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Getting Beyond Visual Impact: Designing Renewable Energy as a Positive Landscape Addition

Hanna K. Szumilas-Kowalczyk

Nicholas Pevzner
University of Pennsylvania, School of Design, Philadelphia, US, pevzner@design.upenn.edu

GETTING BEYOND VISUAL IMPACT: DESIGNING RENEWABLE ENERGY AS A POSITIVE LANDSCAPE ADDITION

Hanna K. Szumilas-Kowalczyk Warsaw University of Life Sciences-SGGW, Department of Landscape Architecture,Warsaw, Poland
Nicholas Pevzner University of Pennsylvania, School of Design, Philadelphia, US

ABSTRACT
The critical necessity of scaling up renewable energy to meet the challenge of climate change implicates vast swaths of American landscape. Renewable energy infrastructure has long concerned itself with minimizing its visual impact, in order to decrease opposition from local landowners and users of the landscape. As energy facilities proliferate across the landscape, their visual impact can be expected to grow as well—both in terms of the scale of installations, as well as the amount of territory affected.

On public lands, renewable energy infrastructure has had to compete with alternate public uses of the land, including scenic and recreational values. Managers of public landscapes have developed specific procedures for describing the visual impact to landscapes stemming from energy development, and specific methodologies to evaluate whether a particular project should proceed.

In most contemporary energy planning processes that include landscape design professionals, these designers' scope is limited to comparing the visual impact of discrete energy installations: the spacing, height, and alignment of wind turbines or solar panels, for example. We argue for a more inclusive approach to incorporating spatial design considerations, earlier in the planning process, as a way of incorporating public aspirations and opinions about the energy landscape, expanding the field of potential planning outcomes, and identifying synergies for co-locating multiple positive elements. How can energy infrastructure actively participate in the shaping of a positive landscape experience, and not just try to minimize its impact on the landscape?

This paper will present several examples of infrastructure-driven landscape transformations that actively incorporated public input and visual assessment considerations, at the municipal and regional scales, in order to develop energy planning frameworks with high social acceptance. One case study looks at the spatial planning around wind turbine installations in the Wieringermeer polder in the Netherlands, which used design to develop a consistent image for wind installations, and create a "recognizable new layer in the cultural landscape" that reflects the qualities, scale, and character of the underlying landscape (H+N+S Landschapsarchitecten, 2014). One other European example demonstrates the impact of an iterative design process in producing the successful Middelgrunden wind farm in Copenhagen, Denmark.

We analyze the potential of these kinds of planning processes on American renewable energy infrastructure planning. We note examples of energy planning that are successfully minimizing conflict between social and ecological stakeholders, focusing on California programs such as the Desert Renewable Energy Conservation Plan (DRECP), but that would benefit from incorporating design methodologies more extensively to manage visual landscape impact.

INTRODUCTION
Confronting the challenge of climate change will entail a dramatic decarbonization of the energy sector by midcentury, with profound effects on landscape. Renewable energy will play an increasingly large role

in the production of electricity, necessitating a huge buildout of new renewable energy facilities to meet this need. Renewable energy systems require an order of magnitude more space than fossil fuel energy infrastructure. As renewable energy facilities proliferate across the landscape, their visual impact can be expected to grow as well—both in terms of the scale of installations, as well as the amount of territory affected.

Renewable energy infrastructure has long concerned itself with minimizing its visual impact, in order to decrease opposition from local landowners and users of the landscape. Land managers typically try to balance the concerns of multiple stakeholders, and effort is made to reduce the perceived alteration to a natural or bucolic landscape by technological "intrusions," which is how renewable energy technologies are often seen.

Landscape design considerations in the deployment of renewable energy infrastructure are typically limited to comparing and mitigating the visual impact of discrete energy installations: the color, spacing, height, and alignment of wind turbines or solar panels, for example. In this paper, however, we argue that design and planning can proactively be used to connect renewable energy facilities to a larger regional landscape identity, and to specific spatial considerations, as a way of convincing a larger share of the public that the renewable energy landscape can be a beneficial—rather than antagonistic—part of the landscape. We argue for a more inclusive approach to incorporating spatial design considerations, earlier in the planning process, as a way of acknowledging public aspirations and opinions about the energy landscape, expanding the field of potential planning outcomes, and identifying synergies for co-locating multiple positive elements on a site.

Our aspiration is that energy infrastructure can actively participate in the shaping of a positive landscape experience, and not just occupy itself with trying to minimize its impact on the landscape.

BACKGROUND AND LITERATURE REVIEW

Current approaches to renewable energy planning

The prevailing design and planning principle for siting renewable energy infrastructure in both the United States and the European Union is based on avoiding conflict, primarily through physical distance (setbacks). This approach assumes that the infrastructure will generally have a negative impact on the landscape (either on the quality of views from residential areas, or of conservation areas).

However, the development of renewable energy facilities close to residential areas or conservation areas is gradually becoming inevitable. In smaller and more densely populated countries, land areas far from homes or conservation areas are already difficult to find. In larger countries such as the United States, large tracts of land with low population density are still available, but as Rand and Hoen (2017) have noted in the case of wind power, "the 'low hanging fruit' wind sites (those that have good wind resources and are close to loads and transmission, yet far from communities) have largely been developed, implying that future wind development likely will happen increasingly near communities." For most renewable energy technologies, distance alone will become an increasingly difficult strategy to utilize while simultaneously growing the capacity of the renewable energy sector.

Current strategies for mitigation of the negative impact based on "hiding" those facilities does not work in regions dominated by flat landscape and dispersed buildings. This influences opposition to these facilities even if people generally support renewable energy (Wolsink, 2000; Frantal, 2018). "Best practices" for the renewable energy planning process include several specific principles, such as: siting facilities away from the most prominent land features, locating new facilities in already disturbed landscapes and clearings, locating facilities in less prominent areas and far from focal points, using color to reduce contrast, using site-specific locations and topographic features to reduce visibility, and increasing distance from potential observers (Apostol, McCarty, & Sullivan, 2017). One can observe that the main strategies of these principles is to increase the distance away from potential observers, and to build renewable energy infrastructure far from settlements and tourist areas, with the idea that limiting the number of potential observers reduces potential negative impact of the facilities.

Renewable energy landscapes are different in Europe and the United States, even if they are based on the same theoretical fundamentals. European energy landscapes are usually more “crowded” and more intensively used by other forms of human activity, with which renewable energy facilities have to compete. In the United States, renewable energy is usually planned in areas far from the potential observers, in areas of high natural quality. European practices are different in each country, and these practices have a big impact on the level of renewable energy development in each.

Policies and national laws also have significant impact on the process of planning and designing renewable energy facilities, regulating aspects of their visual and aesthetic impact. Development of renewable energy landscapes is strongly regulated by laws like the National Environmental Protection Act (NEPA) in the United States, the European Landscape Convention (ELC) in Europe, Canadian provincial guidelines such as British Columbia’s Clean Energy Act of 2010, U.S. state laws and guidelines like the California Environmental Quality Act (CEQA) or the Guidelines for the Review and Evaluation of Potential Natural Resources Impacts from Utility-Scale Wind Energy Facilities in Vermont, procedures of Environmental Impact Assessment (EIA) in Europe and Environmental Impact Statements (EIS) in the U.S., as well as specific laws in each country (e.g., Poland’s Act of May 20, 2016 on investments in wind farms). Much of the legal and regulatory statutes and frameworks that apply to the siting of renewable energy projects in the U.S., Canada, and Australia is covered by Smardon, Bishop and Ribe (2017), while that of European countries is covered by Bell (2017) and Roth et al. (2018).

Some of these laws require public participation in the process of planning, designing, or assessing the visual impact of the proposed projects (Smardon, Bishop, & Ribe, 2017). This process, however, may vary in different countries. Smardon and Palmer (2017) provide a guide to various versions of participatory processes, and argue that projects that engage in participatory public processes have tended to have better public approval and more success. One advanced method for a participatory process is that offered by Pond et al. (2010), and includes a sequence composed of participatory scenario building through community workshops, data-rich modeling, and visualization/visioning; this approach has the advantage of multiple rounds of engagement with the public, demonstrating responsive changes to project design in each round.

However, even in public participation methodologies, the active participation of spatial design principles is more rare. The public consultation process employed in Copenhagen during the design of the Middelgrunden wind farm—one of the case studies that we will describe in detail in the “Case Study” section—not only incorporated mediation of public opinion, but adopted a siting layout that was rooted in a spatial and geometric reading of its site, one that would likely not have been achieved without the inclusion of spatial design considerations.

New approaches

Most established legal and regulatory frameworks for renewable energy facilities seek to regulate their intrusion into the landscape, by mandating minimum distances or setbacks, controlling the materials and color, and minimizing the removal of vegetation. Instead, as the case studies in this paper show, renewable energy facilities can be treated not as an intrusion into the landscape that must be mitigated, but rather as a new layer integrated into the cultural landscape, which can create a positive new image of energy landscapes despite their close proximity. This new layer of the cultural landscape can then be read alongside older layers of cultural use, and even over top of traces of older energy landscapes (Pasqualetti, 2013).

One approach to rethinking renewable energy planning zooms out to take a regional view, looking not only at individual renewable energy components but at the larger placement of multiple components and facilities within a broader landscape context—their interactions with one another, with the natural and cultural landscape, and with the way an observer might move through that landscape. Today this approach is mostly found in Europe, where planning requires highly space-efficient solutions both on the local and regional level (Bell, 2017). In European countries, which tend to be densely built-up, practically all utility-scale renewable energy investments may have some significant impact on the various types of landscape in a region. (Stremke & van den Dobbelsteen, 2013). Thus, these projects need to respect historic, cultural and natural heritage. The European Landscape Convention of the Council of Europe (2000), requires authorities to protect landscapes both on the local and regional scale, while other European laws, such as Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 (which amended Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment), requires that member states extend EIA procedures on visual impact assessment. This includes utility-scale renewable energy facilities and their impacts.

Our case study examples emphasize that modifications in variables of visual representation of renewable energy facilities, such as the number of elements, their position, direction, orientation, size, shape, interval and color, may be used to create a positive perception of renewable energy landscape, rather than simply mitigating the visibility of the infrastructure (Bell, 2004; Sullivan, 2017). This echoes Roth et al. (2018) who have similarly suggested that different kinds of renewable energy technologies may have positive visual impacts, such as providing a sense of identity in certain landscapes. The reception of the infrastructures is of course not limited to the infrastructures themselves, but is rooted in observers' feelings about the landscape in which they are located, and these feelings are shaped by their larger attitudes about technology and landscape.

Theoretical background: technology in the landscape

Prominent in attempts to minimize the visibility of renewable energy facilities is the fear that energy technology will destroy a landscape's scenic beauty (Rand & Hoen 2017). At least in North America, the prevailing cultural attitude towards infrastructure in general, has tended towards denial. As Strang (1996) has noted, "[d]esigners have most often been charged with hiding, screening and cosmetically mitigating infrastructure, in order to maintain the image of the untouched natural surroundings of an earlier era. They are rarely asked to consider infrastructure as an opportunity, as a fundamental and regional form" (Strang, 1996). This tension between infrastructure and natural surroundings (or scenic beauty) has as much to do with attitudes about nature as with infrastructure.

Sijmons and Van Dorst describe the ways in which wind turbines fit the category of what the Dutch philosopher Smits (2002) had described as "monsters" (i.e., something that provokes both fascination and abhorrence thanks to its ambiguous position between cultural categories): wind turbines, they say, seem for many observers to be out of place, appearing both very urban yet situated in the landscape, acting as power plants but being decentralized, at once retro and high-tech (Sijmons & van Dorst 2013). Sijmons and van Dorst suggest that the way past this public attitude lies in a slow and gradual process of domesticating the new technology on the societal level. More tangibly, when it comes to overcoming public fear about specific renewable energy project, they suggest using a “pluralistic and hands-on participatory process” where stakeholders “actively enter the design process” (Sijmons & van Dorst 2013). This approach puts designers at the center of the mediation of both the public process, as well as of the challenge of integrating the technology into the landscape. Participatory processes are a well-established practice (Smardon & Palmer, 2017; Pond et al., 2010). From the theoretical point of view of the integration of technology into the landscape, such participatory processes help to “domesticate” the technology into society: rather than removing observers as much as possible and keeping them at arms' length, the idea is to include them in the experience of the landscape (including their own personal experience), of which the technology is an essential layer or part.

Public participation also clarifies public sentiment about “the environment” as opposed to specific landscapes. While the assumption of support for renewable projects might be expected based on public support for “environmentally friendly” practices, specific landscape impact is not the same as environmental impact broadly construed, and mistaking support of one for support of the other may result in opposition. To overcome social barriers to projects, the key is to understand people's close relationship with the visual representation of the landscape and loss of place identity which comes with utility-scale projects, which dominate over other elements of the landscape (Pasqualetti, 2011). Attitudes towards and social acceptance of specific renewable energy facilities vary by country and by type of technology, as well as based on a complex combination of factors that include demographic variables, personal experiences with renewable energy facilities, and perception of “fit” with the local landscape, among other factors (Smardon & Pasqualetti, 2017). We understand that negative views and opposition go beyond just visual impact, and that social opposition goes beyond simple NIMBY-ism (Wolsink, 2006; Devine-Wright, 2005), and can be tied to place-attachment, and resistance to the alteration of the landscape itself.

In contrast to the theory that assumes an inherently antagonistic relationship between natural landscapes and energy technology (or technology and infrastructure of any kind), can be posited the idea of the technological sublime (Nye, 1994). In this formulation, the technological object overwhelms the observer with its scale and grandeur, inspiring emotions traditionally reserved for the most wild and rugged natural landscapes, and potentially resulting in an appreciation of the new intervention despite its contrast to the surrounding landscape.

Similarly, in Robert L. Thayer’s classification of technology in landscapes, wind farms and other such large energy technologies fall into the category of iconic technology—highly conspicuous and standing out from its background—at least in the U.S. cultural context (Thayer, 1992). While he says that “the more conspicuous and focal a technology is, the less it is likely to be valued in the American landscape,” he nonetheless suggests that symbolic meaning can lead to the public’s re-appraisal of a technology. Using the example of a wind turbine array coexisting with grazing sheep, he suggests that despite initial assumptions about the unnaturalness of the technological objects, “the entire landscape composition may read as a symbol of efficient, benign, multiple use of rural land.” Less forceful than the contrast implied by the technological sublime, perhaps, but in Thayers reading the ability for both landscape functions to coexist simultaneously—the agricultural and the technological—enables a new reading of the wind farm as a productive and beneficial addition to the landscape.

Strang, too, argues for a redesign of single-purpose infrastructures to integrate multiple functions. Critically, he also argues for a hybridization of functions between nature and infrastructure, rather than merely a multi-purpose infrastructure: "An architectural method that exploits the unignorable marriage between nature and technology provides an opportunity for new spatial and visual possibilities that result from using infrastructure as a fundamental component of architectural design. Nature and infrastructure, working together, must both be allowed to express themselves as a major determinant of urban and regional form" (Strang, 1996). The case studies we present in this paper also operate in this manner—engaging the structure of their surroundings, accentuating elements of the cultural landscape, and foregrounding the role of designers to actively mediate public engagement through iterative manipulation of the form of the renewable energy facility at both the larger scales of the region, and at the fine scale of the observer's experience.

GOALS AND OBJECTIVES

- look for the alternatives to current processes of designing and planning renewable energy infrastructure
- present examples of successful landscape architects' and planners' early involvement of planning and designing renewable energy facilities, which helped to create new attractive images of this infrastructure
- present examples of positive public participation in renewable energy design process, where instead of assessing a ready project (which usually results in criticism of the impact of the facility), stakeholders were involved early in the process and were allowed to co-develop the final outcome

METHODS

This research is a qualitative inquiry, where the case study method was applied to describe new approaches in planning and designing renewable energy landscapes (Creswell, 2012). Case studies were analysed by following (to some extent) the specific methodological approach for case study analyses in landscape architecture, which is described by Francis (2001). The suggested format consists of basic elements like photographic documentation, description of the project background, its significance and impact on the landscape, lessons learned from the project, but also the role of landscape architects and planners in the design and in the process of making decisions alongside project development.

Case studies presented in this paper were identified after a literature study, which involved a search for specific examples of renewable energy landscape planning and design process, using SCOPUS and Web of Science tools as well as materials published by leading landscape architecture offices involved in renewable energy projects. Research covered projects developed in both the United States and the European Union.

Each example presented in this paper was studied in relation to specific aspects of renewable energy infrastructure's impacts on landscape transformation, including: the timing of when landscape architects and planners were involved in the renewable energy infrastructure design process, the level of public involvement in project proposal assessment, the level of consideration of the project impact on the landscape (both regional and local), the size of the planned project, its distance to potential viewers, and the spatial strategies that were implemented in the proposed design. We also analyzed the laws, planning documents, and EIAs prepared for these projects to see how the legal basis behind them impacted the different approaches toward the renewable energy infrastructure's planning and design.

The case studies were compared to current attempts in California for the consolidation of spatial management practices for streamlining that state's transition to renewable energy.

CASE STUDIES

Wieringermeer Wind Energy Spatial Quality Plan, Netherlands

In the municipality of Hollands Kroon, the landscape architecture firm H+N+S Landschapsarchitecten developed a spatial quality plan for wind energy that strove to guide future development of wind turbines in the Wieringermeer polder (H+N+S Landscape Architects, n.d.). This area had been a pioneer in wind energy development in the Netherlands, with numerous solitary wind turbines having been erected on farms early on, followed by a number of linear turbine arrays erected throughout the Wieringermeer. The polder landscape can be characterized as open, large-scale, and rational, with clear geometric lines of fields and canals bounded by its ring dykes. Roads run parallel to some of the canals, and these lines are reinforced with linear tree plantings of single and double rows of trees (see Figure 1 below). Many of the linear arrays of turbines already ran along canals or ditches, but varied widely in their turbine type, their height, rotor diameter, color, material, and spacing.

Figure 1: Typical landscape quality in the Wieringermeer polder Source: H+N+S Landscape Architects 2014

The designers' goal was to produce "a number of clear linear installations that form a recognizable new layer in the cultural landscape and match the scale of the project and the size of the Wieringermeer polder," while increasing the installed capacity of wind power in the polder from the current 130 MW, up to 300-400 MW; a guiding principle was "to achieve the greatest possible order, rhythm and regularity" (H+N+S Landscape Architects, n.d.). They were aiming for arrays of at least 4 turbines, spaced at an equal distance, on one center line, of the same type (see Figues 2, 3 and 4). They had rules for simple lines, compound lines, and curved lines of turbines. The team evaluated visual conflicts having to do with perspectival effects of lines crossing one another in a messy way, stacking up one behind another, or jumping scale. They identified areas where turbines needed to be removed so as to create moments of open horizon (see Figure 5), which would let an observer visually distinguish between several major linear systems. The designers determined the most significant lines in the polder landscape to emphasize, with the aim of connecting various existing linear segments into longer, more continuous, and more rhythmic lines of turbines along these major paths. The designers arrived at a simplified configuration that prioritized three large linear systems, consisting of a number of large line configurations, with a plan to remove solitary wind turbines over time, and then a phased decommissioning of various minor linear arrays if these were to become unnecessary in the future (H+N+S Landscape Architects, 2014).

The designers write that “by scaling up the current linear installations and removing solitary turbines there’s an opportunity to better reflect the essence of the polder: big sizes, unity and clear lines” (H+N+S Landscape Architects, n.d.). In operating on the new technological layer that is being added onto the agricultural landscape, the design team is also looking for opportunities to craft new functional links to recreation and historical landscape patterns, while reorganizing and clarifying the meaning of the energy layer on the landscape.

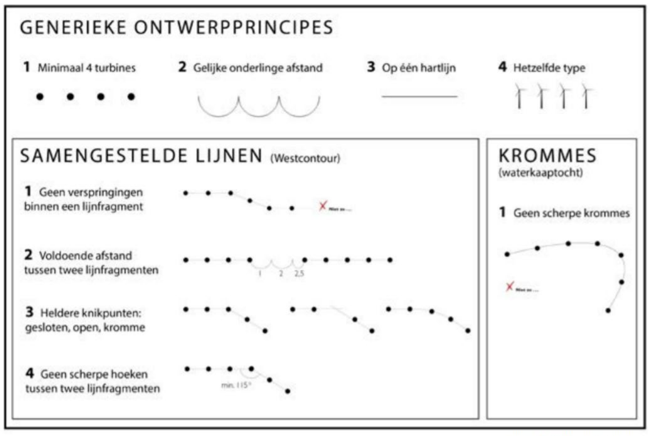

Figure 2: General principles of the Wieringermeer wind farm spatial planning. Source: H+N+S Landscape Architects 2014

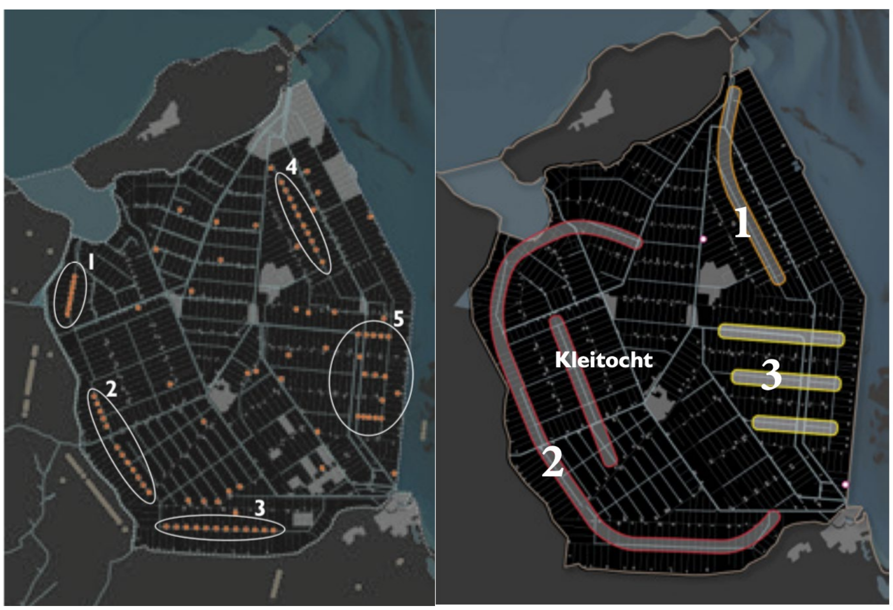

Figure 3: Starting condition of single turbines and mismatched lines [left], and the proposed new structure of major linear structures, which respond to elements of the cultural landscape [right]. Source: H+N+S Landscape Architects 2014

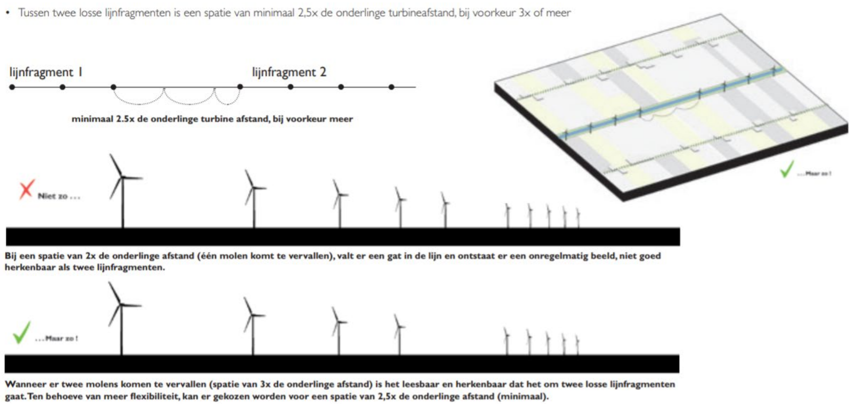

Figure 4: Rhythm and spacing: creating moments of open horizon, which allows observers to visually distinguish between several linear turbine arrays. Source: H+N+S Landscape Architects 2014

Figure 5: Proposed recreational experience in close proximity to renewable energy infrastructure. Source: H+N+S Landscape Architects 2014

Middelgrunden Offshore Wind Farm, Denmark

The case of the iconic offshore wind farm array off the coast of Copenhagen, Denmark, offers perhaps the most classic example of public involvement in the renewable energy design and planning process, which had a clear effect on the project's positive reception.

This array consists of 20 two-MW turbines, positioned in a gentle arc in the shallow waters of the Middelgrunden shoal. It is notable for its proximity to the historic core of Copenhagen (see Figure 6), and to popular tourism locations such as Amager Beach; the turbine array is plainly visible from these popular destinations, which made the choice of location controversial, and yet the project enjoys popular support and attracts local pride, including as an icon and a tourist attraction (Larsen et al., 2005).

The spatial design of the project stems from an open planning process, which involved the public's participation at an early stage, and crucially, one that actively incorporated public feedback about visual impact. In the Middelgrunden case, the public consultation entailed changing the number, placement, and appearance of turbines. The public process also incorporated extensive use of computerized visualizations, which allowed for a more informed discussion of landscape impact and changes to view (Jessien & Larsen, 1999).

According to Sørensen et al. (2002), the original plan for Middelgrunden entailed 27 turbines in three rows. However, "[a]fter the public hearing in 1997, where this layout was criticised, the farm layout was changed to a slightly curved line and the number of turbines had to be decreased to 20." Because the original 1.5 MW turbines were changed to 2 MW models, the overall capacity of the wind farm remained unchanged despite the reduced number of turbines.

The design of the gentle arc was not a random or willful design choice, but was grounded in readings of the cultural landscape, with reference to Copenhagen's urban structure and specific points of cultural importance. As the project's EIA points out, the 20 turbines "will be placed in a circular arc with a radius of 12.5 km and with centre at Slotsholmen (The Danish Parliament). That makes the wind farm part of the arch formed by the historical works of Copenhagen." (Environmental Impact Assessment of the wind farm at the Middelgrunden Shoal, 2001). The arc is an extension of historic circular structures around the old historic city center (see Figure 7), such as the Vestvolden (the medieval defensive ramparts), and Ring Road 2. The EIA continues, "The circular arch will be simple and easily recognisable from all angles...When approaching Copenhagen from air or water the pattern will appear as part of the lines surrounding the centre of Copenhagen. It will appear calm but yet dynamic. The disturbing sight of all turbines behind each other will rarely be seen. From all angles the view to the Middelgrunden fortress will be undisturbed."

The broad popularity and acceptance of this particular renewable energy facility may also have something to do with the fact that ten of the turbines are owned by the city's municipal utility, and the other ten jointly owned by the Middelgrunden Offshore Wind Farm Cooperative, which consists of 8,650 members. Local ownership and economic investment in a project has been shown to increase a project's local acceptance (Devine-Wright, 2005), but this Danish example nonetheless demonstrates the benefits of an early and prolonged public process, a clearly articulated and communicated spatial agenda, and early involvement by experts versed in spatial questions, for attaining widespread project support.

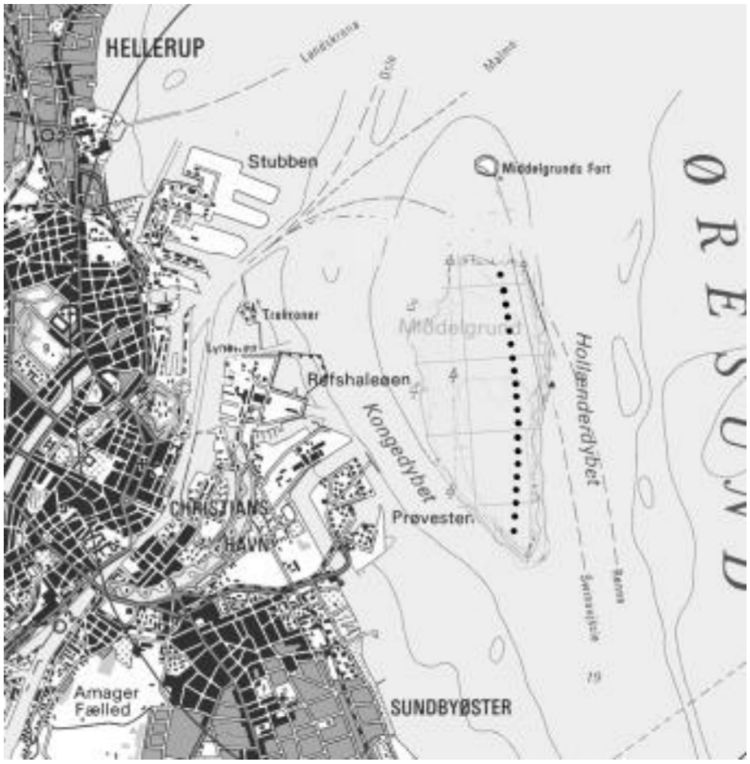

Figure 6: The Middelgrunden offshore wind farm, in very close proximity to the historic Copenhagen urban core. Source: Soerensen 1999

Figure 7: The original 27-turbine plan along three lines, and the longer but more elegant 20-turbine plan along a gently curving arc. Source: Larsen et al. 2005

California and the Desert Renewable Energy Conservation Plan

In the United States there are not many examples of thinking about renewable energy infrastructure as an element of spatial design, which might have a positive impact on the landscape. However there are some early examples of thinking that the transition to renewable energy is inevitable, and that a bigger contribution of these sectors in the market will have a significant impact on the quality of the landscape, not only on the local, but also on the regional scale.

One of the first large-scale attempts to improve the fit of renewable energy to the landscape is California's Desert Renewable Energy Conservation Plan (DRECP). This plan is done at the landscape scale, and is an example of using zoning strategies to develop renewable energy on the one hand, and conserve natural areas on the other (see Figure 8).

The DRECP is the product of collaboration of several agencies: the California Energy Commission, the California Department of Fish and Wildlife, the U.S. Bureau of Land Management (BLM), and the U.S. Fish and Wildlife Service (FWS). It is located in seven southern counties in California, and covers 22.5 million acres of mainly desert regions (DRECP 2019).

The project was divided into two phases. In the first, which focused on public land managed by the BLM, the area was divided into four main categories: Development Focus Area, Conservation Designations, Recreation Designations, and Variance Lands. This allowed the BLM to designate areas specifically for renewable energy development, with an accelerated permitting process; areas where renewable energy is possible in specific situations; and areas where renewable energy development is prohibited. In the second phase, local, state and federal plans for renewable energy development were aligned to the general strategy of the DRECP. This plan helps to achieve the political goals of meeting renewable energy development targets in a way that protects the most valuable conservation areas with unique visual and environmental resources (DRECP. Documents 2010- 2019).

The main goal of this plan was to achieve economic goals while at the same time protecting some areas from renewable energy development. It successfully steers energy development to the areas with the best energy potential. By concentrating most of the infrastructure in specific sites, it protects the other areas from renewable energy development.

The DRECP included extensive public consultation, involving both state and federal agencies (e.g., the California State Lands Commission, California Department of Parks and Recreation, the National Park Service, the U.S. Environmental Protection Agency), local governments, renewable energy companies, non-governmental organizations, electric utilities, industry associations, Native American tribes, and other experts in renewable energy planning including landscape architects and ordinary people (DRECP. Participants. Stakeholder 2010-2019).

This plan creates zones with the best conditions for renewable energy development, but does not specify the type of renewable energy development in each zone. The plan requires protection of visual resources on federal, state and private lands, but does not have any provisions related to the specific visual impact of renewable energy facilities on each specific location, and does not regulate the specific design of any renewable energy facility. Still, each project on public land requires an EIS procedure, and each project developed on state and private land has to follow the assessment of the California Environmental Quality Act (CEQA). In general, the zoning allows for renewable energy infrastructure intensification, while ensuring a balance of public input and participation.

The visual impact of the particular proposed projects is unfortunately still analyzed relatively late in the process. The projects' design is always dictated by the investor, and only in the assessment phase can experts argue that some specific wind turbines should be removed from the project as proposed, for example, but do not have the power to work early enough in the process to modify the kinds of important visual variables that H+N+S had the ability to modify in the Dutch case study. In our opinion, more agency should be granted to experienced spatial design professionals to determine how exactly renewable energy infrastructure might be incorporated into the landscape.

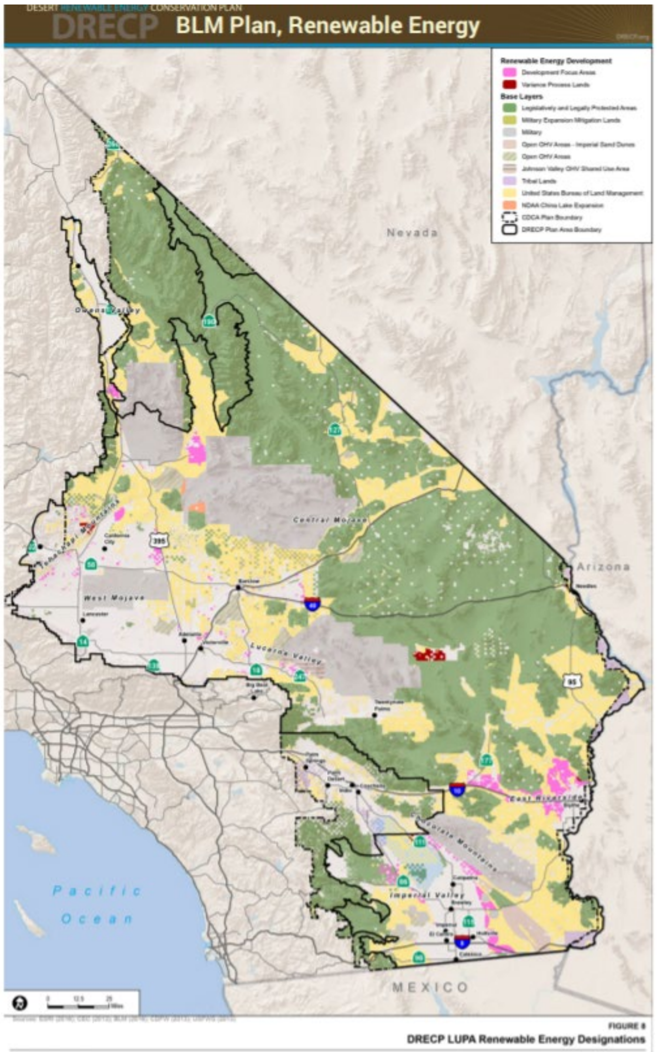

Figure 8: Renewable Energy Designations. DRECP, BLM Plan Renewable Energy. Source: DRECP_Renewables_Fact_Sheet.pdf

DISCUSSION AND CONCLUSION

In Europe the importance of the proper design of renewable energy facilities is becoming clearer than ever. Perception of infrastructure varies from site to site, and in countries where renewable energy was initially developed with poor visual quality, this usually affects the level of acceptance of these projects. With a lack of spaces that can be used exclusively for renewable energy, there is a constant spatial conflict with other types of land use; many of the facilities are also clearly visible also from nature conservation areas. To create a positive image of subsequent renewable energy facilities, we should take a step back from using existing best practices, which do not work in every environment, and focus more on developing new "smart" practices, which fit better with the existing socio-cultural landscapes of specific regions (Frantal 2018).

There are certainly examples of landscape architects and landscape planners carefully considering the visual impact of proposed renewable energy facilities on their surrounding landscape, such as setting out maximum thresholds for change and articulating the factors that contribute to cumulative landscape impact from renewable energy development (White Consultants 2013), or even planning pre-emptively for the spatial arrangement and specific height and alignment of future energy projects well in advance of their arrival (Danish Ministry of Environment and Food - Nature Agency, 2007). The example of South Fork Valley PV Solar Project, as described in Apostol, McCarty, and Sullivan (2017), included detailed visual mitigation measures such as the modification of setbacks from the highway, the enlargement of buffer zones, the adopting of a more rangeland-appropriate fencing style and grassland vegetation regime, and the minimizing of the visual impact of solar panels on a church that had been a special component of the local cultural landscape. But examples of proactively retaining landscape designers to actively design positive landscape experiences for visitors encountering new renewable energy infrastructures, in order to invite visitors in rather than hiding from them, unfortunately remain rare.

The California example suggests that corridors can be proactively laid out across vast stretches of landscape, and although the DCREP doesn't fully consider the ground-level landscape experience of these corridors, and maintains its focus on mitigating conflict, it demonstrates the potential of such a policy tool if deployed with more intentional design considerations. The Middelgrunden example shows the importance of a holistic planning vision that can operate at multiple nested scales, reinforcing special local landmarks and geometries even if these are only ever seen from airplanes or on maps. The Dutch Wieringermeer case study is perhaps the most useful as an example of detailed long-term design and planning, which lays out not merely the spatial strategy for a single renewable energy site, but a set of spatial and geometric design principles that can be referenced for multiple future projects within the planning area. It offers compelling experiential narratives of imagined close-up encounters between visitors and renewable energy infrastructures, suggesting spatial improvements at both the facility siting scale and the architectural scale of how individual turbines meet ground. They assume the inevitability, and desirability, of an intimate encounter of the public with the infrastructure, instead of trying to keep these visitors at bay.

What we can learn from the experience of small European countries, which invest in good design for wind farms and solar farms, is that the transition to renewable energy sources will be better perceived if the infrastructure is treated as equal element of the landscape, and not as an intrusion. When the focus is on covering up the negative impact of the facilities, renewable energy infrastructure comes to be perceived as something that cannot have a positive impact. Our examples show that early involvement of landscape architects and planners in the energy planning process, and then in a specific project's design, allows for the creation of a positive image for renewable energy infrastructure, allowing it to assume its role as an additional, positive, layer to the existing cultural landscape.

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