Finance & Investment in Nature Positive Energy

Nature Positive solar investment: industry guidance

INDICATORS FOR NATURE-RELATED DISCLOSURES AND FUTURE MARKETS

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Foreword

The ongoing degradation of our natural environments poses significant risks to our collective well-being and economic stability. We see the consequences of biodiversity loss and ecosystem service disruption, which undermine our climate goals and sustainable development. As one of the leading nations in renewable energy initiatives, this research supports our transition to renewable energy sources so that we can start to account for nature appropriately.

The NERC UKRI-funded pilot studies into integrating finance and biodiversity for a nature-positive future are an important step in understanding our relationship with nature and how we measure it. These studies highlight the urgent need for robust indicators and metrics that relate to biodiversity and ecosystem services.

Integrating biodiversity into finance is crucial for building a nature-positive future. In the context of building a green future, delivering on national priorities, and unlocking technology to achieve Net Zero by 2050, funding for research that integrates biodiversity into finance is essential. This study provides valuable insights into how financial mechanisms can support biodiversity, creating robust frameworks and standards for Nature Positive investments.

The Taskforce on Nature-related Financial Disclosures (TNFD) will play a critical role in shaping these frameworks. The TNFD provides a risk management and disclosure framework for organisations to report and act on evolving nature-related risks. Metrics can help to ensure that biodiversity considerations are embedded into financial decision-making, leading to more sustainable and resilient economic systems.

Measuring and disclosing our impacts and interactions with nature, in the same way as we account for other resources, brings the importance of both protection and restoration of nature to the forefront. We are already witnessing a surge in organisations wishing to develop their own nature restoration initiatives, and this isn't just because more companies are taking an interest in nature. It is because now, more than ever before, we have the ability to quantify our interventions. The metrics available, and the emerging reporting frameworks, are bringing nature out of the realms of intangible benefits, and into the realms of asset management. This shift has the potential to unlock huge funding potential for nature.

Integrating robust, standardised indicators into the solar industry's operational and financial frameworks to ensure that Nature Positive practices are not only adopted but also effectively reported and scaled, will play an important role in nature disclosures. This integration is not just about mitigating risks — it's about seizing an opportunity to lead in sustainable development.

We can no longer afford to delay. We must swiftly transition our economic and financial systems to value and invest in our natural environment. We must stop treating nature and climate as separate issues. They are intricately interwoven, with one underpinning the other.

Tackling climate change means reducing emissions and ensuring our natural environment is robust and healthy. This means recognising the interconnections between nature and our energy systems and ensuring that the millions of species within these ecosystems are protected. Our actions today will determine the resilience and prosperity of our economy tomorrow.

Dr. Tim Coles OBE

Project Director and founder
of Operation Wallacea
Director & Chief Executive Officer
(CEO) rePLANET

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Executive summary

The changing context of nature-related disclosures

Business, investors and our wider society have clear dependencies on nature. Declines in nature pose severe risks, thus there is an urgent need to halt the loss of biodiversity globally to ensure a healthy environment and economy. The UN Convention on Biological Diversity adopted the Kunming-Montreal Global Biodiversity Framework (GBF), which aims to halt and reverse biodiversity loss by 2030 and achieve recovery by 2050. This target has been referred to as 'Nature Positive' and reflects the increasing international commitment to nature recovery. In this context, disclosures by business and industry on the impacts of their activities on nature have been incorporated increasingly into sustainability reporting frameworks. Nature-related disclosures are currently voluntary but are likely to become mandatory across the globe in the future.

Opportunities for nature from land use change to solar in the UK

The UK is one of the world's most nature-depleted countries. Change in land use has been one of the main drivers of loss of nature in the UK. The UK Government's Net Zero Growth Plan has targeted a five-fold increase in solar capacity by 2035. Change in land use to solar can enhance nature, as well as the many ecosystem services and benefits that nature provides. This provides opportunities for Nature Positive investment and potential trading on developing nature markets.

The need for indicators and metrics in Nature Positive reporting

Nature Positive investment and trading require robust indicators and metrics relating to biodiversity and ecosystem services. These indicators and metrics need to meet the needs of different parts of the solar value chain, including law firms, investment banks, asset managers, pension funds, solar farm management companies, and ecological consultancies.

A suite of indicators for Nature Positive reporting for the solar industry needs to satisfy the needs of different user groups. The indicators best-suited to reporting on management outcomes at site-level are different from those needed for nature-related financial disclosures or strategic reporting to investors.

Executive summary continued

Requirements for Nature Positive indicators

Nature Positive indicators need to be standardised, representative, auditable and well-suited to showing trends over time. Indicators to be used in financial disclosures must be suitable for scaling up over a portfolio of assets.

Recommended indicators for Nature Positive reporting from solar farms

Indicators well suited to the monitoring and reporting of Nature Positive actions at individual solar farms, and also suitable for scaling up across of portfolio of assets for use in disclosures are: area of habitat; habitat connectivity; level of biodiversity; plant species richness; invertebrate species richness; bird species richness; soil carbon content; resources for pollinators; bee and butterfly species richness; the number of ecosystem services actively managed; educational outreach; scientific collaboration; and active community engagement.

The above indicators map well on to existing disclosure frameworks, across the indicator categories of ecosystem extent, ecosystem connectivity, ecosystem condition, ecosystem services, and engagement. Indicators needing further methodological development before use in financial disclosures are greenhouse gas mitigation and the number of biodiversity indicators with a sampling plan in place. Indicators which are better suited to site-level reporting and monitoring are: soil total nitrogen; soil organic matter and organic carbon; grazing animal stocking density; and bat species activity.

The wider benefits of Nature Positive monitoring and reporting

Companies that are early adopters of Nature Positive indicators will be best placed as the industry and regulatory contexts around nature disclosures develop further. Incorporating Nature Positive indicators into reporting can also bring additional value outside of nature enhancement, including reputational and philanthropic benefits. More widely, there is potential for societal benefits, such as improving people's connection with and value placed on nature, in line with the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) indirect drivers of biodiversity loss. The more extensive application of nature positive indicators has the potential to transform solar supply chains and provide opportunities for innovative business models across the supply chain.

> *"Nature positivity will become more prominent in the coming years – it will be a way for companies to differentiate themselves and attract capital."*
>
> **Kathryn Deegan** | RBC Capital Markets

1.0 The case for Nature Positive investment in the solar industry

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BDB PITMANS

> *Local communities need to see that there are not just benefits for the developer and the significant generation of renewable energy, but there are also significant local benefits both for the community and for ecology.*

Richard Marsh | BDB Pitmans

1.1 The need for nature disclosure in business and finance

Businesses have clear impacts and dependencies on nature, so declines in nature pose significant risks to business and investors.[1] In 2020, the World Economic Forum reported that more than half of global GDP depends on nature,[2] with biodiversity loss one of the top three perceived risks to global society over the next decade.[3]

In response to the risk that biodiversity loss presents, nature has been increasingly incorporated into organisational sustainability reporting frameworks. For example, the Taskforce on Nature-related Financial Disclosures (TNFD) encourages companies, investors and other streams of capital to disclose on their nature-related impacts, dependencies, risks and opportunities.[1] Although nature disclosures are currently on a voluntary basis *(Table 1)*, the direction of movement is towards mandatory nature disclosures as signalled by the trajectory of the Taskforce on Climate-related Financial Disclosures (TCFD) when the Financial Conduct Authority's Listing Rule (LR 9.8. 6R (8)7) made disclosures against the TCFD recommendations a requirement on a "comply or explain basis".

Table 1. Current regulatory and voluntary financial disclosure initiatives relevant to Nature Positive solar investments.

Disclosure initiative	Requirement
Sustainable Finance Disclosures Regulation (SFDR), Annexes III, V and PAIs*	Regulatory
Corporate Sustainability Reporting Directive (CSRD)	Regulatory
International Sustainability Standards Board (ISSB) - S1 and S2	Voluntary
Taskforce on Climate-related Financial Disclosures (TCFD)	Voluntary
Taskforce on Nature-related Financial Disclosures (TNFD)	Voluntary

* In the UK, the EU SFDR will likely be applied alongside the UK Sustainability Disclosure Requirements (SDR) developed by the Financial Conduct Authority (FCA), expected to come into effect during 2024. The UK SDR shares many aspects with the EU SFDR but introduces a greenwashing rule, sustainability labels and associated conditions.[4]

1.0 The case for Nature Positive investment in the solar industry continued

1.2 Nature Positive by 2030

To ensure a healthy economy and thriving society we must maintain resilient ecosystems that provide us with the valuable services on which we depend, from flood control and pollination through to the regulation of air and water quality. Biodiversity – the diversity within and between species of living organisms and their ecosystems – is key to the provision of these ecosystem services.[5] Yet across the globe, nature is declining; biodiversity loss is occurring at the fastest rate in human history and wildlife populations have decreased by 69% on average since 1970.[6,7] These declines are caused in part by the increasing demands that we place on ecosystems as our population and per capita resource demands grow.[6,8]

To address the urgent issue of biodiversity decline, the global societal goal to halt and reverse nature loss by 2030 was codified in the UN Convention on Biological Diversity's Kunming-Montreal Global Biodiversity Framework,[9] commonly referred to as 'Nature Positive by 2030'. The Nature Positive goal aims to 'Halt and Reverse Nature Loss by 2030 on a 2020 baseline, and achieve full recovery by 2050'.[10] Achieving this goal will require collaboration across business, finance, government and wider society[10] and increased contribution from business and finance towards Nature Positive outcomes.[1]

"Clarkson & Woods have been excited to learn from and contribute towards this important project, the importance of which cannot be understated. For nature positive solar to be sustainable, a robust basis for finance investment is fundamental. This study will only go to improve opportunities to support biodiversity design, management and enhancement within solar arrays."

Tom Clarkson | Managing Director, Clarkson & Woods

1.3 Opportunities for biodiversity enhancement at solar farms

The UK was recently declared one of the world's most nature-depleted countries, with dramatic declines in biodiversity over the last 50 years.[11] Change in how we use land has been one of the key drivers of this nature loss.[11] The UK Government's Net Zero Growth Plan includes a target to increase solar energy capacity five-fold by 2035,[12] representing a significant amount of land. Yet unlike some other forms of land use change, only about a third of a solar farm's land area is over-sailed by panels. Solar farms can deliver a suite of biodiversity and ecosystem co-benefits in addition to low carbon energy.[13] Solar farm life-times are for up to 40 years which provides time for nature recovery compared with other land use.[14]

In combination with solar's position at the crossroads of climate, nature and strategic land use policy, the industry is uniquely placed to incorporate natural capital, biodiversity and ecosystem service enhancement on solar farms.[13] This outlook also offers promising opportunities for Nature Positive investment and potential for trading on nascent nature markets.

1.0 The case for Nature Positive investment in the solar industry continued

1.4 Identifying challenges and opportunities for Nature Positive solar investment

Knowledge of solar's Nature Positive potential has driven the development of guidance in collaboration with industry and academia on how to assess, manage and monitor solar farms for nature, namely the Solar Energy UK Natural Capital Best Practice Guidance,[14] the Solar Park Impacts on Ecosystem Services (SPIES) Decision Support Tool[13] and a standardised protocol to assess natural capital and ecosystem services at solar farms.[15] These documents provide important guidance targeted largely at ecologists and land managers. However, the characteristics of indicators and metrics best-suited for Environmental, Social and Governance (ESG) disclosure, or for monitoring Nature Positive investments may differ from those used most commonly for assessing ecological change.

The overarching aim of this report is to present an outline of potential indicators for use in the monitoring and reporting of Nature Positive investments. This includes consideration of the differing perspectives of those along the UK solar farm value chain; from investors, law firms, pension funds and asset managers, to ecologists and land managers. Links between the proposed indicators and relevant ESG disclosure frameworks and biodiversity targets are also identified. The report concludes by highlighting the potential sources of revenue arising from Nature Positive investment at solar farms.

"Wychwood is proud to work with NextEnergy Capital and its partners to undertake research which improves our understanding of natural capital and helps us to become more effective in protecting and enhancing nature."

Guy Parker | Director, Wychwood Biodiversity

2.0 Measuring biodiversity and ecosystem services

2.0 Measuring biodiversity and ecosystem services

2.1 The need to measure biodiversity

Biodiversity is a foundational component of natural capital; the stocks of Earth's environmental assets which include air, water, soils and minerals, through which valuable ecosystem services flow.[16] Almost all of the products and services that we value are underpinned by biodiversity.[17] For example, the diversity of soil microorganisms directly influences processes such as soil nutrient cycling, which in turn ensures healthy soils and the growth of important food crops.[18] As such, measuring biodiversity, be it pollinators or soil microorganisms, gives an indication of the state of these associated ecosystem services and the benefits we obtain from them.

INDICATOR GROUP

A group of indicators relating to similar characteristics of an ecosystem – ecosystem extent, ecosystem condition, ecosystem connectivity, ecosystem services and societal engagement with ecosystems.

INDICATOR

A non-quantitative measure of an ecosystem characteristic, e.g. biodiversity. Useful for communicating more complex concepts to a wider audience.

METRIC

A quantitative measure of an indicator, given in the appropriate units, e.g. biodiversity units, calculated according to the Defra Biodiversity Metric.

Box 1, Definitions of indicators and metrics

2.2 Methods for measuring biodiversity

Biodiversity is complex and its measurement can be difficult. Typically, we measure biodiversity using **indicators** and **metrics** *(Box 1)*. Biodiversity indicators and metrics help us to communicate information on ecosystems by summarising complex data to provide an overview on the state of biodiversity. This makes indicators and metrics valuable tools in monitoring trends in biodiversity and reporting this information to a wider audience.[19] The most common approaches to measuring biodiversity and ecosystem services include surveys to count the number of different species (such as bees and butterflies, or invasive species), or analysing DNA from soil and water.[18] Remote sensing techniques may also be used to assess the cover of a particular target habitat, and biodata may be available from local Biodiversity Records Centres.

Indicators and metrics outlined in Solar Energy UK's guidance for monitoring of biodiversity at solar farms are beginning to be used at sites across the UK and demonstrate biodiversity enhancements where solar farms are managed for nature.[14,20] By considering the needs of stakeholders involved in ESG reporting and green finance, these indicators and metrics can be expanded upon to include measures suitable for the monitoring and reporting of Nature Positive investments at solar farms.

3.0 Indicators and stakeholder needs

3.0 Indicators and stakeholder needs

I am delighted that WiseEnergy has been able to contribute in some small way to this vitally important work and our shared goal of net-zero.

Rebecca Carter | Global Managing Director, WiseEnergy

3.1 Indicator use

Appropriate indicators and metrics are required to monitor and report on Nature Positive investments at solar farms. It is important that indicators are suited to the needs of different parts of the solar farm value chain.

Indicators can be grouped according to how they are used by stakeholders *(Figure 1)*. Those stakeholders concerned with site-level management may be focused on measures that can be used in combination to understand the management needs of a particular site, such as detailed additional indicators recommended by Solar Energy UK guidance,[14] or indicators of management commitments from the Wild Power Scorecard,[21] whereas some may find a set of core indicators that are recommended for monitoring at every solar farm more relevant. Conversely, those involved at an ESG reporting level will be primarily concerned that indicators meet the requirements of disclosure initiatives such as the TNFD, whilst investors and green finance stakeholders need headline indicators that are widely accepted, easily communicated and linked to nature credit markets.

KEY FINDING 1

Indicators are used in different ways across the solar industry, including to inform management actions at a single site, to meet ESG reporting requirements and to provide high-level information for investors.

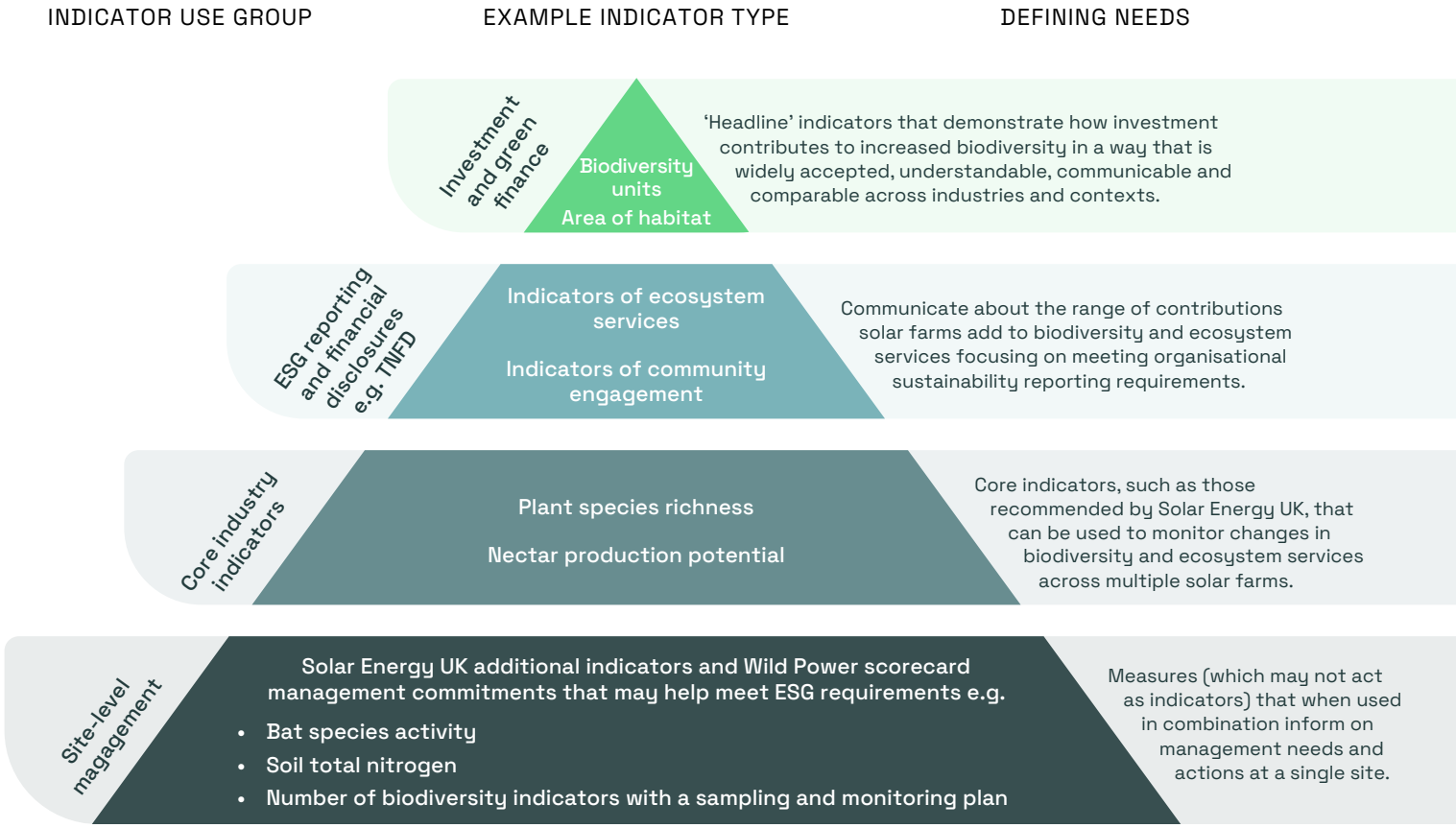

Figure 1. The main ways that solar stakeholders use indicators for the monitoring and reporting of Nature Positive solar investments.

3.2 Stakeholder priorities

It is not feasible for a single set of indicators to meet the requirements of stakeholders across the UK solar farm value chain, due to the differing needs and priorities of those in the industry. Ecologists and land managers, who are less bound by disclosure and reporting requirements, are primarily concerned with the practicality and feasibility of measuring indicators on the ground, the variability of results due to the complexity of nature and the potential for trade-offs in ecosystem services. They prioritise a set of indicators for use at finer scales, such as site or habitat level *(Table 2)*. Meanwhile, finance stakeholders and those involved with ESG reporting place importance on a set of indicators that can provide broad-level information across a portfolio of assets. They value scalable and comparable indicators that produce auditable data compatible with financial disclosure regulations. Finance stakeholders are also concerned by the potential for greenwashing, which can result in damaging reputational impacts.

KEY FINDING 2

Solar farm stakeholders can be divided into two main groups based on their priorities around indicator use: 'ESG and green finance' and 'Ecology and land use'. Understanding of these differing priorities is key and calls for a nuanced set of indicators – no single set can meet the needs of all stakeholders in the solar industry.

Table 2. Key stakeholder priorities around the use of indicators.

Stakeholder group	Key stakeholder priorities
ESG AND GREEN FINANCE 	• Prioritise a set of **aggregated indicators** to provide broad-level information across portfolios. Desire to consider the upstream supply-chain impacts. • Data should be meaningful with **comparable metrics** between multiple sites. • Data needs to be **auditable** and methods need accreditation or certification. Desire for an accreditation or certification scheme for public reporting. • Indicators of engagement are seen as important for PR and public affairs and provide **reputational benefits** whilst being an important aspect of disclosure. **Community gain** is key within planning decisions. • Seeing consistent trends in data is important when communicating at higher levels. • There must be scope for indicators and metrics to evidence and integrate with **financial disclosure** regulations and best practice. • Concerns around the potential for **greenwashing**.
ECOLOGY AND LAND MANAGEMENT 	• Prioritise a set of indicators for use at **finer scales**, such as at site or habitat level. • A focus on the **practicality** and **feasibility** of measuring indicators. • Indicators need to be **representative** of the underlying feature of interest with low potential for misinterpretation. • Awareness that nature is inherently unpredictable, and this poses challenges e.g. certain indicators will not produce linear results year on year and vary temporally, **spatially and due to management actions**. • Concern around potential **trade-offs** between ecosystem services.

3.3 Indicator selection

Stakeholder requirements, priorities and perspectives around indicator use can be summarised into a set of core needs *(Table 3)*. Meeting these needs using ecological indicators poses a series of challenges which must be addressed to enable successful monitoring and reporting on Nature Positive outcomes and investments. Yet there are potential solutions to these issues. Providing both a set of indicators for use across asset portfolios and another to address site level outcomes could address issues of scaling, whilst data sharing, standardisation and development of a certification scheme may overcome concerns around greenwashing. Further co-development and sharing of insights across the solar industry is essential to ensure an effective and adopted system.

KEY FINDING 3

Indicators need to be communicable, credible, consistent, feasible and scaleable to meet the needs of stakeholders in relation to reporting of Nature Positive investments.

Table 3. A summary of the main overarching stakeholder needs and themes around the use of indicators for monitoring and reporting on Nature Positive investments at solar farms. Challenges associated with ecological indicators meeting these needs are highlighted and potential solutions or areas for further development are also provided where relevant.

CORE NEEDS	ASSOCIATED CHALLENGES	POTENTIAL SOLUTIONS
The need for indicators and metrics to be communicable and understandable to a range of stakeholders.	Identifying a set of indicators that can be broadly and meaningfully communicated poses a significant challenge. If indicators are excessively generalised the complexity of nature may not be adequately captured. In contrast, indicators for use at finer more detailed scales can be harder to communicate at management and investor levels. Comparing metrics as benchmarks becomes challenging, especially considering regional differences.	• Developing an indicator tier system to address specific needs across different levels (e.g., an aggregated set for portfolio-level use, a detailed set for site-level use).
The need for indicators and metrics to be scalable across a portfolio of sites.	Certain indicators for use in on-site monitoring have feasibility issues around scaling due to the time and cost required e.g. regular site visits to assess bird species richness. The figures obtained from indicators may be less meaningful when scaled over a portfolio.	• Create an aggregated set of indicators specifically for portfolio level use. • Utilise eDNA as a scalable method for measuring certain biodiversity outcomes and monitoring. e.g. to measure presence of invertebrates and other taxa.[20,22]
The need for indicators and metrics to better address potential risks (e.g., greenwashing) and build trust with the public.	The lack of a cohesive approach within the industry erodes confidence. Lack of an approach to ensure the integrity of data e.g. to provide auditable evidence. The lack of benchmark data for comparison. The complexity of nature indicators used to assess the environmental aspect of sustainability is a barrier to developing a universal accreditation system that can be used to evaluate different solar farms based in different regions.	Quality of Accreditation and Third-Party Auditability. (i) Engaging with prestigious and reputable third parties to ensure the environmental initiatives and claims that are not only credible but also scientifically sound. (ii) Keeping transparency throughout the accreditation and auditing process. Meeting requirements set by authoritative ecological and environmental bodies e.g. Chartered Institute of Ecologists, to establish credibility. Establishing a consistent approach through standardisation. (i) Developing a standardised set of terminologies and definitions used across the industry. (ii) Developing a protocol that facilitates an industry-wide data sharing and promotes innovation and best practices. Linking metrics to tangible environmental impacts (e.g., carbon emissions, water usage, and waste reduction).

Table 3. continued

CORE NEEDS	ASSOCIATED CHALLENGES	POTENTIAL SOLUTIONS
The need for indicators and metrics to address public and community interests and concerns.	Addressing public and community concerns may involve allowing site access for visits or recreation, however there are challenges around cost, security and health and safety.	• Potential to explore the development of virtual solar farms to reduce the cost and impact.
The need to identify trends and patterns in data generated from indicators and metrics for reporting purposes.	Currently insufficient monitoring on solar sites. Tendency for uncertainty and ambiguity in the data e.g. weather events and management interventions may lead to discrete jumps in indicators such as pollinator species richness and the dynamics of growth can vary. Lack of consistent trends or perceived 'outliers' in the data can cause issues when communicating with management and investors.	• Communicate data with context, including the variability and inherent limitations, especially in the early stages lacking extensive historical data. • Consider additional supplementary metrics alongside core metrics to reveal variations, trends, and potential areas of impact beyond the primary data. • Offer a synthesised view of environmental performance at the portfolio level, integrating diverse indicators into a cohesive analysis for strategic decision making and reporting. • Prioritise continuous and consistent data collection throughout the life cycle of each project or site to mitigate misunderstanding and inaccuracies, particularly when juxtaposing ecological progress with financial performance.
The need for indicators and metrics to show trends over time scales relevant for reporting.	Some indicators such as soil carbon change over relatively long timescales for reporting, which may make it difficult to demonstrate benefits/change.	• Monitor these indicators internally until they accumulate enough significant data for external reporting. • Provide clear short term, medium term or long term indicators, which will reduce negative perceptions on how much progress has been made. • Acknowledge and embrace uncertainty emerging from the process of completion.
The need for indicators and metrics to be consistent with wider ESG regulations.	There is a challenge in aligning certain indicators with sustainability regulations and financial disclosures due to the lack of approved quantitative methods applicable to solar farms.	• Link to additional supplementary or voluntary disclosures. • Development of separate disclosure standards for solar farms (could link to the standardisation need). • Further development of methods appropriate for solar farms.
The need for indicators and metrics to demonstrate tangible values to stakeholders.	Not all indicators and metrics provide tangible benefits.	• Recognition of the internal value of what the metrics show (e.g., employee retention/motivation/talent acquisition) as a passive rather than proactive indicator. • Individuals are interested in the tangible benefits for selling the "investment." e.g. linking activities to the site (such as honeybee hives providing honey or tea products).

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments

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4.1 Indicators for different applications

A longlist of indicators and metrics that address some of the issues around varying stakeholder needs and perspectives is provided below *(Table 4; see Appendix for details on the process for selecting indicators)*. These indicators can be divided into two broad categories: those suitable for use in financial disclosures, often across a portfolio of sites, and those better suited to site-level management. In addition to the indicators outlined in this report, other indicators and metrics may be used at solar farms for ecology and management purposes, particularly those from existing guidance such as the Solar Energy UK Natural Capital Best Practice Guidance.[14]

Indicators that will be used in financial disclosures must be suitable and ecologically meaningful to scale up over a portfolio of assets, whilst remaining understandable and relevant to high-level disclosure requirements. Examples include indicators of community engagement or biodiversity units *(Table 4)*. In contrast, some indicators are more appropriate for use in site level monitoring and reporting, due to their tendency to vary over space and time, which prevents meaningful figures when summarising across a portfolio (e.g. total soil nitrogen, since some nitrogen is essential for plant growth but excess nitrogen can be damaging to ecosystems). High costs may also prevent some metrics being measured regularly across a portfolio, so these may be restricted to addressing management aims at particular sites.

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

Table 4. A provisional set of potential indicators and metrics for use in the monitoring and reporting of Nature Positive investments and actions at solar farms. The suitability of indicators for financial and ESG disclosures is considered, assessing the feasibility of scaling up over a portfolio of assets and how meaningful that data would be. Indicators highlighted in green: are suitable for financial disclosures; yellow: are moderately well suited to disclosure, according to context and/or pending further development; blue: are better suited to site level use. See Appendix 7.2 (Table A) for full detailed methods.

POTENTIAL INDICATORS AND METRICS			FEASIBILITY TO SCALE	MEANINGFULNESS OF DATA	SUITABILITY FOR DISCLOSURE
Indicator group	Indicator	Metric			
Ecosystem extent	HABITAT EXTENT	Habitat area	High – protocol already used in solar farm monitoring using UK Hab methodology. Site visits and/or desk based study required.	Moderate – changes in extent of target habitat would take place over relatively long time periods, but data could be combined or compared across sites to give total amount of habitat type across a portfolio.	HIGH SUITABILITY FOR USE IN DISCLOSURE AND SCALING UP OVER A PORTFOLIO OF ASSETS.
Ecosystem connectivity	HABITAT CONNECTIVITY	Habitat connectivity index	High – methodology clearly outlined in the Scottish Government report, however relatively complex desk based GIS analysis is required.	Moderate – changes in connectivity would take place over relatively long time periods. Method provides a value of functional connectivity – the ability of species to move between habitat patches based on their dispersal abilities and the type of intervening land cover. This would map onto the TNFD additional disclosure for connectivity.	
Ecosystem condition	BIODIVERSITY	Biodiversity units	High – data likely already available for newer sites. Requires site visit and calculation of BNG using the Defra Biodiversity Metric prior to site construction.	High – combined units across sites would be a meaningful representation of increases in biodiversity across sites compared to previous land use.	
		Plant species richness (and % cover per species)	High – requires site visit to assess plant species richness using botanical quadrats. Solar Energy UK Methodology already used at solar farms.	Moderate – total species richness across a portfolio of sites can be calculated by pooling species occurrence data from each individual site; richness data can provide basis for calculation of alpha diversity (diversity within a particular area i.e. site level) and beta diversity (the diversity between different locations of the same habitat. Can also be adapted to include: - presence/absence of invasive species - calculation of nectar production potential (if adapted to include % cover of species per quadrat).	
		Invertebrate species or taxa rich-ness	Moderate – requires site visit to assess invertebrate species richness. Time and cost variable depending on taxa of interest. Several methods can be used, including pitfall traps, sweep netting transects. Solar Energy UK Methodology already used at solar farms.	Moderate – total species richness across a portfolio of sites can be calculated by pooling species occurrence data from each individual site; richness data can provide basis for calculation of alpha diversity (diversity within a particular area i.e. site level) and beta diversity (the diversity between different locations of the same habitat.	

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

Table 4. continued

POTENTIAL INDICATORS AND METRICS			FEASIBILITY TO SCALE	MEANINGFULNESS OF DATA	SUITABILITY FOR DISCLOSURE
Indicator group	Indicator	Metric			
Ecosystem condition	BIODIVERSITY	Bird species richness	Moderate – requires site visits to perform breeding and/or overwintering bird surveys. However, Solar Energy UK methodology is already used at solar farms.	Moderate – total species richness across a portfolio of sites can be calculated by pooling species occurrence data from each individual site; richness data can provide basis for calculation of alpha diversity (diversity within a particular area i.e. site level) and beta diversity (the diversity between different locations of the same habitat.	HIGH SUITABILITY FOR USE IN DISCLOSURE AND SCALING UP OVER A PORTFOLIO OF ASSETS.
Ecosystem services	POLLINATION	Bee and butterfly species richness	High – requires site visit to assess bee and butterfly richness by using transects. Solar Energy UK Methodology already used at solar farms.	Moderate – total species richness across a portfolio of sites can be calculated by pooling species occurrence data from each individual site; richness data can provide basis for calculation of alpha diversity (diversity within a particular area i.e. site level) and beta diversity (the diversity between different locations of the same habitat.	
		Nectar production potential	High – can be calculated from botanical quadrats (if % cover of species is recorded) using an open access dataset of nectar sugar values of common grassland plant species. Solar Energy UK Methodology already used at solar farms.	Moderate – dataset gives empirical nectar productivity value or modelled nectar productivity value by species in kg of sugars/ha cover/year. Gives an estimate of the resources available for pollinators.	
	CLIMATE REGULATION	Soil carbon content	Moderate – requires site visit to collect soil cores from across the site and lab analysis using an elemental analyser and mass spectrometer to determine soil carbon content.	High – although soil carbon is quite variable between sites, aggregating soil carbon across a portfolio of sites will provide an estimate of total carbon content in content, typically reported as t C per km.[2]	
	ECOSYSTEM SERVICE MANAGEMENT	Number of ecosystem services actively managed	High – would require checking against site records e.g. management plans and counting the number of ecosystem services actively managed, applying a framework such as CICES to ensure consistent categorisation of ecosystem services.	Moderate – would give an indirect estimate of commitment to managing ecosystem services across a portfolio. Would need to account for potential trade-offs in ecosystem services e.g. intensity of grazing for agricultural production compared with carbon and soil management.	

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

Table 4. continued

POTENTIAL INDICATORS AND METRICS			FEASIBILITY TO SCALE	MEANINGFULNESS OF DATA	SUITABILITY FOR DISCLOSURE
Indicator group	Indicator	Metric			
Societal engagement	COMMUNITY ENGAGEMENT	Number of community or educational visits. Number of scientific or research visits. Active engagement with community through presence of community ownership or financial support to community groups.	High – would require checking against records community access, visits, financial support, status of community ownership per each site.	Moderate – total number across sites would give an overall picture of community engagement across the portfolio.	HIGH SUITABILITY FOR USE IN DISCLOSURE AND SCALING UP OVER A PORTFOLIO OF ASSETS.
Ecosystem condition	**BIODIVERSITY**	Number of biodiversity indicators with a sampling and monitoring plan in place.	Moderate – would require checking against site records and counting the number of biodiversity indicators. However, biodiversity indicators would need to be better defined.	Moderate – Indirect estimate of commitment to managing sites for biodiversity.	**MODERATE SUITABILITY – MAY BE SUITABLE FOR USE IN DISCLOSURE AND SCALING PENDING FURTHER DEVELOPMENT OF METHOD.**
Ecosystem services	**CLIMATE REGULATION**	Greenhouse gas mitigation potential	Low – method would need to be developed for solar farms.	High – data would be meaningful as a total figure of greenhouse gas mitigation potential in kt CO2 eq/ year/km.[2]	
Ecosystem connectivity	HABITAT CONNECTIVITY	Distance to nearest semi-natural grassland	High – high feasibility to scale, could be assessed using GIS, desk study and/ or site visit.	Low – this is not very representative of landscape scale connectivity, and does not provide meaningful information when totalled across a portfolio. Would not meet the TNFD additional disclosure for connectivity.	LOW SUITABILITY – MORE APPROPRIATE FOR LOCAL LEVEL REPORTING AND MONITORING DUE TO ISSUES WITH SPATIAL OR TEMPORAL VARIABILITY, COMPARABILITY OF DATA OR TIME CONSUMING AND EXPENSIVE METHODS. MAY BE FEASIBLE TO SCALE BUT RESULTS MAY NOT BE MEANINGFUL.
Ecosystem condition	NUTRIENT STATUS	Soil total nitrogen	Moderate – relatively time consuming method of collection and measurement across a portfolio of sites (site visit and lab analysis using the dry combustion method).	Low – soil nitrogen is highly variable across spatial scales and whilst it is essential for plant growth, excess nitrogen can be very damaging to ecosystems. Total nitrogen across a portfolio would therefore not be meaningful as a Nature Positive indicator.	

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

Table 4. continued

POTENTIAL INDICATORS AND METRICS			FEASIBILITY TO SCALE	MEANINGFULNESS OF DATA	SUITABILITY FOR DISCLOSURE
Indicator group	Indicator	Metric			
Ecosystem condition	HUMAN IMPACT	Grazing animal stocking density	Moderate – would be relatively simple to scale across sites but would require details from land managers on the number of livestock and timings of grazing, which may not be available.	Low – given as the number of livestock units per hectare and represents grazing intensity.	LOW SUITABILITY – MORE APPROPRIATE FOR LOCAL LEVEL REPORTING AND MONITORING DUE TO ISSUES WITH SPATIAL OR TEMPORAL VARIABILITY, COMPARABILITY OF DATA OR TIME CONSUMING AND EXPENSIVE METHODS. MAY BE FEASIBLE TO SCALE BUT RESULTS MAY NOT BE MEANINGFUL.
	BIODIVERSITY	Bat species activity	Moderate – requires multiple site visits to monitor the number of bat passes per species.	Low – gives an idea of bat species activity on a site at a particular moment in time. Data cannot be aggregated meaningfully across sites.	
Ecosystem services	CLIMATE REGULATION	Soil organic matter and organic carbon	Moderate – relatively time consuming method of collection and measurement across a portfolio of sites (site visit and lab analysis required).	Low – soil organic matter is important for soil health and fertility. Soil organic matter is sometimes estimated at site level as % loss-on-ignition (LOI), but this method has low accuracy, and is not suitable as a measure for aggregating across a portfolio of sites.	

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

4.2 Indicators and metrics suitable for disclosures

Knowledge in this area is still developing and it is important to consider the below challenges associated with the use of ecological indicators for disclosure.

1.

SPATIAL VARIABILITY, SCALING AND DATA COMPARISON

Certain indicators will vary spatially across sites and regions for a variety of reasons, including differences in climate and weather, topography and management practices. Examples include soil organic carbon and total nitrogen content, which are largely determined by the soil type, land use and fertiliser application. This inherent variability across spatial scales can make it difficult to compare data for such measures from different sites and reduces the validity of aggregating certain measures such as nitrogen content across a portfolio of sites (Table 4).

2.

TEMPORAL VARIATION

Similarly, some indicators will vary significantly over time or will require different timescales for reporting; for example, the species richness of bees, butterflies or birds is particularly susceptible to changes in management practices and weather conditions. A particularly wet year could result in dramatically lower bee and butterfly species richness compared with an average year. This could present challenges around communicating results to management or investors. Other indicators, including those of soil status such as soil organic carbon, require longer periods of monitoring before results will be observed.

3.

POTENTIAL FOR TRADE-OFFS

Ecosystem services are all interconnected and the relationships between services are complex. Enhancement of one ecosystem service may result in degradation of another, for example grazing livestock such as sheep on a solar farm will enhance the provisioning ecosystem service of livestock production on the site. However, this could negatively impact other ecosystem services such as pollination regulation if the site is grazed during important times for pollinators (April - July) or if wildflower buffers are not protected from grazing.

4.

READINESS OF INDICATORS FOR USE

Not all indicators are ready for use on solar farms now – some, such as greenhouse gas mitigation potential may have potential for future use but do not currently have an appropriate method applicable to solar farms.

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

4.3 Corporate case study

NEXTENERGY CAPITAL – A SUSTAINABLE APPROACH TO MANAGING INVESTMENT

NextEnergy Capital (NEC) stands at the forefront of the global transition towards sustainble low carbon energy generation, driven by a core commitment to sustainability. Central to NEC's mission is recognising the intricate relationship between human activities and the natural world. NEC has chosen to incorporate nature into their disclosures, reflecting their philosophy of responsible stewardship and proactive environmental management.

NATURE AS A PRIORITY FOR SUSTAINABILITY

NEC's philosophy acknowledges that sustainable investment goes beyond financial returns; it encompasses environmental and social impacts as well.

As a business, by better understanding how it interfaces with nature, NEC can implement process measures, interventions and controls to proactively conserve biodiversity, promote ecosystem health, and minimise ecological footprints. This ethos is embedded in the NextEnergy Group's new flagship Sustainability Report, where Nature forms one of three ESG material priorities within their sustainability framework.

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

Our commitment to integrating nature into our investment strategies isn't just about securing long-term financial prosperity, it's about protecting the planet and improving business resilience through understanding our dependencies on the natural world. Our collaborative research partnerships with academia increase our knowledge base, refine our strategies and demonstrate our dedication to sustainable investment practices.

Ross Grier | Chief Operating Officer, Head of UK Investment

UNLOCKING OPPORTUNITIES FOR SUSTAINABLE GROWTH

Looking to the future, NEC continues to evolve their climate-focused activities to integrate Nature Positive investment opportunities. This plan includes the development of robust nature disclosure mechanisms and the continued improvement and integration of biodiversity considerations into investment decision-making processes.

By embracing transparency, accountability, and innovation, NEC is poised to drive positive environmental outcomes while delivering sustainable returns for investors.

THE VALUE OF NATURE POSITIVE INDICATORS

Improved understanding of Nature Positive indicators and metrics:

- has the potential to standardise data collection requirements across the industry.
- can build a picture of solar's contribution to biodiversity in the UK through its direct operations.
- can demonstrate solar's contribution in the context of internationally recognised standards and frameworks such as the TNFD.
- can help to identify environmental hotspots and vulnerabilities, laying the groundwork for targeted interventions, and leveraging the interconnected opportunities between climate and nature.

In a world where biodiversity loss and ecosystem collapse is ranked the third biggest environmental risk over the next decade, NEC is really stepping up to the challenge, navigating the intersection of nature and finance.

Hing Kin Lee | Vice President of Nature

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

PAVING THE WAY TO A SUSTAINABLE FUTURE

NEC's sustainable approach to managing investments demonstrates their commitment to environmental stewardship and responsible corporate citizenship. By committing to incorporating nature disclosures, NEC is mitigating risks and unlocking opportunities for sustainable growth and innovation.

As a leader in the sustainable low carbon energy sector, this sets a precedent for integrating environmental considerations into investment practices, paving the way towards a more sustainable future for all.

Why a nature strategy for NextEnergy?

INTERFACE WITH NATURE

Understanding how we interface with nature and assessing our exposure, as well as direct impact, to nature risks and opportunities.

CLEAR ACTIONS, INITIATIVES, POLICIES AND PARTNERSHIPS

To outline a series of concrete actions, initiatives, policies, and partnerships to address nature-related issues effectively.

RISK MANAGEMENT AND OPPORTUNITY DELIVERY

To proactively manage risks associated with environmental degradation, biodiversity loss and ecosystem collapse.

DRIVERS OF BIODIVERSITY LOSS

To reduce drivers of biodiversity loss, including habitat destruction, climate change, pollution, overexploitation of resources, and invasive species across our direct operations and upstream supply chains.

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

4.4. Linking indicators to ESG disclosure frameworks and biodiversity targets

A set of the indicators and metrics outlined above that can be scaled across a portfolio of assets are summarised in Table 5a & b. Several of the indicators are relevant to the requirements of regulatory and voluntary ESG disclosure frameworks *(Table 5a and Box 2)* and biodiversity targets *(Table 5b and Box 2)*. These indicators directly map onto disclosures or targets with clear commonalities between the indicator and the disclosure or target, or the indicator is explicitly referenced in the disclosure or target method (such as habitat connectivity). Links between these indicators, disclosures and targets are detailed in Appendix Tables B-F.

Other indicators do not directly map onto the disclosure frameworks because the link between the indicator and the disclosure or target is indirect or does not fully meet the disclosure or target in its current form *(Table 5a & b)*. For example, the number of ecosystem services actively managed is less directly relevant to the ecosystem services indicator in the TNFD as it is an indicator of management commitments, rather than a quantitative measure. These indicators can still contribute to understanding, such as the area of habitat indicator potentially informing the TNFD ecosystem condition indicator, because it can show the extent to which a desired habitat type has been reached during ecological restoration.

Finally, some indicators do not contribute to how disclosures or targets are currently calculated, but may inform related narrative and discussion or be used in combination with other indicators and metrics *(Table 5a & b)*. For example, area of habitat and habitat connectivity index could inform discussion on the EU SFDR element 'Activities negatively affecting biodiversity sensitive areas'. It is important to note that relevance may be case-specific, as reporting requirements are largely based on materiality to a business, and the legislation and standards also advocate for that approach.

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

Table 5a. Relevance of potential indicators to ESG disclosure frameworks.

The indicator directly maps to this disclosure

The indicator contributes to understanding this disclosure

The indicator does not contribute to how this disclosure component is currently calculated, but could inform related narrative and discussion

Indicators can have multiple levels of relevance to different elements within disclosure frameworks

POTENTIAL INDICATORS AND METRICS FOR FINANCIAL DISCLOSURES			ESG DISCLOSURE FRAMEWORKS			
Indicator group	Indicator	Metric	TNFD	EU SFDR	CSRD (ESRS)	IFRS ISSB
Ecosystem extent	HABITAT EXTENT	Habitat area				
Ecosystem connectivity	HABITAT CONNECTIVITY	Habitat connectivity index				
Ecosystem condition	BIODIVERSITY	Biodiversity units				
		Plant species richness				
		Invertebrate species richness				
		Bird species richness				
Ecosystem services	POLLINATION	Bee and butterfly species richness				
		Nectar production potential				
	CLIMATE REGULATION	Soil carbon content				
	ECOSYSTEM SERVICE MANAGEMENT	Number of ecosystem services actively managed				
Societal engagement	COMMUNITY ENGAGEMENT	Number of community/ educational visits				
		Number of research/ scientific visits				
		Presence of community ownership or financial support to community groups				

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

Table 5b. Relevance of potential indicators to biodiversity targets.

The indicator directly maps to this target

The indicator contributes to understanding this target

The indicator does not contribute to how this target component is currently calculated, but could inform related narrative and discussion

Indicators can have multiple levels of relevance to targets

POTENTIAL INDICATORS AND METRICS FOR FINANCIAL DISCLOSURES			BIODIVERSITY TARGETS		
Indicator group	Indicator	Metric	UN SDGs	CBD targets and Kunming-Montreal Global Biodiversity Framework indicators	UNEP-WCMC Land Use Finance Impact Hub Positive Impact Indicators Directory
Ecosystem extent	HABITAT EXTENT	Habitat area			
Ecosystem connectivity	HABITAT CONNECTIVITY	Habitat connectivity index			
Ecosystem condition	BIODIVERSITY	Biodiversity units			
		Plant species richness			
		Invertebrate species richness			
		Bird species richness			
Ecosystem services	POLLINATION	Bee and butterfly species richness			
		Nectar production potential			
	CLIMATE REGULATION	Soil carbon content			
	ECOSYSTEM SERVICE MANAGEMENT	Number of ecosystem services actively managed			
Societal engagement	COMMUNITY ENGAGEMENT	Number of community/ educational visits			
		Number of research/ scientific visits			
		Presence of community ownership or financial support to community groups			

4.0 Selection of indicators for monitoring and reporting on Nature Positive investments continued

Box 2: Linking indicators to relevant ESG disclosures and biodiversity targets.

TASKFORCE ON NATURE-RELATED FINANCIAL DISCLOSURES (TNFD)

All of the indicators map either directly onto or contribute to understanding of indicators outlined in the TNFD additional global disclosure metrics. The level of relevance for the ISSB is the same as that for the TNFD as the standards are expected to align with the TNFD in the future.

- Area of habitat and connectivity index map directly to A5.1 ecosystem extent and A5.2 ecosystem connectivity respectively in Annex 2 of the recently published TNFD recommendations.
- All indicators of ecosystem condition align with A5.0 ecosystem condition.
- Indicators of ecosystem services are relevant to A6.0 ecosystem services.
- Engagement corresponds to A20.0 proportion of sites that have active engagement with local stakeholders on nature-related issues.

SUSTAINABLE FINANCE DISCLOSURES REGULATION (SFDR)

Many of the indicators align with aspects of the EU SFDR:

- The biodiversity units metric directly maps onto the EU SFDR and “do no significant harm” (DNSH) biodiversity indicator, which requires that companies disclose activities negatively affecting biodiversity sensitive areas or that damage biodiversity.
- Similarly, the species richness metrics contribute to understanding on the DNSH biodiversity indicator.
- The soil carbon metric contributes to the understanding of elements of EU SFDR such as PAI, which requires Scope 1, 2 and 3 of financed emissions annually, and voluntary indicators on land degradation, desertification and soil sealing.

CORPORATE SUSTAINABILITY REPORTING DIRECTIVE (CSRD)

Indicators of ecosystem extent, condition and connectivity align directly with elements of ESRS E2 and E4 of the CSRD. Soil Carbon content may also contribute to understanding on the E1-6 standard of the CSRD - Gross Scope 1, 2, 3 and Total GHG emissions, and may inform discussion around ESRS E1-1 - Transition plan to reach climate neutrality by 2050.

Metrics such as area of habitat, connectivity index and all indicators of ecosystem condition may inform discussion around goal 15 of the UN SDGs. Similar links between the indicators and elements of other biodiversity targets such as those outlined by the CBD and UNEP-WCMC Land Use Finance Impact Hub can be made, including indicators of ecosystem services, which map directly to CBD Target 11 ‘Restore, Maintain and Enhance Nature’s Contributions to People’. As several of these frameworks are still in draft versions and the guidance is rapidly developing, these links may evolve over time and should be re-visited frequently.

5.0 Next steps for Nature Positive solar investment

5.0 Next steps for Nature Positive solar investment

5.1 Beyond disclosure: further uses of indicators

It is increasingly likely that nature disclosures will become mandatory across nations and sectors in the near future, thus there is benefit to companies to begin to proactively integrate these considerations into their reporting frameworks. Companies that adopt this anticipatory position of incorporating nature into disclosures will be strategically positioned to navigate and benefit from this evolving landscape as the industry and regulatory contexts develop.

In addition to disclosure, there are further potential benefits associated with the use of Nature Positive indicators. These include reputational and philanthropic benefits associated with company-level voluntary nature disclosures and the visibility of a company in contributing to biodiversity targets. Moreover, engaging local communities through educational visits, providing funding for community groups or investigating opportunities for community ownership could lead to reduced reputational risk through improved community acceptance. Nature also has inherent value outside of monetary gains; alongside the five main drivers of biodiversity loss, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) identifies people's disconnection with nature and the subsequent lack of value placed on nature as indirectly contributing to biodiversity loss.[6] The use of Nature Positive indicators and metrics may help to address this issue through adding value to nature and strengthening people's connection with nature.

5.0 Next steps for Nature Positive solar investment continued

5.2 Sources of revenue: Compliance markets

Creating and conserving natural capital at solar farms offers potential returns on the compliance market.[14] The main source of revenue will likely be biodiversity units,[14] with a minimum of 10% Biodiversity Net Gain (BNG) now mandatory for both small sites and major developments under the Environment Act for new land development projects.[23]

BIODIVERSITY UNITS AND HABITAT BANKING

A growing body of evidence highlights the potential for biodiversity enhancement at solar farms. New solar farms are required to produce a minimum net gain of 10% in biodiversity units over the existing baseline value on the site. Where a new solar farm development provides an increase in Biodiversity Net Gain above the statutory requirement, there is a potential opportunity for the solar farm to become a 'habitat bank'. As such, and subject to a legal agreement, the excess biodiversity units could be registered and sold on the compliance market. These biodiversity units would then be available for purchase by other developers as an off-site solution to their own BNG requirements.

This opportunity for habitat banking would also be available to existing solar farms that enhance their biodiversity through habitat enhancement or creation. As well as providing a potential source of income to fund further enhancements and additionality, these biodiversity units demonstrate Nature Positive actions, enhancing reputational value, and generating important evidence for regulatory and voluntary nature-related financial disclosures.

5.3 Looking to the future of Nature Positive solar investment

The work outlined in this report has focused on developing indicators for monitoring and reporting on Nature Positive investments at the operational phase of the solar farm life cycle. There is a significant need for additional work to embed natural capital considerations within the solar energy sector that transform supply chains and develop innovative business models. This entails a thorough evaluation of the environmental impacts of solar panels across their entire lifecycle, including production, operation, and end-of-life recycling. Adopting such a comprehensive approach is crucial in enabling a more sustainable and nature-conscious solar industry.

6.0 Glossary of key terms

6.0 Glossary of key terms

Biodiversity Net Gain (BNG) is a conservation approach that ensures development or human activities result in a quantifiable and verifiable increase in biodiversity compared to the pre-existing condition. It involves assessing the potential impacts of a project on biodiversity, and then implementing measures to offset those impacts that cannot be avoided or mitigated through habitat restoration, conservation, or enhancement efforts. Biodiversity net gain is aimed at promoting sustainable development and halting biodiversity loss, fostering a positive contribution to nature and ecosystems.[24,25]

Convention on Biological Diversity (CBD) is the first global agreement that covers all of the aspects of biological diversity. The Convention has three main objectives: to conserve biological diversity, to use biological diversity sustainably and to ensure fair sharing of any benefits originating from the use of genetic resources.[26]

Corporate Sustainability Reporting Directive (CSRD) is a legislature that updates the rules around social and environmental information that companies must report. The updates will provide stakeholders and investors with the information needed to assess the impact of companies on the environment and people. It will also ensure that investors can assess the financial risks and opportunities associated with climate change and a range of sustainability issues.[27]

Ecosystem services are the link between the processes and functions of ecological systems and resulting benefits for human wellbeing within economic and social systems. They include provisioning services (e.g. the provision of crops and timber), regulating services (e.g. the regulation of water flow, carbon and nutrients) and cultural services (e.g. recreation, sense of place, and knowledge and learning).[6,13]

European Union Sustainable Finance Disclosure Regulation (EU SFDR) is a transparency framework put in place by the European Union that outlines how those participating in the financial market should disclose sustainability information, thus helping those who wish to invest in companies and projects that support sustainability objectives to make well-informed decisions.[28]

Greenwashing involves companies or organisations exaggerating or misrepresenting eco-friendly initiatives, certifications, or claims to attract consumers who are environmentally conscious and enhance their public image. Thus greenwashing can undermine genuine efforts to promote sustainability and could harm the environment.[29]

Habitat banking refers to a market whereby biodiversity units from Nature Positive actions can be purchased to offset debt resulting from environmental damage.[30]

International Financial Reporting Standards (IFRS) is a not-for-profit public interest organisation with the purpose of developing internationally recognised accounting and sustainability disclosure standards that are of high quality, easily comprehensible and enforceable.[31]

International Sustainability Standards Board (ISSB) is an initiative established by the IFRS aiming to empower participants of the capital market with the correct information to support economic investment decision making. ISSB provides market-informed standards to establish a common language regarding voluntary sustainability-reporting initiatives and allow companies to disclose useful and comparable information.[31]

6.0 Glossary of key terms continued

Kunming-Montreal Global Biodiversity Framework (GBF) is a framework adopted during the fifteenth meeting of the Conference of the Parties (COP 15). The framework supports the realisation of the Sustainable Development Goals (SDGs) whilst outlining a pathway to a world living in harmony with nature by 2050. Among the framework targets is the goal to 'Halt and Reverse Nature Loss by 2030 on a 2020 baseline, and achieve full recovery by 2050'.[32]

Natural Capital is the stock of natural resources and ecosystem services provided by the Earth's ecosystems. It includes resources such as clean air, water, fertile soils, biodiversity, forests, and oceans, which support life and human well-being. Natural capital is the foundation of human economies and underpins ecosystem services such as pollination, climate regulation, and water purification.[29]

Task Force on Climate-related Financial Disclosures (TCFD) is an initiative tasked by the Financial Sustainability Board to develop recommendations for improved disclosures on organisations' climate-related risks and opportunities.[33]

Taskforce on Nature-related Financial Disclosures (TNFD) is a framework that assists businesses in integrating their impacts and dependencies on nature into their decision-making processes. This framework draws from the Climate-related Financial Disclosures (TCFD) and its connection to carbon markets.[1]

United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) is a global centre of excellence on biodiversity and nature's contribution to society and the economy. The UNEP-WCMC works at the junction of science, policy and practice to address the global nature crisis.[34]

United Nations Sustainable Development Goals (UN SDGs) are a series of 17 global goals within The Agenda for Sustainable Development, adopted by the United Nations. Together the goals aim to 'end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity'.[35]

World Economic Forum (WEF) is an international non-governmental international organisation that aims to influence global decision making and act as a platform for public-private cooperation on global economic issues by bringing together leaders from various sectors, including business, government, academia, and civil society.[36]

World Wildlife Fund (WWF) is an international non-governmental organisation engaged in wilderness preservation and the reduction of human impacts on the environment, particularly the causes of global nature decline.[37]

7.0 Appendices

7.0 Appendices

7.1 Indicator selection process

A database of potential indicators and metrics of natural capital on solar farms was developed, compiling indicators from several sources including:

An academic dataset of natural capital indicators and metrics on semi-natural grasslands and farmland.[16]

Indicators and metrics selected by an academic journal article on feasible indicators for use by ecological consultants at solar farms.[15]

Key and additional component metrics from the Solar Energy UK standardised approach to ecological monitoring for utility scale solar farms.[14]

Metrics from the Wild Power Score Card,[21] which mainly focuses on management actions and management commitments.

To produce a concise set of indicators suitable for use at solar farms, a set of criteria on what makes a 'good indicator', were developed, based on existing academic literature of indicator selection. Criteria were adapted for the solar farm context and each potential indicator was assessed against these criteria, with those that did not meet criteria adequately being excluded from the list.

Stakeholders from across the solar farm value chain were interviewed and two workshops were conducted to gain an understanding of stakeholder needs and perspectives around indicators and their use in disclosure and reporting. The findings from this work with stakeholders are summarised in Section 3 *(Tables 2 and 3)*. This information, in addition to the 'good indicator' criteria, was used to generate a shortlist of potential indicators and metrics, outlined in Table 4.

7.2 Detailed indicator metrics and methods

Table A. Detailed methods for measurement of the full set of indicators and metrics highlighted in this report, including those recommended for portfolio level use and those better suited to local level reporting and site level use.

POTENTIAL INDICATORS AND METRICS			METHOD	REFERENCE
Indicator group	Indicator	Metric		
Ecosystem extent	HABITAT EXTENT	Habitat area	Measurement can be done using the UK Hab V2 methodology. Requires site visit and/or desk based study to determine the area of particular habitat types within the site boundary.	UK Habitat Classification System V2. 2023 https://ukhab.org/
Ecosystem connectivity	HABITAT CONNECTIVITY	Distance to nearest semi-natural grassland	Distance to nearest semi-natural grassland can be measured following the method outlined in Redhead et al., (2013) which involves GIS analysis to measure the distance between patches of target habitat (likely semi-natural grassland for UK based solar farms).	Redhead, J. W., Sheail, J., Bullock, J. M., Ferreruela, A., Walker, K. J. & Pywell, R. F. 2014. The natural regeneration of calcareous grassland at a landscape scale: 150 years of plant community re-assembly on Salisbury Plain, UK. Applied Vegetation Science, 17, 408-418. NatureScot report: Blake, D. & Baarda, P. 2018. Developing a habitat connectivity indicator for Scotland.Scottish Natural Heritage Research Report No. 887. Saura, S., Estreguil, C., Mouton, C. & Rodríguez-Freire, M. 2011. Network analysis to assess landscape connectivity trends: application to European forests (1990-2000). Ecological Indicators, 11, 407–416.
		Habitat Connectivity Index	Habitat connectivity index is a GIS method developed by NatureScot and based on a method developed by Saura et al. (2011) for assessing connectivity trends in European forests. The method uses the metric Equivalent Connected Area (Probability of Connectivity). This value includes information on the habitat area, the size and numbers of patches, how the habitat patches are arranged in the area, as well as the effect that the intervening landscape has on species movement between patches of habitat. The method outlined in the appendices of the NatureScot report uses EUNIS land cover data for Scotland and SEPA datasets, so English/Welsh alternatives would need to be used.	
Ecosystem condition	BIODIVERSITY	Biodiversity units	Calculated by using the Defra Biodiversity Metric (currently version 4.0). Requires a site visit and desk-based analysis to calculate BNG units.	Defra 2021 Biodiversity Metric www.gov.uk/guidance/biodiversity-metric-calculate-the-biodiversity-net-gain-of-a-project-or-development Suggested in: Natural Capital Best Practice Guidance: Increasing biodiversity at all stages of a solar farm's life cycle (2022). Solar Energy UK.

Table A. continued

POTENTIAL INDICATORS AND METRICS			METHOD	REFERENCE
Indicator group	Indicator	Metric		
Ecosystem condition	BIODIVERSITY	Plant species richness	Botanical quadrat methodology is outlined in the Solar Energy UK Best Practice Guidance. Quadrats are placed at several locations with each site (e.g. under panels, in gaps between rows of panels, in margins or biodiversity areas) and plant species richness determined.	Natural Capital Best Practice Guidance: Increasing biodiversity at all stages of a solar farm's life cycle (2022). Solar Energy UK.
	BIODIVERSITY	Invertebrate species richness	Methodology is outlined in Carvalho et al., 2023. It uses the Environmental Change Network (ECN) invertebrates protocol. The exact method will depend on the taxa of interest e.g. light or pitfall trapping, transect surveys or soil coring.	Carvalho F., Treasure L., Robinson S.J.B., Blaydes H., Exley G., Hayes R., et al. 2023 Jan; 4 (1). Towards a standardized protocol to assess natural capital and ecosystem services in solar parks. Ecological Solutions and Evidnce. ECN. (1996). The ECN invertebrates protocol (1). UK Environmental Change Network.
	BIODIVERSITY	Number of biodiversity indicators with a sampling and monitoring plan in place	This is included in the WildPower Scorecard. Method involves collating information of the number of biodiversity indicators with a sampling and monitoring plan across a portfolio of sites or site. Biodiversity indicator would need to be better defined.	Solar Biodiversity Scorecard. WildPower.
	BIODIVERSITY	Bat species activity	This is measured via surveys from a suitably qualified ecologist as the number of bat passes per species at the site. Methodology can follow that of Fuentes-Montemayor et al., (2011) or Bat Conservation Trust Good Practice Guidelines (2016).	Fuentes-Montemayor, E., Goulson, D. & Park, K. J. 2011. Pipistrelle bats and their prey do not benefit from four widely applied agri-environment management prescriptions. Biological Conservation, 144, 2233-2246. Collins, J. (ed). 2016 Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.

Table A. continued

POTENTIAL INDICATORS AND METRICS			METHOD	REFERENCE
Indicator group	Indicator	Metric		
Ecosystem condition	HUMAN IMPACT	Grazing animal stocking density	This can be estimated as the number of livestock units per ha as described in Gibbons et al., (2024).	Gibbons, J. M., Williamson, J. C., Williams, A. P., Withers, P. J. A., Hockley, N., Harris, I. M., Hughes, J. W., Taylor, R. L., Jones, D. L. & Healey, J. R. 2014. Sustainable nutrient management at field, farm and regional level: Soil testing, nutrient budgets and the trade-off between lime application and greenhouse gas emissions. Agriculture Ecosystems & Environment, 188, 48-56.
	NUTRIENT STATUS	Soil total nitrogen	Soil total nitrogen Can be measured using the dry combustion method in an elemental analyser, as described by Mojeremane et al., (2010).	Mojeremane, W., Rees, R. M. & Mencuccini, M. 2010. Effects of site preparation for afforestation on methane fluxes at Harwood Forest, NE England. **Biogeochemistry**, 97, 89-107.
Ecosystem services	POLLINATION	Nectar production potential	Methodology is described in the Solar Energy UK Best Practice Guidance. It uses % species cover data from botanical quadrats to infer nectar production potential using the UK CEH dataset of nectar sugar values of common grassland plant species. The dataset gives a nectar productivity value by species in kg of sugars/ha cover/year.	Natural Capital Best Practice Guidance: Increasing biodiversity at all stages of a solar farm's life cycle (2022). Solar Energy UK.
	POLLINATION	Bee and butterfly species richness	Methodology is outlined in the Solar Energy UK Best Practice Guidance. Surveyor walks ten 100m transects per site, recording all bumblebees and butterflies which are seen within a 5mx5m square ahead of them.	ECN. (1996). The ECN invertebrates protocol (1). UK Environmental Change Network.
	CLIMATE REGULATION	Soil carbon content	This can be measured using an elemental analyser and mass spectrometer, as described by Chapman et al., (2013).	Chapman, S.J., Bell, J.S., Campbell, C.D., Hudson, G., Lilly, A., Nolan, A.J., Robertson, A.H.J., Potts, J.M. and Towers, W. (2013), Comparison of soil carbon stocks in Scottish soils between 1978 and 2009. Eur J Soil Sci, 64: 455-465.
	CLIMATE REGULATION	Greenhouse gas mitigation potential	The method outlined in Fitton et al., (2011) could be adapted to develop data relevant to solar farms, e.g., if GHG mitigation potential based on vegetation type, condition, soil type and management at solar farms were researched, estimates could be made.	Fitton, N., Ejerenwa, C. P., Bhogal, A., Edgington, P., Black, H., Lilly, A., Barraclough, D., Worrall, F., Hillier, J. & Smith, P. 2011. Greenhouse gas mitigation potential of agricultural land in Great Britain. Soil Use and Management, 27, 491-501.

Table A. continued

POTENTIAL INDICATORS AND METRICS			METHOD	REFERENCE
Indicator group	Indicator	Metric		
Ecosystem services	CLIMATE REGULATION	Soil organic matter and organic carbon	Soil organic matter and organic carbon can be estimated using the Loss-on-ignition (LOI) method at solar farms as outlined in Carvalho et al., (2023) following the method of Emmett et al., (2008). A basic measure of soil organic carbon stocks can be made using these LOI figures, either by dividing the % LOI by 2, or by using a simple regression equation.	Carvalho F., Treasure L., Robinson S.J.B., Blaydes H., Exley G., Hayes R., et al. 2023 Jan;4(1). Towards a standardized protocol to assess natural capital and ecosystem services in solar parks. Ecological Solutions and Evidence. Emmett, B. A., Frogbrook, Z. L., Chamberlain, P. M., Griffiths, R., Pickup, R., Poskitt, J., Reynolds, B., Rowe, E., Rowland, P., Wilson, J., & Wood, C. M. 2008. Countryside survey technical report no. 3/07: Soils manual v1.0. UK Centre for Ecology and Hydrology.
	ECOSYSTEM SERVICE MANAGEMENT	Number of ecosystem services actively managed	Methodology is adapted from the WildPower Scorecard, with proposed adaptation to use the Common International Classification Of Ecosystem Services (CICES), in order to provide standardisation. Method would involve collating information of the number of CICES ecosystem services actively managed across a portfolio of sites. Active management would be inferred where management for particular ecosystem services is referenced in the site management plan.	Solar Biodiversity Scorecard. WildPower. Haines-Young, R. and M.B. Potschin (2018): Common International Classification of Ecosystem Services (CICES) V5.1 and Guidance on the Application of the Revised Structure.
Societal engagement	COMMUNITY ENGAGEMENT	Community ownership or financial support to community groups Number of scientific or research visits Number of community or educational visits	The method would involve accessing site records to establish the total number of scientific, research, community or educational visits across a portfolio per year.	Proposed in the current project. The indicator relating to active community engagement requires further work to develop an appropriate metric.

7.3 Mapping of indicators and metrics to disclosure frameworks and biodiversity targets

Tables B-F. Relevance of potential indicators and metrics to biodiversity targets, related indicators and ESG disclosure frameworks.

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

Table B. Ecosystem extent

POTENTIAL INDICATOR AND METRIC		DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/ TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
HABITAT EXTENT	Area of Habitat	TNFD IFRS ISSB (see notes)	A5.1 Ecosystem extent.	Direct	*The ISSB is working with the TNFD and is therefore expected to align with or adopt the TNFD as its approach in the anticipated ISSB S3 standard (not yet released). Therefore scoring on relevance of solar indicators to the ISSB mirrors that of the TNFD.*	Recommendations of the Taskforce on Nature-related Financial Disclosures Annex 2
			A5.0 Ecosystem condition.	Contributes to understanding	*If accounting for habitat type.*	
		EU SFDR	Mandatory indicator: Activities negatively affecting biodiversity sensitive areas. Additional indicator: Natural species and protected areas.	May inform discussion		European Union Sustainable Finance Disclosure Regulation PAI indicators
		CSRD ESRS 4 Biodiversity and Ecosystems	Disclosure Requirement E4-5 – Impact metrics related to biodiversity and ecosystems change lists ecosystem extent.	Direct		Corporate Sustainability Reporting Directive ESRS 4 Biodiversity and Ecosystems

Table B. Ecosystem extent continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

POTENTIAL INDICATOR AND METRIC		DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
HABITAT EXTENT	Area of Habitat	UN SDGs	Goal 15, target 15.1: 'Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type'. 15.5 Protect biodiversity and natural habitats.	Contributes to understanding		United Nations Sustainable Development Goals
		CBD targets and associated Kunming-Montreal Global Biodiversity Framework indicators	Target 1: 'Plan and Manage all Areas To Reduce Biodiversity Loss - A.2 Extent of natural ecosystems'.	Direct		Convention on Biological Diversity: The Biodiversity Plan for Life on Earth. Targets for 2030
			Target 2: 'Restore 30% of all Degraded Ecosystems' - 2.2 Area under restoration.	May inform discussion		
			Target 3: 'Conserve 30% of Land, Waters and Seas' - 3.1 Coverage of protected areas.			
		UNEP-WCMC Land Use Finance Impact Hub Positive Impact Indicators Directory	BIO 01 'Area of Critical Habitat under management for protection', BIO 02 'Area of on-site Natural Habitat under management for protection', BIO 03 'Area of avoided conversion of natural ecosystems', BIO 04 'Area under management for ecological restoration'.	Contributes to understanding	*In BIO 01 'critical habitat' is defined as areas with high biodiversity value as per the International Finance Corporation (IFC) Performance Standard 6.*	Land Use Finance Impact Hub Positive Impact Indicators Directory

Table C. Ecosystem connectivity

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

POTENTIAL INDICATOR AND METRIC		DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
HABITAT CONNECTIVITY	Habitat connectivity index	TNFD IFRS ISSB (see notes)	Directly relevant to "A5.2 Ecosystem connectivity" (if using a quantitative measure).	Direct	*The ISSB is working with the TNFD and is therefore expected to align with or adopt the TNFD as its approach in the anticipated ISSB S3 standard (not yet released). Therefore scoring on relevance of solar indicators to the ISSB mirrors that of the TNFD.*	Recommendations of the Taskforce on Nature-related Financial Disclosures Annex 2
		EU SFDR	Could inform discussion around activities negatively affecting biodiversity-sensitive areas.	May inform discussion		European Union Sustainable Finance Disclosure Regulation
		CSRD ESRS 4 Biodiversity and Ecosystems	Disclosure Requirement E4-5 – Impact metrics related to biodiversity and ecosystems change lists ecosystem connectivity (both structural and functional measures). ESRS draft reporting standards 1, 2 and specifically ESRS E4. ESRS E4 Sustainable Land/Agriculture practices or policies. ESRS 4 42(c), (d), (e) Changes in Ecosystem Connectivity. ESRS 4 45(b) iii Ecosystems extent and condition. ESRS AR30. (b) ii.	Direct		European Union Corporate Sustainability Reporting Directive ESRS 4 Biodiversity and Ecosystems

Table C. Ecosystem connectivity continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

POTENTIAL INDICATOR AND METRIC		DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
HABITAT CONNECTIVITY	Habitat connectivity index	UN SDGs	Goal 15: 'Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.' 15.5 Protect biodiversity and natural habitats.	Contributes to understanding		United Nations Sustainable Development Goals
		CBD targets and associated Kunming-Montreal Global Biodiversity Framework indicators	Target 2: 'Restore 30% of all degraded ecosystems' which lists 'Maintenance and restoration of connectivity of natural ecosystems' under component indicators. Target 3: 'Conserve 30% of Land, Waters and Seas' which lists 'Protected Area Connectedness Index' under component indicators.	Contributes to understanding		Convention on Biological Diversity: The Biodiversity Plan for Life on Earth. Targets for 2030
		UNEP-WCMC Land Use Finance Impact Hub Positive Impact Indicators Directory	BIO 01 'Area of Critical Habitat under management for protection', BIO 02 'Area of on-site Natural Habitat under management for protection', BIO 03 'Area of avoided conversion of natural ecosystems', BIO 04 'Area under management for ecological restoration'.	May inform discussion	*In BIO 01 'critical habitat' is defined as areas with high biodiversity value as per the International Finance Corporation (IFC)* Performance Standard 6.	Land Use Finance Impact Hub Positive Impact Indicators Directory

Table D. Ecosystem condition

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

	POTENTIAL INDICATOR AND METRICS	DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/ TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
BIODIVERSITY	Biodiversity units	TNFD IFRS ISSB	A5.0 Ecosystem condition.	Direct	*The ISSB is working with the TNFD and is therefore expected to align with or adopt the TNFD as its approach in the anticipated ISSB S3 (not yet released). Therefore scoring on relevance of solar indicators to the ISSB mirrors that of the TNFD.*	Recommendations of the Taskforce on Nature-related Financial Disclosures Annex 2
	Plant species richness (and % species cover)					
	Invertebrate species richness					
	Bird species richness					
	Biodiversity units	EU SFDR	Activities negatively affecting biodiversity-sensitive areas.	Direct		European Union Sustainable Finance Disclosure Regulation
	Plant species richness (and % species cover)			Contributes to understanding		
	Invertebrate species richness					
	Bird species richness					

Table D. Ecosystem condition continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

	POTENTIAL INDICATOR AND METRICS	DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
BIODIVERSITY	All metrics of biodiversity as above	CSRD ESRS 4 Biodiversity and Ecosystems	Disclosure Requirement E4-E4-1 to E4-6. Transition plan on biodiversity and ecosystems. Aligned with the Post-2020 Global Biodiversity Framework of no net loss by 2030, net gain from 2030, full recovery by 2050, and the EU Biodiversity Strategy for 2030. E4-2- Policies related to biodiversity and ecosystems. E4-3- Actions and resources related to biodiversity and ecosystems. E4-4 Targets related to biodiversity and ecosystems. E4-5 Impact metrics related to biodiversity and ecosystems change (includes indicators to report on ecosystem condition (including species richness). E4-6 Potential financial effects from biodiversity and ecosystem-related impacts, risks and opportunities.	Direct	*The ISSB is working with the TNFD and is therefore expected to align with or adopt the TNFD as its approach in the anticipated ISSB S3 standard (not yet released). Therefore scoring on relevance of solar indicators to the ISSB mirrors that of the TNFD.*	European Union Sustainable Finance Disclosure Regulation ESRS 4 Biodiversity and Ecosystems
	All metrics of biodiversity as above	UN SGDs	Goal 15: 'Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss'. 15.5 Protect biodiversity and natural habitats.	Contributes to understanding		United Nations Sustainable Development Goals

Table D. Ecosystem condition continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

	POTENTIAL INDICATOR AND METRICS	DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
BIODIVERSITY	Plant species richness (% species cover)	CBD targets and associated Kunming-Montreal Global Biodiversity Framework indicators	Target 6: Reduce the Introduction of Invasive Alien Species by 50% and Minimise their Impact - 6.1 Rate of invasive alien species establishment'.	Contributes to understanding	*If adapted to include presence/absence of invasive species as part of plant % species cover as per Solar Energy UK guidance.*	Convention on Biological Diversity: The Biodiversity Plan for Life on Earth. Targets for 2030
	All metrics of biodiversity as above	UNEP-WCMC Land Use Finance Impact Hub Positive Impact Indicators Directory	BIO 05 'Species Threat Abatement and Recovery (STAR) value of land under management for protection'. BIO 06 'Species Threat Abatement and Recovery (STAR) value of land under management for restoration'.	May inform discussion	*These indicators account for the number of species present, their status according to the IUCN Red List of Threatened Species™ and the proportion of species' ranges occurring within an area (the site or sites).*	Land Use Finance Impact Hub Positive Impact Indicators Directory

Table E. Ecosystem Services

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

POTENTIAL INDICATORS AND METRICS		DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
POLLINATION	Bee and butterfly species richness	TNFD IFRS ISSB (see notes)	A6.0 Ecosystem services.	Direct	*Number of ecosystem services actively managed provides understanding of this framework element as this is a management commitment rather than a quantitative measure.* *The ISSB is working with the TNFD and is therefore expected to align with or adopt the TNFD as its approach in the anticipated ISSB S3 standard (not yet released). Therefore scoring on relevance of solar indicators to the ISSB mirrors that of the TNFD.*	Recommendations of the Taskforce on Nature-related Financial Disclosures Annex 2
POLLINATION	Nectar production potential					
CLIMATE REGULATION	Soil total Carbon concentration			Contributes to understanding		
ECOSYSTEM SERVICE MANAGEMENT	Number of ecosystem services actively managed					
POLLINATION	Bee and butterfly species richness	EU SFDR	Activities negatively affecting biodiversity-sensitive areas. Disclosure Requirement related to ESRS 2 IRO-1 Description of processes to identify and assess material biodiversity and ecosystem-related impacts, risks and Opportunities - 'identified and assessed dependencies on biodiversity and ecosystems and their services at own site locations'.	Contributes to understanding		European Union Sustainable Finance Disclosure Regulation

Table E. Ecosystem Services continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

	POTENTIAL INDICATORS AND METRICS	DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
CLIMATE REGULATION	Soil carbon concentration	EU SFDR	EU SFDR PAI requires Scope 1, 2 and 3 of financed emissions annually (i.e. the funds activities and supply chain). EU SFDR Annex V for Article 9 funds could utilise disclosure on emissions avoided(calculated as a function of generation and IFI harmonised factors). Aids demonstration of progress on "climate change mitigation" and continues Article 9 classification. Article 9 under DNSH.	Contributes to understanding		European Union Sustainable Finance Disclosure Regulation
POLLINATION	Nectar production potential		Disclosure Requirement related to ESRS 2 IRO-1 Description of processes to identify and assess material biodiversity and ecosystem-related impacts, risks and Opportunities - 'identified and assessed dependencies on biodiversity and ecosystems and their services at own site locations'.	May inform discussion		
ECOSYSTEM SERVICE MANAGEMENT	Number of ecosystem services actively managed		Disclosure Requirement related to ESRS 2 IRO-1 Description of processes to identify and assess material biodiversity and ecosystem-related impacts, risks and Opportunities - 'identified and assessed dependencies on biodiversity and ecosystems and their services at own site locations'.	May inform discussion		

Table E. Ecosystem Services continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

POTENTIAL INDICATORS AND METRICS		DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
POLLINATION	Bee and butterfly species richness	CSRD ESRS 4 Biodiversity and Ecosystems	Disclosure Requirement E4-1 – Transition plan on biodiversity and ecosystems. Aligned with the Post-2020 Global Biodiversity Framework of no net loss by 2030, net gain from 2030, full recovery by 2050, and the EU Biodiversity Strategy for 2030. Disclosure Requirement E4-5 – Impact metrics related to biodiversity and ecosystems change (includes indicators to report on ecosystem services). Disclosure Requirement related to ESRS 2 IRO-1 Description of processes to identify and assess material biodiversity and ecosystem-related impacts, risks and Opportunities - 'identified and assessed dependencies on biodiversity and ecosystems and their services at own site locations'.	Direct	*Companies should disclose their impacts and dependencies on ecosystem services.*	Corporate Sustainability Reporting Directive ESRS 4 Biodiversity and Ecosystems
CLIMATE REGULATION	Soil Carbon concentration					
CLIMATE REGULATION	Soil Carbon concentration	CSRD (ESRS E1)	ESRS E1-1: 'Transition plan to reach climate neutrality by 2050'. ESRS E1-5 GHG emission reductions targets. ESRS E1-6: 'Gross Scope 1, 2, 3 and Total GHG emissions.' ESRS E1-7 GHG removals and carbon credits. ESRS E4-2 Sustainable Land/ Agriculture practices or policies.	Contributes to understanding		Corporate Sustainability Reporting Directive Environmental Sustainability Reporting Standards ESRS E1 Climate change

Table E. Ecosystem Services continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

	POTENTIAL INDICATORS AND METRICS	DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
POLLINATION	Nectar production potential	CSRD ESRS 4 Biodiversity and Ecosystems	Disclosure Requirement E4-1 – Transition plan on biodiversity and ecosystems. Aligned with the Post-2020 Global Biodiversity Framework of no net loss by 2030, net gain from 2030, full recovery by 2050, and the EU Biodiversity Strategy for 2030. Disclosure Requirement E4-5 – Impact metrics related to biodiversity and ecosystems change (includes indicators to report on ecosystem services). Disclosure Requirement related to ESRS 2 IRO-1 Description of processes to identify and assess material biodiversity and ecosystem-related impacts, risks and Opportunities - 'identified and assessed dependencies on biodiversity and ecosystems and their services at own site locations'.	Contributes to understanding	*Can make indirect inferences on suitability of site for pollinators.*	Corporate Sustainability Reporting Directive ESRS 4 Biodiversity and Ecosystems
ECOSYSTEM SERVICE MANAGEMENT	Number of ecosystem services actively managed			May inform discussion	*Can make inferences onmanagement commitments to manage sites for ecosystem services.*	
ECOSYSTEM SERVICES	All metrics of ecosystem services	UN SDGs	Goal 15: 'Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss'. 15.5 Protect biodiversity and natural habitats.	May inform discussion		United Nations Sustainable Development Goals

Table E. Ecosystem Services continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

POTENTIAL INDICATORS AND METRICS		DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
POLLINATION	Bee and butterfly species richness	CBD targets and associated Kunming-Montreal Global Biodiversity Framework indicators	Target 11: Restore, Maintain and Enhance Nature's Contributions to People - 'B.1 Services provided by ecosystems'.	Direct		Convention on Biological Diversity: The Biodiversity Plan for Life on Earth. Targets for 2030
POLLINATION	Nectar production potential					
CLIMATE REGULATION	Soil Carbon concentration					
ECOSYSTEM SERVICE MANAGEMENT	Number of ecosystem services actively managed			Contributes to understanding		
POLLINATION	Bee and butterfly species richness	UNEP-WCMC Land Use Finance Impact Hub Positive Impact Indicators Directory	BIO 05 'Species Threat Abatement and Recovery (STAR) value of land under management for protection'. BIO 06 'Species Threat Abatement and Recovery (STAR) value of land under management for restoration'.	May inform discussion	*These indicators account for the number of species present, their status according to the IUCN Red List of Threatened Species™ and the proportion of species' ranges occurring within an area (the site or sites).*	Land Use Finance Impact Hub Positive Impact Indicators Directory
POLLINATION	Nectar production potential					

Table E. Ecosystem Services continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

	POTENTIAL INDICATORS AND METRICS	DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
ECOSYSTEM SERVICE MANAGEMENT	Number of ecosystem services actively managed	UNEP-WCMC Land Use Finance Impact Hub Positive Impact Indicators Directory	CMA 01 'GHGs sequestered through restoration of native vegetation'. CMA 02 'GHG emissions avoided due to non-conversion of natural habitat'. CMA 03 'GHG emission reduction and sequestration from changes to on farm practices'. PRO 05 'Soil Organic Carbon and healthy soil'.	May inform discussion	*Depending on the ecosystem service.*	Land Use Finance Impact Hub Positive Impact Indicators Directory
CLIMATE REGULATION	Soil Carbon content		Soil Organic Carbon and healthy soil.	Direct	*Soil organic carbon can be measured using soil total carbon method if soils with a high level of inorganic carbonates are first pre-treated with acid.*	
			GHG emission reduction and sequestration from changes to on farm practice.	May inform discussion		

Table E. Ecosystem Services continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

	POTENTIAL INDICATOR AND METRICS	DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
ECOSYSTEM SERVICES	All metrics of ecosystem services as above	CSRD ESRS E4	E4-1 to E4-6 Transition plan on biodiversity and ecosystems. Aligned with the Post-2020 Global Biodiversity Framework of no net loss by 2030, net gain from 2030, full recovery by 2050, and the EU Biodiversity Strategy for 2030. E4-2- Policies related to biodiversity and ecosystems. E4-3- Actions and resources related to biodiversity and ecosystems. E4-4 Targets related to biodiversity and ecosystems. E4-5 Impact metrics related to biodiversity and ecosystems change (includes indicators to report on ecosystem condition (including species richness). E4-6 Potential financial effects from biodiversity and ecosystem-related impacts, risks and opportunities. Disclosure Requirement related to ESRS 2 IRO-1 Description of processes to identify and assess material biodiversity and ecosystem-related impacts, risks and Opportunities - 'identified and assessed dependencies on biodiversity and ecosystems and their services at own site locations'.	Direct		Corporate Sustainability Reporting Directive ESRS 4 Biodiversity and Ecosystems

Table F. Engagement

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

	POTENTIAL INDICATORS AND METRICS	DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/ TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
COMMUNITY ENGAGEMENT	Number of community or educational visits per year	TNFD IFRS ISSB (see notes)	A20.0 Proportion of sites that have active engagement with local stakeholders on nature-related issues.	Direct	*The ISSB is working with the TNFD and is therefore expected to align with or adopt the TNFD as its approach in the anticipated ISSB S3 standard (not yet released). Therefore scoring on relevance of solar indicators to the ISSB mirrors that of the TNFD.*	Recommendations of the Taskforce on Nature-related Financial Disclosures Annex 2
COMMUNITY ENGAGEMENT	Number of research or scientific visits per year					
COMMUNITY ENGAGEMENT	Site has active engagement with the community (community ownership, financial support to community groups)				*Active engagement should be better defined.*	
COMMUNITY ENGAGEMENT	All metrics of engagement as above	EU SFDR	Article 11: 'Transparency of the promotion of environmental or social characteristics and of sustainable investments in periodic reports.'	May inform discussion		Corporate Sustainability Reporting Directive

Table F. Engagement continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

	POTENTIAL INDICATORS AND METRICS	DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
COMMUNITY ENGAGEMENT	All metrics of engagement as above	CSRD ESRS	Draft ESRS S3 Affected Communities. Disclosure Requirement S3-2 – Processes for engaging with affected communities about Impacts – whether engagement occurs with affected communities. ESRS E4 Biodiversity and ecosystems: Disclosure Requirement related to ESRS 2 IRO-1 Description of processes to identify and assess material biodiversity and ecosystem-related impacts, risks and opportunities includes text on avoiding negative impacts on ecosystem services relevant to affected communities. impacts may be avoided.	May inform discussion		European Union Sustainable Finance Disclosure Regulation ESRS S3 Affected Communities
COMMUNITY ENGAGEMENT	All metrics of engagement as above	UN SGDs	Goal 15, targets 15a 'mobilise and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems' and 15b 'mobilise significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation'. Goal 15, target 15.9: 'Integrate ecosystem and biodiversity in governmental planning'.	May inform discussion	*Expanding local community knowledge and engagement may inform discussion around targets 15 a.1 and 15 b.1.* *Indicators of engagement may also inform discussion around. Target 15.6 which promotes fair and equitable sharing of benefits from the use of genetic resources.*	United Nations Sustainable Development Goals

Table F. Engagement continued

The indicator directly maps to this disclosure/target

The indicator contributes to understanding this disclosure/target

The indicator does not contribute to how this disclosure/target component is currently calculated, but could inform related narrative and discussion

POTENTIAL INDICATORS AND METRICS		DISCLOSURE FRAMEWORK OR BIODIVERSITY TARGET	FRAMEWORK/TARGET ELEMENT OR INDICATOR	RELEVANCE OF SOLAR INDICATOR TO DISCLOSURE OR TARGET	NOTES	FRAMEWORK OR TARGET REFERENCE
COMMUNITY ENGAGEMENT	All metrics of engagement as above	CBD targets and associated Kunming-Montreal Global Biodiversity Framework indicators	Target 12: Enhance Green Spaces and Urban Planning for Human Well-Being and Biodiversity, which lists 'Recreation and cultural ecosystem services provided' under component indicators.	Direct		Convention on Biological Diversity: The Biodiversity Plan for Life on Earth. Targets for 2030
COMMUNITY ENGAGEMENT	All metrics of engagement as above	UNEP-WCMC Land Use Finance Impact Hub Positive Impact Indicators Directory	LG 02: Number of participants benefiting from increased access to essential services.	May inform discussion		Land Use Finance Impact Hub Positive Impact Indicators Directory
COMMUNITY ENGAGEMENT	All metrics of engagement as above	CSRD ESRS	ESRS E4 Paragraph 2 Objective to set out disclosure standards that include interrelation between biodiversity and nature considerations with indigenous and affected communities. ESRS E4 Paragraph 20 (e) Process to conduct consultations with affected communities on sustainability assessments of shared biological resources and ecosystems. ESRS E4 Paragraph 31 (d) List key stakeholders, their involvement and how they are affected. ESRS S3 Affected Communities.	Direct		Corporate Sustainability Reporting Directive ESRS 4 Biodiversity and Ecosystems

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