### 19, 20 e 21 marzo 2025 **CORTINA D'AMPEZZO**

Transizione sostenibile, competitività e innovazione: il ruolo della Life Cycle Assessment





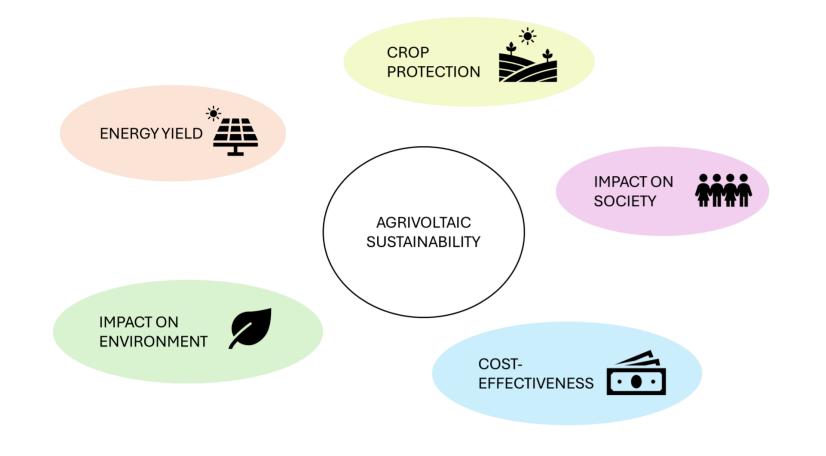


## **Symbiosyst**



# Enhancing Agrivoltaic Sustainability: Proposing an SDG-Based Lifecycle **Assessment Methodology Beyond Traditional LCA**

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The study proposes a holistic methodology that includes environmental sustainability and social aspects. This new approach aims to **complement traditional LCA** by engaging stakeholders and experts to ensure all relevant sustainability aspects are considered. The methodology is tailored to specific applications and **aligns Key Performance Indicators** (KPIs) with the Sustainable Development Goals (SDGs) [1] to enhance communication and

Agrivoltaic applications were selected as case study, as part of SYMBIOSYST project [2]. The final goal is to provide a framework that accounts for the complex nature of a multi-output system, which produces both agricultural products and energy.

*Figure 1. Representation of the key aspects related to agrivoltaics sustainability* 

### **METHODOLOGY**

## **AGRIVOLTAICS CASE STUDY**

- 1. GOAL AND SCOPE DEFINITION
- STAKEHOLDERS AND EXPERTS' ENGAGEMENT AND LITERATURE REVIEW

Goal **Objective**: Analyse sustainability level of an agrivoltaics system

understanding of the results.

**Target audience:** Policy makers, Agrivoltaics organizations

<u>Scope</u> Impact categories: Social and environmental impact

System boundaries: All lifecycle stages of an agrivoltaics system

**Stakeholders and experts engaged:** Photovoltaics, agricultural, social sciences, survey and biodiversity Literature references: European legislative framework (e.g., [3], [4]) and available guidelines (e.g., [5], [6], [7], [8])

# IDENTIFY SUSTAINABILITY HOTSPOTS

Table 1. Schematization of the selected KPIs into categories and subcategories, with associated SDGs

5.		SUSTAINABILITY HUTSPUTS	Table 1. Schematization of the selected KPIs into categories and subcategories, with associated SDGs			ssociated SDGs	Human Rights
	FOR EVER	Y LIFECYCLE STAGE	Category	Subcategory	Associated SDGs	SUSTAINABLE DEVELOPMENT	12. Presence of explicit code of conduct that protect human rights of workers Is there a transparently available document, statement or set of rules, that define the organization position
				Diversity and gender	5 – Achieve gender equality	GOALS	regarding the human right respect and protection of workers involved in the agrivoltaic plant? (e.g., no illegal labour, adequate salary, adequate working hours, no child labour, no forced labour, health insurance guaranteed, etc.) If yes, please specify the tipe of document in "Other"
				equality			Do not know
4.		RM HOTSPOTS INTO KPIS AND	Social	Health and safety	8 – Promote economic growth		○ No
				Fair working conditions	8 – Promote economic growth		Other
				Suppliers social	12 – Sustainable consumption patterns		
				responsability			13. Records on all workers stating names and ages or dates of birth are kept on file Is there a document containing all the workers' ID record?
				Stakeholder engagement	11 – Sustainable cities development	Energy	
				Product certification	12 – Sustainable consumption patterns		
				Energy community	11 – Sustainable cities development	32. PV electricity yield kWh of PV AC electricity annually produced per k Please specify the value and the reference year in If the specific value if not available, please specify	
				Communication and	5 – Achieve gender equality	etc.) These information might be available in the PV m O Do not know	odule information sheet.
5.	QUANTIF	Y INDICATORS AND DEFINE		transparency		Other	egularly and adequately documented?
	SCORING	GMETHOD		Material supply	12 – Sustainable consumption patterns	33. PV electricity coverage Share of the annual electricity consumption requi machines; that is covered by PV electricity. Please specify in "Other" the share of coverage Do not know	uired by the farm (e.g., light, irrigation, charging of electric
				Environmental screening of	12 – Sustainable consumption patterns		
				suppliers			
			Environmental -	Circularity and Eco-design	12 – Sustainable consumption patterns	⊖ Other	Crop quality
			Photovoltaic	End-of-life	12 – Sustainable consumption patterns	34. Tracking system optimization	55. Crop yield variation
6	Δςςοριατ	E KPIS WITH SDGS		Electric efficiency	7 – Affordable energy access	Are there optimized tracking algorithms in place Do not know	Variation of crop yield kg of fruit/vegetable per hectare, per year, in comparison with the same area of non-agri- PV field. Please, specify below the following information: - Annual crop yield of fruit or vegetables per unit of Agri PV field (e.g., X kg fruit/ hectare)
0.	AJJOCIA			GHG emissions	13 – Combat climate change	No, there are no trackers, only fixed moun	<ul> <li>Annual crop yield of fruit or vegetables per unit of traditional field, without Agri-PV (if not measured directly, specify source)</li> </ul>
				Landscape integration	15 – Protect terrestrial ecosystems	Yes, the mounting structures are provided	
				General	13 – Combat climate change	O Other	56. Plant phenology - Plant vigor - Plant/ sprout height
				End-of-life	12 – Sustainable consumption patterns		Is there a difference between average height of the plant (for horticulture)/ length of shoots (for trees) in a control area, and in an Agri-PV area of the same size, at certain point in time? If yes, please quantify the difference in meters, in "Others"
7				Water	6 – Sustainable water management		O Do not know
7.		E REFINEMENT WITH TAICS EXPERT'S FEEDBACK	Environmental - Agricultural	Land use	15 – Protect terrestrial ecosystems		Other
				Biodiversity	15 – Protect terrestrial ecosystems		57. Plant phenology - Plant vigor - Diameter Is there a difference between the average diameter of the plant in a control area, and in an Agri-PV area of the same size, at collection time?
				Testing	15 – Protect terrestrial ecosystems		
			ABricantara	Crop quality	15 – Protect terrestrial ecosystems	_	If yes, please quantify the difference in meters, in "Others" Do not know
				Soil improvement and	15 – Protect terrestrial ecosystems		O No difference
				preservation			O Other
		WORST GRADE BEST GRA		Machinery	15 – Protect terrestrial ecosystems	L	

The questionnaire has been sent to **six agrivoltaic** plant demonstrators within SYMBIOSYST, and it is currently in its first revision phase. After this initial round of refinement, a second version of the questionnaire will be sent to another set of agrivoltiaic demonstrators external to the SYMBIOSYST project. The results of this final iteration will be available at the end of the project in the project website.

### REFERENCES

[1] SDGS webpage, https://sdgs.un.org/goals

[2] SYMBIOSYST webpage, https://www.symbiosyst.eu/ [3] EP (European Parliament), 2020. Social Sustainability – Concepts and Benchmarks.

[4] DIN, 2021. DIN SPEC 91434:2021-05 Agri-photovoltaic systems - Requirements for primary agricultural use. 1st Edition 2021.

[5]UN, 2011. Guiding Principles on Business and Human Rights: Implementing the United Nations "Protect, Respect and Remedy" Framework.

[6] MASE, 2020. Linee Guida in materia di Impianti Agrivoltaici

[7]Fraunhofer ISE, 2024. Agrivoltaics: Opportunities for Agriculture and the Energy Transition.

[8] SPE (Solar Power Europe), 2023. Agrisolar Best Practices Guidelines. Version 2.0. Solar Power Europe.





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