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Tackling the ecological and climate crises in the European Union

Summary

Climate action should phase out fossil fuels and nuclear energy while prioritising renewable energies that can minimise impacts on nature and take into account nature's ecological capacities. Aligning energy solutions that can tackle both the ecological and the climate crises will require policy priorities that can safeguard nature and human livelihoods. To reach net-zero emissions by 2040 and minimise the impact of energy generation on nature, the EU should adopt a combination of efforts such as:

1. Reduce primary energy consumption by at least 35% from 2019 levels in all sectors by 2030 by modernising and electrifying production processes, decentralising and improving the grid network, as well as lowering the energy demand in the transport sector.
2. Limit new installations of renewable energies whose impacts on nature cannot be mitigated or whose carbon emissions are not neutral. In particular, focus on solar, wind and geothermal that undergo careful site selection and management, and avoid hydropower and forest biomass.
3. Protect and restore natural carbon stocks by strictly protecting primary and old-growth forests, wetlands, peatlands, seagrasses and kelp forests, as well as restoring degraded agricultural land.

Introduction – aligning perspectives

Both the ecological crisis and the climate crisis threaten the health of the planet, including human livelihoods and biodiversity. Healthy ecosystems are key to sustaining life on earth; hence, climate action must work with and for nature. Efforts to tackle climate change will require a combination of a reduction in energy consumption, increased renewable energy to replace fossil fuels and enormous increases in energy efficiency to cut greenhouse gas emissions by at least 65% by 2030 compared to 1990. Furthermore, the protection and restoration of natural carbon sinks, as well as a changed food system, will be imperative to achieve the EU's climate protection requirements and reach net-zero emissions by 2040.

However, reduction of carbon emissions should not be the only factor when prioritising climate action. Impacts on nature and its ecological capacities must also be considered. Not all renewable energy is generated sustainably and some can have damaging consequences for nature. For example, in most cases, energy generated through hydropower and forest biomass is destructive to nature. However, with careful site selection and management, certain types of renewable energy such as solar, wind and geothermal can make a significant contribution to climate change mitigation and can be less destructive.

Under the 2015 Paris Agreement on Climate Change, the EU committed to ensure that ecological integrity is maintained when taking measures to reduce greenhouse gas emissions, with particular reference to biodiversity.[1] Therefore, future scenarios that model energy demand must consider the carrying capacity of nature, including the cumulative ecological impacts of all human activities. Future scenarios should consider the latest scientific research and scenario-related work under both the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

[1] Recital, paragraph 13. Article 4, point 13. Article 6, point 1 and point 2. https://unfccc.int/sites/default/files/english_paris_agreement.pdf

Independent research on ecological impacts of renewable energy needs to be carried out before enabling investments. Without sufficient information, the precautionary principle must be applied. It is fundamental that renewable energy is not permitted because of 'Imperative Reasons of Overriding Public Interest' when these can have significant impacts on nature, a public good and therefore of public interest in itself.

To minimise the impact of energy generation on nature, the EU should:

1) Reduce energy consumption, in particular through deep renovations of buildings and improvements in electricity grids.
2) Prioritise renewable energy that can align with nature by optimising energy systems that can support solar, wind and geothermal energy while limiting forest biomass and new hydropower installations.
3) Plan new generation of energy so as to ensure that impacts on the natural environment, from the mix of generation types and the location of new developments, are minimised.
4) Maintain and restore natural carbon stocks, including strictly protecting primary and old-growth forests, wetlands, peatlands, seagrasses and kelp forests, as well as restoring degraded agricultural land.

Investing in energy efficiency to reduce consumption

Reducing energy consumption will be fundamental for achieving a carbon-neutral future. At least one third of energy savings will be needed to halt global warming at 1.5°C. Furthermore, the conversion of energy to electricity usually foresees a loss, as does the transmission and distribution, i.e. the energy is lost before it reaches the end-user. For example, in 2019, primary energy consumption (total domestic energy demand) reached 1,352 million tonnes of oil equivalent (Mtoe), while final energy consumption (what end-users actually consume) reached 984 Mtoe.[2]

To achieve the level of ambition in energy savings, a reduction of energy consumption is required in all sectors, including modernising and electrifying production processes to cut primary energy demand, decentralising and improving the grid network to reduce energy losses at the end source, as well as lowering the energy demand of the transport sector. Therefore, the level of energy consumption in the EU in 2030 should be equivalent to at least 45% in energy savings compared to PRIMES 2007[3] projections for both primary and final energy.

Energy efficiency in buildings

Buildings are responsible for 15% of direct greenhouse gas emissions in the EU.[4] To address the decarbonisation of buildings, the number of deep renovations (e.g. heating, cooling, ventilation, hot water) will need to be tripled, with at least 75% improvement, in particular through electrification based on renewable electricity of heat pumps, technology changes and behavioural change. Heat pumps can increase the use of renewable electricity for heating and can cover more than 50% of gross final heat consumption by 2040.[5]

A substantial increase in more efficient appliances will be needed, including banning the installation of new fossil fuel-based heating systems to phase them out. Furthermore, there

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[2] Eurostat Energy Efficiency [nrg_ind_eff] - last update of data 27/01/2021
[3] E3MLab (2008). 2030 European Energy and Transport Trends. Trends to 2030- update 2007 (PRIMES 2007). Online available: https://ec.europa.eu/energy/sites/ener/files/documents/trends_to_2030_update_2007.pdf
[4] European Environmental Agency 2021. Trends and Projections in Europe. Copenhagen
[5] Mühlenhoff, J. and Bonadio, J., 2020. Buidling a Paris Agreement Compatible (PAC) Energy Scenario, CAN Europe/EEB technical summary of key elements. Paris Agreement Compatible Scenarios for Energy Infrastructure, 52.

must be a significant reduction of resource use; where there is a need for material, this needs to tap into re-used/recycled material. There should be a minimum legal energy performance requirement for buildings and buildings should be regularly audited to monitor energy consumption and take further actions where needed.

Smart green grids

Given the increasing electrification of the energy sector to reduce carbon emissions and accommodate different renewable sources, European electricity grids will need to be improved. Current systems are built to only accommodate a limited number of large centralised production facilities, such as large coal and gas power plants, hydropower plants and nuclear power stations. However, renewable energy such as solar and wind can be intermittent, unlike energy from centralised power plants, and thus requires a system that can match the electricity demanded with the electricity generated.

Smart grids have a greater capacity to connect intermittent renewables, such as solar and wind energy, and determine which energy to transmit to the consumer. Smarter grids can enable the storage of electricity, monitor and control smart consumer appliances in homes, and enable easy to use online monitoring of electricity consumption in real time.

Grid development will also require an increase in power lines to connect to new sources of energy as well as to enable smarter grids that can decentralise the production of electricity from smaller sources such as solar panels on houses and small wind turbines. Nevertheless, new power distribution lines can have an impact on wildlife and ecosystems and therefore, where possible, should be placed underground and integrated with already built infrastructure as much as possible.

Phasing out fossil fuels and nuclear energy

Fossil fuels and nuclear energy have no role to play in a future energy system that has a low impact on nature and is driven by energy efficiency and renewable energy. Thus, the EU will have to stop using fossil fuels and nuclear as energy to reach climate neutrality by 2040, in particular phasing out coal and gas, and closing down nuclear power plants.

Coal is one of the most intensive and polluting fuels. In 2020, around 9% of the EU's total greenhouse gas emissions came from burning coal.[6] Mining and burning coal are detrimental to human health as well as to nature and the ecosystem. They cause emissions of dangerous substances including sulphur dioxide and nitrogen oxide, and contaminate air, water and soil. Coal will need to be phased out by 2030 and replaced with renewable electricity and, for certain intensive industries, with electricity from renewable hydrogen. Coal should not be replaced with fossil gas.

Fossil gas emits greenhouse gases, such as carbon dioxide and methane. On that account, it should not be seen as a transition fuel and should be phased out by 2035. Demand for gas should be reduced by maximising energy efficiency and investing in renewable energies, instead of investing in gas infrastructure. This ensures that the EU does not become dependent on yet another fossil fuel. Non-fossil gasses such as hydrogen or biogas should not be used as a replacement for fossil gas, given their limited sustainable production. A transition from fossil gas should focus on electrification of the energy system, while non-fossil fuels should be prioritised to help those sectors that are most difficult to decarbonise.

Nuclear power is responsible for some of the worst man-made industrial disasters in recent times. For example, data from the 2011 Fukushima Daiishi Power Station already suggests a

[6] Europe Beyond Coal: European Coal Plant Database, 3 Nov 2021

decline in populations of birds, butterflies and cicadas.[7] Nuclear energy also lacks a safe, long-term technical solution for nuclear waste. The 2014 airborne leak of radioactive material from the Waste Isolation Pilot Plant, the third largest deep geological repository for radioactive waste, illustrates the high-risk of nuclear waste. The long-term impacts of nuclear waste can significantly harm the objectives of pollution prevention, biodiversity and circular economy.[8] The inclusion of nuclear energy would go against the EU's environmental objectives and the EU's commitment for a safe environment for future generations and should consequently be phased out in Europe.

Prioritising renewable energy that has a low-impact on nature

A transition from fossil fuels to renewable energy is key to tackling climate change and reducing greenhouse gas emissions. This renewable energy transition can also align with nature protection and restoration objectives under the right conditions. However, the EU will have to prioritise certain renewable energies over others since not all renewables are sustainable and some can have significant impacts on nature. Among others, renewable energy infrastructure can lead to habitat destruction, barrier effects for wildlife migration, displacement of species from certain habitats, as well as collision of animals with built structures.[9]

Moreover, the presence of renewable energy infrastructure can also displace other human activities which can have knock-on effects such as reduced habitat availability, thereby extending the impacts of a development far beyond its initial footprint. Together with reducing energy consumption by half by 2040, the focus of electricity production from renewable energy should lie on solar, wind, and geothermal. Furthermore, these energy sources will also require investments in decentralisation and improvement of the electricity grid, as well as in improvements of buildings, especially in rural areas, to accommodate for new renewable sources of energy.

Renewable Energies to prioritise

Solar energy – Photovoltaic and thermal

Solar energy can be one of the most cost-effective forms of renewable energy, in particular Photovoltaic (PV) cells mounted on or integrated into buildings. Environmental impacts associated with solar power include land use and habitat loss, water use, energy use and the use of hazardous materials in manufacturing. These impacts can vary greatly depending on the technology: photovoltaic (PV) solar cells or concentrating solar thermal plants (CSP).

Energy produced through solar PV cells can require large bulks of material and high amounts of energy to mine, manufacture and transport. These energy costs are usually recovered after 1 to 4 years depending on the technology used.[10] Nevertheless, solar PV cell energy

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[7] Mousseau, T.A. and Møller, A.P., 2014. Genetic and ecological studies of animals in Chernobyl and Fukushima. Journal of Heredity, 105(5), pp.704-709.
[8] Wehrden, H.V., *et al*. 2012. Consequences of nuclear accidents for biodiversity and ecosystem services. Conservation Letters, 5(2), pp.81-89.
[9] Lammerant, L., Laureysens, I. and Driesen, K. (2020) Potential impacts of solar, geothermal and ocean energy on habitats and species protected under the Birds and Habitats Directives. Final report under EC Contract ENV.D.3/SER/2017/0002 Project: "Reviewing and mitigating the impacts of renewable energy developments on habitats and species protected under the Birds and Habitats Directives", Arcadis Belgium, Institute for European Environmental Policy, BirdLife International, NIRAS, Stella Consulting, Ecosystems Ltd, Brussels.
[10] Alsema, E.A., de Wild-Scholten, M.J. and Fthenakis, V.M., 2006, September. Environmental impacts of PV electricity generation-a critical comparison of energy supply options. In 21st European photovoltaic solar energy conference (pp. 3201-07).

can be used to replace existing building cladding materials and can be one of the most viable forms of renewable energy in an urban environment.[11]

Ground-mounted solar installations can also have detrimental effects when habitats are cleared, which can destroy soils and fragment landscapes. Furthermore, the extraction of material to produce solar energy can also impact nature outside of Europe. As with wind installations, many impacts can be reduced or avoided by appropriate planning and siting. Nevertheless, solar PV energy systems generate the greatest amount of power per area among renewables, including wind, hydroelectric, and biomass.[12]

Furthermore, as with all technologies, solar energy can also have unintended waste of by-products. Recycling and proper disposal of solar panels should also be envisioned, in particular holding solar panel manufacturers responsible for implementing a recycling programme.

An increase in solar PV could make solar energy the second most important electricity source in Europe by 2040, covering almost 30-40% of electricity generation. Furthermore, with an expansion of district heat networks solar thermal heat supply can be expected to more than double by 2050.[13]

Solar is a cost-effective energy source and a major driver for electrification and decentralisation of the energy grid. While solar power is limited to the day time and areas with sufficient solar irradiation and suitable locations, with increasing innovation in the capacity to store solar energy, the potential of solar can expand even further. By 2040, the EU should generate at least 2,000 TWh from solar energy.

Wind energy

Electricity generated by wind turbines onshore and offshore is dependent on the wind speed and usually, with traditional technologies, on the size and positioning of the blades. In particular, the higher the position of the blades and the larger the blades are, the stronger and more stable the energy produced by the wind will be and the further apart wind turbines are, the less drag and turbulence they create. Thus, energy produced through traditional wind technologies is dependent on an adequate location and sufficient space.

With proper planning, onshore wind can become the EU's most important electricity source with the potential to reach more than 2500 TWh by 2040, while offshore wind energy can see an increase to around 800 TWh by 2040.[14] New wind turbine technologies have also been developed to allow for small and community wind energy (i.e. distributed wind), in particular to power rural areas. These new technologies enable individuals to produce their own energy and facilitate a decentralised grid planning approach.

Wind farms, especially industrial infrastructures, can have detrimental environmental impacts if the surrounding ecology is not well understood. Furthermore, the material to produce wind turbines, which is mostly sourced through extraction outside of Europe, has its own impact on nature. These impacts can be avoided through planning approaches that account for the sensitivities of ecosystems and for cumulative impacts caused in conjunction with other human activities. Moreover, the EU needs to establish a landfill ban on all

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[11] Tsoutsos, T., Frantzeskaki, N. and Gekas, V., 2005. Environmental impacts from the solar energy technologies. Energy policy, 33(3), pp.289-296.
[12] Hernandez, R.R., Hoffacker, M.K. and Field, C.B., 2014. Land-use efficiency of big solar. Environmental science & technology, 48(2), pp.1315-1323.
[13] (see footnote 5)
[14] (see footnote 5)

decommissioned windfarms and re-use, recycle or recover 100% of decommissioned materials.

Wind farms, large or small, should not be placed in migratory routes of animals (e.g. birds, mammals etc), breeding areas or in protected areas. Important areas for foraging should also be avoided. This ensures that the most important areas for wild animals are not impacted. Furthermore, wind turbines should only be produced from recycled material. Extraction from and destruction of natural ecosystems, including outside of Europe, should be limited. By 2040, the EU should generate at least 3,300 TWh from wind energy.

Geothermal energy

Geothermal energy is produced from the heat generated beneath the earth's solid surface which can easily take place at a shallow level (i.e. ambient heat) without the need to penetrate deep into the soil. Ambient heat can be captured through heat pumps and can be a key driver for electrification of heating. Therefore, through renovation of buildings and increased installation of heat pumps, the potential of shallow geothermal energy will also increase. Primary energy supply of geothermal energy can increase by more than ten-fold by 2040.[15]

There are different types of geothermal energy production that carry their own impacts, including habitat loss from site selection, noise pollution, and thermal pollution of groundwater. Non-closed systems, such as dry and flash steam plants, can also emit gases from deep aquifers, including carbon dioxide, arsenic and mercury. Overall, the impact of geothermal energy on nature, in particular soils, is yet not well understood and more research should be carried out to ensure any future increase in its production will have a minimal impact on nature.

Geothermal energy can be used to complement the fluctuations of wind and solar energy. Phasing-out gas and oil boilers will be an important step for increasing the use of geothermal energy through heat pumps. By 2040, the EU should generate at least 1,100 TWh from geothermal energy.

Ocean energy

Ocean energy comprises different technologies that range from using the kinetic energy of waves, to changes in temperature or salinity gradient. Aside from some tidal range technologies, ocean energy is still not market operational and, until 2040, it is expected to only play a marginal role in the European energy mix.[16]

Research on the impacts of ocean energy on nature is still ongoing. In particular, its impact on habitat changes and degradation, including underwater and coastal habitats, as well as noise pollution and electromagnetic interference require greater attention before ocean energy becomes market operational. By 2040, the EU should generate at least 10 TWh from ocean energy.

[15] (see footnote 5)
[16] (see footnote 5)

Shifting perspectives on problematic energies

Hydropower

Hydropower severely impacts riverine ecosystems and freshwater biodiversity worldwide.[17] Research on the effects of dams in the Mediterranean, for example, shows that hydropower generation, including small hydropower, is potentially the most important driver of freshwater fish species extinction, due to its severe impairment of river connectivity and fish migration.[18] In addition, the construction of hydropower infrastructure leads to habitat destruction and deteriorating living conditions for wildlife by altering hydrological regimes and sediment flows and by leading to the hydromorphological deterioration of river channels, and increased erosion and deforestation.

In many cases, the impacts hydropower plants have on river ecosystems are difficult to mitigate due to their far-reaching ecological effects. For example, the majority of demand-oriented hydropower designs inevitably imply unnatural fluctuations in river flow, which in turn impacts species migration and may lead to the destruction of crucial habitats such as floodplains, alluvial forests and wet meadows.

Similarly, the idea that river fragmentation can be mitigated through fish ladders is largely a false promise. Firstly, fish ladders only tackle one aspect of river fragmentation and where they are placed, many fish cannot find them (especially during downstream passage), or climb them. Secondly, they require regular and costly maintenance. Finally, even if fish ladders are overcome, fish migration is further disrupted by reservoirs, dried river sections and flow fluctuations.

At the same time, the current and potential electricity contribution of hydropower, particularly small hydropower, is negligible, considering the costs for building and maintenance of hydropower infrastructure. In 2019, the EU's 19,000+ existing hydropower plants only produced 320 TWh[19] i.e. 2% of EU total energy supply. If all of the 5,500+[20], planned hydropower plants would be built, this share would only increase by around 0.5%.[21] Furthermore, climate change is expected to negatively impact the productivity of many hydropower plants in the future.

The impacts of hydropower on nature are vast while the amount of energy derived is limited. Further investments in hydropower projects in Europe are therefore neither ecologically sustainable nor financially viable. On the contrary, by 2040, hydropower generation in Europe should be reduced by at least 20 TWh, 7% less compared to 2019 production, and the EU should remove some hydropower plants to restore free-flowing rivers and floodplains.

Bioenergy

The conversion of biomass (agricultural and forest products) into energy for heat, electricity and transport fuels, is a rapidly growing source of energy in Europe. Since 2009, bioenergy has been extensively promoted as crucial for reaching the EU's renewable energy target. It currently makes up the vast majority of the EU's renewable energy mix with a share of almost 60%.

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[17] WWF. 2020. Living Planet Report 2020 — Bending the curve of biodiversity loss. Almond, R. E. A., M. Grooten and T. Petersen (Eds). WWF, Gland, Switzerland.
[18] Freyhof, J., L. Bergner and M. Ford. 2020. Threatened Freshwater Fishes of the Mediterranean Basin Biodiversity Hotspot: Distribution,
extinction risk and the impact of hydropower. EuroNatur and Riverwatch: i – viii + 1 – 348.
[19] As per Eurostat complete energy balances [nrg_bal_c] - last update of data 06/06/2021
[20] EuroNatur, GEOTA, RiverWatch, WWF, Hydropower pressure on European rivers: The story in numbers, 2019
[21] Average amount of energy generated by hydropower by 19,000 plants in 2019 was 0.018 TWh. For 5500 plants, they would generate 98.5 TWh more energy for 2019.

Bioenergy from crops such as wheat, sugar, oilseeds and maize is, however, land-inefficient, given the high amounts of land, water and other resources needed to produce each unit of energy.[22] Increasing bioenergy output will therefore require an increasing diversion of land area, which can directly change natural ecosystems or intensify ecological destructive agricultural production.[23] Bioenergy can also lead to indirect land use changes (ILUC), when farmers have to clear other wild areas to grow food to make up for the loss of land to bioenergy production.[24]

Bioenergy derived from most forest biomass is also highly destructive to nature and has encouraged logging of trees, including in protected areas.[25] In Europe, 86% of all forest habitats are already in an unfavourable condition as a result of poor forest management, with clearcutting and removal of old and dead trees having the most harmful effect on wildlife habitats.[26] Burning forest biomass also contributes to carbon emissions and should therefore not be considered a carbon-neutral energy source.[27, 28]

To adhere to biodiversity targets, the use of bioenergy must be reduced by almost two thirds until 2040. A decrease of bioenergy in heating, especially in inefficient individual heating and in rural areas is essential and will require deep renovation of buildings and a switch to other energy sources. Forest biomass should not be further pursued in Europe.

Renewable hydrogen gas

Renewable hydrogen is not a primary source of energy but an energy carrier requiring conversion from renewable electricity and which causes significant energy losses. It is a limited resource that should be carefully used and only in conjunction with surplus electricity which cannot be stored, such as wind and solar electricity. Renewable hydrogen gas will only help tackle climate change if it is exclusively produced with renewable electricity and replaces fossil fuels only in distinct demand sectors where there is no other sustainable alternative.

Renewable hydrogen only holds potential for contributing to the phase-out of coal and fossil gas in energy-intensive industries where replacing power or heat with fossil free electricity (i.e. direct electrification) will take more time. Renewable hydrogen, together with other non-fossil gasses such as liquid synthetic fuels, synthetic methane and renewable ammonia, should be used efficiently, and only in sectors where electrification is not currently possible such as shipping and aviation. In the transport sector it should be accompanied by efforts to lower energy demand, such as promoting public transport, shared vehicle use, and reduced air travel.

[22] Reid, W.V., Ali, M.K. and Field, C.B., 2020. The future of bioenergy. Global change biology, 26(1), pp.274-286.
[23] Everaars, J., Frank, K. and Huth, A., 2014. Species ecology and the impacts of bioenergy crops: an assessment approach with four example farmland bird species. Gcb Bioenergy, 6(3), pp.252-264.
[24] Anderson-Teixeira, K.J., Snyder, P.K., Twine, T.E., Cuadra, S.V., Costa, M.H. and DeLucia, E.H., 2012. Climate-regulation services of natural and agricultural ecoregions of the Americas. Nature Climate Change, 2(3), pp.177-181.
[25] Sinclair, L. and Rougieux, P., Comparing reported forest biomass gains and losses in European and global datasets, FORESTS, ISSN 1999-4907 (online), 12 (2), 2021, p. 176, JRC121997.
[26] Camia, A., Giuntoli, J., Jonsson, R., Robert, N., Cazzaniga, N.E., Jasinevičius, G., Grassi, G., Barredo, J.I. and Mubareka, S., 2021. The use of woody biomass for energy production in the EU. Publications Office of the European Union.
[27] Booth, M.S., 2018. Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy. Environmental Research Letters, 13(3), p.035001.
[28] Norton, M., Baldi, A., Buda, V., Carli, B., Cudlin, P., Jones, M.B., Korhola, A., Michalski, R., Novo, F., Oszlányi, J. and Santos, F.D., 2019. Serious mismatches continue between science and policy in forest bioenergy. GCB Bioenergy, 11(11), pp.1256-1263.

Planning future energy installation in line with nature

To minimise the impact of renewable energies on ecosystems, future energy installations should be planned through a strategic and ecosystem-based spatial approach that considers impacts on species, habitats and the climate. Strategic planning helps minimise conflicts and ensure a win-win for tackling both the climate and biodiversity crisis.

Determining the potential contribution of different renewable energy sources to the energy mix therefore requires assessing if the ecosystem has the capacity to sustain the production of those renewable energies, including the cumulative ecosystem impacts that other human activities cause. For example, the impact of offshore wind farms on seabirds is additional to the impact fishing activities have on those same populations.

Therefore, determining the sensitivity of biodiversity to human activities, including energy installations, is a fundamental requirement prior to the development of spatial plans. These sensitivity assessments decrease the negative effects of planned projects/activities on biodiversity and aid decision-making. Sensitivity mapping helps identify known potentially sensitive locations, locations that are not considered to have adverse implications for wildlife, and locations for which further information is needed to determine whether renewable energy installations are compatible with biodiversity conservation priorities.

All stages of the life cycle and the habitats and locations that support essential functions, such as feeding, breeding, wintering, resting, and migration stopovers, need to be considered. Sensitivity maps should be regularly updated based on new distribution and animal behaviour data. Energy planning should prioritise the use of available areas with low ecological sensitivity.

Spatial plans should exclude energy related activities from protected areas and buffer zones, as these areas are fundamental instruments to stop biodiversity loss[29].

Furthermore, Strategic Environmental Assessments (SEA) should be undertaken for all renewable energy and network infrastructure plans – both for individual renewable energy sources or combined plan – to determine their appropriateness. In addition, more detailed, comprehensive and project-specific Environmental Impact Assessments should always be carried out before any proposed renewable energy installation and associated infrastructure (e.g. powerlines, access roads onshore) can be approved.

Moreover, cumulative impacts of plans or projects must be assessed in-combination with other plans or projects in the same area to account for combined and cumulative effects of existing and proposed projects and other human activities. In some cases, restrictions on other human activities will be required to prioritise renewable energy production.

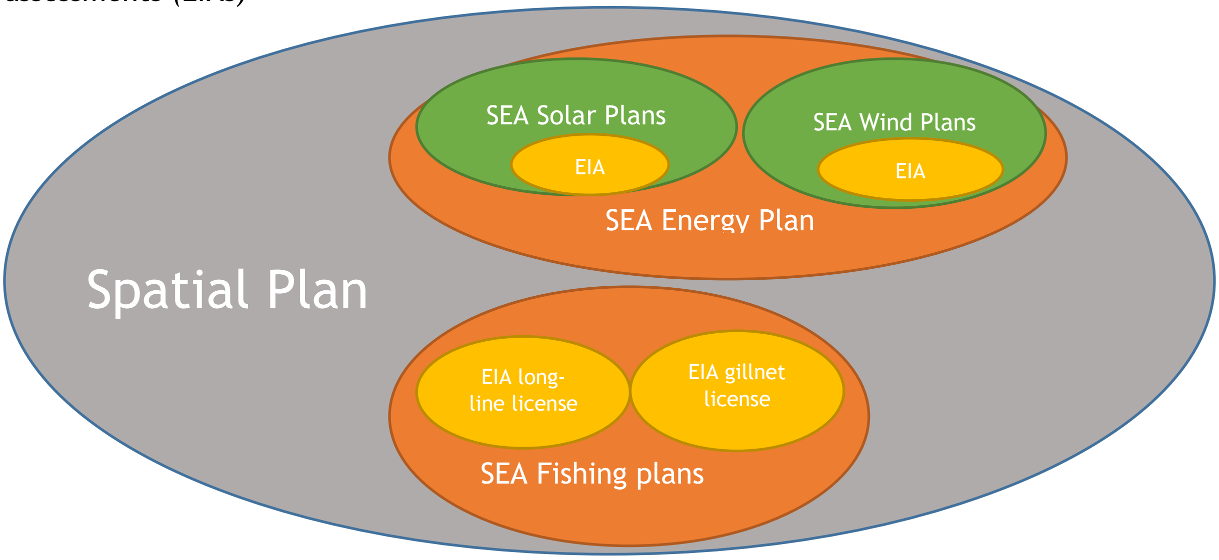
All sensitivity analyses and assessments should be carried out in a scientifically sound way, by independent technical experts and not by project proponents. NGOs, together with other stakeholders, should be informed and consulted from an early stage to ensure the best possible results for both renewable energy development and nature conservation, and all documents should be made available to the public.

Given the already degraded state of nature[30], climate mitigation efforts should also be directed at restoring and increasing the resilience of ecosystems. Therefore, decisions on renewable energy plans and projects will need to be preceded and accompanied by targeted

[29] IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany.
[30] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0097

plans and projects for species and habitat protection and restoration. For example, removing invasive species will improve habitats and help increase populations. Furthermore, given the limited capacity of ecosystems, not all human activities can take place at once. To increase and maintain species populations and habitats while prioritising energy investments that helps reach climate change objectives, decisions to limit other human activities (e.g. hunting and fishing) in specific areas are inevitable.

Figure 1: *Visual diagram illustrating the relationship between sectoral plans and spatial plans and the strategic environmental assessments (SEAs) and environmental impact assessments (EIAs)*



Protecting and restoring natural carbon sinks

Natural ecosystems such as old-growth forests, wetlands, peatlands and seagrass beds are effective solutions for carbon sequestration. Restoring these ecosystems will provide the EU with long-term and cost-efficient measures to mitigate and adapt to climate change. Restoration of nature must be a fundamental component of EU policies aiming to tackle climate change.

Restoring natural carbon sinks will also require greater protection measures for areas of high ecological value, including halting logging in primary and old-growth forests, peatland extraction as well trawling of Posidonia beds. By 2030, each EU member state's land and sea area must be restored by at least 30%.

Soils are globally the biggest carbon pools, storing about 3,480 Gt (around 75%) of carbon.[31] Global agricultural systems have the potential to sequester from 1,500 up to 4,300 Mt of carbon dioxide per year under appropriate management practices. Given that agriculture is currently a major emitter of global greenhouse gasses, a shift away from destructive agricultural practices towards a more fair and sustainable food system could convert agricultural lands into carbon sinks by enhancing soil carbon pools.[32]

The EU must reduce greenhouse gas emissions by at least 65% by 2030 compared to 1990 levels, and this must be achieved through the shift to renewable energies and energy savings. However, protecting natural carbon sinks should not be used as an offsetting mechanism to

[31] Lal, R., 2004. Soil carbon sequestration impacts on global climate change and food security. science, 304(5677), pp.1623-1627.
[32] Smith, P. and Wollenberg, E., 2013. Achieving mitigation through synergies with adaptation: Pete Smith and Eva Wollenberg. In Climate change mitigation and agriculture (pp. 81-88). Routledge.

legitimise delays in the shift to renewable energies and energy savings. Therefore, any reduction of greenhouse gas emissions through the protection and restoration of natural carbon sinks, and the improvement of agricultural practices should be accounted separately and should be additional and with their own targets.

Investing in research and monitoring

In consultation with relevant experts, independent and rigorous research and monitoring should be implemented by national governments to improve the scientific understanding of the impacts of renewable energy installations on nature. Ecological data gaps are a significant problem for understanding the interactions of renewable energy development and wildlife. Research is vital to improve the scientific understanding of impact risks, especially before implementation of large-scale energy developments. Without such information the precautionary principle must be upheld.

Sufficient financing should be provided by governments and the EU to encourage peer-reviewed scientific research, especially into the cumulative effects of renewable energy installations.

Monitoring before, during and after construction is needed to investigate the effects and potential population level impacts on wildlife and habitats, and to apply appropriate management measures. Relevant monitoring data needs to be exchanged and published transparently to ensure a coordinated and environmentally-sound energy transition across Europe.

Finally, technological innovation should be encouraged to maximise efficiency in energy production. Research and development of new technologies[33], as well as as-yet-unseen innovations that may have the potential to reduce ecological impacts, should be encouraged and supported.

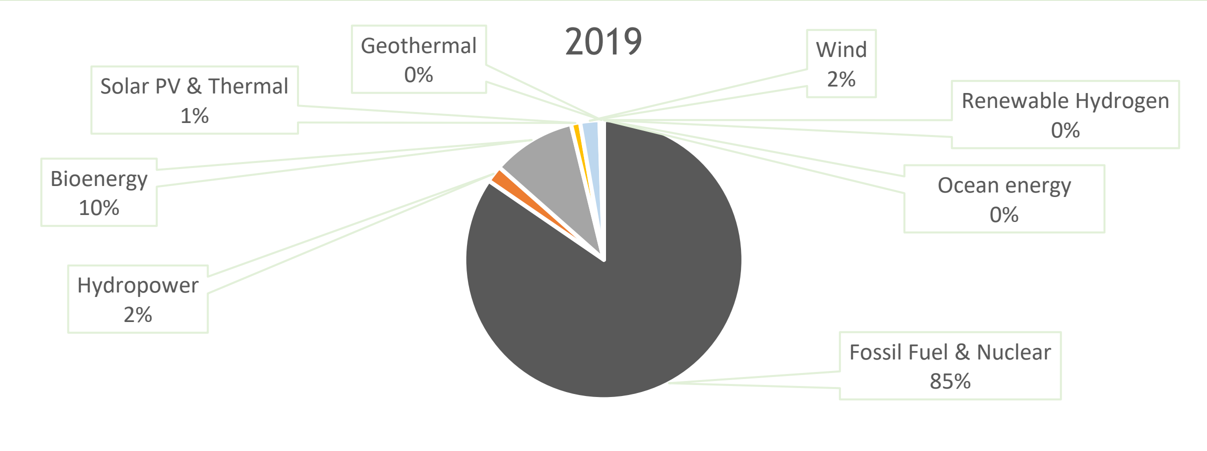
Conclusion – the future is energy and nature together

There are limited scenarios that model energy demand while considering the carrying capacity of nature. Future scenarios that model energy demand in the EU must reflect the EU's commitment to ensure that ecological integrity is maintained when taking measures to reduce greenhouse gas emissions. This includes considering the cumulative ecological impacts of all human activities. For example, the Paris Agreement Compatible Scenario for Energy Infrastructure (PAC) from Climate Action Network (CAN) Europe and the European Environmental Bureau (EEB) attempts to consider the carrying capacity of nature.[34] Future scenarios should follow the same thinking and consider the latest scientific research and scenario-related work under both the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

The charts below visualise EuroNatur's recommendations on the possible shift from fossil fuels to renewable energy with a breakdown per fuel type, based on current production in 2019 and where the EU should be in 2040.

[33] Examples of such developments include bladeless wind turbines and low-impact floating structures
[34] (see footnote 5)

***Graph 1**: Visual demonstration of the total energy supply by energy type in 2019 (according to Eurostat)*



***Graph 2**: Visual demonstration of the total energy supply that can be produced by energy type in 2040 (according to EuroNatur's position)*

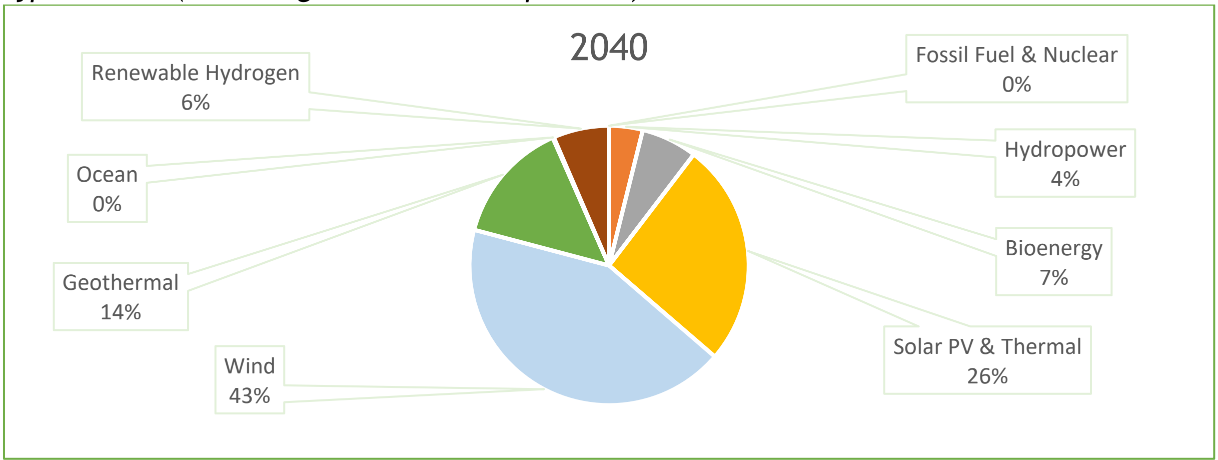


***Table 1**: Comparison of total energy supply by energy type in 2019 (according to Eurostat) and potential energy that can be supplied in 2040 (according to EuroNatur's position)*

Energy Fuel EU 27	2019 (TWh)[35]	2040 (TWh)[36]
Fossil Fuel & Nuclear	13890.5	0
Total Renewable energy	2534.5	7210+
Hydropower	320	Up to 300
Bioenergy	1592	Up to 500
Solar PV & Thermal	174	2000+
Wind	367	3300+
Geothermal	80	1100+
Ocean	0.5	10+
Renewable Hydrogen	1	Up to 500

[35] Eurostat complete energy balances [nrg_bal_c] - last update of data 06/06/2021
[36] These are potentials opportunities for which EuroNatur foresees for each fuel type and is mainly derived from the PAC scenario from CAN Europe and the EEB (see footnote 5)

Recommendations:

With the right policies, achieving net-zero emissions by 2040 through low impact renewable energy is possible.

1. The EU must reduce greenhouse gas emissions by at least 65% by 2030 compared to 1990 levels, and this must be achieved through the shift to renewable energies and energy savings.
2. By 2040, primary energy consumption must be reduced in the EU by at least 35% from 2019 levels in all sectors, in particular through deep renovations of buildings and improvements in electricity grids.
3. The EU must modernise and electrify production processes, decentralise and improve the grid network, and lower the energy demand in the transport sector.
4. By 2040, the share of energy from renewable sources in the EU's gross final consumption of energy should be 100%.
5. The EU must prioritise renewable energies that can align with nature by optimising energy systems that can support solar, wind and geothermal energy while limiting forest biomass and new hydropower installations.
   - The use of bioenergy must be reduced by almost two thirds by 2040 and burning of forest biomass should be discontinued.
   - By 2040, hydropower generation in Europe should be reduced by at least 20 TWh (7%) compared to 2019 production, if not more. Select hydropower plants should also be removed to restore free-flowing rivers and floodplains.
6. The EU must carefully plan new generation of energy so as to ensure that impacts on the natural environment from the mix of generation types and the locations of new developments are minimised.
   - Energy planning should prioritise the use of available areas with low ecological sensitivity.
   - Spatial plans should exclude energy related activities from protected areas and buffer zones, as these areas are fundamental instruments to stop biodiversity loss
7. The EU must invest in maintaining and restoring natural carbon stocks, including by strictly protecting primary and old-growth forests, wetlands, peatlands, seagrasses and kelp forests, as well as restoring degraded agricultural land.

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