The increasing entry of the energy subject in spatial planning policies: new visions for energy landscapes

Pistoni Roberta
École nationale supérieure de paysage de Versailles Marseille, LAREP
r.pistoni@ecole-paysage.fr

Abstract

The energy topic is of great concern to our society, because of the increasing tensions of fossil resources supply and emission of greenhouse's gas to the atmosphere resulting in climate change. The landscapes we live in are transforming and becoming increasingly complex in their relationship to energy and we can observe an evolution of the European and national directives and laws progressively increasing the place of energy in spatial planning policies as well as the subject of the ordinary landscape. The spatial planning documents are participating in changes and the evolution of landscapes and they are developing new visions for future energy landscapes. The research explores and compares the spatial planning system in France and the Netherlands, enabling to follow the evolution of two different planning cultures, as they incorporate new relationships between energy and landscape.

Key words: France, Netherlands, renewable energy production, energy sufficiency

1. Energy Transition and Changing Landscapes

From an energy point of view, each territory is an open thermodynamic system with inputs and outputs of energy (Stremke, van den Dobbelsteen and Koh, 2011). In every territory, whether urban or rural, energy is more or less intensely consumed and potentially produced; these actions are closely dependent on local characteristics, both natural (such as topography) and human (technical, economic, etc.) (Mérenne-Schoumaker, 2007). However, over the centuries, we have witnessed a progressive disconnection between society, its territory, and its resources (Magnaghi, 2010), and consequently its landscape. Gradually, due to the exponential use of fossil resources, the link between consumption and production sites has been broken. This rupture has led to the forgetting of the 'localization' of energy resources and has been accompanied by the decline in knowledge and know-how in energy management, which, for example, used to guide the construction of houses according to the correct orientation to benefit from maximum solar gains. Suddenly, all of this was no longer necessary: the power of energy seemed to solve all problems thanks to technological development.
Today, the ecological awareness of the depletion of fossil resources and the environmental destruction associated with their exploitation changes the game. With climate change as a contributing factor, we are witnessing attempts to reverse this trend, and the stakes for a transition towards a low-carbon and efficient energy system are becoming increasingly important in national and international discourse. The current energy transition requires space, with all the implications this entails for the landscape in a nearby 'here' instead of the indefinite 'elsewhere' of fossil resources. On the stage of the energy debate, localization thus brings with it the question of the landscape, where are combined functions related to energy production

from renewable sources, reduction of energy consumption as well as the optimization of energy flows (Stremke, Oudes and Picchi, 2022).

Landscape is here addressed according to the European Landscape Convention (2000) as perceived and conceived by the people and whose character is the result of the action and interaction of natural and/or human factors. So this convention puts a dynamic approach towards landscape and in the Recommendations on the guidelines for its implementation is stated at point E to 'Integrate the landscape dimension in territorial policies' that 'The landscape dimension should be included in the preparation of all spatial management policies, both general and sectoral, in order to lead to higher-quality protection, management or planning proposals' (CM/Rec(2008)3, 1-E). So ELC encourages including landscape concerns in the national planning systems and after the ratification of the convention by the different nations these systems are progressively including landscape, potentially going beyond the preservation of exceptional landscape and in the direction of a more operational and extended concept of ordinary landscape.

Moreover in Europe, after several directives (e.g. energy package 20-20-20 of 2009, REpowerEU 2022) and national laws (e.g. LTECV in France) the energy topic has entered the spatial planning system in national contexts (Lopez, Pellegrino and Coutard, 2019), due to the need to give a regulatory framework, for examples of the choice of sites for renewable energy technologies in territories but also to improve the energy sufficiency in the built environment.

Therefore, potentially planning instruments could combine the landscape and energy topics and address them together. The understanding of this connection could be useful because it is recognized that the planning instruments participate in changes and the evolution of ordinary landscapes (Labat and Donadieu, 2013), so their analysis leads to an understanding if landscape is consciously addressed in these documents and if these landscapes 'changes' are intentionally thought out. Otherwise landscape, conceived as our living environment, could be an unplanned consequence, resulting from the superposition of different planning strategies and actions for energy management.

The research establishes an international comparison between France and the Netherlands, two nations that have integrated strategies for transitioning from fossil fuels to renewable and decarbonized energy sources into their political agendas, as confirmed by the latest documents: 'Klimaatakkoord' 2019, 'Loi Climat et Résilience' 2021. However, there are differences in the timing of their commitment as well as in the public policies and planning instruments linking space and energy that allow to put the results into perspective. Moreover the Netherlands is a nation with a surface area of 1/13 of the French one with a population density about four times higher than the French one, differences that could lead to differences in the way to approach spatial planning.

In the following section we explore the French and Dutch planning instruments to study if, and to what extent landscape and energy are treated together. The guiding questions are: in planning documents when addressing the energy transition process is landscape considered mainly in its visual and esthetical component as something to be preserved? Or is landscape addressed as an evolving and dynamic entity to be planned and designed?

2. The Potential relation between energy and landscape in the planning system in France and the Netherlands

This section is not an exhaustive vision of all the documents and ways in which energy is addressed in the planning system, but the goal is to give a general overview illustrating the type of documents existing in the two nations and their possible link with the energy and landscape topic.

In France we assist to a progressive inclusion of the energy topic in the spatial planning documents, in particular with the two Laws 'Grennelle de l'Environnment' (2009-20010), which emphasised the trend for a territorialization of climate and energy policy in France (Nadai et al. 2015) and which introduced a new planning documents the 'Plan climat énergie territorial' [Territorial climate energy plan] (PCET) compulsory for municipalities or inter-municipalities with more than 50.000 inhabitants. Subsequently with the law 'Loi transition énergétique pour la croissance verte' [Law energy transition for the green growth] (LTECV) the PCET become the 'Plan climat aire énergie territorial' [Territorial climate air energy plan] (PCAET), becoming compulsory for all municipalities and inter-municipalities counting 20.000 inhabitants, therefore greatly expanding the number of local communities that need to develop this plan, compared to the PCET.

In France, the energy topic seems to be more prominent in the planning system when compared to the Dutch one, because there are compulsory and specific documents which have to treat the energy subject at all the territorial levels, such as the 'Schéma régional d'aménagement de développement durable et d'égalité des territoires' [Regional scheme for spatial planning, sustainable development and territorial equality] (SRADDET) setting energy ambitions for the region and the PCAET a document that focuses on climate, air and energy to establish goals for a territory (inter-municipality) on short and long terms and to define actions, to implement them.

Moreover there are other planning documents that address several subjects including energy. One is the 'schémas de cohérence territoriale' [Territorial Coherence Scheme] (SCoT) a planning instrument that guarantees the implementation of strategic inter-municipal planning and it ensures the reference framework and coherence with different sectoral policies such as infrastructure, mobility, energy and climate, etc. Another document is the 'plan local d'urbanisme intercommunal' [Local urban inter-municipal Plan] (PLUi), a planning instrument at inter-municipal scale, that determines a global project for spatial and urban planning and which determines the conditions for land use and its development. This document could integrate several energy topics, such as the development of wind parks, photovoltaic parks, heat networks and energy sufficiency. For example, the PLUi could impose on new construction a minimum amount of renewable energy production and insulation.

In the Netherlands, the planning system, fixed by the 'Wet Ruimtelijke Ordening' [Spatial planning act] (WRO) of 2008, is more flexible and seems to favour integrated planning instruments (Janssen-Jansen and Woltjer, 2010). Compulsory energy focused planning documents that all provinces or municipalities have to elaborate do not exist. However the importance of introducing energy in planning instruments is recognized and it is compulsory to deal with energy, both from a renewable energy production than energy sufficiency perspective, in the *structuurvisie* [structural vision] which defines the strategic point of view for spatial development, and set actions for the provinces and for the municipalities. Every tier could

develop several *structuurvisie* that could be centered on a specific topic (e.g. agriculture) or that could be cross-sectoral. Moreover in the zoning plan (*bestemmingsplan*), which establishes the land uses, their development and regulations at municipal level, energy topics could be included for example defining the areas for renewable energy production and the rules on how to implement them.

A particular approach is reserved, however, for the wind turbine planning policy, following the Energy Agreement for Sustainable Growth (2013), which settles the national objective of 6000 MW of electricity production from onshore wind turbines. The national government required provinces and municipalities to integrate it in their planning instruments, defining suitable areas on national territory for its implementation, in a very top-down perspective. The only national *structuurevisie* that is energy focused deals with wind energy development (Structuurvisie Windenergie op land, 2014). This planning system is now in progress of changing due to the Environment and Planning Act [Omgevingswet] that came into effect in 2024.

Concerning the connection between landscape and energy in several French and Dutch planning instruments there is the possibility to establish a connection, but this is left to the discretion of local institutions in both countries. This means that in the Netherlands in the *structuurevisie* of provinces and municipalities or in the municipal *bestemmingsplan* these topics could be adressed together, although there is no obligation to do so. France seems to be potentially well equipped to enhance this integrated vision through the PLUi and SCoT, that operate at an inter-municipal level and deal with both energy and landscape concerns, and therefore could create synergies between the two subjects.

In particular now, the relationship between landscape and energy is specifically mentioned for the elaboration of the SCoT. It can be read in the orientation and objective document in Article L. 141-4 3° of the Urban Planning Code that the SCoT relies, among other things, on 'the preservation and enhancement of landscapes, with the objective of integrating and enhancing the landscape quality of various human activities, notably renewable energy production and transportation installations.' On the other hand, the French PCAET which is the energy and climate focused, do not have to address any link with landscape, and often even a spatial approach is not addressed.

3. The Path towards Energy Transition of three Territories

In order to give insight on how these energy landscape topic is treated specifically in planning documents, at different scales, three territories are analysed: two 'Territoires à énergie positive' [Energy positive territories] (TEPOS) in France, the Community of Communes (CC) des Monts du Lyonnais and the CC du Thouarsais, and one in the Netherlands, the municipality of Goeree-Overflakkee (Province of Zuid-Holland/South Holland). All three territories have set ambitious energy goals both from renewable energy production and energy sufficiency at the horizon 2030-2050, with an affirmed intention to integrate them with landscape considerations. Although they could not be defined as representative for other territories, the reason to choose them was: to inquire about possible 'best practices' of what is feasible to accomplish. The results, however, draw attention to several limits on how landscape and energy transition are

included in these documents. These territories, comparable in dimension and are rural, but also include urban areas, and are they are characterised by 'ordinary' landscape, meaning that they are not the object of particular degree of safeguards for heritage or natural characteristics (e.g. UNESCO).
The case studies were explored through an analysis of the different planning documents, from the regional to the inter-municipal and municipal scale and completed by semi-structured interviews with the technical services in charge of the development of the planning documents as well as elected representatives.

3.1 *Communauté de communes* Monts du Lyonnais

The idea of commitment to the energy transition process of the CC of Monts du Lyonnais started in connection with the building sector in 2006. According to the interviews developed with the energy transition technical service and an elected representative, the starting point of the gradual commitment to the transition process was the creation and development of the 'Parc Eco Habitat' a resource and information centre about retrofitting techniques and environmentally friendly construction.
Subsequently the local institutions of the CC Monts du Lyonnais were awarded the call for 'expressions of interest' (AMI) launched by ADEME and the Rhone-Alpes region in 2012, to encourage territories to commit and achieve TEPOS objectives for 2050. So in 2013, territorial local institutions engaged in a volunteer PCET thanks to the economic support of the AMI-TEPOS award call. Subsequently and according to the news rules settled by the law LTECV of 2015 the CC Monts du Lyonnais developed a compulsory PCAET.
The landscape perspective was introduced in 2013 through the development of a landscape plan financed by the ministry of environment and finalised in 2017, in order to be included in the SCoT that was in the process of revision and update. In the commission of the landscape plan the energy issue was not explicit in the initial request, but it emerged as a priority during a public workshop with local stakeholders such as elected officials, technicians, and residents, organised by the landscape architect responsible for developing the landscape plan. Several topics were displayed based on the landscape analysis, and the present stakeholders had to choose among the priority objectives, with energy being highlighted. However, according to the interviews the landscape plan, even if it was centred about energy, it was not really used to support the elaboration of the PCAET which started in 2016.

3.2 *Communauté de communes* Thouarsais

The local institutions have since long addressed the energy subject in the territory of CC Thouarsais, through the development of renewable energy projects, where in 1984 a swimming pool heated with solar panels was constructed. Since then several projects followed, one of the bigger was the 'Technologies Innovantes pour la Production d'Énergies Renouvelables' [Innovative technologies for renewable energy production] (TIPER); with the objectives of high rates of renewable energy production from several different technologies: photovoltaic, wind energy, biogas, in an area with polluted ground soil. This interest and commitment towards the

energy subject, that also allowed economic implication, brought the CC Thouarsais to be one of the founder territories of TEPOS network in 2010.
In this context the elaboration of the landscape plan of the CC Thouarsais has been conceived from the beginning by local institutions with a primary focus on achieving energy objectives to become TEPOS. The landscape plan comes in 2017-2018 at a time when the CC was developing a PCAET in which the development of additional wind turbines, photovoltaic and biogas projects were addressed. The landscape plan was seen as a tool capable of informing a renewable energy development more grounded and integrated in the landscape. Moreover the landscape plan fed into the PLUi, which was being developed during the same period, and particularly the territorial institutions decided to elaborate an 'Orientation d'aménagement et de programmation' [Planning and Programming Orientation'] (OAP), a part of PLUi, on the theme of 'Energy and Landscape' focused on wind energy development to establish a framework and a support tool for deploying new parks well integrated into the landscape. It is interesting to note that this OAP is binding for local institutions, whereas a landscape plan is not, stressing the importance for the CC to develop defined orientation for the development of wind parks on the territory, which were starting to raise some opposition.

3.3 The municipality of Goeree-Overflakkee

In Goeree-Overflakkee the starting point to engage in energy spatial planning has been the Energy Agreement for Sustainable Growth (2013), which sets goals at national scale for energy sufficiency of 100 PJ and a production of 6,000 MW of onshore wind energy by 2020. The local institution of Goeree-Overflakkee in 2013 commissioned a landscape architecture firm to create a document linking landscape and energy: 'Goeree-Overflakkee, Sustainable Energy in the Landscape.' This document was developed following the definition of national goals, distributed top-down among the different provinces, where the municipality, given its low population density, was identified for the production of 300 MW of onshore wind turbines.
The aim of this landscape study was to analyse the current state and develop different scenarios for analysing local resources and the location of renewable energy production facilities in the landscape going beyond just wind energy. This study served as a tool for understanding and supporting negotiations with the Province of Zuid-Holland for a reduction to a wind production of 225 MW, filling the gap with an energy mix from photovoltaic panels and biogas production, considering the agricultural and breeding activities of the territory.
Moreover the document contributed to developing the provincial-level planning *Structuurvisie Ruimte en Mobilitiet* (2014) [Structural Vision for Space and Mobility] and at the municipal-level the urban documents like *Structuurvisie Goeree-Overflakkee windenergie* (2014) and *bestemmingplan* [zoning plan]. This landscape document was particularly used for defining wind development zones and criteria on how to implement them.
Recently, following the 'Nationaal Klimaatakkoord' [National Climate Agreement] in 2019, a new national program called 'Regionale Energie Strategieën' [Regional Energy Strategies] (RES) has been introduced in the Netherlands. This program, led and coordinated from national to municipal level, mandates the development of territorial energy strategies for the 30 identified territories covering the entirety of the Netherlands. Each territory must outline in its RES how and to what extent it will contribute to the production of renewable electricity, the

transition of the heating system in the built environment, as well as energy storage and infrastructure. The national objective is to produce at least 35 TWh of electricity from renewable sources and reduce CO2 emissions by 49% by 2030. It is explained that the different territories have 'to make the *Regionale Energie Strategieën* (qualitative and quantitative) spatially possible' (Climate agreement., p. 223). The local institutions of Goeree-Overflakkee were among the first to commission a consortium of architects, landscape architects, urban planners, and engineers to conduct a study on three spatial and landscape energy scenarios for the development of Regional Energy Strategy: 'Energy Production in Goeree-Overflakkee. Scenarios for Sustainable Energy Supply by 2030' (2017). The three scenarios address renewable energy production through a technologies mix, as well as consumption reduction and optimization of flows, also addressing building renovation and transport infrastructure systems. These documents are the basis for developing and implementing the new Environment and Planning Act [Omgevingswet], which is in progress, and changing the content and process of the previous planning system.

4. A Crossed Perspective of the Planning Documents of the French and Dutch Territories

4.1 Connection between Landscape and Energy in the Planning Documents

Table 1 sums up the results found in the analysed documents between energy transition, operational principles and their connection or not to the word landscape. I inquired about energy principles which are defined both as operational principles which implementation could impact landscape changes (e.g. development of wind turbine and photovoltaic panels), but also as spatial/landscape design principles which, if implemented, could improve energy management (e.g. building orientation to maximise solar gains). In the table renewable energy production and energy sufficiency measures are addressed separately, because they are each energy transition pillars for which distinctions appear in planning documents.

Table 1, Sum up the energy transition highlighted actions appearing in planning documents in the three analysed territories, highlighting their connection with landscape. The landscape plan and the Dutch landscape focused report. Green background colour corresponds to the explicit connection of the energy action with the word 'landscape' word. The white background colour means that the action detailed could lead to landscape repercussion but the connection is not established in the document.

	Renewable energy production	**Energy sufficiency**
CC MONTS DU LYONNAIS (FR)		

SRADDET- Schéma régional d'aménagement de développement durable et d'égalité des territoires - 2019	Wind turbine implementation: landscape preservation	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
SRCAE - Schéma régional du climat, de l'air et de l'énergie - 2014	Wind turbines and on ground PV implementation: landscape integration	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
	Hydroelectric, wood energy, biogas technologies implementation	
SRE - Schéma regional éolien - 2012	Integrating wind turbines in landscape from the site choice to their implementation phase: landscape design principles	/
PCET - Plan climat énergie territorial - 2015	Wind turbine implementation: landscape preservation	Compact settlements form, building retrofitting, slow mobility, etc.: spatial designing principles for low energy consumption
	Biogas, photovoltaic panels, hydroelectric technologies implementation	
PCAET - Plan climat aire énergie territorial – 2019	- Wind turbine implementation: landscape preservation -Wood-energy sector: exploitation and preservation of the forest as a strong element in the landscape	Compact settlements form, building retrofitting, slow mobility etc.: spatial designing principles for low energy consumption
	Biogas, photovoltaic, hydroelectricity facilities implementation	
SCoT - Schéma de cohérence territorial - 2016	- To develop a mix of RE technologies projects: landscape integration - PV implementation: landscape integration	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
Plan de paysage - 2016	PV panels implementation and wood energy sector development: landscape design principles	Energy building retrofitting: landscape design principles
CC THOUARSAIS (FR)		
SRCAE - Schéma régional du climat, de l'air et de l'énergie – 2013	Development of trees and hedges for wood energy: landscape as a basis for the development	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
	Wind turbines, photovoltaic panels, solar heating, biogas power plant,	

	agrofuel, geothermal technologies implementation	
SRE - Schéma regional éolien - 2012	Wind turbines, landscape design integration principles and site plans	/
SRADDET - Schéma régional d'aménagement de développement durable et d'égalité des territoires - 2020	- Implementation for wind turbines and PV parks: landscape preservation	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
PCAET - Plan climat aire énergie territorial - 2018	- Implementation for wind turbines and PV parks: landscape preservation - *Bocage* landscape suitable for the development of wood energy sector	Energy building retrofitting, raising inhabitant awareness of territory inhabitants: spatial design principles for low energy consumption
	Biogas, solar heating, geothermal technologies implementation	
SCoT- Schéma de coherence territorial - 2018	RE technologies implementation to be reconciled with landscape issues	Building retrofitting, new high energy performance buildings, slow mobility, etc.: spatial design principles for low energy consumption
PLUi - Plan locale d'urbanisme intercommunal- 2018	RE development in agricultural land holdings: landscape integration	Compact settlements form, building retrofitting, new high energy performance buildings, slow mobility, etc.: spatial design principles for low energy consumption
	- Possible rules derogation for RE technologies implementation in buildings -Specific principles for PV integration in buildings.	
Orientation d'aménagement et de programmation (OAP), landscape & energy – 2018	- Landscape design principles for wind turbine site plans - design principles for landscape integration	/
Plan de paysage – 2018	- Energy transition landscape analysis - Wind turbines, photovoltaic panels, wood energy, biogas technologies implementation: listing of landscape design principles (there is no a detailed action plans)	Energy building retrofitting, slow mobility, local food production systems, raise awareness about sustainable behavior: listing landscape design principles (there is no a detailed action plans)

GOEREE-OVERFLAKKEE (NL)		
Structureevisie windenergie – 2014	Wind turbine site choice for implementation. Landscape design principles	/
Structureevisie Goeree-Overflekkee – 2011	Implementation of a RE technologies from a mix of sources (wind, sun, tidal, geothermal): possible landscape compensations	Energy building retrofitting, building by good solar orientation: spatial design principles for low energy consumption
Bestemmingsplan (zoning plan)	- Principles/rules for wind turbines and photovoltaic panel facilities implementation. - Site choice for wind turbines and on ground photovoltaic parks.	Rules for energy-saving measures in building, to avoid sprawled settlement: spatial design principles for low energy consumption
Landscape report: 'Goeree-Overflakkee. Sustainable energy in the landscape' – 2012	Landscape design principles for RE technologies implementation	/
Landscape report: 'Energy producing Goeree-Overflakkee. Scenarios for making the energy supply more sustainable until 2030' - 2017	Several scenarios for RE technologies (wind turbine, photovoltaic panels, tidal, geothermal) implementation: landscape design principles.	Several scenarios for energy building retrofitting, high-performance new buildings, slow mobility: landscape design principles for low energy consumption
Province Zuid-Holland Structureevisie Ruimte & Mobilitet. Visie - 2014	- Wind turbine implementation: landscape integration - Photovoltaic parks: landscape impact Geothermal implementation	Energy cascading from industrial, to residential, energy building retrofitting, high energy performance buildings, slow mobility, etc.: spatial design principles for low energy consumption
Province Zuid-Holland Structureevisie Ruimte & Mobilitet. *Programma ruimte* (spatial program) - 2014	- Wind turbine implementation: landscape integration - Photovoltaic parks: landscape impact Geothermal implementation	Energy-efficient buildings, heat networks, etc.: spatial design principles for low energy consumption
Province Zuid-Holland Structureevisie Ruimte & Mobilitet. Verordening ruimte (spatial regulations) - 2014	Wind turbines implementation	/

The first visible result is that landscape direct concern both in France and in the Netherlands is associated with wind parks. The landscape impact of renewable energy technologies implementation remains the most debated landscape issue towards energy transition in France as in the Netherlands. Wind turbine implementation principles are directly related to their landscape impact most of the time. Here is where landscape is mostly addressed by a preservation point of view. This is followed by the landscape concerns around PV parks on the ground, connected to the visual impact and also about preserving agricultural land.

The preservation of landscape aesthetics is a point of view broadly addressed everywhere and to which is recognized much attention especially for the development of renewable energy technologies in order to 'preserve scenic values' (e.g. Apostol *et al.*, 2016) even if aesthetics and sentiment of beauty is recognized to be something variable through time and space.

However the majority of documents address several types of renewable energies technologies implementation, such as biogas power plants, but there is no direct connection with landscape characteristics in these cases. We find this primary focus on wind turbines also because there are several specific planning instruments devoted to wind turbines, for instance, the obligatory 'Scheme regional eolienne' [regional wind turbine scheme] (SRE) at regional level in France, or the wind energy and landscape OAP voluntarily developed in the CC Thouarsais, or in Goeree-Overflakkee the *structuurvisie windenergie*. There are no other documents specifically developed about other renewable energy technologies such as photovoltaic parks. However, in France, the law LTECV introduced a new document the 'schéma régional biomasse' [regional biomass scheme] with the goal to estimate biomass potential and its accessibility in the region in order to facilitate the development of renewable energy production. This shows an enlargement, compared to the sole wind turbine SRE focus, but in the territories under analysis these documents were still under elaboration with no possibility to examine them. In the Netherlands it is possible to develop several *structureevisie* about different topics estimated to be of relevance for the territory. In Goeree-Overflakkee, regarding energy transition, only the one wind-energy exists, showing that, as compared to other sources, their site plans and implementation remain the main concern. Indeed, the binding regulations of the Province Zuid-Holland in its *structuurvisie Ruimet & Mobilitat*, relating energy transition concerns, addresses only wind turbines.

Another point that the Dutch and French planning documents have in common is that energy transition and landscape are developed in separate chapters (e.g. SCoT Monts du Lyonnais, *structureevisie GoereeOverflakkee*), complicating the articulation between the two and showing how they are not easily associated.

Another result identified is that none of the French and nor Dutch planning instruments have landscape associated with energy sufficiency measures, except for the French landscape plans and the second landscape report of 2017 of Goeree-Overflekkee, but these documents are not regulatory and binding. Compulsory planning instruments highlight principles that, from a spatial/landscape planning and design perspective, could encourage reducing energy consumption. However their potential landscape effects are not addressed at all, even if the changes required in urban areas could be extensive (e.g. external isolation, compact urban form).

Moreover, for the French case, the PCAET document being energy-climate-air centred is a very relevant document for territory analysis and fixing energy goals. Nevertheless, it lacks explicit

insight into spatial/landscape dimensions that could be a significant and valuable support in establishing energy goals (e.g. exploration of available surface area and sites for photovoltaic or wind turbines) as well as the way to achieve them (e.g. establishing synergies among functions). An interesting tool could be the introduction of energy potential maps (e.g. Oudes and Stremke, 2018) representing solar or wind but also biomass potentials as well as heat cold storage sites that could be further exploited through a cascading process. Indeed this kind of representation requires reliable data at a local level, that are in many cases not available and needs to be crossed references with the other characteristics and resources of the territory (e.g. topography, etc.).
In the Netherlands there is not a specific energy planning instrument even if *structuurvisie* could be dedicated to energy topic. However, a new instrument has been recently introduced through the Dutch *Nationaal Klimaatakkoord* (2019): the *Regionale Energie Strategieën*, that, as explained above, aims to define energy targets while considering its spatial component, for all Dutch territories covering all the Netherlands. Unfortunately, the translation of this instrument in the new planning system introduced by the environmental act is still ongoing and no further exploration could be done during the research period. However, this shows how, in the Netherlands as in France, energy transition development is left less to the discretion of local institutions and strongly encouraged.

4.2. The need for quantitative high resolution energy data for spatial planning

Another point of discussion is the accessibility of spatial data for energy. The difficulties to access statistical disaggregated data on energy could be defined as an impediment for further insight about the spatial components of energy within territories. Indeed, it is needed in order to develop more spatial conscious and efficient projects that connect energy supply and demand. We acknowledge that for now, in France as well in the Netherlands, the electricity produced is injected in the main power grid, so the energy produced somewhere in a photovoltaic park could be used at a distance far away, and the grid handles fluctuations that are intrinsic to renewable energy production. Nevertheless, the idea to have a better comprehension of the local consumption and production from a spatial perspective is valuable in order to better answer the needs of the territory and to establish synergies among functions.
Several critical points could be stressed, in particular a difficult access to statistical data about energy at local scale. Not all territories have stats available on general energy production or consumption nor by sector for each municipality. For example, for CC Thouarsais, data about energy for the development of the PCAET is only at the *communauté de communs* (grouping many municipalities) scale, and lacks precise information about locations. The CC Monts du Lyonnais benefits from the more complete open statistical data provided by the region, 'Observatoire Régional de l'Energie et des Gaz à Effet de serre' (OREGES), which provides energy data at municipal level as well as from a historic perspective. But the data remains incomplete and figures about industries are almost totally absent. The CC are using them to develop the PCAET. In the Netherlands for the province of Zuid-Holland, data are at the territorial (group of municipalities) level, and in some cases at the municipal level. However

this topic has been directly addressed in connection with the development of the *Regionale Energie Strategieën* for all the Dutch territories and the construction of a database is in progress. In order to better understand the topic I led a parallel investigation in order to find the energy data used for the planning documents, and see if other more local high resolution data were accessible. I contacted the offices that backed the technical services departments of the territory under analysis and other accessible databases, such as the regional office. One of the main problems is that for privacy issues the data on energy consumption for the industrial sector are not made public. This absence is, for example, mentioned in the PCET of CC Monts du Lyonnais that underlines this approximation ('PCET SIMOLY'2015, 26). This difference in data disaggregated is found in the lack for example of maps in the PCAET of CC Thouarsais, resulting in no illustrations of spatially local potential and consumption.
The need for high resolution data on energy and their difficult access aligns with the results from other research that explored this gap, showing how the connection between local data on energy and territorial characteristics (e.g. building age) could actively support the definition of a strategy for energy consumption reduction (Pincetl *et al.*, 2016). Some research also emphasises the need to access spatio-temporal dimension and how this data could be useful for environmental designers and urban planners to implement tailor-made energy strategies (Voskamp *et al.*, 2016).

4.3 Sectors including energy goals and a landscape perspective in planning documents

Throughout the studied planning documents, energy transition is addressed across sectors, housing, transport, agriculture, and industry. However, the connections between these sectors and landscape are few and not clearly established in the documents.
I noticed that all the actions regarding energy sufficiency such as the implementation of external insulation in buildings or the implementation of paths and streets for low mobility are not directly associated with landscape.
The same could be said for the agricultural sector that, especially considering the rural character of the analysed cases, could play a major role toward achieving energy goals, through biogas production, biofuel production, wood energy, etc. For this sector, again connection with landscape is under-evoked. Yet all these actions could induce major landscape changes through possible changes in agriculture: the type of crop cultivated, new trees and hedges plantations, etc., beyond the installation of the biogas power plant itself. We found some association made to landscape in the CC Thouarsais's PCAET relating to the implementation of a hedge system for wood-energy sector development. However, the connection is absent in the regional planning instrument (SRCAE). Landscape is mentioned in connection to agriculture when these documents explain how the implementation of PV parks should respect and preserve food production.
Beyond the landscape impact, some research has shown how a better analysis of biomass production for energy from a spatial perspective could lead to better choices in scale for implementation and improving positive social impact (van der Horst and Vermeylen 2011). Moreover it is explored how landscape viewpoint could sustain conscious choices on more suitable areas for biomass development (Howard et al. 2013).

Another sector for which landscape is not entered in the discussion is the industrial sector. Even if the industrial sector is stressed in the French document, such as the PCAET, and in the Dutch ones there is no clear connection with spatial perspectives. The industrial sector is primarily connected to improvements for energy efficiency where machines are used to reduce energy demands, an aspect hardly connected with landscape. However, in the planning document some focus exists on identifying waste energy/heat to be re-used in other nearby manufacturing facilities, companies, etc. For this energy cascade a spatial analysis of proximity among industries and areas could back the process.
However, in the Dutch case, it is mentioned the idea of heat energy cascade from Rotterdam's industrial harbour to the residential areas in the landscape report of 2017. This gives prominence to the idea that these two topics are starting to be linked.

5. Are Planning Documents Moving towards Integration between Energy Transition and Landscape?

Planning instruments carry a project framework to shape the future of territories. In this paper I explored the way they address energy transition and landscape together and what role is given to landscape design and planning from an institutional perspective in the energy transition process.
Generally speaking, from the French planning documents emerge a preservation, aesthetic vision of landscape, connected to heritage and natural beauty, which persists in connection with the energy transition issues and renewable energy technologies in particular. The same attitude was found in some Dutch documents as well, however it is accompanied by a more explicit landscape design attitude. In Goeree-Overflakkee, every time that local institutions settled energy goals a landscape document was commissioned to inform the decision-making, and integrate the planning system. This difference could have its roots in the traditional attitude towards landscape, which varies between the two nations. In France, landscape has long been associated with nature and heritage in legislation (Donadieu, 2012). In the Netherlands, this attitude coexists with a strong planning and project perspective (e.g. de Jonge, 2009), in a land that is mainly considered as man-made.
It would be interesting for the years to come to follow this inquire questioning the 'Zone d'accélération de la production d'énergies renouvelables' [Renewable energy production acceleration zone] introduced by the law accelerating the production of renewable energies (APER) in 2023, and see if an evolution in the relations with landscape will occur. The same could be said for the Netherlands where the enter into force of the Environment and Planning Act [Omgevingswet], at the beginning of 2024 introducing a new planning system will lead to changing in the relations between landscape and energy.
Moreover another path to further explore is that, the actual results show an understanding that spatial organisation could affect energy sufficiency but it is not directly connected to the idea that it could lead to landscape impact or change. And vice versa, the landscape viewpoint is not considered to be useful as leverage to improve energy sufficiency. Nevertheless, in the Dutch context, with the progressive entry into force of the Environmental act [Omgevingswet], a connection could be observed between reduction of energy consumption and landscape. Indeed

even if renewable energy technologies are visible in landscape energy sufficiency measures remains one of the major challenges for the years to come, requiring a profound restructuring on how to plan, design and inhabit our territories, cities and their landscapes.

References

Apostol Dean, Palmer James, Pasqualetti Martin J., Smardon Richard, Sullivan Robert (2016) *The Renewable Energy Landscape: Preserving Scenic Values in our Sustainable Future*. London: Routledge.

Council of Europe (2000) *European landscape convention*, Florence.

Donadieu, Pierre (2012) *Sciences Du Paysage. Entre Théories et Pratiques*. Paris : Edition TEC&DOC.

Janssen-Jansen Leonie and Woltjer Johan (2010) 'British discretion in Dutch planning: Establishing a comparative perspective for regional planning and local development in the Netherlands and the United Kingdom', *Land Use Policy*, 27(3), pp. 906–916.

de Jonge Jannemarie (2009) *Landscape Architecture between Politics and Science*. PhD Wageningen University.

Labat Didier and Donadieu Pierre (2013) 'Le paysage, levier d'action dans la planification territoriale', *L'Espace géographique*, Tome 42(1), pp. 44–60.

Lopez, Fanny, Pellegrino, Margot and Coutard, Olivier (2019) *Les territoires de l'autonomie énergétique: espaces, échelles et politiques*. London : ISTE editions.

Magnaghi, A. (2010) *Il progetto locale: verso la coscienza di luogo*. Torino: Bollati Boringhieri.

Mérenne-Schoumaker Bernadette (2007) *Géographie de l'énergie : acteurs, lieux et enjeux* (1 vol). Paris: Belin.

Oudes Dirk and Stremke, Sven (2018) Spatial transition analysis: Spatially explicit and evidence-based targets for sustainable energy transition at the local and regional scale, *Landscape and Urban Planning*, 169 (Supplement C), pp. 1–11.

Pincetl Stephanie, Graham Robert, Murphy Sinnott and Sivaraman Deepak (2016) Analysis of High-Resolution Utility Data for Understanding Energy Use in Urban Systems: The Case of Los Angeles, California, *Journal of Industrial Ecology*, 20(1), pp. 166–178.

Stremke, Sven, van den Dobbelsteen Andy and Koh Jusuck (2011) Exergy landscapes: exploration of second-law thinking towards sustainable landscape design, *International Journal of Exergy*, 8(2), pp. 148–174.

Stremke, Sven, Oudes, Dirk and Picchi, Paolo (2022) *Power of landscape: novel narratives to engage with the energy transition*. Rotterdam: nai010 publishers.

Voskamp Ilse, Spiller Marc, Bregt Arnold K., Vreugdenhil Corné and Rijnaarts Huub (2016) Space-time information analysis for resource-conscious urban planning and design: A stakeholder based identification of urban metabolism data gaps, *Resources, Conservation and Recycling*, 128, pp. 616-525.

Acknowledgements

This paper is relaborated on the basis of a doctoral thesis dissertation.