

Agrivoltaics for Noah's Ark: Photovoltaic Landscapes around Rice Paddies

AN INTERNATIONAL ARCHITECTURE COMPETITION TO DESIGN THE AGROVOLTAIC GARDEN AT NEORURALEHUB

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Registration Deadline & Submission Deadline: 20 June 2022; 12.00 GMT+1

Introduction: The NeoruraleHub Project

The NeoruraleHub aims to address soil depletion in the Po Valley resulting from intensive agriculture that has left the ground dry. The project created a model of renaturalization, which was initially applied to 400 hectares of land, predominantly covered by rice paddies, but which quickly grew to a thousand – a feat that earned the title of a FAI (Fondo Ambiente Italiano) site in 2019.

NeoruraleHub was launched in 2018 on the heels of a twenty-year collaboration by Piero Manzoni and Giuseppe Natta, who tried to bring 400 hectares of 1,700 owned properties back to the environmental conditions present before intensive cultivation. Aligned with strategies in the European New Green Deal, they reintroduced biodiversity by planting two million native plants that had disappeared with the introduction of agriculture. Species of migratory and sedentary birds quickly returned. In just twenty years, they were able to reconstitute the agricultural landscape as it existed before intensive farming – in fact, as it had existed thousands of years prior. Biodiversity increased by 170 percent, soil fertility increased, and the use for insecticides decreased.

After more than 70 years of intense cultivation, 400 hectares of re-naturalized land (now called the Po Valley) stand out in the aerial view of this land, like a green handkerchief in the middle of a desert.

Giuseppe Natta visionary and initiator of the NeoruraleHub project, saw it as a way of giving back to nature what has been taken. Giuseppe was influenced by his father Giulio who won the Nobel Prize in 1963 a recognition for his discoveries in the field of chemistry and polymer technology related to the production of isotactic polypropylene.

The *Agrivoltaics for Noah's Ark design* competition is one of many activities by the Italian Network for Sustainable Agrivoltaics (www.agrivoltaicosostenibile.com) – a network launched by ENEA (Italian National Agency for New Technologies, Energy, and Sustainable Economic Development) in collaboration with ETA Florence Renewable Energies. This project is also related to the ten-year effort by ENEA called, *Photovoltaics /Forms / Landscapes* (www.pv-landscapes.com), organized in collaboration with ETA Florence Renewable Energies.

The concept for *Agrivoltaics for Noah's Ark* is by Alessandra Scognamiglio, coordinator of the Sustainable Agrivoltaics Task Force at ENEA and both creator and chair of *Photovoltaics /Forms / Landscapes*.

ART. 1 COMMISSIONING PARTY, ORGANIZERS, MEDIA PARTNERS & SUPPORT

Commissioning Party: NeoruraleHub Srl - Via Vittor Pisani, 20, 20124 Milano (MI)

Organizers: In the framework of the activities of Italian Network for Sustainable Agrivoltaics
ENEA Italian National Agency for New Technologies, Energy and Sustainable Economic Development - Lungotevere Thaon di Revel, 76, Roma (IT)
IN/Arch National Institute of Architecture - Via G.A. Guattani 24, Roma (IT)
ETA Florence Renewable Energies – Via A. Giacomini, 28, Firenze (IT)
AIAPP Italian Association of Landscape Architecture - Via San Niccolò, 6, Firenze (IT)

Media Partners: Archiportale e Archilovers

Secretariat: IN/Arch National Institute of Architecture

Institutional Support by: Ministry of Ecological Transition
Lombardy Region
Municipality of Giussago
National Council of architects, landscape architects and conservationists
Legambiente
SITdA The Italian Society of Architectural Technology

Sponsors: Solarelit
REM TEC

ART. 2 TYPE OF COMPETITION

This is a single-phase design competition that will be carried out via a computer module and open to any applicants meeting the requisites laid out in article 6 and 7, to be awarded as outlined in articles 15 and 16.

The official language of the design competition is English.

The official unit of measurement for this competition is the metric system.

ART. 3 CONTEXT, THESIS, AND OBJECTIVES OF THIS COMPETITION

Context: General Characteristics of Agrivoltaic Systems

Agrivoltaic systems comprise both a photovoltaic system and the space (“pore” or “void” space) that exists between and under the photovoltaic units, within which agricultural activity is carried out. The spatial configuration of the photovoltaic system and the technical specifications must facilitate synergy between agricultural production and the production of electricity from photovoltaics. This means that

the design and choice of specific components must be such as to allow adequate control of light transmission (to allow a good compromise between photovoltaic conversion and photosynthesis).

If in traditional photovoltaic systems all the spatial choices (layout of the plant, positioning of the modules) are implemented with the aim of maximum energy generation at minimum cost; in the case of agrivoltaic systems, there is a compromise necessary to allow for an integrated performance that is optimal with respect to the needs of the entire project (both electricity + agricultural production).

In principle, the spatial scheme of on ground photovoltaic systems consists (in the northern hemisphere) of rows of photovoltaic modules oriented according to the E-W axis, spaced at a minimum distance to prevent shading, with photovoltaic modules inclined at the optimal tilt angle depending on the latitude (or mounted on single or double axis tracking systems) for maximum solar capture, at a height from the ground that permits standard maintenance operations.

The spatial scheme of an agrivoltaic system is generally characterized by a greater "porosity", that is, by a greater distance between the rows of photovoltaic modules, and by a greater distance of the modules from the ground: this is to allow the cultivation of select crop species and to ensure that they have proper access to solar radiation.

The Thesis of this Competition

In the context of Europe's energy transition, the use of large ground-mounted photovoltaic systems is an essential solution for achieving the national goals of several countries. However, there are many barriers to the implementation of these systems, including those related to concerns about land use, such as photovoltaics using land that could otherwise be used for agriculture.

"Agrivoltaic systems" offer a possible solution to addressing these concerns, as they maximize land use by generating both energy and food simultaneously. In order for the energy transition to take place within an ecological framework, agrivoltaic solutions must be sustainable.

The thesis is that agrivoltaic systems can be an opportunity to transform the energy transition into an ecological transition through the development of complex visions that go beyond pure technological designs to test new approaches and integrative designs.

This competition seeks to advance research supporting a sustainable vision; particularly one in which agrivoltaic systems seen as a resource for communities, going beyond the productive value of electricity and agriculture, to also add social and recreational value.

It is a matter of how to design agrivoltaic systems as a part of the landscape and doing so in a way that empowers the local population to participate in the sustainable transformation of their landscape. For example, in cases where agrivoltaic systems are created near urban centers, making the land a simultaneous opportunity to provide citizens with spaces usable for outdoor recreational activities (from agrivoltaic systems to agrivoltaic gardens).

The Specific Objectives of this Competition

Within the aforementioned context, this competition has a two fold objective:

(1) To create an agrivoltaic system with an approximate size of **minimum 1MWp** and max **3 MWp** on a total area of 8 hectares, which must enable rice cultivation within the same perimeter. In essence, this project will suggest spatial and technological choices that allow for a synergy between photovoltaic energy generation and rice cultivation (e.g., considering optimal irradiation on the cultivation surface and the possibility of using agricultural equipment); and,

(2) To design the proposed agrivoltaic system as a part of the landscape. This means integrating the panorama of the agrivoltaic system with the structural and semantic texture of the landscape itself, while thinking systemically about ways that to even improve the qualities of the local ecosystem through this site intervention.

Creating value in the “void”

The NeoruraleHub offers *restitution* to the land in a place where human actions, such as monoculture, have drastically reduced biodiversity and flattened the horizon. It is a poetic act, in which man returns, supported by technology and technique, to replace the fullness of monoculture with the emptiness of Nature.

For example, in the margin bands (Environment Field Margin) of the NeoruraleHub, vegetation is free to grow naturally around the areas used for rice cultivation. These “empty” bands, constituting areas of biodiversity, support the cultivated areas by working as barriers against insect and parasitic infestations and thereby preventing the need for insecticides throughout the cultivation process.

Similarly to the above approach (which attributes a restitution value to “empty” bands), this competition has the specific objective of creating an agrivoltaic in the area between and under the photovoltaic modules garden (a.k.a., the "pore space" or “void”).

In this competition, this space is one in which not only rice cultivation exists, but also fauna, flora and people relate to each other.

The void, from the point of view of the project, constitutes a value.

We want community to feel welcome at the “void” spaces that comprise the agrivoltaic garden at the NeoruraleHub.

More specifically the agrivoltaic garden will have three added values to the overall agrivoltaic ecosystem:

(1) It will be conceived as a biodiversity conservation area, in which anthropic intervention is reduced to a minimum (i.e. design should include an area of regeneration and connection).

(2) It will be a second community and recreational area (i.e. design should include a recreational area for the community).

(3) It will be an area where solutions are tested, supporting sustainable agriculture (i.e. design should include a productive area for photovoltaic technology and agricultural crops).

This competition requires a precise effort on the part of designers. If current practice thinks, and imagines, agrivoltaics merely as a plant, the aim of the competition is precisely to overcome this vision and generate new perceptions.

The discipline of analysis, which separates, divides and quantifies, must also be overcome by a more complex and inclusive vision; one in which photovoltaics is not only profitable, but also add value, including aesthetic, social, and ecological). In other words, it is necessary to move from designing photovoltaic systems to photovoltaic landscapes, or ultimately, to think of the photovoltaic field as a (technological) garden, as an "image and metaphor of living in harmony in order to prepare for a relationship, that must be rethought, between people, animals, and nature "(Cit. Massimo Venturi Ferriolo, *Oltre il Giardino*).

Thinking of a photovoltaic field as a garden, recovers the human sense of living, in which there is the useful but also the beauty as a possibility of expression of those human needs that are not downgraded by the field of utility. It is a way to develop visions for new cultural landscapes of the XXI century.

ART. 4 NEEDS EXPRESSED BY THE COMMISSIONING PARTY

Special consideration needs to be given to safety, as the aim of this project is for a space that will be utilized and frequented by community members. Design considerations for safety and accessibility must be considered in the submitted proposals.

ART. 5 THE PROJECT AREA

The entire NeoruraleHub area extends over approximately 1,700 hectares within the NeoruraleHub territory of Giussago and other neighboring municipalities around Pavia. Its current structure was achieved (starting in 1996) through numerous renaturalization and regeneration interventions, such as: the formation of over 107 hectares of wetlands, 78 hectares of woods, 65 hectares of reforestation from timber, 50 hectares of meadows, and 110 km of hedges and field rows.

The concept expressed with the adjective "neorural" refers to a rural area in which existing agricultural activities are complemented by other environmental benefits made possible by renaturalization interventions, such as, for example, the quality of the landscape, biodiversity, the enhancement of renewable resources, or the improvement of health and quality of life. Management of the NeoruraleHub, in line with the Community Agricultural Policy, seeks to restore harmony with the natural and territorial elements lost during the modernization of agriculture, by introducing corrective measures that maximize the productive use by making it compatible with the greatest possible biodiversity. Under these conditions, 800 hectares of rice, 200 hectares of maize, 100 hectares of other arable land are

generally cultivated each year, resulting in the production of about 50,000 quintals of harvested rice, 60,000 quintals of chopped corn, and 2,000 quintals of soy – a yield qualitatively indifferent from traditional agriculture. To date, the area for agri-environmental use occupies about 25% of the entire farm area.

Specifically, the area covered by this competition covers about 8 hectares of agricultural land and is adjacent to the rice drying plant, as well as to: a shed hosting test rooms for innovative technologies supporting a circular economy; laboratories; and others research and development plants.

ART. 6 PARTICIPATION REQUIREMENTS

Applicants must be architects or landscape architects, registered with their respective professional associations or registrars in their country of origin, qualified to practice and therefore authorized to participate in architectural design competitions on the date of publication.

Competitors may participate through temporary groups.

Each group must appoint a group lead to serve as the sole contact person for the Organizers and Commissioning Party.

For the purposes of this competition, each group (even groups created exclusively for submitting a proposal) constitutes a single entity; although the authorship of the project proposal expressed will be recognized, with equal qualifications and rights, to all members of the group.

Each group must include:

1. An architect
2. An architect or landscape architect qualified to practice for at least 5 (five) years, prior to the date of publication of this competition.
3. A landscape architect (registered in Section A, Sector C, of the Professional Order) or affiliated with IFLA abroad under the single title of Landscape Architect.
4. An agronomist / forestry doctor.
5. An experienced electrical system designer or energy engineer (production, transformation, distribution).
6. A structural engineer.

Participants in the competition are permitted to engage consultants and additional collaborators, as part of a multidisciplinary approach, even if not registered in professional orders or registers. That being said, the qualification and nature of engagement must be declared for each party contributing to the proposal of the competing group.

Participation in any capacity (group leader, group member, consultant, collaborator) of a competitor in more than one group is grounds for exclusion of both the single competitor and the group or groups involved.

ART. 7 EXCLUSIONARY CRITERIA FOR PARTICIPANTS

The following individuals are prohibited from participating in a submission:

- Members of the Jury Panel and their relatives up to the fourth degree and their relatives up to, and including, the second degree
- Directors of the aforementioned commissioning party, organizers, media partners, and supporting organizations, including their spouses, relatives and in-laws up to the third degree
- Full-time and part-time employees of (including those with fixed-term or consultancy contracts with) the aforementioned commissioning party, organisers, media partners, and supporting organisations
- Anyone who has participated, in any capacity, with the drafting of this announcement and any relating documents

The attempted participation of even one person from the above excluded participants calls for the elimination of that submission.

ART. 8 WAIVER OF CLAIMS

All applications are accepted pending the discovery of any expressed ground for exclusion.

Applicants and groups excluded for any reason, may not, in any way, file suit or claims against the commissioning party, organizers, media partners, and supporting organizations for the costs incurred in any way related to their participation in this competition.

ART. 9 ACCEPTANCE OF THE REGULATION

By participating in this competition, applicants and their group members accept, without reservation, all the criteria, requirements, and waivers contained in this document.

Failure to comply with what is declared herein results in automatic exclusion from the competition.

Applicant are obliged, under penalty of exclusion, to adhere to strict non-disclosure - including not to publish, circulate, or make known any information about this project before the Judging Committee has selected and publicly declared a selected competitor.

ART. 10 DOCUMENTATION PROVIDED TO COMPETITORS

All group Leads will be provided with:

(a) Competition forms:

- declaration relating to the constitution and composition of the group and the absence of grounds for exclusion

(b) Technical documents:

- general and specific photographic documentation of the area under intervention and surrounding context
- a general plan of the area, with identification of the area (**in editable dwg or dxf formats**)
- extracts of existing municipal and supra-municipal urban planning tools and related legislation

The abovementioned documents will be published in a dedicated section of the competition website, www.sustainablephotovoltaiclandscapes.com, and can only be downloaded after registering as indicated in Article 10.

ART. 11 INFORMATIVE VIDEOS

There will be pre-recorded informative videos about the themes and objectives of this project, including: in-depth information on possible design methodologies for agrivoltaic systems; examples of new types of land art or functional environmental art able to produce energy; characteristics of the project area.

These videos can be found on the user area competition website, www.sustainablephotovoltaiclandscapes.com, only after registering on the project website.

ART. 12 REQUEST FOR CLARIFICATIONS

Requests for clarification can only be submitted according to the procedure specified on the competition website, www.sustainablephotovoltaiclandscapes.com, and must be submitted by 20 April 2022.

Answers to all questions received will be published, by the Secretariat, on the competition website by 30 April 2022 and should be considered by all candidates and inform submissions.

All communications between competitors and the Secretariat must be made through the competition website.

ART. 13 REQUIRED SUBMISSION STRUCTURE

(a) Text-based documents

All text-based submissions must be shared as a single file in PDF format, no larger than 10 MB, consisting of a:

Report: A technical and descriptive elaboration of the project idea. Explanatory sketches, graphic diagrams, and similar visuals may also be inserted. The text and visuals will be contained in a no more than 5 folders with a maximum of 2,000 characters each (including spaces), and using UNI / A4 formatted, vertically-oriented pages.

Landscape analysis: Various studies drawn-up to provide a foundation of insights in which to identify the solutions that will enable the environmental and landscape improvements desired in the context of the competition's aim. The analysis will be contained in no more than 3 folders with a maximum of 2,000 characters each (including spaces), and using UNI / A3 formatted, horizontally-oriented pages. The following accompanying studies should be produced:

- Study of anthropic and natural semiology on which to build the proposed direction of the project (the analysis-project process must be well demonstrated);
- Study of the historical milestones and invariants on which to build the semiotics of the project (signs, historical elements, alignments of the landscape);
- Study of the aesthetic value of the landscape that the project intends to enhance and on which to build the visual and perceptive values of the project;
- Study of the ecological and agricultural ecosystems in use as reference for creating the agrivoltaic layout;
- Study of the colors and materials of the local productions for reference when proposing a photovoltaic structure;
- Qualitative valuation of the ecosystem services provided by the proposed landscape based on the CICES classification of the European Environment Agency.

Economic evaluation: An estimate of the costs required for the proposed intervention(s). Formatted as a budget summary, broken down by types of operations to be carried out and references to market prices.

An average installation cost for agrivoltaics of 1,200 €/kW should be taken into account. The economic evaluations must be submitted as a table contained in no more than 3 folders on UNI A4 formatted pages.

(b) Graphic documents

The three tables must be shared as printable PDF documents and must not individually exceed 50 MB.

All graphic drawings must be submitted using **number 3 UNI A1 formatted tables** in 3 PDF files, as specified below and on the website, www.sustainablephotovoltaiclandscapes.com. In general, all the

tables should have a free composition for the layout that must contain all drawings, sketches, diagrams, photo-restitutions, and text describing the design idea. All images must be horizontal and numbered.

Tables 1 and 2: Describe the design choices and present infographics on how these are based on the landscape analyses documented. Share the plani-volumetric insertion, masterplan, photo-restitutions, drawing, sketches, and diagrams using the most appropriate scale – always indicating the metric scale used. One or more photos of the project insertion within the area is required, to evaluate the proposal in its context.

Table 3: A selection of more detailed drawings and any construction details. The table may contain sketches, diagrams, and what's needed to fully convey the design choices.

Both the textual and graphic documents must contain a header with a motto for the project proposal and the name of the designated group Lead.

(c) Administrative documents

(d) Declaration relating to the constitution and composition of the group and the absence of grounds for exclusion. See Article 10, section a) of this document.

(e) Copy of identification credentials and documents

ART. 14 SUBMISSION DEADLINE & MODALITY

Group leaders will receive an email confirmation with a User ID and password after they have correctly registered to participate in this competition at www.sustainablephotovoltaiclandscapes.com. These log-in credentials will be used by the group to access the competition materials and to submit their proposal.

Opening date for submission 23 March 2022.

Entries made in any other form will not be considered.

There are no registration fees.

Competitors are advised to constantly consult the competition website for any updates, modifications, or notices regarding the proposal submission procedure.

All required projects and administrative documents must be submitted via the competition website no later than 12.00 GMT+1 on 20 June 2022.

The competition platform server is synchronized with an NTP (Network Time Protocol) server and will not accept late submissions.

Group Leads will receive an automatic receipt of completion (including documents transmitted) after correct submission via the platform.

The aforementioned Organisers decline any and all responsibility for failure to access the submission system and / or for failure to correctly transmit any and all documents within the deadline for any reason, including technical failures that may occur to the competitors, including those beyond their control – be it due to human error, natural disaster, electronic failings or any other set of circumstances.

ART.15 EVALUATION & SELECTION

(a) Preliminary checks

After the submission deadline, Secretariate members will:

- Verify compliance with the deadline and submission protocols and draft a list of proposals received;
- Verify the received documents with regard to:
 - Completeness on the basis of the provisions in Article 14;
 - Compliance with the requirements for individual participants and the composition of groups in accordance with the provisions in Article 6.

(b) The Jury Panel

The Jury Panel, appointed by the Organisers, will be composed of the following members:

- Fabrizio Cembalo Sambiasi, AIAPP, IT
- Matteo Marini, NeoruraleHub, IT
- Annalisa Metta, IN/Arch, IT
- Elizabeth Monoian e Robert Ferry, LAGI Land Art Generator Initiative, US
- Heinz Ossenbrink, former Joint Research Centre of European Commission, DE
- Alessandra Scognamiglio, ENEA, IT
- Sven Stremke, Wageningen University|Amsterdam Academy of Architecture, NL
- Christian Thiel, European Commission JRC, IT
- Legambiente, IT

Project proposals will be evaluated based on their compliance with the requirements outlined throughout this document.

The Jury will select projects based of the following criteria:

- Quality of the landscape analysis and consistency with the design choices;
- Originality, innovation and overall quality of the project proposal with particular reference to the landscape qualities offered by the intervention;

- Maximization of the ecosystem services including the generation of renewable energy;
- Consistency of the project proposal with the overall aim of this project; and
- Clarity as to what the proposed vision is, including clarity in the text and graphic documents.

Submissions will be evaluated successive sieves focusing on the aforementioned criteria. Members of the Jury Panel will work remotely, via the competition website and assign a score, permitting a final qualitative ranking.

The top 10 proposals, those receiving highest score, will be discussed by the Selection Commission during a (virtual or physical) meeting to select the winning project proposals of this competition.

Note for the record of the evaluation process and this meeting will be drawn up and signed by all members of the Jury Panel.

ART. 16 WINNING PROJECTS

One proposal will be selected as the winner of this competition.

The Commissioning Party will award the winning group the professional opportunity to further design the agrivoltaic gardens.

A second-place proposal will be awarded an all-inclusive prize of 5000 Euro (five thousand Euro).

A third-place proposal will be awarded an all-inclusive expense reimbursement of 3000 Euro (three thousand Euro).

ART. 17 PUBLICATION AND EXHIBITION OF PROJECT PROPOSALS

The award ceremony will take in Milan during the Photovoltaics | Forms | Landscapes 2022 event, scheduled for 27 September 2022 at the occasion of the 8th World Conference on Photovoltaic Energy Conversion.

The Commissioning Party has the right to share submitted proposals with the public, provided that proper citing is given, highlighting the names of the authors and collaborators. Extracts of select proposals can and may be shared via a competition catalog or in other publications, without any compensation of any form for the competitors. At the same time, competitors hold the right to publish their works without limitations, in any case, *after* the conclusion of the competition and announcement of the winners.

In particular, the Commissioning Party, as per the competition calendar will:

- publish received proposals on the competition website;

- set up an exhibition showcasing received project proposals, with eventual publication in a catalog.

ART. 18 COPYRIGHT

All materials submitted by participants during this competition will remain the intellectual property of the authors, who, when submitting their works, authorize it to be used, disseminated, and published.

Art. 19: PROCESSING OF PERSONAL DATA

Data collected will be processed using IT tools pursuant to Legislative Decree 30 June 2003, n. 196 and subsequent amendments and of the Regulation (EC) 27 April 2016, n. 2016/679 / EU, exclusively in contexts and procedures to which these specifications refer.

Pursuant to Article 71 of the Presidential Decree n. 445/2000, the Commissioning Party have the right to carry out suitable random checks, in any case, and in all cases, where doubts arise about the truthfulness of the self-declarations made for the purpose of participating in the competition.