RENEWABLE BORDERS

Carlos Gonzalvo and Julia Capomaggi (eds.)

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DAAD
Bundesministerium für Bildung und Forschung
Universitat de Girona
across

Foreword Across

Ariane Korn
Project Coordinator Across (DAAD)

200 million citizens —30% of the Europe's population— live, work, and study in border regions. Their existence is enriched by linguistic and cultural diversity, by labour market and educational opportunities. Thousands of companies benefit from their location in the border regions serving nearby export markets. However, citizens and companies experience cross-border challenges and setbacks due to their peripheral position in geographic and political terms. Nine universities in 4 cross-border regions have therefore set up *Across – The European University for Cross-Border Knowledge Sharing*. The Across partner universities pool and share their knowledge and experience to improve the learning experience and business opportunities for students, learners, regional stakeholders and citizens of the cross-border regions. This will be achieved through jointly organized and designed high quality education and training, collaborative research and joint outreach and communication activities.

The International Summer Schools are a matter close to the heart of Across. They represent central concerns of our university alliance. Firstly, they strengthen the international exchange between teachers and students beyond the borders of physical space. Second, they test new formats for knowledge transfer. And third, the Across Summer Schools reflect innovative findings from the four Across Focus Areas such as Management of Natural resources in Cross-Border Regions. Across has been supporting the Seasonal Schools since summer 2021 by awarding scholarships to students from Across partner countries and by providing logistical preparation, implementation and follow-up for the events. This activity is only possible thanks to the support of the German Academic Exchange Service (DAAD), Federal Ministry of Education and Research (BMBF) and the generous support of Chemnitz University of Technology.

As Across, we experiment, learn and grow together with our partners and look forward to future cooperation and constructive exchange. We would like to take this opportunity to thank Dr. Carlos Gonzalvo and Dr. Julia Capomaggi from the University of Girona for their excellent cooperation in the realization of the Across International Summer School on *Renewable Borders* whose discussions, results and further information on the integration of renewable energy systems into our landscape and architecture can now be shared now with a wider community, thanks to this insightful and beautiful publication.

8 *The Solar Power Series*, Tom Hegen (2021)

9 *Atacama. Changing Perspectives*, Jamey Stillings (2022)

Beyond borders

Carlos Gonzalvo and Julia Capomaggi
University of Girona

Electric consumption worldwide is projected to sharply increase in the coming decades, driven by population growth and the electrification of more and more human activities, like transportation, communication, industry, and housing. Electricity is thus becoming central to modern society. Most optimistic forecasts suggest that, by 2050, production will be primarily based on renewable energy sources, with the aim of achieving zero greenhouse gas emissions and reducing dependence on fossil fuels. The construction of the necessary infrastructure for this energy transition, such as solar and wind farms, is shaping significant economic, political, and social transformations, while also deeply influencing landscape quality and territorial configuration. Natural resources like the sun or wind do not recognize political borders, historical boundaries of regions or countries. On the contrary, they introduce a new dimension of a continuous, anonymous geography that blurs the conventional concept of borders.

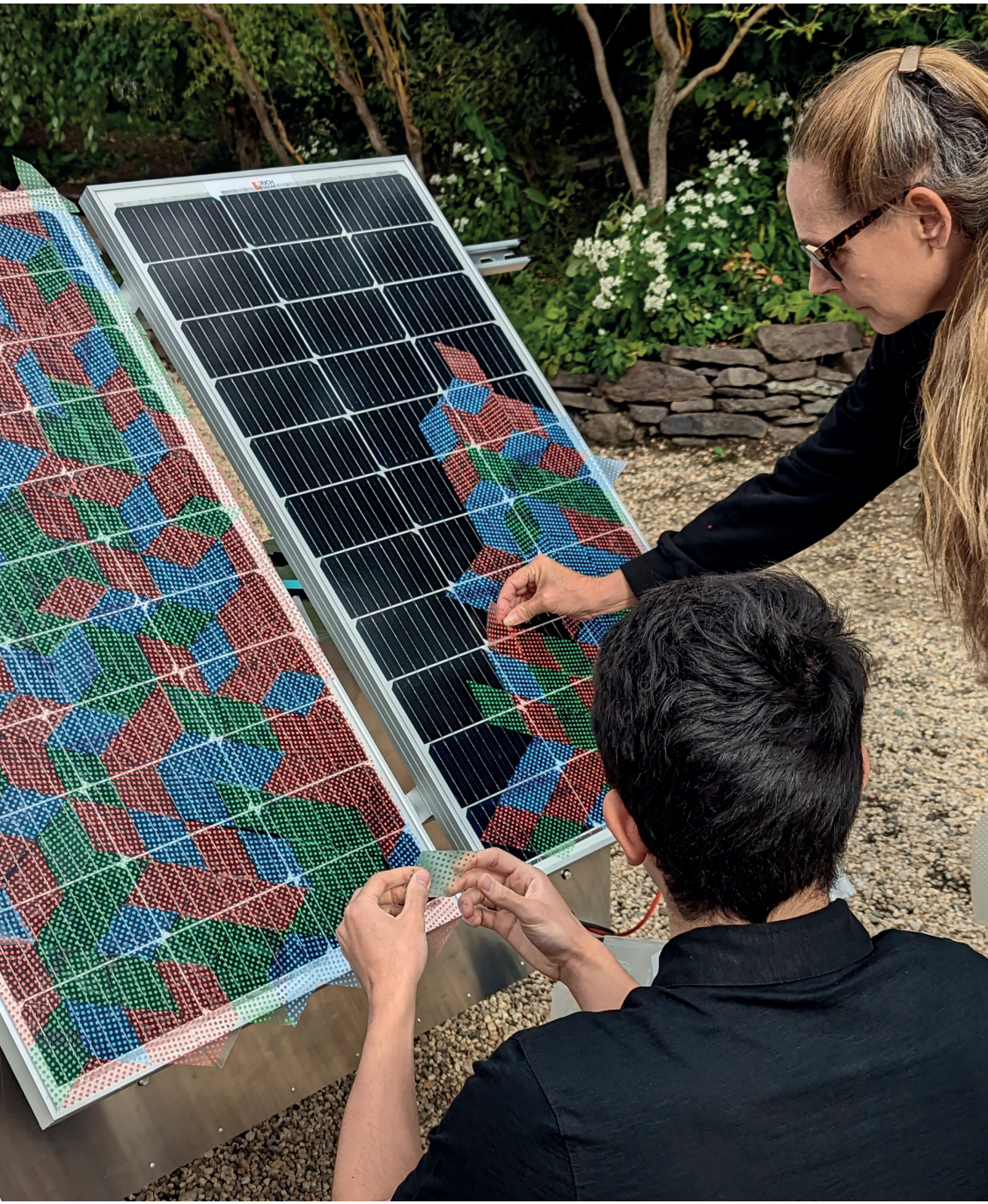
One of the aspects generally emphasised with the installation of solar and wind farms concerns their visual impact, and are emblematic of problems associated with the construction of extensive power plants in natural landscapes. Their construction consumes hundreds of hectares of land and significantly alters the skyline. However, these concerns seem to overshadow a more significant issue: the homogenization of territories as they repeat a single solution across the globe, even when the conditions of the sites are completely different. The technical design is an oversimplification of the problem, resulting in a single technology that is designed and implemented to varied scenarios without adapting to local conditions. The system components of this infrastructure are few in number and completely disregard the previous configuration of the territory and the problems traditionally associated with architecture. The built infrastructure of these plants severs any connection with the landscape and memory, it is devoid of any sense of place that evolved in response to historical development and the particular local idiosyncrasies. Traditional constructions, regardless of their technological development, were based on local techniques and materials, evolving with accrued intergenerational experience, with mutual their territory, technology, and architecture were intrinsically.

The new renewable energy infrastructure also represents an unprecedented global imposition without the consensus of the local population, rapidly altering the territory's configuration in just a few years.

This imposition also causes a significant transformation of the traditional concept of borders, "lines" that separate tradition, language, or architectural resolution. In this sense, areas hosting these massive infrastructure often transition from productive tissues of the primary sector at the local level —mainly livestock and agriculture— to predominantly industrial ones that function on a global scale. However, these facilities rarely benefit the local population, as the energy produced is usually consumed hundreds of kilometres away. Furthermore, they operate autonomously, without labour, and are owned by large energy corporations, resulting in the distribution of profits among a few hands far away from the affected territories. These corporations are thus building a geography that is drastically different from what the first power plants of rudimentary technology could create.

The new renewable facilities disregard the historical, cultural, social, economic, political, and architectural values rooted in the territory, solely to harness wind and solar energy as inexhaustible natural resources in electricity generation. The global implementation of these plants evokes a sense of loss, as it destroys the previous state formed over centuries. However, their construction offers a valuable opportunity to begin imagining the present transformation of the territory by adopting a multidisciplinary approach. The problem posed by these facilities, as we will see, transcends mere technological development and the foreseeable increase in consumption of resources as the only possible paths to progress. The terms "renewable" and "borders" precisely invite to incorporate other dimensions and disciplines to address this issue in a renewed and cross-cutting manner, forming a complex network through the knowledge provided by politics, landscape, history, art, and architecture.

This publication, prepared on the occasion of the international workshop *Renewable Borders* —held in the German city of Chemnitz in October 2023— aims to offer different approaches to the problem of new renewable facilities and their relationship with border configurations. Can we still consider them as immutable lines destined to endure? How does energy production influence the evolution of these limits? What lexicon do we use to define it? In what ways can we represent them? Far from offering concrete answers, the six essays compiled in this publication pose new questions in an open and exploratory manner, uncovering a new field of inquiry that needs renewed thinking beyond the confines of borders.



12 *Collaborative Solar Mural*, Alex Nathanson (2023)

The dilemma presented by renewable energies has polarized the environmental community, fostering unexpected alliances between environmental preservationists and proponents of fossil fuels. Our existing social and political structures encourage conflict and polarization instead of cultivating solutions and consensus, leading to a state of paralysis. To chart a way forward, we must assess the advantages and drawbacks of available options and proactively make decisions. It's crucial to recognize that seeking a flawless option with no downsides is an elusive pursuit. As renowned dancer and choreographer Martha Graham once remarked, every moment of choice is both a sacrifice and an opportunity. As human beings, we can learn from the consequences of past actions and apply this knowledge to foresee the potential results of our future actions. In this critical moment of choice, shall we focus solely on the sacrifices or enthusiastically embrace the opportunities before us?

13 "The promise and challenge of renewable energy", Jamey Stillings (2014)

Frivolous energies

Alex Nathanson
Solar Power for Artists

The energy transition requires incorporating *play*, *friction*, and *communication* into design. These characteristics are often derided as frivolous or inefficient, but are crucial for addressing the climate crisis. The energy transition is a monumental, rapid, and complex undertaking, and the consequences of failing to adapt to the crisis are dire. It already impacts people all over the world, exacerbating existing racial, economic, geographic, and gender inequalities. This is a systemic crisis, brought about through unfettered growth by a few at the expense of many. Personal behavioural change is generally considered a waste of time at best and a potentially dangerous distraction from the real actors profiting off of it. So where does that leave us, as individuals and as designers?

Even through the lens of systemic crisis, it's clear that we can't accomplish these energy goals or adapt without understanding local challenges and the roles of individuals within complex systems. A report reflecting on Superstorm Sandy's impact —*Social Cohesion as a Climate Strategy*, 2022— found that while governmental responses could be slow, community organisations provided critical services in real-time. It concludes that community resiliency must be supported through capacity building measures like resiliency training and building community owned infrastructure. Energy justice requires the costs and benefits of the energy transition to be equitably distributed. It also suggests that everyone has the opportunity to participate in decision making processes. This is not only a social justice issue, but it is crucial to the success of the transition which will not succeed when large swathes of the population are ignored.

Design theorists and community organisers have argued that adapting to a changing climate will make designers out of us all. Even without considering the impacts of the climate crisis, economic and racial disparities in infrastructure are pervasive. To address these shortcomings, individuals and communities have always improvised, remixed, and hacked. The need for community capacity building and energy justice requires that both renewable technologies and the knowledge for caring for them are located within communities. This necessitates reevaluating concepts often dismissed as impractical and immeasurable. It requires designing for *play*, *friction*, and *communication*.

Play fosters numerous skills that are necessary for resiliency and adaptation. It encourages creative problem solving, imagining, and

collaboration. It enables learning and making. It creates the opportunity for imbuing energy transition technologies with meaning and cultural relevance. *Play* is also about joy, and through *play* opportunities for optimism can emerge. To be designed for *play* is to allow for reinterpretation and remixing. It facilitates experimentation with relative safety. By playing, technology's affordances become clear. *Play* creates space for collaborations and affinities that might not have otherwise existed. The process of remixing presents the opportunity to redefine expertise and expand the idea of a designer.

Friction is shunned in most design fields. Frictionless design beckons us to move fast and consume. A speedy transition leaves people and communities behind. The right kind of *friction*, found through codesign and user-centred practices, can increase access. The extra effort that *friction* requires can also improve usability and enable healthier interactions between people and the built environment. It is imperative that we design for and learn to live with *friction*. Planetary limits are the greatest sources of *friction* and, as architect Daniel Barber points out, we'll crash into them whether or not we design for it. Designing for the right kind of *friction* forces us to design for intentional use and appropriate levels of consumption, while also negotiating complexity.

Infrastructure is a *communication* interface. It can tell us something about the people who design, build and use infrastructure. *Communication* can erase or elevate. Communicative infrastructure is generous. It opens up the black box and makes its inner workings more knowable and reusable. Communicative infrastructure adapts to the changing climate and the adaptations being made. The language of the climate crisis is not universal. As energy justice advocate Shalanda Baker has described, energy is a cultural term that means different things to different people. This ambiguity plays out in arguments over siting energy resources and extracting the minerals that become those technologies. Infrastructure, like solar panels, is often viewed as deterministic and devoid of meaning. Making these technologies communicative requires understanding their affordances to reveal their nuances. Communicative infrastructure does not appear, but emerges from within a community as a reflection of its values.

In a world with borders and the imperative for making systems more equitable, *play* is no longer frivolous, *friction* is no longer a waste, and *communication* is no longer voluntary. These are necessary ideas to help make a messy and imperfect transition more likely to succeed.

16 Open pit mining in Germany (2013)

When examining the world, I observe emerging geographies. Currently, the predominant geographies are those of self-extraction, powerful in their geographical influence. There's a practical functionality to all of this. These geographies cut across traditional divides —north-south, east-west— and disregard borders. In this geography, citizenship is not a prerequisite; firms can move freely. Here lies a distinction from historical imperialisms. In the old imperialisms, there was a concerted effort to assimilate cultures and languages, such as the French civilising mission in Africa. Today, that's totally out. In contrast, contemporary imperialism has shifted to a global extractive mode. Once the extraction is complete, there is little interest in the local population or their transformation. The companies in the present buy land, extract resources, and then depart with no further concern for the area. This exemplifies the extreme extractive capacity of the global world, a departure from older models.

17 "New Geographies of Extraction", Saskia Sassen (2018)

Critical borders

Jakob Kullik
Chemnitz University of Technology

The configuration of the territory through its borders is conditioned by the emergence of increasingly aggressive forms of extraction and production that alter not only the natural environment but also the economic, social, and political model of countries. For far too long, this problem has remained below the radar of political decision-makers and has been left unaddressed. In the context of the climate crisis, critical minerals play a crucial role in the energy transition towards a more sustainable model. Among these minerals, lithium, cobalt, platinum, and predominantly rare earth elements stand out, with the latter being essential for the development of less polluting technologies. As the world moves away from the 1970s oil crisis towards an economy less dependent on fossil fuels, a competition ensues in this new geography to secure the dependence on these minerals, led so far by Chinese state-owned enterprises. These enterprises are building a global network of dependency around them, encountering little resistance from other countries.

Beijing holds a dominant position in the global market for rare minerals, granting the ability to play as a potential means of exerting pressure. China's dominant position with regard to these strategic raw materials is not a passing geopolitical trend, but has been a structural market problem with technological and security-related implications for the industrialised countries of the West for some time. The geostrategic importance of these minerals is magnified in a scenario where economic security and technological autonomy are linked to social progress and the advancement associated with less polluting technologies. But why are these minerals so important?

In recent years, the United States, the European Union and Japan have classified them as strategic materials due to great economic significance and high supply risk associated with them. A disruption in the supply chain of these minerals would lead to price hikes and consequently reduce supply, potentially causing a global crisis. Another reason for their high value lies in their use for the development of military as well as energy systems. These minerals are fundamental for the development of the most advanced technologies in the energy transition, such as electric vehicles, batteries, wind turbines, photovoltaic panels, as well as interconnected applications of Industry 4.0. Without them, many devices simply would not work.

Most analyses of China's role in the rare earths market overlook the fact that not only does the People's Republic produce the majority of the raw materials, but Chinese companies now also dominate almost all downstream sectors of the value chain up to the final product. At the first stage, China currently controls about 80 percent of world production, which corresponds to 170,000 tons of rare-earth materials per year. Secondly, its technological companies also lead in the manufacture of components, equipment, and final products. At the same time, China is the largest consumer of rare earths for its own industry, replacing the United States as a leader in the energy and technology market, not only due to low production costs but also due to governmental support. This monopoly position, from extraction to product commercialization, creates a challenging situation for the economic, political, social, and energy security of Western nations.

The construction of contemporary geography requires a global assessment of the problem and the consensual search for solutions, in terms of natural resources, politics, economy, and geostrategy. To borrow a phrase from the Australian historian Christopher Clark who described the path to World War I, the Western nations seem to be "sleepwalking" into its next resource crisis. While these nations want energy transition, climate protection and a greater autonomy in security policy, political leaders still fail to grasp the full strategic significance of the rare earths. If the West seeks to reduce its dependence on the Chinese market, it must understand that the problem is not only linked to resource extraction but also conditioned by politics, economy, and the crossing of borders. In other words, the development of a common policy that transcends the traditional conception of borders as merely divisive lines.

These lines between Western countries should be understood as an opportunity for cooperation and joint development. Ideally, there would be long-term cooperation between industry and politics not only in Europe, but also at the transatlantic level. The US, the EU and Japan could intensify their ongoing dialogues on raw materials and extend them to include aspects of security and defence policy that result from their dependence on Chinese rare earths. The West, through the revision of its borders, must adopt a strategic approach to face this challenge of a globalised world. The time has come to face the challenge of raw materials and security policy and address the opportunity to focus on the contemporary border configuration.

20 *Washington State Wind Farm*, Nachelle Nocom (2019)

The constructions in the landscape were the castle, the monastery, and the church. In the past century, the silo, warehouse, nuclear power plant, and dam were added. These structures, though few in number, claimed the land but never encroached upon the sky. In contrast, wind turbines generate unprecedented visual pollution. It is no longer a matter of isolated units but rather fields of wind turbines showcasing their technological prowess across thousands of hectares, whether along the coastline, on hill crests, or in vast plains. These colossal turbines defy the horizon, block the sky, and assail the very concept of emptiness to forcefully inscribe the imperative union of technology and economy. Let us keep the sky clear from these wind turbines that, once they have wrought their harm, will become useless. We cannot rely on the triumphant economy to erase the traces of these offenses. They will leave behind these giant turbines in the landscape as witnesses to their obsolescence and lack of profitability.

21 "Eoliennes et paysage", Claude Parent (2007)

Renewable surfaces

Julia Capomaggi
University of Girona

James Corner begins his essay "Eidetic Operations and New Landscapes" by asserting that image and landscape are inseparable, making it impossible to define one without the other. In the same essay, he refers to the definition of the landscape, alluding to two meanings. Firstly, the English term "landskip," which refers to the image of the landscape and its construction in the collective imagination through a fragment, primarily visual, laden with meaning and iconicity. Second, the German term "lankdschaft", which incorporates the relationship between field and building, considering patterns of occupation, activity, and the form of space. The landscape evidences the formal, material, tactile, and ideological traces that have structured society over time.

If landscape is inseparable from image, what type of image is landscape? An image can be a graphic, a painting, a drawing, or a photograph, as well as a memory, a perception, or a description. All these forms contribute to define landscape.

22 *Changing Perspectives*, Jamey Stillings (2022)

The new landscapes formed by renewable energies, especially photovoltaic panels and wind turbines, reveal areas of the earth's surface with greater exposure to wind and sunlight, producing landscapes of energies that are both terrifying and hypnotic. They deal with the miniaturization of monumentality and the immensity of artifice. Terrifying due to the nakedness of productive technology and immense in their unlimited capacity for aggregation and growth, showing extreme indifference to the context in which they are implanted. These new landscapes force to reformulate the types of images with which we record them, to revise maps and the way of representing them, photography, and the capacity of technology to photograph everything, the way we describe and remember them.

In 1935, Le Corbusier published *Aircraft*, one of the earliest testimonies that promoted aerial observation as an opportunity to look at and understand cities and landscapes in a different way: "The eyes now see in substance what the mind could only subjectively conceive; the view from the air is a new function added to our senses; it is a new standard of measurement; a basis of a new sensation. Man will make use of it to conceive new aims." Since the last century, aerial photography, or landscape captured from the air, has proliferated owing to the development of technology linked to military engineering. Our view of the earth from above is related to the accessibility of flight, and presents an endless multiplication of satellite images, and the ability to travel the world from our mobile devices and personal drones. Aerial views make clear the human order imposed through rigid layout of infrastructure, transportation, and property. They allow for the mapping and control of both natural and artificial systems. Aerial views reflect not only human actions but also globally imposed policies of regional control and extraction. They condition how we see, understand, and act in our built environment, leading to the generation of a new landscape and a new reality.

Historically, maps have been representations based on experiences that selectively highlight or exaggerate certain features. The drawing of a map does not typically incorporate these ephemeral infrastructures, such as solar panels and wind turbines. These demonstrate an awareness of regional and global ecological policies, revealing a new scale of planning. As Baudrillard expressed in 1983, "simulation is no longer that of a territory, a referential being or substance. It is the generation by models of a real without origin or reality: a hyper-real. The territory no longer precedes the map, nor does it survive. Henceforth, it is the map that precedes the territory."

The new landscape presents itself as the juxtaposition of ordered patterns according to radial, linear, or reticular structures on flat or

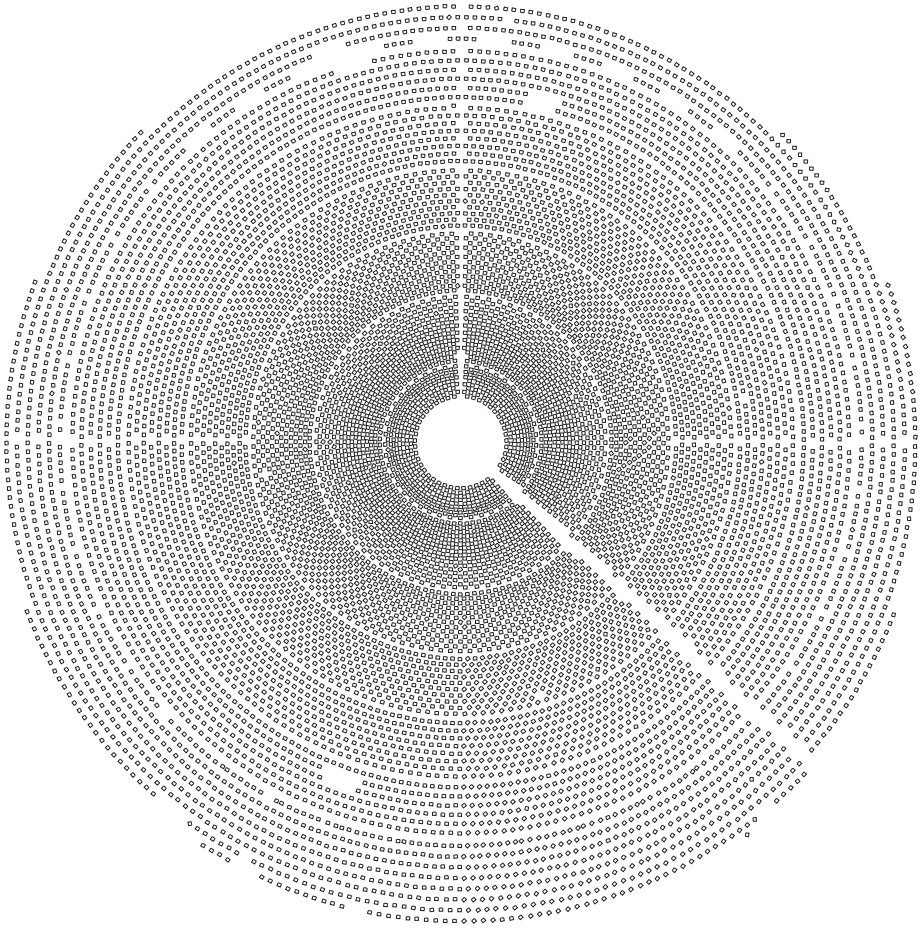
undulating terrain. These rigid human imposed patterns of infinite growth interact with cultivated fields, flooded areas, populated areas, or industrial polygons, or with large infrastructures that reorganize the territory of barely traveled roads. These juxtapositions allow to read all the incongruities of political, social, and ecological forms manifested on the earth's surface when viewed from above, where the borders between municipalities, regions, or countries begin to disappear.

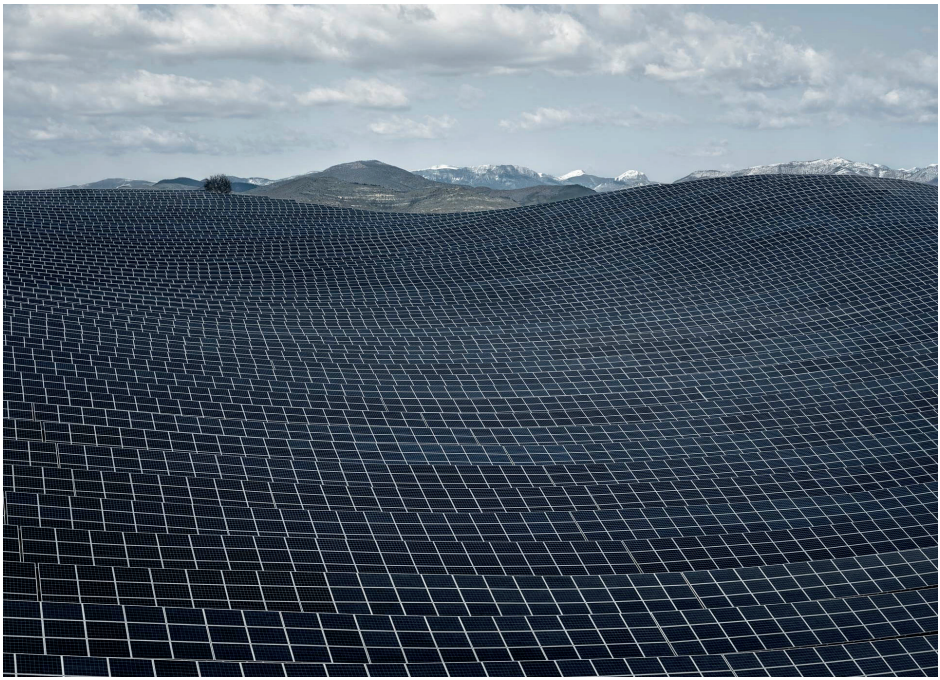
The new landscapes of renewable energies envelop the earth's surface with blankets of photovoltaic panels and wind turbines. Their patterns of military rigidity and iconic monumentality cover and erase traces and footprints of the natural landscape they impregnate. In this way, renewable energy facilities construct a new landscape that, on the one hand, eliminates the ability to understand and contextualize it through a fragment, and on the other hand, removes the sedimented layers that accumulate and interact in landscape construction. The old definitions of "landskip" and "lankdschaft" acquire a renewed dimension. These new surfaces cover natural and artificial landscapes; they are no longer rigid or static but interact with the environment, rotating and reflecting in accordance with the intensity of wind and sunlight. They are also not permanent.

In 1541, Jacopo Bonfadio defined the term *Teza Natura* —Third nature— as all physical environments that fall between existing categories, those that arise following their own growth laws without external manipulation, and those altered by humans for practical purposes. Bonfadio refers to the green undulating meadows of Lake Garda, describing them as "nature incorporated with art and made artifact is connatural with art and becomes a third nature to which I could not give a name." Teza natura is a landscape where human intervention combines art and nature, creating a balanced and holistic beauty. The landscape of renewables is a technified version of nature, fields of artifacts cultivated that interact with the sun and wind, constructing a landscape of beauty that, as Bonfadio specified, is difficult for us to name and categorize, but can be identified as an emerging fourth nature.

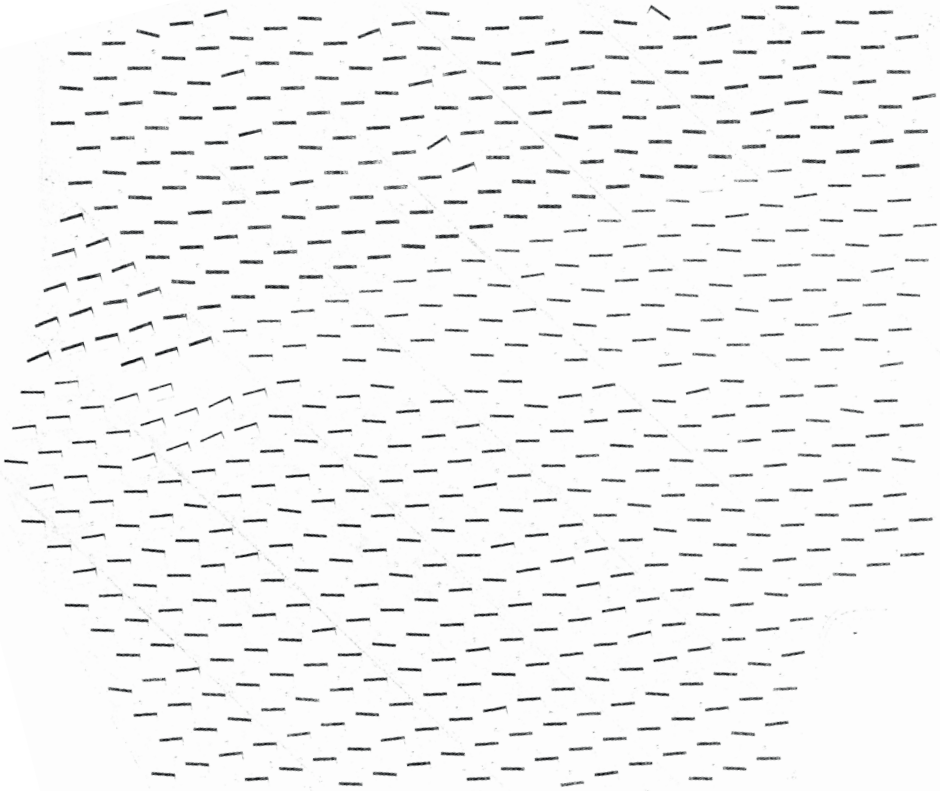
25 Karapınar/Konya, Türkiye

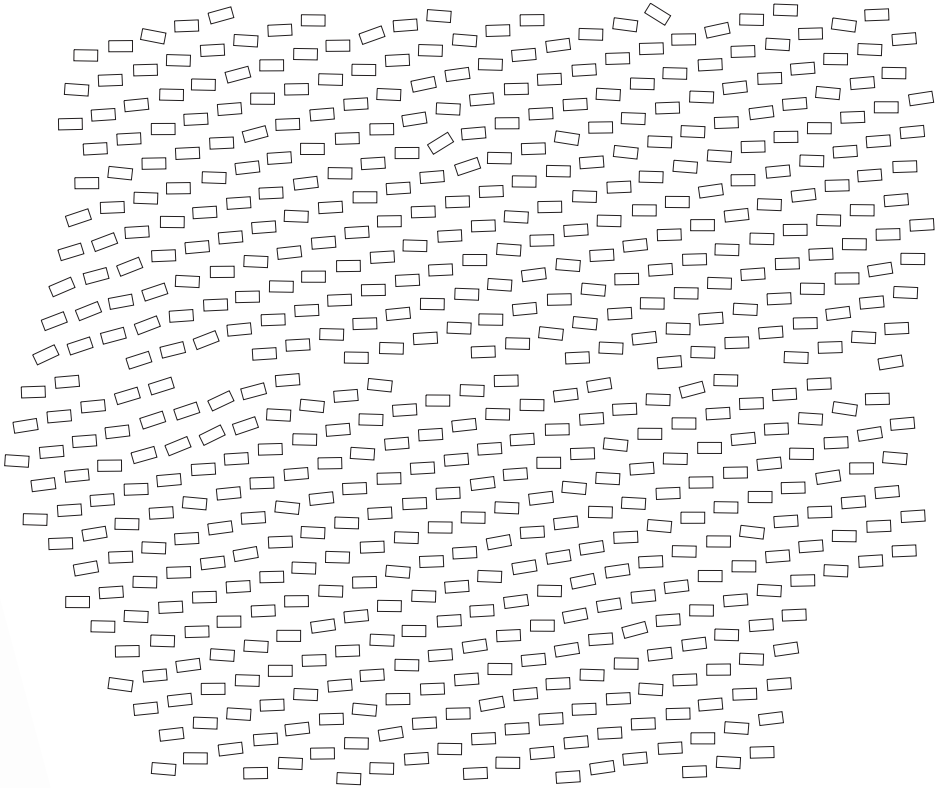
26 *Crescent Dunes Solar*, Jamey Stillings (2021-2023)

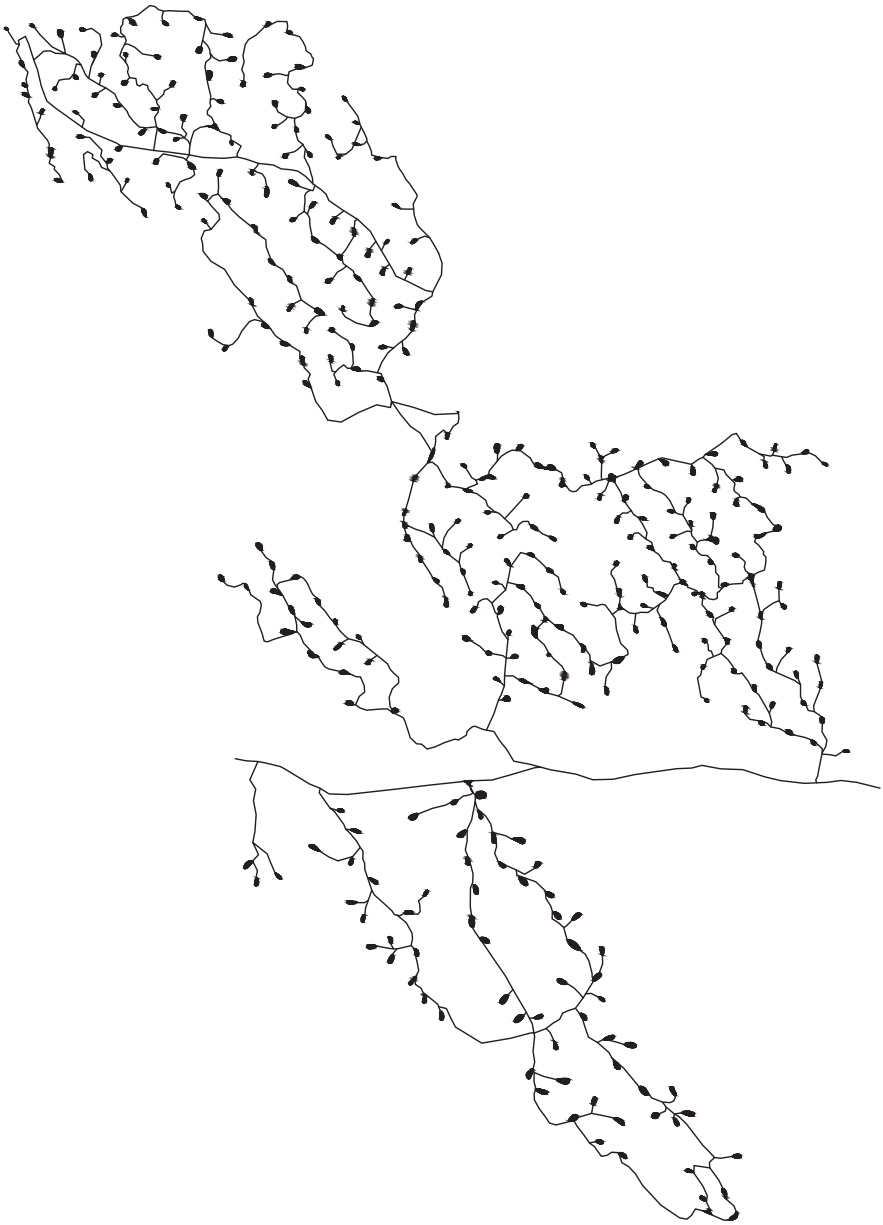




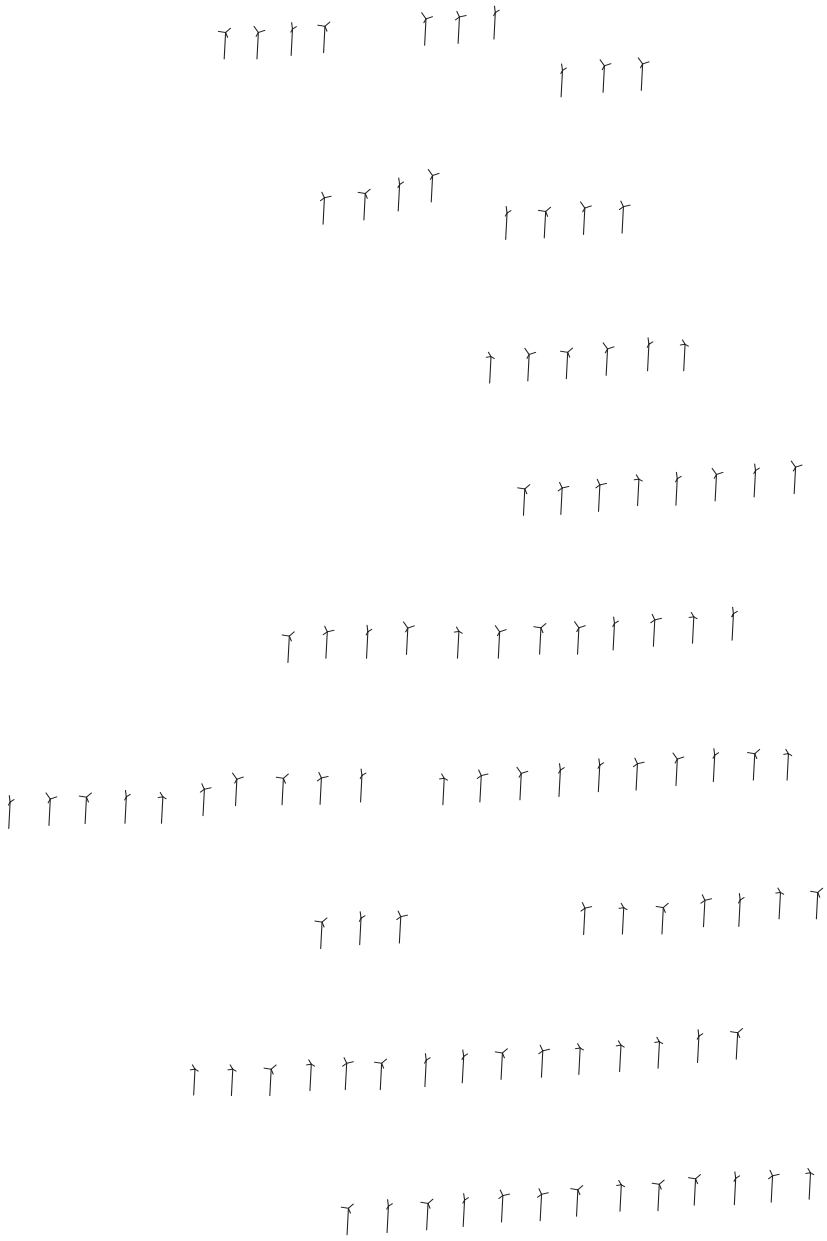
28 *The Solar Power Series*, Tom Hegen (2021)







34 *Changing Perspectives. Ocotillo Wind*, Jamey Stillings (2023)



38 *Pérgola Fotovoltaica*, Fernando Alda (2004)

Our perception of the world often follows a dichotomy akin to a division between the front and back of a house. The “front of house” encompasses all the visually pleasing aspects, meticulously maintained landscapes, picturesque facades, parks, and museums. Conversely, the “back of house” hosts the indispensable but often overlooked components of our existence: waste disposal, power plants, and other essential infrastructure. Despite its fundamental role, the back of house is frequently neglected, lacking the same level of care and presentability accorded to the front of house. It is imperative to adopt a holistic perspective that erases the distinction between front and back of house. Traditional planning, which involves segregating different elements, needs to evolve. Future solutions lie in fostering novel synergies and reimagining our infrastructure, wind parks and solar fields should be conceived with a front-of-house approach, envisioning them as integral components of the future we inhabit.

39 “How do we speed up climate action?”, Bjarke Ingels (2021)

Energy production in the cityscape

Dorota Gawryluk and Dorota Anna Krawczyk
Bialystok University of Technology

The use of technology exerts a significant influence on the urban environment; shaped both by popular knowledge and the limitations imposed by techniques, materials, and climate. Historically, these constraints led to technological advancement of infrastructure like aqueducts, mills, or water wheels, which allowed meeting the needs of their time. Though obsolete now, they reveal technology's capacity to generate a new landscape. The introduction of increasingly efficient energy production technologies contributes to transforming the cityscape, reaching a more sustainable stratum. Photovoltaic panels, due to their size, cost, and versatility, have become common elements in major cities, increasingly attached to buildings. While this technology improves energy performance, these installations homogenise the image of any city globally.

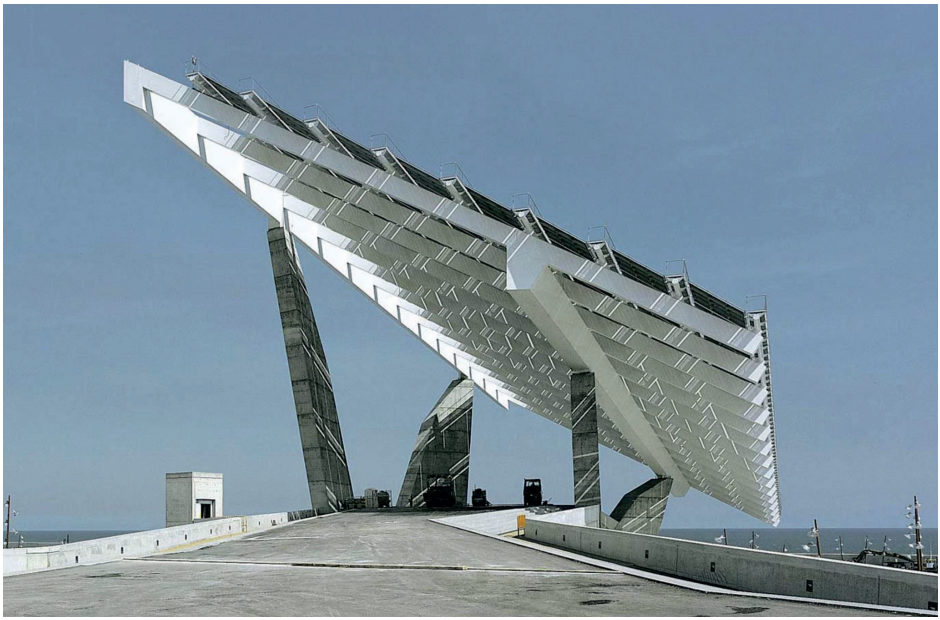
To prevent such a homogenisation, what solutions can engineering and architecture offer? The origin of photovoltaic technology is relatively recent, so there is still a long way to go to implement it efficiently in the urban setting. Currently, its incorporation in architecture remains insignificant. During the 1950s, this technology was excessively costly, limited to research areas. The oil crisis led to extensive research and a reduction in production costs. The first commercial installations emerged in the 1990s, mainly in Germany and Japan. The implementation of *Agenda 2030* is driving the widespread use of this technology to reduce polluting sources. However, its implementation is still conditioned by decisions solely of technical origin, such as the location and orientation of panels, which depend on mathematical calculations and conditions beyond architecture and the sense of place.

Urban solar facilities are often static and immovable, following a single purpose and a globally repeated model. Additionally, in some cases, the quality of architecture makes it difficult to place these panels efficiently. This problem, combined with the lack of sensitivity from those incorporating them, underscores the need to address conflicts with this type of facility. They have to be incorporated in order to combine efficiency, site characteristics, and architectural resolution. The proliferation of these panels urges professionals in engineering, landscape, and architecture to reflect together on the future of energy production in the city.

One of the first interventions aimed at combining the efforts of technical teams and architects, was erected for the Universal Forum of Cultures

held in Barcelona in 2004. Elías Torres and José Antonio Martínez Lapeña, in collaboration with the engineering company Esteyco, conceived the *Pérgola Fotovoltaica* as a grand sculpture facing the sea, capturing sunlight, generating electricity, and responding to the city's conditions and needs. This canopy spans multiple scales, from the monumental structure at the urban scale with recreational and festive activities underneath. Symbolically it offers a resolution of a traditional problem of Mediterranean cities.

The proposal places electric production at the centre while also incorporating popular culture and the character of urban life. It maximises solar capture with its southern orientation, a 35-degree inclined plane, and an area of about 4,000 m^2. At the same time, it functions as a precious shade structure used especially in summer, typical of Mediterranean cities. In this sense, the changes brought about by the construction of these facilities not only demonstrate the search for more sustainable energy solutions but also the ability of architecture, landscape, and engineering to incorporate energy production. New proposals in the urban environment should be conceived as more than just simple repetition of a model and pattern of solar panel. The presence of these urban structures would help redefine the everyday environment, integrating technological innovation with architectural expression and bringing energy production at the heart of urban life.



41 *Pérgola Fotovoltaica*, Fernando Alda (2004)

42 Traditional water wheel (2019)

The capitalist system which orients current efforts to shift energy regimes is based on a fundamental logic: grow or die. As long as energy production remains grounded in the logic of the capitalist market, it will continue to obey capitalism's fundamentally irrational drive to generate ceaselessly expanding profits through endless growth. Truly sustainable energy production will only be possible if power is taken out of the hands of these gargantuan profit-seeking corporations. In order to make this shift, we need to stop thinking of energy as a commodity and instead conceive of it as part of the global commons, a vital element in the great stock of air, water, plants, and collectively created cultural forms that have traditionally been regarded as the inheritance of humanity as a whole. But the commons also consist of intangible, non-finite collective resources such as knowledge, shared customs, means of communication, and even more ineffable things such as collective affects, all of which might be termed the social commons.

Heritage and power

Marco Acri
University of Nova Gorica

Cultural heritage forms a rich tapestry woven with the threads of traditions, traditional knowledge, and the unique territorial identities that fortify local communities. In an ever-evolving world that redefines the concept of border, the focus on heritage preservation, the advocacy for circular economy and landscape and environmental sustainability conservation assumes crucial significance in shaping the resilience of societies. This heritage comprises both tangible and intangible elements that delineate a territorial identity to which diverse communities can connect. The contemporary understanding of heritage or aesthetic community attests to the acknowledgment of novel community paradigms characterised by shared values, extending beyond mere historical legacies.

Tangible aspects, such as artefacts and monuments, serve as a physical bridge to the past, while intangible elements like language, rituals, and traditional knowledge embody the essence of a culture and drive the generation of tangible assets. Passed down through generations, traditions act as living expressions of cultural heritage. This embedded traditional knowledge encompasses the accumulated wisdom in areas such as agriculture, medicine, and craftsmanship. Furthermore, traditions are inspired and nourished by the *Genius Loci* —the spirit of the place—, a territorial force that provides specific resources and sparks ideas and solutions.

Borders, whether physical or conceptual, wield an influence on the preservation and transmission of cultural heritage. They can serve as both barriers or bridges, delineating territorial identities that are shaped by geographical and climatic constraints. They may also facilitate exchange and enrichment. Navigating these borders is a nuanced process that requires diversity without compromising the essence of individual cultures. In an increasingly interconnected world, the challenge lies in striking a balance that respects the autonomy of cultural identities while fostering mutual understanding. The acknowledgement of the significance of the past, as manifested in cultural heritage, and the increasing threats to its existence has underscored the importance of conservation as safeguard for future generations.

Landscapes, shaped by traditions and historical practices, serve as repositories of cultural narratives. These landscapes are dynamic, as they evolve continuosly through human interactions with the natural world.

Preserving cultural landscapes involves recognizing the intricate interplay between traditions, land-use practices, and environmental stewardship. The connection between cultural landscapes and preservation introduces new concepts of resilience. Resilience, in this context, refers to the ability of communities to adapt to change while preserving the integrity of their cultural landscapes. Traditional knowledge, by definition, reflects the efficiency of dealing with scarce resources and optimising their qualities for the benefit of both individuals and communities. Optimisation is energy saving. Traditional energy practices, deeply rooted and passed down through generations, have been a sustaining force for communities over time.

Understanding and integrating these practices into modern energy solutions can contribute to both environmental sustainability and cultural resilience. This entails not only devising ways to generate energy but also seeking methods to curtail consumption, akin to the approach embedded in traditional knowledge. Fortunately, today we have a new ally in the quest for energy efficiency and cultural heritage preservation: the widely embraced concept of circular economy. Focused on minimising aligns seamlessly with the principles of cultural heritage conservation. Its application involves sustainable tourism, the repurposing of existing built sites, innovative conservation techniques, and a strong commitment to adaptation. Furthermore, nature-based solutions are being applied to urban regeneration, reintegrating many traditional practices and combining innovation with preservation to enhance resilience.

This approach leverages cultural heritage as a positive force for local economies while also minimising environmental impact of energy production. Adopting this perspective, providing energy in a border context necessitates a comprehensive understanding of cultural and historical nuances. Traditions can guide compatible transformations of the landscape and offer insights into the resilience of a place, including considerations for the responsible production, use and "abuse" of energy. The intricate interplay between cultural heritage, traditions, traditional knowledge, borders, conservation, sustainability, preservation, circular economy, landscape, energy, and cultural landscapes is crucial for fostering resilience. The challenge lies in charting a course that respects the unique identities of communities, promotes environmental stewardship, and embraces a holistic approach to cultural resilience in the face of global challenges and a rapidly changing world.

Renewable lexicon

Compilation of essential terms defined by students during the workshop to refer to the landscape shaped by renewable energy facilities.

Sustainable development

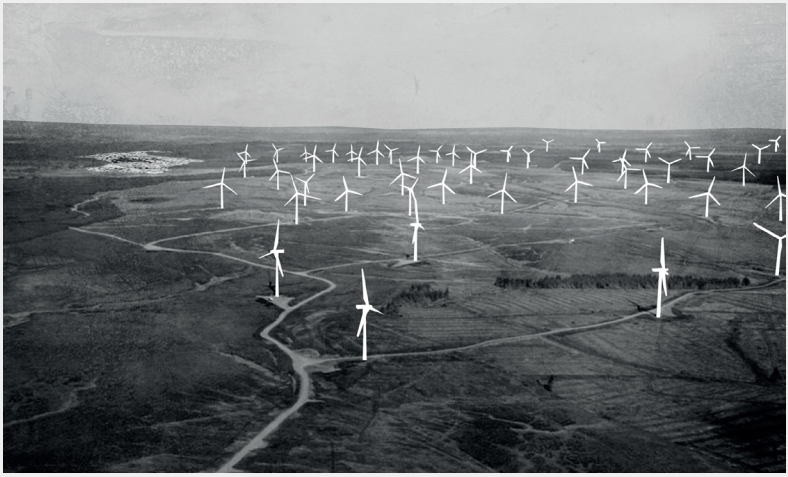
Innovation and progress drive the continual evolution of ideas, technologies, and practices, fostering the emergence of new solutions and the enhancement of existing systems. Development embodies a forward-moving force that guides societies through challenges and enables adaptation to changing environments. Sustainable development, as underscored in the report *Our Common Future* (1987), emphasises the balance between meeting present needs and preserving resources for future generations, advocating for a coexistence between human activities and the environment. When assessing renewable energies, it involves a comprehensive evaluation considering their environmental impact, waste management strategies, and negative effects on ecosystems, alongside their clean energy benefits.

Control and ownership

Control encompasses the legal rights and responsibilities, enabling possession, utilisation, and transfer of the propriety. In the context of renewable energy facilities, questions emerge not only about the control of the footprint they occupy but also the impact on the surrounding landscapes. These facilities wield significant influence over various aspects of their environment, including politics, aesthetics, and local activities. International corporations often evade responsibility for environmental and community impacts. This raises ethical concerns regarding their ability to dictate land or sea usage for such developments. Discussions on control and ownership should prompt reflection on the balance between profit-driven decisions and their broader consequences on ecosystems and communities.

Bigness and footprint

Renewable energy facilities require vast expanses of land, far surpassing the footprint of conventional power plants by 200 to 300 times. Meeting all of Europe's energy needs with renewables would necessitate allocating 3.50% of the continent's land, equivalent to the size of Germany. Beyond generating noise emissions, dynamic motion, and shading effects, the presence of renewable facilities often conflicts with historical land uses. This quandary prompts consideration of the wisdom in sacrificing the biodiversity and ecological services



of fields, forests, and mountains for energy outputs ranging from 2 to 4 MWh/hectare. Solving the land use challenge requires us to consider if renewable facilities and technology can adapt to prioritise sustainability while maintaining the integrity of the natural environment and accommodating other land uses.

Acceptance and engagement

The imposition of renewable energy facilities often triggers challenges among neighbouring residents, emerging environmental, political, economical and social issues. These projects often fail to deliver concrete benefits to the locals, exacerbating community dissatisfaction. To foster acceptance and engagement, models such as the Copenhagen Middelgrunden wind farm (2001), characterised by local ownership, warrant further exploration. Achieving this kind of solution demands a holistic approach that ensures not only technical and technological issues but also contributes to the economic prosperity and welfare of affected communities. Balancing sustainable engineering practices with regard to local concerns becomes paramount in navigating the complexities surrounding the renewable energy facilities development.

Living and non-living

Natural environments form interactions between living and

non-living elements shaping ecosystems, that comprises flora and fauna. Their composition, growth and resilience is based on the capacity to absorb disturbances while preserving functionality, structure, and characteristics. The installation of renewable energy facilities can upset this delicate balance created over centuries, causing disruptions ranging from integration challenges to its outright destruction. In vulnerable natural ecosystems like oceans and forests, ethical questions arise regarding the compromise of stability for energy infrastructure. Is it justified to prioritise short-term energy needs over the preservation of ecosystems? Are the benefits of energy production outweighing the essential services provided by these settings, such as oxygen generation and carbon dioxide absorption?

Tangible and intangible

The cultural heritage encompasses both tangible and intangible assets, reflecting the collective identity, knowledge, and values of communities across generations. Rooted in the unique spirit of the place —*Genius Loci*— tangible and intangible heritage venerates the historical evolution and distinctiveness of the sites. The large-scale facilities of energy production carries the risk of disrupting these ties with the only pursuit of increasing consumption

and resources as the sole path to progress. Considerations when defining these projects must extend beyond mere practicality, economy and functionality. Traditional architecture and local techniques enrich this heritage by imbuing settings with a sense of belonging and connection to the site.

Mixed use

Each site has its own functions and works independently, dedicated to a purpose, be it agriculture, livestock, industry, or energy production. These human activities involve varying maintenance requirements, and impacts on the landscape. Nevertheless, there is an opportunity for renewable energy facilities designs to incorporate multiple uses, minimising divergence and reducing footprint. For example, photovoltaic panels could serve dual purposes as coverings for fruit tree orchards, vineyards, or crop fields, while windmills could be integrated with forest patterns or livestock. Exploring the potential for such combined facilities could expand the land use and alleviate the overly specialised and compartmentalised nature of current practices.

Non-extractive energy

Carbon dioxide emissions primarily stem from the combustion of fossil fuels, industrial activities, agricultural practices, deforestation, waste disposal, and transportation. Renewable energy farms provide a solution by generating electricity without emitting greenhouse gases. While these facilities strive for carbon neutrality or even carbon negativity throughout their operational lifespan, their carbon footprint is not entirely eliminated. Factors such as mineral extraction, transportation methods, and energy use in manufacturing contribute to their carbon footprint. While no energy source is entirely emission-free, technological advancements can aid in minimising environmental impact and transitioning toward a more sustainable energy future.

Large scale and lifespan

The technological obsolescence and the disposal of large-scale facilities in the near future is a growing concern. While solar panels and windmills typically have a lifespan of about 25 years, certain components may require replacement in a short period of time, such as electronic components lasting between 5 to 10 years, and materials like polymers needing replacement every 10 to 20 years due to corrosion and erosion. Moreover, materials from these facilities are often not recycled, failing to contribute to a circular economy. For instance, polymers contribute to microplastic pollution, releasing particles into the air during their lifespan and ending up in landfills contaminating the

soil once discarded. Additionally, microchips and electronic components are frequently exported to Africa for burial in waste sites. Renewable energy generation may be perceived as environmentally friendly, however the disposal practices associated with them raise significant questions about their true environmental impact.

Renewable waste

The International Renewable Energy Agency forecasts an increase in waste from wind turbine blades and photovoltaic panels, estimating 43 million tonnes and 78 million tonnes respectively by 2050. Wind turbines comprise various materials including steel, iron, fibreglass, copper, and aluminium, alongside rare earth minerals, all assembled on a concrete foundation. Recycling these materials poses challenges, often resulting in landfill or incineration. Similarly, photovoltaic panels contain hazardous chemicals like lead and cadmium, making safe removal difficult without dismantling the entire panel. Limited disposal options exist due to the risk of contaminating land and groundwater. Given these concerns, is it sustainable to continue generating such vast amounts of waste? Shouldn't our goal be a renewable energy infrastructure designed for a fully circular economy, minimising waste and maximising resource efficiency?

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Dr. Marco Acri is graduated in History and Conservation of Architectural and Environmental Heritage at the IUAV University of Venice, specialising in Urban Management at the Erasmus University of Rotterdam and in Management of Cultural Heritage at the University of Nova Gorica. He is currently employed as senior lecturer and directing the international relations of the Master and Doctorate programme in "Cultural Heritage Studies", presently running 5 EU funded projects in different programmes. His academic experience has also matured thanks to professional experience at Unesco CLT, World Monuments Fund, IMED, Federculture, Marco Polo System GEIE, International Academy of Environmental Sciences, especially within collaborative international projects on the conservation and management of cultural and environmental heritage.

Dr. Julia Capomaggi (ed.) is a professor and Serra Húnter researcher at the University of Girona. Prior to joining UdG, she was an Associate Professor at ETSAV, Elisava, Associate Professor (tenure-track) at the University of Illinois at Chicago, conducted workshops at the Rural Studio (Auburn University), was a visiting professor at the Boston Architectural College, and an assistant professor at the National University of Rosario. She holds a PhD in Architecture and a Master's degree in Architecture. She is a founding partner of the architecture firm JL Office with Lluís Ortega. Her work has been recognized with awards and distinctions, including the First Prize in Europan 9, AIA, MCHAP, AJAC, and FADEA, and has been published in magazines such as *Interiors*, *Flat out*, *Plot*, *Passatges d'Arquitectura*, *Journal of Interior Design* and *Arquitectura Viva*. Her work has been exhibited in Venice, Barcelona, Rosario, and Chicago. She is a member of the research group "Architecture and Territory" at UdG and a regular collaborator of the PROTO research group at UPC.

Dr. Dorota Gawryluk is an architect and professor at Bialystok University of Technology, specialising in landscape architecture. Her expertise extends to the history of urban planning. She has actively participated in international schools under the Erasmus+ and Nawa programs and also contributed to projects such as Vipskills, AddOnSkills, Spinaker, and Glocal, taking on leadership roles.

Dr. Carlos Gonzalvo (ed.) is a PhD Architect currently serving as a postdoctoral researcher and

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Dorota Anna Krawczyk is an expert in the field of renewable energy sources and currently serves as the Vice-Rector of International Cooperation at Bialystok University of Technology. With a strong background in academia and project management, she has coordinated numerous international initiatives. Additionally, she has been instrumental in organising summer schools in Bialystok, fostering valuable learning experiences.

Jakob Kullik is a political scientist, research associate and PhD candidate at Chemnitz University of Technology. He is a guest researcher at Helmholtz Institute Freiberg for Resource Technology. He is a member of the Young Foreign Policy Experts of Konrad-Adenauer-Stiftung, Young Security Policy Experts of the Federal Academy for Security Policy (BAKS) and Association of German and Russian Economists "dialog e.V.". He received scholarships from the Konrad-AdenauerStiftung, the Foundation of German Business and the German Academic Exchange Service. His areas of expertise are Resource Markets and Foreign, Security and Resource Policy of Germany, the EU and Russia, Geopolitics and Resources and Cybersecurity in Germany and Russia.

Alex Nathanson is a designer, technologist, artist, and educator. His work is mainly focused on exploring both the experimental and practical applications of sustainable energy technologies. He is the founder and lead designer of the education and art platform *Solar Power for Artists* and its partner studio, Energy Transition Design LLC. The mission of both organizations is to make sustainable energy accessible, tactile, and understandable. As a solar power designer, he has created interactive and educational projects for the Climate Museum, Solar One, and the NYC Department of Education. In collaboration with Tega Brain and Bennedetta Piantella, he co-created the Solar Protocol project. His book *A History of Solar Power Art and Design* was published by Routledge in 2021.

Renewable borders

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