sustainability

MDPI

Article

Regional Strategy, Municipality Plans and Site Designs for Energy Transition in Amsterdam, The Netherlands: How Sustainable Are Implementation Processes on Different Spatial Levels?

Paolo Picchi [1,2,*], Dirk Oudes [1,3] and Sven Stremke [1,3]

[1] Academy of Architecture, Amsterdam University of the Arts, 1011 Amsterdam, The Netherlands
[2] DIDA—Department of Architecture, University of Florence, 50121 Florence, Italy
[3] Environmental Sciences Group and Landscape Architecture Chair Group, Wageningen University & Research, 6708 Wageningen, The Netherlands
* Correspondence: paolo.picchi@unifi.it

Abstract: Energy transition has a prominent role in 21st-century urban agendas. Worldwide, cities pursue the local implementation of international, national and regional agendas aiming at a sustainable energy transition. Landscape integration, multifunctionality and community participation are three of the key concepts here. These concepts are interpreted differently across the different spatial levels. The object of this paper is to analyse the application of the three sustainability concepts at the regional, local and site levels for the city of Amsterdam, the Netherlands. The results show that the degree of implementation of the concepts depends on what factors are considered important at each spatial level. At the regional and local levels, landscape integration with regards to social factors such as finances and co-ownership drive successful implementation, thanks to the organisation of effective participatory processes. At the site level, landscape integration and multifunctionality with regards to spatial factors such as the ecological, recreational and historical landscape factors drive successful implementation through effective landscape design activities. However, the sustainability of the energy transition implementation process is affected by a lack of social-ecological systems thinking. Participation processes—if present—focus either on social or spatial factors but fail to interconnect them. The regional and local levels that currently demonstrate major abstraction and separation of social and spatial factors would benefit from effective exchange with the site level. At that scale, design activities are the arena to combine and reconcile social and spatial factors.

Keywords: renewable energy; urban landscape; urban space; social-ecological systems; landscape architecture

check for updates

Citation: Picchi, P.; Oudes, D.; Stremke, S. Regional Strategy, Municipality Plans and Site Designs for Energy Transition in Amsterdam, The Netherlands: How Sustainable Are Implementation Processes on Different Spatial Levels? *Sustainability* **2023**, *15*, 5876. https://doi.org/10.3390/su15075876

Academic Editors: Andrea Nicolini and Ricardo García Mira

Received: 7 October 2022
Revised: 10 March 2023
Accepted: 23 March 2023
Published: 28 March 2023

1. Introduction

Signatories of the United Nations Climate Agreement from Paris 2015 agreed on the goal to limit global warming to 1.5 °C compared to the pre-industrial era. In response, the European Union member states decided to reduce their greenhouse gas emissions by 55% in 2030. In the meeting of the European Council on 20 June, 2019, a large majority of members agreed that to reach these objectives the transition towards renewable energy sources is unavoidable. Furthermore, the European Directive 2018/2001 promotes a decentralized renewable energy (RE) generation and the participation of communities in the decision making about RE (Art. 26–27 [1]).

Spatial planning for energy transition is currently implemented at the regional level in most EU member states. In The Netherlands, provinces are in charge of producing so-called regional energy strategies (RES) that, among others, indicate areas where renewable energy (RE) plants could be installed. Furthermore, regional guidelines have been created to set criteria and parameters for RE plants. In some regions, for example in the province of North Holland, guidelines also comprise landscape design principles that have been defined through participatory processes [2]. Landscape design is understood here as a common ground between society and regional and local plans to reconcile issues and interests of different actors [3]. Other countries such as France, United Kingdom, Italy, Denmark and Australia have been providing tools since the early 2000s for the landscape integration of RE power plants at the regional scale, especially wind turbines (see, e.g., [4]).

At the local level, countries are frequently confronted with two realities: one reality where the urgency of the global climate crises demands a fast and cost-efficient centralised transition towards a zero-carbon energy system, and another reality where local stakeholders call for decentralisation and more participation in decision-making processes [5,6]. Stakeholders advocate social equity, demanding direct participation as actors in the economic process: for example, through the creation of energy communities or RE plants co-ownership when those are installed in their living environment [7–9]. Beside social equity, stakeholders also advocate for landscape sustainability, wanting direct participation in the decision-making process about the changes in their living environment due to the RE plants [10,11]. The living environment is understood here as landscape defined in the European Landscape Convention: 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Art. 1 [12]).

In both social equity and landscape sustainability advocating, some authors recognise that stakeholders advocate the landscape integration of RE plants: when plants are promoted, co-designed, co-financed and (partly) owned by social and ecological systems. The social and ecological systems (SES) framework is borrowed from social sciences and adopted by spatial disciplines as a planning tool regarding renewable energy and other issues, e.g., [13–16]. The SES framework interlinks the challenges of social equity and ecological sustainability [17]. Such a framework thus requires an interpretation of both the physical landscape structures and the social structures supporting social and ecological processes. For example, an energy community is a social system based on a network of social relationship (neighbourhood) [18] aiming at energy self-generation through the installation of solar panels. Solar panels are physical landscape structures that spatially interact with some other SES [14].

Currently, RE plants are hardly integrated in the landscape as part of the SES. In spatial planning grey literature (reports, governmental documents, et cetera), landscape integration is widely interpreted as placing RE plants at sites with a non-conflicting land use, (e.g., [19]). This interpretation is quite simplistic: it is based on a lack of conflicting relationships between RE plants and other landscapes functions, while the landscape integration concept is based on setting up synergetic relationships between a RE plant and the other landscape components and functions. The SES framework, too, is based on the synergetic relationships that we can set between different landscape components and functions. Furthermore, we learn from the literature in the social sciences that the integration in SES is an important factor in transitions [14,20–22].

A second relevant concept advocated by stakeholders is the multifunctionality of RE plants. For example, a solar field may compete for space with other landscape functions such as food production or tourism. Functions can be combined: a local farming cooperative, for example, can keep cultivating the ground beneath the solar panels using an Agri-photovoltaic system and keep the field accessible to tourists [23–25]. Nowadays, large-scale RE plants such as solar fields rarely include other functions next to RE generation within their perimeter. The majority of solar power plants are mono-functional [26].

Both social equity and landscape sustainability are embedded in the so-called sustainable energy landscape concept: sustainable energy landscapes are defined as "a physical environment that can evolve on the basis of locally available renewable energy sources without compromising landscape quality, biodiversity, food production and other life-supporting ecosystem services" (p. 4 [27]). The development of sustainable energy landscapes requires informed decision-making and genuine community participation. The latter may benefit the sustainability of the energy transition depending on the context, not only in terms of position, quality and quantity of renewable energy technologies (RET) at the planning level but possibly also in terms of co-ownership of power plants and co-design of integrated and multifunctional energy systems (see, e.g., [10,26,28,29]).

In this paper we focus on a part of The Netherlands for two reasons. Firstly, community participation is part of spatial planning processes. Secondly, due to the high population density and land use competition, the attention for both landscape integration and multifunctionality has grown in the last decade. In the Netherlands, the National Climate Agreement aims to reduce CO_2 emissions by 49% by 2030 (and 95% by 2050). To achieve the 2030 objective, the electricity sector must annually produce 35 TWh from solar panels and wind turbines on land. Additionally, the National Climate Agreement includes targets such as energy efficiency for all sectors [30]. The RES are established through different means such as regional design ateliers, which are meant to address the spatial implications of the energy transition and also initiate a dialogue between different actors [2]. Provinces also set up guidelines for the planning implementation of the energy strategy, with stipulations regarding the search for suitable areas for renewable energy development. Municipalities conduct the search for areas and develop the local site design.

This paper reports on research conducted in Amsterdam. The metropolitan region of Amsterdam deals with a high population density (900 inhabitants/km^2) while pursuing sustainability goals. The municipality of Amsterdam is currently trying to find suitable areas and stimulate innovative design thinking for the local implementation of RE. The municipal department Ruimte en Duurzaamheid (in English: Space and Sustainability) (R&D) aims at strengthening daily practices to advance the local design implementation of the RES. For this purpose, a multi-year research project called METRO (Dutch acronym for metropolitan energy transition and spatial organization) has been established with one of the local knowledge institutions. The partnership's main objectives were to foster innovative site design for the local implementation of RE in the Amsterdam metropolitan area and to organise a yearly Masterclass (MC) on site design for civil servants.

The objective of this paper is an analysis of the application of the three sustainability concepts at the regional, local and site levels for the city of Amsterdam, the Netherlands. The expected outcomes are new insights into the sustainability of the implementation process and new indications to advance procedural knowledge. The following section will introduce the case study, while the applied method will be introduced in Section 3. The Section 4 will report the outcomes of the analysis. The final sections discuss the outcomes and conclude this paper.

2. Case Study

To analyse the application of the three sustainability concepts at the regional, local and site levels, we will first describe the main facts related to the three concepts in the case of Amsterdam. The following Sections 2.1–2.3 describe the main facts at the regional, local and site level. The site level concerns a renewable energy cooperative initiative and the MC 2021.

2.1. The Regional Level

The metropolitan region of Amsterdam is part of the regional energy strategy North Holland Zuid (RES NHZ), roughly the southern half of the province North Holland. The energy target of RES NHZ is to reach 2.7 TWh in 2030 [19]. In RES NHZ, design choices are made taking into account local conditions and other spatial issues. Landscape integration and multifunctionality are central in spatial considerations and choices made in public consultation programmes. The results of public consultation and choices are presented in the form of landscape design guidelines commissioned to a design consultancy. Based on these guidelines, the regional energy strategy provides stipulations regarding the search for areas suitable for the generation of RE: wind and solar energy and heat from the ground and water. The guidelines are sent to municipalities to further refine the search for suitable areas and the feasibility in terms of current environmental policy and regulations (Figure 1).

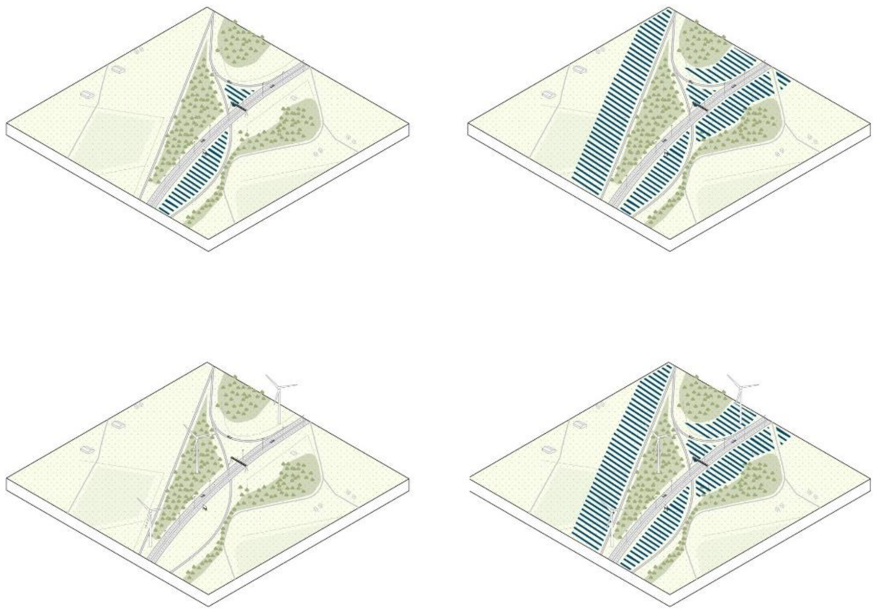

Figure 1. A sample of drawings as presented in the RES NHZ landscape design guidelines commissioned to design consultancy. The A9 zone from Haarlem to Alkmaar is a potential suitable area for solar (**top**) and wind (**below**) development. In this case design principles are supposed to inform the municipalities to search for suitable areas with similar characteristics (p. 19 [31]).

With regards to community participation, in RES NHZ it is indicated that at least 50% of RE generation should be owned by local initiatives and that locals have to be consulted about possible nuisance and the effects of RE plants on landscape values. Therefore, in RES NHZ, municipalities are urged to organise participatory processes and are provided with recommendations in terms of involvement of stakeholders, issues to be dealt with and tools to be used.

2.2. The Local Level

In May 2021, the Amsterdam City Council approved the RES NHZ and currently works on its implementation. At the local level, the municipality's target is to provide for a minimum of 127 MW installed capacity of wind energy (capacity in 2021 was 75 MW) and 400 MW installed capacity of solar energy on large roofs and ground-mounted by 2030 [19]. The municipality of Amsterdam uses the suitable areas identified in the RES NHZ and the accompanying design guidelines. In addition, Amsterdam has designated additional search areas for wind and solar energy, including 150 MW capacity of solar energy on small roofs. The map below shows the suitable areas that the municipality of Amsterdam used in wind and solar development planning by adhering to the RES NHZ 2021 guidelines (Figure 2).

With regards to landscape integration and multifunctionality, the municipality keeps on with the identification of suitable areas using landscape integration and multifunctionality as main criteria. Based on current official land use, it first considers the effects of RE plants on nature and the landscape: maps are used to compare the suitable areas of the RES NHZ to landscape values in international, national and provincial policy. Values include possible overlay with cultural heritage sites, natural reserves, Natura 2000 areas and provincial high-quality landscapes [19] (Figure 3). After this first phase, the municipality of Amsterdam starts a second phase in which several territorial institutions are consulted. The outcomes of this consulting phase point to the preference for clustering wind turbines as much as possible to limit a fragmented perception of the landscape. In line with RES NHZ guidelines, traffic nodes and business parks, the North Sea Canal zone, the Amsterdam-Rhine Canal zone, expressways and railways and high-voltage power lines are identified as suitable areas for wind turbine aggregation.

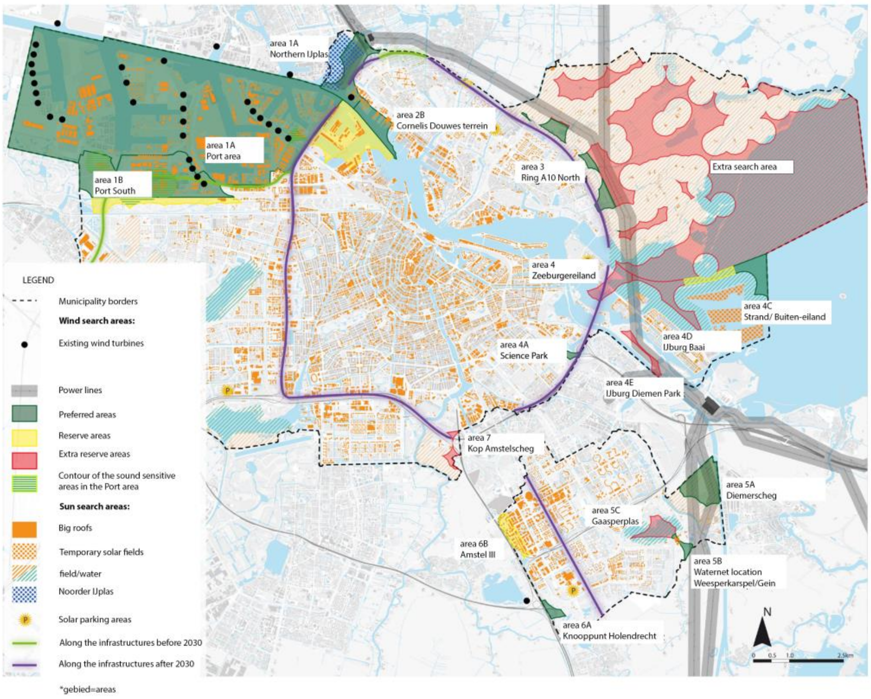

Figure 2. The suitable areas for renewable energy development in the municipality of Amsterdam according to RES NHZ, version 1.0. In green are reported the preferred areas: where to cooperate with initiators as soon as possible, subject to conditions. In yellow are reported the reserve area: this area can be used if the target cannot be realised in the green-coloured areas. In red are reported the extra reserve area: this area can be used if the target cannot be realised in the green- and yellow-coloured areas (terms in the legend are translated by the author (p. 96 [19]).

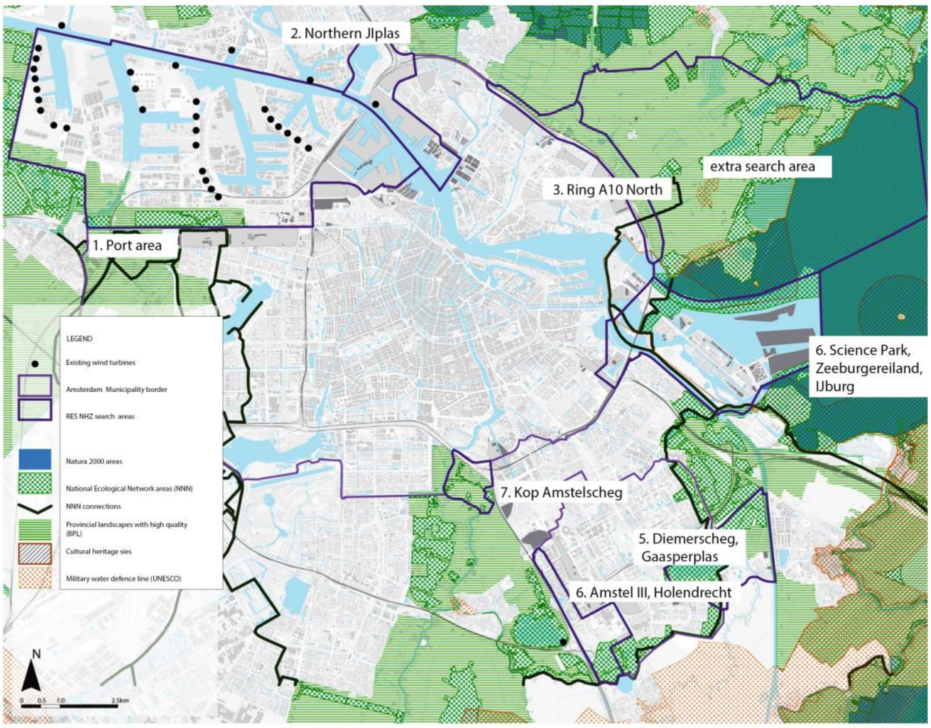

Figure 3. The map results from the scan the municipality of Amsterdam operated to check wind suitable areas integration and effects on landscape and nature values. In dotted green, the nature reserve areas; in blue, the Natura 2000 sites; in green lined texture, the cultural landscapes; and blue, the cultural heritage protected areas. (Translated by the author (p. 103 [19])).

The suitable areas identification is also supported by participatory processes. Beside the consultations with territorial institutions, the municipality sets up participation plans to describe how residents and stakeholders should be involved for the entire municipal area. One of the initial steps in this participation plan are resident consultations on relevant themes such as landscape integration, noise and cast shadows, nature and ecology, financial participation and local profit. The consultations embrace the multifunctionality concept, too, by focusing on the question of which other spatial tasks can simultaneously be addressed together with RE generation. Residents can select topics about which they want to be informed. Expert sessions can be organised on demand and landscape visualisations can be made to support the consultation. The community is an active part of the organisation.

2.3. The Site Level

Once approved by the board, the plan is implemented at the site level: the municipality, project initiators, residents and stakeholders jointly develop a site design for the area. In this section we focus on one of the suitable areas for wind development: the Noorder IJ-plas (Figure 4). The energy target for this area is to install 21 MW of wind power using 7 wind turbines of 3 MW each. Here, the site design started in March 2020 thanks to a participatory wind development project promoted by the municipality of Amsterdam and initiated by a local cooperative, the NDSM Energie (the acronym of Dutch Company for Ships Constructions, the former site use).

Figure 4. The Noorder IJ-plas is an area around an artificial lake that was created by the excavation of sand required for the construction of the Amsterdam motorway ring. The area then filled with fresh water, and it is now a recreation landscape rich in nature, with paths and holiday cottages close to the city centre (photos by the author).

With regards to landscape integration and multifunctionality, the spatial possibilities for wind turbines in the Noorder IJ-plas are explored by means of a GIS analysis. This analysis makes use of relevant landscape characteristics and existing functions: dwellings and buildings, safety and infrastructure, ecology, flight routes, archaeology, cultural landscapes and history. The available space for wind energy in the project area is determined on the basis of required distances from land uses incompatible with large wind turbines that follow from legislation and regulations, policy and expert judgement. Figure 5 shows the outcome of the spatial possibilities analysis in the form of a map [32].

With regards to community participation, the process considers in a first phase the possible ways the cooperative NDSM Energie of local companies and residents can be given the opportunity to participate, invest and, thus, become co-owners of wind turbines. Additionally, allocation of part of the profit (by means of a fund) for the benefit of the immediate environment is investigated, such as nature development and sound insulation.

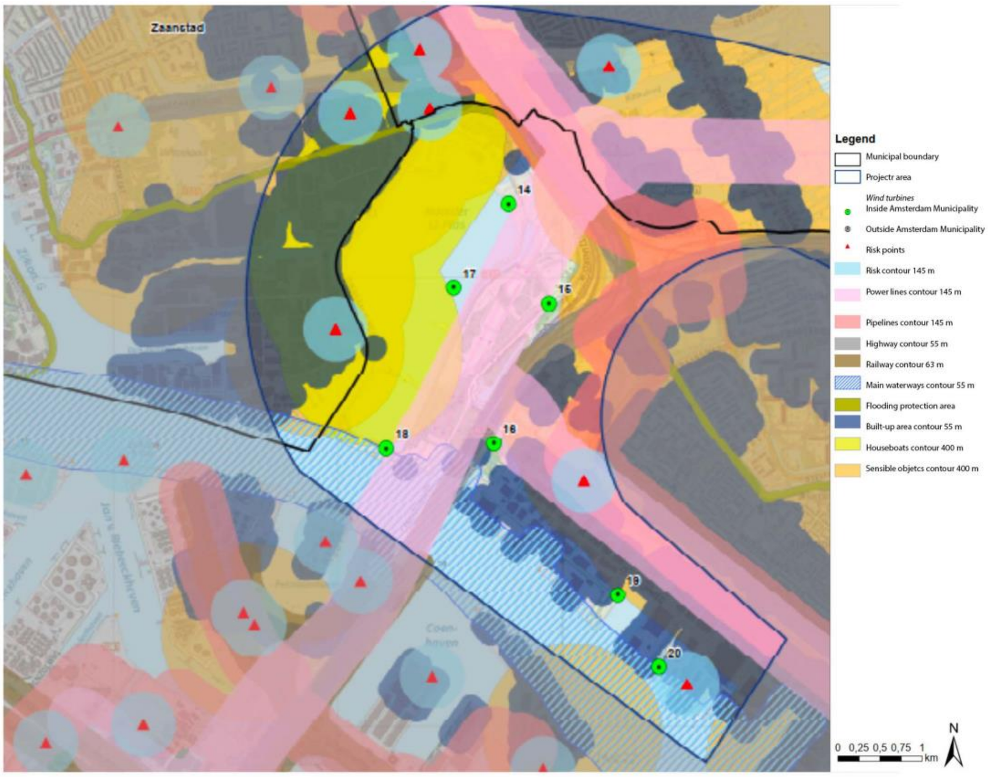

Figure 5. The map shows that there are possibilities for up to 7 wind turbines of 3 MW with a height of up to 146 metres. The exploration indicates where windmills technically fit in the search area, how many windmills will eventually come and where further work will be required during the development process (translated by the author (p. 9 [32])).

In a second phase, the participatory process works out a preliminary completion of the site design into a concrete project for permit request. The project focuses on different tasks such as thinking about the optimal integration of wind turbines, necessary follow-up research and the number and precise locations of the wind turbines.

The site design of the Noorder IJ-plas suitable area is commissioned to the authors knowledge institution as a MC 2021 assignment. The objective is to explore alternative design solutions for the site wind development, also by proposing different RET. The outcomes are functional to the NDSM cooperative project. The Masterclass approach and method has been exhaustively described by Picchi et al. [33]. With regards to landscape integration and multifunctionality, the MC design activities are centred on the generation and storage of renewable energy while safeguarding multiple socio-cultural and ecological functions and the provision of as many ecosystem services as possible. The aim is to create potential added value for the local community and to enhance the overall landscape quality.

The outcomes of the design activities show that the IJ-plas water surface is a unique landscape entity, characterised by a perception of peacefulness and isolation, with views of the North Sea canal. The location can contribute to both the *genius loci* and energy generation. This landscape entity can host cultural and nature-integrated renewable energy systems co-owned and maintained by the local community. More specifically, the MC outcomes show an alternative number and position of wind turbines in the NDSM Energie cooperative site design: three at the vertex of an ideal triangle, to become a landmark highlighting the IJ-plas landscape. These are therefore supplemented with photovoltaic (PV) panel systems that generate RE while supporting biodiversity and recreation: this synergy is facilitated by a semi-floating PV system that supports the formation of vegetation and ground between land and water. The alignments of PV arrays follow the structure of the former 19th-century polder landscape. The three horizontal axis wind turbines are also supplemented by vertical axis wind turbines along the main walk and bike path. The latter is also intended as an energy route to explore the different ways a landscape can generate RE from local energy sources. Primary and secondary biomass contribute to the generation of thermal energy for the neighbourhood heat network. Finally, the deepest water of the IJ-plas is proposed to function as a site for energy storage (Figure 6).

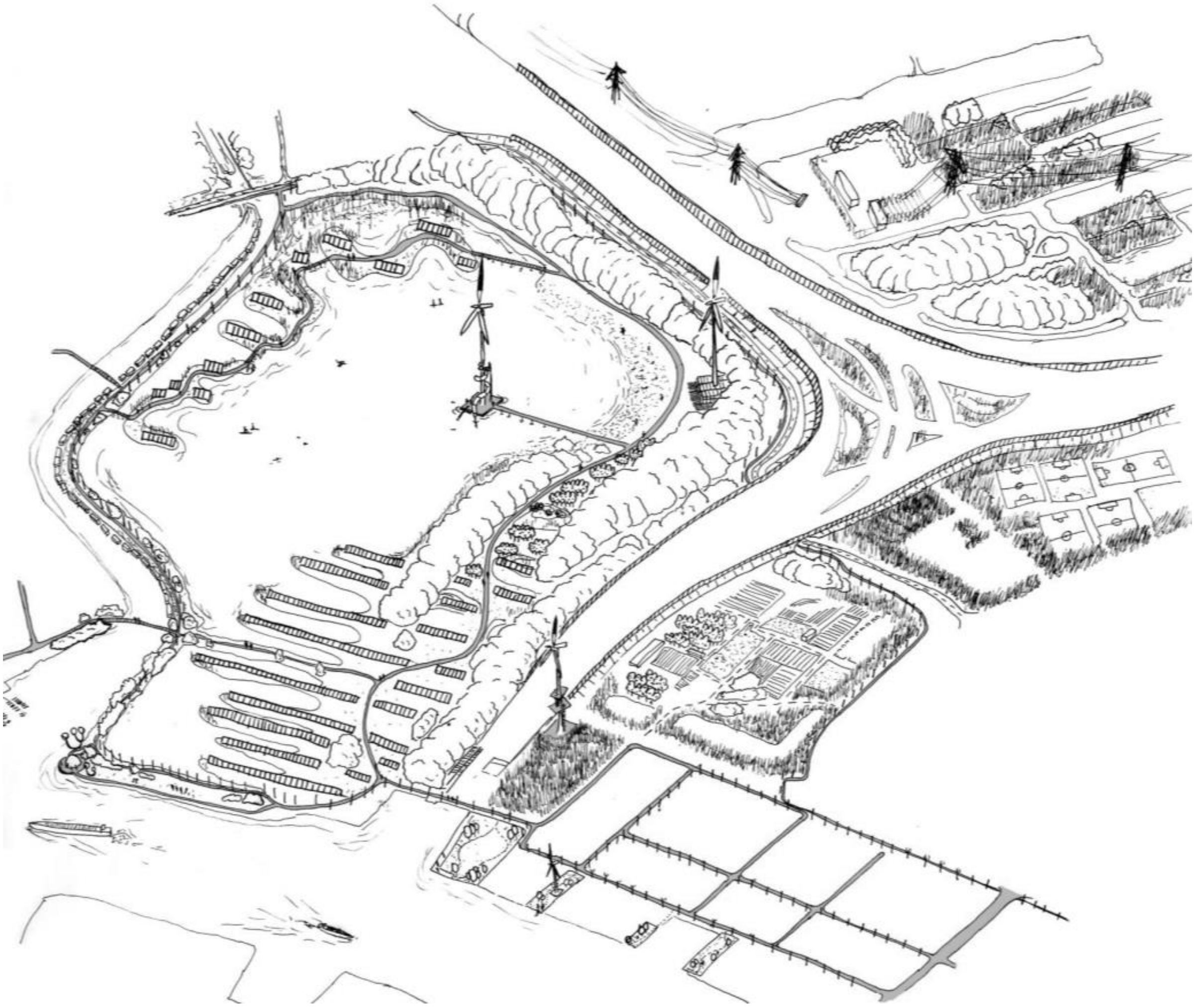

Figure 6. The drawing represents a bird-eye view of the design concept developed during the METRO Masterclass 2021 for the local implementation of RES NHZ wind development area 2A Noorder IJ-plas (by participant Jeroen Muller).

There was no community participation due to the nature of the MC activities (see [30]). Yet, the MC does take the findings from the NDMS cooperative participatory process into consideration.

3. Methods and Materials

An analysis of the application of the concepts landscape integration, multifunctionality and community participation was conducted by studying official policy documents (including guidelines), documents about the planning of implementation activities, reports on implemented activities and MC outcomes at the regional, local and site levels. The table below reports the list of analysed documents (Table 1).

Table 1. List of analysed documents and their sources.

Document Type	Title (Translated from Dutch)	Level	Source
Consultancy outcomes report	RES NHZ—perspective on spatial quality	Regional	https://energieregionhz.nl/app/uploads/2021/04/nhz-mer-en-milieueffecten.pdf (accessed on date 18 January 2022)
Regional strategy agenda	RES 1.0 Noord-Holland Zuid	Regional	https://energieregionhz.nl/app/uploads/2021/07/nhz-res-1-2021 0708.pdf (accessed on 18 January 2022)
Public consultancy outcomes report	RES 1.0 Thematic tables	Regional	https://energieregionhz.nl/thematafels (accessed on 31 January 2022)
Official design guidelines	Quality impulse solar parks Integration of solar parks into the North Holland landscape	Regional	https://api1.ibabs.eu/publicdownload.aspx?site=noordholland&id=1100089189 (accessed on 25 January 2022)
Consultancy outcomes report	Design process A9	Local	https://energieregionhz.nl/app/uploads/2021/03/Ruimtelijke-Samenhang-Rapport-A9-feb-2021.pdf (accessed on 1 February 2022)
Concept report	The wind vision. Space for windmills in Amsterdam	Local	https://www.commissiemer.nl/docs/mer/p25/p2582/2582-046 windvisie.pdf (accessed on 3 February 2022)
Participation plan report	Windmills cooperative Noorder-IJ-plas	Site	https://amsterdam-wind.nl/noorder-ij-plas/ (accessed on 6 July 2021)

The analysis is based on a 'narrative synthesis with a special focus' method, typical of qualitative research analysis [34]. The analysis is organised by grouping the main facts from each territorial level under landscape integration, multifunctionality and community participation. The rationale of the grouping is based on the need to step out of any current official distinction between territorial and administrative levels and to analyse the application and implementation of concepts as a unique inter-level process. This grouping will enable a more effective narrative synthesis per concept along the implementation processes. The narratives synthesis focuses on a sample of social and ecological factors, namely the *co-ownership and financial factors*, the *recreational factors*, the *ecological factors* and the *historical factors.* Those factors have been selected based on criteria of recurrency in the analysed documents at the three levels. For example, at the site level, the landscape integration can have higher application performance with regards to the co-ownership and financial factors, while there is no application regarding the ecological factors (so that the financial factors are well integrated in the social structure through participation, while energy development is not integrated in the natural or historical systems).

The metrics applied in the narrative synthesis give a qualitative assessment of the implementation process: a measure of the degree of application of concepts during the implementation process. This is based on the principles and adapted from the qualitative performance assessment of strategic planning processes as in Tapinos et al. [35], with a Likert scale scheme as showed in the table below (Table 2). The figure below (Figure 7) shows a graphic framework of the analysis process.

Table 2. Definition of the degrees of application for the qualitative performance assessment.

Degree of Application	Definition
0 points—No Application	-
1 point—Addressed	The application is mentioned as relevant in the general discussion, yet no further specification on how to apply it is mentioned
2 points—Guided	The application is guided through a sequence of procedural indications
3 points—Designed	The application is designed but not implemented
4 points—Implemented	The application is processed

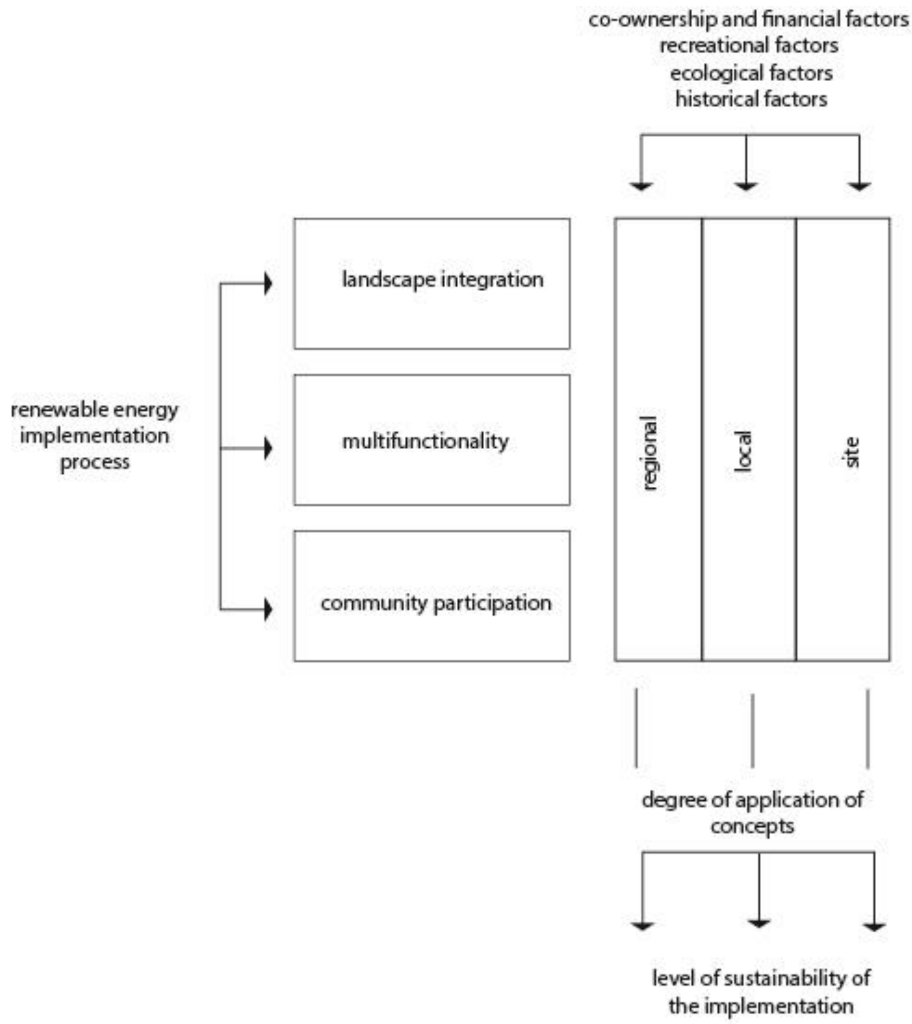

Figure 7. The graphic framework shows the analysis process.

With regards to the quality of the research: the heterogeneity of the facts used by the authors to interpret the application of the concepts necessitated a continuous check both in definition and application. The four MC editions each year involved actors from the three levels, providing the opportunity to validate the concept interpretation and application. This was performed with parties from the three territorial and administrative levels according to a triangulation of experts approach [36]. The following section will report the outcomes of the analysis.

4. Results

4.1. Landscape Integration

At the regional level, we found that landscape integration is applied when discussing spatial development principles. In RES NHZ, the question of landscape integration is considered relevant with regards to recreation and ecological factors. The level of application is minimal: the relevance of landscape integration is pointed out, and the province is asked to incorporate it in its regulations for spatial quality (for example the provincial Kwaliteitsimpuls Zonneparken suggests that PV arrays are laid out in such a way that they refer to historical landscape alignments) [37].

At the municipal level, landscape integration is implemented by adhering to the RES NHZ indications. Amsterdam prioritises it in the search for suitable areas and consultation plans. The concept is implemented in the planning for ecological, historical and recreational factors, and the municipality guides the way co-ownership and financial factors should be implemented at the site level.

At the site level the NDSM Energie participatory process complies municipality indications and implements the application of landscape integration. The way co-ownership and financial matters should fit into the site's social context is attentively designed in the participatory plan.

The landscape integration of wind turbines with regards to ecological, recreational and historical factors is applied in the maps of the available space for wind turbines [32]. Differently from the social factors, general indications are given of where turbines could be placed to guide further site design elaborations. Local stakeholders have given concrete information that has guided the design in terms of landscape integration. Complementary to the NDSM Energie work, the MC 2021 implemented landscape integration in design activities with regards to ecological, recreational and historical factors. The co-ownership and financial matters were taken in consideration in the design activities, but there was no further implementation, as these were not part of the MC objectives.

4.2. Multifunctionality

In RES NHZ 2021, multifunctionality is a relevant concept and applied in the guideline's design principles for potential development areas along the motorways A7 and A9. The concept is used to combine multiple functions such as solar energy generation, agriculture, recreation and symbolic value and nature development.

At the local level, Amsterdam strives for multifunctionality in the participatory plans: the municipality stresses the need to consider which spatial tasks can simultaneously be developed together with RE generation, in particular with regards to ecology and recreation. Yet, multifunctionality is not implemented in, for example, the process of scanning for suitable areas for wind energy development.

At the site level, the NDSM cooperative is not applying the multifunctionality concept in spatial terms. The participatory consultations rather revolve around how other landscape functions can be financially supported by energy development through the cooperative itself [32]. Multifunctionality was specifically implemented in the design activities of the MC 2021 with regards to ecological, recreational and historical factors, while the co-ownership and financial matters were merely pointed out as being relevant in the design process.

4.3. Community Participation

In RES NHZ, community participation is considered a relevant tool to foster the energy transition from a social point of view. Especially with regards to co-ownership and finances, specific guidelines for how to build up an effective participatory process are provided. Those are not provided for the spatial factors, such as the ecological one. The spatial factors are considered relevant in participation but more at the local scale.

The municipality of Amsterdam largely applies community participation, designing the format of the participatory processes to be implemented at the site level. The participatory processes focus on all factors apart from the historical ones. There is more concern for co-ownership and financial matters than for other factors. At the site level, the NDSM Energie cooperative organised participation in terms of all factors except the historical ones.

The MC 2021 did not directly engage with a participation process, but the outcomes stressed the relevance of co-design in the design thinking process for ecological, recreational, historical and co-ownership and financial matters. The figure below summarises the outcomes of the narrative synthesis analysis (Figure 8).

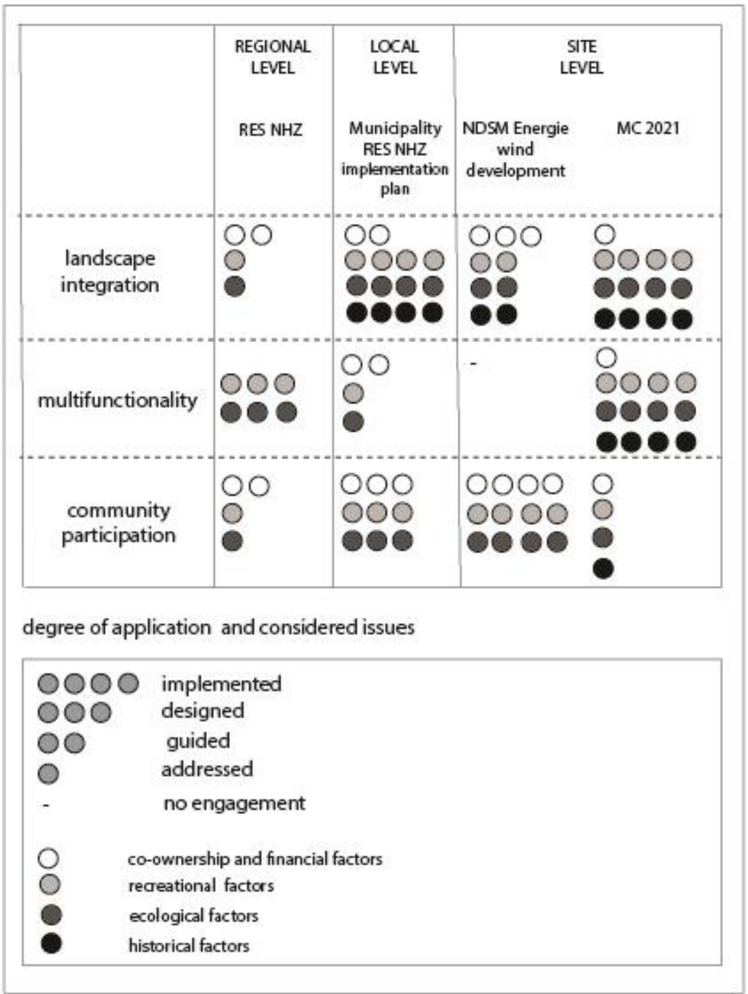

Figure 8. The matrix reports the outcomes of the narrative synthesis analysis: the dots represent the different degrees of application, while the different colours indicate the examined factors.

5. Discussion

With regards to landscape integration, a first discussion point emerges: how is landscape integration interpreted in the RE implementation process? The introduction of this paper stressed that stakeholders advocate landscape integration. Scholars such as Geels [20], Kemp and Loorbach [21], Westley [22] and Castan Broto et al. [14] highlight that the integration of landscape in existing SES can foster transitions and accommodate stakeholders. In the spatial planning of the municipality of Amsterdam, for example, landscape integration is interpreted as the placing of RE plants in land uses free of other functions, avoiding contacts and interactions with other uses and functions, thus missing out on the opportunity to create synergies between them. On the contrary, it is possible to interpret landscape integration through a SES perspective. Landscape integration is realized when there is support for RE initiatives at local and site levels. Think of energy communities, for example: RE plants are co-owned by a local community cooperative, meaning that they are integrated in a social system. This is in line with the literature that underlines the importance of social equity with regards to energy transition [7–9]. In Amsterdam, region and municipality guide the way participatory processes can support local initiatives for RE generation at the site level, and the NDSM Energie cooperative complies and implements it. Yet, if the social factors are the most relevant, there should be more of an effort to think about them jointly with the spatial factors of energy transition. The adoption of the SES approach in spatial planning as advocated by scholars such as Campos et al. [13], Castan Broto et al. [14], Holstenkamp [15] and Ghodsvali et al. [16] has not been implemented.

With regards to multifunctionality, a second discussion point emerges: how is multifunctionality interpreted in the RE implementation process? The introduction of this paper stresses that stakeholders advocate multifunctional RE plants. Local communities complain about the inaccessibility of sites that may take up a large part of the available space in their neighbourhood, as in the case of solar power plants. The interpretation of multifunctionality is different for each spatial level. For example, the municipality of Amsterdam interprets multifunctionality in a broader perspective compared with the regional level because they include social cooperation. This interpretation is aligned with the SES approach in planning, e.g., [13–16]. This comprehensive interpretation facilitates the creation of synergies between, for example, an energy community (social equity) and spatial functions such as recreation or biodiversity (ecological sustainability) at the site level. However, at the site level, we noticed how the energy cooperative falls short and does not truly implement SES thinking. Consequently, the gap between social and spatial factors persists during the RE implementation process.

With regards to community participation, a third point of discussion emerges: at the local and site levels, the social factors emerge as deserving more attention in the urban energy transition discourse. The social factors are also more often implemented through participation. In Amsterdam, however, spatial factors were hardly addressed during the participatory activities. It is only in the site design process during the MC 2021 that spatial factors (historical, ecological and recreational) receive concrete and deserved attention yet miss out on a truly inclusive participation of local stakeholders.

6. Conclusions

The aim of this research was to conduct an analysis of the application of three sustainability concepts—landscape integration, multifunctionality and community participation—during the energy transition at regional, municipal and site levels.

Landscape integration and multifunctionality are applied on all levels. Their interpretation, however, depends largely on what factors are considered most important at the different spatial levels. Social factors such as equity and spatial factors such as biodiversity and many others are not yet considered as interconnected topics in the implementation of energy transition. The sustainability of the energy transition in Amsterdam and elsewhere would benefit from social-ecological systems thinking.

Community participation—if present—attentively focuses on social factors and fails to interconnect them with the spatial factors. Yet, the literature affirms that combining both social and spatial factors may significantly foster transitions.

The 2021 Masterclass provided concrete examples of how landscape integration and multifunctionality can be fully implemented thanks to a social ecological system perspective. The interconnection of social and spatial factors fully justifies the application of landscape integration, multifunctionality and community participation concepts. Those three concepts, in turn, are beneficial to the sustainability of the implementation process at the regional scale.

Finally, the regional and local levels that currently demonstrate major abstraction and separation of social and spatial factors would benefit from effective exchange with the site level. At that scale, design activities are the arena to combine and reconcile social and spatial factors. These, in turn, will provide a solid foundation for the further advancement of sustainability with regards to energy transition and other transformative challenges.

Author Contributions: Conceptualization, P.P. and S.S.; methodology P.P. and D.O.; validation P.P.; formal analysis P.P.; investigation P.P.; resources, P.P.; data curation, P.P.; writing-original draft presentation P.P.; writing—review and editing S.S. and D.O.; visualization, D.O.; supervision, S.S.; project administration S.S.; funding acquisition, S.S. and D.O. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the municipality of Amsterdam, Department Ruimte en Duurzaamheid.

Data Availability Statement: All the available data are presented in this paper, no other data were created.

Acknowledgments: We would like to acknowledge the support for the METRO masterclasses by Maaike Zwaart, Hubertine Peters and Valerie Deckers at the municipality of Amsterdam, Department Ruimte en Duurzaamheid, and the active participation of the civil servants from the municipality during the four editions of the masterclass. We would also like to thank Alessandra Scognamiglio, ENEA, for promoting and supporting the publication of this paper in the special issue "Energy Transition and Cities: Renewable Energy Storage, Production and Social Issues". We would also like to thank ETA-Florence Renewable Energies, Angela Grassi, for the support during the final phase of this paper.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. EU. Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the Promotion of the Use of Energy from Renewable Sources (Recast). 2018. Available online: https://eur-lex.europa.eu/eli/dir/2018/2001/oj (accessed on 23 April 2019).
2. Kempenaar, A.; Puerari, E.; Pleijte, M.; van Buuren, M. Regional design ateliers on 'energy and space': systemic transition arenas in energy transition processes. *Eur. Plan. Stud.* **2021**, *29*, 762–778. [CrossRef]
3. Nassauer, J.I.; Opdam, P. Design in science: Extending the landscape ecology paradigm. *Landsc. Ecol.* **2008**, *23*, 633–644. [CrossRef]
4. Laviscio, R. Paesaggio ed energie rinnovabili. Il supporto degli Enti territoriali ad una progettazione integrata. *Ri-Vista. Res. Landsc. Archit.* **2018**, *16*, 66–85.
5. Van der Horst, D.; Vermeylen, S. Local rights to landscape in the global moral economy of carbon. *Landsc. Res.* **2011**, *36*, 455–470. [CrossRef]
6. Pasqualetti, M.J. Morality, space, and the power of wind-energy landscapes. *Geogr. Rev.* **2000**, *90*, 381–394. [CrossRef]
7. Brown, D.; Hall, S.; Davis, M.E. What is prosumerism for? Exploring the normative dimensions of decentralised energy transitions. *Energy Res. Soc. Sci.* **2020**, *66*, 101475. [CrossRef]
8. Szulecki, K.; Overland, I. Energy democracy as a process, an outcome and a goal: A conceptual review. *Energy Res. Soc. Sci.* **2020**, *69*, 101768. [CrossRef]
9. Trahan, R.T.; Hess, D.J. Will power be local? The role of local power organizations in energy transition acceleration. *Technol. Forecast. Soc. Change* **2022**, *183*, 121884. [CrossRef]
10. Stremke, S.; Picchi, P. Co-designing energy landscapes: Application of participatory mapping and. In *Handbook on the Geographies of Energy*; Edward Elgar Publishing: Cheltenham, UK, 2017.
11. Stremke, S.; Oudes, D.; Picchi, P. (Eds.) *The Power of Landscape—Novel Narratives to Engage with the Energy Transition*; Nai010 Publishers: Rotterdam, The Netherlands, 2022; ISBN 978-94-6208-716-3.
12. Europe, C.O. European Landscape Convention. Report and Convention. 2000. Available online: https://www.coe.int/en/web/conventions/full-list?module=treaty-detail&treatynum=176 (accessed on 18 January 2022).
13. Campos, I.; Marín-González, E.; Luz, G.; Barroso, J.; Oliveira, N. Renewable Energy Prosumers in Mediterranean Viticulture Social–Ecological Systems. *Sustainability* **2019**, *11*, 6781. [CrossRef]
14. Castán Broto, V.; Trencher, G.; Iwaszuk, E.; Westman, L. Transformative capacity and local action for urban sustainability. *Ambio* **2019**, *48*, 449–462. [CrossRef]
15. Holstenkamp, L. What do we know about cooperative sustainable electrification in the global South? A synthesis of the literature and refined social-ecological systems framework. *Renew. Sustain. Energy Rev.* **2019**, *109*, 307–320. [CrossRef]
16. Ghodsvali, M.; Dane, G.; de Vries, B. The nexus social-ecological system framework (NexSESF): A conceptual and empirical examination of transdisciplinary food-water-energy nexus. *Environ. Sci. Policy* **2022**, *130*, 16–24. [CrossRef]
17. Leach, M.; Reyers, B.; Bai, X.; Brondizio, E.S.; Cook, C.; Díaz, S.; Espindola, G.; Scobie, M.; Stafford-Smith, M.; Subramanian, S.M. Equity and sustainability in the Anthropocene: A social–ecological systems perspective on their intertwined futures. *Glob. Sustain.* **2018**, *1*, e13. [CrossRef]
18. Boon, F.P.; Dieperink, C. Local civil society based renewable energy organisations in The Netherlands: Exploring the factors that stimulate their emergence and development. *Energy Policy* **2014**, *69*, 297–307. [CrossRef]

19. RES NHZ. 2.7 TWh Duurzame Energie in 2030. Noord Holandse Energie Regio. 2021. Available online: https://energieregionhz.nl/app/uploads/2021/07/nhz-res-1-20210708.pdf (accessed on 22 January 2022).
20. Geels, F.W. From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Res. Policy* **2004**, *33*, 897–920. [CrossRef]
21. Kemp, R.; Loorbach, D. Dutch Policies to Manage the Transition to Sustainable Energy. 2006. Available online: https://repub.eur.nl/pub/7629/DRIFT-2006-002.pdf (accessed on 24 January 2022).
22. Westley, F.R.; Tjornbo, O.; Schultz, L.; Olsson, P.; Folke, C.; Crona, B.; Bodin, Ö. A theory of transformative agency in linked social-ecological systems. *Ecol. Soc.* **2013**, *18*, 27. [CrossRef]
23. Scognamiglio, A. 'Photovoltaic landscapes': Design and assessment. A critical review for a new transdisciplinary design vision. *Renew. Sustain. Energy Rev.* **2016**, *55*, 629–661. [CrossRef]
24. Toledo, C.; Scognamiglio, A. Agrivoltaic Systems Design and Assessment: A Critical Review, and a Descriptive Model towards a Sustainable Landscape Vision (Three-Dimensional Agrivoltaic Patterns). *Sustainability* **2021**, *13*, 6871. [CrossRef]
25. Oudes, D.; Brink, A.V.D.; Stremke, S. Towards a typology of solar energy landscapes: Mixed-production, nature based and landscape inclusive solar power transitions. *Energy Res. Soc. Sci.* **2022**, *91*, 102742. [CrossRef]
26. Oudes, D.; Stremke, S. Next generation solar power plants? A comparative analysis of frontrunner solar landscapes in Europe. *Renew. Sustain. Energy Rev.* **2021**, *145*, 111101. [CrossRef]
27. *Sustainable Energy Landscapes: Designing, Planning, and Development*; Stremke, S.; van den Dobbelsteen, A. (Eds.) CRC Press: Boca Raton, FL, USA, 2012.
28. Arler, F. A five-step model for ethically informed decision-making. In *Theoretical and Applied Ethics*; Aalborg Universitetsforlag: Aalborg, Denmark, 2013; pp. 39–64.
29. Picchi, P.; Verzandvoort, S.; Geneletti, D.; Hendriks, K.; Stremke, S. Deploying ecosystem services to develop sustainable energy landscapes: A case study from The Netherlands. *Smart Sustain. Built Environ.* **2022**, *11*, 422–437. [CrossRef]
30. SER. *Ontwerp Klimaatakkoord*; SER: Den Haag, The Netherlands, 2018. Available online: https://www.klimaatakkoord.nl/binaries/klimaatakkoord/documenten/publicaties/2018/12/21/ontwerp-klimaatakkoord/Ontwerp+van+het+Klimaatakkoord_compleet_web.pdf (accessed on 24 January 2022).
31. Ontwerptraject A9. Ruimtelijke-Samenhang-Rapport. Amsterdam. 2021. Available online: https://energieregionhz.nl/app/uploads/2021/03/Ruimtelijke-Samenhang-Rapport-A9-feb-2021.pdf (accessed on 24 January 2022).
32. NDSM Energie. Coöperatieve Windmolens Noorder IJ-Plas. Hoe Maken We er Onze Molens Van? Participatieplans. Amsterdamwind. 2020. Available online: https://amsterdam-wind.nl/noorder-ij-plas/ (accessed on 6 July 2021).
33. Picchi, P.; Oudes, D.; Stremke, S. Linking research through design and adult learning programs for urban agendas: A perspective essay. Ri-Vista. *Res. Landsc. Archit.* **2020**, *18*, 198–213.
34. Campbell, M.; McKenzie, J.E.; Sowden, A.; Katikireddi, S.V.; Brennan, S.E.; Ellis, S.; Hartmann-Boyce, J.; Ryan, R.; Shepperd, S.; Thomas, J.; et al. Synthesis without meta-analysis (SWiM) in systematic reviews: Reporting guideline. *BMJ* **2020**, *368*, l6890. [CrossRef] [PubMed]
35. Tapinos, E.; Dyson, R.G.; Meadows, M. The impact of performance measurement in strategic planning. *Int. J. Product. Perform. Manag.* **2005**, *54*, 370–384. [CrossRef]
36. Patton, M.Q. Enhancing the quality and credibility of qualitative analysis. *Health Serv. Res.* **1999**, *34 Pt 2*, 1189–1208.
37. Kwaliteitsimpuls Zonneparken. Kwaliteitsimpuls Zonneparken Inpassing van Zonneparken in Het Noord-Hollandse Landschap. 2020. Available online: https://api1.ibabs.eu/publicdownload.aspx?site=noordholland&id=1100089189 (accessed on 25 January 2022).