Operational Blueprint: Designation of Renewables Acceleration Areas

February 2025

The Operational Blueprint for designation of Renewables Acceleration Areas was prepared by the Energy Community Secretariat and The Nature Conservancy within the partnership on the project "Planning, programming and permitting of RES projects in the Energy Community".

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I. Introduction

The Ministerial Council of the Energy Community set in December 2022[1] the national renewable energy (RE) 2030 targets for each Contracting Party, as well as a first overall Energy Community target of 31% of energy from renewable energy sources (RES) in gross final energy consumption across all Contracting Parties (CPs). The Clean Energy Package was integrated into the Energy Community legal framework in 2021[2] and in 2022[3], primarily aiming to enable the electricity markets coupling and to set the basis for integrated planning of energy and climate objectives, policies and measures within National Energy and Climate Plans (NECPs).

While most of the CPs achieved the overall 2020 RE targets, the majority of them has not reached the RE targets in the electricity sector.[4] The Western Balkans' installed capacity for electricity generation from solar and wind sources is currently around 1.5 GW, or only 7% of their total installed capacity, which amounts to 20.4 GW.[5] Specifically, they have 662 MW of utility-scale solar capacity and 865 MW of wind capacity in operation.[6] A significant portion of the utility-scale solar capacity (38%) was added in 2023, while a large share of the wind capacity (48%) became operational in 2019.[7] The installed RES capacity of all CPs in 2022 was 28.765 MW.[8] According to a study conducted for the Central and South-Eastern Europe Energy Connectivity Group (CESEC Group), power generation from renewable energy sources in the EU Member States of the CESEC Group would need to slightly more than double to reach the RES targets, whereas, for the CPs the increase should be at least four-fold.[9]

The interest in connecting intermittent solar and wind energy sources to the electricity grid is significant in the CPs, ranging from 0.7 times (Montenegro) to 3.7 times (Albania) the capacity of the existing power plants.[10] Therefore, for the massive scale-up of renewable energy projects, the electricity grids need to be reinforced and modernised, and flexibility solutions need to be ensured.

On the other hand, the development of wind and solar can have significant effects on ecosystems, biodiversity and communities.[11] A recently conducted study for the pan-European region, covering also some CPs (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia) highlighted that the business-as-usual siting approach, which is based primarily on maximising development potential patterns, disproportionately targets high-conflict land cover types.[12] The study showed that roughly half of the installed capacity for both wind and solar was predominantly built on high-conflict land cover types. Moreover, it concluded that achieving 2030 renewable energy targets exclusively on low-conflict land will present a significant challenge for countries with ambitious RE targets and high proportions of high-conflict land, including almost all CPs of the Western Balkans.

1 Decision of the Ministerial Council of the Energy Community D:2022/02/M-EnC
2 Decision of the Ministerial Council of the Energy Community D:2021/14/MC-EnC
3 Decision of the Ministerial Council of the Energy Community D:2022/03/MC-EnC
4 RE targets in electricity sector were reached only by Montenegro and Ukraine. Certain progress was made by Albania, Serbia, Bosnia and Herzegovina and North Macedonia, but none of them managed to meet the targets. Kosovo* and Moldova fell significantly short of their targets. See for more: Energy Community CBAM Readiness Tracker, June 2023.
5 Global Energy Monitor, REScoop.EU, CEE Bankwatch Network, Electra Energy: Report A race to the top Western Balkans, July 2024.
6 Ibid.
7 Ibid.
8 Energy Community Secretariat calculations for total RES capacities.
9 European Commission, Study on the Central and Southeastern Europe energy connectivity (CESEC) cooperation on electricity grid development and renewables, March 2022, pages 10 and 64.
10 Energy Institute Hrvoje Požar's Permit-Granting and Planning of Energy Projects in the Energy Community: Overview, Recommendations, and Best Practices (Permitting Study), page 119.
11 IUCN, Mitigating biodiversity impacts associated with solar and wind energy development – Guidance for project developers.
12 Kiesecker JM, Evans JS, Oakleaf JR, Dropuljić KZ, Vejnović I, Rosslowe C, Cremona E, Bhattacharjee AL, Nagaraju SK, Ortiz A, Robinson C, Ferres JL, Zec M and Sochi K (2024), Land use and Europe's renewable energy transition: identifying lowconflict areas for wind and solar development. Front. Environ. Sci. 12:1355508. doi: 10.3389/fenvs.2024.1355508.

Finally, it is essential to overcome administrative obstacles to scaling up renewable energy projects and related infrastructure, particularly addressing lengthy permitting processes and inadequate integration of spatial and energy planning. For example, the procedures for the connection of renewable energy projects to the transmission grid in CPs may take from 1 year (Ukraine) to 7 years (Bosnia and Herzegovina).[13] A permitting delay of 2 years for solar plants is estimated to cost approximately EUR 25 000, representing 10% of project costs, while a 7-year delay for wind plants incurs an estimated cost of EUR 4 850 000, accounting for 9% of project costs.[14] The length of these procedures is partly a consequence of insufficient grid infrastructure, but it is partly a consequence of inadequate queue management procedures to separate highly feasible projects from purely speculative ones. The former is difficult to address quickly as it requires building additional infrastructure, but the latter could be addressed comparatively quickly through updates to the legal framework. When it comes to spatial planning, four of nine CPs do not have updated National Spatial Plans,[15] while the zone layering, including sensitivity mapping for the development of renewable energy projects is not defined, except there is a certain progress in Albania.[16]

In 2022, the European Commission introduced accelerated permitting procedures in non-binding Recommendation[17] updated in 2024[18] aimed at speeding up the deployment of renewable energy projects, and reducing administrative barriers and fast-tracking the approval process, particularly in light of the REPowerEU initiative and the need to urgently address the security of supply issues that the war in Ukraine brought and reduce dependency on fossil fuels.

Following up on the Recommendation, the revised Renewable Energy Directive EU/2023/2413[19] (revised RED) introduced the concept of renewables acceleration areas (RAAs) that requires Member States to designate areas in which the deployment of renewable projects will not significantly impact the environment. The projects developed in RAAs may consequently benefit from the exemption from environmental impact assessment (EIA) and streamlined and expedited procedures, ultimately aiming to shorten the permitting procedures. The European Commission published the Guidance on designating renewables acceleration areas[20] to ensure timely implementation of the concept in the Member States by February 2026, as required by revised RED.

13 Permitting Study, page 119.
14 World Economic Forum, How permitting processes are hampering Europe's energy transition, September 2024.
15 Permitting Study, page 78.
16 Permitting Study, page 82.
17 Commission Recommendation of 18.5.2022 on speeding up permit-granting procedures for renewable energy projects and facilitating Power Purchase Agreements, C/2022/3219 final.
18 Recommendation and guidance on speeding up permit-granting for renewable energy and related infrastructure projects, 13 May 2024.
19 Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652.
20 Commission Staff Working Document, Accompanying the document Commission Recommendation on speeding up permit-granting procedures for renewable energy and related infrastructure projects, 13 May 2024.

When it comes to the Energy Community region, the study Permit-Granting and Planning of Energy Projects in the Energy Community: Overview, Recommendations, and Best Practices[21] (Permitting Study) commissioned by the Energy Community Secretariat and Policy guidelines on the Permit-Granting and Planning of Energy Projects in the Energy Community[22] assessed RES-related permitting and planning issues, identified the barriers, and provided recommendations along with best practices for overcoming planning and permitting bottlenecks in CPs.

Following up the Permitting study and Policy guidelines, the cooperation with the Nature Conservancy (TNC) was established, aiming to support CPs in proactively identifying low-conflict sites for solar and wind projects. Unlike the business-as-usual siting approach, where sites are selected primarily based on their development potential and environmental and social conflicts are mainly detected during the EIA process, TNC smart siting approach involves detecting areas with high development potential, but proactively excludes areas with a likely negative environmental and social impact. The added value of this approach is that the assessment detects suitable areas on a planning strategic level and identifies potential conflicts linked to socio-environmental values at the moment before the location is selected,[23] thus reducing financial risk and risk of delays.

At its 22nd meeting in December 2024, the Ministerial Council of the Energy Community adopted a Recommendation on accelerating the deployment of renewable energy projects inviting CPs to prepare legal and institutional setting for the implementation of the provisions of revised RED concerning the RAAs concept, streamlining permitting processes and facilitating grid connections. [24]

This Blueprint aims to support decision-makers and experts in the Energy Community region in understanding the concept of RAAs and the means for its implementation, by providing an analysis of different types of priority surfaces against several factors. The Blueprint will also explain the necessary steps to be taken by relevant authorities, from the point of committing through data collection to the designation of RAAs. This Blueprint targets solar[25] (both rooftop and ground-mounted) and onshore wind[26] projects due to their anticipated substantial contribution to the installed power generation capacity in the Energy Community region by 2030 and beyond.[27]

21 Energy Institute Hrvoje Pozar, Permit-Granting and Planning of Energy Projects in the Energy Community: Overview, Recommendations, and Best Practices, June 2024.

22 Energy Community Secretariat, Policy guidelines on the Permit-Granting and Planning of Energy Projects in the Energy Community, PG 02/2024/, 15 June 2024.

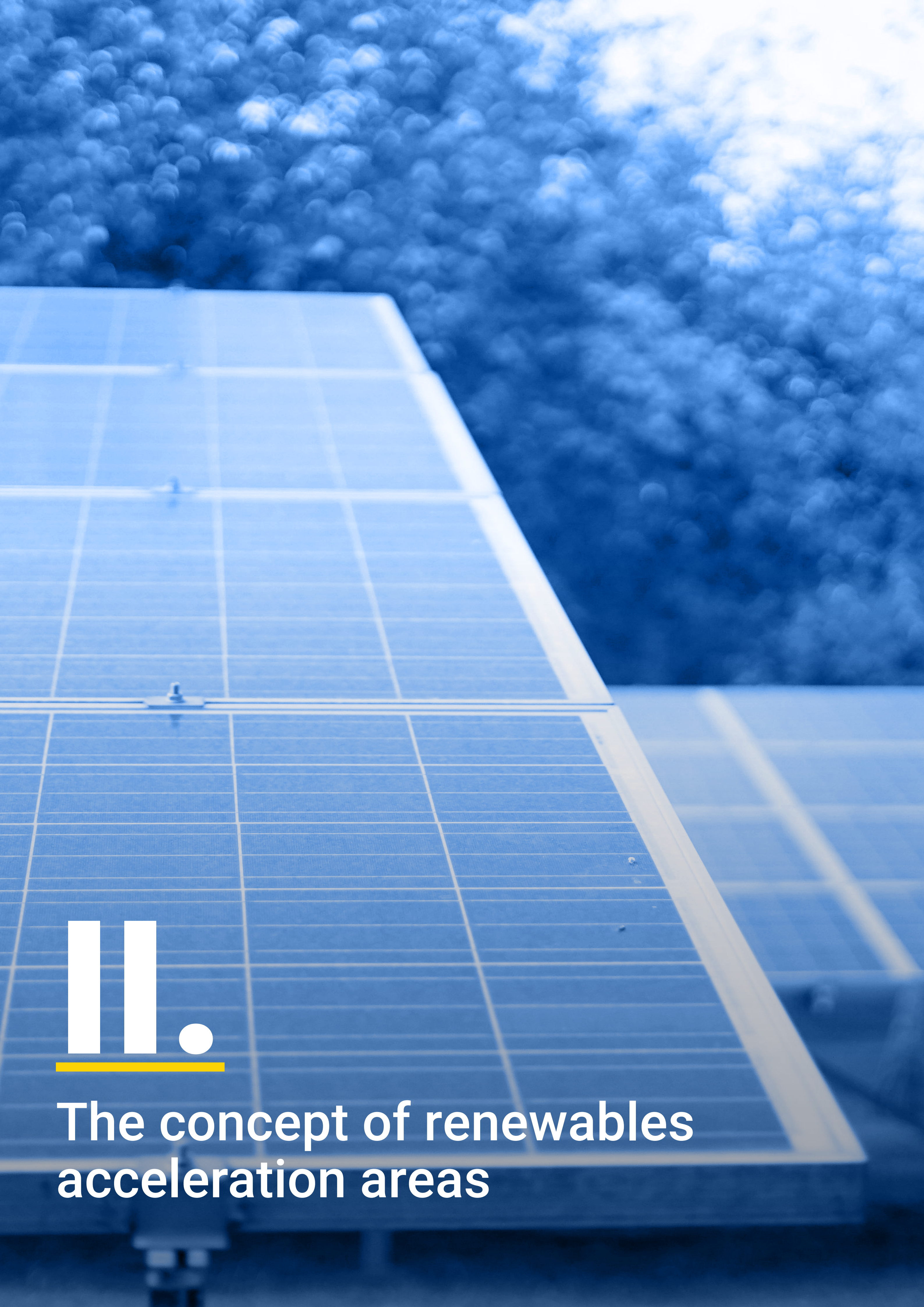
23 The approach has been already applied in several projects in Southeast Europe region described in Chapter III.

24 Ministerial Council Recommendation 2024/1/MC-EnC on accelerating the deployment of renewable energy projects and implementing the energy efficiency first principle of 12 December 2024.

25 The EU Solar Strategy aims to bring 320 GW of solar photovoltaic by 2025 (more than doubling compared to 2020) and almost 600 GW by 2030. According to some estimates, rooftop PV only could provide almost 25% of the EU's electricity consumption. See more: EU Solar Energy Strategy, COM 2022/221 final.

26 In 2022, wind energy provided on average 16% of electricity consumed in the EU and often reaches more than 30% per day. The EU target of at least 42.5% of renewables by 2030 will require the installed capacity to grow from 204 GW in 2022 to more than 500 GW in 2030. See more: European Wind Power Action Plan, COM/2023/669 final.

27 European Commission, Study on the Central and Southeastern Europe energy connectivity (CESEC) cooperation on electricity grid development and renewables, March 2022, page 64.



II.

The concept of renewables acceleration areas

The revised RED introduces a set of provisions for identifying and mapping areas with high development potential where renewable energy generation plants and co-located storage[28] would not have a significant impact on environment. In these areas, permitting timelines are shortened, and environmental assessments are simplified to encourage rapid deployment of renewables like wind and solar.

Renewables acceleration areas should be designated for one or more renewable energy technologies, as a subset of areas identified as necessary for achieving 2030 energy targets set in NECPs (Article 15c). The revised RED envisages the following criteria to be taken into account in the RAA designation process:

> prioritising artificial and built areas; [29]

> excluding Natura 2000 sites and areas designated under national protection schemes for nature and biodiversity conservation, major bird and marine mammal migratory routes, as well as other areas identified on the basis of sensitivity maps and the tools referred to in the next point;

> using tools and datasets to identify the areas where the renewable energy plants would not have a significant environmental impact, including wildlife sensitivity mapping.[30]

Mapping the low-conflict areas

The exercise of mapping low-conflict areas may extend beyond the priority areas. In case the analysis is conducted for the whole territory of one CP or a smaller region, the availability of data and data quality on protected areas, habitat types and species that might be endangered will determine the scope of the study and the need for additional analysis. Therefore, the process of identifying low-conflict areas would require different timelines and scopes for each CP, so the analysis is comprehensive and excludes the possibility of designating RAAs on high-conflict areas. This approach improves the understanding of the areas that need to be protected.

It's important to emphasise that the lack of data for a particular area does not imply that the area will be designated as an RAA. On the contrary, it indicates that the area will be excluded from consideration for such designation, or that additional sensitivity mapping will be carried out.

28 Co-located storage means an energy storage facility combined with a facility producing renewable energy and connected to the same grid access point (Article 2 (44) (d) revised RED).

29 Revised RED specifically lists the following areas that should be prioritised for designation: rooftops and facades of buildings, transport infrastructure and their direct surroundings, parking areas, farms, waste sites, industrial sites, mines, artificial inland water bodies, lakes or reservoirs and, where appropriate, urban wastewater treatment sites, as well as degraded land not usable for agriculture. More about the specific types of areas in the next chapter.

30 In the European Commission's Guidance on designating renewables acceleration areas good practices and recommendations on the means for implementing the concept are provided; among others, the TNC project in Zadar is recognised as an example of good practice.

Upon the mapping exercise, the next step is the preparation of a plan where the RAAs are identified (the RAA plan). An integral part of the RAA plan is a mitigation rulebook consisting of a set of mitigation measures for designated RAAs that developers have to comply with aiming to avoid or reduce negative environmental impact (Article 15c(1)(b)). Namely, revised RED prescribes that mitigation measures shall be defined in the RAA plan and applied by individual projects in such way as to ensure compliance with the obligations from the Habitats Directive 92/43/EEC concerning conserving natural habitats, the habitats of species, as well as disturbance of the species (Article 6(2)) and strict protection for animal species (Article 12(1)), as well as from the Birds Directive 2009/147/EC concerning protection for all species of birds (Article 5) and the Water Framework Directive 2000/60/EC concerning prevention of deterioration of all bodies of surface water (Article 4(1)(a)(1)).

When defining mitigation measures, it is crucial to take into account the specificities of each identified RAA, the type of renewable energy technology and co-located storage and the potential environmental impacts (Article 15c (1)). This is particularly important if the national legislation has not implemented the EU environmental acquis. In that case, mitigation measures have to be particularly firm. A mitigation hierarchy framework should be adhered to, to manage risks and potential impacts. Namely, first and foremost, it is important to anticipate potential risks and design the system in a way to avoid them, and then implement measures to reduce the impact that cannot be avoided. As stressed in the Commission's recommendation, careful selection of areas where the deployment of renewable energy sources is not expected to have a significant environmental impact can be considered the first measure to avoid or significantly minimise the negative environmental impact. Annex 3 of this blueprint provides a list of mitigation measures that may be applied depending on the environmental impact and technology.

Finally, the draft RAA plan, along with a mitigation rulebook has to undergo a strategic environmental assessment in accordance with the Strategic Environmental Assessment Directive,[31] as well as to the appropriate assessment in accordance with the Habitats Directive if it is likely that the plan will have a significant impact on Natura 2000 sites.

Aiming to accelerate permit-granting procedures, revised RED introduces certain advantages for renewable energy plants and co-located storage located in designated RAAs. For example, it prescribes the maximum duration of the permitting procedures up to 12 months (Article 16a (1))[32] and obliges the Member states to introduce administrative tacit approval for intermediate steps (Article 16a (6)). The revised RED provides for the possibility to exempt renewable energy projects from conducting environmental impact assessment and appropriate assessment, provided that projects comply with the mitigation measures set in the RAA plan (Article 16a (3)). However, it is important to note that the new applications will still be subject to a screening process by the competent authorities, to identify if there is a high probability of significant adverse effects (Article 16a (4)). If competent authorities still find that compliance with the mitigation measures from the RAA plan are not enough to avoid the significant unforeseen adverse effects, they may require that such renewable energy projects are subject to an EIA and, if applicable, to an assessment pursuant to Habitats Directive 92/43/EEC.

The designation of RAAs necessitates thoughtful consideration of various environmental factors to ensure that the development of renewable energy projects in these areas minimises environmental impact, allowing at the same time shortening the permitting procedures and fast scale-up of renewable energy projects.

31 Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment, OJ L 197, 21.7.2001.

32 The permit-granting procedure in accordance with Article 16 (1) of revised RED includes all administrative stages from the acknowledgment of the completeness of the permit application to the notification of the final decision on the outcome of the permit-granting procedure by the relevant competent authority or authorities. The procedure also covers all relevant administrative permits to build, repower and operate renewable energy plants, as well as heat pumps and co-located energy storage, and assets necessary for the connection of such plants, heat pumps and storage to the grid, including grid-connection permits and environmental assessments.

III.

TNC smart siting approach

The TNC smart siting approach identifies areas suitable for the deployment of renewable energy projects where the risk for conflicts with environmental and social values is minimal. While the standard, or "business-as-usual" approach to site selection taken by RE developers typically incorporates some consideration of possible conflicts, a clear emphasis is put on development potential mapping, and a majority of potential environmental and social conflicts can only be detected at the planning stage when the project location is already defined. If significant conflicts are detected at this stage, the project may have already incurred costs, which is a financial risk borne by the developer that TNC proactive approach can mitigate.

The TNC approach takes into consideration the specificities of the analysed territory, county-specific data, and legislative setup, as well as the characteristics of the considered renewable energy technology. It uses a broad range of available data from national and international sources, including existing EIAs and research for the specific ecosystems, habitats or species conducted by national authorities, research institutions and NGOs. Moreover, local experts familiar with the country's biodiversity context are engaged to provide an understanding of local circumstances and verify the results.

When data on protected areas, species or habitats is unavailable or of insufficient quality, and there is a reasonable assumption that development in a certain area may cause negative impacts, the TNC smart siting approach needs to be applied in a precautionary way. Such areas should either be assigned a high conflict score or excluded from the analysis.

The TNC smart-siting approach integrates four steps. The first step involves constraint and development potential mapping. Constraint mapping is an exercise of excluding land based on legal/regulatory (i.e. zoning restrictions and protected area regulations) and biophysical (i.e. steep slopes, areas prone to flooding, etc.) constraints. Development potential mapping takes constraint maps and filters these maps further through a set of economic criteria (e.g. resource yield, available grid capacities, proximity to power lines and transport infrastructure). Potential sites are further ranked according to their suitability for wind and/or solar development.[33]

The second step involves wildlife sensitivity mapping, which identifies environmental or biodiversity conservation values, and detects potential conflicts, by analysing a number of datasets concerning protected areas, habitats, endangered species, migratory and corridor routes, land cover, etc. The criteria and respective thresholds for sensitivity mapping are defined through a consultative process with national experts having relevant expertise. The third step involves examining social values within a region to identify potential areas of social conflict. The investigation is conducted by analysing a number of datasets concerning historical and cultural values, touristic and recreational zones, visual aesthetic landscapes, agricultural land, freshwater systems, forest cover, etc. Additional assessments/modelling may be conducted for sensitive species or habitats, or cultural and social values, depending on the data gaps and request of national authorities.

In the second and third step, the TNC smart siting approach uses a coarse-filter and fine-filter approach to identify environmental and biodiversity hotspots and thus map potential conflicts with renewable energy development. The coarse-filter approach detects ecosystems or land cover classes and can often be derived from already available land-use land cover maps. The fine-filter approach is used to complement the coarse-filter approach, by detecting the occurrence and distribution of habitats or species not covered in the first filter. The following species categories may be analysed: endangered species at the global level (i.e. those meeting International Union for Conservation of Nature – IUCN Red List criteria) or regional level (the EU Birds and Habitats Directives and the Bern Convention), species of special concern, endemic, disjunct - geographically isolated populations and wide-ranging.[34]

The results of each of these three steps are maps that depict areas with a high suitability and low socio-environmental risk for conflicts.[35] The fourth step involves bringing together three maps and choosing areas suitable for low-conflict renewable energy deployment. The estimated generation potential in these areas is typically compared with the set RE targets.

It should be noted that throughout the mapping process, due regard is given to stakeholder engagement and collaboration, including national and local authorities, experts and specifically the local community, who provide valuable insights and resources at every stage and help to verify results and align priorities. More on the means of stakeholder engagement is provided in Chapter VII.

33 These criteria are weighted typically between 0 and 1 and sum to 1.

34 For more information about this approach, please see the Handbook for Practitioners, pages 17–19.

35 Annex 2 contains the list of data that should be collected and analysed for creating maps.

TNC projects in the EU Member States and Western Balkans

The TNC smart siting approach may be applied on the whole territory (such as in the case of the study developed for solar PV in Serbia, Croatia or Portugal), the territory of a city or canton (Nikšić in Montenegro and Zadar County in Croatia) or only for a specific type of priority areas (brownfields and degraded lands in North Macedonia).

A pilot project in Zadar County, Croatia, conducted in 2018-2020, revealed that over 1.1 GW of solar and wind potential is available in the county's areas where the lowest risk of environmental and social conflicts is estimated. For comparison, this estimated potential is equivalent to half of Croatia's 2030 wind and solar target. In the next phase, the national authorities of Croatia decided to extend the analysis to the whole territory of Croatia within the process of designation of RAAs in accordance with the revised RED. TNC, in collaboration with the Hrvoje Požar Energy Institute, produced biodiversity conflict maps, which were published in December 2024 for Croatia's Ministry of Environmental Protection and Green Transition. The advanced maps analyse approximately 1 million animal observations spanning 350 species, offering detailed distribution models for key species from vulnerable groups such as birds, bats and large carnivores. By incorporating data on habitats, species and ecological processes, these maps enable precise risk assessments and support informed decision-making for solar and wind energy development. The Zadar County project is also recognised in the Commission's Guidance on designating renewables acceleration areas as a best practice for implementing the RAA concept. Moreover, TNC's team is currently supporting Portugal in mapping low-conflict areas and designating RAAs in accordance with the revised RED.

When it comes to the Energy Community region, the study in the city of Nikšić, Montenegro resulted in the conclusion that concentrating only on areas with the lowest conflict potential and moderate to high development prospects, there are approximately 4 km² available for wind power and 50 km² for solar power. This translates to an estimated potential capacity of around 40 MW for wind and 2.7 GW for solar. Building on the Nikšić study, Montenegro recently launched a countrywide study aiming to identify low-conflict areas for the whole territory. Moreover, a map with the top 100 sites for solar utilities of more than 10 MW was created for the whole territory of Serbia, estimating that 1 GW of solar energy could be deployed on 25 km². Finally, in North Macedonia, phase one focused on the wind and solar potential of brownfield areas, while the second phase analysed appropriate locations on the entire territory, still prioritising barren land. The results indicated that North Macedonia has 64 000 hectares suitable for solar PV and 4 600 hectares for wind energy. Even after fully excluding all critical bird and plant habitats, the potential remains as high as 11 GW for solar PV and 0.35 GW for wind energy.

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IV.

Priority areas for renewable energy deployment

Revised RED specifically lists the following areas that should be prioritised for RAA designation: rooftops and facades of buildings, transport infrastructure and their direct surroundings, parking areas, farms, waste sites, industrial sites, mines, artificial inland water bodies, lakes or reservoirs and, where appropriate, urban wastewater treatment sites, as well as degraded land not usable for agriculture.[36] While revised RED sets out that these areas are to be prioritised, constraints and risks related to them should still be assessed, since they still may have environmental and social values that might be endangered by the development of renewable energy projects. These priority areas can be analysed separately; however, they can also be integrated into a more comprehensive study.

For the purpose of this blueprint, these priority areas are grouped into five clusters: 1) rooftops and facades of buildings; 2) transport infrastructure corridors and parking areas; 3) degraded land not suitable for agriculture; 4) waste sites, quarries, industrial sites and coal mines; and 5) artificial inland water bodies, lakes and reservoirs and urban wastewater treatment sites. These will be described and analysed against nine aspects: regulatory aspects, biophysical/technical aspects, infrastructure access, environmental impact, mitigation measures, social impacts, economic considerations, ownership and relevant stakeholders. The stakeholders that need to be involved in the process of designation of RAAs on specific priority areas are listed. These stakeholders need to be additionally involved along with institutions in charge of environment, nature protection, energy and spatial planning, which are key players in this process.

IV.1 Rooftops and facades of buildings

The benefits of the designation of RAAs on rooftops and facades of buildings for solar PVs may extend to other sectors, such as construction, and contribute to other targets, such as energy efficiency or energy poverty. The newly adopted Energy Performance Building Directive (EU) 2024/1275 (EPBD)[37] requires the permit-granting and simple notification provisions of revised RED to be extended to buildings' solar installations. Moreover, according to the new EPBD, all new buildings should be designed to optimise their solar energy generation potential.[38] While rooftop PVs should be supported, it is necessary to extend the analysis of suitable areas to other types of priority surfaces, and beyond, because building PVs alone will not be enough to reach RE targets.[39]

1. **Regulatory aspects:** placing PV installations on certain types of buildings may be prohibited, such as those having historical or cultural protection status. Moreover, CPs should address risks associated with non-compliance with regulatory requirements, such as building without a construction permit. Since this is a frequent issue in CPs, they should simultaneously address illegal construction to mitigate the risk of unsuccessful investments. On the other side, to simplify the installation of solar PVs on rooftops, many CPs (Albania, Kosovo*, Moldova, Montenegro, North Macedonia, Bosnia and Herzegovina, in the entity Republika Srpska, and Serbia) prescribed that the construction permit is not needed for the small-scale installations used for self-consumption.[40]

2. **Infrastructure access:** all buildings should be connected to the distribution grid and preferably fitted with prosumer-compatible electricity metering systems to enable implementation of net metering or net billing.

3. **Technical aspects:** to assess the national potential of rooftops and facade PVs, available rooftop and facade areas need to be estimated. For this calculation, the technical conditions of buildings, such as the slope of the roof, the safety and permissible roof load of the roof, insolation and shading, and energy demand of buildings, will have to be taken into account.

4. **Environmental impact:** PVs on buildings have a low environmental impact; however, special consideration shall be given to the avoidance of obstruction and disturbance of nesting birds and roosting bats.

36 Article 15c (1) (a) (i) of revised RED.
37 Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings (recast).
38 Article 10 of EPBD (EU) 2024/1275.
39 EU Commission Guidance on designating renewables acceleration areas, page 1.
40 Permitting Study, pages 56–57.

5. **Mitigation measures:** before placing installations, buildings should be monitored for the presence of birds and bats and, if necessary, adequate mitigation measures taken, including providing alternate nesting/roosting places, securing wiring to prevent entanglement or electrocution, etc.

6. **Social impacts:** estimates suggest that installing PV systems may increase the value of buildings and apartments by 6% to 7%[41], making neighbourhoods more attractive and future oriented. Moreover, the PV installations are visible, which can increase public awareness and motivate society to integrate solar installations in their buildings. Despite the listed positive impacts, care should be taken when considering buildings valued for their historical, architectural and/or aesthetic value.

7. **Economic considerations:** while the initial investment may be significant for one average household, self-consumption may lower electricity bills depending on the consumption of households and adopted net metering or billing scheme. Targeted incentives for residential buildings would be welcomed, since households, especially vulnerable ones, may not be able to cover high investment costs. The incentives may be in the form of investment subsidies, favourable loans, exemption on VAT, etc. Moreover, energy saving company (ESCO) may take responsibility for the upfront costs of renovation of buildings and solar PV installations, as well as for implementation and management of the project, while guaranteeing a certain level of energy savings and being compensated based on the actual savings achieved.

8. **Ownership:** the ownership differs to the following sub-categories of buildings: single residential buildings, multi-apartment residential buildings, non-residential and public buildings. Decision-making in multi-apartment buildings is the most complex one, due to the requirement of unanimity in many jurisdictions, for which reason the implementation may be delayed. On the other hand, public buildings have usually an exemplary role, due to the simplicity of decision-making. Moreover, as of 2024, CPs are obliged to renovate at least 3% of the total floor area of heated and/or cooled governmental buildings annually[42], which is also an opportunity to accelerate the installation of solar PVs on rooftops and facades of public buildings.

9. **Relevant stakeholders:** ministries, national or local agencies in charge of buildings, energy and construction, regional and local authorities, housing associations and building managers.

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41 Asproudis, E., Gedikli, C., Talavera, O., & Yilmaz, O., Returns to solar panels in the housing market: A meta learner approach, Energy economics, Volume 137, September 2024.

42 Article 5 of Directive 2012/27/EU of 25 October 2012 on energy efficiency, as amended by Directive (EU) 2018/2002 as adapted and incorporated by the Ministerial Council decisions 2015/08/MC-EnC, 2021/14/MC-EnC and 2021/14/MC-EnC.

IV.2 Transport infrastructure corridors and parking areas

Solar and wind projects are commonly built near transport infrastructure corridors, such as highways, railways and airports. Additionally, solar power plants may be built on noise barriers, resting areas and parking lots. These structures offer significant benefits in terms of accessibility, grid connectivity and public awareness. One study employed geospatial data to evaluate the potential for large-scale deployment of vertical solar panels along major roads and railways in Europe, considering factors such as environmental constraints, land use limitations and techno-economic parameters.[43] The findings indicate a potential PV capacity of 403 GWp within the EU, which equates to 55% of the EU's total solar PV capacity target for 2030. The potential for integration of solar PVs into transport infrastructure corridors may be further assessed at the national level in transport strategies or by companies that manage transport infrastructure networks.

1. **Regulatory aspects:** compliance with safety regulations, especially in relation to electrical installations in public spaces and near transport routes, needs to be considered. The construction of objects in the buffer zones near transport infrastructure might be restricted. The width of buffer zones depends on the type of road (major or minor road) and proximity of the settlement and differs in every jurisdiction. In case the jurisdiction does not define buffer zones, siting experts use typical buffer zones of 200 m for major roads and 100 m for minor.[44]

2. **Infrastructure access:** proximity to the electricity transmission and/or distribution infrastructure, specifically power lines and substations, reduces the cost of connecting projects to the electricity grid, and proximity to transport routes facilitates access for construction, maintenance and monitoring. Depending on the size of the project, its technical requirements, the characteristics of the terrain and other factors, the feasible distances can vary, and should be assessed on a case-by-case basis.

3. **Technical aspects:** noise barriers must be structurally capable of supporting the additional weight of solar panels and withstanding wind loads, as well as tolerating vibrations from passing vehicles. The mounting system must absorb or tolerate these vibrations without damaging the panels or the barrier. The solutions range from vertically integrating standard modules and mounting them on noise barriers to custom designs with acoustic absorbers between PV strings, including small-width modules on triangular absorbers.[45] Installing renewable energy plants on land near transport infrastructure requires the assessment of soil stability and drainage requirements to prevent soil erosion and water detention. Finally, solar panels can cause glare, potentially distracting drivers or train operators; therefore, anti-glare coatings or specific design considerations are necessary to mitigate this risk.

4. **Environmental impact:** installing solar plants on noise barriers, rest areas or parking lots has minimal environmental impact. However, building solar or wind farms in the vicinity of road passes are sensitive as to increase the risk of additional habitat fragmentation and may limit the movement of animals.

5. **Mitigation measures:** given the limited ability of animals to pass the transport infrastructure, PV and wind plants should be located at a suitable distance from road crossings and bridges, ensuring safe movement of animals. When defining the mitigation measures, mitigation measures defined in existing EIAs for transport infrastructure and already applied should be taken into account.

6. **Social impacts:** local communities are not expected to have objections against the construction of renewable energy plants on transport infrastructure unless the land near transport infrastructure is used for agriculture. Projects near and on transport infrastructure are highly visible, which can increase public awareness of and support for renewable energy and can serve as demonstrative examples.

43 Kakoulaki et al., European transport infrastructure as a solar photovoltaic energy hub, https://doi.org/10.1016/j.rser.2024.114344.

44 TNC Handbook for Practitioners, page 41.

45 Fraunhofer-Institut für Solare Energiesysteme ISE, Photovoltaic Noise Barriers as Energy Generating Infrastructure: Functional Overview about Five Solutions, presented at European Photovoltaic Solar Energy Conference and Exhibition 2023.

7. **Economic considerations:** placing installation near the transport infrastructure can result in lower costs due to proximity to the grids and roads, while land transaction costs may vary depending on the ownership of the land near the transport infrastructure.

8. **Ownership:** the land near transport infrastructure may be both privately or publicly owned, while noise barriers, rest areas and parking lots are usually owned publicly and managed by one company. Installing renewable projects are often easier on publicly owned property, as public entities tend to support initiatives aligned with sustainability goals, simplifying negotiations.

9. **Relevant stakeholders:** ministry, national and local agencies in charge of transport, companies in charge of management of transport infrastructure and parking areas.

IV.3 Degraded land not suitable for agriculture

Land degradation is reduced capability of the land to produce benefits from a particular land use under a specified form of land management.[46] There are five degradation processes (aridity, vegetation decline, soil erosion, soil salinisation and soil organic carbon decline) that have a major influence on land productivity.

When it comes to agricultural land, it might not be suitable for agriculture due to contamination or poor soil quality. Even degraded land with sparse vegetation may still have restoration potential, which should be assessed before repurposing such land for construction. If the restoration of degraded agricultural land for food production or biodiversity protection is not possible, identifying and repurposing these areas may lead to designating them as RAAs.

Multiple usage of land

The revised RED also emphasises that the multiple usage of land should be promoted (Article 15b (3)). When integrating energy production with other activities in a given area, it is essential to consider the existing uses of that area. Pursuing land restoration alongside renewable energy deployment can support climate mitigation and biodiversity.

Solar energy installations often require a full repurposing of land solely for energy production, limiting its original use and disrupting ecosystems, soil health and biodiversity, especially if not designed with environmental considerations like pollinator habitats. However, fertile agricultural land may be utilised for both food production and solar power generation simultaneously in a process called agrivoltaics. Many EU Member States introduced in their laws the concept of agrivoltaics and extended the incentives for this type of renewable projects.

When it comes to wind power, it allows for coexistence with traditional land activities, such as farming or grazing, due to the smaller physical footprint of wind turbines. However, if wind turbines are installed on land owned by small landholders, the land around them might not be fully usable for farming.

46 United Nations Office for Disaster Risk Reduction, definition of land degradation.

1. **Regulatory aspects:** the use of agricultural land for other purposes than agricultural is usually forbidden or restricted; however, some jurisdictions allow for agricultural land of the lowest fertility to be used for renewable projects. For example, agricultural land graded as high or very high degraded according to Land Multi-degradation Index (LMI)[47] having the poorest quality may be utilised for the installation of accelerated deployment of renewable energy projects.[48] An additional limitation might be that the regulation does not recognise the multiple uses of land and that repurposing might be needed. The land repurposing procedure might need the development of a plan outlining the new use for the land, obtaining necessary permits from local authorities that ensure compliance with environmental and zoning regulations, as well as payment of certain administrative fees.

2. **Infrastructure access:** if the land is near transmission or distribution lines and transport infrastructure, installing and connecting a PV plant to the grid will be more straightforward and cost-effective. However, if the land is remote, significant investment may be needed to extend the grid or build new transmission or distribution lines, which could be a barrier to development.

3. **Biophysical aspects:** assess the soil conditions to ensure that the land is sufficiently stable and that the installations do not exacerbate erosion or cause any soil and/or groundwater contamination.

4. **Environmental impact:** the barren land with sparse vegetation may still have restoration potential and be used for food production or may have value for wildlife species, particularly birds, insects and small mammals that thrive in semi-natural habitats. Therefore, restoration potential needs to be assessed on a case-by-case basis. Moreover, construction on eroded land may increase runoff, leading to sedimentation in nearby water bodies, which can harm aquatic ecosystems.

5. **Mitigation measures:** in case of risk of erosion or contamination, it is important that soil erosion and contamination prevention and control measures are integrated. If it is determined that the construction may cause habitat loss and deterioration, land management plans may be implemented with measures for the development of grassland habitats and crop areas.[49]

6. **Social impacts:** it's possible that the local communities will oppose the construction of renewable plants on agricultural land even though it is degraded; this might be the case if the nearby land is suitable for agriculture and may be negatively impacted by the construction. Encouraging local communities to participate not only in the permitting process, but also in the co-ownership over renewable energy plants, enhances transparency and fosters trust with local communities.

7. **Economic considerations:** the land transaction costs may vary depending on the ownership of the land. In case the land is contaminated or eroded, implementing geotechnical adaptations might increase the costs of the project.

8. **Ownership:** agricultural land may be either privately or publicly owned. The implementation of renewable projects might be easier if the land is publicly owned because public entities are often more supportive of renewable energy initiatives on their land as they align with adopted sustainability goals, reducing the complexities of negotiations.

9. **Relevant stakeholders:** ministries and national or local agencies in charge of agriculture, energy and spatial planning, and cadastral offices.

47 European Soil Data Centre, Land degradation in Europe.

48 European Environmental Bureau, Land for renewables, Briefing on spatial requirements for a sustainable energy transition in Europe, July 2024, page 18.

49 IUCN, Mitigating biodiversity impacts associated with solar and wind energy development – Guidance for project developers, Case Study 22 - Southill solar farm.

IV.4 Waste sites, quarries, industrial sites and coal mines

A particular type of investment that can be utilised is a brownfield investment on sites previously developed for industrial or commercial purposes that require further development before reuse. The development of solar and wind parks may occur on closed or partially closed waste, industrial sites and/or coal mines, as well as quarries, by turning previously unusable land into productive areas. There is already an example of a renewable installation on a former lignite mine in the Energy Community region, particularly the Oslomej solar power plant in North Macedonia.[50] Moreover, renewable energy installations may be placed in or near existing mines and industrial sites that have high energy consumption, leading to the use of this renewable energy and cost reduction.[51] A potential first step in systematically addressing all national brownfields, including quarries, could involve establishment of a national program, accompanied by a comprehensive registry and their reuse potential.

1. **Regulatory aspects:** The absence of a clear and consistent national definition of brownfields, coupled with the lack of an up-to-date register of brownfield sites and quarries detailing their status, closure dates and rehabilitation measures, can create significant uncertainty in project planning and development. Additionally, complex and varying rules, along with fragmented frameworks governing land use, environmental remediation and redevelopment, may further hinder progress. Land on and around (e.g. buffer zone) brownfields where installations are to be constructed may or may not be contaminated, necessitating specific regulations tailored to the conditions of the site. If the land is contaminated with pollutants that are subject to national and international regulations, it can be reused, including for renewable energy plants only after the regulations are implemented. In case degraded land is not contaminated, it should be assessed if it may be revitalised and used for other purposes of higher value, such as for recreation or other benefits of the local community. Finally, national legislation and/or spatial plans may limit the construction of facilities and installations on mine lands only for mining purposes, and not for renewables projects. This is a regulatory barrier that may slow down the permitting procedures, since it requires certain repurposing procedures.[52]

2. **Infrastructure access:** industrial sites, quarries and coal mines are usually in the proximity of the electricity corridors and transport infrastructure, which may be beneficial for the deployment of renewables if capacity is available.

50 Oslomej Power Plant
51 EU Commission guidance on renewables acceleration areas, page 11.
52 See an example in North Macedonia: Using Mine Lands and other Brownfields for Solar and Wind Power Deployment in North Macedonia: Study and Methodology

3. **Technical/Biophysical aspects:** land stability and safety—the structural stability of the land needs to be assessed to ensure it can support solar or wind installations. Moreover, placing a solar plant near coal mines can expose solar panels to significant dust accumulation, which reduces their efficiency by blocking sunlight and increasing maintenance requirements. This may require applying anti-soiling coatings, optimising and adjusting panel tilt, as well as regular maintenance.

4. **Environmental impact:** in case the soil is contaminated, any construction can be dangerous. Depending on the level of contamination, implementation of measures for decontamination, as well as a pollution management plan, will be needed to safely deploy renewable energy plants. Moreover, closed open-pit mines[53], quarries and abandoned mines[54] can serve as potential habitats for bats. Finally, placing solar installations near coal mines and industrial sites can result in higher water consumption for cleaning due to the increased accumulation of dust on solar panels, reducing their efficiency and increasing the need for cleaning.

5. **Mitigation measures:** to protect potential habitats for bats in case of installing wind farms on mines, regular monitoring during different seasons needs to be carried out, and a lighting system that is bat-friendly, as well as noise reduction measures to avoid disturbance, need to be applied.[55] To address the risk of potential water consumption, dry cleaning systems (such as brushes or air blowers) could be used to remove dust, or coatings can be applied to the surface of solar panels to make them more resistant to dust accumulation.

6. **Social impacts:** to address local community concerns about job loss and economic security from mine closures, retraining programs for ex-miners and their inclusion in renewable energy projects can create alternative employment opportunities, supporting goals of just transition.

7. **Economic considerations:** the necessary geotechnical adaptations due to uneven terrain or unstable subsoil may result in higher costs compared to a greenfield site. Moreover, if a current user of contaminated land is at the same time a developer, it might have to bear the costs of remediation measures. On the other side, state often being the only owner of mines, along with existing infrastructure, may lower the costs compared to greenfield sites. Therefore, it might be beneficial to support the development of renewable projects with customised incentives. For example, the U.S. Inflation Reduction Act introduced a 10% tax credit for renewable projects on brownfields, helping to partially offset the average additional cost of 10–15% associated with siting renewables on these lands.[56] Moreover, Greece used the Just Transition Fund to finance its Just Transition Development Plan, aiming to close all the operating lignite plants in the country by 2028 (mainly operating in Western Macedonia[57] and Megalopolis regions) and deploy solar energy projects.[58]

8. **Ownership:** these areas are usually in public ownership, and their use by private companies may be established through public-private partnerships.

9. **Relevant stakeholders:** ministries in charge of environment, waste management, economy and energy; utilities and companies in charge of waste management and coal mines; industry associations; mine trade unions; local municipalities.

53 Emma Theobald, David J. Hosken, Patrick Foster, and Kelly Moyes. "Mines and Bats: the Impact of Open-Pit Mining on Bat Activity," Acta Chiropterologica 22(1), 157-166, (3 September 2020).
54 Bat Conservation International, Abandoned Mines.
55 Peste et al, How to mitigate impacts of wind farms on bats? A review of potential conservation measures in the European context, Elsevir, December 2014.
56 The Nature Conservancy, Mining the Sun, Transforming mine lands and brownfields into clean energy hubs, 2024.
57 The Midas touch: Greece's biggest coal region is transforming into a renewable energy
58 Just Transition in Greece

IV.5 Artificial inland water bodies, lakes and reservoirs, urban wastewater treatment sites

Solar floating installations require a calm, unobstructed water surface, making irrigation canals, quarry lakes, or reservoirs suitable locations for these types of projects. The specificity of the 'floatovoltaics' is that they float on pontoons, which ensures the stability of the electricity-generating system. Electricity is transmitted from the floating panels to the onshore transmission system through waterproof, corrosion-resistant and durable underwater cables. The whole water surface is not to be covered by panels; an assessment of optimal surface coverage needs to be carried out, taking into account the potential of negative environmental impact, evaporation reduction, investment costs and project feasibility.[59] In addition to floating PV, ground-mounted PV systems could be installed over canals for drainage, irrigation or similar water management structures. This cluster also includes the wastewater treatment facilities, whose operation requires significant amounts of energy. To address the issue of the high energy consumption of these plants, in April 2024 the EU revised the Urban Wastewater Treatment Directive of 1991, requiring plants to use at least 40% renewable energy sources by 2035, and 100% by 2045.[60]

1. **Regulatory aspects:** installing floatovoltaics on water bodies may be restricted or forbidden, due to its negative environmental impact described below, as well as due to safety regulations. The percentage of surface coverage should be determined according to the quality of the water, intended use of the water body and biodiversity. For example, Spain prescribed that 5% coverage on non-eutrophic reservoirs and 15% on eutrophic reservoirs is allowed. [61]

2. **Infrastructure access:** while some artificial water bodies (reservoirs, quarry lakes) are near existing electrical and transport infrastructure, others may require additional investments in connections to grid and roads (irrigation canals).

3. **Biophysical/technical aspects:** solar panels and supporting structures should withstand water movement, varying water levels and weather conditions. Developing reliable anchoring systems to keep the floating panels in place without damaging the water body's infrastructure is needed.

4. **Environmental impact:** due to the shading and warming effect from PV panels, placing solar installations on water bodies can significantly change temperature cycles, nutrient and evaporation levels and, consequently, species composition. In some cases, some of these changes can be positive, e.g. reducing evaporation in completely artificial water reservoirs and canals. One important consideration is that certain artificial water bodies can still be important habitats and therefore important for biodiversity. For example, carp fishponds are important sites for birds in areas with few natural wetlands and any significant change to conditions can be disruptive for these habitats.

5. **Mitigation measures:** the required mitigation measures need to be tailored to the intended use of the artificial water bodies and can include ensuring proper spacing between solar panel arrays to allow sunlight to reach the water surface or including reflective coatings or passive cooling designs to prevent excessive heat build-up.

6. **Social impacts:** the installations can interfere with other uses of the water body, such as recreation, fishing or irrigation, and communities may have concerns about aesthetics and changes to the landscape.

59 European Commission, Joint Research Center, Communication on the potential of applied PV in the European Union: Rooftops, reservoirs, roads, October 2023.

60 Proposal for a Directive of the European Parliament and of the Council concerning urban wastewater treatment (recast) https://data.consilium.europa.eu/doc/document/ST-7108-2024-INIT/en/pdf

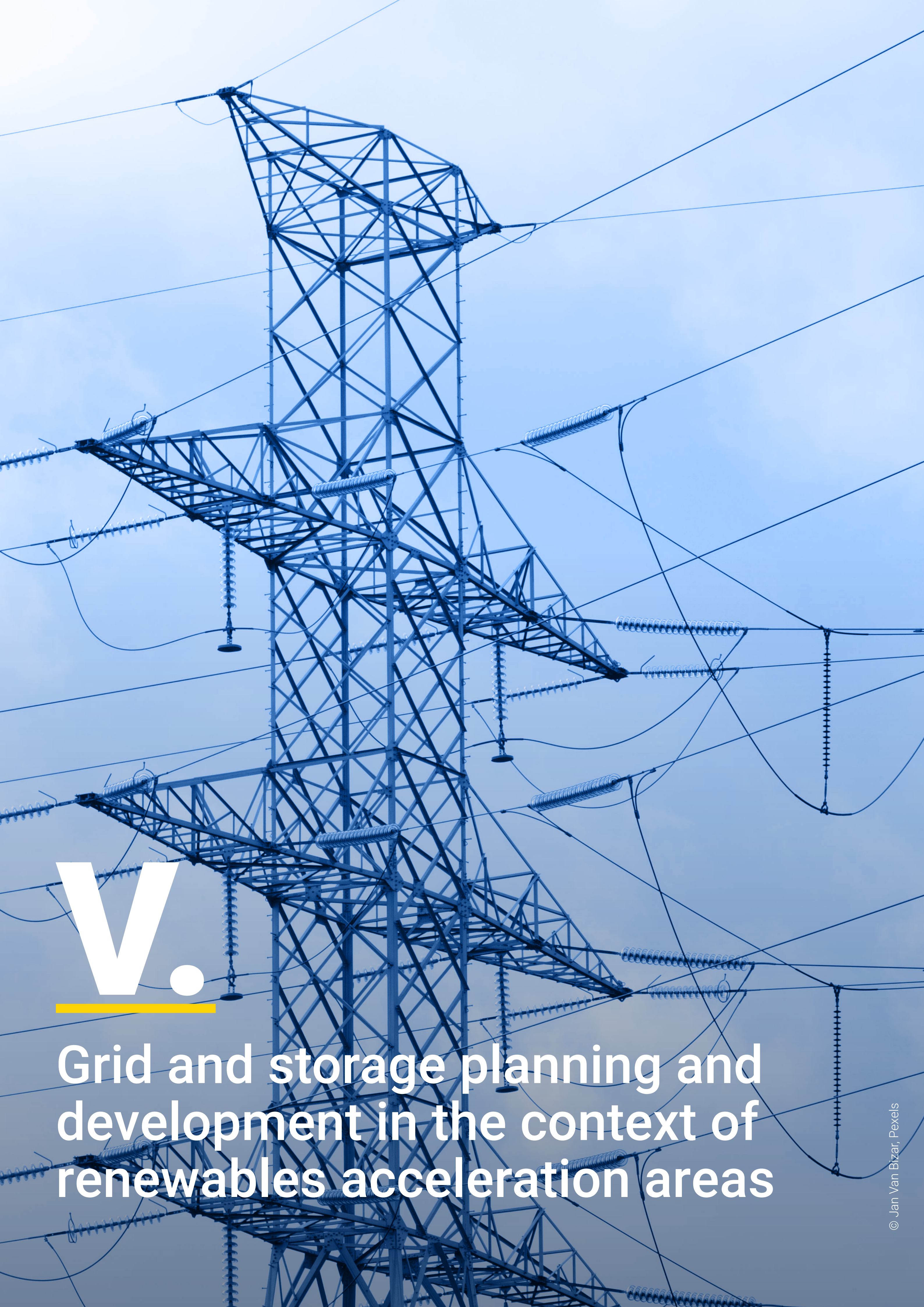
61 Spain approves rules for floating solar installations on reservoirs.

7. **Economic considerations:** the cost of specialised equipment, materials and installation, as well as complex maintenance, can be higher than for land-based solar systems. A recent study published by National Renewable Energy Laboratory - NREL indicates that in the U.S., the installation costs for a 10 MW floating PV plant are approximately 25% higher than those for an equivalent ground-mounted PV plant. Notably, the difference in installation costs decreases as the system size increases.[62] On the other hand, in the case for example of hydropower reservoirs, floating solar may reduce evaporation and primary production and thus reduce reservoir and hydropower plant maintenance costs.

8. **Ownership:** these areas are usually in public ownership, and usage by private companies may be established through public-private partnerships.

9. **Relevant stakeholders:** ministries, utilities and companies in charge of communal activities/natural disaster/water management.

62 Ramasamy, Vignesh and Robert Margolis. 2021. Floating Photovoltaic System Cost Benchmark: Q1 2021 Installations on Artificial Water Bodies. Golden, CO: National Renewable Energy Laboratory. NREL/TP-7A40-80695. https://www.nrel.gov/docs/fy22osti/80695.pdf.



V.

Grid and storage planning and development in the context of renewables acceleration areas

Grid upgrade and modernisation are core instruments for enabling the massive scale-up of renewable energies. Both transmission and distribution networks will need to be reinforced in parallel with the accelerated deployment of renewable energy plants, and increased demand due to clean mobility and electrification of heating and cooling, transport and industry.

Interconnections play an important role by enabling electricity to be transferred across regions. According to the revised TEN-E Regulation (EU) 2022/869 from June 2022,[63] Projects of Common Interest (PCI) for the EU[64] and Projects of Energy Community Interest (PECI) for the Energy Community[65] contribute to enhancing cross-border energy connections, energy supply and renewable energy sources.[66] Cross-border transmission infrastructure across Europe is expected to double by 2030, with an additional 23 GW of capacity to be added by 2025 and further 64 GW by 2030.[67]

Moreover, flexibility options are essential for ensuring the stability and reliability of power systems, especially as renewable energy sources become more prevalent. The flexibility options include technologies and mechanisms that allow electricity supply and demand to be balanced, such as energy storage systems and demand response. For storage systems, including co-located storage installed alongside renewable energy generation facilities, the setup reduces the need for fossil fuel-based backup power, minimises grid congestion and allows for greater integration of renewable energy. Additionally, it can provide ancillary services like frequency regulation, voltage support and peak shaving, further stabilising the electricity system and improving overall grid flexibility. Advancements in smart grid technologies and digital tools enhance grid management, allowing for more efficient integration of distributed energy resources and better forecasting of energy demand.

Currently, the existing infrastructure capacities represent a bottleneck to the energy transition. Namely, as indicated in the EU Action Plan for Grids[68], the existing grid in the Member States cannot manage the influx of new renewable energy sources seeking to connect. In both the Energy Community region[69] and Member States, there is an increasing backlog of renewable energy projects awaiting grid connections, with waiting times extending up to nine years in some cases[70]. The CESEC Study showed that in 2040 and 2050, the number of regions and technologies requiring RES curtailment increases significantly compared to 2030 scenarios, and without further grid reinforcement, Western Balkan will most likely experience bottlenecks.[71] Taking into account that there is a significant disparity between the time required to construct a wind or solar power plant (2 to 3 years) and the time needed to develop the transmission infrastructure to connect it to the grid (5 to 10 years), this highlights a substantial gap between the renewable energy deployment and the practical realities of infrastructure development, potentially delaying the integration of clean energy into the system and hindering overall energy transition goals.

As indicated in the EU Action Plan for Grids, TSOs and Member States should ensure that enough electricity transmission projects are designed, planned and developed to meet the EU's identified infrastructure needs for 2030, 2040 and 2050, considering the NECPs. Moreover, EU-wide Ten-Year Network Development Plan (TYNDP) scenarios[72] prepared by ENTSO-E shall fully be in line with the energy efficiency first principle and with the Union's 2030 targets for energy and climate and its 2050 climate neutrality objective and shall take into account climate and renewable energy targets set by NECPs.[73]

63 TEN-E regulation shall be transposed in the national legislation of Contracting Parties by the end of 2024.

64 Projects of Common Interest. Ministerial Council Decision 2024/7/MC-EnC on the establishment of the list of Projects of Energy Community Interest.

65 Priority projects of Energy Community.

66 The first Union list under the revised TEN-E of November 2023, identifies 166 projects, including 68 electricity projects (12 for storage), 5 smart grid projects, and a new category of 12 offshore infrastructure projects. When it comes to the Energy Community, the list of strategic cross-border energy projects in the region that will get the PECI label is adopted in December 2024 by the Ministerial Council.

67 System needs study – Opportunities for a more efficient European power system in 2030 and 2040 , TYNDP 2022, ENTSO-E, May 2023.

68 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Grids, the missing link - An EU Action Plan for Grid, COM/2023/757 final.

69 Permitting Study, page 119.

70 Accelerating Permitting for Renewable Energy

71 European Commission, Study on the Central and Southeastern Europe energy connectivity (CESEC) cooperation on electricity grid development and renewables, March 2022.

72 EU TYNDP is a long-term cross-sectoral infrastructure planning tool that involves developing different scenarios and identifying infrastructure gaps. Under the umbrella of the pan-European market coupling process, ENTSO-E takes into account and assesses the need for the infrastructure reinforcement of CPs. However, it is non-binding and relies on national development plans (NDP) prepared by transmission system operators.

73 Article 48 of Electricity Regulation (EU) 2019/943, and Article 12 of TEN-E Regulation.

Therefore, to deliver grid and storage infrastructure crucial for decarbonisation, there is a need to align network development with goals for future expansion of renewable generation capacities.

To achieve this goal, the regulatory framework may be improved by introducing anticipatory grid and storage investments into the national network development plans (NDPs) and transmission and distribution tariffs, as envisaged in the proposal for Electricity Market Design.[74] The EU Action Plan for Grids explicitly states that the anticipatory investments can be relevant for RAAs with high development potential.[75] Namely, anticipatory investments strengthen the grid in preparation for potential future requirements that extend beyond currently confirmed generation and demand needs, ensuring that grids are fit for the accelerated uptake of RES.[76]

Currently, TSOs have an obligation to create NDPs for long-term investments, including main transmission infrastructure that needs to be built or upgraded over the next 10 years.[77] When it comes to distribution systems, Electricity Directive (EU) 2019/944 introduced the obligation for DSOs to develop and publish NDPs every two years, setting out the planned investments for the next five to 10 years.[78] The role of national regulatory authorities (NRAs) with this regard is significant, them having the power to assess if NDPs are consistent with the ENTSO's TYNDP and NECPs,[79] as well as to approve, monitor and evaluate the implementation of NDPs.[80]

In practice, restrictive and inflexible regulatory frameworks are impeding anticipatory investments,[81] with regulators reluctant to approve funding for uncertain projects due to the risk of the infrastructure becoming a stranded asset.[82] Therefore, TSOs and DSOs are unlikely to invest in network development without specific RES projects requiring connection to a reinforced grid.

The European Union Agency for the Cooperation of Energy Regulators (ACER) and the Council of European Energy Regulators (CEER) have recently released a paper analysing how anticipatory investments are addressed at the level of Member States, suggesting measures to enhance electricity grid development to achieve the EU's climate and energy goals. The analysis concluded that while regulatory frameworks of Member States do not define anticipatory investments, the Member

74 Proposal for a Regulation of the European Parliament and of the Council amending Regulations (EU) 2019/943 and (EU) 2019/942 as well as Directives (EU) 2018/2001 and (EU) 2019/944 to improve the Union's electricity market design - COM/2023/148 final.
75 An EU Action Plan for Grid, page 8.
76 ACER and CEER provide recommendations on anticipatory investments to accelerate electricity grid expansion for the energy transition.
77 Article 51(1) Electricity Market Directive (EU) 2019/944.
78 Article 32 (3) of Electricity Market Directive (EU) 2019/944.
79 Article 51(5) Electricity Market Directive (EU) 2019/944.
80 Article 51(6) Electricity Market Directive (EU) 2019/944.
81 DSO Entity, DSOs Fit for 55, Challenges, practices and lessons learnt on connecting renewables to the grid, November 2023
82 ACER and CEER provide recommendations on anticipatory investments to accelerate electricity grid expansion for the energy transition.

States' transmission and distribution system operators often adopt a forward-looking approach in the process of network planning, including RES connection requests, EV charging infrastructure or other drivers of network expansion.[83] NRAs of Member States recognise and propose that governments should "*determine zones appropriate for RES intake (sometimes labelled as "renewables acceleration areas"), which would feed into the planning of the grid reinforcements needed to accommodate new connection requests»,* while ACER and CEER recommends that "*NRAs could consider greenlight to a project to progress permit granting and other preconstruction activities as much as possible, without the regulatory approval of the project construction (which would come later, when the need is confirmed); such an approach would speed up the project implementation while limiting the risks of "sunk costs" for the society to the (small) pre-construction costs, in case the need will never be confirmed*.»[84] Such instruments could minimise uncertainties around new network development and should enable NRAs to make more informed decisions.[85]

To expedite grid and storage upgrades, the revised RED (Article 15e) promotes accelerated development of grid and storage infrastructure, allowing national authorities to adopt plans designating specific areas for such projects where minimal environmental impact is anticipated. Infrastructure projects in these areas could gain from more streamlined environmental assessments. These infrastructure plans are essential to complement and support the realisation of the RAA plans and integration of renewable energy plants into the electricity system in designated RAAs.

An important part of these plans is a rulebook that establish appropriate and proportionate rules, including on proportionate mitigation measures that project developers will need to implement when developing grid and storage projects. Infrastructure system operators have to be consulted when the infrastructure plans are prepared.

The implementation of mitigation measures shall ensure avoidance of adverse effects on the environment, or their significant reduction, where it is not possible to avoid such effects. Similarly, as in the case of RAA plans, the plans for grid projects shall avoid Natura 2000 and protected areas to the extent possible, while plans for storage projects shall always exclude Natura 2000 and protected areas.

In any case, the plans shall be subject to SEA and assessment pursuant to the Habitats Directive, where applicable. When it comes to EIA, competent authorities may, under justified circumstances exempt grid and storage projects being built in those areas from EIA, an assessment under the Habitats Directive and Birds Directive, if they comply with appropriate and proportionate rules, including on proportionate mitigation measures in order to avoid adverse effects on the environment. However, competent authorities will still carry out a screening process of projects located in dedicated infrastructure areas, aiming to identify if any of such projects is highly likely to give rise to significant unforeseen adverse effects that were not identified during SEA. If such adverse effects are identified, appropriate and proportionate mitigation measures shall be applied to address those effects; or if this is not possible, the operator shall adopt the appropriate compensatory measures. If competent authorities choose not to designate these areas, the standard rules under the EU environmental law will continue to apply.

83 ACER and CEER provide recommendations on anticipatory investments to accelerate electricity grid expansion for the energy transition.

84 ACER and CEER, Position on anticipatory investments, March 2024, page 7.

85 ACER and CEER, Position on anticipatory investments, page 8.

VI.

Co-located storage

As indicated above, the benefits of the RAA concept extend to both RE plants and co-located storage systems. The revised RED defines co-located storage as an energy storage facility that is combined with a facility producing renewable energy and connected to the same grid access point.[86] Unlike standalone storage projects installed and operated independently of generation units, co-located energy storage systems are developed alongside power generation units. Co-located storages allow surplus solar energy produced during periods of high generation or low prices to be stored and later exported during the evening peak when demand is higher, enabling rapid charging and discharging.

Although multiple energy storage technologies can offer flexibility services, batteries are considered the most suitable option for this purpose. This is because they can share the same substation and connection point, as well as utilise the same road infrastructure, thereby reducing the overall land footprint.

Co-located storages may be referred to also as utility-scale stationary battery storage systems, large-scale or grid-scale battery storage, and may have a capacity ranging from around a few megawatt-hours (MWh) to hundreds of MWh.[87] One example of such a project is a hybrid park Haringflit located in the Netherlands, consisting of a wind farm of 22 MW, a solar farm of 38 MW and a 12 MWh energy storage unit[88] of 288 battery packs placed in 12 shipping containers.[89]

The amount of land needed per megawatt-hour of lithium-ion battery storage can vary based on factors such as the specific technology used, the design and capacity of the battery storage system, and local regulations. A general guideline suggests that approximately 0.023 acres (cc. 93 m^2) are needed per 1 MWh of storage capacity.[90] This estimate includes not only the physical footprint of the battery containers but also space for safety, access and any necessary infrastructure, such as inverters and transformers. As technology advances and battery systems become more compact, this land requirement may decrease over time. For large-scale installations, such as those used in grid storage, the overall land-use efficiency can be improved through careful site selection and design.

While batteries are a crucial energy storage technology, these also bring significant environmental and safety concerns, depending on the type of batteries and its lifecycle stages, such as raw material extraction, manufacturing, usage and disposal. For example, one of the main risks of the widely used lithium-ion batteries is thermal runaway—a rapid and uncontrollable rise in battery temperature that can result in fires or explosions, potentially releasing toxic gases such as hydrogen fluoride.[91] To address risks to human health or the safety of persons, property or the environment, the EU has revised the Battery Regulation in 2023[92], incorporating important provisions to harmonise requirements on sustainability and safety, performance and durability, labelling and information, and end-of-life and second-life management, that way minimising environmental impact and encouraging their recycling, reuse and repurposing.

The deployment of battery storage can be significantly influenced by the design of the regulatory framework, which can either facilitate or hinder the implementation of energy storage systems. Most jurisdictions treat energy storage as "generation" for licensing and regulation purposes.[93] However, a well-designed framework should account for its dual role as both generation and consumption, and that way maximise the added value that energy storage can bring to the energy system.[94] Some of the regulatory interventions that the EU Commission's Recommendation on energy storage proposes are the following: (i) incentives could be introduced to promote demand-side flexibility; (ii) double taxation could be eliminated; (iii) dedicated permit-granting procedures could be established; and (iv) tailored network charges and tariffs could be created for energy storage systems.[95]

86 Article 2 of revised RED.
87 IRENA (2019), Innovation landscape brief: Utility-scale batteries, International Renewable Energy Agency, Abu Dhabi.
88 Haringvilet hybrid energy park.
89 Battery Storage Systems.
90 https://www.convergentep.com/landowners/
91 Battery Testing Risks and Hazards: Exploring the Thermal Runaway Threat and Safety Measures in Lithium-Ion Batteries.
92 Regulation (EU) 2023/1542 of the European Parliament and of the Council of 12 July 2023, concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC.
93 CMS Expert guide to energy storage.
94 Commission Recommendation of 14 March 2023 on Energy Storage–Underpinning a decarbonised and secure EU energy system 2023/C 103/01 C/2023/1729.
95 Commission Staff Working Document Energy Storage–Underpinning a decarbonised and secure EU energy system.

When it comes to establishing dedicated permit-granting procedures, revised RED provisions on accelerating permitting procedures for RE plants within RAAs are applicable also to co-located storages. Namely, revised RED prescribes that the permit-granting procedure for co-located energy storage, as well as for their grid connection, if located in RAAs, shall not exceed six months.[96] Moreover, the lack of reply by the relevant competent authorities within the established deadline is to be considered as approved, if it is not the case of final decisions and the principle of administrative tacit approval exists in the national jurisdiction concerned.

In conclusion, ensuring compliance with all safety and environmental regulations to mitigate health and safety risks, alongside establishing a regulatory framework that incentivises the adoption of co-located storage systems—including streamlined permitting procedures within RAAs—are essential conditions for enhancing the uptake of co-located storage solutions.

96 Article 16a (2) revised RED.

VII.

Workflow - step by step - from commitment to renewables acceleration areas plan

Designating RAAs at the national level requires thorough organisation of the project team and the inclusion and coordination of various stakeholders. The cycle of designating RAAs typically involves 10 steps; however, the exact scope and sequence of steps will depend on the current progress in identifying low-conflict areas and specific objectives for carrying out the mapping. The following text describes each of the next steps.

1) Committing to the designation of RAAs, goal and scope-setting

The very first decision that competent authorities need to make is a commitment to engage in this process. The ministry responsible for energy may take the lead in this process, as it relates to the renewable energy acquis. However, it is essential to recognise the equal importance of the ministries responsible for environment and spatial planning, necessitating a collaborative, co-decision approach. The role of a leading institution is to gather and coordinate all relevant stakeholders. Moreover, it should think through and decide at this moment what the goal and scope of the whole process is and for what purpose the RAA designation will be carried out. Namely, the maps designating low-conflict areas should support potential developers in choosing the optimal locations, and support national authorities in the process of issuing permits for RE projects and/or for the creation of auctions for specific sites. To effectively implement this support, the areas designated as RAAs should be integrated into national and/or local spatial plans. Moreover, at this moment it is also important to decide on the scope of the exercise: which technology to support through RAA plans - wind or solar, and for which territory or areas to do the mapping exercise. The decision on technology will be dependent on the resource potential of a CP and strategic and policy acts in the field of energy, while the decision on geographical scope (the whole or part of the territory) or specific areas (i.e. coal mines) will rely on the national regulatory framework, data availability and various aspects that are analysed in detail in Chapter IV. The decision on geographical scope/areas may be postponed for a later stage after the Working Group is established if additional analysis is needed.

The designation of RAAs may be delegated to the regional and/or local authorities, or if a country has a federal structure, the decision-making may be delegated to entities. A similar approach was adopted in Germany, where each state is obliged to designate on average 1.4% of its area for onshore wind plants and carry out its own planning, guided by a set of uniform rules issued by the federal government.[97]

Some CPs already demonstrated a commitment to identifying low-conflict areas by adopting targeted policies and measures in the process of energy and climate policy planning, including their NECPs. For example, Serbia included in its final NECP a measure that aims to integrate energy and spatial planning and designate low-conflict areas for deployment of renewable energy plants, allocating EUR 0.1 million for this measure.[98] This is particularly important, in the context of the requirement of revised RED that RAA plans shall be reviewed periodically, as appropriate, when updating NECPs (Article 15c (3)).

2) Stakeholder mapping and engagement plan

To conduct the mapping exercise, the leading institution will have to seek the support of experts in various fields: renewable energy, electricity infrastructure, environment, nature protection, cultural heritage, natural resources management, spatial planning, etc., as well as the support of other relevant stakeholders, such as TSOs, DSOs, NRAs, institutes and agencies in charge of environment, nature protection and/or spatial planning, regional and local authorities, local communities and civil society, international organisations, NGOs, representatives of project developers, utilities, etc. At the outset of the process, a list of mandatory stakeholders should be established, along with an additional list of relevant stakeholders to involve if RAAs are to be designated for specific areas. For example, if the scope of the study is transport infrastructure, the additional stakeholders might be companies in charge of managing roads and railways. Therefore, mandatory stakeholders are those who own data on renewable energy, electricity infrastructure, environment, nature protection, cultural heritage, water, land management and spatial planning, while additional stakeholders are those who have decision-making powers (own and/or manage) with regard to the specific priority areas, as indicated in Chapter IV. The engagement plan should outline an approach to actively involve important stakeholders, foster collaboration and ensure transparent communication throughout the project's lifecycle.

97 EU Commission Guidance on designating renewables acceleration areas, page 6.
98 PM45 of National Energy and Climate Plan of the Republic of Serbia, August 2024.

3) Establishing a Working Group and Steering Committee

To successfully implement the project, two bodies need to be established: a Working Group, and a Steering Committee. The main task of the Working Group would concern the facilitation of the collection and analysis of all data described in step 4 needed for the creation of maps in step 5, as well as the creation of maps or support external experts engaged for this task. The Working Group should consist of representatives of all relevant stakeholders that are mapped in step 2, along with a multidisciplinary team of experts and potentially external consultants who would provide technical expertise and support national or local authorities in the development of RAA plans. The Working Group should create an implementing program with a precise timeline, roles and responsibilities of all members. On the other hand, the Steering Committee's role would be to follow the development of the project, steer the work of the Working Group, mitigate and solve potential risks and ensure that results of the study are included in the national policies. It should be composed of representatives of decision-making institutions.

4) Collecting and Analysing Data

The quality of maps will depend on the quality of the data. Having good quality data - especially concerning areas, ecosystems and habitats that need to be protected - is crucial for mapping as it ensures accurate identification of areas vulnerable to environmental impacts, leading to more effective mitigation measures. It involves the collection and analysis of data listed in Annex 2 and relies extensively on the existing national and/or regional spatial maps and maps of protected areas, as well as strategies for different fields, such as energy, environment, transport, water management, etc. When it comes to social values, in addition to desk research, a better understanding of social values in a specific community can be obtained by engaging directly with members of the community who could provide information and insights on cultural, religious and other social values.

It is important to note that data collection, analysis and management require significant time, which should be carefully allocated depending on the scope of available data and additional analysis needed, including monitoring of biodiversity in line with the IUCN framework.[99] Therefore, it should be carefully planned, allowing for enough time to collect necessary data and analyse them. The respective ministries, agencies and institutes shall facilitate the smooth exchange of data, preferably using electronic tools to create an inventory with detailed baseline data of good quality. While various public authorities and companies are owners of data, their capacity to perform the analysis is often insufficient and in practice, the analysis is usually carried out by experts in relevant fields.

Key limitations for CPs lie in the unavailability, non-digitalised data, and outdated spatial plans.[100] Moreover, the implementation of the environmental acquis is progressing, but still facing systematic failures.[101] In such cases, data gaps might be addressed by conducting additional sensitivity mapping. Sensitivity mapping is using Geographic Information Systems to gather, analyse and display spatial and geographic areas containing species and habitats sensitive to a specific activity, such as the development of solar and wind plants. Such mapping takes into account existing data, including existing EIAs and research for the specific ecosystems, habitats or species conducted by different research local and/or international institutions and NGOs, while field surveys and involvement of local experts familiar with the country's biodiversity context enables the verification of results. Wildlife sensitivity mapping is typically used to guide strategic planning decisions during the early site selection phase of development and is designed to operate at a landscape scale, often encompassing regional, national or multinational areas. However, it should be emphasised that the sensitivity mapping does not eliminate automatically the need for site-specific Appropriate Assessments under Article 6 of the Habitats Directive or EIAs. These exemptions are provided in cases as defined in the revised RED.[102]

99 Dalton, D., Berger, V., Kirchmeir, H., Adams, V., Botha, J., Halloy, S., Hart, R., Švara, V., Torres Ribeiro, K., Chaudhary, S. & Jungmeier, M. (2024). A framework for monitoring biodiversity in protected areas and other effective area-based conservation measures: Concepts, methods and technologies. IUCN WCPA Technical Report Series No. 7, Gland, Switzerland: IUCN.

100 Permitting Study, page 78.

101 Client Earth, Euro Nature and Riverwatch, Are Balkan Countries Safeguarding Their Rivers? A Legal Analysis of Environmental Standards in Six Western Balkan countries.

102 Allinson, T., Jobson, B., Crowe, O., Lammerant, J., Van Den Bossche, W. and Badoz, L. (2020) The Wildlife Sensitivity Mapping Manual: Practical guidance for renewable energy planning in the European Union. Final report for the European Commission (DG ENV) (Project 07.027733/2017/768654/SER/ENV.D.3).

5) Creating Maps

After the data are collected and analysed, information on resource yield, development potential and environmental and social values are consolidated, and individual data layers are visualised. These layers are combined so that the final product is one map showing potential areas for RAA designation. This step should be implemented by experts having experience in spatial planning, siting, biodiversity and renewable energy, as well as electricity infrastructure. Each map should include an explanatory note that outlines the process and provides detailed information about the map.

6) Drafting the RAA plan and site-specific Mitigation Rulebook

The RAA plan shall include the rationale and methodology behind the choice of technology and types of areas to be designated as RAAs, the process of carrying out the assessment and list of stakeholders that were involved, maps of the designated RAAs, findings of the draft SEA, and public engagement plan. The Mitigation Rulebook shall include for each designated area an identified environmental impact, a list of measures that developers need to comply with, as well as an explanation of the assessment based on the criteria explained in Chapter II (priority surfaces, exclusion of Natura 2000 or equivalent protected sites in CPs, use of appropriate tools and datasets). Both draft RAA plans and site-specific Mitigation Rulebook will have to go through the SEA and, if applicable, an appropriate assessment.

7) Strategic Environmental Assessment/Appropriate Assessment

The main phases of SEA in line with the SEA Directive include screening, where it is determined if a plan or program requires an SEA; scoping, which identifies the environmental aspects to be assessed; and assessment, where environmental impacts are evaluated, followed by reporting. For RAA plans, however, they are automatically subject to SEA, eliminating the need for the screening phase.

According to the Energy Community Policy Guidelines on the Permit-Granting and Planning of Energy Projects,[103] the competent authority should identify relevant stakeholders early and ensure public access to information using a hybrid approach for broader engagement. CPs are advised to require public consultations on the SEA report's scoping, with a minimum of 30 days for feedback. Scoping opinions should be published on dedicated websites and shared via national and local media, including electronic platforms. Additionally, a framework for assessing cumulative impacts from multiple projects should be integrated to address significant environmental consequences effectively.[104] CPs should develop technical secondary legislation outlining the content of SEA reports for RAAs, emphasising the role of SEA in defining project-level measures within plan-level assessments in order to enable the development of detailed rulebook with tailored mitigation measures, based on area type, RE technology, and existing assessments like EIA or appropriate assessment, could streamline project-level requirements and facilitate implementation.[105] To enhance impact assessments and plan goals, CPs are encouraged to use questionnaires and interviews with authorities and stakeholders during SEA scoping. Dialogue and negotiation should also be integrated into spatial and land-use planning, following EIA guidance on effective consultation processes.[106] If a transboundary impact is identified, CPs should outline transboundary consultation steps during the SEA procedure, ideally at the scoping stage. Clear and well-structured data on potential cross-border environmental impacts of RE projects is essential for informed decision-making and effective collaboration.

The monitoring aspect is designed to track both positive and negative environmental impacts over time and ensure that unforeseen adverse effects are detected early. SEA monitoring is not static; it should feed into an adaptive management process. If unexpected impacts arise, or if mitigation measures prove ineffective, corrective actions will be necessary. It is recommended to ensure that the monitoring results of plan or programme implementation, as outlined in the SEA report, are made publicly accessible on a centralised information platform.[107] A standardised monitoring protocol should be included in the SEA report, specifying roles, scope, format, location, frequency, timing and methods, while also designating the responsible authority for conducting the monitoring and ensuring the disclosure of results.[108]

103 Energy Community Secretariat, Policy Guidelines on the Permit-Granting and Planning of Energy Projects in the Energy Community
104 Ibid.
105 Ibid.
106 Ibid.
107 Ibid.
108 Ibid.

The appropriate assessment, under the Birds and Habitats Directives, evaluates the potential impact of plans or projects on protected areas, such as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). This assessment examines whether the project, in combination with others, could harm protected habitats or species.[109] If significant impacts are identified, alternative solutions must be explored to avoid or mitigate these effects, ensuring that the integrity of these sites is maintained. If negative impacts are identified, the plan may be modified or rejected, or alternative solutions may be implemented to avoid or reduce those impacts. In cases where no viable alternatives exist, and the plan is deemed essential, compensatory measures may be required to offset the damage to the protected habitats or species.[110]

8) Community Engagement

The success of deploying renewable projects is fundamentally tied to the acceptance and active participation of the communities affected by these projects, along with ensuring their voices are included in the processes. By showcasing the benefits that renewable energy projects can offer, while also acknowledging the potential shortcomings they may cause, these projects must secure the essential social buy-in. A number of projects around Europe have been halted due to opposition from local communities who raised their voice due to environmental, economic and social concerns. Designation of RAAs requires meaningful, extensive and timely community engagement that enhances trust in the energy transition.

The approach where key decisions are made even before the involvement of communities and the decisions are provided only for commenting does not ensure fairness and social acceptance. It is important to engage the communities as early as possible to maintain longstanding trust to ensure buy-in for future projects. Methods of engaging may be traditional such as public discussions, press releases in local media and workshops, but innovative approaches are welcomed such as social media outreach, engaging with school and youth groups, employing local liaisons, using digital spatial tools for enabling participation of civil society or general public, etc.

One of the examples of digital tools is participatory mapping or public participation geographic information system (PPGIS), which allows regional and national authorities to involve the public in decision-making processes. For instance, PPGIS enables local residents to identify or geolocate "places of importance" on a map based on project-related factors, such as key social values, preferences for site locations or concerns. This data can be integrated into a larger GIS framework to pinpoint areas where project development is less likely to cause conflict.

For a better understanding of the comprehensive framework of the community engagement strategy and examples of good practices the TNC`s paper on Good practices for engaging stakeholders, fostering collaboration, and promoting socioeconomic benefits[111] and Policy Guidelines on the Permit-Granting and Planning of Energy Projects in the Energy Community[112] may be used.

9) Adopting and publishing the RAA plan

Depending on the goal that is set in the first step, there might be a need for the RAA plan to be formally adopted by relevant institutions or governments and published in the official gazette. The adopted RAA plan needs to be reviewed periodically, as appropriate, in particular in the context of the updating of the integrated NECPs.

10) Next steps

Upon the adoption and publication of the RAA plan, additional steps might be needed, again depending on the goal that is set in the first step. In case the CP decides to fully transpose revised RED provisions, a parallel process of amending legislation will need to be carried out, as well as the integration of RAAs into national and/or regional spatial plans.

109 Ibid
110 Ibid.
111 The Nature Conservancy, Enabling a Community-Powered energy Transition: Good practices for engaging stakeholders, fostering collaboration, and promoting socioeconomic benefits, March 2024.
112 See footnote 103.

Annex 1 - Glossary

Acronym	Term	Definition
	Agri-Photovoltaics	Agri-Photovoltaics (Agri-PV) consists of the simultaneous use of land for both solar photovoltaic power generation and agricultural production.
	Birds Directive	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds.
	Business-as-usual siting approach	An approach for selecting sites for renewable energy projects based primarily on evaluating their development or production potential.
	Brownfield sites	Land within the urban area on which development has previously taken place. Examples of brownfield land are mine lands, landfills, former industrial sites, former military sites and locations at which chemical or oil spills have occurred.
CESEC	The Central and South-Eastern Europe Energy Connectivity Group	The High-Level Group set up in 2015 to coordinate efforts to facilitate cross-border and trans-European energy infrastructure projects. It includes EU Member States: Austria, Bulgaria, Croatia, Greece, Hungary, Italy, Romania and Slovenia, as well as all Energy Community Contracting Parties.
	Development Potential	Potential for the development of onshore wind and solar photovoltaic projects that is determined by assessing a set of economic criteria, such as resource yield, available grid capacities, proximity to power lines and transport infrastructure.
DSO	Distribution System Operator	An operator of the electricity distribution network, tasked with the development, maintenance and operation of low and medium voltage (typically up to 35 kV) powerlines and associated infrastructure.
EIA	Environmental Impact Assessment	An assessment of all the effects that a project is likely to have on the environment during all phases of the project carried out according to Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment amended by Directive 2014/52/EU.
GIS	Geographic Information System	A computer system that stores, manages, analyses, edits and maps geographic data.
	Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.
NECP	National Energy and Climate Plan	A plan that outline objectives, policies and measures in five dimensions of the Energy Union: decarbonisation, energy efficiency, energy security, internal energy market and research, innovation and competitiveness for the period of 10 years according to Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council.

Acronym	Term	Definition
PV	Photovoltaic	Systems that generate electricity directly from sunlight using the photovoltaic effect in arrays of semiconductor panels.
Revised RED	Revised Renewable Energy Directive	Directive (EU) 2018/2001 as amended by Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652.
RAA	Renewables acceleration area	A specific location or area - whether on land, sea or inland water - that is designated as particularly suitable for the installation of renewable energy plants.
	Smart siting approach	A spatial mapping approach that aims to identify low-conflict areas suitable for the deployment of renewable energy projects, by evaluating both development potential and potential for environmental and social conflicts. The approach is applied in the early phase of project preparation, before the decision on location is taken.
SEA	Strategic Environmental Assessment	An assessment of all the effects that a plan or program may have on the environment, carried out according to Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.
TSO	Transmission System Operator	An operator of the electricity transmission network, tasked with planning, development, maintenance and operation of high-voltage (typically ≥100 kV) powerlines and associated infrastructure, as well as interconnections to other countries' transmission systems.
	Wildlife sensitivity mapping	Tools used to identify at an early stage in the planning process areas containing ecological communities sensitive to a specific influence or activity, by using e Geographic Information Systems to collate, analyse and display spatial and geographic data.
	Water Framework Directive	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy.

Annex 2 - Technical guidance on data inventory and analysis

As indicated above, the TNC approach is suitable for carrying out the designation of RAAs. This Annex lists inputs needed for creating spatial maps when applying the approach. This list is neither exhaustive nor prescriptive - teams should consider elements relevant to their national circumstances and scope of the project. Namely, not all data from tables 1 and 2 will be necessary if the focus of the mapping is one of the priority areas.

The creation of the extensive spatial database is essential for mapping and involves several important steps: scoping of data, identifying available data, collecting, processing, analysing data and integrating it into the model. Data scoping concerns the identification of data that needs to be collected, taking into account the decision of the RE technology and geographical scope or priority areas for which the assessment is carried. The second step involves identifying available datasets that can be used directly or as proxies for the mapping. Moreover, it also requires a decision on carrying out additional sensitivity mapping. With regard to the collection of data, the tables below list baseline data that needs to be collected for carrying out analysis and mapping. National datasets held by respective governmental or research institutions may be complemented by open-source data that are governed by international and/or regional initiatives, NGOs, etc. Processing the data includes deciding on GIS projection and resolution. Since most renewable energy analyses utilise raster data, we suggest establishing a standard raster resolution at the outset. Data analysis involves the combination of all baseline data and conversion to raster datasets. Finally, model integration assumes data integration into models and the creation of development potential ranking.[113] The model should be developed for or adapted to the national circumstances and available and accessible data.

Table 1: List and description of baseline data necessary for creating constraint maps and development potential (the first step of TNC methodology)

Description	Data type and unit	Sources of data	Data owners	If data are not available
Data needed for excluding areas based on legal constraints				
Protected areas	Boundaries of protected areas and buffer zones	Primary and secondary national legislation on nature protection, acts on designation of protected areas, national parks, national and local spatial plans, acts on protected areas based on international conventions, etc.	Ministries and agencies in charge of environmental protection and spatial planning	World Database of Protected Areas The European inventory of Nationally designated areas Emerald Network Map Important Bird Areas (IBA)
Military zones	Boundaries of the zones plus buffer zone	National, regional and/ or local spatial plans	Ministries in charge of defence and spatial planning	

113 The Nature Conservancy, Renewable Energy Transition: Handbook for Practitioners Version 1

Description	Data type and unit	Sources of data	Data owners	If data are not available
Touristic zones and recreational areas	Boundaries of the zones plus buffer zone	National, regional and/or local spatial plans	Ministries in charge of tourism and sport, and spatial planning	
Cultural, historical and spiritual sites	Boundaries of the sites plus buffer zone; Locations of UNESCO World Heritage sites	National, regional and/or local spatial plans; National and international programs for culture protection	Ministries in charge of culture, Institutes for protection of cultural monuments, and spatial planning	Locations of UNESCO World Heritage sites
Data needed for excluding areas based on biophysical factors				
The slope of the terrain	Degrees/percent	Calculation by using Google Earth Extraction from Digital Elevation Model (DEM)	Geographical institutes, academic institutions;	n/a
Elevation	Meter	National, regional and local spatial plans Google Maps – terrain	Geographical institutes, academic institutions; Ministry in charge of spatial planning	Suttle Radar Topography Mission (STRM)
Waterbodies - lakes and rivers	Boundaries of rivers and lakes, plus buffer zones	National, regional and or local water and natural disaster management plans	Geographical and hydrometeorological institutes, Academic institutions, authorities in charge of water management and natural disaster	https://www.floodmap.net/
Land cover	Type of coverage of land (for example, crops, grass, forests, built-up areas)	CORINE land cover GlobeLand database National Soil Maps ESA CCI land cover	Publicly available	n/a

Description	Data type and unit	Sources of data	Data owners	If data are not available
Data needed for excluding areas based on the current infrastructure				
Airports, highways and roads, railways, gas pipelines, transmission lines	The boundaries of the infrastructure and the width of buffer zones	National, regional and/or local spatial plans	Ministries in charge of transport, infrastructure, and spatial planning	Data can be supplemented with global data from https://data.nextgis.com and Open Street Map
Existing and planned solar and wind farms, industrial areas	The boundaries of the infrastructure and the width of buffer zones	National databases of existing and planned solar and wind projects,	Ministries in charge of energy and industry, TSOs	Global Renewables Watch EU Industrial Database
Existing and planned settlements	Boundaries of settlements	Global Human Settlements	Publicly available	n/a
Data needed for the mapping of development potential (resource yield and other economic considerations)				
Wind speed	m/s	m/s	Ministry in charge of energy, Geographical state institutes, Academic institutions, Hydrometeorological institutes	Global Wind Atlas
Global Horizontal Irradiance (GHI)	kWh/m^2 per day	National data Photovoltaic geographical information system	Ministry in charge of energy, Geographical state institutes, Academic institutions, Hydrometeorological institutes	
Transmission and Distribution Electricity Network and Available Grid Capacities	Data on existing and planned transmission and distribution power lines and power facilities, including available grid capacities, voltage level (in kV) and their distance from potential suitable areas (in m)	Network Development Plans (NDPs) of TSOs and DSOs; grid hosting capacity maps; ENTSO-e Ten-Year Development Plan Energy and Industry Geography Lab	TSOs and DSOs, national regulatory authorities	Global Infrastructure Map

Description	Data type and unit	Sources of data	Data owners	If data are not available
Access to Transport Infrastructure	Data on existing and planned network major and minor roads and their distance from potential suitable areas (in m)	https://wiki.openstreetmap.org/wiki/Highways Open Street Map TENTec Map	Publicly available	Global Infrastructure Map

Table 2: List and description of baseline data necessary for carrying out sensitivity mapping (the second and third step of TNC methodology)

Description	Data type and unit	Source of data	Data owners	If data are not available
Data needed for sensitivity mapping concerning nature protection				
Protected areas (Emerald, Special Protection Areas - SPA, Important Bird Areas - IBA)	Location, surface area and boundaries of the protected areas	Emerald Network Map Important Bird Areas (IBA) World Database on Protected Areas CORINE land cover Ramsar List	Publicly available	n/a
Endangered species	Types of endangered species and boundaries of the habitats	Key Biodiversity Areas (KBA) IUCN RedList Species ranges	Publicly available	n/a
Endangered and rare habitats, habitats and migratory routes of importance for birds, bats and large carnivores	Protected sites under Birds and Habitats Directive and their boundaries; Boundaries of the habitats	Natura 2000 habitats Key Biodiversity Areas (KBA) Bird Migration Atlas Movebank Migration Mapping Tool EURING	Publicly available, national environmental agencies and institutes	n/a

Description	Data type and unit	Source of data	Data owners	If data are not available
		Data needed for sensitivity mapping concerning human environments		
Agricultural land	Cropland extent	National spatial plans CORINE Land Cover	Publicly available	Global Food Security-Support Analysis Data
Forests	Forest condition	National spatial plans CORINE Land Cover GRID-Arendal	Publicly available	Forest Landscape Integrity Index
Freshwater systems	River networks	Mapping the world's free-flow rivers	Publicly available	n/a

Table 3: List and description of additional data to consider for RAAs on specific priority areas

Description	Data type and unit	Source of data	Data owners	If data are not available
		Specific data for rooftops and facades of buildings		
Available rooftop areas		National or municipal inventories of building stocks; Building renovation strategies	Ministries in charge of construction and energy	Use high-resolution satellite imagery to identify and measure rooftops. OpenStreetMap
Technical features of buildings	The year of the construction; the state of rooftops and facades	National or municipal inventories of building stocks; Building renovation strategies	Ministries in charge of construction and energy	Publications of regional projects, such as SLED
Ownership over buildings	Private or public	Cadastre	Publicly available	n/a
Decision-making	In the case of multi-apartment buildings, investigate what consensus among apartment owners is needed for installations (unanimity, majority or simple majority)	Legislation on housing, buildings or energy efficiency	Publicly available	n/a

Description	Data type and unit	Source of data	Data owners	If data are not available
Specific data for transport infrastructure corridors and parking areas				
Road and railway networks	Type (primary, secondary, motorways, trunk roads), location, direction, length and width of roads and railways	Open Street Map TENTec Map Geographic Information System of the European Commission (GISCO)	Publicly available	n/a
Specific data for degraded land not suitable for agriculture				
Land use	Different land purposes: agriculture, forestry, construction, recreational, industry, barren land	Cadastre registries, spatial plans	National cadastre and land registry; local administration offices on spatial planning	n/a
	Repurposing	Laws and rulebooks on urban planning	Publicly available	n/a
Agricultural land quality	It is usually expressed in the range of classes (ie. from I to VI class)	Cadastre and land registry	Cadastre and land registry	National Soil Maps
Land ownership	Private or public ownership	Cadastre and land registry	Cadastre and land registry	
Specific data for waste sites, industrial sites and coal mines				
Waste sites	Number, location and surface area of closed and active waste sites/landfills	National Waste Management Plans or registries of brownfield locations	Ministries in charge of industry and waste management; national and local agencies for development	EEA's reporting obligations database covers CPs CORINE Land Cover land cover
Industrial Sites	Number, location and surface area of closed and active industrial sites	National Industrial Strategies and Plans Energy and Industry Geography Lab	Ministries in charge of industry and business activities; national and local agencies for development	EEA's reporting obligations database covers CPs

Description	Data type and unit	Source of data	Data owners	If data are not available
Mining sites	Number, location and surface area of closed and active mining sites	National Energy Strategies, NECPs, Energy Balances	Ministries in charge of energy and mining; companies that mange coal mines	EEA's reporting obligations database covers CPs.
Specific data for artificial inland water bodies, lakes and reservoirs, urban wastewater treatment sites				
Areas covered by water bodies (artificial inland water bodies, lakes and reservoirs)	Number, location and surface area (in m2) of water bodies	Water management plants	Wastewater utilities, Water regulators	EEA's reporting obligations database covers CPs
Urban wastewater treatment sites	Size of plants, energy demand of a plant, geographical location (rural vs urban) and presence/absence of anaerobic digestion, flow rate	Wastewater management plans of urban wastewater treatment plants	Wastewater utilities, Water regulators	HydroWaste - global database of wastewater treatment plants (WWTPs) Regional projects, such as RCDN Studies of expert associations, such as in Serbia

Annex 3 - Negative environmental impacts and mitigation measures

Both solar and wind technologies may impose various negative impacts on land use, biodiversity, ecosystems and human communities throughout their lifecycle. Mitigation measures can be implemented at various stages, including planning or site selection, construction, operation, and decommissioning, depending on at which stage of lifecycle a negative impact may arise. Monitoring of environmental impact should span over the project's lifetime. The scope and the selection of mitigation measures will depend on the renewable energy technology and phase of the project, as well as site geomorphological, biological and environmental characteristics where a plant is located.

In addition to mitigation measures that are listed in Chapter IV for specific priority areas, the table below provides indicative list of negative impacts that solar and wind technologies may have on biodiversity, as well as mitigation measures that need to be considered to avoid or reduce the impact and restore the damage. This table relies on the recommendations provided in the guidelines for project developers published by IUCN [114] and a guidebook to electrify in harmony with nature of Eurelectric.[115]

Table 4: Overview of possible environmental impacts and mitigation measures

Type of Impacts	Cause	Mitigation measures for solar	Mitigation measures for wind
Habitat loss and deterioration, reduction in species richness, soil erosion	Clearance of land, construction, operation, decommissioning	Mounting the panels on the driven pile or screw foundations instead of heavy foundations Careful scheduling of construction/ decommissioning to avoid disturbing biodiversity during sensitive periods Installing adequate drainage infrastructure to minimise the fragmentation of freshwater habitats Implement habitat restoration measures after construction and decommissioning to rehabilitate affected areas	Careful scheduling of construction/ decommissioning to avoid disturbing biodiversity during sensitive periods Implement habitat restoration measures after construction and decommissioning to rehabilitate affected areas
Injury or mortality of species	Electrocution	Adding insulation to existing poles and wires Orienting powerlines with wires horizontally, rather than vertically	Careful routing of power lines in the project design stage Scheduling measures in the operation stage

114 IUCN – International Union for Conservation of Nature, Mitigating biodiversity impacts associated with solar and wind energy development: guidelines for project developers, 2021.

115 Eurelectric, A guidebook to electrify in harmony with nature, the Power Plant 2.0 project, 2024.

Type of Impacts	Cause	Mitigation measures for solar	Mitigation measures for wind
	Collision due to reflection effects	Installation of bird diverter devices, use of non-polarising white tape around and/or across panels to deter aquatic insects	n/a
	Collision due to configuration of plants or power lines	Reduce the vertical spread of lines, increase the visibility of lines, and/or decrease the span length	Utilise bird-friendly turbine designs, such as those with slower blade speeds Installing visual deterrents on wind turbines to increase visibility Use of bird detection system
Barrier effect – disruption to movement and/ or migrations	Fencing, construction and operation	Securing ground clearance under security fences, gaps between the base of the fence and the ground, and gates to allow medium-sized mammals to pass	Careful scheduling, and re-scheduling of construction work and operation of the plant
Pollution (dust, light, noise and vibration, solid/ liquid waste)	Construction, operation and decommissioning	Creation and implementation of a pollution management plan, to ensure the avoidance of pollution and proper waste disposal	Creation and implementation of a pollution management plan, to ensure the avoidance of pollution and proper waste disposal Utilisation of noise abatement technologies i.e. quieter turbine models, as well as noise reduction technologies for both underwater pollution and onshore farms
Changes in microclimate, creation of local “heat islands”	Shadow effects	Covering surrounding with vegetation	n/a

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