energy generation can make the agricultural sector "climate smart" by increasing access and energy availability for a variety of uses, improving resilience to extreme weather events, and reducing local pollution. In the case of rural development, renewable

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[25] World Bank (2013), "Thirsty Energy: Securing Energy in a Water-Constrained World", p. 3, (http://documents.worldbank.org/curated/en/835051468168842442/Thirsty-energy).

[26] WWAP (United Nations World Water Assessment Programme). 2014. The United Nations World Water Development Report 2014: Water and Energy. UNESCO, Paris.

[27] Jossi (2018), "Putting the 'farm' back in solar farms: study to test ag potential at PV sites", EnergyNews, (https://energynews.us/2018/01/22/midwest/putting-the-farm-back-in-solar-farms-study-to-test-crop-potential-at-pv-sites/).

energy can be a driver for increasing social welfare of remote and rural communities and creating new jobs in the new, low-carbon economy[28]..

Renewable energy from waste can also be mentioned in this category because of the very high potential, most often unexploited, of producing bioenergy from agricultural waste[29] and even from food waste that is generated by restaurants, supermarkets, and households. One of the main barriers to the development of this type of renewable energy is the absence of established value chains, so this is one of the areas where cross-sectoral cooperation could result into multiple benefits (waste reduction, renewable energy production, job creation).

A similar consideration can be made for wood energy, which is commonly used for heating and cooking in many countries, and forest biomass in general which include byproducts from wood industry). Forests play an important role in producing and regulating freshwater flows, and forested watersheds are essential for sustaining freshwater supply. The SDGs related to water (SDG 6) and land (SDG 15) explicitly acknowledge the linkages between forests and water[30]. Forests are also an important source of energy. Wood energy is humanity's first fuel and continues to be an important source of energy and the leading source of renewable energy. Wood energy accounts for about 45% of primary energy from renewable sources. In many developing countries, wood energy provides the majority of total energy supply and, surprisingly, in several developed countries, wood energy provides nearly 25% of total energy supply[31]. The provision of energy from forests can be a key factor in forest degradation but can also be the key to sustainable forest management if the appropriate value chains are set up and sustainability principles accounted for[32]. Overall, waste valorization has a major role to play in increasing the sustainability of bioenergy production and contributing to rural development (valuing waste can generate an important secondary income stream for farmers and wood producers).

Box 2: Wood energy: linking forestry and rural development

Looking at the UNECE region, one third of the surface of UNECE member States is covered by forests. This significant share of land cover implies that the management of forests has direct and indirect impacts on other land use in general and water management in particular.

Wood is also a major source for heating in countries in economic transition, where it is often harvested and traded in informal ways. Many users in these countries prefer green wood to lower the burning temperature (due to inefficient burning equipment) leading to severe degradation of indoor and outdoor air quality. The inefficient use causes higher wood consumption and uncoordinated removal of wood leads to high pressure on easily accessible areas of forests close to

[28] IRENA (2019), "Renewable Energy and Jobs – Annual Review 2019" (https://www.irena.org/publications/2019/Jun/Renewable-Energy-and-Jobs-Annual-Review-2019).

[29] See for instance http://www.fao.org/3/a-i8150e.pdf

[30] UNECE (2018), "Forests and Water - Valuation and payments for forest ecosystem services" (https://www.unece.org/fileadmin/DAM/timber/publications/sp-44-forests-water-web.pdf).

[31] UNECE (2017), "Wood Energy in the ECE Region - Data, trends and outlook in Europe, the Commonwealth of Independent States and North America" (https://www.unece.org/fileadmin/DAM/timber/publications/SP-42-Interactive.pdf).

[32] See for instance WWF (2012), "Living Forests Report: Chapter 4 - Forests and wood products" (http://d2ouvy59p0dg6k.cloudfront.net/downloads/living_forests_report_ch4_forest_products.pdf).

road infrastructure. The resulting degradation of the local forest resource has detrimental effects for water runoff and soil erosion that in turn increase sediment charges of rivers and dams.

Wood energy, even if derived from unrecorded removals and traded informally, is an important source of livelihood in rural areas. The overall contribution of wood energy to national economies is an often neglected and widely underestimated economic factor in countries in economic transition. A FAO study[33] in Serbia analysed in detail the contribution of wood fuels to climate change mitigation and the economy of Serbia and found:
- Current use of wood energy substitutes for imports of light heating oil to the value of EUR 1.3 billion or EUR 650 million in the case of substituting for natural gas (Serbian GDP in 2010: EUR 60 billion).
- Use of wood fuel avoided CO2 emissions of about 7 million tonnes from fossil fuels.

Countries in economic transition may consider assessing in detail the social, economic and environmental role of wood energy and consider embracing wood energy as one of the solutions in achieving SDG7. Wood energy projects at national level can contribute to (i) improving air quality, (ii) increasing income generation in rural areas, (iii) developing new industrial sectors (e.g. stove manufacture), (iv) reducing pressure on national forest resources and (v) reducing erosion and runoff from slopes, reducing sediment charges in rivers and improving filtration of drinking water.
The biggest comparative advantage of wood fuel is its local application for generating heat. Countries may consider using wood chips for switching fuels in larger public buildings such as hospitals, schools and administrative buildings in places with abundant resources. Wood chips are the fuel of choice for such medium and big scale heat applications. These wood chips do not necessarily need to come from forests but could also arise from infrastructure maintenance, such as roadside greening, electric power line vegetation control, park and garden management, etc.

2.2.3 Renewables and the Environment (ecosystems)

While non-renewable energy sources generally have a detrimental effect on ecosystems and the environment, the effect of renewable energy is overall less environmentally harmful, even considering that different technologies have various degrees of ecological footprint. Notably large-scale hydropower development has major impacts and cumulative effects of small-scale hydropower can also be significant. The positive environmental impact of distributed and integrated renewable energy in the context of housing (both in urban and rural contexts) is well documented: renewable technologies for water heating and electricity self-generation can help reducing indoor pollution and cut down significantly carbon footprint of households. Overall, these "green" residential solutions can attract an ecologically sensible tourism to remote areas of high environmental value.

The deployment of large-scale of renewable generation brings environmental benefits, in terms of green-house gas emission reduction, where it substitutes or reduces the need for production from more polluting and more carbon-emitting alternatives (as such giving a crucial contribution to facing

[33] FAO (2015), "WISDOM Serbia - Spatial wood fuels production and consumption analysis" (http://www.fao.org/3/a-i4394e.pdf).

the global environmental and climate crisis). Nevertheless, as with any other infrastructure development, these may bring a non-negligible environmental impact (as in the case of off-shore and on-shore wind power generation, and its impact on marine and land ecosystems), not only when building and operating it, but also when decommissioning it (end-of-life equipment)[34].

It is important to stress that renewable energy is not intrinsically biodiversity-friendly, and may bring disturbance when deployed in areas that impact wildlife and natural habitats,. It is of outmost importance then to support research into solutions that effectively integrate biodiversity into the design of renewable energy. Box 2 provides a very good example of how this research can lead to multi-benefit solutions (to agriculture and energy) and support biodiversity conservation at the same time.

Box 3: Pollinator-friendly solar: from science to policy

The interrelation between solar photovoltaic power and agriculture is traditionally understood as one of competition for a mutually needed resource: land use. The ability to site solar photovoltaic installations on agricultural land which could otherwise be used for farming or raising of livestock is one of the main arguments against this otherwise generally non-intrusive renewable technology. Turning this trade-off into a synergy, a number of initiatives turn solar power plants into pollinator habitats and bee boxes, to assist declining bee populations in the United States and elsewhere.

A team of researchers [35] from the Environmental Science division of the Argonne National Laboratory (United States) has been examining the potential benefits of establishing pollinator habitat at utility-scale solar energy (USSE) facilities to conserve biodiversity and restore ecosystems. The area around solar photovoltaic installations generally remains uncultivated. However, research has shown that these locations are perfect for planting native species, which are key habitats for pollinators such as honeybees and monarch butterflies, in hopes of encouraging steady population growth of pollinator species.

The research focused on three common crops (soybeans, almonds and cranberries) that are dependent on insect pollinators for their annual crop yields and quantitatively assesses the financial benefits from making solar farms near those crop types pollinator-friendly.

Drawing from this research, the State of Illinois has adopted a "Pollinator-Friendly Solar Energy Bill" in 2018[36], along with the States of Maryland and Minnesota, that encourages solar developers to create habitats for bees, monarch butterflies and other pollinators within their solar sites. This is a very good example of policy making using scientific research and industry practices to encourage and further enhance nexus-compatible initiatives and lead to concrete policy actions.

[34] Potential unintended environmental consequences of renewable energy development are evaluated in J. Kiesecker et al., "Hitting the Target but Missing the Mark: Unintended Environmental Consequences of the Paris Climate Agreement", Front. Environ. Sci., 09 October 2019 (https://www.frontiersin.org/articles/10.3389/fenvs.2019.00151/full).

[35] Walston et al. "Examining the Potential for Agricultural Benefits from Pollinator Habitat at Solar Facilities in the United States", Environ. Sci. Technol. 2018, 52, 7566−7576, 1.(https://pubs.acs.org/doi/10.1021/acs.est.8b00020)

[36] Environmental Law and Policy Center, Press Release: "Illinois Pollinator-Friendly Solar Energy Bill Passes, Adds Momentum to Solar Energy Development", May 30, 2018. (http://elpc.org/issues/clean-energy/solar/press-release-illinois-pollinator-friendly-solar-energy-bill-passes-adds-momentum-solar-energy-development/).

2.3 Transboundary coordination and cooperation

The need for coordination and cooperation is evident in the case of transboundary basins, where the ability to work together in the management of water resource, even at a technical level through the effective exchange of information across the basin, can be crucial to avert disasters related to extreme weather events or water contamination. Planning jointly, coordinating policies and actions and exchange of data and information can significantly add to the effectiveness of water management in shared basins. Overall, effective transboundary cooperation can bring significant benefits to riparian countries compared to non-cooperation. These can be economic (e.g. increased opportunity for market integration) but also of other nature (e.g. increased political stability, environmental sustainability, etc.)[37].

As discussed, renewable energy deployment can come with negative transboundary impact and, at the same time, there can be complementarities and common interests that motivate cross-border cooperation (Box 3). Platforms and channels established for transboundary cooperation could play a key role in the discussion on renewable energy planning at basin level(accounting for the specific hydrogeology of the basin and potential for joint projects) (Chapter 3), hydropower being the most obvious example. For other technologies, benefits might relate to, for example, scale, coordinating in obtaining technology and optimizing the use of cross-border infrastructure, particularly for flow regulation and storage to address variability concerns.

It is worth noting that a variety of examples of mechanisms and platforms to exchange information and coordinate on the management of international waters exist in international practice, but most transboundary basins are still lacking cooperation frameworks. The prospect of sustainable renewable energy development at regional level (often already discussed in parallel) should raise the interest of policy makers in transboundary cooperation.

Box 4 – The Water Convention's Nexus approach to transboundary cooperation

The Parties to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (the Water Convention) have established a Task Force on the Water-Food-Energy-Ecosystems Nexus to oversee nexus assessments of natural resource management in shared water basins. Using a Transboundary Basin Nexus Assessment (TBNA) methodology developed specifically for this purpose, a series of transboundary assessments have been carried out exploring intersectoral challenges as well as opportunities that arise from closer cooperation on natural resource management across sectors and countries. So far, the methodology has been applied to six transboundary river basins and one shared groundwater aquifer[38]. The experience acquired has

[37] UNECE (2015), Policy Guidance Note on the Benefits of Transboundary Water Cooperation: Identification, Assessment and Communication. United Nations; UNECE (2018), Identifying, assessing and communicating the benefits of transboundary water cooperation. United Nations.

[38] The findings of the first three assessments (Alazani/Ganykh (Azerbaijan, Georgia), the Sava (Bosnia and Herzegovina, Croatia, Montenegro, Serbia, and Slovenia), the Syr Darya (Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan)) can be found at

been documented in a comprehensive synthesis Report[39] that illustrates the methodology and the lessons learned, providing a solid foundation for further analytical work on the subject.

The value of transboundary coordination on renewable energy was demonstrated in all nexus assessments, particularly in the Drina River Basin[40]. One key result of the Drina assessment – supported by an integrated analysis of the energy system and water resources - was that riparian countries could optimize their energy production by adopting a more coordinated approach to hydropower operation in the basin. Moreover, cooperation could be critical for flood management, climate resilience, and environmental sustainability. This is informing dialogue between environmental authorities, water administrations and energy policy makers on future investments, including on renewable energy.

2.4 Stakeholders, strategies, policy, and projects

In order to ensure the best understanding of the interlinkages between sectors, all relevant actors, private and public, should be given the opportunity to offer input, to assist in the identification of interrelations and to participate in their accurate, transparent and impartial assessment. Each group of stakeholders has its own perspective on renewable energy and may overestimate or underestimate the effects of a proposed initiative, sometimes due to lack of information or to the presence of barriers to their involvement in the decision-making process.

Stakeholder involvement needs to start early in the decision-making process and continue throughout all its various steps and phases. Such a process will guarantee that the participation of stakeholders and the specificities of the nexus sectors will be taken into consideration from the high-level, strategic phase of renewable energy planning, to the intermediate phase of adopting concrete policies and measures to achieve the strategic goals and, finally, to the final phase of implementing those policies to create sustainable renewable energy projects.

Conceptually, the three phases or steps may at first appear to have a linear progression: beginning with strategies, then moving on to policies to implement them and, finally, to specific projects that are deployed according to the strategies and policies previously established. In practice, though, the strategies are designed in parallel with policies, and projects are being developed according to the rules already in place, so that it seems more appropriate to talk about three parallel "tracks" of the decision-making process.

UNECE (2015), "Reconciling resource uses in transboundary basins: assessment of the water-food-energy-ecosystems nexus". The findings of the nexus assessment on the Drina River Basin (Bosnia and Herzegovina, Montenegro and Serbia) can be found at UNECE publication (2017) "Assessment of the water-food-energy-ecosystem nexus and benefits of transboundary cooperation in the Drina River Basin". The assessments of the Drin River Basin (Albania, Kosovo , Montenegro, and North Macedonia) and of the North-West Sahara Aquifer System (Algeria, Libya and Tunisia) are ongoing.

[39] UNECE (2018), "Methodology for assessing the water-food-energy-ecosystems nexus in transboundary basins and experiences from its application: synthesis". (www.unece.org/fileadmin/DAM/env/water/publications/WAT_55_NexusSynthesis/ECE-MP-WAT-55_NexusSynthesis_Final-for-Web.pdf)

[40] UNECE (2017), op. cit. fn. 29.

The following chapters will guide energy policy makers through a step-by-step process for developing *Strategic RE planning*, *Sustainable RE policy*, and *Sustainable RE projects*. These three are supported by a multi-stakeholder dialogue, which is what practically brings the different aspects together and allows for an exchange about the cross-sectoral and sustainability considerations at the three levels (Figure 4). Altogether, this process should help policy makers identifying and appropriately addressing these synergies and trade-offs, notably by involving more effectively multiple stakeholders in the decision-making process.

By suggesting step-by-step processes and indicating good practices and instruments available, this report proposes a “tool-kit” to integrate linkages between renewable energy and the nexus sectors at all relevant levels of decision making. However, since this tool-kit has not been developed on the basis of a thorough review of the literature, but rather on empirical grounds, it should not be regarded as a comprehensive tool-kit. It is, nevertheless, a sort of “path-finder” for policy makers who want to better understand and start acting upon the many cross-sectoral tradeoffs and synergies related to renewable energy deployment.

This structure is designed to gather the input of a variety of stakeholders whose area of interest, power, or mandate, can be very different. Moreover, depending on the type of decision to be taken, the roles and responsibility of each stakeholder may vary. Hence, it is important that energy policy makers design the process of stakeholder engagement ad-hoc, knowing the type of process (it can be the development of a strategic plan for sustainable development in a region; the revision of a National Action Plan for renewable energy; the evaluation of a proposed project, etc.) and the related geographical scale of reference.

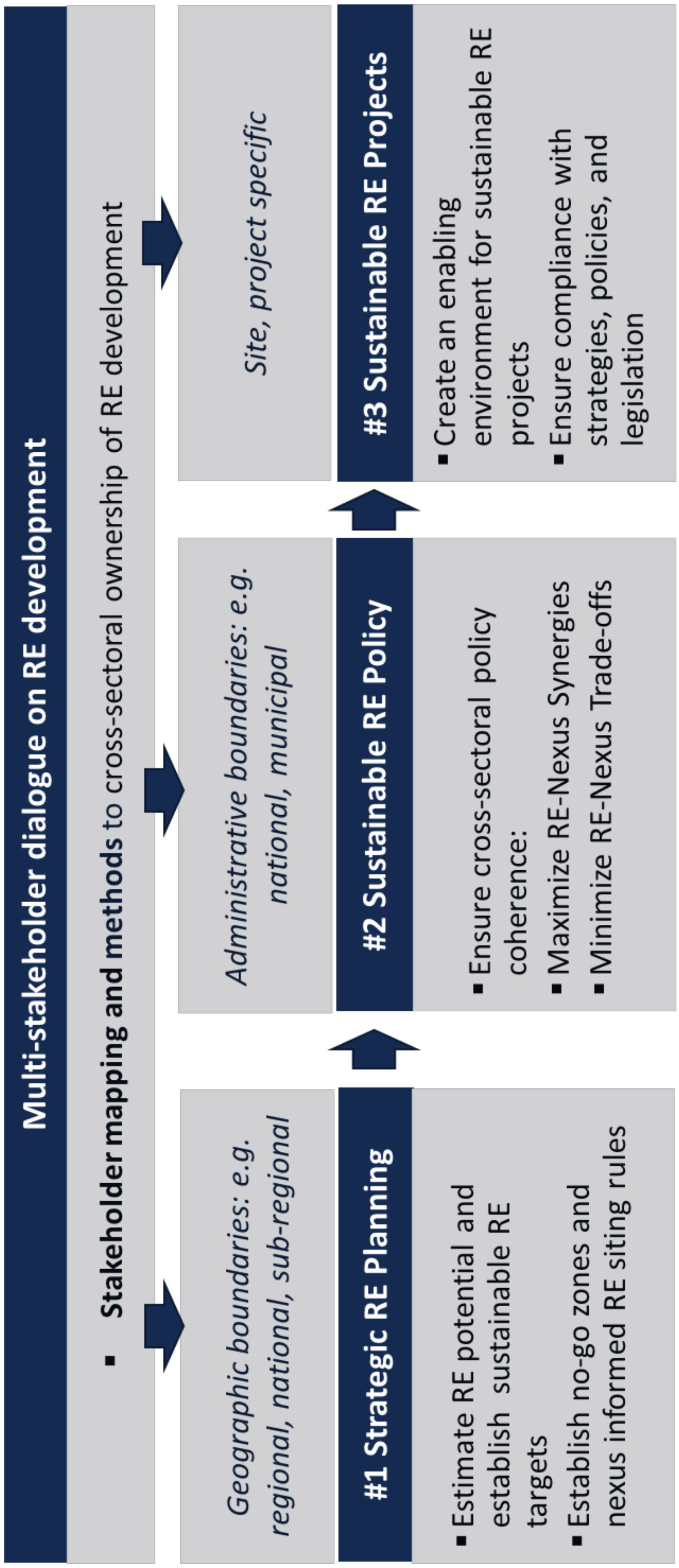

Figure 4: Multi-stakeholder dialogue and the three tracks of Sustainable RE development: Planning, Policy, Projects

3. Setting up the multi-stakeholder dialogue and public participation

In order to appreciate the importance of multi-sectoral and multi-stakeholder dialogue and public participation in the context of sustainable renewable energy deployment it can be useful to recall that there are many interlinkages between SDG-7 and the other 16 goals. These have been thoroughly mapped in research, showing that an impressive amount of sustainable development targets truly relies on energy, and on the transformation of the energy sector. This is not only because of productive sectors will require more energy, but also because many changes will only be possible with the widespread adoption of clean, smart, and integrated energy technologies[41].

The identification of common priorities and goals across sectors, stakeholder groups and members of the public at large should be made through a "nexus dialogue" on renewable energy based on 1) the specific objectives and priorities of each stakeholder group, and 2) the SDGs as a common frame of reference for the social, environmental and also economic benefits arising from the coordinated use of finite resources such as water, land and energy sources.

There is a multitude of actors who are concerned by renewable energy development and could, at least theoretically, contribute or impede its deployment. Therefore, if energy policy-makers are the ones responsible of developing sustainable renewable energy systems - introducing policies and measures to achieve this goal and overseeing the implementation of renewable energy projects that put policies into action - several other stakeholders both within the energy sector and outside of it are also naturally involved, interested, or affected.

The tool-kit presented in this report targets primarily energy policy makers and suggests that they convene all other stakeholders in the development of strategic planning, policy, and projects. It is important to underline that it is first and foremost in the interest of energy policy makers to engage in such dialogue. As already mentioned, a clear benefit from generating a common vision for renewable energy development, across sectors and throughout society, would be the reduction of risks and barriers related to renewable energy investments. Furthermore, it would create the conditions for making other stakeholders and policy makers from various sectors real owners of the renewable energy transition process, which would result in higher overall ambition, awareness, and capacity of integration.

Once stakeholders are well-defined and mapped, energy policy makers then plan for their involvement drawing from different methods available to increase their input in the participatory process. The policy under development significantly influences who needs to be involved. After a basic description of key stakeholder groups, this chapter briefly recalls three of such methods: public participation and transparency, cross-sectoral analysis and integrated modelling, and regional and transboundary coordination.

Interactive forms of public participation such as multi-stakeholder dialogues, may be used as a part of the public participation procedure, but only in addition to and not instead of public hearings or

[41] Nerini et al. (2018), "Mapping synergies and trade-offs between energy and the Sustainable Development Goals, Nature Energy vol. 3, January 2018, p.12 Fig. 2". (https://doi.org/10.1038/s41560-017-0036-5).

inquiries42. A physical public hearing may be supplemented by technologies such as audio- or video-conferences to enable stakeholders who cannot physically attend the hearing to participate.43 It is critical to ensure responsive, inclusive, participatory and representative decision-making at all levels by effectively engaging the public in line with Target 16.7.

3.1 Mapping stakeholders

Energy policy makers should map stakeholders based on the role they play, or could play, in the decision-making process. It is crucial that stakeholders from within the energy sector as well as in the water, food, and environment sectors are clearly identified, so that they can be effectively targeted and appropriately incentivized to take an active part in the process (See Figure 5).The following paragraphs describe five groups of stakeholders without giving more detailed characterization to keep their description simple and widely fitting. Depending on the context of each country, region, and even municipality, there can be a different of configuration of key sectors and actors.

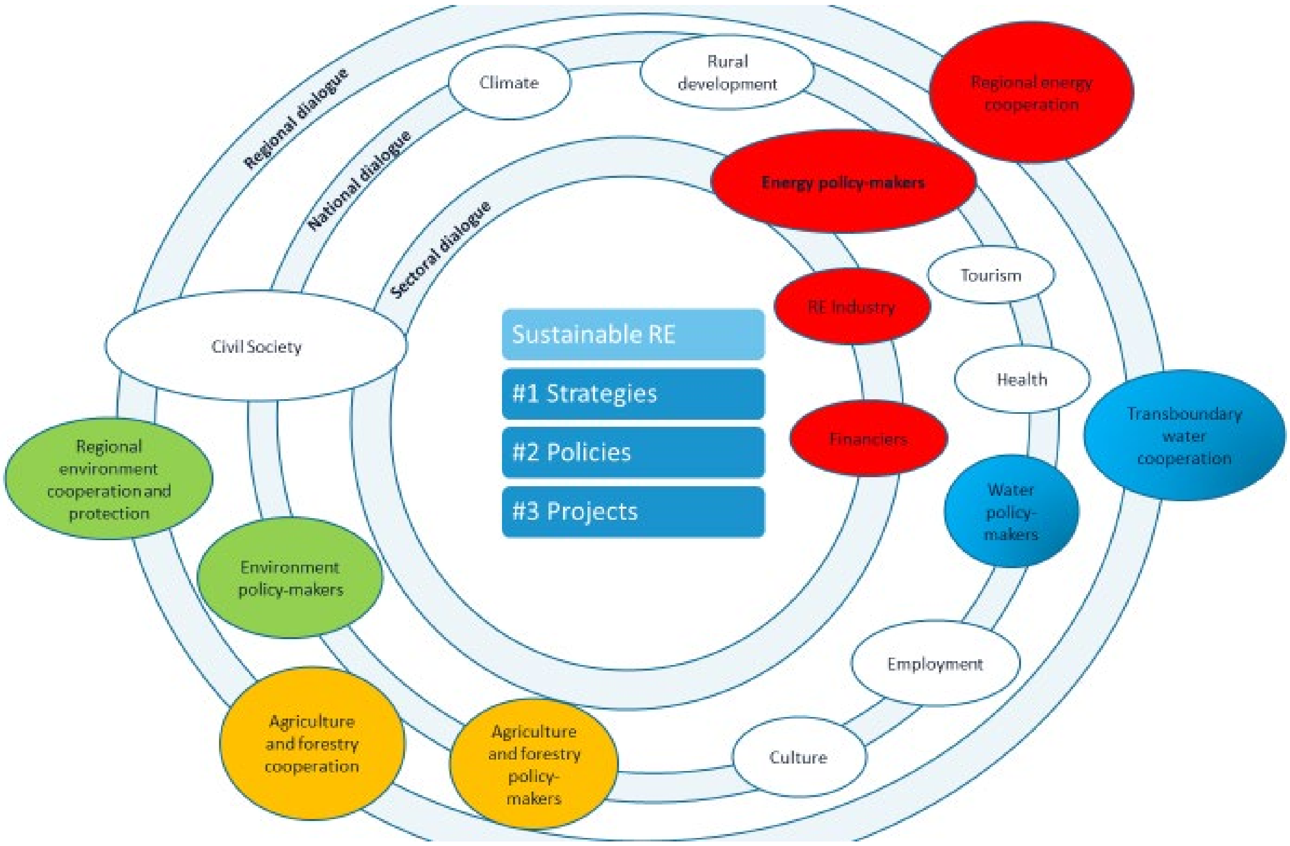

Figure 5: Multiple stakeholders to be involved in regional, national, and sectoral dialogues to develop sustainable RE Strategies, Policies, and Projects.

[42]UNECE (2015), “Maastricht Recommendations on Promoting Effective Public Participation in Decision-making in Environmental Matters” (the “Maastricht Recommendations”), para. 123. (https://www.unece.org/fileadmin/DAM/env/pp/Publications/2015/1514364_E_web.pdf)

[43] Para. 120 of the Maastricht Recommendations

Energy Policy-Makers

They are the recipients of input from other stakeholders, both from within the energy sector and from other sectors. It should be noted here that stakeholder consultations should not be a matter of form but substance; therefore, energy policy makers, as key owners of the renewable policy-making process, have the obligation to actively seek relevant and informed input from the other stakeholders and to take it into consideration in the development and implementation of policies. In that light, energy policy is the focal point where cross-sectoral input is concentrated, evaluated and internalized in the decision-making process.

Policy-makers from other nexus sectors

The improvement of cross-sectoral dialogue and coordination is key to understand the specificities of cross-sectoral interrelations of renewable energy deployment and take them into due consideration. The primary role of stakeholders from different sectors is to offer new perspectives on renewable energy development and to spell out the requirements and possibilities for cooperation in each sector. This is crucial information that may otherwise be overlooked[44]. The input of nexus sectors to plans, policies, and projects is indispensable to ensure their sustainability, and merits the commitment to establish an institutional dialogue between policy makers of different sectors.

To keep a simple parallel with the water-food-energy-environment nexus seen from the perspective of natural resource management, we suggest the engagement of policy-makers from the water, agriculture and forestry, and environment protection sectors, but it should be noted that the categorization of policy makers on the basis of their mandate and areas of competence depends rather on the specific institutional setting in place. Furthermore, there can be sectors who rely or influence natural resource management in different ways, that energy policy makers may want to involve in the process because of their strategic importance (e.g. tourism, housing, navigation), cross-cutting policy areas of relevance (e.g. climate change, sustainable development, etc.), and/or sectors whose participation in the process can be considered beneficial or tactical (e.g. health, rural development, finance, culture).

The public

"The public" is an inclusive concept that is commonly accepted by 46 ECE Member States and the European Union; it means one or more natural or legal persons, their associations, organizations or groups.[45] The role of the public is of crucial importance. From highly influential NGOs with deep sectoral know-how and wide global or regional outreach, to small associations and groups that defend the interest of local communities and to local inhabitants. At the level of strategic planning, their role is to guarantee that the interest of society and the environment is appropriately considered when mapping and assessing the potential of renewable energy across the territory. By being actively

[44] For a comprehensive analysis of stakeholder involvement in nexus-cognizant policymaking, Mohtar et al. (2016), "Water-Energy-Food Nexus Framework for facilitating multi-stakeholder dialogue", Water International. (doi:10.1080/02508060.2016.1149759).
[45] See article 2 (4) of the Aarhus Convention: https://www.unece.org/env/pp/treatytext.html

involved, civil society organizations would be able to develop a common "vocabulary" with policy makers, which would help to make their concerns and suggestions better understood.

When it comes to policies and measures that have an impact on energy consumers or vulnerable groups, they can guarantee that their interest is protected. For each specific renewable energy project that is constructed, civil society holds the key to maximize social impact (which also passes, crucially, by the identification of synergies to respond to the real needs to the populations and the local economy) and ensure social acceptance. Last, but not least, with the transformation of the energy sector towards more decentralized production, citizens are becoming "prosumers" (producers and consumers). This is broadening the scope of public participation to include an informed discussion across the interest parties, on financial support mechanisms and market regulations.

Renewable energy industry

In its broadest sense, "renewable energy industry" includes industry associations as well as project owners, project developers, EPC contractors, equipment manufacturers and everyone else involved in the renewable energy value chain. What these groups have in common is that they represent the interest of the private sector. They can rely on the required knowledge and experience to identify, design, and implement renewable energy projects with cross-sectoral synergies and minimal trade-offs and based on the best technology available.

For the renewable energy industry, sustainability concerns may still be perceived as an additional set of hurdles and obstacles to overcome in the long process to bring a project to completion. Instead, it is necessary that the industry actors become co-owners of the process of increasing the sustainability of renewables (see Chapter 6).

Financiers and investors

The role of financiers and investors is to bring to the table considerations on the financial feasibility of any planned development at the level of projects, which is the ultimate requirement for their realization. Sometimes, sustainability is associated to increased costs and reduced return on investment rates (particularly in the case of substantial trade-offs that need to be mitigated or compensated). This reality does not consider the potential of renewable energy projects to generate multiple benefits and the many interests at stake that could lead to co-finance and de-risking of investments.

"Impact investing" is investing with the intention to generate positive, measurable social and environmental impact alongside a financial return[46]. Although traditionally undertaken by institutional bodies with public sector mandates, such as development banks and international financial institutions (IFIs), private impact investment is set to increase aggressively, with recent demand by investors for environmentally friendly investments driving growth in green financing world-wide[47].

[46] More information at The Global Impact Investing (GIIN) website: https://thegiin.org/impact-investing/

[47] Viraj Desai, "Green Financing Set for Aggressive Growth Globally in 2019", Indvstrvs website, available at https://indvstrvs.com/green-financing-set-for-agressive-growth-globally-in-2019/

Overall, several innovative financing facilities exist, such as blending instruments that aim to achieve policy objectives by combining grants with loans or equity from public and private financiers[48]. These can allow for the effective introduction of sustainability concerns in the investment decision and for leveraging finances explicitly in line with policy objectives. Also, at the level of international donors providing financial assistance to developing countries, the perspective of financing initiatives that advance multiple SDGs at the same time could raise interest, as it provides for a much more efficient utilization of financial resources and as such is coherent with the core principles of the Agenda 2030.

3.2 Methods to increase input from the public and other stakeholders

The closer involvement of public at large and concerned stakeholder in the decision-making process is supposed to build the ownership that is necessary to drive change in all relevant sectors, as needed to sustainably deploy of renewable across a certain territory. It is crucial that all stakeholders feel confident that their opinions will be heard and considered when taking decisions. This space of dialogue could be crucial when there are trade-offs at stake, and failing to engage in a constructive dialogue can lead to friction among the parties involved.

Multi-stakeholder, multi-sectoral cooperation is needed to ensure that the compatibility of renewable energy deployment is well integrated with the nexus sectors, throughout the decision-making process. The more this dialogue influences various sectoral plans, policies, and projects (for example, by creating a water-energy partnership for utilities on energy recovery from wastewater treatment, or by identifying key areas where renewable energy can support the development of green tourism) the more this process is meaningful from a nexus perspective. It would be important that the value of this multi-stakeholder process is recognized by institutions at the highest level, and appropriately supported. This way it does not remain an isolated exercise, but it becomes a natural reference for the renewable energy decision-making process, and potentially a reference for similar cross-sectoral policy efforts.

3.2.1 Effective public notification and access to information

The lack of effective public notification and access to all relevant information within decision-making procedures related to renewable energy leads to raising public and stakeholder concerns, disinformation and breaking possible dialogue. This challenge can be overcome by decision-makers through designing the effective public notification and access to all relevant information from the very start. Competent authorities must ensure that the notification and accompanying information is available to the public throughout the entire public participation procedure and for the duration of the time period for any administrative or judicial review procedures regarding the final decision.[49] In some cases, additional notification is needed, for example when (i) there is doubt that all of the public concerned has been notified, (ii) the proposed activity will entail more than one decision, (iii) new information comes to light, (iv) additional information which could not be provided with the original notification comes available, and (v) the public participation procedure is changed in any material way.[50]

[48] European Commission Website, Innovative Financial Instruments (blending), available at https://ec.europa.eu/europeaid/policies/innovative-financial-instruments-blending_en
[49] Para. 60 of the Maastricht Recommendations
[50] Para. 62 of the Maastricht Recommendations

During the decision-making cycle, the information should at minimum be accessible for examination (i) at the seat of the competent public authority, (ii) electronically (if feasible), (iii) at a suitable easily accessible location if the seat of the competent authority is located far away from the place of the activity, and (iv) during usual working hours.[51] Practical measures to facilitate effective access, assistance and impartial guidance should be put in place to support the public in getting access. [52] During the decision-making cycle, additional information should be made available to the public as soon as it becomes available to the public authority. The presence of additional information should be clearly signalled in all places where information is accessible to the public.[53] If large amounts of new information becomes available, the public authority should ensure that the remaining time frame enables toe public to prepare and participate effectively.[54]

3.2.2 Public participation and transparency

The crucial issue of public participation in renewable energy deployment is becoming more pronounced as renewable energy becomes more mainstream and visible. Effective public participation is necessary to establish channels of communication with society, who is the ultimate beneficiary of the transition to clean energy. The Aarhus Convention provides a legal framework of reference for policy makers on the specific subject of public participation on environmental matters (Box 4). Because of the importance of public participation as a means to increase transparency and acceptance of decisions, anticipate risks and reduce costs to remedy wrong decisions at a later stage, and improve the quality of the final decision, multilateral development banks are increasingly integrating it in their own procedures (Box 5).

The issue of public participation is not only important when discussing the deployment of renewable energy projects on large scales, to prevent frictions or compensate negative impacts. It is also crucial when it comes to small scale distributed renewable energy, like solar PV or small hydropower, to design policies and programs that facilitate their sustainable uptake among citizens and effectively responds to the needs of local communities.

Box 5: The Aarhus Convention, on public participation on environmental matters

At the international level, the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (the Aarhus Convention) was adopted in 1998 and entered into force on 30 October 2001. The Convention is open for accession by any UN Member State. It has been ratified by 46 States and the EU. The Aarhus Convention provides a solid framework for public participation in decision-making in environmental matters, at the local and domestic levels, and across borders[55].

[51] Para. 92 of the Maastricht Recommendations
[52] Paras. 97-98 of the Maastricht Recommendations
[53] Para. 105 of the Maastricht Recommendations
[54] Para. 105 of the Maastricht Recommendations
[55] More information available at: https://www.unece.org/env/pp/introduction.html.

The Aarhus Convention empowers people with the rights to access information, participate in decision-making in environmental matters and to seek justice in environmental matters . Public authorities of the Parties to the Convention must ensure inter alia:

(a) access to environmental information: Information on the state of the environment, and also on policies or measures taken, or on the state of human health and safety should be accessible by all. Moreover, public authorities should actively disseminate environmental information in their possession.

(b) public participation in decision-making related to environmental matters: the public, including NGOs promoting environmental protection, should be able to participate in decision-making process from outset when all options are open, including by taking part in hearings and commenting projects, plans and programmes relating to the environment; and their inputs should be taken into account in decision-making; moreover, final decisions should be made publicly available along with reasons and considerations on which the decision is based.

(c) access to justice: The members of the public should have the right to judicial or administrative review procedures to challenge: refusal or an inadequate response to a request for environmental information; the legality of a decision, act or omission to permit a specific activity; acts or omissions by private persons or public authorities that contravene national environmental law..

The Aarhus Convention step-by-step model of effective public participation procedure in environment-related decision-making is presented in Figure 6.

Figure 6: Key elements of effective public participation in decision-making

Box 6. Multilateral Development Banks in increasing transparency and public participation

Bilateral and multilateral donors as well as International Financial Institutions (IFIs) can have a very prominent role in providing mandate-driven financiers to advance policy objectives, among which the transition to clean energy sources is a key global priority. Among other things, they can help increase transparency and public participation at the project development stage, by introducing processes and safeguards for projects that apply or secure funding. Many financing institutions with a social or environmental mandate have established platforms that allow for public concerns against financing a project to be voiced.

For example, the European Bank for Reconstruction and Development (EBRD) has established the Project Complaint Mechanism (PCM), an accountability mechanism that has been put in place by the Bank to review complaints about Bank-financed projects. It provides individuals and civil society organizations that may be directly or adversely affected by an EBRD project with a means to raise complaints. The PCM allows for transparency and visibility of complaints and it fosters public participation and access to information on projects that are either considered for financing or have secured the support of the Bank. Public participation and access to information requirements should be prioritized for projects with significant impact (e.g. utility scale wind/solar), but also for projects with substantial transboundary effects (e.g. hydropower projects that affect water flows between countries), where notification and consultation procedures for planned projects (but also the operation of existing ones) should be established.

Experience has shown that a transparent, open and clear dialogue on a proposed initiative early in the planning stage can help addressing many public concerns that can delay or even derail projects due to unyielding public resistance. The introduction of public participation and consultations can allow for a constructive discussion beyond “not in my back yard” concerns associated with renewable energy technologies, where such concerns are unfounded and owed to lack of information. On the other hand, when such concerns are founded, public participation can help identifying them and bringing them to the forefront, so that they can be adequately and timely addressed. Finally, awareness-raising initiatives for broader and more integrated renewable energy should be supported, so that the civil society itself can more effectively act as a vehicle of sustainable renewable energy uptake.

3.2.3 Cross-sectoral analysis and modelling

To properly reflect all sectoral priorities, modeling tools of different complexity can be utilized to identify what would be the implications of a particular policy and hence help to identify the “optimal” policy approach across all sectors and to prioritize actions and take decisions accordingly[56] (see section 4.2 for tools for sustainable renewable energy planning). Cross-sectoral analysis and modeling is increasingly important due to the close interrelation of the sectors (nexus), but also due to the need for more drastic policy interventions, for example, in order to align with the requirement to limit global warming to below 2°C relative to pre-industrial levels (and even more so in the case of 1.5°C)[57], which inevitably requires taking action across the whole spectrum of the economy. Cross-sectoral analysis and modeling tap into the knowledge and experience of professionals from different sectors and synthesizes their aggregated expertise into models that incorporate multi-disciplinary variables and perspectives (See Box 6).

[56] For example, in N. Bieber et al. (2018), “Sustainable planning of the energy-water-food nexus using decision making tools”, Energy Policy 113 584–607, the authors developed and applied a detailed modeling framework of Ghana’s Greater Accra Metropolitan Area that took into consideration all three components of the energy-water-food nexus as a guidance for policymakers that plan interventions in the energy sector.

[57] For the importance of analytics in policymaking with nexus considerations in mind and review of available analytical tools for policymakers and other stakeholders, Mohtar et al 2016), op. cit.fn.33.

This approach is particularly valuable in the adoption and implementation of environmental policies. The concept of “integrative governance advocates” for a cross-sector coordination and collaboration in governance that aims to reduce redundancies (duplications and overlaps in policy functions), cover gaps (areas where proper policy arrangements are absent) and avoid incoherence (contradictions in policy and implementation measures)[58]. This integrated governance approach applies both at the planning stage (with the identification of relevant stakeholders) and the implementation stage (with various methods to mobilize public and private sector stakeholders) and is fully aligned with the multi-track process for integrating sustainability concerns in renewable energy decision making that is proposed in the following chapters.

Box 7 - Quantifying cross-sectoral impacts for nexus-informed policy making: The World Bank’s Thirsty Energy Initiative

The World Bank, under the Thirst Energy Initiative, has partnered with the Energy Research Center of the University of Cape Town, South Africa, to incorporate water constraints into the country’s energy-planning model and to foster a more sustainable system[59].

The project revolved around the concept of creating a “water-smart energy model” and the initiative’s main conclusions are documented in the report “Modeling the Water–Energy Nexus: How Do Water Constraints Affect Energy Planning in South Africa?”[60].

The key message of the Project is that accounting for the regional variability of water supply and the associated costs of water supply infrastructure can significantly impact energy planning, especially in a water-scarce country like South Africa. The report establishes a model to choose between dry cooling and water cooling of adopts two different scenarios: one where true water supply and infrastructure costs (including regional variations of availability and costs within the country) are included in a model to choose between dry or water cooling and one where such costs weren’t accurately reflected. The report proves that when not accounting for cost of water, the model chooses more water intensive option to increase energy resources. On the other hand, once water costs are incorporated in the model, technologies that are less water intense but more costly (and were for that reason ignored when water costs weren’t accounted for) become more competitive.

The Report’s outcome is important because it proves that adopting a systemic perspective of the nexus sectors can result in different energy choices than would be reached by optimizing for energy resource development alone.

[58] Weitz et al (2017), “Closing the governance gaps in the water-energy-food nexus: Insights from integrative governance”, Global Environmental Change 45 (2017) 165–173, 168.
[59] World Bank website, “Thirsty Energy: Water-Smart Energy Planning in South Africa”, (https://www.worldbank.org/en/news/feature/2017/06/15/thirsty-energy-water-smart-energy-planning-in-south-africa).
[60] World Bank Group (2017) “Modeling the Water-Energy Nexus : How Do Water Constraints Affect Energy Planning in South Africa?”, (https://openknowledge.worldbank.org/handle/10986/26255).

This case study is a very good example of how cross-sectoral analysis and modeling can help energy sector planners to properly incorporate nexus factors (such as water constraints) in their decision-making process.

3.2.4 Regional and transboundary coordination

The existence of regional coordination and cooperation platforms channels of communication, or at least initiatives, is a prerequisite for the coordinated planning of renewable energy deployment. The prospect of energy trade can also be a booster for investments, and regional market requirements can be a driver for the implementation of regulations based on best international standards. Basin level, transboundary cooperation mechanisms or initiatives play a similar role when it comes to water issues: they are necessary to implement coordinated planning, and they can drive different countries' national policies and regulation on water management towards common higher standards.

A good example of how a regional platform can act upon the sustainability of renewable energy deployment comes from the Energy Community (EnC). The EnC Secretariat often issues statements that reflect the commitment of the countries to tackle a certain issue. One of these statements (2018) focused on the impact of small hydropower development[61]. In the Statements it reads that: "*Hydropower development projects are subject to a so-called screening obligation. If significant negative effects on the environment are established at this stage, a full environmental impact assessment on various factors (such as human beings, fauna and flora, soil, water, air, climate, landscape, material assets, cultural heritage and the interaction between those) must be carried out. The project can only go forward if measures to avoid, reduce and, if possible, offset its major adverse effects are established. When carrying out the screening procedure, the cumulative impacts of different projects in the same geographical area have to be taken into account*".

When it comes to the renewable energy and water, transboundary cooperation is simply needed to discuss on a multitude of issues that require coordination, or even joint management: from flow regulation, to water quality control (including sedimentation), even aquifer management and protection (in case of shared groundwater resources). The Water Convention provides a global legal framework of reference (Box 7) but it is only the existence of transboundary cooperation initiatives on the ground that allows countries to act together. The International Sava River Basin Commission (ISRBC) can be used as an example where a well-established transboundary cooperation platform was used to discuss the impact of multi-sectoral developments (including renewable energy) on the basin water and land resources, in an attempt to broaden the scope of cooperation, in support of the implementation of the Framework Agreement on the Sava River Basin (FASRB)[62].

It is also worth recalling that regional cooperation on agriculture and forestry, as well as on environment, can be important fora of discussion for sustainable renewable energy, simply because of the role that these sectors play (or rather should play, once they are better involved) in catalyzing

[61] Issued in November 2018. Available at: https://www.energy-community.org/news/Energy-Community-News/2018/011/13.html.

[62] https://www.unece.org/environmental-policy/conventions/water/envwaterpublicationspub/envwaterpublicationspub74/2017/reconciling-resource-uses-in-transboundary-basins-assessment-of-the-water-food-energy-ecosystems-nexus-in-the-sava-river-basin/doc.html

renewable energy investments with high social impact and in aligning investments towards the protection of nature and biodiversity for the common good, respectively.

Box 8 - The Water Convention, supporting transboundary cooperation

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes, (the Water Convention[63]) is one of UNECE's multilateral environmental agreement that aims to ensure the sustainable use of transboundary water resources by riparian states through the promotion of transboundary cooperation. The Water Convention was adopted in Helsinki in 1992 and entered into force on 6 October 1996. It has been ratified by 42 States and the European Union. Although it was initially negotiated as a regional instrument, it has been amended to become available to all UN Member States as of March 2016.

The Water Convention strengthens transboundary water cooperation and measures for the ecologically-sound management and protection of transboundary surface waters and groundwaters. The Convention promotes and encourages the implementation of integrated water resources management, in particular the basin approach[64].

The Water Convention has three central obligations for States-Parties (or principal pillars[65]):

(a) to prevent, control and reduce transboundary impacts: Parties are required to take measures to prevent, control and reduce any transboundary impact on the environment, human health and safety and socioeconomic conditions as well as to use water resources sustainably, taking into account the ecosystem approach and to set water-quality objectives and criteria, draw up contingency plans and minimize the risk of accidental water pollution.

(b) to ensure reasonable and equitable use: Parties should consider the basin particularities to ensure the equitable use of waterways and should take into account the needs of future generations.

(c) to promote cooperation through agreements and joint bodies: Parties required to conclude transboundary agreements and set up joint bodies (river or lake commissions) at the basin level to cooperate on the management and protection of their transboundary waters. As a framework agreement, the Convention does not replace bilateral and multilateral agreements for specific basins or aquifers; instead, it fosters their establishment and implementation, as well as further development

The Convention promotes cooperation in the use of hydropower resources and in reducing transboundary impacts from such use. Beyond that aspect, though, the cooperation at the basin level encouraged by the Water Convention can help create platforms for coordinated action by riparian states on broader issues, such as joint deployment of (non-hydro) renewables at the basin

[63] More information at the UNECE Website: https://www.unece.org/env/water.html.
[64] More information at the UNECE Website: https://www.unece.org/env/water/text/text.html
[65] UNECE (2017), The Water Convention: responding to global water challenges (https://www.unece.org/fileadmin/DAM/env/water/publications/brochure/Brochures_Leaflets/A4_trifold_en_web_2018.pdf).

level or coordinated planning of energy-agriculture synergies (irrigation and renewables) and other such basin-wide initiatives. Namely joint bodies created to implement the Convention´s obligations could evolve into such water cooperation platforms where related issues, notably impacts from sectoral development on water resources, are discussed. Such possibilities are subject to mandates defined by States for joint bodies.

4. Track 1: Strategic Renewable Energy Planning

4.1 Step-by-step process for Strategic Renewable Energy Planning

Renewable energy potential is a resource that needs to be exploited to promote social wellbeing. Despite the fact that, by definition, renewable resources are naturally replenished, sub-optimal exploitation of said resources does not only mean that the benefits are not capitalized on but also that the associated costs are incurred into, such as the opportunity costs associated with not utilizing it, not utilizing it at its maximum potential, or not utilizing it at the most appropriate time. In other words, taking decisions regarding the exploitation of this potential with strictly sectoral benefits and costs in mind is limiting.

Strategically planning for renewable energy deployment means reducing sectoral competition for the same resources and developing a common vision for renewable energy development. This vision should influence policy developments in various sectors and ensure a cross-sectoral coherence in action. As a result, strategically plan for sustainable and nexus-compatible renewable energy deployment means first of all agreeing on no-go zones, high potential zones, and areas where development is possible but trade-offs should be addressed. The following process is proposed to reach this agreement (Figure 7).

Depending on the case, strategic planning can be carried out with different geographical boundaries of analysis in mind. These can be the hydrographical boundaries of a river basin, the administrative limits of national borders or a municipality, or even those of an economic macro-region. In any case, due to the multi-sectoral nature of the exercise, which must consider the inter-dependency of systems with different geographical boundaries[66], the process will naturally include the consideration of elements across-scales.

The first step is to determine the stakeholders who need to be involved in strategic renewable energy planning, and to involve them (Chapter 3). The following table gives a generic example of such an assessment (Table 1):

Table 1: Stakeholders involved in Strategic RE Planning

Stakeholder Group	**Level of involvement**	**Role**
Energy Policy Makers	HIGH	Leading the Sustainable RE Planning process.
Other Nexus Policy Makers	HIGH	Ensuring coherence with other nexus sectoral plans.
Civil Society	HIGH	Ensuring public participation and consultation.
Renewable Energy Industry	MEDIUM	Observer. Consulted on technology and innovation and economic viability.
Financiers & Investors	LOW	Observers. Consulted on financing possibilities.

[66] Liu et al. (2017) *Challenges in operationalizing the water–energy–food nexus*. Hydrological Sciences Journal Vol 61, Issue 11.

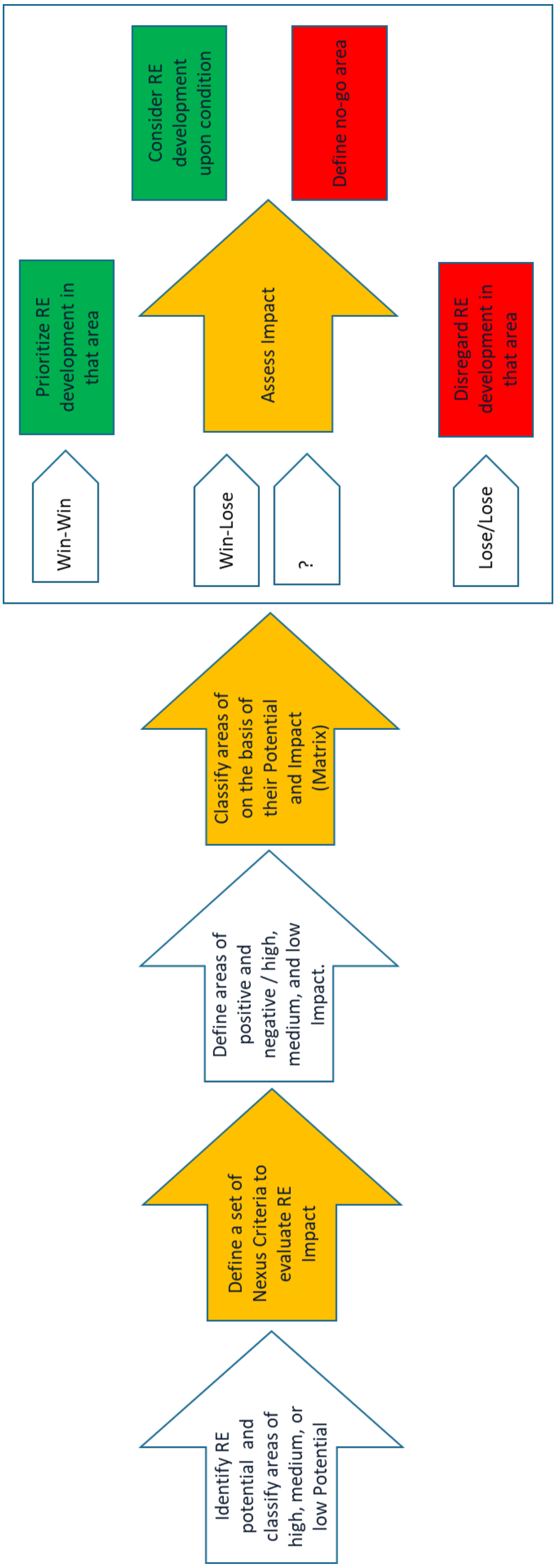

Figure 7: Step-by-step process for Strategic RE Planning. In yellow, the steps that require high involvement of cross-sectoral stakeholders

The key steps of the process described above would be as follows:

- **I**dentify spatial distribution of renewable potential and specify (according to energy sector-specific criteria) the areas where this potential is technically and economically exploitable. Classify areas of high, medium or low potential (HP, HP, LP) This assessment should be done per each technology. The use of Geospatial information System (GIS) mapping for RE resource assessment (see section 4.2) would allow to use those maps as basis or support for more in-depth analyses such as GIS-based energy system planning and modelling (e.g. planning of the electrical grid)[67], hydrological modelling for basin management[68], and others.

- Define, through a process of intersectoral consultation of authorities, public consultation and cross-sectoral analysis, a commonly accepted set of Nexus Criteria to evaluate the impact of renewable energy development on the different sectors. For example, a set of Nexus Criteria can be:

  - The preservation of nature protection or biodiversity reserves (e.g. Natura 2000);
  - The preservation of agricultural land and/or the valorization of agricultural activities;
  - The optimization of flow regulation for multiple purposes and the protection from hydrogeological risk.

- Apply the Nexus Criteria to identify geographical areas that are High, Medium or Low Impact from the perspective of nexus sectors, both in Positive (synergies) and Negative (trade-offs) terms. This will produce six categories of areas: Low Positive Impact (LPI), Medium Positive Impact (MPI), High Positive Impact (HPI) on one hand and Low Negative Impact (LNI), Medium Negative Impact (MNI) and High Negative Impact (HNI) on the other (see Table 2).. Like the assessment of renewable energy potential, this assessment should be carried out per technology. For example:

  - for biomass: the most suitable forests for wood-energy production, and high-productivity agricultural land (where agricultural by-products are available in high amounts) can be considered PI areas; forest land where there is a problem of forest degradation NI.
  - for solar: synergies can lie in the possibility of providing off-grid solutions where the grid doesn't reach consumers, or desalination where freshwater is scarce, or the renewable energy transition of entire communities through mini-grid solutions,

- Classify areas based on their renewable energy potential (high, medium, low) and their impact on nexus sectors (high, medium, low; positive or negative). A possible classification (to be established based on consultation among stakeholders) Could be:

  → Areas of medium and high exploitable renewable energy potential (HP and MP) that coincide with zones with any degree of positive impact (LPI, MPI, and HPI) can be classified as "win/win" zones.

[67] GIS-Based Planning and Modeling for Renewable Energy: Challenges and Future Research Avenues https://www.mdpi.com/2220-9964/3/2/662

[68] Van Der Knijff, J. M., Younis, J. and De Roo, A. P. J. (2010) LISFLOOD: a GIS-based distributed model for river basin scale water balance and flood simulation, International Journal of Geographical Information Science, Vol. 24, No.2, 189-212

→ Areas of low-potential (LP) and any degree of negative impact (HNI) can be considered "lose/lose".

→ Areas of medium and high potential (MP and HP) and any degree of negative impact are "win/lose".

→ Areas of low potential (LP) and any degree of positive impact (HPI) are uncertain.

The Potential/Impact Matrix summarizes this classification (Table 2).

Table 2: Potential/Impact Matrix

	Low **P**ositive **I**mpact	**M**edium **P**ositive **I**mpact	**H**igh **P**ositive **I**mpact		**L**ow **N**egative **I**mpact	**M**edium **N**egative **I**mpact	**H**igh **N**egative **I**mpact
Low **P**otential	?	?	?		Lose/Lose	Lose/Lose	Lose/Lose
Medium **P**otential	Win/Win	Win/Win	Win /Win		Win /Lose	Win /Lose	Win /Lose
High **P**otential	Win/Win	Win/Win	Win/Win		Win /Lose	Win /Lose	Win/Lose

➢ Prioritize renewable development in win/win areas. Given the shared interest, consider possibility of developing renewable projects in close coordination across-sectors.

➢ Disregard renewable development in lose/lose areas.

➢ Assess the impact of renewable energy deployment in areas that are "win/lose" and the potential in uncertain areas. The assessment should be based on rigorous analyses (see tools available in section 4.2). This step is essentially a negotiation across sector and therefore it is crucial that the principles of transparency and public consultation are respected (see Chapter 3). The outcome of this dialogue is:

  - The agreement on no-go zones for renewable energy deployment;
  - The agreement on areas where renewable energy deployment is conditional to mitigation or compensation measures;
  - The identification of areas where renewable energy deployment can be considered despite low resource potential, because of its added value in other nexus sectors.

This process directly informs three policy questions of critical importance:

1. The definition (or redefinition) of renewable energy targets. This can be done for each technology based on the above cross-sectoral discussion. This would mean, essentially, disregarding the potential in high negative impact areas considering the potential in other areas as agreed based on negotiation.

2. The identification of key areas where new strategies, policies, and action plans are needed, or existing ones should be revised, to encourage, forbid, and facilitate renewable energy deployment, both in the energy sector and in the other nexus sectors (see Track 2 Sustainable RE Policy, chapter 5).

3. The elaboration of context-specific nexus-informed siting rules for renewable energy deployment (see section 4.3.6).

4.2 Tools available

4.2.1 Spatial mapping of renewable energy potential

The mapping of renewable energy potential, be it wind, solar, hydropower or biomass, is essential to establish the role renewables can play in a country's energy mix. For example, the RE-Map platform provided by IRENA provides a repository of the renewable energy potentials from various sources, by country and by region[69], and the Global Atlas[70] provides information on exploitable renewable energy potentials in Geographic Information System (GIS) format. This information (that draws from key geographical, demographic, and techno-economical parameters) can be used for planning renewables both at utility-scale and off-grid. For higher geographic resolutions, and/or technology-specific questions, there can more information available from academia, the industry, and civil society, which may account for surveys, specific standards of environment protection, or results from integrated modelling and complex optimization - which highlights once again the crucial importance of stakeholder engagement in the process of strategic RE planning.

4.2.2 Energy system planning and modelling accounting for Nexus considerations

Energy modelling including cross-sectoral considerations is necessary to take informed decisions when it comes to new investments. The impact of climate change on water resource availability is a clear example of critical interlinkage: will there be enough water – including considering variability and projected change in the long term - to justify a certain investment in hydropower? Land and water use competition can be other crucial constraints, when planning for biofuel production[71]. In general, choices related to energy production can have indirect effects on other sectors (even beyond direct resource competition) that only integrated modelling can account for[72]. There are number of tools available to carry out nexus-informed energy system modelling exercised. A list (updated to 2018) can be found in the paper "Energy modelling and the Nexus concept"[73].

4.2.3 Geographic Information System(GIS)-based optimization of new investments in renewable power generation

Basing renewable energy planning on GIS information is useful because the potential of different sources is highly distributed, and siting generation plants will need to be done accordingly. Yet as

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69 Visit the portal at: https://www.irena.org/remap

70 The Global Atlas for Renewable Energy is a web platform that allows its users to find maps of renewable energy resources for locations across the world. More information available at https://www.irena.org/globalatlas

71 Munoz Castillo et al. (2019). *The land-water nexus of biofuel production in Brazil: Analysis of synergies and trade-offs using a multiregional input-output model*. Journal of Cleaner Production 214: 52-61. DOI:10.1016/j.jclepro.2018.12.264. (http://pure.iiasa.ac.at/id/eprint/15653/)

72 Bazilian et al. *Considering the energy, water and food nexus: Towards an integrated modelling approach. Energy Policy* (2011), 39, 7896–7906.

73 Brouwer et al. (2018), *Energy modelling and the Nexus concept.* Energy Strategy Reviews Volume 19, January 2018 (https://www.sciencedirect.com/science/article/pii/S2211467X17300652).

discussed even where resource potential is high, there can be significant constraints or limitations to project deployment, from the presence of settlements, to a very high distance from the power grid, to the presence of natural and biodiversity areas that need to be protected. GIS-planning allows for a detailed account of all these factors and therefore, from a nexus perspective, should become a common good practice[74].

Spatially-explicit energy system optimization can be done using different tools (for instance in the list above), but the most critical aspect of this analysis is the definition of criteria to be applied to the optimization. The process suggested in 4.1 can be greatly supported by this type of analysis, as the criteria for optimization are basically the GIS representation of Nexus Criteria.

A basic sequence of activities supporting the process of GIS-based least-cost optimization of renewable energy investments (for instance, towards a certain target of renewable energy generation)could be:

1. Develop the model of the energy system
2. Map points of generation and consumption, and distribution lines
3. Map the spatial distribution of renewable energy sources potential (4.2.1)
4. Apply geographic constraints to find no-go zones:
   i. Natural constraints (elevation, slope)
   ii. Nexus-related (e.g. nexus criteria)
5. Exclude from the map no-go zones
6. Define minimum desired production potential
7. Define optimal mix of investments in renewable generation based on:
   i. costs of technology
   ii. distances (cost of building new transmission)
   iii. potential costs of mitigation measures

4.2.4 Spatial multi-criteria decision analysis (SMCDA)

Geospatial optimization decisions can be further informed by introducing cross-sectoral variables. Spatial optimization tools exist that combine a variety of factors and criteria to reach decisions on renewable energy siting. Using a combination of GIS, engineering tools as well as social, environmental and economic variables, geospatial planning can assist decision-makers to select between alternatives and to substantiate their decisions in a transparent and scientific manner[75]. When introducing such a decision-making process, the criteria chosen should also include environmental and social factors that may affect the final choice for reasons not related to sector-specific priorities, such as distance from cultural or natural heritage sites or proximity to wildlife breeding or feeding grounds (for wind), or forest or agricultural residue availability (for biomass)[76], etc. This type of analysis that allows for integration of nexus priorities in the decision-making process by selecting the appropriate criteria. Moreover, these approaches define "optimal" siting as that which creates the highest level of consensus, advocating for a high level of stakeholder involvement throughout the entire decision-

[74] Camargo & Stoeglehner (2018) *Spatiotemporal modelling for integrated spatial and energy planning.* Energ Sustain Soc (2018) 8: 32 *(*https://link.springer.com/article/10.1186/s13705-018-0174-z)

[75] Hanssen et al. (2018), "Spatial Multi-Criteria Decision Analysis Tool Suite for Consensus-Based Siting of Renewable Energy Structures", Journal of Environmental Assessment Policy and Management Vol. 20, No. 3 (doi: 10.1142/S1464333218400033).

[76] Woo et al. (2018), "Optimizing the Location of Biomass Energy Facilities by Integrating Multi-Criteria Analysis (MCA) and Geographical Information Systems (GIS)", Forests 2018, 9, 585. (doi:10.3390/f9100585).

making process to ensure that the final decision is the one that constitutes the best possible compromise.

Renewable energy siting is one of the key factors that affect the type and intensity of impacts in other sectors. In order to promote nexus synergies, there are several complementarities between deployment of renewables and management of nexus-linked resources, such as water and land. Those complementarities should be considered at the planning stage by including relevant criteria in the SMCDA process, in order to identify zones where they apply.

4.2.5 Nexus-informed siting rules for renewable energy technologies

Solar Sharing

One of the main issues on solar PV siting is competition for land that could be utilized for growing food. The concept of mixed, multipurpose land use through co-production of food and energy, known as "solar sharing"[77], is well established in certain countries (notably in Japan that is also highly advanced in "floating solar" technology). By elevating and arranging PV panels accordingly, photosynthesis can still take place and farming machinery can be used. Recent research[78] has also shown that this may not even be a trade-off but also a synergy in some situations, since certain shade-tolerant crops perform better under the partial shade offered by the panels than without it; research also supports that even shade-intolerant crops can be grown under solar PV installations[79]. From a long-term planning perspective, incentivizing this approach in predominantly farming communities could also allow for increase in rural development and more secure income streams for agricultural populations. Possible decline in farming output could also be controlled by closely monitoring produce output and mandating the dismantling of solar arrays in case output drops below a certain percentage, as in the case of Japan where panels are installed in light-weight bases and can be removed if farming produce output drops below 80%[80].

Multi-purpose dams

The potential for hydropower dams to contribute to flood prevention has been documented and understood for many years[81]. In the same vein, multi-purpose dams can allow for a variety of other synergies (beyond flood control) between all three nexus sectors to manifest, for example irrigation for agriculture, water storage and supply management, and electricity storage; moreover, their role in climate change adaptation (through water storage) is becoming more prominent. Introducing those factors as criteria in a multi-criteria analysis on hydropower siting can influence the final decision on

[77] IRENA (2015), op. cit. fn. 3, p. 83 Box 2.14.

[78] Barron-Gafford et al., (2019), "Agrivoltaics provide mutual benefits across the food–energy–water nexus in drylands", Nature Sustainability, 2019. (doi: 10.1038/s41893-019-0364-5).

[79] Sekiyama et al. (2019), "Solar Sharing for Both Food and Clean Energy Production: Performance of Agrivoltaic Systems for Corn, A Typical Shade-Intolerant Crop", Environments 2019, 6, 65; (doi:10.3390/environments6060065).

[80] IRENA (2015), op.cit. fn.3; Junko Movellan, "Japan: Next-Generation Farmers Cultivate Crops and Solar Energy", 10.10.2013, Renewable Energy World website (https://www.renewableenergyworld.com/2013/10/10/japan-next-generation-farmers-cultivate-agriculture-and-solar-energy/)

[81] Pircher (1990), "The contribution of hydropower reservoirs to flood control in the Austrian Alps, Hydrology in Mountainous Regions. II - Artificial Reservoirs; Water and Slopes (Proceedings of two Lausanne Symposia, August 1990). IAHS Publ. no. 194,1990".

whether and where to establish a new large hydropower plant. Also the design and the eventual operation influence the potential for multiple uses. It is necessary to take other, intermittent, renewable energy potential into account and consider the river basin and the hydraulic systems as a whole. More than that, this approach can help navigate the various complexities associated with the management of a multi-purpose dam, since some of the purposes lead to conflicting operational approaches. This analysis, incorporating nexus-relevant criteria for the planning and operation of large hydropower projects, should also be performed on a regional scale between riparian states. The Transboundary Basin Nexus Assessment (TBNA) methodology synthesized in a 2018 publication by UNECE[82] can be a useful tool to accompany planning new multi-purpose dams on a regional scale and to agree on rules to operate them for maximum disbursement of social benefit between riparian countries. New hydropower is commonly subject to strict environmental and socio-economic impact assessment, including through the financial institutions policy; such studies substantiate evaluating trade-offs. .

Rural development

Renewable energy can play a crucial role in the advancement of the rural economy in remote communities. Deployment of renewable energy can provide hosting communities with significant benefits, among which: new revenue sources; new job and business opportunities; innovations in products, practices and policies in rural areas; capacity building and community empowerment; affordable energy[83]. To tap into those benefits, a synergistic approach must be promoted, integrating the non-energy related benefits of renewable energy into rural development strategies. For instance, France has developed a strategic plan for anaerobic digestion that is dedicated to rural areas, called EMAA (plan Énergie Méthanisation Autonomie Azote). The strategic goal of the plan is to have 1.000 anaerobic digesters on farms in France by 2020. The purpose of EMAA is dual: on one hand, to develop a model to maximize the positive externalities of anaerobic digestion (e.g. reduction of greenhouse gas emissions and recovery of organic waste), on the other to provide an additional source of income to farmers[84]. The effects of renewable energy deployment in rural communities should be considered also when deciding upon the siting rules of renewable energy. As noted, "*long term national strategies for energy decarbonization should identify not just geographical opportunities for renewables installation, but also the potential synergies with the economic needs of such disadvantaged areas and remote communities*"[85].

Another example of rural development through renewables comes from Serbia's Rural Development Policy, a cross-sectoral policy that recognizes renewables as a tool for sustainable rural development. The policy provides subsidies for farmers to install solar PV to attain multiple benefits. In fact, PV can provide additional income for farmers through a diversification of economic activities, making rural households become more financially independent but also more self-sufficient from an energy perspective. More broadly, PV deployment in rural contexts can support the creation of new jobs(both

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[82] UNECE (2018), op. cit. fn. 30.

[83] OECD (2012), "Linking Renewable Energy to Rural Development, Executive Summary Brief for Policy Makers". (http://dx.doi.org/10.1787/9789264180444-en).

[84] European Court of Auditors (2018), Special Report No. 05 "Renewable energy for sustainable rural development: significant potential synergies, but mostly unrealised" (https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=44963).

[85] IEA-RETD (2016), "REvLOCAL - Revitalisation of local economy by development of renewable energy". (http://iea-retd.org/archives/publications/revlocal).

for on-farming and off-farming activities)[86]. The interesting aspect is that this synergy was identified and put into operation by the Ministry of Agriculture, not the Ministry of Energy, but it should be noted that further discussion may still be needed to eliminate the risk of PV speculation on agricultural land.

Biofuels and Indirect Land Use Change (ILUC)
When biofuels are produced on existing agricultural land[87], they directly compete with the production of food, feed and fibre crops. This competition may result in a shift of food and feed crop cultivation in newly reclaimed land (e.g. forests, wetlands and peatlands). This land use change is associated with an increase in carbon dioxide (CO2) emissions released into the atmosphere that can be directly attributed to the production of biofuels, which practically offsets the emission savings from the use of biofuels instead of fossil fuels. Because of this, to properly assess biofuel potential CO2 emissions caused by ILUC should be factored into policy decisions and considered when setting up incentives for their production. The need to make biofuels more sustainable, to help further reduce Greenhouse Gas (GHG) emissions, to provide a sustainable energy source particularly for developing countries and remote populations and to encourage greater market penetration of advanced biofuels is undeniable; therefore, modelling ILUC emissions is a complex challenge, as it was evident for instance in a European Commission attempt to adopt a comprehensive policy on this issue between 2010-2012[88].

4.3.6 Strategic Environmental Assessment

Strategic Environmental Assessment (SEA) is a systematic decision support process, aiming to ensure that environmental and possibly other sustainability aspects are considered effectively in policy, plan and program making[89]. SEA is an internationally established instrument, to assess the environmental and social consequences of new policies, plans or programmes prior to decision making and is legally required in an increasing number of countries (presently 106 countries).

The need to assess the environmental impact of energy activities at an early stage of planning, as well as the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries, are enshrined both in most national legislations but also in the Espoo Convention and the Protocol on Strategic Environmental Assessment (SEA) (Box 8).

Box 9. The Espoo Convention and the Protocol on Strategic Environmental Assessment SEA

[86] The Policy was discussed during the Renewable Energy Hard Talks held in Serbia on 21 and 22 March 2019. More information available at the UNECE Website: https://www.unece.org/energywelcome/areas-of-work/renewable-energy/unece-hard-talks.html.

[87] Conventional (first generation) biofuels are biofuels produced from food crops (e.g. sugar, starch and vegetable oils) that are produced from land using feedstock which can also be used for food and feed. Advanced (second and third generation) biofuels are produced from feedstock that do not compete directly with food and feed crops, such as wastes and agricultural residues (i.e. wheat straw, municipal waste), non-food crops (i.e. miscanthus and short rotation coppice) and algae..European Commission Memo on Indirect Land Use Change (2012), available at https://ec.europa.eu/commission/presscorner/detail/en/MEMO_12_787

[88] More information at European Commission website: https://europa.eu/rapid/press-release_MEMO-12-787_en.htm

[89] Fischer, T. B. (2007). Theory and Practice of Strategic Environmental Assessment, Earthscan, London.

The Convention on Environmental Impact Assessment (EIA) in a Transboundary Context (Espoo Convention) is a UNECE convention signed in Espoo, Finland in 1991 and ratified by 44 States and the EU. The convention reinforces transboundary harmonization in legal and regulatory issues, notably EIA. It obliges States to notify neighbors about plans for projects that are foreseen to affect their environment and to carry out public participation and consultation processes between the involved States. In 2003, the Parties to the Espoo Convention adopted the Kyiv Protocol in 2003, which provides that a Strategic Environmental Assessments (SEA) should be undertaken much earlier than EIA in the decision-making process.

The EU SEA Directive (on the assessment of the effects of certain plans and programs on the environment)[90] establishes that SEA is required for all plans and programs(e.g. on land use, transport, energy, waste, agriculture, etc.)that involve projects that are likely to have significant environmental effects (and therefore would require an obligatory EIA).

The application of SEA to development of the renewable energy sector at the various planning stages can provide the following benefits:

(a) SEA can ensure that renewable energy development is in line with environmental and health objectives and commitments a given country has adopted;

(b) At the strategic/policy level, SEA can facilitate the discussion on scenarios for renewable energy development. Thus, it can contribute to selection of the most appropriate energy mix, which considers environmental and health risks as well as benefits of all reasonable alternatives, and thus enables objective comparison.

(c) SEA applied at the strategic/policy level can support proper consideration of renewable energy development in other, including parallel, planning schemes (e.g. spatial or land-use planning) by providing recommendations on priority renewable energy resources to be further developed and/or locations to be primarily further explored.

(d) SEA can streamline development of specific projects and relevant project-level assessment (EIA), for instance by identifying locations where major environmental or health risks can be excluded or mitigated. Therefore, development and approval of specific projects including EIA can be carried out without main problems. A proper application of SEA – in line with the provisions of the UNECE Protocol on Strategic Environmental Assessment – can help to maximize environmental and social benefits resulting from renewable energy development, while avoiding or minimizing potential adverse effects.

Other important regional instruments are Directive 2014/52/EU amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment and Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment.

[90] Directive 2001/42/EC https://ec.europa.eu/environment/eia/sea-legalcontext.htm

These Directives are also part of the EU acquis that must be transposed by Energy Community (EnC) Member States and is therefore important for many of the countries of the ECE Region.

Adherence to this criterion for proposed energy projects should be examined both in a national and a transboundary context. Moreover, the evaluation should not be limited to the existence or lack of an Environmental Impact Assessment (EIA) or Strategic Environmental Assessment (SEA) requirement but, more importantly, to qualitative aspects (quality control, public participation, governmental capacity to create and evaluate EIAs/SEAs, monitoring, etc) of how this requirement is actually enforced in practice.

4.3 Climate strategies to drive coherence of action across sectors and within regions

Because of the cross-cutting nature of climate mitigation and the global dimension of the fight to climate change, the development of climate strategies offers a unique opportunity for intersectoral and regional dialogue. Renewable energy deployment in one of the key actions to be taken in the energy sector, and as such is crucial for climate strategies and forms an essential part of them.

An example of how strategic renewable planning can be integrated with broader climate policy is the EU (and Energy Community)requirement for Member States to develop National Energy and Climate Plans (NECPs) that cover the five dimensions of the Energy Union for the period 2021 to 2030 (one of which is decarbonization of the economy). This approach of jointly planning for energy and climate at the national strategic level is a good example of cross-sectoral, long-term planning that holistically approaches nexus sectors. Notably, Member States are also strongly encouraged to identify areas suitable for joint or coordinated planning within a region, and to consult other governments as early as possible in the NECP preparation process. The 2018 EnC Publication "Policy Guidelines by the Energy Community Secretariat on the development of National Energy and Climate Plans under Recommendation"[91], extending the application beyond the EU to the EnC Contracting Parties, provides that "*The various national plans in a region should complement and where possible reinforce each other, using national strengths to address the region's challenges in the most secure and cost-effective way. Particular attention should be paid to ensuring a coordinated approach concerning the development of new energy resources and infrastructures*".

This initiative can be considered a good practice for establishing an integrated planning approach that, beyond climate change (SDG 13), also incorporates priorities on water-energy-food-ecosystem nexus interlinkages (SDGs 2, 6, 7, 14) and other interlinked sectors[92]. Within such an integrated approach, the positive and negative impacts of strategic decisions in the energy sector would be identified at the regional level and the decision to proceed or not for the benefit of society would be better informed by the comparison with a broader variety of options arising from regional cooperation.

[91] 2018/01/MC-EnC. More information at the Energy Community Website: https://www.energy-community.org/news/Energy-Community-News/2018/06/19.html

[92] For example, poverty elimination (SDG 1), good health and well being (SDG 3), decent work and economic growth (SDG 8), reduced inequalities (SDG 10), sustainable cities and communities (SDG 11), and responsible consumption and production (SDG 12).

5. Track 2: Sustainable Renewable Energy Policy

The process proposed in this Chapter aims to analyze renewable energy policies from the perspective of cross-sectoral trade-offs and synergies, to enhance renewable energy sustainability. Both existing and new policies can be analyzed through this process, using the Sustainability Assessment Matrix proposed for this purpose. This process aims at identifying, assessing and classifying synergies and trade-offs between the renewable energy policy that is being examined and the policies of other nexus sectors. Crucially, it identifies gaps and barriers that exist both in the renewable energy policy that is being analyzed and in the policies of the nexus sectors involved. With adjustments, the proposed method could be replicated in other contexts (for example, water or environment), to collect opinions from involved public and private stakeholders, during the consultation process for a new policy measure or the amendment of an existing policy measure.

5.1 Step-by-step process for Sustainable RE Policy development

As for Track 2, the first step is to set up the multi-stakeholder dialogue based on stakeholder mapping and on the recognition of the potential contribution of each group to the development of Sustainable Energy Policies (see Table 3).

Table 3:Stakeholders involved in Sustainable RE Policy

Stakeholder Group	**Level of involvement**	**Role**
Energy Policy Makers	HIGH	Review or development of own policy and associated measures.
Other Nexus Policy Makers	HIGH	Review or development of own policy and associated measures.
Civil Society	HIGH	Counterpart for measures for consumers and prosumers.
Renewable Energy Industry	LOW	Observer. Consulted on technology and innovation.
Financiers & Investors	LOW	Observers. Consulted on financing possibilities.

The steps of such a process (see Figure 8) are the following:

- Identify cross-sectoral linkages between energy and the food – water – ecosystems nexus. The identification process should also allow for identification of transboundary dimensions of linkages.

- Evaluate those linkages classifying them as positive or negative.

- Assess whether the results of those linkages are adequately addressed in existing or planned policy measures: if the identified synergies are promoted and the identified trade-offs are addressed or mitigated.

- For linkages that are not appropriately addressed, understand if they are not due to a lack of policy measures (gap) or due to the presence of conflicting policy measures (barrier), stopping synergies from happening and generating trade-offs.
- Propose actions that address those linkages (i.e. that promote positive or mitigate negative impact).
- Consult stakeholders on proposed actions and their suitability and adjust them as needed.
- Adopt proposed actions and proceed with planned policy.

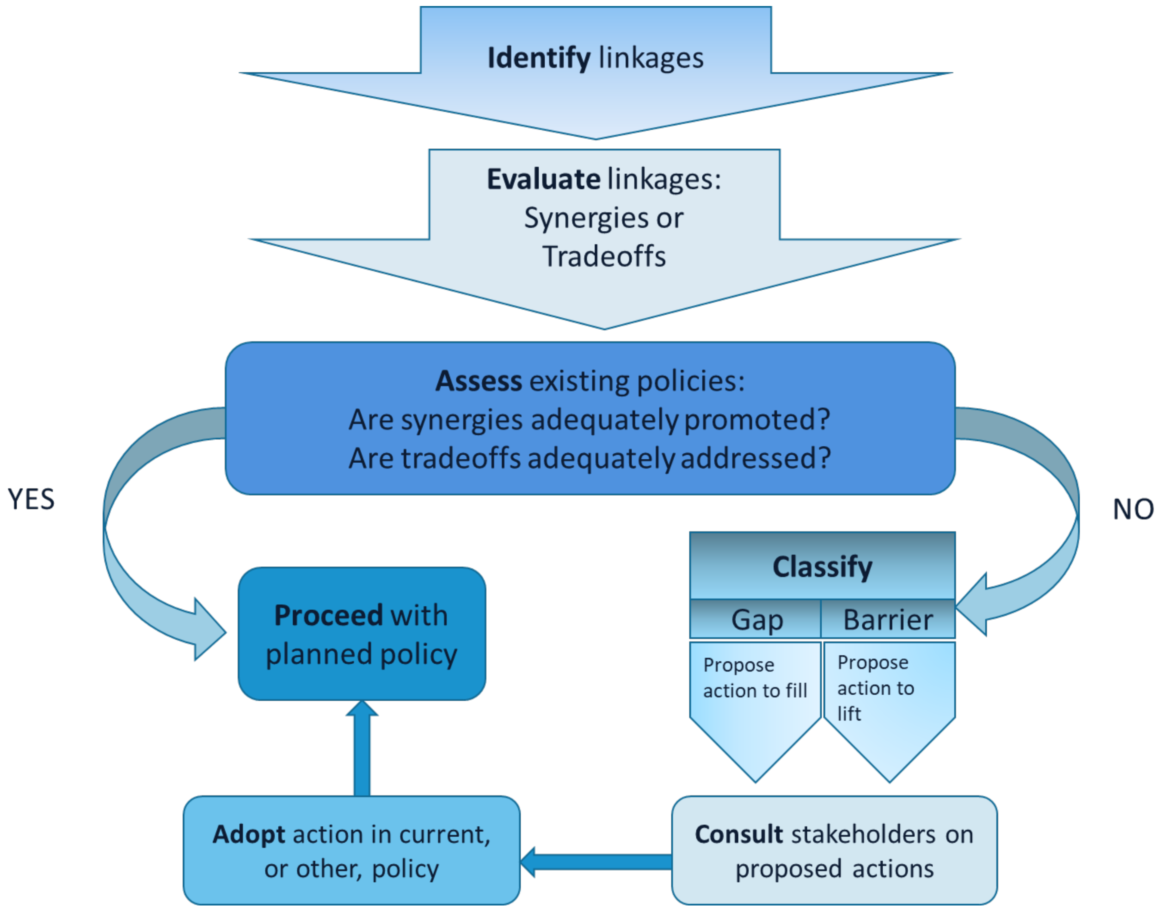

Figure 8: Step-by-step process for Sustainable RE Policy development

5.2 Sustainability Assessment Matrix (SAM)

The use of a Sustainability Assessment Matrix (SAM) like the one proposed below can help implementing the process throughout its steps (Table 4).

The process identifies cross-sectoral linkages between a proposed (or existing) renewable energy policy and nexus-relevant areas (water, food, ecosystems) and allows for the examination of potential transboundary dimensions. For clarity, each cross-sectoral section is further deconstructed into more subsections, in order to better specify where the linkage with energy lies: for example, the "water" section is broken down into three different sub-categories: "water access", "water management" and "water infrastructure". Of course, the sub-categories can be increased or can be broken down further to a third level of categories, making the Matrix as flexible, detailed and analytical as users may desire.

Table 4: The Sustainability Assessment Matrix

Nexus Sectors		Synergies			Trade-offs	
		Identification	Assessment		Identification	Assessment
Water						
Water supply/services						
Water management						
Water infrastructure						
Agriculture and Forestry						
Land availability						
Land quality						
Rural development						
Agroforestry						
Ecosystems						
Natural environment						
Wildlife/habitats						
Indirect environmental impact of RE						
Cultural impact						
Transboundary aspect						
Transboundary impact on Water						
Transboundary impact on Food/ Agriculture						
Transboundary impact on Ecosystems						

Users should classify the linkages under the respective column ("synergies" or "trade-offs") by marking "IDENTIFIED", with a brief description of the linkage (see example below). This is to assess if linkages are adequately addressed in the existing or planned policy and through related measures. It should be noted that "addressing" a linkage in this context is a neutral term related to the desired outcome: "addressing" a synergy means actively promoting or allowing for it, "addressing" a trade-off means taking measures to minimize or mitigate its effects. For an identified synergy that is addressed (i.e. encouraged), the measure used to encourage is to be mentioned. Likewise, for an identified trade-off that is mitigated, the mitigation measure is to be noted. Users should mark "ADDRESSED" under the "Assessment" column of the Matrix if the linkage is addressed, and briefly note the measure used to address it.

For linkages that are not ADDRESSED, policy makers can note whether the linkages are not addressed due to lack of relevant policy measures or due to existence of conflicting policy measures. This is how users establish whether there is a GAP or BARRIER in existing policies related to a specific linkage. A

GAP is a case where the identified synergy is not facilitated or promoted,or where the identified trade-off is not offset, minimized or mitigated. Similarly, users can establish whether there is a BARRIER in existing policies. A BARRIER is a case where an existing policy (which can be related to energy or to other sectoral policies) either blocks a synergy or makes an identified trade-off more difficult to mitigate. Users can mark in the "Assessment" Column the existence of a GAP or BARRIER for non-addressed linkages. In the case of a GAP, the lack of a proper measure is noted, while in the case of a BARRIER, the specific measure is identified.

Once the GAPS or BARRIERS are identified and described, all policy makers concerned with them should discuss how to best fill them and lift the, respectively. Public consultation gathering input from all stakeholders is extremely important at this point. Having built consensus on how to better deal with identified and non-addressed linkages, the proposed actions are adopted, and the planned policy can be adopted with sustainability and nexus priorities effectively integrated.

The proposed analytical process of evaluating cross-sectoral linkages in policies using the SAM can be useful to energy policy makers and other relevant stakeholders for a variety of reasons:

- It allows for a detailed mapping of linkages across nexus sector, which can be useful to all policy makers, even beyond matters strictly related to renewable energy.
- It shows areas where there is no impacts, allowing energy policy-makers to focus on the existing issues and opportunities and engage into a concrete discussion with specific stakeholders.
- It identifies areas were impacts are addressed and no further intervention is required, which is an important means of monitoring the effectiveness of actions that have already been taken.
- It showcases where the policy framework as a whole is lacking, and as such it stimulates the action of policy makers from other sectors. In fact, the most effective way to fill a GAP or to lift a BARRIER could fall under the responsibility of a policy maker from another sector, even country.
- In explicitly invites input from nexus policy-makers and makes them co-owners of the process. Not only they can bring to the table their priorities and concerns: they also receive clear directions to contribute concretely to sustainable renewable energy deployment.
- It allows investors with green mandates to have a "checklist" for the compatibility of projects with policy requirements (as well as, potentially, with eligibility requirements for financing from "green financing" streams).

Below is an indicative application of the use of the SAM, and specifically the Agriculture section of it (Table 5). It is filled out for a (hypothetical) policy measure to support the deployment of solar PV in rural areas through financial incentives would look as below.

Table 5: Example of implementation of the Sustainability Assessment Matrix

Nexus Sectors		**Synergies**			**Trade-offs**	
		Identification	**Assessment**		**Identification**	**Assessment**

Agriculture						
Land availability		**IDENTIFIED**: Solar PV technologies exist that allow for elevated panels for farming and also show synergies with increasing bee populations.	**GAP**: The policy can incentivize usage of elevated PV technologies for maximizing benefit from land usage. **BARRIER**: Land zoning rules that prevent Solar PV on farmland should include exception for PV plants that use elevated technology.		**IDENTIFIED**: New PV installations will use land that could be exploited for farming etc.	**ADDRESSED**: Zoning rules allow installation of PV on lands already available for industrial usage or for integrated farming solutions.
Land quality		**NOT IDENTIFIED**	-		**IDENTIFIED**: PV plant parts and, particularly, storage equipment can adversely affect soil if improperly disposed after decommissioning	**GAP**: Obligation to recycle at decommissioning / after fixed amount of years.
Rural development		**IDENTIFIED**: Small Solar PV can provide alternative revenue sources and increased financial security to farmers.	**GAP**: A clause should be included in the proposed policy that makes permitting simpler for farmers that install small (<100KW) PV plants. **BARRIER**: A tax law provision exists that doesn't allow farmers to enjoy certain tax exemptions if they have alternative revenue from non-farming activities.		**IDENTIFIED**: Easier income due to solar subsidies can disincentivise local agricultural populations from being involved in the more physically demanding and financially unstable agricultural professions. **IDENTIFIED**: Local communities often react to large scale RE installations. Consultation: a legal framework or existing process	**GAP**: Increase living standards of agricultural workers, promote modernization of farming activities through incentives for modern equipment and supply chain processes. **GAP**: Include a requirement for all projects above a certain size to pay contributions to local communities/ municipalities

5.3 Linking Sustainable RE Policy to Strategic RE Plans

A crucial factor in increasing sustainability of renewable deployment is the existence of long-term, strategic planning at the national and/or regional level, including considerations of the part that renewable energy is envisaged to play in it (Track 1). In other words, counting on sustainable strategies facilitates the development of sustainable policies. However, even though the benefits of integrated strategic planning are getting more attention, sector-specific approaches remain the norm when developing national energy strategies. The role of renewable energy within a country's long-term energy vision is often not planned strategically.

Even where they exist, Renewable Action Plans and Roadmaps that countries prepare for renewable energy do not take into consideration broader sustainability and cross-sectoral concerns, nor they examine different deployment scenarios in order to identify the ones with more positive outcomes across all interlinked sectors. The EU Energy *acquis* can be regarded as a benchmark when it comes to sustainability, at least when it comes to climate and environment (see section 4.3). However, even EU policies for renewables are not necessarily developed based on integrated planning or a rigorous evaluation of cross-sectoral considerations. The National Renewable Energy Action Plans (NREAPs) that EU Member States developed according to the Renewable Energy Directive[93], aim to set clear, actionable targets for renewable energy but do not prescribe the evaluation of the broad benefits of renewable energy and the verification of their compatibility with sustainability principles.

To make these elements explicit, Strategies should embrace a broader thematic scope and examine cross-sectoral as well as regional linkages, while Action Plans should include both cross-sectoral and transboundary impacts of the planned actions. To that effect, the possibility of coordinating on the development of Renewable Energy Action Plans between neighboring countries could be a clever move towards higher resource use efficiency and increased regional cooperation.

[93] 2009/28/EC, that also constitute an obligation of Energy Community Member States.

6. Track 3: Sustainable Renewable Energy Projects

Strategic and policy choices would not deliver on sustainable energy deployment without the active engagement of those actors who deal directly with the development of projects on the ground. They practically hold the key to the realization of projects that are sustainable socially and environmentally, "nexus-proofed", and highly beneficial for local communities, and their task is to translate all these qualities into project plans that are technically feasible and financially sustainable. While this task is undeniably complex, it is important to recognize that sustainability issues (particularly those related to environment) are becoming more and more of a concern across the entire spectrum of society. Hence there is a momentum towards investments, projects, and partnerships that explicitly seek to promote sustainability, improve efficiency or resource use, and increase innovation. In the case of renewable energy, this drive can generate projects which benefits go far beyond the production of low-carbon electricity and that can easily qualify for impact financing.

In this context, policy makers are called to create a favorable environment for private actors to channel this positive potential. They should gather together project developers, financiers, investors, and the wider community of citizens (and potential prosumers), to discuss the potential impacts/risks and benefits of sustainable renewable energy solutions and to find innovative ways to deploy them. Clearly, at the same time, they also have the ultimate responsibility to ensure that private actors will comply with strategic priorities, policy and legislation. Essentially, policy makers can think of Track 3 as a two-step process of incentivization on the one hand, and facilitation of compliance on the other (Figure 9).

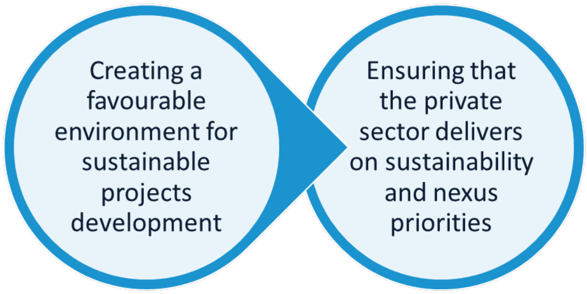

Figure 9: Two-step process for Sustainable RE Projects development (policy maker perspective)

Stakeholder engagement and consultation in the phase of project development is particularly important because the benefits and impact on the environment and the hosting community (direct and indirect) can be clearly defined. Once identified, these will be the subject of "negotiation" among stakeholders. This is confirmed both in literature and practice, notably through the experience of large projects that involve the relocation of human settlements, or trigger disputes over land use. This report does not describe this subject in detail (leaving it to the reader to find the most appropriate mechanisms of stakeholder engagement with hosting communities). Instead, with reference with the broad groups of stakeholders described in Chapter 3, Table 6 simply highlights the importance of effectively involving *all* groups.

Notably, policy makers from nexus sectors should be more or less involved in project development depending on the project's characteristics and the specific synergies and/or trade-offs at stake. A project may be strongly supported by agricultural policy makers because of the strategic role it has on rural development, for instance. In this case, agriculture policy makers will play a role that is similar to that of energy policy makers, and just like them they need to ensure that the project responds to strategies, policies, and legislation. This confirms the crucial importance of developing integrated strategies (Track 1) and coherent policies (Track 2) that place renewable energy in the bigger picture of sustainable development.

Table 6: Stakeholders involved in Sustainable RE Projects

Stakeholder Group	Level of involvement	Role
Energy Policy Makers	HIGH	Check sustainability incentives and compliance with strategies, policies, regulation, legislation. Depending on the project, setting partnerships.
Other Nexus Policy Makers	HIGH/LOW	Depending on the project, they can play a similar role to Energy Policy Makers.
Civil Society	HIGH	Counterpart in local communities.
Renewable Energy Industry	HIGH	Ensuring best available technology for project.
Financiers & Investors	HIGH	Financing and ensuring bankability of project.

6.1 Creating a favourable environment for Sustainable RE Projects development

The development of a renewable energy project is driven by actors who do not necessarily operate on the same set of priorities than policy-makers. Project owners, sponsors, contractors and (commercial) investors are primarily interested in concluding the commissioning of projects within the shortest time and the lowest cost, to maximize their return of their investment. Nevertheless, it is important that they are also committed to develop sustainable projects, which are in line with the government's social, economic and environmental priorities. In order to achieve this, they need to become co-owners of the process to increase sustainability in the renewable energy sector[94].

An important element for policy-makers to achieve the active engagement of project developers and other private actors is having a system of incentives in place. In this respect, it is possible to identify

[94] For a detailed discussion on the issue Opperman et al. (2017), The Power of Rivers: A Business Case. The Nature Conservancy: Washington, D.C.

at least four groups of incentives that can encourage private actors to seek sustainability and nexus-compatibility in renewable energy project development and design (Figure 10).
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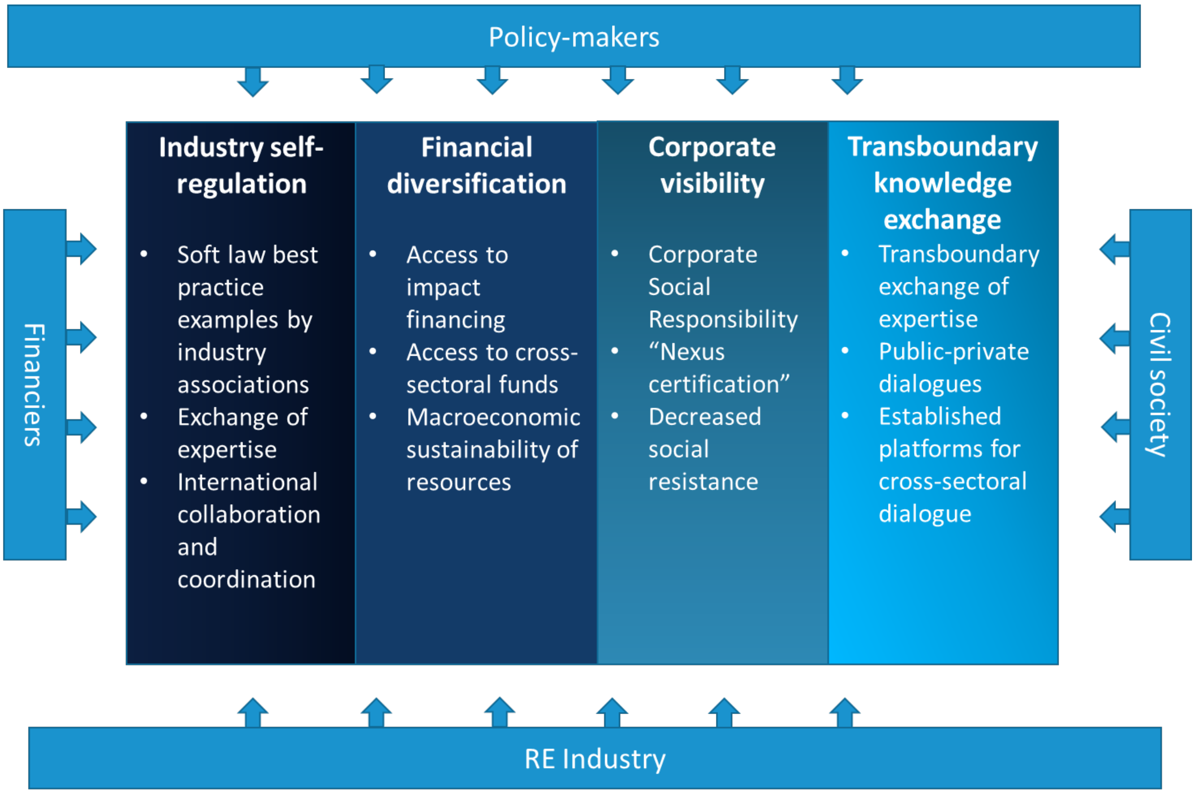

Figure 10: Checklist of Incentives for private actors to become co-owners of the sustainable RE development process

Industry self-regulation

A key incentive for private actors to engage in sustainability is the explicit encouragement and recognition (especially by policy makers) of sustainability guidelines and best practices. Actors like international industry organisations can play an important role in producing and disseminating sustainability guidelines as well as encouraging the uptake of best practices by project development actors and industry members. This is because they are representing the interest of these actors and are in a position to disseminate knowledge. These practices constitute a sort of self-regulation within the industry. An example of industrial best practices dissemination through "soft law" is the International Hydropower Association's "Hydropower Sustainability Guidelines on Good International Industry Practice"[95], a code of conduct primarily addressed to industry actors with good practices for sustainable development of hydropower (Box 9).

Box 10: The International Hydropower Association's guidelines for sustainable hydropower.

Hydropower is one of the main areas where the interlinkages between energy, water and agriculture are made evident and significant trade-offs can be identified between usage of water for energy and its availability and suitability for consumption and irrigation.

[95] IHA, op. cit. fn. 34.

Moreover, since many rivers are internationally shared, hydropower is a prime example of the need of transboundary coordination and cooperation in the management of a common resource. The impact of hydropower projects mandates the harmonisation of rules on sustainable deployment and usage at various stages of a project's lifetime.

The International Hydropower Association (IHA) has adopted a comprehensive set of guidelines[96] and specific tools[97] to assess the sustainability of a hydropower project, to identify gaps and to promote continuous improvement. The most important tool is the Hydropower Sustainability Assessment Protocol (HSAP), a tool for assessing hydropower projects across a range of social, environmental, technical and economic criteria. The HSAP provides an international common language on how these criteria can be addressed at all stages of a project's lifecycle: planning, preparation, implementation and operation.

The conformity of a hydropower project with the IHA guidelines and the utilization of the available tools to plan and implement new projects (but also manage existing ones) in a sustainable and nexus-aligned way should be a necessary criterion for the greenlighting of candidate projects.

Non-industrial players like inter- and non-governmental organizations can also play a key role when It comes to spreading best practices throughout the industry. In the field of bioenergy, for instance, FAO developed the Bioenergy and Food Security (BEFS) Approach to guide and to support countries through the main stages of the bioenergy policy development and implementation process[98]. The BEFS Approach provides tools for evidence-based policy formulation, risks assessment and de-risking process, as well as a monitoring and evaluation framework that includes 24 "sustainability indicators" commonly agreed between FAO and the Global Bioenergy Partnership (GBEP)[99], which is a joint initiative of policy-makers, industry and civil society. One of the most important parameters of the BEFS Approach is its emphasis the sustainable development of biomass that should not compromise food security and instead exploit synergies with rural development and climate action.

Another available tool which use could be encouraged is IRENA's Project Navigator[100], an online platform that provides guidance and resources for renewable energy project development. Although not specifically focused on sustainability, it provides basic information on the role and format of Environmental Impact Assessments in the project development process. An interesting feature of the navigator is that it supports users in planning the process of decommissioning in a sustainable way, by recycling most parts and properly disposing of the rest. This crucial dimension of a project is often overlooked in the planning phase, but it will become of crucial relevance in the future, when the first generation of technology reach their lifecycle's end.

Corporate Visibility and Recognition

[96] IHA (2018), "Hydropower Sustainability Guidelines on Good International Industry Practice". (https://www.hydropower.org/publications/hydropower-sustainability-guidelines).

[97] More information available at IHA Website: https://www.hydropower.org/topics/featured/hydropower-sustainability-assessment-protocol

[98] More information at the FAO Website. (http://www.fao.org/energy/bioenergy/bioenergy-and-food-security/en/)

[99] More information at the GBEP Website. (http://www.globalbioenergy.org/)

[100] More information available at IRENA Project Navigator Website. (https://navigator.irena.org/index.html)

With global industry leaders increasingly focusing on environmentally conscious agendas in their corporate branding strategies, renewable energy companies could also build their brands around sustainability and nexus-alignment. Corporate Social Responsibility (CSR) and sustainable practices in project development could increase the social as well as financial value of energy companies, particularly publicly traded ones. The examples of oil and gas companies becoming active in RE development, of automotive companies focusing on electric vehicles, or information technology companies sourcing only renewable energy for the energy needs showcase the fact that sustainability has become a key element for brand recognition.

A simple policy measure to stimulate this momentum could be the establishment of awards for projects that have cross-sectoral synergies or that successfully mitigate trade-offs. This could provide recognition and visibility to sustainably-minded industry actors while showcasing successful industry practices that can be replicated, and it would give a (non-financial) incentive to industry actors to spend additional efforts in research and innovation towards sustainability.

Financial diversification

Financial diversification of revenues could also provide a strong incentive for a project's alignment with nexus objectives. As soon as electricity production from renewables reaches "grid parity" (i.e. is comparable with the cost of purchasing electricity from the grid), government subsidies and other forms of support for renewables will soon come to an end, but project developers may seek additional support by exploring cross-sectoral synergies. For instance, a modern plant for Combined Heat and Power (CHP) production from biomass might be obliged to sell electricity to the grid at market price (non-subsidised), but it could still receive subsidies for providing heat to the local district heating systems, under the condition that it secures a large percentage of its fuel from local agricultural residues. In a similar vein, to stimulate a solar PV installation in a remote region with restricted water access, a part of its capital expenditure (CAPEX) could be covered by a grant, on the condition that it will also establish, power and operate a water pump, desalination facility or water purification facility. These are two practical examples of how financial diversification can stimulate cross-sectoral synergies (and tap into a broader resource of financial support).

The idea of achieving more with less, to promote synergies generate positive impact across sectors, is not only a key pillar of the sustainability concept (and the Agenda 2030), as it has a profound economic rationale.It reflects the principle of economic efficiency in the utilisation of available resources, which allows natural resources to generate more value for a longer amount of time. This aspect is deeply rooted in sustainability theory but is not a mainstream principle guiding energy investments, mainly because the economic benefits of introducing sustainability in resource management and service provision are sometimes hard to realize. They are also difficult to model, measure and evaluate, since they may take a long time to appear and may involve many parameters that cannot be easily quantified. In fact, a leading private investor opined on the subject of "impact investment" that, until the economic impact of environmentally- and socially-conscious investments can be measured, it will remain difficult to persuade investors that it is worthy to invest in a socially responsible manner[101]. In this area, the role of financiers could be crucial; the finance industry is very

[101] James Coulter, co-CEO of TPG Capital, interviewed by Nancy Hungerford for CNBV exclusive, opined that "…until we can measure impact well in a way that gives people confidence it's going to be hard to be definitive that you're delivering. And if you can't measure it how do you know you've really achieved it…we need metrics to prove impact…". Transcript available at CNBC Website. (https://www.cnbc.com/2019/09/23/cnbc-transcript-james-coulter-co-ceo-of-tpg-capital.html).

well equipped to quantify and assess the economic benefits of sustainability and to develop tools and processes that can show the economic impact of sustainable investments. Clearly, the role of policy makers is once again that of convening a much-needed multi-stakeholder dialogue on the topic sustainable renewable energy development.

Regional and transboundary exchange of knowledge

Renewable developers, project owners and financiers can cooperate and exchange experiences and best practices on increasing sustainability and nexus–compatibility at regional level. Technologies are evolving, costs are dropping, and new, more sustainable ways to model and manage the linkages between energy, water, food and ecosystems develop at a rapid pace. Despite that, it is not always easy to follow all technological developments or to be aware of all new concepts or ideas, even more so in countries with underdeveloped renewable energy markets or low institutional capacity. Focusing on the exchange of ideas and technical expertise, promoting "good" renewable projects, showcasing innovation, prioritising research and development and promoting overall sustainable practices in renewable project development could help building an industry culture that understands and utilises innovative technical solutions to achieve nexus objectives.

The role of policy makers is crucial in this context. Through multi-stakeholder, cross-sectoral policy dialogues, good policies can be shared, good practices can be made public, good projects can gain visibility and sustainability-oriented developers can expand their business, transfer their expertise and build valuable partnerships. This can have very positive spill-over effects on other sectors. Notably, in the context of transboundary river basin management, sharing knowledge and discussing best practices in general, is a practical way of advancing cooperation.

The Nexus-Focused Renewable Energy Hard Talks (see Box 10) are a very good example of public and private sector stakeholders exchanging opinions on policies and projects at the regional level, with sustainability at the centre of discussion.

Box 11 - Cross-sectoral, transboundary policy dialogues: the nexus-focused Renewable Energy Hard Talks in Western Balkans

The Renewable Energy Hard Talks are events organized by the UNECE Group of Experts on Renewable Energy (GERE), in cooperation with host countries and other institutional partners[102]. These events are country-focused, multi-stakeholder policy dialogues that aim to identify risks and barriers to renewable energy investments specific to the host countries, and to recommend policy options from international practice to address them, with the ultimate purpose of de-risking

[102] Including the European Commission, USAID, the Renewable Energy Policy Network for the 21st Century (REN21), dena (the German Energy Agency) and others. More information on the Renewable Energy Hard Talks available at: https://www.unece.org/energywelcome/areas-of-work/renewable-energy/unece-hard-talks.html

investment[103]. In Bosnia and Herzegovina[104] (2018) Serbia[105] (2019) and the GERE and the Task Force on the Water-Food-Energy-Ecosystems Nexus of the Water Convention (see Box 7) combined experience to carry out a nexus-focused dialogues during the Hard Talks, including considerations of transboundary coordination when applicable.

These “Nexus Hard Talks” called upon participants (including public sector stakeholders, private sector developers, civil society representatives and financiers) to share their views on the sustainability and nexus aspects of renewable energy. To this end, a specific session of each event was focused on exploring synergies between renewables and the nexus by dedicated workgroups, each focusing on a different renewable technology type. As an outcome of the Hard Talks, participants agreed on the need to integrate sustainability in renewable energy planning, policy-making and investment, and a number of concrete policy recommendations to increase renewable investment in the host countries were adopted according to participants’ input, with some of them having a sustainability dimension[106].

6.2 Ensuring that the private sector delivers on sustainability and nexus priorities

When engaging with project developers and private actors, policy makers should bear in mind that it is key that the outcomes of engagement are sustainable and in line with the government’s social, economic and environmental priorities. Projects must be designed, implemented and operated in compliance with the relevant national laws and in coherence with the international commitments of the government (e.g. 2030 Agenda).).). Because of the key role that Public-Private Partnerships (PPPs) can have in the deployment of renewable energy, UNECE has developed a Standard on PPPs in Renewable Energy [107]. As explained in such standards, in light of SDGs, it is important to measure the impact of projects beyond simply energy generation. In order to do this, the UNECE standards provide guidance to policy-makers to design and implement PPPs that have a “People First”. This”.” approach[108]. The People-first PPP is defined as an approach that achieves a set of socially, economically and environmentally desirable objectives outcomes, by being in line with the UN SDGs, putting people as the main beneficiaries of the projects, increasing access to water, energy, transport and education, especially for the vulnerable members of society, promoting social cohesion,

[103] To achieve this objective, the first four Hard Talks applied a version of the United Nations Development Program (UNDP) “Derisking Renewable Energy Investments” methodology to analyze each host country’s energy and renewables sectors, to identify barriers and risks to investment and to provide policy recommendations, based on international best practices as well as on country-specific particularities, towards de-risking (and, therefore, de-blocking) renewable energy investment.
[104] The Sarajevo Hard Talk was held on 4-5 December 2018. More information available at: http://www.unece.org/index.php?id=50834
[105] The Belgrade Hard Talk was held on 21-22 March 2019. More information available at: http://www.unece.org/index.php?id=51516.
[106] The recommendations from the Hard Talks in Bosnia and Herzegovina and Serbia are available at: http://www.unece.org/index.php?id=52576
[107] The UNECE Standard on PPPs in Renewable Energy can be accessed here: https://www.unece.org/fileadmin/DAM/ceci/ppp/Standards/ECE_CECI_WP_PPP_2018_07-en.pdf
The document can be accessed here: https://www.unece.org/cicppp/public-private-partnerships-ppp/icoeppp/ppp-standards.html
[108] For more information, see the UNECE Guiding Principles on People-first PPPS in support of the SDGS: https://www.unece.org/fileadmin/DAM/ceci/ppp/Standards/ECE_CECI_2019_05-en.pdf

improving the quality of life of communities and contributing to ending hunger and promoting women empowerment[109].

By way of illustration, renewable energy projects that are "people-first" must achieve environmental and social sensitivity, being in "*full compliance with domestic environmental and social protection laws, and international best practice standards*". Governments are thus advised to adopt a set of measures:

- Identify and assessing the environmental and social impacts of partnerships (and projects);
- Implement policies that guide engagement with respect to such impacts (Track 2);
- Develop a management program, including mitigation measures, which addresses the impacts throughout the life of the project;
- Communicate with stakeholders who are affected by the project, through communication and disclosure;
- Institute grievance mechanisms to resolve issues;
- Require Environmental and Social Impact Assessments in order to ensure the environmental and social compatibility of a project.

Ultimately, policy makers should develop a framework that ensures that economic and social gains from a project exceed the cost to end users, off takers and government, accounting also for the costs to the environment and related mitigation activities. The assessment of a project should be based on a "value for people"(VfP) approach. This means that projects should address critical challenges facing humanity such as fighting hunger, poverty, promoting wellbeing by increasing access to essential services, tackling a social agenda promoting social cohesion, etc. The VfP approach proposes that projects' performance be measured by their outcomes and impacts. These should bring the greatest benefit to the people measured with respect to the SDGs.

While economic regulation is necessary, it should not be considered in isolation from other regulatory functions, such as environmental, health and safety rules/regulations and use of natural resources. Notably, the risks associated with climate change are often underestimated when host governments and project sponsors analyses a project's viability. It is important to diligently analyses and address such risks in the early stages of a project, agree on a fair share of subsequent revenue risks, and eventually consider available insurance instruments.

[109] See p. 5

7. Conclusions

This publication focuses on the aspects of sustainability and intersectorality of renewable energy deployment (synergies and trade-offs), with the aim of providing policy makers with a conceptual framework to navigate them. A more effective consideration of these aspects in policy making can help maximizing the benefits brought by a wide deployment renewable energy to society and the environment, and at the same time reducing the negative impact potentially associated with it. In the language of the 2030 Agenda for Sustainable Development, this can help achieving multiple SDGs at the same time while reducing multi-sectoral competition for natural resources, which are increasingly under pressure due to increasing demands, climate change, and widespread environmental degradation.

The report proposes a non-comprehensive “tool-kit” for renewable energy policy makers and guides them through the processes of strategic planning, sustainable policy, and sustainable project development, all of which should be carried out as multi-stakeholder, multi-sectoral consultations. This tool-kit includes step-by-step guidance as well as methods and tools to integrate nexus priorities and sustainability concerns in the renewable energy development comprehensively, organically, and systemically. Crucially, it also integrates the consideration of transboundary impacts and regional cooperation opportunities in the decision -making process.

The application of the tool-kit will strengthen cross-sectoral ties among stakeholders but will also, crucially, help energy policy makers identifying the actors that are responsible for further action in the various sectors, and engaging with them (in this report, we suggest engaging at least with the sectors of water, agriculture/forestry, and environment). All stakeholders are called to identify common priorities, set sustainable goals and targets (notably of renewable energy), discuss opportunities for partnerships, and define mechanisms to eliminate negative impacts. The potential of establishing coordination frameworks for climate change action or sustainable development and, where applicable, transboundary cooperation frameworks to facilitate such exchanges is also acknowledged.

The benefits of regional cooperation in maximising synergies across borders, as well as of addressing transboundary trade-offs in a coordinated, cooperative manner, cannot be overstated. The most evident benefit is economic, because adopting a coordinated approach in planning and deploying renewables on a large scale helps exploiting the complementarity of resources and capacities available, that naturally have varying potentials throughout the territory. Crucially, utilising a diversified mix of resources can also increase the capacity to absorb larger amounts of variable renewable energy such as wind and solar, ultimately optimizing the potential of the resources available.

The key to successfully exploit synergies and effectively address trade-offs is the capacity of energy policy makers to engage with other sectors and to convene these multi-stakeholder dialogues, thereby generating a cross-sectoral ownership of renewable energy developments and beneficial partnerships. For instance, policy makers are called to identify and address at the gaps and barriers that exist to the exploitation of synergies and to the resolution of trade-offs by applying a Sustainability Assessment Matrix. Even from a preliminary application of the Matrix it is evident that filling gaps and addressing barriers extends beyond the competences of policy makers, underlining the need to work with other actors outside the energy sector in applying the Matrix.

The tool-kit proposed in this report is non-comprehensive. Experts and practitioners are invited to contribute to its improvement with appropriate tools and methods. Furthermore, policy makers are invited to test the application of it in their strategies, policies, and projects, to validate its applicability and to provide feedback. The UNECE stands ready to support their effort according to its mandate and available resources.