

PhD in Architecture. History and Project

Research Title: Energy Morphologies Energy production plants vs urbanscapes

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Contact	Milestones and Deliverables of the first step of the research project are available on request. Research title: <i>Holistic approach for PV plants design and operation</i> . Team members: Mauro Berta (DAD), Alessandro Casasso (DIATI), Luca Davico (DIST), Enrico Fabrizio (DENERG), Antonia Spanò (DAD), Filippo Spertino (DENERG), Paolo Tamborrini (DAD), Tiziana Tosco (DIATI), Elena Vigliocco (scientific director, DAD), Giulio Zotteri (DIST).
Context of the research activity	<p>In relation to the research fields of the PhD course, the proposed investigation belongs to the category identified as “project research and transformation processes of built landscapes” (http://dottorato.polito.it/asp/it/tematiche_di_ricerca).</p> <p>In 2000, the European Landscape Convention states that landscape «means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors». 15 years later, the 17 goals of the 2030 Agenda for Sustainable Development (2015), taking into account the three dimensions of the development --- economic, social and ecological ---, bring together two topics that until that moment were separated: sustainable development and fight against poverty. This activates an overturning of the meanings of transformative actions applied to landscapes: from this moment on, acting on a territory means planning jointly the artefact and the relationships that work on it, interpreting the project of any artefact as project of an integrated system. In this frame, in 2019 the European Green Deal asserts that Europe will become the first continent with zero emission. The document reaffirms the strategy defined by the European document COM (2018) 7732 that proposes the highest diffusion of renewable energies and the application of electricity to support a progressive decarbonisation. For this reason in</p>

all EU the construction of new plants for the production of electricity is increasing and is currently redefining large urban areas. As example in Italy, PV energy has increased from 483 MW installed in 2008 to 20,865 MW in 2019 (source: GSE, *Il solare fotovoltaico in Italia*, 2020). If we consider that 42% of PV fields are installed on ground, it is easy to understand how these produce a non-negligible impact on the landscape that the European Convention aims to protect.

In 2020, Enel Green Power appointed Politecnico di Torino to identify new operative tools for the design of large PV plants. Dealing with PV plants that have an extension of about 100 hectares, it is crucial to put in discussion the relationship that they can establish with landscapes and urban settlements. About the installation of these infrastructures, irreconcilable instances tend to prevail more and more often: on the one hand, those that assume the landscape as an absolute and non-negotiable value that has only to be preserved; on the other, those that consider the economic development as the only goal to be pursued. Assuming that any landscape is the product of an intentional and conscious uninterrupted process, the research aims at providing interpretative and innovative tools for designing and planning new energy urban morphologies that, at different scales, can be an opportunity for the redevelopment or the (re)design of territorial complex systems.

As in the nineties, DIPRADI -- Dipartimento di Progettazione Architettonica e Disegno Industriale -- promoted **INFRA. Forme insediative e infrastrutture** (research that investigated the relationship between urban settlements and infrastructural systems), nowadays the challenge is to investigate how the project of these new productive energy plants can produce a positive new urban layout.

Currently this topic is absorbing the attention of many research centres such as ETH Zurich that has developed the research project ENERGYSCAPES (2019). The focus of this research project is on how renewable energy infrastructures can be integrated into the Swiss landscape in such a way that they can be accepted by the population. See: https://energyscape.ethz.ch/downloads/ENERGYSCAPE_Brosch%C3%BCre_Empfehlungen_191213_FIN_WEB.pdf; https://energyscape.ethz.ch/index_EN.html

Objectives

Historically, thanks to his creativity, man has always “take” from nature the energy he needed: the heat to warm up and cook from firewood, the mechanical force to move his machines from water and wind. After the increase in energy needs and the transition to fossil and nuclear energy, the ecological balance of the planet has been put into crisis. Current efforts are all focused on accelerating the transition to renewable energy. The problem is that PV and wind power plants must be increased by 50% in order to replace fossil and nuclear power. For this reason, a new paradigm is needed.

Motivation for the project

A. Lack of knowledge: energy urbanscapes are not sufficiently investigated because of their “recent” identification.

B. Lack of awareness: confusion in the description of energy urbanscapes.

	<p>C. Pressure: energy renewable large plants will transform radically our landscapes and urban areas.</p> <p>D. Strengthen the quality of the projects: reduce the conflict between preservation/transformation of the urbanscape.</p> <p>Objectives</p> <p>1) Critical and operative register of the state of the art on morphological studies of urban areas and landscape (comparative research study).</p> <p>2) Identification and description of energy urbanscapes from a morphological point of view. Construction of an atlas of energy urban settlements and landscapes.</p> <p>3) Set up of tools for the project of new energy urban settlements and landscapes (verification through meta---project simulations).</p> <p>Work program</p> <p>Indicatively, the research project is organized in 3 main Work Package.</p> <p>WP1 – Anatomy of the architectural components of renewable energy plants. <i>Deliverable 1: Energy components abacus and energy plants layouts.</i></p> <p>State of the art on energy plants. Analysis of large plants and their components from an historical perspective (from hydroelectric power plants and dams of the beginning of the last century to recent PV plants). Focus on hydroelectric plants, PV plants and wind power.</p> <p>WP2 – Anatomy of places: identification of recurrences and taxonomy identification. <i>Deliverable 2: Energy urban---landscapes atlas.</i></p> <p>State of the art on morphological studies of urban areas and landscape. Set up of an interpretative grid of the morphologies of the peripheral and urban landscapes in which the plants are located. Divided by category of productive plant, the sites are analysed and classified. Specific case studies will be studied for each category. Focus on how the plant has transformed the existing system (historical perspective).</p> <p>WP3 – Interpretative tools set up: in relation to the examined case studies and the emerged criticalities and potentialities, identification of innovative tools for designing new energy urban morphologies that, at different scales, can be an opportunity for the redevelopment or the (re)design of territorial complex systems. Meta---project simulations. <i>Deliverable 3: Project tools identification.</i></p>
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<p>Skills and competencies for the development of the activity</p>	<p>Knowledge of international and national policies on environmental sustainability, landscape and cultural heritage protection.</p> <p>Knowledge of tools for data georeferencing.</p> <p>Knowledge in the field of renewable energy and their territorial impact.</p> <p>Ability to make the disciplines of architectural project interact positively with environmental and energy engineering as well as sociology.</p>
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