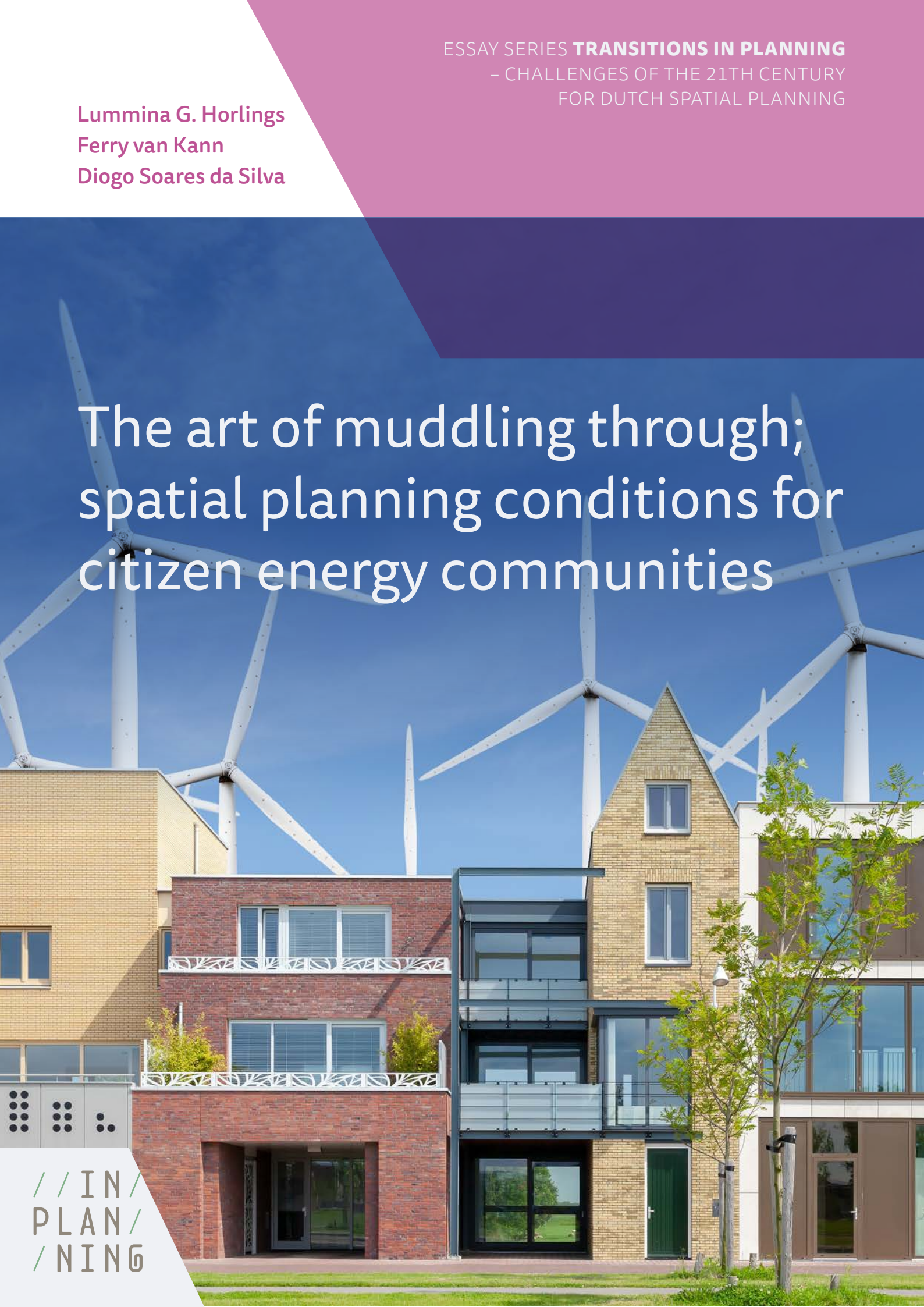
ESSAY SERIES **TRANSITIONS IN PLANNING**
– CHALLENGES OF THE 21TH CENTURY
FOR DUTCH SPATIAL PLANNING

Lummina G. Horlings
Ferry van Kann
Diogo Soares da Silva

The art of muddling through; spatial planning conditions for citizen energy communities



//IN/
PLAN/
/NING

Date of publication:
January 26th, 2023

DOI-code:
10.17418/TIP.2023.ART.04

Contact information:

- **Prof. Dr. L.G. Horlings**
  Department Spatial Planning and Environment,
  Faculty of Spatial Sciences, University of Groningen
  Landleven 1, 9747 AD
  Groningen
  The Netherlands
  Website: https://www.rug.nl/staff/l.g.horlings/
  Email: L.G.Horlings@rug.nl
  Tel: +31 651126725
  ORCID: 0000-0002-8690-7986

- **Dr. Ferry van Kann**
  Department Spatial Planning and Environment,
  Faculty of Spatial Sciences, University of Groningen
  Landleven 1, 9747 AD
  Groningen
  Netherlands
  Website: https://www.rug.nl/staff/f.m.g.van.kann/
  Email: f.m.g.van.kann@rug.nl
  Tel: +31 642135403
  ORCID: 0000-0002-0258-0200

- **Diogo Soares da Silva**
  PhD student Wageningen University and Research center
  Hollandseweg 1, 6706 KN
  Wageningen
  The Netherlands
  Email: diogo.soares.silva@gmail.com
  ORCID: 0000-0003-2734-6733

Biographical notes

Lummina Horlings is a full Professor in Socio-Spatial Planning at the University of Groningen. She is interested in how and why citizens collectively shape more sustainable places and engage in climate action.

Ferry van Kann is an Assistant Professor Environmental Planning at the University of Groningen. He is interested in how spatial planning can support the energy transition while making places better together.

Diogo Soares da Silva was involved in the EU Marie ITN Program Sustainable place-shaping (SUSPLACE) as an Early Stage Researcher at Wageningen University.

>> The art of muddling through; spatial planning conditions for citizen energy communities

Lummina G. Horlings
Ferry van Kann
Diogo Soares da Silva

SUMMARY

>> This essay focuses on the energy transition as a relevant issue for spatial planning as it has large spatial implications. Particularly against the background of climate change, there is an urgent call for a fundamental change of our energy system. Part of this change is a growing role for citizen initiatives that collectively focus on renewable energy, referred to in this paper as citizen energy communities (CECs). While the role of citizens in energy transition has been discussed in different disciplines, and regional scientists have reflected on citizen participation in community energy production, the role of spatial planning in supporting these bottom-up processes deserves more scholarly attention.
We aim to answer the key question: What are spatial planning conditions for energy transition driven by CECs in different institutional contexts? To understand and illustrate these conditions, we use a comparative study of three case studies in three different countries, the Netherlands, Wales (UK), and Portugal. Based on an empirical study and a literature review, which include an analysis of the dilemmas and socio-spatial (mis)matches in the field of energy, we provide recommendations for favourable planning conditions supporting CECs. The results show that CECs build new institutional arrangements and coalitions. The analysis of the cases underpins that the specific geography, the institutional context and involvement of relevant stakeholders are key factors to take into account. Finally, we conclude that in order CECs to flourish, spatial planning should 1) balance top-down goals and area-specific implementation, 2) consider temporality (including long-term visioning and short-term incrementalism or 'muddling through') and 3) pay attention to the impact of the energy transition on multiple spatial scales.

Key words: **energy transition; energy initiatives; community; decentralisation; area-specific planning**

1 INTRODUCTION

>> The impacts of climate change are occurring faster than previously predicted and will affect all places and regions in the world (IPCC, 2021). Global temperatures will continue to rise for generations to come, largely due to greenhouse gases (GHG) which have been and continue to be emitted into the atmosphere as a result of human activity. Currently about two-thirds of the enhanced greenhouse effect is caused by CO2 and one-third by other gases, of which about half by methane. Adaptive governance strategies so far have failed to stay below the Paris agreement goal, thus increasing the risk of societal collapse (Bendell and Read, 2021). To keep climate warming below 1.5 degrees temperature rise as agreed during the global Paris agreement, CO2 emissions have to be cut back by 50% before 2030 and the zero emission target has to be reached before 2050 (IPCC, 2021). One of the dominant forces triggering GHG emissions is the burning of fossil fuels to fulfil energy needs (Ripple et al., 2020). Climate change thus urgently calls for a fundamental change in our energy system referred to as energy transition (Rotmans et al., 2001). Markard et al. (2012, p.956) define energy transition as the '...long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption'.
In November 2018, the European Commission (EC) unveiled its strategic, long-term plan that aims for a climate-neutral economy by 2050, in line with the Paris Agreement goal (European Commission, 2018). In this strategy, the energy sector is expected to be "nearly decarbonised" by 2050, fueled by nuclear energy and a "strong penetration of renewable energy sources" that is facilitated by system optimization.

Energy transition is a relevant issue for spatial planning as it has large spatial implications; renewable based infrastructure of solar panels, wind turbines, hydropower stations and biomass production is - in contrast to fossil fuels - located above the surface and highly visible (Van Kann, 2015). Integrating such infrastructure into landscapes will therefore not go unnoticed, especially in urban regions (Zuidema and De Boer, 2017).
The decarbonisation of society is a multi-actor and complex process, involving energy suppliers, businesses involved in energy transport, households, and regulatory multi-level governments. It has been suggested that new actors can anticipate alternative scenarios and strategies in the face of an energy transition (Sarrica et al., 2016). Recently we see the emergence of collective energy initiatives, initiated as civic bottom-up processes focusing on renewable energy issues. However, civic engagement not just takes place in the field of energy transition, but also in the wider context of sustainability and transformations (Walker and Devine-Wright, 2008; Seyfang and Haxeltine, 2012; Smith and Seyfang, 2013; Hoppe and van Bueren, 2015; Bauwens et al., 2016; Berka and Creamer, 2018; de Boer et al., 2018).

Energy initiatives have been referred to with different terms such as citizen initiatives (Schoor and Scholtens, 2015; Hoppe and van Bueren, 2015; Soares da Silva et al., 2018), local energy initiatives (Van Aalderen and Horlings, 2020), community energy (Bauwens, 2016), citizen energy (Blanchet, 2015), citizen participation in the energy sector (Yildiz et al., 2015) and renewable energy communities (Dóci et al., 2015). The reasons for citizen energy communities (CECs) to engage in energy transition include environmental, economic and social motivations (Brummer, 2018; Seyfang et al. 2013). CECs contribute to energy savings of households, a reduction in CO_2 emissions and the production of renewable solar and wind energy. It has been suggested that their wider societal impact also includes more autonomy (or self-governance/ independency), an increased awareness of the need for energy transition among citizens and more liveability, social cohesion or other benefits for the wider community (Berka & Creamer, 2018; Brummer, 2018; Mulugetta and Urban, 2010).

The European Union's recognition of the importance of these new energy actors is well stated in its current legislation. The Clean Energy for all Europeans package (EU, 2019) defines in legal terms what constitutes a "renewable energy community" (REC) and a "citizen energy community" (CEC). We will use the term citizen energy community here which is according to the EU: a legal entity based on a) voluntary and open participation, controlled by its members and shareholders and b) which has as its purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits; and (c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders (Roberts et al., 2019).

The role of citizens in energy transition has been discussed in different disciplines such as Law, Psychology and Environmental Sciences (Germes et al., 2021; Sloot et al., 2018; Stroink et al., 2022). Furthermore, spatial scientists have reflected on the role of public engagement in energy projects and policies (Devine-Wright, 2011), community wind energy (Baxter et al., 2020), community energy participation (Bauwens and Devine-Wright, 2018) and aspects such as equity, justice and vulnerability (Hall, Hards & Bulkeley, 2013). However, we would argue that spatial planning conditions that support citizen engagement from the bottom-up, deserve more scholarly attention. Specifically more insight is needed on how to reach national energy targets via decentralised and area-specific planning and how this might differ in varied institutional contexts. This calls for an international comparative perspective. We have selected CECs in three countries (Netherlands, Portugal and Wales), all initiated by citizens, independently from third parties (both companies and public institutions),

which operate locally, to illustrate how spatial planning conditions play a role in supporting or hindering these CECs. Our key question in this essay is: What are spatial planning conditions for energy transition driven by CECs in different institutional contexts? With spatial planning conditions we refer to the physical, social and institutional context in which CECs operate, including policy rules, regulations and financial instruments.

The structure of the paper is as follows. First we will describe some theoretical background on energy transition from a spatial planning perspective and argue that the energy system can be characterised by dilemmas and existing socio-spatial mismatches. This results in an analytical framework used as a lens to analyse our empirical cases. By comparing CECs in the Netherlands, Wales and Portugal, we will illustrate how such communities are supported or constrained by institutions and spatial planning contexts and how decentralised and place-based policies play a role therein. In the discussion and conclusions, we provide recommendations on favourable planning conditions supporting CECs.

2 LITERATURE REVIEW: SPATIAL PLANNING AND SOCIO-SPATIAL MISMATCHES IN ENERGY TRANSITION

>> Before introducing our analytical framework in section 3, a further explanation of the context on spatial planning and the energy sector is needed to understand the socio-spatial complexity in this field and how area-specific planning and co-production between governments and citizens might play a role here. We will also analyse the socio-spatial dilemmas and mismatches which occur in the context of energy transition.

Trends in spatial planning

Especially in north-west Europe spatial planning has shifted towards more deregulation and decentralisation. While on the one hand we have witnessed a retreat of the State, devolving responsibilities to the EU level, tasks and responsibilities have also been decentralised to the sub-national (regional) level and local level. Decentralisation is understood as "a process, the aim of which is to transfer tasks and power from a higher to a lower echelon in an organisation, whereby the lower echelon both performs the task an assumes responsibility for it" (Elzinga and Hagelstein, 1998, p.111). Decentralisation has been considered as a potential pathway for developing area-specific planning that can effectively bring collaboration and competing stakeholders together in a locally-grounded governance network, taking into account local circumstances (Wu, 2021, p.43).

The shifting of rules and roles from government to governance in the last decades (Innes, 1996; Healey, 1997; Rhodes, 1997), has raised new opportunities for the production of renewable energies but also resulted in dilemmas and

socio-spatial mismatches as we will show below. The planning context of energy transition has become more dynamic, more diverse, more interconnected, more fluid and, hence, more complex. Due to an increased social fragmentation and complexity, we also see an increased plurality of governance approaches (Zuidema, 2011). Actors have become less capable of realising their ambitions independently, therefore we witness an increased collaboration between private, civic and governmental actors within the energy system.

The amount of space needed and the choice of location requires serious area-specific planning, seeking a balance between local opportunities for producing energy, and the risks of facing spatial constraints and societal resistance (Wu, 2021). Planning needs to be adapted to local and regional circumstances and communities while balancing the varied interests and perceptions of stakeholders (Fuchs and Hinderer, 2014; Wiehe et al., 2020). Though initially research didn't sufficiently pay attention to the spatial context (Coenen et al., 2012), the socio-spatial aspects of transformation processes have recently gained more attention in academic literature (Calvert, 2015; Hansen and Coenen, 2015; Truffer et al., 2015). Coenen et al (2021, p.220) for example witnessed a sharp increase in research outputs that recognize local- and regional- level processes contributing to energy system transitions in different parts of the world (Coenen et al., 2021, p.220; Mattes et al., 2015; Ruggiero et al., 2021; Yu and Gibbs, 2018).

Area-specific planning (Wu, 2021) also termed as place-based policies (Barca, 2009) has gained more governmental interest in the last decade to build on local knowledge, mobilise regional assets and exploit synergies and to strengthen a comparative advantage in places (Barca et al., 2012). Attention to the specific (perceived) characteristics of places has also been advocated as a means for sustainable place-shaping, 'connecting people and communities to place' (Horlings, 2016, 2018).

Area-specific planning has been advocated in the context of energy transition to develop tailor-made solutions which are more sensitive to local circumstances and local and stakeholder interests (Van Kann, 2015; Zuidema and De Boer, 2017).

A decentralisation of policies can support tailor-made solutions, handing over tasks, roles and responsibilities to local energy initiatives in a way that acknowledges the specificities of particular places and institutional settings. However, there are also legitimate concerns about decentralisation as this depends on the willingness and capabilities of local and regional governments and thus does not guarantee that national targets are met (Wu, 2021). This raises questions how conditions for successful decentralisation and co-production between CECs and other organisations might differ in varied institutional contexts.

Dilemmas and mismatches in energy transition

An institutional context of decentralisation and collaboration between various actors, as can be witnessed in the Netherlands, potentially offers the space for co-production on the regional and local level and CEC to emerge. Co-production, as defined by Ostrom (1996: 1079), is "the process through which inputs used to produce a good or service are contributed by individuals who are not in the same organisation". This can generate synergy between the actions of governments and citizens, with citizens taking an active role, not a merely a consultative one (Soares da Silva and Horlings (2020, p. 366). However, this also brings obstacles, and mismatches to the surface. We have identified here the following three main socio-spatial mismatches.

First, in terms of actors involved, the market of energy production is still dominated by large companies internationally, while renewable energy produced by local CECs is growing. This limits the possibilities for a further decentralisation of energy production. The question raised by Hisschemoller (2012, p.123) "can ordinary citizens … make a significant contribution …", might still be answered with "no, unless" if we talk about numbers. The European Association Energy Cities is however emphasising other contributions in terms of provision of technical expertise and acting as a partner to support local economic and social objectives (Energy Cities, 2018).

Secondly, energy sources such as wind power require large plots of land, which makes peripheral rural areas with low population density most suited for production. However, the spatial lay-out of energy infrastructure, the cables which transport electricity, is less dense in rural areas at the end of the energy grid. Grid capacity is a serious problem in for example the Netherlands, calling for organised action at a central level. Figure 2 clearly illustrates this, as less densely populated provinces are completely marked as areas with a (near future) lack of grid capacity. This is even more problematic as the demand of energy is especially high in densely populated urban and industrial areas. This results in logistic challenges for the transport of energy, as well as a demand for innovative energy storage solutions. Also internationally we see mismatches as the countries which have the space and opportunity to provide renewable energy, such as water powered renewable energy in Norway, are not the countries with the highest demand, due to low population densities.

Third, the factor time plays a role here as well. The production of renewable solar, tidal and wind energy is fluctuating with the seasons, weather and day-night rhythm. The peaks in energy production most often don't run parallel in time with the demand for energy. To provide just a simple example, on the household level, most solar energy is produced in summer, while energy for heating is needed in the winter. And even on a sunny winter day, most heat might be needed during long and dark nights, illustrating that time and timing

(over longer and shorter periods) are critical factors. This calls for energy storage solutions which require space as well.

To deal with these mismatches, coordination beyond geographical and administrative borders is needed, which might require a directive role of the state. This raises the question if decentralised place-based approaches will be an obstacle or an opportunity in dealing with these challenges, and how this might differ between countries.

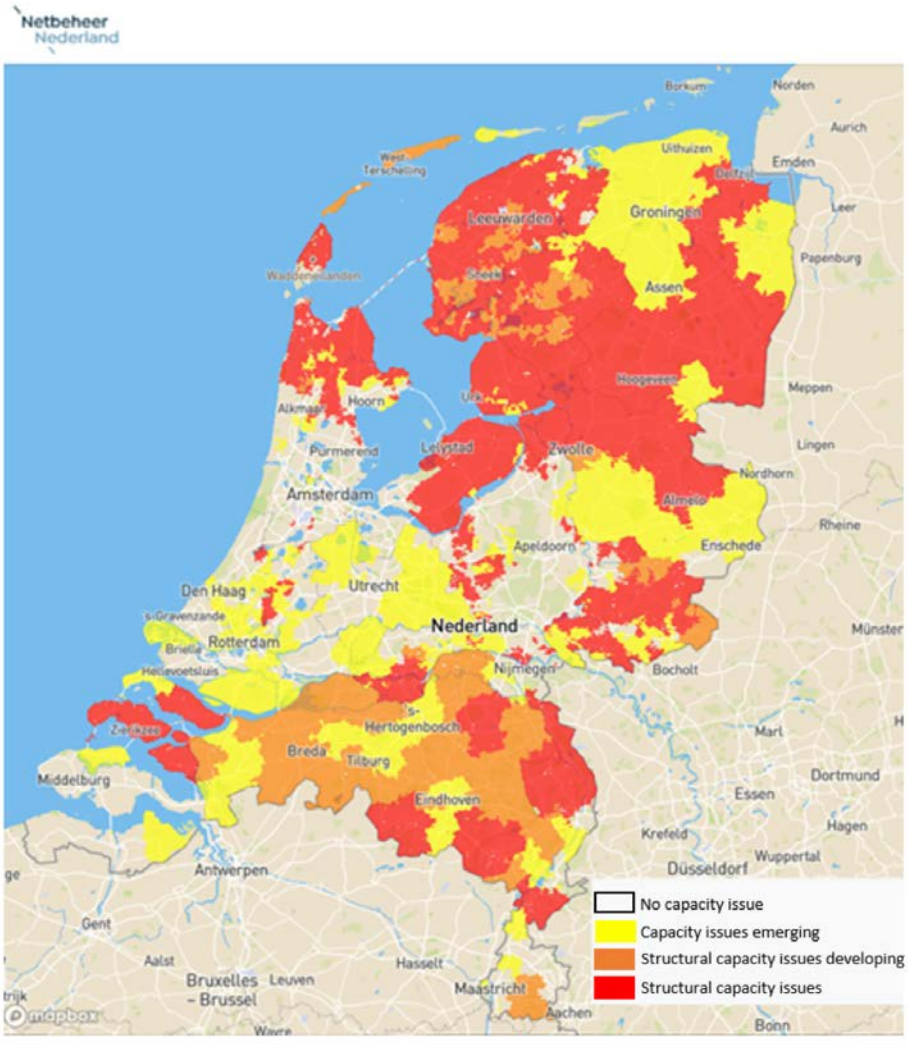


FIGURE 1
Grid capacity issues in the Netherlands (orange and red zones are already problematic).
Source: Netbeheer Nederland, 2021 – translation by authors)

3 ANALYTICAL FRAMEWORK

>> The theoretical framework we use summarises the trends described before. First we assume that in the national context of spatial planning and energy transition differences between countries with regard to aspects of (de) centralisation, area-specific planning and co-production between civic, private and governmental actors all play a role in providing a more or less favourable institutional setting for energy transition and CECs.

We also assume that not just the national context influences CECs but also the local and regional context. Our aim is to derive insights from the cases how spatial planning conditions play a role in supporting or hindering CECs in different countries. With spatial planning conditons we refer tro the physical, social and institutional context in which CECs operate, including rules, regulations and financial instruments. Furthermore we will reflect on how these spatial planning conditions might influence the existing socio-spatial mismatches described in the previous section. Figure 2 provides an analytical model which includes spatial policies and place-based characteristics, the role of the CEC itself, such as the organisation form and actors involved in the community, and how these influence the described dilemmas and (mis)matches. This framework will serve as a lens to analyse the Dutch context and two international satellite cases which offer a comparative perspective.

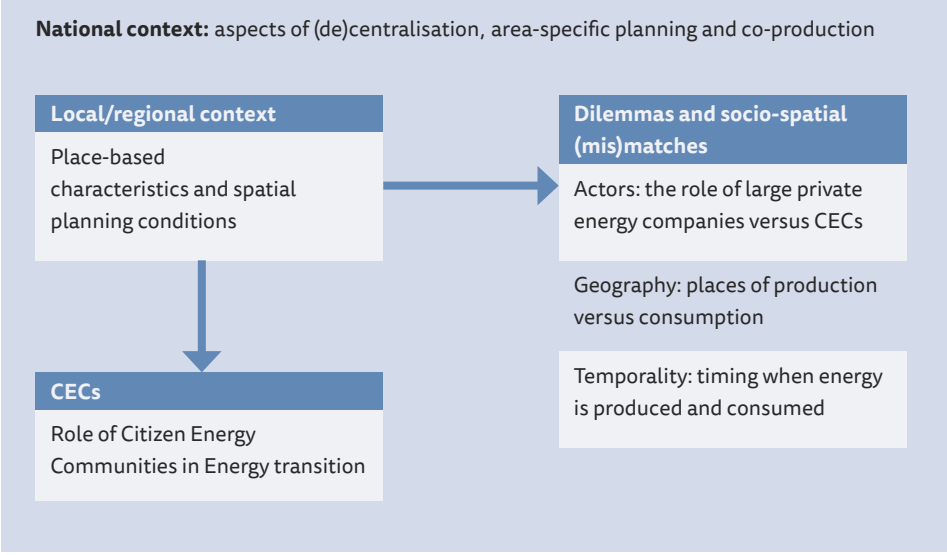


FIGURE 2
Analytical framework.

4 METHODS

>> While the focus in this essay is on the Dutch planning context, an international comparative perspective offers the opportunity to illustrate how institutional differences, including the degree of decentralisation, play a role in the governance of CECs. The analysed CECs, located in three countries, have a different relationship with the EU: The Netherlands is a founding member, Wales is part of the UK, which has left the EU in 2020, and Portugal has been a member state since 1986. These countries have distinct welfare systems (Esping-Andersen 1990; Ferrera 1996), governance and planning practices, culture and traditions, different shares of renewable energy production and consumption, and, although they share(d) a common EU strategy, the implementation of legislation regarding CECs in these countries is in a different phase.

The CECs selected in these countries are all initiated by citizens, independently from third parties (both companies and public institutions), and operate locally. Data collection consisted of policy documents, reports, news articles, documentation provided by the CEC, and in-depth interviews with some of the main actors of the initiatives. Respondents were selected via the contact person of each initiative. These interviews were supported by semi-structured interview guides, following the same structure for all three cases. The interview guides contained open-ended questions about the interviewees' backgrounds, their motivations to set up the CEC, their history, interactions with other actors (including residents), and about the energy sectors in their countries/regions. The interviews were conducted face-to-face, their audio recorded, and posteriorly transcribed for analysis. The analysis was based on codes derived from the elements of the conceptual framework.

In the following sections we first briefly describe the Dutch context on energy transition based on policy documents on the national and regional level, followed by a description of the cases of Awel Aman Tawe/Egni, Coopérnico and WindpowerNijmegen. We will then analyse the cases based on the elements of our framework and draw conclusions on the spatial planning conditions for successful co-production between CECs and other organisations within these different institutional environments.

5 RESULTS

5.1 Dutch spatial planning and energy transition

Although Dutch national renewable energy ambitions are in place for more than twenty years already, a significant acceleration in the energy transition is only recognised recently. In line with Rotmans et al. (2001), it is clear that the first phase of the energy transition took quite some time. This can be explained by

the abundance of natural gas in the Netherlands, connected to well-developed infrastructures and institutions, which resulted in a lock-in situation. This changed due to a growing public awareness, protests and political debates after earthquakes which occurred in the gas mining area in the North of the Netherlands. As a consequence, policies aiming to transition to a 'gas free' society became even more concrete and strict than in other parts of Europe, where natural gas from Norway, Russia, or Algeria was still considered a clean resource.

A second reason for slow implementation of renewable energy infrastructure in the Netherlands is the density of land-use where every single square metre of land is contested and various spatial interests and functions compete. Spatial policy to integrate renewable energy in landscapes was almost lacking, until recently when regional energy strategies were developed, while national policies are mainly focused on providing subsidies (SDE, SDE+) for renewable energy techniques which cannot compete with cheap fossil fuels. However, there is still an uneven economic playing field between fossil fuels and renewable energy, as not all societal and environmental costs have been included in the price (ECN, 2014-2017).

Next to subsidies in the late 2000's, the national government did allocate large onshore wind turbine parks as part of their spatial policies. The style of governance used in these plans was very much a top-down one, mainly considering technical aspects such as available land, wind speed, and energy infrastructure. However, several of these nationally (top-down) enforced projects have resulted in significant local and regional resistance.

Partly as a consequence of this failed process of planning large windparks, and partly resulting from the "Nationaal Klimaatakkoord", a joint agreement between governments, companies and NGOs on the national level, a new more decentralised governance strategy has emerged. This strategy, the so-called Regional Energy Strategies (RES), combines (inter)national set goals regarding greenhouse gas emissions and therefore renewable energy targets (like a share of 70% renewables in the electricity generation in 2030) with a decentralised planning approach. Thirty regions have been asked to develop their own regional energy strategies, making use of area-specific capacities to limit the demand for energy, to generate electricity based on wind and solar power, and develop ideas to replace natural gas in the heating sector. The aim of these regional energy strategies is not just to suggest technical solutions and locations, but regional authorities should, according to the national government, take citizen involvement, participation and co-ownership seriously in renewable energy projects. Together with the idea that such projects should be 'smartly' integrated in the physical environment, the socio-spatial dimension of the energy transition is now firmly on the political agenda. Though the

regional energy strategies illustrate a shift towards more area-specific energy planning and place-based policies, and aim to build coalitions between actors on the local and regional level, it is not clear if and how CECs benefit from this process of decentralisation.

5.2 Case study 1 – WindpowerNijmegen, The Netherlands

Coöperatie WindpowerNijmegen (WPN) is a citizen-owned energy cooperative based in Nijmegen, a city in the east of the Netherlands. Established in 2013, WPN completed the building of a wind farm three years later. It was funded with the help of over a thousand residents who have purchased shares. On May 22th Zonnepark de Grift was opened, a solar park located on the same site as Windpark Nijmegen-Betuwe. Together, the energy generated by the four turbines and 11000 solar panels will be able to supply 1.475 huishoudens per year with sustainable energy.

A strong societal, institutional, and financial support for citizen-led initiatives has contributed to WPN's success story. WPN has faced some local opposition, but an agreement with concerned residents was soon reached. This includes an environmental fund, tied to the amount of energy produced in the wind farm, that is used to finance projects that can benefit local citizens. As citizens in the city of Nijmegen can become shareholders in this peri-urban project in a village outside the administrative borders of their city, this stimulated a dialogue between urban and peri-urban citizens; also locals became more aware of energy and sustainability issues, as one of the respondents mentioned.

Nationally, the Social Support Act has effectively transferred some roles and responsibilities to citizens that were once part of the core functions of the State. As central and local public institutions retreat from said roles, they empower civic society to take matters in their own hands. With regard to initiatives that aim at producing green energy, this discourse is complemented by incentive schemes and financial support from all layers of government. The municipality of Nijmegen was already interested in producing wind energy in the area where the wind farm was built, and owned the plots of land where the wind farm was built. It also financed its environmental impact assessment, and provided a small loan. The local political context has also benefited WPN, as the municipality is committed to sustainability efforts — it was chosen as 2018's European Green Capital — and citizens support the environmental politics in this traditionally politically left wing city. On the regional and national level some stimulating funds were available. For example, a national incentive scheme ensures WPN is compensated for a period of 15 years, to cover the difference between the cost price of the energy it produces and its sale price. This safeguards the profitability of the operation of the windfarm for the foreseeable future, making citizens more eager to invest in their shares.

Although there was no previous collaboration between the initiators of WPN and local stakeholders, the initiative has benefitted from the know-how of two of its initiators. One was already a wind power developer, and another had worked for a regional NGO, the Foundation for Nature and Environment of Gelderland (GNMF).

CECs can be part of networks and 'umbrella' organisations on different levels who lobby, exchange knowledge between CEC and communicate best practices. On the provincial level associations such as the Vereniging Energie Coöperaties Gelderland (VECG) are active while on the national level ODE Decentraal supports CECs. REScoop, is the European network of CEC acting as an umbrella organisation. WPN in Nijmegen is linked to the provincial umbrella organisation and therefore connected to other CECs in the area.

5.3 Case study 2 – Coopérnico, Portugal

Coopérnico is the first CEC operating in Portugal. It was founded in Lisbon in 2013 by a group of 16 citizens. Since our first interview with one of the initiators of Coopérnico took place in October 2017, the membership base has doubled from just over 700 in 2017 to 1447 members in the first two years. These members, spread throughout the country, have invested over €1,5 million funding a total of 22 solar PV projects in partnership with nonprofits, other cooperatives, and municipal entities, 19 of them active. Just like its membership base, this CEC has a national scope, however with projects installed in ten different regions. Often, Coopérnico itself contacts their prospective partners, offering to finance the investment of solar panels to be installed on top of their buildings. Other times, a network of Coopérnico members identifies opportunities for collaboration with local institutions. Coopérnico submits the project for a feasibility and profitability study, which is then shared with the local partner in order to decide if they are able to proceed with a crowdfunding round amongst its members. The partners are then compensated through the payment of a yearly rent and the offer of energy efficiency services; after the first 15 years of operation, the solar panels are offered, free of cost, to the partner. For this reason, Coopérnico prioritises working with non-profit organisations and social enterprises in order to provide them with additional sources of income.

Institutional support for citizen-led initiatives was nonexistent when Coopérnico was formed, and so was legislation regarding community energy. One of the respondents cited the fact that most decision makers in the Portuguese energy sector were trained while working in (formerly) state-owned, monopolist energy companies, which is one of the reasons that they have a vision of citizen participation that is mostly passive, viewing individuals as mere consumers. Thus, energy production is still seen in the country as a responsibility of the state and/or large energy companies. Despite the recent liberalisation of the energy sector, market conditions are still seen as not

ideal for the appearance of small players such as Coopérnico, especially due to the high fees that need to be paid upfront in order to enter the market as an electricity supplier and distribution, something that has been in the works for Coopérnico since 2017. In the words of the respondent, "it's a whole system that is set up not to facilitate citizen participation".

More recently, the national commitment to reaching EU decarbonization goals was made visible through Portugal's National Energy-Climate Plan 2030. This plan recognises the existence and the role CECs can have in reaching those goals, especially through solar PV. One of the lines of action in the document is "to promote the dissemination of decentralised energy production from renewable sources" (Direção-Geral de Energia e Geologia 2019:87). This is to be done not through the attribution of grants or subsidies, but through changes in the legislative framework that remove obstacles to the growth of the sector. In October 2019, legislation that sets the legal scheme applicable to self-consumption of renewables was finally approved, partially transposing the EU directive 2018/2011 on the promotion of the use of energy from renewable sources. It recognises, for the first time, the existence of renewable energy communities and their right to produce, consume, share, store, and sell the energy they produce; it also states that this should be done "without public subsidies", hinting that this legislation will not be combined with further subsidies for energy production. Coopérnico did not receive any public funding or subsidy. Coopérnico's first projects were funded through loans from bigger and more established European CECs. From then on, a pool of members, who pay €60 for the purchase of a minimum of three titles of share capital, had opportunities to invest and crowdfund each of the individual projects, receiving dividends.

None of the initiators had previous experience working in cooperatives. Only one of the initiators used to work in the energy sector, first at a major electrical utilities company, then as the owner of a small company that sold energy solutions. Every project Coopérnico develops involves an entirely new partnership with a different entity, so there was no prior collaboration between partners. However, the know-how gathered through negotiating and funding each project provides Coopérnico with additional experience when establishing new partnerships with other organisations. Some proactive members of the cooperative can also serve as gateways to new partnerships, as they are also members of other associations or institutions that could be prospective partners.

Coopérnico's projects are subject to feasibility and profitability studies prior to any crowdfunding round. The solar panels are installed on top of buildings owned by the partners. That keeps costs with land quite low. Coopérnico pays an annual rent to the partner for the installation of the panels on top of their

buildings, which is, on average, equivalent to one month's worth of electricity paid by the institution. On the downside, a respondent mentioned this as one of the reasons some contracts fall apart, as prospective partners expect to have much bigger financial gains from the partnership. Another constraint is that each project ends up being limited with regard to the size of the buildings where panels are installed, in order to avoid a much larger land use.

Coopérnico is a member of the European network REScoopand is an active member of its project REScoop Plus, a project that aims at sharing knowledge and best practices from well-established energy cooperatives at the European level to new CECs established in countries with little to no tradition in community energy, and/or legislative framework that supports them. It is also involved as a partner in research projects such as COMPILE, Medsol, and PEARLS.

5.4 Case study 3 – Awel Aman Tawe/Awel/Egni, Wales, UK

Awel Aman Tawe (AAT) is a CEC established in 1998 in the village of Cwmllynfell, South Wales. The initial idea behind the initiative was to build a wind park that would not only produce clean energy but also generate profits to fund local community projects, raise awareness about renewable energy, and provide employment opportunities in a region hit hard by the shutting down of the coal mine industry. In February 2017, seventeen years after the CEC received its first grant, the wind park was finally built. Due to a long, morose, and complicated planning process, only two wind turbines ended up being built, although the original plan included the construction of five turbines. This wind energy venture is managed by a distinct entity set up under the umbrella of AAT, Awel Co-op. The £3 million raised through a share offer ensured Awel could pay back the loans it was granted through the planning process, and the cooperative has since been able to pay full interest back to the investors after the first year of operation of the wind park that generates an average of 12,404 MWh/year, with an installed capacity of 4.7MW. Besides producing clean energy, AAT has also engaged residents through an arts and climate change programme that included, among others, poetry workshops and competitions, a theatre project and a film festival.

In 2014, AAT also set up Egni, the first solar PV cooperative of Wales. It operates similarly to Coopérnico, and it has since installed 179kW of solar power on top of seven community buildings and schools in South Wales, generating 163,376 kWh of power over the year 2018. At the time of the data-collection, Egni was aiming to scale up and install solar panels in up to 250 buildings all over the Welsh territory, from schools and community centres to breweries and rugby clubs.

The establishment of Awel predates discourses of decentralisation promoted by recent British governments. The initiative has its roots in a Local Agenda 21 meeting that took place in the Welsh village of Gwaun Cae Gurwen in September 1998. Through A21 meetings, local communities were encouraged to think of sustainable ways of dealing with local and global issues. The idea for a non-commercial, community-led wind park was the first of its kind in the UK. Being pioneers ensured the initiative had some initial governmental support from the now-defunct British Department of Trade and Industry (DTI), which agreed to fund the consultation process.

On the downside, it also meant planning authorities were not totally aware of the benefits brought by such initiatives, and the inflexibility of planning procedures created numerous setbacks to the building of the wind park. By the end of the 1990s, almost 70% of projects for wind parks in Britain failed to get the necessary planning permissions to go ahead (Elliott, 2003). AAT's wind farm planning permission was rejected in 2005, 2007 and 2008 on the grounds of landscape and visual impact, before finally being accepted in 2009—after reducing the number of turbines from five to two. The respondent mentions AAT faced opposition from local authorities for political reasons, as they were "against Welsh government planning policy, which allocates lots of wind turbines to this area". When AAT was granted all the needed licensing to start building the wind park, in late 2015, UK policies regarding renewables had changed, with subsidies and tax relief for the co-op share offers being withdrawn. By this time, and due to concerns with this policy changes, UK's then government-owned Green Investment Bank (GIB) abstained from financing the rest of the project.

Simultaneously, a wave of protests surrounding wind parks were being held across the country. Although attitudes towards renewable energy were generally positive, new wind park developments often faced opposition not only from concerned local citizens but also through non-local organised groups like Country Guardian (Owens and Driffill, 2008, Devine-Wright, 2011) in a way that somewhat resembles opposition to nuclear power. During the lengthy consultation process with residents of surrounding villages, AAT found fierce opposition from an organised group in one of the villages. Although a local referendum promoted by the initiative showed a majority of residents were in favour of the project, AAT ended up facing opposition at every step of the planning process, which translated into a long process of years to obtain common land consent applications. This included building cycles and riding tracks in order to ensure public access to the area.

A respondent mentioned that with the advent of new community schemes in Wales, there now seems to be a better understanding of what community energy can bring to the table, leading to more aware and more interested planning

authorities. The Welsh Government is cited by the respondent as being AAT's major ally during all the process. It ultimately provided the last £3.55 million loan that allowed AAT to ensure the project's financial viability; during the planning process, it also provided technical support and advice through the Ynni'r Fro and Local Energy Services programmes.

There was no past collaboration between the initiators of AAT and other stakeholders in the area. The respondent refers that even their partnership with major stakeholder Welsh Government "doesn't feel like a partnership as such" as they feel WG would not perceive the agreements between the two parties as a partnership per se. As in Coopérnico's case, AAT's solar energy cooperative Egni establishes a new partnership with each new developed project; just like its Portuguese counterpart, it had some support from older, more established solar co-ops, especially from England.

Summarising, compared to the other two analysed initiatives in Wales and Portugal the Dutch Cooperative WindpowerNijmegen has benefitted from a favourable institutional environment. In the next sections, we show an overview of the three case studies, along with a discussion of the results and conclusion to answer the central research question.

6 SYNTHESIS, DISCUSSION AND CONCLUSIONS

Spatial planning and CECs

Table 1 shows a synthesis of the case-study results and how renewable energy provided by CECs can be described along the spatial planning conditions (social, physical and institutional). We identified the following set of conditions that more or less play a role in supporting or hindering CECs.

The CECs perform varied *practices*. This includes building new relations with collaborating actors, the participation in research projects and networking on higher scales for example via membership of an umbrella organisation. The organisational characteristics of CECs themselves play a role here as well, responding to local and regional challenges while also adapting to spatial policies on multiple levels. The results also show that a *social context* which favours civic engagement or sustainable development supports CECs. *Co-production* was organised differently; *physical characteristics* of the place didn't play a major role in the processes of co-production in these cases. While horizontal collaboration between a variety of actors could be observed in all cases, vertical multi-level collaboration was more explicit in Portugal, due the role of Coopérnico which seems to function both as a CEC and as an intermediary umbrella organisation. The CECs were not clearly rooted in a

TABLE 1
Overview case-study results and spatial planning conditions.

Informed by...	Coopérnico	Awel Aman Tawe	Windpower Nijmegen
Practices	Active membership in REScoop. Participation in multiple research projects.	Development of an arts and climate change project. Collaboration with established English solar PV co-ops.	Benefits of having initiators with past experience developing wind projects. Membership in a regional cooperative network. Participation in networking events. New links between citizens, and rural-urban relations
CEC characteristics	Pioneers of decentralised energy in the country. National commitment to decarbonization and recognition of the role of CEC.	Pioneers of community wind energy in the UK. Planning authorities and civil servants were initially not aware of the potential for community energy.	Nijmegen was the European Green Capital of 2018. Widespread citizen support for green politics and green initiatives in the city.
Co-production and history of past collaboration	No previous collaboration. One of the initiators used to work in an energy company. Network of proactive members as gateways to new partnerships.	No previous collaboration; even the current agreement "doesn't feel like a partnership".	No previous collaboration (new cooperative). One of the initiators works for a regional environmental foundation.
Social context	No support for citizen-led initiatives when the initiative was started. Very centralised energy market. No local opposition to projects.	Support for sustainable development solutions (Agenda 21) Access to grants. Some local opposition, widespread anti-wind activism.	Strong institutional support for citizen participation at the national level. No significant local opposition to the wind park.
Local physical conditions	Projects are developed in buildings owned by local partners. Size of buildings is a constraint to installed capacity.	Due to negative environmental assessments the number of turbines was reduced from 5 to 2. Long process for obtaining common land consent applications. Necessity to build access and cycle tracks as part of the project.	Plans for the area included wind energy since the mid-90s. The land where the wind turbines are on is owned by the municipality.
Institutional support via Rules, policies, arrangements	No public funding. Funded almost exclusively by members. National decision makers trained under a highly centralised model. Very recent legislation on community energy.	Difficult, morose, and costly planning process. Diminishing incentives and unstable policy for renewable schemes at the national level. Pivotal material, technical support and advice from the Welsh government.	Institutional and financial support from all layers of government: municipal, regional and national.

history of past collaboration, indicating that path-dependency in this sense didn't play a role here. In Wales, environmental assessments had an influence on decreasing the number of windmills. In settings where common or publicly owned land is available, this offers opportunities for community owned wind energy projects as the case of Nijmegen shows.

Institutional support via decentralised policies was offered especially in the Netherlands and the UK. Especially regulatory and financial incentives turned out to be crucial for the start and development of the CECs.

Based on the results, we come back to our main question about spatial planning conditions for energy transition driven by CECs in different institutional contexts. CECs are local, place-based initiatives that can contribute to dealing with the three identified dilemmas and mismatches, though many of them are still in a pioneering phase. In general, it can be argued that these initiatives potentially reduce the vulnerability of the system by including more actors on different governance levels and geographical scales. By implementing concrete practices such as installing urban roofs for solar panels and dedicating peri-urban sites for wind energy, they expand the spaces for renewable energy production, though their energy performance is still limited and should not be overestimated. The results also showed that CECs build new institutional arrangements and coalitions.

As mentioned before, energy transition requires a careful balancing between centralised goals to address climate challenges and decentralised area-specific implementation of renewable energy production via CECs (Van Aalderen and Horlings, 2020; Wu, 2021). Decentralisation of policies and governance styles adaptive to the local situation can support co-production and the building of tailor-made coalitions between actors. Top-down planning and centrally determined targets on renewable energy and the planning of large wind parks often result in implementation problems at the local and regional scale. However community ownership (Walker, 2008) can result in more awareness and less resistance as local citizens become shareholders. Not just (co-) ownership but also citizen participation plays a crucial role in the acceptance as the analysis of community-owned wind parks has shown (Sperling, 2017).

Socio-spatial mismatches in energy transition

With regard to the socio-spatial mismatches identified earlier, the comparison of the three different cases underpins that the specific geography and involvement of relevant stakeholders is key. The first mismatch deals with the power imbalances between large private energy companies and CECs. Although the role and power of large private companies should not be underestimated in terms of agenda-setting or their influence on national debates, in our cases training and know-how seem to have been more relevant for CECs. Especially

in the Portuguese case it was emphasised that some local decision makers were trained during previous jobs while working in (formerly) state-owned, monopolist energy companies, which has contributed to a more passive attitude towards citizen participation. On the contrary, in the development of Coopérnico projects participation didn't seem to be an obstacle, and former experiences were built on when establishing new partnerships. Both Coopérnico and the Welsh organisation AAT are also working as an umbrella organisation stimulating exchange of expertise and therefore supporting CECs. Finally, the Nijmegen case illustrates that local initiators benefited from existing know-how, by connecting their initiative to umbrella organisations on higher geographical scales. Thus considering conditions for energy transition driven by CECs, the availability of know-how on how to start and implement energy projects in general is crucial. With supportive local policies, citizen participation and land-ownership, the development of a wind farm and a solar park is a realistic option for a CEC.

The support of umbrella organisations benefited all three CECs. Intermediary organisations between public, civic and private actors play a crucial role by positioning and professionalising local initiatives, supporting them with resources, and representing these by playing an advocacy role towards governments. The relevance of such organisations has also been acknowledged in the wider context of rural spatial development, connecting grassroots initiatives, public actors, knowledge institutes, and entrepreneurs (Wellbrock, 2013), and contributing to a further professionalisation and upscaling of best practices in nature and landscape care (Runhaar et al., 2016),

The second mismatch, the geographical disconnection between places of production and consumption, can be better understood based on the illustrative cases. A distinction can be made between small-scale investments like solar panels on roofs and solar windmills built by farms on the one hand, and on the other hand, large-scale solar-fields, wind turbine parks that function on a higher spatial level, both in terms of planning process, and energy delivery. CECs that focus on the use of solar energy, like in the Portuguese case, can implement more or less stand-alone projects. The local energy grid most of the time matches production and consumption on the spot and in time. This allows citizens to participate in projects contributing to their own energy demand in their own area. In contrast, large projects are more dependent on the regional or even (inter)national electricity grid. If the local demand for renewable energy is large enough, like in Nijmegen, then the geographical mismatch is limited. However, if demand –for electricity is a bit more distant, a lack of grid capacity can be an obstacle, which cannot be solved on the local scale.

In the Welsh case, getting planning permissions seemed impossible, until the project was resized from five to two turbines. Here an institutional regime on

a higher governance level was hindering the CEC, while simultaneously on UK level ambitious goals existed regarding energy transition. This example highlights again the relevance of a better understanding of this spatial mismatch, as the national demand for space for renewable energy infrastructure is high, while the acceptance of plans is locally dependent on significant public participation or own local initiatives and ownership.

Finally, the third mismatch regarding temporality potentially emphasises again a role for spatial planners. First there is the relevance of periodicity in demand and supply of energy. The availability of sun and wind varies not only on a daily basis (day and night), but also at least seasonally (summer and winter). This results in a need for diversification of the energy system on an (inter)national level while simultaneously including more local storage or buffer capacity. CECs can play a role in experimenting with new local storage innovations, however they often face resistance from more powerful energy companies or restricting rules and regulations.

Today, the (inter)national grid with the connected centralised power facilities are used to balance energy production and supply. However, this becomes less of a suitable option in a future system that is fuelled by CECs. This brings significant infrastructure challenges on the table, where it is unclear on what governmental level this should be solved, let alone who should be in the lead. It also creates questions with regard to timing, such as what kind of energy will be available, when and produced by whom?

These issues emphasise the need for strategic planning on the regional level, co-production and coordination between producing energy actors especially in situations where grid capacity is low. Grid access is now largely determined by whoever applies first, which doesn't not create an optimal balance between demand and supply. In congruence with the water sector in the Netherlands, where waterboards are responsible for the quality and quantity of water supply, 'energy boards' or broader 'climate boards', might be an interesting type of organisation to further explore.

The developments described before increase the already existing complexity of and uncertainty within the energy system. Uncertainty itself is not unfamiliar to spatial planning. Van Dijk et al. (2019-17) recall three fundamental uncertainties with regard to the environment, choices, and political value judgement, as essential to planning. In the face of unpredictable energy developments (such as the reduced supply of gas from Russia after the war in Ukraine started) and climate change and the risks of large-scale disruptions, these uncertainties will become even more pregnant. This means that in order for CECs to flourish, strategic spatial planning should carefully a) balance ambitious top-down targets with area-specific implementation in multi-

stakeholder arenas b) consider temporality (including long-term visioning and short-term incrementalism) c) and include attention for the impact of energy transition on multiple spatial scales to deal with geographical tensions and mismatches.

Acknowledgements: the data-collection for this paper took place during the Marie Curie ITN project SUSPLACE. This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 674962.

>> References

Barca F. (2009) An agenda for reformed cohesion policy: a place-based approach to meeting European Union challenges and expectations. EU, Brussels.

Barca F., McCann P., Rodríguez-Pose A (2012) The case for regional development intervention: place-based versus place-neutral approaches. J Reg Sci 52:134–152. https://doi.org/10.1111/j.1467-9787.2011.00756.x

Bauwens T. (2016) Explaining the diversity of motivations behind community renewable energy. Energy Policy 93:278–290. https://doi.org/10.1016/j.enpol.2016.03.017

Bauwens T. And Devine-Wright P. (2018) Positive energies? An empirical study of community energy participation and attitudes to renewable energy. Energy Policy 118, pp. 612-625.

Bauwens T., Gotchev B., Holstenkamp L. (2016) What drives the development of community energy in Europe? the case of wind power cooperatives. Energy Research & Social Science 13:136–147. https://doi.org/10.1016/j.erss.2015.12.016

Baxter J., Walker C., Ellis G., Devine-Wright P., Adams M., Smith Fullerton R. (2020). Scale, history and justice in community wind energy: An empirical review, Energy Research & Social Science 68: 101532.

Bendell, J. and Read, J. (2021) Deep Adaptation; Navigating the realities of climate chaos, Policy Press, Cambridge, UK.

Berka A.L., Creamer E. (2018) Taking stock of the local impacts of community owned renewable energy: A review and research agenda. Renew. Sustain. Energy Rev. 82:3400–3419.

Blanchet, T. (2015) Struggle over energy transition in Berlin: How do grassroots initiatives affect local energy policy-making? Energy Policy 78:246–254. https://doi.org/10.1016/j.enpol.2014.11.001

Bock, B.B. (2012) Social innovation and sustainability; how to disentangle the buzzword and its application in the fi eld of agriculture and rural development Studies in Agricultural Economics 114: 57-63 https://doi.org/10.7896/j.1209

Brummer, V. (2018) Community energy–benefits and barriers: A comparative literature review of Community Energy in the UK, Germany and the USA, the benefits it provides for society and the barriers it faces. Renewable and Sustainable Energy Reviews, 94: 187-196.

Calvert, K. (2015) From 'energy geography' to 'energy geographies': perspectives on a fertile academic borderland, Progress in Human Geography, 40: 105–125.

Coenen, L., Benneworth, P. and Truffer, B. (2012) Toward a spatial perspective on sustainability transitions, Research Policy, 41: 968–979.

Coenen, L., Hansen, T., Glasmeier, A. and Hassink, R. et al. (2021) Editorial Regional foundations of energy transitions. Cambridge Journal of Regions, Economy and Society, 14: 219–233, doi:10.1093/cjres/rsab010.

De Boer J., Zuidema C., Gugerell K. (2018) New interaction paths in the energy landscape: the role of local energy initiatives. Landsc Res 43:489–502. https://doi.org/10.1080/01426397.2018.1444154

Devine-Wright P. (2011) Renewable Energy and the Public: From NIMBY to Participation, Earthscan, London.

Dóci G., Vasileiadou E., Petersen A.C. (2015) Exploring the transition potential of renewable energy communities. Futures 66:85–95. https://doi.org/10.1016/j.futures.2015.01.002

ECN (2014-2017) correctiebedragen SDE+ 2014, 2015, 2016, 2017 by ECN. Online: https://www.ecn.nl/nl/samenwerking/sde/sde-correctiebedragen/index.html

Elliott D. (2003) Energy, Society and Environment: technology for a sustainable future, Routledge, Oxford.

Elzinga, D.J. & G.H. Hagelstein (1998) Centralisatie en decentralisatie, in: Korsten, A.F.A. & Tops, P.W., Lokaal bestuur in Nederland: inleiding in de gemeentekunde, Alphen aan de Rijn, Samsom, pp. 107-121

Energy Cities (2018) Energy Cities and REScoop.eu answer to the Committee of the Regions' Stakeholders consultation: "Models of local energy ownership", Energy Cities, Friends of Earth and RESCOOP.eu, Online: https://energy-cities.eu/policy/committee-of-the-regions-opinion/

Esping-Andersen, G. (1990) The Three Worlds of Welfare Capitalism, Princeton University Press, US.

EU (2019) Energy topics. Online, downloaded on 27-9-2021, https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en.

European Commission (2018) A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy. Online, downloaded on 29-9-2021.

Ferrera M. (1996) The "Southern Model" of Welfare in Social Europe. Journal of European Social Policy. 6(1):17-37. https://doi.org/10.1177/095892879600600102

Fuchs, G. and Hinderer, N. (2014) Sustainable electricity transitions in Germany in a spatial context: between localism and centralism, Urban, Planning and Transport Research, 2:1: 354-368. https://doi.org/10.1080/21650020.2014.960096.

Germes, L.A.M.H., Wiekens, C.J. and Horlings, L.G. Success, Failure, and Impact of Local Energy Initiatives in The Netherlands. Sustainability 2021, 13: 12482. https://doi.org/10.3390/su132212482

Hall S.M., Hards S. and Bulkeley H. (2013) New approaches to energy: equity, justice and vulnerability. Introduction to the special issue, Local Environment, 18 (4): 413-421, DOI: 10.1080/13549839.2012.759337

Hansen, T. and Coenen, L. (2015) The geography of sustainability transitions: review, synthesis and reflections on an emergent research field, Environmental Innovation and Societal Transitions, 17: 92–109.

Hasanov M., Zuidema C. (2018) The transformative power of self-organization: Towards a conceptual framework for understanding local energy initiatives in The Netherlands. Energy Research & Social Science, 37: 85–93. https://doi.org/10.1016/j.erss.2017.09.038

Healey P. (1997) Collaborative planning: Shaping places in fragmented Societies. Macmillan International Higher Education, London (UK).

Hisshemoller, M. (2012) Local energy initiatives cannot make a difference, unless ...., Journal of Integrative Environmental Sciences, 9:3, 123-129, https://doi.org/10.1080/1943815X.2012.716193

Hoppe T., van Bueren E. (2015) Guest editorial: governing the challenges of climate change and energy transition in cities. Energy Sustain Soc 5:19. https://doi.org/10.1186/s13705-015-0047-7,

Horlings, L.G. (2016) Connecting people to place: Sustainable place-shaping practices as transformative power. Current Opinion in Environmental Sustainability 20: 32-40. https://doi.org/10.1016/j.cosust.2016.05.003

Horlings, L.G. (2018) Politics of Connectivity: The Relevance of Place-Based Approaches to Support Sustainable Development and the Governance of Nature and Landscape. In: Marsden, T. (Ed.) Handbook Nature, pp.304-324, Sage, London.

Innes, J,E. (1996) Planning through consensus building: a new view of the comprehensive planning ideal. Journal of the American planning Association, 62(40); 460-472.

IPCC (2021) AR6 Climate Change 2021: The Physical Science Basis. Avaliable online, downloaded on 27-9-2021. https://www.ipcc.ch/report/ar6/wg1/

Leal-Arcas, et al. (2018) Leal-Arcas, R., Lesniewska, F., Filippos, P. (2018), Prosumers as New Energy Actors: 23–26 January 2018, National University of Lesotho On occasion of NULISTICE 2018. https://doi.org/10.1007/978-3-319-93438-9_12

Lenton, T.L. ,Rockström, J., Gaffney,O., Rahmstorf, S., Richardson, K., Steffen, W., Schellnhuber, H.J. (2019), Climate tipping points - too risky to bet against Nature 575(7784): 592-595. PMID: 31776487. https:doi.org/10.1038/d41586-019-03595-0

Markard, J., Raven, R., Truffer, B. (2012) Sustainability transitions: An emerging field of research and its prospects. Research policy, 41: 955-967

Mattes, J., Huber, A. and Koehrsen, J. (2015) Energy transitions in small-scale regions – what we can learn from a regional innovation systems perspective, Energy Policy, 78: 255–264.

Mulugetta, Y.; Urban, F. (2010) Deliberating on low carbon development. Energy Policy 2010, 38: 7546-7549.

Netbeheer Nederland (2021) Capaciteitskaart in voeding elektriciteit. Online: https://capaciteitskaart.netbeheernederland.nl/ Downloaded on 03-08-2021.

Owens S. and Driffill, L. (2008) How to change attitudes and behaviours in the context of energy. Energy Policy, 36(12): 4412–4418. doi:10.1016/j.enpol.2008.09.031

Parkhill K.A., Shirani F., Butler C., et al (2015) We are a community [but] that takes a certain amount of energy: Exploring shared visions, social action, and resilience in place-based community-led energy initiatives. Environ Sci Policy 53: 60–69. https://doi.org/10.1016/j.envsci.2015.05.014

Rhodes, R.A.W. (1997), Understanding governance: Policy Networks, Governance, Reflexivity and Accountability. Philadelphia, US: Open University

Ripple, W., Wolf, C., Newsome, T., Barnard, P., Moomaw, et al.,W. (2020) World Scientists' Warning of a Climate Emergency. Bioscience, Oxford University Press (OUP), Online: https://hal.archives-ouvertes.fr/hal-02397151/ document. downloaded on 29-9-2021

Roberts, J. (2016) Prosumer Rights: Options for an EU legal framework post-2020. Online: https://www.documents.clientearth.org/wp-content/uploads/library/2016-06-03-prosumer-rights-options-for-an-eu-legal-framework-post-2020-coll-en.pdf

Roberts, J., Frieden, D. and d'Herbemont, S. (2019) Compile; Energy Community definitions. Online: https://www.compile-project.eu/wp-content/uploads/Explanatory-note-on-energy-community-definitions.pdf

Rhodes, R.A.W. (1997), Understanding governance: Policy Networks, Governance, Reflexivity and Accountability. Philadelphia, US: Open University

Rotmans J., Kemp, R. Van Asselt, M. (2001) More evolution than revolution: Transition management in public policy. Foresight, 3(1), 15-31

Ruggiero, S., Busch, H., Hansen, T. and Isakovic, A. (2021) Context and agency in urban community energy initiatives: an analysis of six case studies from the Baltic Sea Region, Energy Policy, 148: 111956.

Runhaar, H. A. C., Melman, C. P., Boonstra, F. G., Erisman, J. W., Horlings, L., De Snoo, G. R., Termeer, C. J. A. M., Wassen, M. J., Westerink, J. W. & Arts, B. J. M. (Sep-2016) Promoting nature conservation by Dutch farmers: a governance perspective. International Journal for Agricultural Sustainability. p. 1-22. https://www.tandfonline.com/doi/full/10.1080/14735903.2016.1232015

Sarrica, M., Brondia, S., Cottone, P., Mazzara, B.M. (2016) One, no one, one hundred thousand energy transitions in Europe: The quest for a cultural approach. Energy Research & Social Science, 13, 1-14.

Schoor, T. van der, Scholtens, B. (2015) Power to the people: Local community initiatives and the transition to sustainable energy, Renewable and Sustainable Energy Reviews, 43, 666-675. https://doi.org/10.1016/j.rser.2016.12.116

Smith, A. and Seyfang, G. (2013) Constructing grassroots innovations for sustainability. Glob. Environ. Chang. 23:827–829

Seyfang G., Haxeltine A. (2012) Growing grassroots innovations: Exploring the role of community-based initiatives in governing sustainable energy transitions. Environ Plan C Gov Policy 30:381–400. https://doi.org/10.1068/c10222

Seyfang G., Park J.J., Smith A. (2013) A thousand flowers blooming? An examination of community energy in the UK. Energy Policy 61:977–989. https://doi.org/10.1016/j.enpol.2013.06.030

Sloot, D., Jans, L. and Steg, L. (2018) Can community energy initiatives motivate sustainable energy behaviours? The role of initiative involvement and personal pro-environmental motivation, Journal of Environmental Psychology, 57: 99-106,

Soares da Silva D., Horlings L.G., Figueiredo E. (2018) Citizen initiatives in the post-welfare state. Soc Sci 7:252. https://doi.org/10.3390/socsci7120252

Soares da Silva, D., Horlings, L.G. (2020) The role of local energy initiatives in co-producing sustainable places, Sustainability Science, 15, 363-377.

Sperling, K. (2017) How does a pioneer community energy project succeed in practice? The case of the Samsø Renewable Energy Island. Renewable and Sustainable Energy Reviews, 71, 884-897.

Stroink, A., Diestelmeier, L., Hurink, J.L., Wawer, T. (2022) Benefits of cross-border citizen energy communities at distribution system level, Energy Strategy Reviews, 40: 100821, https://doi.org/10.1016/j.esr.2022.100821

Truffer, B., Murphy, J. T. and Raven, R. (2015) The geography of sustainability transitions: contours of an emerging theme, Environmental Innovation and Societal Transitions, 17: 63–72.

Van Aalderen N., Horlings L.G. (2020) Accommodative public leadership in wind energy development: Enabling citizens initiatives in the Netherlands. Energy Policy 138:111249. https://doi.org/10.1016/j.enpol.2020.111249

Van Dijk T., Van Kann F.M.G., Woltjer J. (2019) Explaining Dutch Spatial Planning, InPlanning Groningen

Van Kann, F. (2015) Energie en ruimtelijke planning, een spannende combinatie, PhD Series InPlanning.

Walker G., Devine-Wright P. (2008) Community renewable energy: What should it mean? Energy Policy 36:497–500. https://doi.org/10.1016/j.enpol.2007.10.019

Walker, G. (2008) What are the barriers and incentives for community-owned means of energy production and use? Energy Policy, 36(12), 4401-4405.

Wellbrock, W. (2013) Well-working operational interfaces; A key to more collaborative modes of governance, PhD thesis. (Wageningen: Wageningen UR).

Wiehe, J., Von Haaren, C., Walter, A. (2020) How to achieve the climate targets? Spatial planning in the context of the German energy transition. Energy, Sustainability and Society, 10(1), 1-12.

Wu, Y. (2021) Planning for Energy Transition; Embracing an area-specific approach in urban China, PhD Series InPlanning.

Yildiz Ö., Rommel J., Debor S., et al (2015) Renewable energy cooperatives as gatekeepers or facilitators? Recent developments in Germany and a multidisciplinary research agenda. Energy Res. Soc. Sci. 6:59–73.

Yu, Z. and Gibbs, D. (2018) Sustainability transitions and leapfrogging in latecomer cities: the development of solar thermal energy in Dezhou, China, Regional Studies, 52: 68–79.

Zeebe, R. E., Ridgwell A. and Zachos, J.C. (2016) Anthropocentric carbon release rate unprecedented during the past 66 mi;;ion years. Nature geoscience 9: 325-9.

Zuidema, C. (2011) Stimulating Local Environmental Policy: Making Sense of Decentralisation in Environmental Governance. PhD manuscript, RUG, Groningen.

Zuidema, C. and De Boer, J. (2017) Resilient energy landscapes: A spatial quest? In Trell, E.-M., Restemeyer, B., Bakema, M.M., Van Hoven, B. (Eds.) Governing for resilience in Vulnerable Places. London: Routledge, pp. 15-37.