Energy Transition in a Cross-Border Context

Mind the Gap

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Abstract

One part of the Regiodeal Project Euregional Sustainbility Center was to investigate what obstacles hinder the development of cross-border renewable energy projects. In cooperation with regional stakeholders the ultimate aim was to use the research results to stimulate practical cross-border projects.

In this report, the obstacles to cross-border projects will be presented directly related to the developments at the German-Dutch border. The ESC researchers organised several workshops and discussed with experts from municipalities what type of cross-border projects were seen as essential to achieve regional renewable energy objectives on both sides of the border. It was also discussed what type of problem the stakeholders experienced with respect to earlier project ideas. After these talks, it became clear that in particular in South Limburg there were several plans for cross-border projects with German partners. The research also showed the reason why in South Limburg there is more need for cross-border cooperation than in the North. In South Limburg, there are serious problems to achieve the renewable energy objectives that are laid down in the Regional Energy Strategy (RES) of South Limburg.

According the monitoring of the RES, it is very unlikely that the objectives of the installed capacities for the year 2030 are met. This is different in the North, were the objectives of the RES for North and Mid Limburg are in reach. In South Limburg, the problems are related for instance to the restrictions due to the Einstein telescope and the halt to wind park permits. Meaning that there are limited resources and geographical options on the Dutch side. Hence, the ESC researchers concluded that there is a relevant case for cross-border projects: it is an urgent need to use cross-border capacities to achieve renewable energy objectives in Limburg. The practical workshops led to an engagement of ESC researchers in the preparation of a concrete renewable energy project, namely the Cross_Heat Interreg project aiming at a connection of district heating networks in Kerkrade/Landgraf and Herzogenrath.

The results of the Regiodeal project will support the work of Cross_Heat during the next 3 years. The researchers will also in the future support the analysis of other projects ideas in the field of electricity connections that are presented in this report.

Table of content

Contents

Introduction

The energy transition in the EU, at national and regional level of the Province of Limburg is a major challenge. This Regiodeal project focused on the need to increase electricity and heat from renewable energies in accordance to European, national and regional climate policy objective. However, transitioning to renewable energy is not only an environmental imperative but also an economic opportunity. It stimulates innovation, creates jobs, and aligns with a vision for a cleaner, more sustainable future. Meaning, that the development of innovative projects in the field of renewable energy is also of utmost importance for the economic development of cross-border territories. Since the Province of Limburg is surrounded by a national border, cross-border developments are an essential element of a successful renewable strategy.

The overall question is: how could cross-border cooperation contribute to the increase of renewable energies given the fact, that border regions are faced with specific obstacles due to the borders as limiting factor as already outlined in a previous ITEM/Maastricht University report.[1] These obstacles are related to: spatial planning, national subsidy schemes, lack of cross-border electricity connections at the distribution level, legal problems with respect to selling electricity across the border and lack of participation and citizens engagement in a real cross-border way.

In Chapter 1, the background, context and problems will be described with an outline of the research objective and the geographical focus. Chapter 2 will describe the specific national objectives with respect to renewable energies and the energy transition in both countries and relevant regions (Länder, Provinces) and border regions. Chapter 3 will present the most prominent projects in the field of renewable energy at the German-Dutch border. Are there real cross-border projects and what are the experiences so far? What type of cross-border conflicts do emerge due to projects in the field of renewable energies, mainly in the field of wind energy? What are currently the problems related to net congestions at both sides of the border and are there any cross-border initiatives to solve them? Chapter 4 will present different categories of the most recent cross-border obstacles in the field of renewable energy projects. What is the nature of problems: how can we distinguish between administrative, financial, legal, technical or spatial planning related problems? In Chapter 4, three current cases at the Dutch-German border in Limburg will be presented where ESC researchers actively are involved in the analysis of potential solutions to cross-border obstacles and discussing certain solutions to the problems. Al the three cases are located in South-Limburg. The cases are about the potential heat transfer from Herzogenrath (DE) to district heating in Kerkrade (NL), the transport of electricity from Herzogenrath to the building complex Rolduc in Kerkrade and a project related to battery storage in Kerkrade/Blijderheide with electricity from Germany. In the case of the first project related to district heating, ESC researchers were involved in the design of an Interreg project and the formulation of the application. Today, ITEM is part of the partner consortium of the Interreg project “Cross_Heat”. Meaning that the work of the Regiodeal project has led to a follow-up project with the participation of Regiodeal partners. Finally, in Chapter 5 conclusions and

[1] See Martin Unfried, 2022: Cross-Border Impact Assessment
2022, Dossier 3: Energy transition and Energy Security. ITEM/Maastricht University.

recommendations will be formulated with respect to future cross-border initiatives in the field of renewable energy.

Background and Context

1.1 Problem Description

The key premise is that cross-border coordination (for instance in the case of spatial planning), cooperation (in the case of electricity connections) at the level of municipality grids and collaboration (in the case of joined cross-border projects) are key to accelerate the increase of electricity production from renewable energies in border regions. A recent prominent example are net congestion problems, meaning that the regional distribution network operator (DSO) in Limburg Enexis is faced with the challenge to fulfil the demands of companies and housing developers to get new power connections or to increase the capacity of an existent power connection. Another challenge of a electricity system with increasing renewables is the availability of back-up capacities. In November 2024, there was for instance a high-pressure area over north-western Europe that had been dominating for days. In this high-pressure area, there was virtually no wind and prolonged cloud cover, which means we hardly see the sun. This weather pattern had resulted in very low renewable energy production. On Wednesday 6 November, Dutch electricity generation from solar and wind energy was even the lowest in almost two years, the yield was only 4 per cent of the electricity demand in the Netherlands. The same weather was also causing energy problems in Germany, where wind energy generation was at its lowest level in 10 years.[2] The opposite phenomena is that there is too much wind and sun and only low demand. In 2024, there were no fewer than 458 hours with a negative base electricity price. This can occur on sunny and/or windy days when there is a surplus of energy and demand remains low at the same time. In a small number of cases, even the all-in price on the Dutch market was negative, meaning that users were paid to purchase electricity. A negative electricity price means that the electricity producer has to pay to supply the electricity.[3] At the level of Transmission System Operators (TSO), the electricity market are interconnected meaning that in times of shortages electricity is imported from other neighbouring countries. However, so far there is no exchange of regional capacities at the border at the level of the Distribution System Operator (DSO), in the case of South Limburg the Dutch Enexis or the German Regionnetz (a daughter of the Aachen based STAWAG). The assumption is that in the new system where renewables are dominating the electricity markets, the connection of neighbouring municipalities for instance could also help with respect to back-up capacities, storage or intelligent business models using for instance the relatively cheap electricity in times of overproduction. Another assumption is, that costly grid infrastructure investments could potentially be reduced when also local and regional grids are better connected.

[2] See: KNMI, Somber windstil herfstweer zorgt voor hoge elektriciteitsprijzen, press report, 8 November 2024. Source: https://www.knmi.nl/over-het-knmi/nieuws/somber-windstil-herfstweer-zorgt-voor-hoge-elektriciteitsprijzen.

[3] See: Energievergelijk: Stroomprijs onder nul, voor het eerst dit jaar negatieve tarieven bij dynamisch contract, 5 March 2025. https://www.energievergelijk.nl/nieuws/stroomprijs-onder-nul-voor-het-eerst-dit-jaar-negatieve-tarieven-bij-dynamisch-contract#:~:text=Negatieve%20kale%20tarieven,00:%20%2D1%20cent%20per%20kWh.

Another aspect of cross-border cooperation emerges in the field of spatial planning. In particular wind parks and solar ground-mounted system need intensive spatial planning procedures. Problems often arise already in the course of national planning procedures, when citizens have the idea that they are not sufficiently consulted in a planning process with wind turbines in the neighbourhood. This is even more complex in cross-border situations. In recent years, there were several cases of cross-border conflicts where local citizen groups were taken action against a wind park planning procedure across the border. Here the assumption is that better cross-border coordination of planning processes and participation could avoid many conflicts and ultimately the delay of many projects.

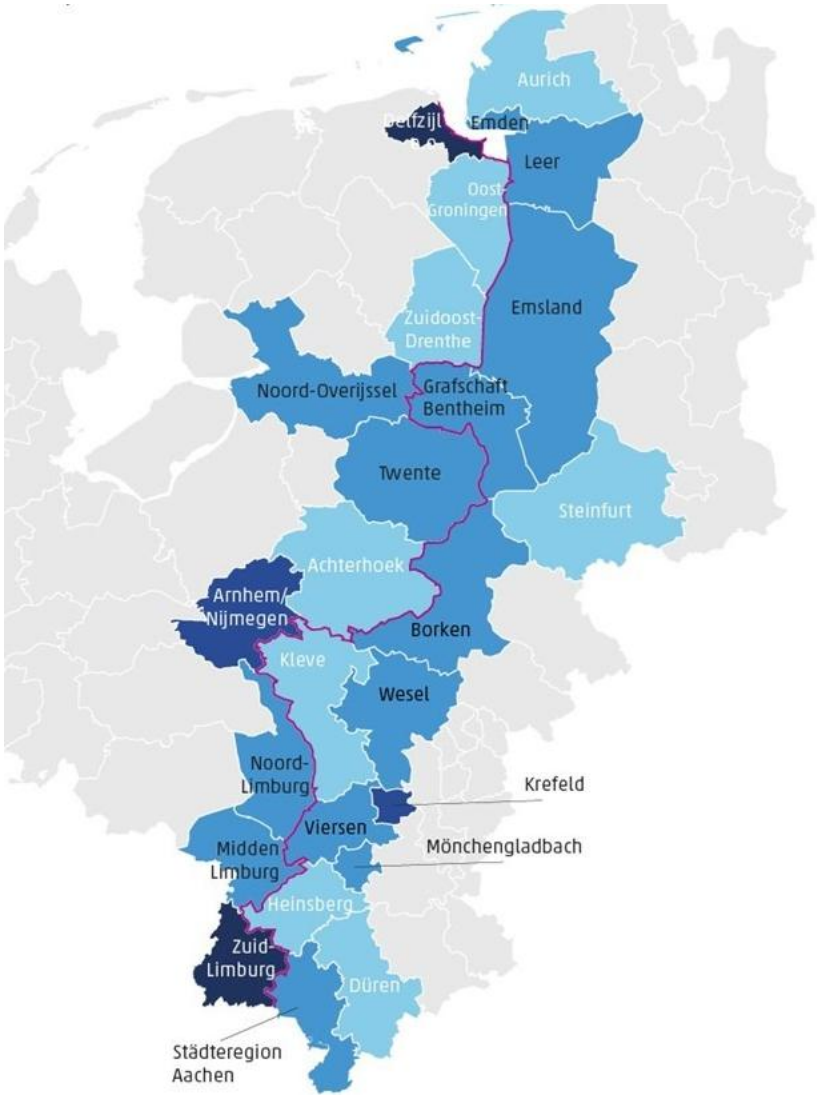
Finally, citizens are also key when it comes to financing and developing projects in the field of renewables themselves. In the Netherlands, the idea of energy communities has been very much stimulated by certain subsidy formats like the 'postcode roos' (until April 2021). This scheme was followed by the Cooperative Energy Generation Subsidy Scheme (SCE). The idea behind is to stimulate the financial participation of citizens in the neighbourhood of the site of renewable energies. Other schemes with the same objective exist in Germany where also energy cooperatives are supported by financial instruments. The 'Citizen Energy Communities' funding programme for onshore wind energy supports wind projects that are implemented with the participation of citizens, for example when an energy cooperative implements the project or is involved in it. In Germany, funding is provided for the comparatively high costs incurred in the planning and approval phase.[4] However, up to date there are no cross-border energy communities at the Dutch-German border developing joint cross-border projects with financial participation of citizens from both sides of the border. It is evident that for the acceptance of projects close to the border, cross-border citizens engagement could be an important instrument in the field of renewable energies.

1.2 Research Objective and geographical focus

Gaining insight into the occurrence, nature and frequency of energy issues in the border regions of The Netherlands and Germany would allow a better identification of cases with high potential for cross-border collaboration. In this sense, different national, regional and local strategies, planning documents and corresponding ambitions will be compared. A focus will be on the regional and local strategies as there are on the Dutch site the Regional Energy strategies for North and South Limburg, or in Germany strategies formulated by the Städteregion Aachen and other Landkreise or municipalities. The research focuses on the border of the Province of Limburg, but will take into account previous cross-border projects and related obstacles at the entire German-Dutch border.

[4] Bundesamt für Wirtschaft und Ausfuhrkontrolle: „Bürgerenergiegesellschaften" bei Windenergie an Land, retrieved on 23 June 2025, see: https://www.bafa.de/DE/Wirtschaft/Beratung_Finanzierung/Buergerenergiegesellschaften/buergerenergiegesellschaften.html.

Map 1: the Dutch-German border situation, Nuts-3 Regions



Source: CBS

In fact, one important part of the research was a mapping exercise to get a grip on cross-border energy projects and related obstacles and best practice cases. The aim was to establish a comprehensive overview on different types of problems (technical, administrative, legal, financial) and to better understand what type of solutions are feasible in the short term or only with major changes in the longer term. The research questions are the following:

- R1 –According to the different energy strategies and policies, what are the objectives in the domain of energy in the Dutch and German border regions that could be helped with cross-border collaboration? And what is the state of affairs in both countries?

- R2 – What type of cross-border initiatives are there today at the Dutch-German border? Are there best practice cases? What are relevant project initiatives at the border of Limburg and NRW?

- R3 What are the obstacles to cross-border cooperation in the field of renewable energy and related aspects (grid capacity, storage, cross-border transfer of energy?

- R4 How to cope with the obstacles of concrete initiatives at the border of Limburg? What are the potential threats and opportunities for three concrete project proposals in South Limburg

    - Transport of residual heat and other heat sources from Herzogenrath to Kerkrade and vice versa for district heating

    - Connection of the building complex Abbey Rolduc (in Kerkrade) to the German electricity grid

    - Connection of a battery storage project in Blijerheide to German buildings with roof installed Photovoltaic electricity production

- R 5 What type of legal, administrative and technical changes are necessary to stimulate cross-border cooperation the field of the energy transition with respect to the cases in Limburg and elsewhere?

2. Renewables and the energy transition

2.1 Policy objectives in the field of renewables and energy transition in the Netherlands and Germany

> R1 –According to the different energy strategies and policies, what are the objectives in the domain of climate change and renewable energy in The Netherlands and Germany, and accordingly in the Dutch and German border regions? And what is the state of affairs in both countries?

The first question refers to the relation between European and national objectives and strategies visà- vis cross-border territories. Is there a sort of translation of EU and national targets into a cross-border perspective, meaning that objectives are defined not only for the national part of the border but also with cross-border territories in mind? The European Union has formulated the following objectives:

> "The energy sector is responsible for more than 75% of the EU's greenhouse gas emissions. Increasing the share of renewable energy across the different sectors of the economy is therefore a key building block to reaching the goal of reducing net greenhouse gas emissions by at least 55% by 2030 and becoming a climate-neutral continent by 2050."[5]

According to the overall objectives, the revised Renewable Energy Directive, adopted in 2023, raises the EU's binding renewable energy target for 2030 to a minimum of 42.5%.[6] It means almost doubling the existing share of renewable energy in the EU.[7]

In the Netherlands, national objectives related to renewable energies are laid down in the "Climate Agreement" (Klimaatakkoord).

> "By 2030, 70 per cent of all electricity will come from renewable sources. This will be achieved through offshore and onshore wind turbines and solar panels on roofs and in solar parks. At the same time, demand for electricity is growing. As the power supply becomes more dependent on unpredictable weather, many measures are needed to maintain a reliable supply."[8]

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[5] See European Commission: Renewable Energy Targets, https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-targets_en#key-facts.

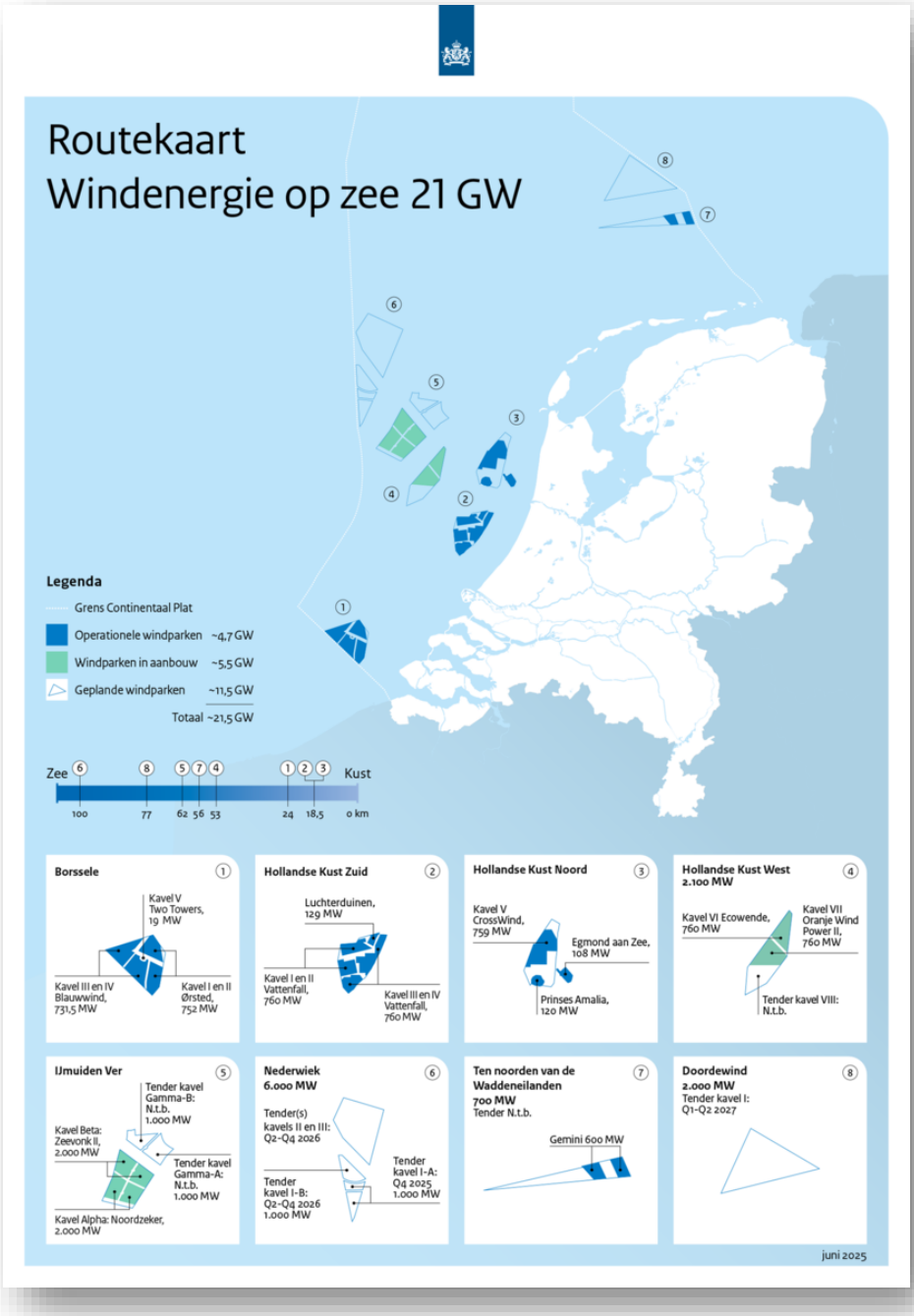
[6] Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652.

[7] The European Commission provides an excellent overview on the evolution of the target on the following site: https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-targets_en#:~:text=The%20revised%20Renewable%20Energy%20Directive%20EU%2F2023%2F2413%20raises%20the,renewable%20energy%20in%20the%20EU.

[8] Klimaatakkoord: Afspraken voor Elektriciteit, https://www.klimaatakkoord.nl/elektriciteit.

The new coalition in 2024 in general was committed to the objectives of the Klimaatakkoord. The coalition emphasised more the role off-shore wind in comparison to on-shore and announced the end of the Dutch solar subsidy system via net-metering in 2027. “With the ambition to achieve 50 gigawatts of offshore wind energy by 2040, we are implementing the current Roadmap for 21 gigawatts in full.” Next to the support of renewables, the objective to build four new nuclear power stations was a change in the Duch energy policy.

Map 2: Roadmap Off-shore Wind Energy in the Netherlands



Source: Rijsoverheid.nl

The latest German objectives were formulated by the previous government's coalition agreement in 2021 and confirmed by the new coalition in 2025.

> "We stand by the German and European climate targets, knowing full well that global warming is a global problem and that the international community must work together to solve it. To this end, we are implementing the Paris Climate Agreement and pursuing the goal of climate neutrality in Germany by 2045 with an approach that combines climate protection, economic competitiveness and social balance and focuses on innovation. We want to remain an industrialised country and become climate neutral."[9]

The official objectives for the electricity sector are the following: "By 2030, at least 80 percent of electricity is to come from renewable energies. Once the phase-out of coal is complete, the electricity supply is to be greenhouse gas-neutral. This is stipulated in the Renewable Energy Sources Act (EEG), which contributes to the implementation of the Paris Climate Agreement."[10]

State of affairs in the Netherlands and Germany

According to the Dutch government, in the period from 2017-2023, the share of renewable energy in the entire energy system increased from 7% to 17%. For electricity specifically, the share of renewable increased from 14% to 47%. This means according to the government that the Netherlands is becoming less and less dependent on imports for electricity. This is due to the rapid growth of solar and wind (offshore) energy.[11]

However, in its 2024 review, the Dutch Planbureau voor de Leefomgeving (PBL) stated that it is extremely unlikely that the Netherlands will reach the legal climate goal of a 55% reduction in greenhouse gas emissions (GHG) by 2030.[12] With current implemented policy ('proposed and adopted'), the government was on track for a reduction of 44%-52% in 2030, compared to 1990 levels. Calculable plans ('scheduled policy') would not add much to this: a net 45%-52% reduction. The Climate and Energy Outlook of the Netherlands (KEV) of 2024 concluded that only additional policy with rapid effect could bring the climate goal for 2030 back in sight. It was highly unlikely that the Netherlands will achieve its statutory climate target of a 55 per cent reduction in emissions by 2030.

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[9] CDU/SPD (2025): Verantwortung für Deutschland Koalitionsvertrag zwischen CDU, CSU und SPD 21. Legislaturperiode, 2025. https://www.cdu.de/app/uploads/2025/04/Koalitionsvertrag-–-barrierefreie-Version.pdf.

[10] See: Homepage of the responsible Federal Ministry of Economy and Energy. https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Dossier/erneuerbare-energien.html.

[11] See Dutch Government/Ministery of Energy and Green Growth: Energienota 2024, https://open.overheid.nl/documenten/9f6aa9ab-3658-47aa-808f-d216a6a7cb8a/file

[12] This was stated in the Climate and Energy Outlook 2024. https://www.pbl.nl/en/latest/news/reaching-2030-climate-goal-becomes-extremely-unlikely-extra-policy-with-rapid-effect-is-needed.

Table 1: Climate and renewable energy objectives in Germany and the Netherlands.

Germany	The Netherlands
Federal Climate Protection Act (KSG) 2021: German greenhouse gas reduction target for 2030: **minus 65** percent compared to 1990.[14] **Forecast:** According to the German government's projection report, the policy instruments implemented will not achieve the sectoral targets or the overall target in any sector.[15]	Overall CO2 target 55% less by 2030 (base year 1990). **Forecast**: The new Climate and Energy Outlook 2022 (KEV) arrives at emissions 39-50 per cent lower in 2030 than in 1990.
Share renewables in overall energy consumption: DE: **2021: 19.7%** (Federal Environmental Agency) Target: 30% renewables in 2030	Share renewables in overall energy consumption: NL: 2021 between **12,0 and 13,4%, renewables** Target: 27% renewables in 2030
Electricity: From a higher electricity demand of 680-750 TWh in 2030, **80 percent** is to come from renewable energies.	Electricity: In 2030, **70 per cent of all electricity** must come from renewable sources. These include offshore and onshore wind turbines as well as solar panels on rooftops and in solar parks.[16]
Overall energy mix/consumption: DE: **2021, 19.7%** (Federal Environmental Agency) Target: 30% renewables in 2030	Overall energy mix/energy consumption NL: 2021 between **12,0 en 13,4%, renewables** Target: 27% renewables in 2030
Heating: Very large share of renewable energies, Aim to generate 50 per cent of heat in a climate-neutral way by 2030.	Heating: No overall target, but targets for the building stock.

Own compilation

During the last days of finalising this Regiodeal report, the Planbureau voor de Leefomgeving published in September 2025 the analysis 2025. Hence, the following new number were still added. In short: The PBL concludes also in 2025 that it is highly unlikely that the Netherlands will achieve its statutory climate target of a 55 per cent reduction in emissions by 2030. With the current policy in place as of 1 January 2025 (‘baseline path’), the country was on track for a 45 to 53 per cent reduction in greenhouse gas emissions in 2030 compared to 1990 levels. Other calculable plans (“additional policy”) add a small 2

percentage points to this: a reduction of 47 to just under 55 per cent. This means that the target falls outside the range. As a result, the chance of achieving the target would be less than 5 per cent.[13] The share of renewable energy in the estimates of this new report 2025 is 1 percentage point lower than in the KEV 2024. It is calculated that approximately 35 petajoules less renewable energy will be used than was estimated in the KEV 2024. The decline in the use of renewable energy would be mainly due to the delay in the construction of various offshore wind farms. As a result, the growth in wind energy is 40 petajoules lower than in the KEV 2024. In addition, it is assumed that there will be more curtailment in large-scale solar power projects.[14]

Implementation of the RED III Directive with respect to renewable electricity production

The deadline for implementing this directive was 1 July 2024. In September 2024, the Commission had already sent formal letters of notice to 26 Member States for failing to fully transpose the Directive. After evaluating the responses received, the Commission decided to send a reasoned opinion to the Netherlands, among others, due to the lack of sufficiently clear and precise information on how the national measures transpose each provision of the Directive.[15]

In the Netherlands, RED III will be implemented through amendments to the Environmental Management Act, the Energy Transport Decree and the Energy Transport Regulations. These amendments are at various stages of adoption, and according to the Ministry of Infrastructure and Waterworks the aim is for the package to enter into force on 1 January 2026, meaning with a considerable delay.

For renewable electricity production, an important part of RED III focuses on speeding up procedures relating to nature and environmental permits. For the Netherlands, this means, among other things, that areas must be designated that can be used more quickly for the generation of renewable energy and the necessary infrastructure. According to the plans of the Dutch government (Rijksdienst voor Ondernemend Nederland), in the final acceleration areas, it will be possible, under certain conditions, to deviate from European nature and environmental legislation. This makes it possible to replace the environmental impact assessment at project level (project EIA), the appropriate assessment and species protection test with a rapid “screening” of up to 45 days. For solar, wind and infrastructure projects, it will be possible, under many conditions, to apply financial compensation for the protection of areas and species where this was not previously possible. However, this requires a more extensive strategic environmental impact assessment (PlanMER) and, if necessary, an appropriate assessment and species protection test to be carried out for each area.

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[13] See: https://www.pbl.nl/publicaties/klimaat-en-energieverkenning-2025.
[14] See PBL: Klimaat en energieverkenning 2025, www.pbl.nl/system/files/document/2025-09/pbl-2025-klimaat-en-energieverkenning-2025-5692.pdf, page 102.
[15] See Netzero.nl: Hoe staat het met de doorvertaling van de RED III? https://nedzero.nl/nl/nieuws/hoe-staat-het-met-de-doorvertaling-van-red-iii#:~:text=Concreet%20voor%20Nederland%20betekent%20dit,(NVDE)%20over%20dit%20onderwerp.

Situation in Germany

The German Expert Council for Climate Policy (Expertenrat für Klimafragen) analyses in its February 2025 review the national climate policy for 2023 and 2024 in detail and draws differentiated conclusions. It sees a number of positive developments. For example, greenhouse gas emissions fell more sharply in the period 2014-2023 than in the period 2010-2019. The Expert Council notes that new measures - emphasising the expansion of carbon pricing, federal funding for efficient buildings in the building sector and federal funding for energy and resource efficiency in the industrial sector - have made a significant contribution to reducing GHG emissions. Despite all the progress made, there are still additional challenges if the 2030 climate targets are actually to be achieved. To this end, the average annual reduction rate of greenhouse gas emissions for the decade 2014-2023 must continue to increase significantly. Furthermore, not all sectors are making equal progress with the transformation. While the transition to non-fossil generation is progressing dynamically in the energy sector, the Expert Council calls for greater efforts to be made in the transport and building sectors in particular. Otherwise, the national climate targets would be not met.[16]

For this research particularly interesting is the fact, that in both countries there is no explicit strategy to foster the energy transition by innovative approaches in border regions.

Regional strategies

In the Netherlands, European and national targets are translated into regional energy strategies (Regionale Energie Strategieën). The Province of Limburg, for instance, has developed two energy strategies, one for South Limburg and the other for North and Middle Limburg. All the regional energy strategies together are supposed to lead to the overall renewable energy targets. The last monitoring of the joint strategies showed that an acceleration of projects is needed. Achieving the combined RES ambition of 55 TWh in 2030 is highly unlikely.[17] In particular, the realisation of wind energy ambitions in terms of projects is stagnating. The number of pipeline projects is steadily declining. This was changing the sun-wind ratio, which is described as unfavourable for the grid. Onshore solar projects are also starting to decline, mainly due to high implementation costs, stricter policies and declining public support.

Every RES region in the Netherlands submits a mandatory progress report to the National RES Programme (NPRES) once every two years, so that progress can also be monitored at national level. The first progress report for the RES South Limburg was published in 2023, a second in 2025. These reports[18] state that the original objective for large-scale generation of renewables is no longer feasible within the remaining period until 2030. Important projects, such as the Parkstad-Zuid wind farm and various solar parks, have been put on hold. Bottlenecks in the electricity grid remain a structural obstacle, with minimal scope for new

[16] See: https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2025/20250205-expertenrat-uebergibt-bundesregierung-bilanz-zur-klimapolitik.html.
[17] RES Monitoring, Deel I –Stand van zaken in de 30 RES-regio's. https://documenten.regionale-energiestrategie.nl/np-res-foto-december-2023/deel-i-stand-van-zaken-de-30-res-regios. Retrieved on 4 July 2025.
[18] Voortgangsrapportage RES Zuid Limburg 3 juni 2025. www.reszuidlimburg.nl/media/2025-07/Voortgangsrapportage-RES-ZL----Definitief.pdf.

connections. In addition, the policy and social preconditions for onshore solar and wind energy have been further tightened. In particular, the development of wind parks has failed. “The contribution of wind energy to the RES bid is currently zero. The only wind turbine in the region is located on the De Beitel industrial estate in Heerlen, but it is technically defective.” This would mean that there are currently no active wind turbines in South Limburg. Also, new wind turbines would be not permitted for the time being in the search and protection area for the Einstein Telescope in the Euregio Meuse-Rhine. As a result, the Parkstad-Zuid wind energy project, comprising four to eight wind turbines, had been suspended for the time being. So far, there is a de facto ban on wind turbines within a radius of 10 km around the search area. In addition, councils and executive committees throughout the Heuvelland region have taken the administrative decision not to allow onshore wind turbines, due to the desire to prevent visual pollution in the landscape.

Much better is the situation with respect to the Regional Energy Strategy North- and Mid Limburg (RES NML). The RES NML aims to generate 1,200 GWh from large-scale solar and wind projects in 15 municipalities. The region has currently achieved 964.5 GWh, of which 616.8 GWh comes from large-scale solar energy and 347.7 GWh from wind energy. In addition, there is another 615.9 GWh in the pipeline for 2030, divided between 434.2 GWh of solar energy and 181.7 GWh of wind energy. In an ideal situation, the region could generate a total of 1,580 GWh in 2030, with a ratio of approximately one-third wind and two-thirds solar generation.[19] Hence both strategies show a very different picture and very different challenges.

Also in Germany, below the level of the Länder governments, Landkreise or municipalities formulate their own strategies with respect to renewables. For instance, the Stadt Aachen and Städteregion Aachen developed an energy plan in 2019 (Regionaler Energieplan Aachen) outlining the potential for renewables in the Städteregion. Another example at local level is the Stadt Herzogenrath (a part of the Städteregion Aachen), which has set itself the target to be climate neutral by 2030.[20] Different from the Dutch approach, there is no streamlined process of strategy building, monitoring and reporting as in the case of the Netherlands. Municipalities or Landkreise are free to develop their own strategies with respect to climate change policy or renewable energies. However, they have particular compulsory tasks if it comes to the designation of areas for wind parks.

The designation of areas for wind turbines in North Rhine-Westphalia is subject to the federal Wind Energy Act (WindBG),[21] which stipulates that 1.8% of the state's land area should be used for wind power, as well as the provisions of the state development plan and regional plans. Municipalities are involved in the designation of wind energy areas through regional planning. Legal requirements include securing wind energy areas until 2027, achieving area targets and taking into account distance regulations. Hence, different from the situation in the Netherlands, there is legal pressure on the municipalities to designate

[19] See RES Noord – en Midden Limburg: Voortgangsrapportage RES Noord- en Midden Limburg De kracht van samen 2024-2025. Published in 2025. www.resnml.nl/media/2025-08/RES-NML-Voortgangsrapportage---definitief-(2)-compressed.pdf.
[20] This was a political objective of the ruling coalition in the municipal council. Herzogenrath is also developing a local climate strategy. https://www.herzogenrath.de/bauen-planen-umwelt/umwelt-undklimaschutz/klimastrategie/, November 2022
[21] Das Gesetz zur Erhöhung und Beschleunigung des Ausbaus von Windenergieanlagen an Land („Wind an-Land-Gesetz“) vom 20. Juli 2022 (BGBl. I S. 1353) ist am 1. Februar 2023 in Kraft getreten.

areas for wind energy. In comparison, the objectives of the Dutch Regional strategies are not legally binding and can be overruled by other objectives as in the case of South Limburg. Also different from Limburg, North Rhine-Westphalia experienced a boom in wind energy in 2024 and early 2025, which is set to continue in order to achieve the target of at least 1,000 new wind turbines by 2027. This is evidenced by a high number of approvals and commissioning, with North Rhine-Westphalia occupying a leading position nationwide[22].

The above described situation shows that in particular in the field of spatial planning of wind energy, a stringent cross-border coordination is needed. Ensuring locations for wind and solar is a major objective of the Dutch regional strategies as well as in the German case. It is very relevant from the point of view of South Limburg to analyse whether it is possible to join certain projects on the German side of the border in order to build up renewable capacities despite the obstacles on the own side of the border.

[22] See Energieatlas NRW: https://www.energieatlas.nrw.de/site/aktuelles/anteileestrommarkt#:~:text=Auch%20dieses%20Mal%20f%C3%BChrt%20die,Strom%2D%20und%20Gaspreis%20in%20NRW.

3. Cross-border initiatives at the Dutch-German border

R2 – What type of cross-border initiatives are there today at the Dutch-German border? Are there best practice cases? What are relevant project initiatives at the border of Limburg and NRW?

3.1 Projects in the field renewables with a cross-border character

Both Germany and the Netherlands are faced with enormous and to some extend similar challenges with respect to renewable energy generation and grid infrastructure. This has of course also repercussion on the border regions and led to initiatives to benefit from cross-border solutions. The most prominent example was the Interreg Projekt Smart Energy Region Emmen (NL)- Haren (D) were high ambitions were confronted with legal and administrative complexity. The aim of the cross-border project was to establish a ‘smart” cross-border energy region where renewable generation and related activities were developed. As part of the project, a first analysis was done by the University of Groningen showing in particular legal problems with respect to cross-border connections at the level of Distribution System Operators and the problem of different subsidy and permitting schemes.[23] Earlier work was also done by co-author Martin Unfried on the specific German-Dutch situation in the field of renewable energy projects.[24]

It is surprising that the project SEREH was an exemption. During the last couple of years, there were only a few cross-border projects at the German-Dutch border aiming at increasing cross-border projects in the field of renewable energies. Most of the other projects under the Interreg Scheme were not really trying to set-up cross-border renewable energy projects, but to work on new technology on both sides of the border and benefit from mutual learning. There are also only a few concrete projects in the current programming period focusing on cross-border renewable energy exchange or production. The most prominent for South Limburg is a project that only started in summer of 2025 under the programme Meuse-Rhine called Cross_Heat where partners from municipalities and science try to work on the preconditions for a connected cross-border district heating system. This project will be described in detailed in the next chapter.

[23] See the reports that have been produced under the framework of the Interreg project Smart Energy Region Emmen/Haaren (www.sereh.eu).
[24] See Martin Unfried: ITEM Grenseffectenrapportage 2022, Dossier 3: Energietransitie en energiezekerheid, https://crossborderitem.eu/energy-transition-and-energy-security/.

Table 2: Overview on past Interreg projects (2007-2013)

Interreg project	Programme	Objective	Cross-border?
SEREH	Deutschland-Nederland	The municipality of Emmen and Stadt Haren (Ems) are working together on a decentralised cross-border electricity and energy market. The objective is to exchange and manage locally generated electricity across national borders. The vision is that in 2025 there will be a regional energy market in Emmen/Haren.	Yes, clear cross-border objectives
SAVE – Gemeinsam für die Energiewende (Together for Energy Transition)	Deutschland-Nederland (Ems Dollart Region)	Sensitize and network the population, the economy and politics in order to increase popular acceptance of sustainability efforts. Promote the energy transition through popular commitment Increase value creation and development of sustainable business models and increase willingness to invest in renewable energies (not necessarily cross-border)	Only mutual learning
Green Cascade	Deutschland-Nederland (Ems Dollart Region	In the Green Cascade project, SMEs and knowledge organizations from Germany and the Netherlands are developing new innovative technologies, production techniques and processes for the biogas value chain. The focus is on increasing economic return and better marketing the input and output streams. Further goals include: stimulating the bio-based economy; increasing the production of biogas; and reducing emissions of CO2 in the German-Dutch border region.	Mutual learning
Task force Wärme Wende	Deutschland-Nederland	On the basis of the current cooperation, the "Heat Turnaround Task Force" will	Mutual learning
		The 'Task Force Heat – WiEfm 2.0' project involves setting up a 'Task Force Heat' in response to the challenges of collective, sustainable heat supply in the EUREGIO. The task force works on the basis of an application and planning tool to be developed as part of the project for calculating a sustainable renewable heating concept at neighbourhood level and tests and establishes	

		the use of state-of-the-art forms of communication in augmented and virtual reality to communicate the opportunities of a '3D heating transition'.	
D2Grids-project	Interreg North-West Europe	The aim of D2GRIDS was to increase the share of renewable energy sources used for heating and cooling to 20% in North-West Europe 10 years after the end of the project.	Mutual learning

Source: own compilation

Table 3: Current Interreg Projects (2021-2027)

Interreg Project	Programme	Objective	Cross-border
CrossHeat	Interreg Meuse Rhine	Evaluation and Preparation of cross-border heat transport/district heating at the Municipalities of Herzogenrath, Kerkrade and Landgraf	Yes
Wind & Regio	Interreg Deutschland/ Niederlande	The main goal of this project is to increase the efficiency of small wind turbines (SWT) in order to establish them as an economical solution on the path to energy self-sufficiency. achieving energy self-sufficiency.	Mutal learning
MAS4TE	Interreg Meuse-Rhine	MAS4TE primarily aims to support individuals living in social housing, who often face higher energy costs. The project tests how extra energy can be stored in batteries or shared, keeping the grid stable. This teamwork supports green energy, fair energy sharing, and closer regional partnerships.	Mutal learning

Source: Interreg Data base, own compilation

This selection of previous and current projects already indicates that many stakeholders in the border region do not have cross-border renewable projects in the pipeline. Otherwise, more projects would apply for Interreg funding. Given the experiences from previous projects like SEREH, this is not a surprise. The project was a showcase that high ambitions to establish a cross-border renewable energy region met with a complex reality of obstacles in particular, when electricity transport across the border is part of the projects. In the preparatory phase of the new project Cross_Heat, the experiences from SEREH were taken into account. Hence, the decision was made to concentrate on heat exchange across the border since the expectation is that this is easier with less legal and administrative problems

compared to electricity connections across the border. It is in general striking that despite the political objectives to accelerate the number of renewable energy capacities in border regions, and the big problems with respect to grid capacities (net congestion), stakeholders are very hesitant to tackle these problems in a cross-border framework.

3.2 Conflicts at the border related to renewable energy projects

One general assumption in the course of this Regiodeal was that better cross-border coordination and collaboration in the field of renewable energy projects would also reduce the conflicts in border situations. In the past, the University of Münster has documented several conflicts related to energy projects in a cross-border context.[25] These conflicts can lead to serious distortion of cross-border relations. Already a decade ago, German nature organizations tried to prevent the building of a coal fired power plant by the company RWE on the Dutch side of the Ems estuary that was finally built in 2015. The German off-Shore wind park Riffgat is not just a fine example of cross-border cooperation. According to the documentation of the University of Münster, it caused cross-border conflicts around the year 2013 about territorial issues. Only after the Netherlands had given up its territorial claims, which had blocked the use of the German wind farm Riffgat in the north of the Ems-Dollart area, could the park be built. It even required a special bilateral territorial agreement between the national governments. Another example: when the Transmission System Operator TenneT was planning to build a 380 kilovolt extra-high voltage line between Doetinchem in the Netherlands and Wesel in Germany, together with the German Amprion GmbH, citizens on the German side articulated strong resistance. Finally, the connection was built and became operational in 2018. These are older cases that indicate that cross-border energy projects can have negative impacts on the perception of cross-border cooperation in border regions. It is problematic if there are on the other hand no positive cross-border renewable energy projects or a positive ‘narrative’ to affirm good coordination and cooperation in the field of climate change. The Euregio Meuse-Rhine has also seen incidents where citizens living close to the border were not satisfied with renewable energy-related projects – in this case a biogas installation in a neighboring municipality.[26] In the near future, these types of incidents could even negatively impact good cross-border relationships if citizens of border municipalities believe they were not involved in the planning process.

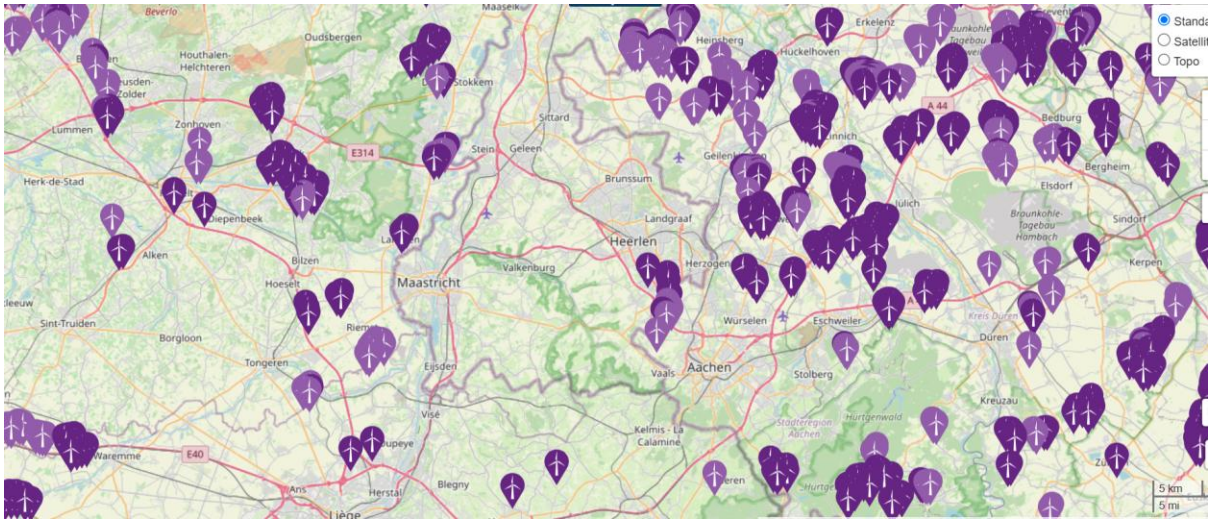
One important reason for more potential conflicts is the intensive planning activity on the German side. Wind power expansion is for instance progressing rapidly in North Rhine-Westphalia. 154 new wind turbines went into operation in the state in 2024, and 680 permits were issued for new projects and are in the pipeline. On the Dutch side, citizens groups in

[25] See the special Niederlandenet site on energy-related conflicts, https://www.unimuenster.de/NiederlandeNet/nl-wissen/umwelt/energiekonflikte/ohnegrenzen.html.

[26] One case involved the planning process of a biogas installation in Lixhe/Visé (BE), near the Dutch municipality of Eijsden. On the Dutch side, a protest group formed that particularly addressed the lack of cross-border participation. See: Brief aan de Belgische Minister over bouw van Biomassa Centrale in Lixhe, pers mededeling Groen-Links Fractie Maastricht, 21 Oktober 2020. On the Belgian side, the project was set on halt (in the summer of 2022).

the Netherlands are concerned that they have enough access to the process and can make their voice heard in the course of the German participation procedures. This concerns very often the “Regionalpläne” (regional plans) where new zones for potential wind park permits are laid down. In NRW, the state's five district governments (Bezirksregierungen) and the Ruhr Regional Association are currently working on new regional plans to make more areas available for wind energy. The ultimate aim is to earmark 1.8 per cent of North Rhine-Westphalia's land area for this purpose. Work on the plans is in the final spurt in 2025. From a Dutch perspective, there is also often the impression that on the German side (or also at the Belgian) wind parks are deliberately located close to the border. And it is true that for instance in Limburg, visible wind turbines are very often not on Dutch but on German or Belgian soil. As the following map shows that has more to do with the fact that on the Dutch site in Limburg there are only a view turbines whereas in NRW for instance, turbines are located not only in border area but throughout the regions.

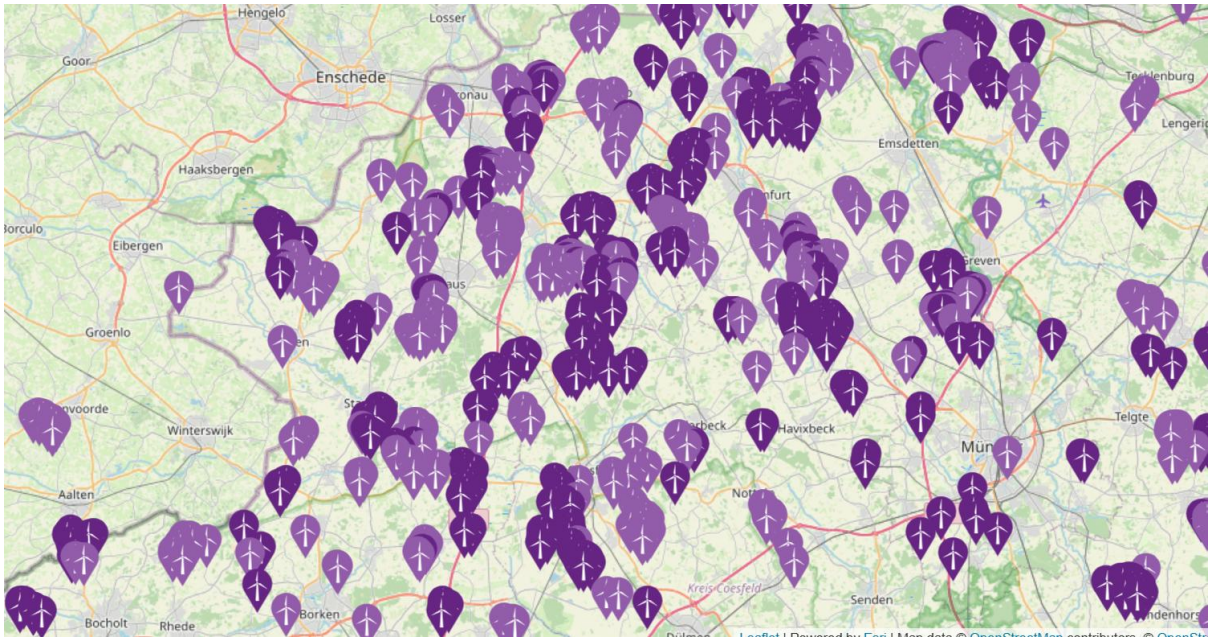
Map 3: Wind turbines at the border of Limburg



Source: World turbine map, https://turbinemap.ventodyne.com/

Also at the border of Gelderland and Overijssel, the situation is very similar. The following map shows the wind park density on the German side in comparison to the less dense situation on the Dutch side.

Map 4: German Wind turbines close to Winterswijk en Enschede



Source: World turbine map, https://turbinemap.ventodyne.com/

It is obvious that in a cross-border territory citizens are concerned about planning processes in their neighbourhood. [27] This is not different from the planning of a wind park on the own side of the country. There are many conflicts in Germany and in the Netherlands with respect to protests from local citizens meaning that conflicts are no cross-border phenomena. Looze/Cuppen have recently done research on the variety of concerns that citizens have when they are opposing wind energy projects. They chose the Netherlands as a focus country because onshore wind conflicts were according to their study extremely prevalent.

Table 4: Themes in opposition to wind energy

Category	Most observed themes in opposition to wind energy
Objects (the 'what')	Health and annoyance (noise, vibration, flicker, visual hindrance)
	Nature conservation (ecological impacts)
	Landscape (emotional connection to landscape)
	Economy (impact on tourism, reduced property values, exacerbation of inequality, distributive injustice)

[27] Annemiek de Looze, Eefje Cuppen, To wind up changed: Assessing the value of social conflict on onshore wind energy in transforming institutions in the Netherlands, Energy Research & Social Science, https://doi.org/10.1016/j.erss.2023.103195.

Category	Most observed themes in opposition to wind energy
	Diversity (lack of variety in types of actors who (can) participate in energy projects; missing perspectives in decision-making; lack of acknowledgement of local diversity in national policy)
Subjects (the 'who')	Justice (recognitional (values and concerns are not considered), procedural (no equal/fair chance of shaping decision-making process, and distributive (costs and benefits not equally distributed))
	Trust (decision-making process perceived to be unfair and untransparent; little faith in policymakers and project developers)
	Communication (lack of open, clear communication about project; lack of transparency on citizens' influence on the project)
Models (the 'how')	Consultation ('pseudo-participation'; not embedding citizen input in actual decision-making)
	Active participation (participation limited to planning stage of projects; limited intensity, frequency, and duration of participation)

Source: Annemiek de Looze, Eefje Cuppen, 2023

For the Dutch situation, de Looze and Cuppen found out that the main causes of conflict in the past included a lack of diversity of actors, justice and trust in decision-making procedures of energy projects. This means, that citizens had the idea that they could not appropriately voice their concerns in the course of the process. The above-mentioned research showed that today projects and (national) policymaking on onshore wind energy have largely opened up to include a wider and more diverse variety of stakeholders. Furthermore, they noted that there has been an "increase in collaborative approaches among governments, project developers, citizens, and nature organisations, for example in the joint development of agreements, participation plans, wind projects, and the founding of learning platforms…" [28] However, they also found out that involved citizens still did not see that the institutional change addressed all the concerns as arisen during the conflict.[29]

The findings for the Netherlands indicate that proper citizens involvement is a major challenge in a national situation. In this respect, it is no surprise that in the case of cross-border relations, it is obvious that citizens even more doubt whether they have a "fair" say in the process on the other side of the border. The following table shows locations where recently conflicts in the case of wind parks are documented and where often citizens complain about the lack of information, communication and participation rights on the other site of the border. At the Dutch-German border in Limburg and further in the North, most of the planning processes are

[28] Ibid page 6.
[29] Ibid page 7.

on the German side, the concerned citizens are forming “action groups” or citizens initiatives on the Dutch side.

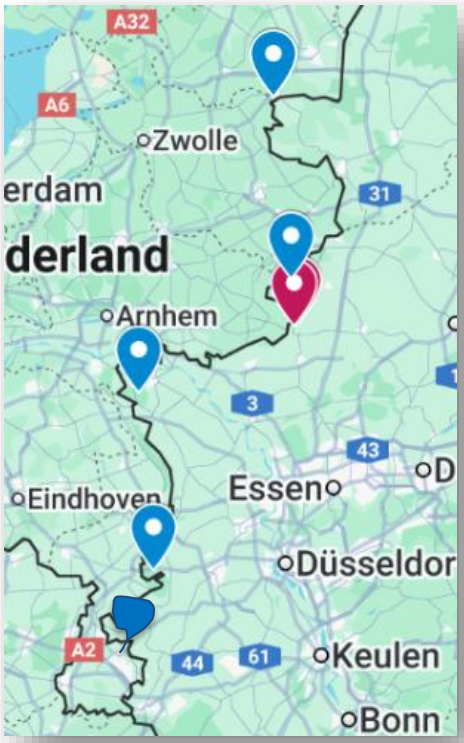
Table 5: Selection of past and current potential conflicts at the Dutch-German border related to Renewable Energy projects

State	Type Project	Area	Reasons for Protest	Arguments	Source
Nederland	Windmolens (DE)	De grens met Ratum Kotten in de gemeente Südlohn	Drie 'mega windmolens' naast Natura 2000 natuurgebied Wooldse Veen ten zuiden van Winterswijk.	Verstoring van vlieg-en foerageergedrag van vogels	https://www.natuurmonumenten.nl/natuurgebieden/wooldse-veen/nieuws/petitie-tegen-duitse-windmolens
Nederland	Windmolens (DE)	Voormalige Britse militaire vliegveld Niederkrüchten-Elmpt.	Vergunning voor de bouw en exploitatie van zeven windenergie-installaties	(1) Strijdig met doelstelling van Grenspark; (2) Negatieve visuele impact; (3) in gebied van trekvogels; (4) bedrijging populaties buizerd, wespendief en de das; (5) vlakbij een aantal habitatrichtlijngebieden	https://www.nmflimburg.nl/wp-content/uploads/sites/12/2022/02/Definitief-bezwaar-tegen-windturbines-in-Elmpt.pdf
Nederland	Windmolens (DE)	Natuurgebied Reichswald Kranenburg, Deutschland	Elf megawindmolens van 266 meter	Duitsland moet rekening houden met de Nederlandse natuur en dan met name als het gaat om de beschermde Natura-2000 gebieden	https://www.gld.nl/nieuws/8268548/duitse-windmolens-tot-in-apeldoorn-en-venlo-te-zien
Nederland	Windmolens (DE)	Kreis Borken (gemeente Vreden)	Zes windmolens	Beschermde diersoorten	https://www.tubantia.nl/haaksbergen/haaksbergen-kritisch-over-duitse-windmolens-te-weinig-aandacht-voor-onze-inwoners-en-belangen~a70cdc94/
Duitsland	Windmolens (NL)	Terrein van defensie bij Coevorden	Drie windmolens	x	https://www.rtvdrenthe.nl/nieuws/30108/duits-verzet-tegen-windmolens-coevorden
Nederland	Windpark Selfkant (DE)	Echt-Susteren	Windmolens	Actiegroep: riciso’s voor de gezondheid. Gebrek aan participatie ontwikkeling Teilplan Erneuerbare Energien/Regionalplan Köln	https://vmlnieuws.nl/echt-susteren/inspraak-windmolens-burgemeester-selfkant-vangt-bot-in-echt-susteren/

Source: own compilation

There is so far no specific research study on cross-border conflicts and citizens participation. In this respect, there is a lack of knowledge on the real causes and the impact of recent participations rights or cross-border cooperation in the border regions. As already mentioned, an increase in conflicts related to wind parks (or solar fields) could also jeopardized cross-border cohesion and good relations. Hence, it would be very important that in the future more attention is paid to cross-border participation and conflict solving in the course of national planning processes.

Map 3: Locations of potential conflicts with respect to wind energy planning



Red: already built Blue: under construction/or in the planning phase

Source: own compilation, google/maps

3.3 Net congestion and cross-border projects in the field of renewable energies

Rather surprisingly, both to the public and regional politicians, Dutch grid operators announced in 2021 that capacity problems were hindering the feeding of renewable electricity into the grid in Limburg and North Brabant. The researcher from Ecorys, in an assignment from the Dutch Ministry of Economy and Climate, have quantified grid congestion. [30] This shows that if one megawatt-hour (MWh) of electricity cannot be delivered to companies, it can cost up to €49,931 per MWh. According to the study, for every undelivered MWh, the Netherlands also loses revenue and grid operators lose market share to foreign competitors. This refers to the following problems:

- business unable to expand their services, markets
- business unable to electrify operations, staying with fossil,
- new business unable to establish themselves (and leaving the country),

[30] See: Ecorys, Maatschappelijke kostprijs van netcongestie, Eindrapport Opdrachtgever: Ministerie van Economische Zaken en Klimaat Organisatie: RVO Klankbordgroep: Autoriteit Consument en Markt (ACM), Netbeheer Nederland, Energie-Nederland, de Nederlandse Vereniging Duurzame Energie (NVDE), Alliander en VNO-NCW, April 2024

- residential buildings projects postponed or cancelled,
- residential buildings electrification postponed, staying with fossil,
- renewable energy production disconnected and thus wasted,
- renewable energy projects cancelled.

The situation persists and is especially difficult in North Limburg, where economic activities were partly on hold. As early as May 2020, the German Federal and the Dutch government signed a joint declaration of intent in relation to further energy co-operation regarding grids and electricity transmission. This document deals in the first place with matters related to the coordination of Transition System Operators (TSOs). Its main objectives are the preparation of grid-development plans, including the fostering of innovation in grid-planning procedures and grid operations, the development of a common Offshore Hub and the improvement of cross-border efficiency measures. So far, no analysis has been carried out as to whether the joint declaration had already positive effects. In the declaration, grid capacities were not explicitly mentioned in relation to renewable energy production.

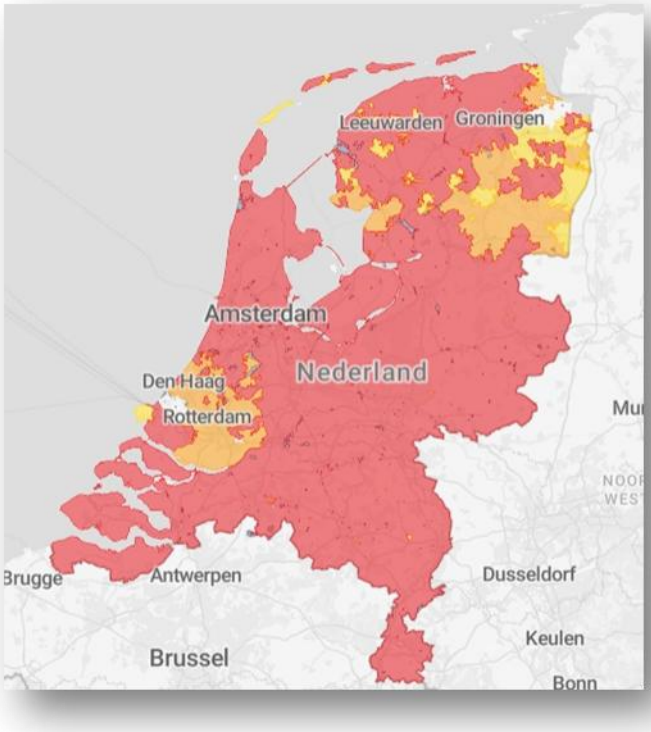
The TSO TenneT announced in June 2022 that there was a provisional pause for new companies requesting a connection to the electricity grid, both for large-scale off-take and electricity generation.[31] According to TenneT, the reason for this was a large increase in requests from industry to electrify, battery initiators and renewable energy producers. In September 2022, TenneT published a study outlining several options to increase net capacity by congestion management.[32] Cross-border options at the level of the distribution grid were not discussed. In April 2025, TenneT announced that certain projects for Limburg were delayed. According to TenneT, the expansion of the Boxmeer high-voltage substation is a prerequisite for tackling the waiting lists in the north of Limburg. The completion date for this substation had been pushed back from 2028 to 2030 because the search for available land for the expansion is taking longer than expected. Essential for tackling grid congestion in Mid and Southern Limburg was the construction of a new high-voltage substation in Graetheide and the upgrading of the overhead connection between Maasbracht and Graetheide. According to TenneT, the completion date for this project has been postponed from 2030–2032 to 2031–2034 due to the presence of protected animal species.[33] TenneT anticipates that, in addition to the projects mentioned in Limburg, projects in other parts of the Netherlands will also be delayed in the coming years.

For the monitoring of the development of the grid situation, the association Netbeheer Nederland of all energy network operators is responsible. In November 2023, the network operators presented the national implementation agenda for regional energy infrastructure, with a proposal to accelerate implementation as much as possible. In addition, a National Action Programme on Network Congestion (LAN) has been set up to ensure that the Netherlands can tackle the network problems and continue to become more sustainable.[34]

[31] See the press release by grid operator TenneT of 9.9. 2022. https://www.tennet.eu/nl/nieuws/grootverbruikers-van-elektriciteit-noord-brabant-en-limburg-kunnenvanaf-nu-weer-worden, retrieved on 23 October 2022.
[32] Tennet (2022): Congestieonderzoek Limburg Analyse naar beschikbare transportcapaciteit voor (duurzame) opwek van elektriciteit onder toepassing van congestiemanagement.
[33] See TenneT press report: “Grote uitbreidingsprojecten hoogspanningsnet Limburg duren langer dan gepland, May 2025.
[34] See description on the homepage of Netbeheer Nederland https://www.netbeheernederland.nl/onze-missie.

Netbeheer Nederland is also publishing regularly a capacity map for the Dutch grid. The colour yellow representing areas where additional access to the grid is difficult but possible without waiting times, the colour red shows areas of the country where a grid connection requires waiting times.

Map 4: Capacity map of the Dutch electricity grid (2024)



Source: https://www.netbeheernederland.nl

In the National Action Programme on Network Congestion, the stakeholders describe the challenges. The task was to build around 50,000 transformer substations by 2050 in addition to the 100,000 substations that already exist. More than 670 high- and medium-voltage substations will also need to be built to meet all economic and sustainability requirements. According to Netbeheer Nederland to achieve this, by 2030 there will be a need for 30,000 more technically trained professionals than are currently employed in the sector.

This means, that grid congestion will be a crucial obstacle to energy related projects in Limburg also in the longer run. It also implies that for the time being innovative ad-hoc solutions are important. There are several smaller projects to tackle the problem. One pilot project was for instance “smart charging” as an initiative of distribution network operator Enexis, charging station operator Vattenfall and the Province. The trial ran from November 2024 to March 2025 at nearly 800 public charging stations (1,600 charging points) spread across nine regions in North Brabant and Limburg. The aim was to create more capacity on the electricity grid at peak times by limiting the power of charging stations.

Grid situation in Germany/NRW

The electricity grid infrastructure is also in Germany of central importance for ensuring an adequate supply for business and private households. A particular challenge in NRW is that grid capacities in the distribution network are limited in many places. According to a study from 2021, the need for grid expansion in North Rhine-Westphalia alone amounts to over 130,000 km by 2040 (60% of which is in the low-voltage range).[35] However, there are less prominent problems with respect to access to the electricity grid for new economic activities or building or development projects and more with respect to the connection of bigger solar power installations. More than 100 distribution network operators in North Rhine-Westphalia, which are responsible for low and medium voltage, are currently experiencing increased demand from companies for grid connections. The reason for this is that more and more companies are turning to photovoltaic systems to reduce their electricity costs.[36] The NRW responsible Ministry of Economic Affairs and Climate Protection has recently started a campaign 'More photovoltaics on commercial roofs'. The situation is not that problematic as in Limburg. For instance in Düsseldorf, according to the grid operator they rarely refuse to connect PV systems.[37]

To conclude, grid congestion is still a big obstacle in the Netherlands for grid access, meaning that both companies cannot enlarge their demand as consumer and producers of renewable energies have problems to get access and sell to the grid. In Germany, there a bigger problems of electricity transport at the high voltages grid from the north to the south, but less problems at the level of the distribution network.

It is striking that there are no plans or no consistent plans to make use of existing grid capacities on one side of the border to make room for the rapid installation of wind or solar parks or very large rooftop PV installations in border regions. It is also striking that in particular in South Limburg, the failure of own renewable energy ambitions has not led to a more ambitious coordination with the German side to develop joined projects on German soil.

[35] See NRW Agency energy4climate (2022): Realisierung von Ladeinfrastruktur bei schlechter Netzanbindung https://www.energy4climate.nrw/mobilitaet/infrastruktur/realisierung-von-ladeinfrastruktur-bei-schlechter-netzanbindung#:~:text=Netzseitige%20H%C3%BCrden,60%20%25%20in%20der%20Niederspannungsebene). ef.Ruhr (et al, 2021): Gutachten zur Weiterentwicklung der Strom-Verteilnetze in Nordrhein-Westfalen auf Grund einer fortschreitenden Sektorenkopplung und neuer Verbraucher, Studie im Auftrag des Ministeriums für Wirtschaft Innovation, Digitalisierung und Energie des Landes Nordrhein-Westfalen.

[36] https://www.energy4climate.nrw/aktuelles/newsroom/fuenf-fragen-zum-netzanschluss-von-photovoltaik.

[37] See: https://www.energy4climate.nrw/aktuelles/newsroom/fuenf-fragen-zum-netzanschluss-von-photovoltaik. The grid operator Netzgesellschaft Düsseldorf mbH operates the grid. In the interview, Frederik Paß explained that there were sufficient capacities for new solar power.

4. Obstacles of Cross-border energy related projects and possible solutions

4.1 Nature of the problems

R3 What are the obstacles to cross-border cooperation in the field of renewable energy and related aspects?

ITEM/Maastricht University did already in 2022 research on possible obstacles in the field of cross-border renewable energy projects. [38] The main finding was that there is a variety of different problems that are hindering the successful implementation of cross-border project leading to substantial disadvantages for border regions. In the follow-up research under the Regiodeal ESC project, it was concluded that the following obstacles are still preventing the implementation of cross-border projects and solutions:

- a more complex spatial planning in a border region than in a non-border region which can also lead to cross-border conflicts about certain sites near the border,

- a difficult situation with respect to cross-border investments since national subsidy schemes, access to the national electricity market and other remuneration systems do not always match,

- there are less cross-border electricity connections on the level of the distribution network than in a national geographic situation meaning that there are disadvantages with respect to grid capacities and more obstacles to implement innovative solutions with respect to net congestion,

- this also means that potential cross-border projects face legal problems with respect to selling electricity to the neighbours across the border,

- and finally, there are different systems to support citizens engagement for instance via energy communities and legal and financial obstacles to form cross-border energy communities.

In the following, the case spatial planning, subsidy schemes and citizens engagement will be elaborated since they also were identified as major obstacles in the course of the ESC Regiodeal project.

Spatial planning

To avoid conflicts in the field of energy or renewable-energy-related projects, better coordination of national and regional spatial planning is key. As already mentioned, wind parks close to a national border, lead to fierce disputes with citizens on the other side of the

[38] See Martin Unfried: ITEM Grenseffectenrapportage 2022, Dossier 3: Energietransitie en energiezekerheid, https://crossborderitem.eu/energy-transition-and-energy-security/

border. In the course of an earlier ITEM project in 2020[39], for instance many experts on spatial planning in the Euregion Meuse-Rhine were interviewed. It turned out that there is Euregional cooperation in many areas, but there was no official working group on spatial planning. There was also no structural communication on the state of affairs regarding the revision of spatial plans. Most spatial-planning experts indicated that more intensive communication would be positive from their perspective. This is especially true for the current situation, were new spatial plans were in the making in the various partner regions (Regional Plan Köln, Plan Ruimte BE Limburg, POVI NL Limburg, Raumplan DG). All of them cover aspects that are relevant for future locations of renewable energy installations. The lack of a cross-border structure is not compensated by bilateral working groups or commissions either. The German-Dutch Spatial Planning Commission (one for the south, one for the north), for example, plays a modest role with respect to the practical coordination of renewable energy projects on the border between Limburg and NRW. Spatial-planning experts specifically mentioned that spatial planning around wind farms and solar farms could be better coordinated, claiming that it is a missed opportunity that the designation of respective zones for wind and solar are not coordinated or at least better communicated across the border. Intensive cooperation between spatial planning experts is already underway in some forward looking border regions, where expert groups are tasked with developing cross-border spatial visions. A recent example of this outside the German-Dutch border region are the developments in the Grossregion (i.e. the Euregion around Luxembourg), where a joint spatial-development plan – the "Spatial development concept for the Grossregion" – was created as part of an INTERREG project. So far, however at the German-Dutch border, the challenges of the energy transition and the difficulties with respect to cross-border renewables projects have not led to increased coordination of spatial planning in the energy field. At the border between the Netherlands and Lower Saxony, an ancient treaty even prevents installations from being constructed close to the border: the Meppen border treaty (Meppener Traktat) of 1824 stipulates that the border area in both countries remain undeveloped for a distance of 380 meters.[40]

Different subsidy schemes

The University of Groningen has done extensive research on the conditions of cross-border electricity transfer and production in the framework of the Interreg project SEREH. Lea Distelmeier and Martha Roggenkamp have analysed in detail the EU and the national legal frameworks and have already formulated several recommendations in order to stimulate the idea of a cross-border energy region with cooperation in various sectors.[41] Lea Distelmeier also participated in a workshop under the umbrella of the Euregional Sustainability Center in

[39] See: Martin Unfried, Wiel Aerts, dr. Vincent Pijnenburg & Pim Mertens (2020): Voorverkenning Grenslandstrategie NOVI-gebied Zuid-Limburg. Study commissioned by the Province of Limburg.
[40] The situation in relation to the Meppen Treaty was also described by practitioners Christoph Pieper (Agrowea GmbH & Co. KG) and Michael Hanhoff (ENERCON GmbH), https://sereh.eu/eindconferentie-sereh-de-resultaten-van-hethaaldbaarheidsonderzoek/. Retrieved on 10 November 2022.
[41] See the reports that have been produced under the framework of the Interreg project Smart Energy Region Emmen/Haaren (www.sereh.eu), Lea Diestelmeier/Martha M. Roggenkamp (2020), Analysis of Current Legal Situation (WP4.I) and Design of Future Legal Framework for Cross-Border Local Energy Systems (WP4.II), Deliverable WP4.I.1 (Current Legal Framework for Cross-Border Local Energy Markets – EU Legal Framework, Deliverable WP4.I.2, Current Legal Framework for Cross-Border Local Energy Markets – National Legal Frameworks). Retrieved on 2.3. 2022 from https://sereh.eu/documenten/.

order to discuss obstacles with practitioners from municipalities. Their studies looked, for instance, at the question of whether national subsidy schemes can be used in a flexible way in the framework of cross-border projects. The conclusion of the analysis of the German-Dutch situation in the framework of the SEREH project was that the current support schemes were generally only valid for producers located in the Member State which offers the support scheme. This means, for instance, that a German wind park in Herzogenrath could not provide the local network in Kerkrade (NL) with electricity on the basis of a Dutch subsidy scheme (SDE++ for instance). On the other hand, a Dutch ground-mounted solar installation would be not eligible for a certain feed-in tariff under the German "Erneuerbare Energien Gesetz" (Renewable Energy Act) and could not participate in tenders. Also under the new Renewable Energy Directive (RED III) the situation has not fundamentally changed.[42] However, the revised Renewable Energy Directive further introduces an obligation for Member States to establish a framework for cooperation on joint projects by 31 December 2025. It also supports the idea to establish a mechanism that allows Member States to harmonize their support schemes in order to meet the national renewable target. So far, this has not been an option for the Dutch or German government, nor has there been any harmonization of subsidy schemes in the Benelux context. Another mechanism under the Renewable Energy directive, with a transnational rather than a cross-border character, has been used in the Netherlands however: In June 2020, the Dutch government agreed with the Danish government on a statistical transfer in the field of renewable energies,[43] whereby 49 PJ of renewable energy were purchased from Denmark. As a result, the Netherlands achieved the binding EU target of a 14% share of renewable energy agreed for that year. The Dutch government paid a certain amount to Denmark, which has a high surplus of renewable energy compared to the target under the EU directive. According to the SEREH study, the mechanisms mentioned here have never been implemented before between NL and DE, so there is no precedent project which could serve as a reference point.[44] Hence, one major conclusion was that the opening up of the subsidy schemes would be a particularly important element in achieving a more adequate cross-border regulatory framework.

Engagement of citizens across the border

In Diestelmeier and Roggenkamp's (see references above) studies on the European and national legislative frameworks, they refer to the role of Citizen Energy Communities and Renewable Energy Communities in the energy transition. On both sides of the border, one element in public acceptance of renewable energy infrastructures is to engage citizens, not only with respect to the planning process, but also in relation to the investments in renewable energies. Citizen participation has become a key concept, from the idea that citizens should also reap financial benefits from the installation of a wind park in their region.

[42] The amending Directive EU/2023/2413 entered into force on 20 November 2023. There was an 18-month period to transpose most of the directive's provisions into national law, with a shorter deadline of July 2024 for some provisions related to permitting for renewables.
[43] See: Agreement for Statistical Transfer of Energy from renewable sources between The Danish State and The Dutch State. A copy of the agreement can be found on https://www.euractiv.com/wpcontent/.
[44] The SEREH study 2020 (Current Legal Framework for Cross-Border Local Energy Markets – EU Legal Framework) referred to the earlier work of Natália Caldés et al (2019), Renewable Energy Cooperation in Europe: What Next? Drivers and Barriers to the Use of Cooperation Mechanisms, see: https://www.mdpi.com/1996-1073/12/1/70/htm. Retrieved on 2 November 2022.

A Citizen Energy Community has been generally defined by Directive 2019/944 (Common rules for the internal market for electricity). However, according to the SEREH study, the definition of Citizen Energy Communities (CEC) does not include a proximity element, so CECs are, in principle, not bound by a confined geographical area or grid. Member States might decide to allow CECs to be open to cross-border participation. The Renewable Energy Directive 2018/2001/EU had previously introduced the concept of special "Renewable Energy Communities". These are defined as legal entities which, in accordance with the applicable national law, are based on open and voluntary participation, are autonomous, and are effectively controlled by shareholders or members located in the proximity of the renewable energy projects owned and developed by that legal entity.[45] Adopted in 2023, the amending Renewable Energy Directive (EU) 2023/2413 enables EU countries to promote energy communities in offshore wind and district heating and cooling networks. To mainstream renewable energies in buildings, countries may also decide to promote cooperation with local authorities through public procurement. These rules build on those already established in 2018 under the revised Renewable Energy Directive (EU) 2018/2001. Energy communities also benefit from simplified registration processes and reduced registration fees for guarantees of origin. In May 2024, the Commission adopted recommendations and guidance documents on renewables permitting and support schemes, calling on national governments to ease permitting procedures and requirements (including for grid connections) for energy communities. In Limburg and neighbouring regions, citizens' Renewable Energy Communities exist on the German, Dutch and Belgian sides. Examples are EMEC (the First Energy Cooperative Maastricht), Energiegewinner eG (Aachen Euregio), Samenstroom (Venlo) or Courant d'Air (Elsenborn, Deutschsprachige Gemeinschaft) or Coöperatie Heerlen Duurzaam.[46] Samenstroom in Venlo for instance promotes citizens participation in wind parks. Recently, there was a subscription for the bonds of Windpark Greenport Venlo – an ambitious local project that will supply no fewer than 40,000 households with sustainable energy from nine wind turbines. Residents and entrepreneurs based in the municipalities of Venlo, Horst aan de Maas, Peel en Maas and Beesel had a unique advantage. They have priority over investors from other municipalities in Limburg or the rest of the Netherlands when it comes to the allocation of bonds.[47]

So far, however, there has been no cross-border energy community with joint projects in the border region. That is a consequence of the complex situation regarding subsidy schemes and the lack of cross-border business models. Until 2021, the Dutch Regeling Verlaagd Tarief (Regulation Reduced Tariff) or the Postcoderoosregeling (Postcode Scheme), for instance, have been the major subsidy schemes to promote the financial participation of citizens in renewable energy projects. A postcoderoos was an area defined by the postcode in which the project was located. Households within these postcodes were allowed to participate in the project and thus buy panels to make their energy consumption more sustainable. The local energy cooperative carrying out the project invited participants within the postcode area to join the project. These participants earned back their investment through their eligibility for an energy tax refund that was linked to their own energy consumption at home. Since this was dependent on a Dutch household and electricity

[45] See SEREH study 2020 (Current Legal Framework for Cross-Border Local Energy Markets – EU Legal Framework), p. 55.
[46] See: https://www.cooperatie-heerlen-duurzaam.nl/over-ons, https://samen-stroom.nl/, https://www.courantdair.be/wp/de/unsere-genossenschaft.
[47] https://samen-stroom.nl/nieuwsbrief-september-2025/.

connection, the scheme, as such, was not exportable to citizens living in Germany. It was replaced by the Subsidieregeling Coöperatieve Energieopwekking (SCE) (Cooperative Energy Subsidy Scheme) on 1 April 2021. One of the conditions for the cooperatives is that all members have access to the cooperative's general meeting and have equal voting rights.[48] The new aspect is that the financial advantage is no longer linked to the tax reduction for private households. The subsidy per kWh is the difference between the base amount and the correction amount, with the correction amount being the market price for energy. If the energy price rises, the cooperative will receive less subsidy, and, conversely, if the energy price falls, it will receive more. However, a special subsidy scheme for energy communities that uses a postcode scheme would be open to Dutch citizens who live in a certain postcode district situated, for instance, next to the postcode where the installation is located but would exclude citizens on the German side of border, even if they live right next to the postcode district where the wind park or solar field is located. Dutch companies located within the postcode area may also participate as members in the energy cooperative, under the condition that they have a 'small-scale user' connection to the grid. As such, this also excludes German companies close to the Dutch border. Thus, this scheme is, by design, inclusive for Dutch citizens who live close to the production site but exclusive for German citizens, even if they live near the site. Dutch and German cooperatives are, in principle, definitely open to citizens from the neighbouring Member State. They can always become members with a certain financial share in the cooperative and benefit from its economic activities. As members, they also have a vote with respect to its activities and business development. However, it is not very attractive for German citizens to join a Dutch cooperative if the 'postcode requirement' makes joining a certain project impossible. Nor is it at all attractive for a German cooperative with German Members to invest in the Netherlands under the Cooperative Energy Subsidy Scheme as its own (German) members would be excluded from investing in a project under the Postcode Scheme.

4.2 Case studies in Limburg

In the course of the project, the researchers organised different workshops with the participation of practitioners from different stakeholders, in particular from municipalities. The intention was to collect information about ongoing projects or project in the pipeline in order to help municipalities to implement them. As a result, very good contacts were made with the municipality of Kerkrade and Herzogenrath in South Limburg and NRW. Despite different discussions with stakeholders form the municipality of Venlo and others, no concrete projects were discussed in North or Middle Limburg. One reason for this could be that according to the review of the Regional energy strategies (see above), the situation in North-Mid Limburg is rather positive, meaning that the objectives for installing renewable energies, mainly wind and solar power, are in reach. In comparison, the situation in South Limburg is quite the opposite, where the implementation is far away from the formulated objectives. This is an indication that there is more pressure to exploitation possible cross-border options in order to avoid a still-stand.

[48] The following information can be found on the homepage of the Dutch government under https://www.rvo.nl/subsidies-financiering/sce/voorwaarden-energiecooperaties.

In the case of Kerkrade, the ESC project and the preparation of an important renewable energy project was to some extend synchronised. Under the ESC framework, the researchers had the time to help and discuss concrete project ideas or test other ideas with respect to the legal, financial or technical feasibility. One project, namely the ambition to link district heating in Kerkrade and Landgraf to a district heating system in Herzogenrath even led to the application under the Interreg Meuse Rhine programme. In July 2025, Interreg gave green light to the project that started in August with the participation of a broader range of stakeholders, including the initial initiator, the municipality of Kerkrade and Parkstad Limburg, as well as the ESC researchers from ITEM/Maastricht university. In this respect, there is a very positive development that parts of the work done under the ESC Regiodeal project will be continued and will hopefully lead to a cross-border heat exchange in the future. The other two case studies that were discussed by ESC researchers and the municipality of Kerkrade are in an earlier stage. Here, the ESC researchers analysed potential obstacles and solutions on the basis of first ideas.

4.2.1 Heat transfer from Herzogenrath (DE) to district heating in Kerkrade (NL) and vice versa

Different workshops formed the platform for intensive discussions of the ESC-Team with stakeholders from Parkstad and the municipality of Kerkrade on possible projects with respect to cross-border energy exchange. Earlier in 2021, an initial feasibility study, also funded by the Regio Deal, showed that there is industrial residual heat available to supply homes in Herzogenrath and Kerkrade/Landgraf.[49] There were initially also ideas about connection a big solar farm on the German side with the electricity network in Kerkrade. This was also discussed in several workshops. The ESC researchers looked into different options and finally recommended for the beginning not to pursue a project in the field of electricity transport across the border but cross-border heat exchange. The big disadvantage of electricity connections in comparison to heat connection: there are legal restriction to connect the Dutch and the German grid at the distribution level. In the current situation, this connection is not legal. Electricity connections at the level of the distribution network operator in a cross-border situation are today only possible if they are on the other side of the border not connected to the grid, meaning a stand-alone solution. This has in particular to do with the national electricity markets and the price mechanisms. The Dutch and the German market are separated and do not belong to the same price zone. Another big problem in the electricity sector are different subsidy schemes for renewable energies. Both problems do not exist in the case of heat exchange. There is no national market only a national regulated price mechanism for district heating. However it is possible to sell heat across the border if national rules are respected. Nevertheless, there are many legal, administrative and financial cross-border questions that have to be discussed.

[49] https://kerkrade.bestuurlijkeinformatie.nl/Document/View/cf313ffe-04d6-459e-a110-5c29348a8b87.

Picture 1: The Eurode Business Center on the border between Kerkrade and Herzogenrath

Source: Eurode.eu

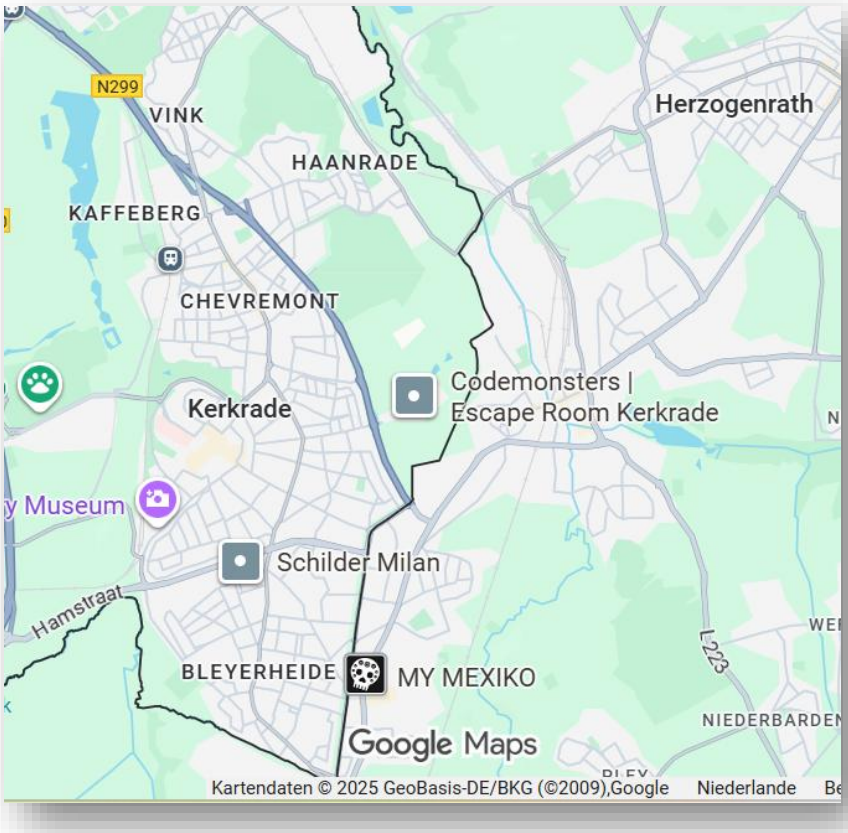
The debate and the intensive cooperation of ESC researchers with Parkstad has contributed to an Interreg application for a 3 year project “Crossheat”. In a longer process in the year 2024/25 a consortium was established and a successful application was written with the help of ESC researchers. The project was finally accepted in the summer of 2025 and started in August 2025. Today, ESC researchers from ITEM/Maastricht university are partner to a broad consortium. Hence, ESC researchers have been an advisor to the Stadsregio Parkstad and the municipality of Kerkrade during the last year. In an intensive exchange, the choice for a heat related project was discussed. With respect to earlier negative experiences with respect to cross-border electricity plans, ITEM supported the idea of limiting a project to heat exchange and the coupling of district heating systems across the border. Initially, there was also on the Dutch side the expectation that residual heat from the company Saint Gobain (glas manufacturing) could play a role as a heat source. The location of the company is very close to the Dutch border. Hence, the heat source from Saint Gobin played a role in the first discussions. ESC researchers also analysed other heat projects in the other border regions and studied best practice. As described earlier, there are at the border of other EU regions pilot projects were municipalities work on heat transport projects across the border. There are already examples where this has been successfully developed: in Strasbourg-Kehl, a pipeline is being built from a German steel factory to bring residual heat to the French heating network in Strasbourg. For this purpose, a public-law company has been set up ‘Grenzüberschreitende Wärmegesellschaft Calorie Kehl-Strasbourg’.[50] In the spring 2025, the glas manufacturer Saint Gobin announced that they will close down the production in Herzogenrath. This did not mean in the first place that the Cross_Heat project had to change its focus. It was always the intention from the beginning to do research on different sources of heat, meaning residual heat from industry/factories but as well from geothermal sources. The case of Saint Gobain just illustrated that it has to be a major concern that a district heating system is not too dependent on a source where the sustainability is not guaranteed.

[50] https://www.calorie-kehl-strasbourg.eu/de/.

There is one crucial difference between the situation in Kerkrade/Herzogenrath and the example at the French/German border. The heating network in Strasbourg already exists; it's just a matter of connecting it. Meaning that the investments are to some extend modest.

Another pilot is located at the border of Germany and Poland. There is also a heat connection in Frankfurt/Oder in the east of Germany to the Polish side of the Oder in the municipality of Słubice. [51] Here, too, there is an existing district heating network in Poland to which German partners deliver heat across the border. As in the case of Kerkrade-Herzogenrath, Frankfurt and Slubice are so-called double cities, meaning they are geographically linked to each other. A double city, refers to the unique cross-border partnership. As in the case of Eurode (the joint cross-border entity established by Kerkrade and Herzogenrath) the partnership transcends traditional twinning by actively fostering cooperation and shared development through joint projects. In this sense, the cooperation between Frankfurt and Słubice could be certainly a role model for Eurode.[52]

Map 5: The national border between Kerkrade and Herzogenrath



Source: Google maps

[51] https://www.sokratherm.de/grenzenlose-energie-1-x-gg-50-h-frankfurt-a-d-oder-pl-slubice/.
[52] Eurode (officially: Openbaar Lichaam Eurode) is a partnership between the Dutch municipality of Kerkrade and the German town of Herzogenrath. Together, the two municipalities form a symbolic 'European city'. They created formal public entity, aimed at ensuring that functioning as a border town causes fewer problems.

ITEM will work on the basis of the knowledge gained and the network established under the Regiodeal ESC project. The aim of CROSS-HEAT is to jointly develop a conceptual heat network, including technical, legal and organisational preconditions. So far, in the border territory between Kerkrade/Landgraf (NL) en Herzogenrath (DE) very little heat comes from sustainable sources such as residual heat or geothermal energy. CROSS_HEAT aims to establish the preconditions to build a large heating system that crosses national borders. This will enable better use of residual heat and geothermal energy, for example from old mines or factories. The project should also help to analyse differences in regulations between countries and finding solutions to legal, technical or financial cross-border problems. Meaning that in the course of the project technical aspects (heat sources, a cross-border heat map) will be developed. The best sustainable heating method will be identified and then tested. Citizens and businesses will be invited to participate in the discussion and will receive information during meetings and courses. Energy companies and investors will also be involved in the collaboration to ensure that the system can actually be built. In parallel, legal and financial aspects will be tackled. The researchers from ITEM will in particular bring in the expertise also developed with the ESC project, on different obstacles of cross-border energy projects. As described in the first chapters, there are not many cross-border projects at the German-Dutch border given the difficult and complex situation and obstacles. The big challenge in the case of the development of a connected district heating network is certainly the synchronisation of planning, the timing of decision making with respect to financing and permitting. Today, Kerkrade/Landgraf and Herzogenrath are planning their potential district heating without looking to the other side of the border.

Map: Planning at the national context in Herzogenrath – mapping of district heating

Source: Energieatlas NRW

As seen on the map above, the German heat map does not take into account potential district heating networks or heat sources of the other side of the border.

The same is true for the Dutch side. The Dutch heat programme and the mandatory German Wärmeplanung, the municipalities have legally defined obligations, deadlines and procedures restricted to the national context. The first challenge will be to find the right moment with respect to cross-border aspects as part of decision-making in both municipalities. In addition, there is the question of how the financing per partner and for joint infrastructure can be arranged. The municipality of Herzogenrath has started already in 2024 with its compulsory “Wärmeplanung”. A first draft is already internally discussed. The idea is the finally at the end of the year, there can be a formal decision made by the municipal council on the document. However, this is not a document with final decisions on investments but to some extend gives an overview on the different potentials in the various quarters of the city. Meaning that in 2026, Herzogenrath will start a public debate on the political consequences of the Wärmeplan (Heat plan) with citizens participation. The city of Kerkrade is also already busy with the compulsory Warmteprogramma. However, this will be linked to a decision making process in the course of the year 2026 where decisions have to be made on investments and technical solutions for different parts of the city. Different from the situation in Herzogenrath, there are plans in Kerkrade to organise not only citizens participation but even a referendum on the final decision on a district heating system. This indicates, that one of the major challenges for Cross_Heat is to deliver cross-border options for a common district heating system in time. Meaning that cross-border options can be part of the decision making process. In order to achieve that the project has to be very much synchronised with the decision making process on the Dutch and German side.

Box 1: The main objectives of the Interreg project Cross_Heat

CROSS_HEAT addresses the cross-border challenge of decarbonising heating in the IMR region, which accounts for 50% of energy consumption, while in the Netherlands only 9,6% (2nd lowest in the EU), in Germany 17% and in Belgium 11,3% of heating energy comes from renewables (Eurostat, 2025). The EU average is much higher (26,2%), with outstanding ratios in Sweden (67,1%), Latvia (61,4%) or Lithuania (53,6%).

In order to decarbonise heating, the project prepares a cross-border district heating (DH) network in the Herzogenrath-Kerkrade-Landgraaf area,

- replacing fossil sources with residual and geothermal heat shared across borders,

- overcoming legal and regulatory differences hindering cross-border heat exchange and joint heating infrastructure operation,

- and engaging regional stakeholders, citizens, and SMEs.

Cross-border cooperation is essential due to the proximity of residual and geothermal heat sources on both sides, the storage and leverage potential of minewater accumulated in abandoned mine tunnel networks under and around the 3 cities, and the need to leverage heat production and use in the whole border area, due to economies of scale, reducing costs and increasing efficiency. Hence, CROSS_HEAT will introduce a novel approach to explore and integrate feasible options for multi-energy (waste & geothermal) heat exchange in a cross-border setting, exploiting abundant residual heat sources and existing, minewater-based heat storage and geothermal leverage capacities. This unique collaboration involves key players as partners or stakeholders, while striving for community and SME engagement

in sustainable energy practices. Its aim is, in the long term, to decarbonise heating, thus significantly reducing greenhouse gas emissions, lowering energy costs, and enhancing energy security and resilience.

CROSS_HEAT will analyse the current heating infrastructure and housing stock, identify alternative heat resources (Work Package 1), select the most feasible heating scenario and develop comprehensive modelling guidelines and tools for integrated cross-border DH solutions (WP2). It will pilot-test the selected DH scenario and create a detailed funding strategy and operational guidelines for its physical implementation (Work Package 3). The project will engage citizens and SMEs through capacity building, dissemination workshops, consultations, and a public information centre. It will also boost cooperation with energy providers, network operators, concession owners, investors and donors via a bankable investment plan and affiliation and investment agreements. It will scale up the solutions across IMR border areas via targeted dissemination actions.

Source: Interreg Description CROSS_HEAT

4.2.2 Electricity from Herzogenrath to the building complex Rolduc

As already described, it was a deliberate decision to limit the scope of the Interreg project to the transport heat across the border. Nevertheless, there are also ideas to benefit from capacities in the neighbouring region in the field of electricity. The assumption with respect to electricity from renewable energies and the question of grid capacities is that Herzogenrath and Kerkrade could offer opportunities for cross-border energy use that matches the need to find local solutions to the grid congestion problem and the problems with extra renewable projects on the Dutch side in South Limburg. On the German side, right on the border, there is a large-scale site for sustainable energy generation, consisting of a solar park with a peak capacity of 15 megawatts and plans for the construction of several wind turbines. This generation capacity exceeds local German demand and could, in theory, also serve Dutch users. In practice, however, this proves to be extremely complex. National and European legislation and regulations and nationally organised infrastructures make it virtually impossible to transport locally generated electricity across the border via low or medium voltage with a connection to the neighbouring grid. This became evident as part of the results of the above already mentioned study funded by the Regio Deal and were previously described in the research under the SEREH Interreg project. The existing regulations on cross-border electricity transport are mainly geared towards large-scale, centrally organised energy supply via high-voltage grids. There is hardly any legal or technical structure available for small-scale, cross-border exchange of electricity.

Nevertheless, specific solutions that can be implemented. One option currently being investigated is to designate specific locations in Kerkrade as separate users of potential German electricity. This means that a location, for example via a direct line, is linked to a German generation source, whereby it is classified as a “customer” under the German system. Rolduc Abbey in Kerkrade serves as a test case in this study. Rolduc Abbey is one of the largest and oldest abbey complexes in the Netherlands and a unique historical monument with a rich history dating back to 1104. Originally founded as a monastery, today it is not only a cultural heritage site but also a lively conference centre with lots of activity, a hotel and a meeting place. Unfortunately today, not the entire complex can be used due to

network congestion meaning that it is not possible at the moment get a stronger grid connection.

Scenario 1

Map 6: Potential connection of Rolduc to the closest German grid connection in Herzogenrath

Source: Municipality of Kerkrade

One solution to the grid problem could be a direct connection to the German grid. This could be a possible scenario. The distance to the German network would be only 400 metres. In a session with the Municipality of Kerkrade, this scenario was discussed in Spring 2025 with ESC researchers Martin Unfried and Steve Clemens who invited also Lea Distelmeier from the University of Groningen. Lea Diestelmeier was involved in the legal analysis of the previous Interreg project SEREH. The researchers assumption was that this would be only legally possible if the connection from Germany is not connected to the Dutch grid, meaning that at Rolduc the German connection is entirely separated from the Dutch grid connection. The researchers analysed the following scenario.

- The part of Rolduc that should be connected is a location in the Netherlands but not connected to the Dutch electricity network;
- there is only a connection cable running from the location Rolduc to a German network meaning there is no transport cable on Dutch but only on German territory;
- and there is also no private grid behind the connection at the site of the Dutch location.

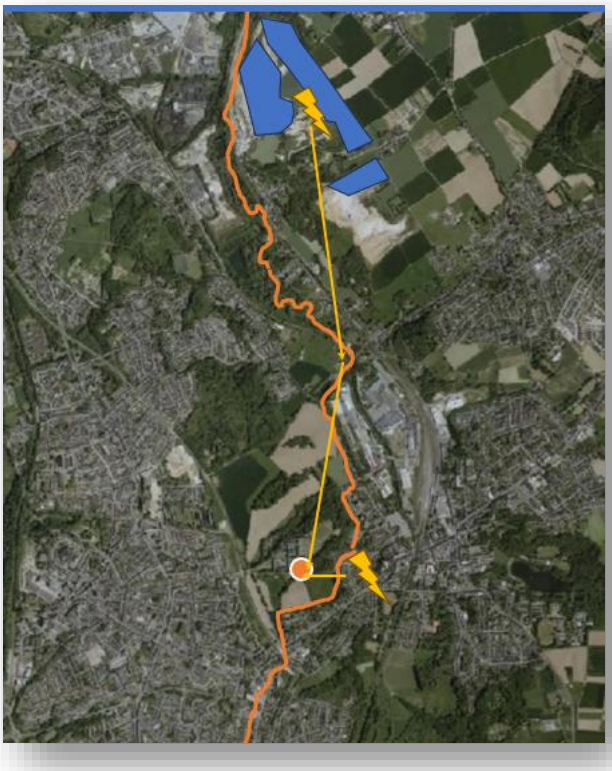
In this case the assessment was that that would be not in conflict with Dutch legislation and therefore could get a green light from the responsible authority. It was also emphasized that it was probably not enough to get legal certainty. With respect to the technical feasibility, such a project would need in any case the support of the regional distribution network operator. In this case that is Enexis on the Dutch and more important Regionetz GmbH on the German side. It was stated, that it is in particular important to discuss all condition with the German network operator Regionetz with respect to liability etc. and clarify the relation to the electricity supplier.

This scenario could be described as a standard solution that is in the first place not focusing on questions of sustainability and the support of renewable energy.

Scenario 2:

In the workshop, another scenario was discussed where the electricity from the German side comes directly from the solar field just across the border in Herzogenrath.

Map 7: Potential connection of Rolduc to the Solar Field in Herzogenrath



Source: Municipality of Kerkrade

A connection to the existing solar park in Herzogenrath could offer a more sustainable option with a clear link to renewable energy production in the neighbourhood. Herzogenrath is home to a solar parks that was for a long time one of the biggest in North Rhine-Westphalia: operated by Green Solar Herzogenrath GmbH, it is a project of EWV Energie- und Wasser-Versorgung GmbH, a subsidiary of Nivelsteiner Sandwerke und Sandsteinbrüche GmbH – and the town of Herzogenrath. With a peak output of more than 14 megawatts (MW), it can supply almost 5,000 households with renewable electricity. The location of the solar park is only a few kilometres away from Rolduc. There is even more renewable energy to come just across the border. In the summer of 2025, the STAWAG Energie GmbH, a wholly owned subsidiary of STAWAG, is constructing an open-space photovoltaic plant with a capacity of 15.5 megawatts in Herzogenrath-Merkstein very close to the location of the Green Solar

park. The electricity will be fed into the grid and will be available inter alia for customers who have a green electricity contract with STAWAG.

In this scenario, there are some unknown variables. The first question would be whether Rolduc could have a direct connection with one of the solar parks independent from the German grid. Both solar park companies are marketing the electricity in the first place as part of their “green electricity” portfolio to their customers. Nevertheless, a combination of scenario 1 and 2 could be perhaps an option. Meaning that there would be a direct cable to the first connection to the German grid (not directly at the solar park). As described above, that would mean that there is no connection to the Dutch grid. Rolduc could become a ‘normal’ consumer and opt for supply from one of the two electricity companies that also sell a green electricity portfolio where the solar parks are included. That could be the STAWAG or EWV. Nevertheless, this would be not really an exclusive link to the electricity produced in Herzogenrath. Another possibility could be a Power Purchase Agreement (PPA). This is a long-term electricity supply contract between the operator of the solar power system and the consumer, i.e. a company. Through a PPA, plant operators and electricity consumers contractually agree on the supply of a certain amount of electricity at a fixed price over a longer period of time. Contracts are usually concluded for a term of up to ten years. A PPA also regulates other conditions, such as contractual penalties for non-compliance.

Under this agreement, solar power is supplied directly from the system to the company and purchased by it. In the first place, this was meant to be interesting for bigger companies with huge electricity demand. The most striking question is, whether a costumer with a relatively low demand (as Rolduc) would be interesting for the owner of the solar parks. The German Energy Agency (Dena) has published the first standard contract for the German PPA market. It is intended to support smaller companies and municipal utilities in particular. The model contract offers the opportunity to conclude a supply contract even without in-depth knowledge of PPA contract types and electricity market effects. In addition, Dena provides information on key aspects and design options.[53] There is even the possibility to agree on on-site PPAs, also known as direct PPAs, where the renewable electricity is generated by the plant operator in the immediate vicinity of the consumer and delivered without passing through the public grid. However, the public grid is usually used for electricity delivery (off-site PPA) and the agreed amount of electricity is settled on a balance sheet basis. In the case of Rolduc, it is unlikely that the project would qualify for an On-site PPA. Either the distance is probably too far away from the producer and Rolduc would be a too small consumer to justify a On-site PPA.

Box 2: What is a direct or On-site PPA?

On-site PPA – With an on-site power purchase agreement, electricity is supplied directly and physically (rather than just on the balance sheet). Physical proximity is necessary, as the generation plant is located behind the consumer's metering point, for example on the company premises itself. With an on-site PPA, charges such as grid fees for the electricity produced by the installed plant can be eliminated or reduced, as it flows to the consumer via a direct power line and not via the public grid. The size of the plant and thus the Power Purchase Agreement is usually based on the consumer's consumption profile. Surplus

[53] https://www.dena.de/infocenter/mustervertrag-standardvertrag-ppa-lieferband/.

residual electricity may then be fed into the public grid. Since the electricity generated in an on-site PPA directly reduces a company's consumption, all on-site PPAs are also corporate PPAs. Example: An industrial company has a suitable hall roof on its premises and wants to reduce its electricity procurement costs. However, the company does not want to install a photovoltaic system on the roof itself, but would like to outsource the investment, project and operating risks. To this end, it concludes an on-site PPA with a project developer, who now installs the photovoltaic system on the hall roof and sells the electricity generated there to the industrial company.

Source: https://www.next-kraftwerke.de[54]

Nevertheless, there are certainly options with respect to buying green electricity from the companies who run the solar parks, or to discuss with the solar park companies whether there are possibilities for a PPA arrangement.

Map 8: Rolduc and the distance to the Green Solar Herzogenrath GmbH

Source: google.maps

[54] Source: https://www.next-kraftwerke.de/wissen/power-purchase-agreement-ppa#physische-ppas-auch-physical-ppas.

As a follow-up to the connection to the German electricity network, Kerkrade is also doing research on possibilities with respect to seasonal storage with the German electricity grid as a backup. Furthermore, together with the Rolduc Abbey Foundation the municipality will look into whether solar panels can be installed above the car park of the Abbey and produce own electricity for the building. Also here, a precondition for a connection to the German grid and having a contract with a German energy supplier would mean that there is no connection to the Dutch grid. This would mean that all other activities like the production of solar power at Rolduc could be not connected to the Dutch grid.

4.2.3 Battery storage in Blijderheide with electricity from Germany

In anticipation of the neighbourhood implementation plans of the Heat Transition Vision and the natural gas-free neighbourhoods, there are ideas for a pilot project that should provide insight into the possibilities of neighbourhood-oriented storage within the Bleijerheide-Nulland neighbourhood. There are many projects that are at the moment difficult to implement because of grid congestion problems at the Dutch side.

Map: The quarter Blijderheide surrounded by the German border

The different plans on the Dutch side:

- Plan to relocate the primary school
- Plan to establish a care centre
- the existing church must be repurposed
- redevelopment of public squares
- New construction/reconstruction of rental properties
- Making the Springbron neighbourhood more sustainable (80%+ poorly insulated homes)

The municipality also takes also account of the problem that there locally insufficient energy generation capacity on the Dutch side for a broader electrification and a switch from heating system based on natural gas to heat pumps or district heating from renewable resources. There are different questions relevant for future decision making:

- Is a battery an option for supplying power to the developments in Bleijerheide?
- Can the battery be charged via the German power grid?
- Can the roofs of the companies in Germany be used to generate power that can be used on the Dutch side.

A neighbourhood battery is a battery that can store self-generated electricity from multiple households. This battery is often placed at a central point in the neighbourhood. All households in the neighbourhood are directly connected to the battery. The electricity generated, which is normally fed back into the grid, is stored in the neighbourhood battery. This electricity can be used at a later time, for example in the evening or on days with less sunlight. At the moment, there are still many obstacles for bigger batteries on the level of neighbourhoods. In the first place, the financial challenges of getting such a project off the ground. Current legislation and regulations are not yet geared towards joint energy storage and sharing. For example, you pay energy tax on electricity from a neighbourhood battery, whereas energy used behind the meter is not subject to energy tax.

A neighbourhood battery is usually a large container with batteries in the neighbourhood. Because such an installation has an impact on the environment, there are strict regulations that it must comply with. These include fire safety and minimum distance from homes. The Dutch government has drawn up guidelines[55]. For example, a neighbourhood initiative usually needs to get a permit and show that it meets all safety requirements. Hence, there are spatial issues that are certainly also an issue in Bleijerheide that is very densely populated. In this respect, next to the investigation on bigger batteries, there should be also research being done with respect to individual home batteries that could create a single virtual energy network that contributes to reducing the load on the local grid. Since the financial situation of many households in Kerkrade is less favourable, it is not likely that private households can invest in batteries. In this respect, one should develop an innovative design where batteries could be installed in private houses with external investment that even could provide financial advantages for less financially healthy households.

The question whether the Batteries can be charged with electricity from the German grid is very much related to the question of the electricity connection that was described above. In the first place under the current legal situation, it is not likely that such a design would get green light from the respective authority. The problem is that the battery has to be connected to the Dutch grid if private households have to be served by the battery. We have seen as part of the previous cases, that the conditions for a German grid connection are rather rigid. One important element is that this is only possible if there is no connection to the Dutch grid. Hence, it is not likely that the whole quarter would be disconnected from the Dutch grid. In this respect, charging a battery on Dutch soil with electricity from Germany would demand a

[55] Rijsdienst voor Ondernemend Nederland: Handreiking vergunningverlening elektriciteitsopslagsystemen In opdracht van het Ministerie van Economische Zaken en Klimaat. https://www.rvo.nl/sites/default/files/2024-07/Handreiking-vergunningverlening-elektriciteitsopslagsystemen.pdf.

very new legal design. This could mean a specific derogation from Dutch legislation. The position of Dutch responsible ministries in the past does not indicate that such a derogation would be granted. The Ministry of Economic Affairs was in the past very hesitant to discuss any derogation with respect to electricity transport across the border at the distribution level. That was for instance the experience in the course of the Interreg project SEREH. Hence, also the question whether a neighbourhood battery could be charged by solar power from the German side would demand innovative political and legal solutions. In this case, there are several obstacles, starting from the gid connection and ending with respect to German and Dutch subsidy systems for solar power that are at the moment not compatible. Nevertheless, the questions with respect to battery storage clearly indicate that there is an urgent need for innovative and creative solutions for cross-border cases. Otherwise, municipalities at the border, and especially a double city like Kerkrade/Herzogenrath will have tremendous disadvantages to tackle the challenges of the energy transition. The open questions raised in this section should be the basis of a very big bi-national project with German and Dutch stakeholders, municipalities and legislators. This refers to cores problems of cross-border cooperation: for the last couple of years questions have been discussed about a legal mechanism that allow to deviate from national legislation and define cross-border areas where national legislation can be accepted on the other side of the border.

5. Conclusions and recommendations

The Regiodeal project and the research on cross-border renewable energy projects has confirmed earlier findings on the problems to get cross-border activities of the ground. These obstacles are related to spatial planning, national subsidy schemes, lack of cross-border electricity connections at the distribution level, legal problems with respect to selling electricity across the border and lack participation and citizens engagement in a real cross-border way. In addition, the very practical analysis of the heat project in Kerkrade/Herzogenrath also showed that it will be a major challenges to synchronise planning and decision making processes with respect to district heating networks.

More attention how to avoid cross-border conflicts and support cross-border engagements

As described in the report, there are many citizens – in particular on the Dutch side – who are very concerned with respect to renewable energy project on the other side of the border. Citizens participation is already difficult with respect to national projects. There are already many conflicts with respect to pure Dutch or German wind park projects. The organisation of a fruitful citizens participation process is even more difficult in a cross-border situation. Cross-border citizens participation was not part of the research design of this project. However, in the course of the project it was obvious that there is a need to further work on the topic. In this respect, one recommendation is to initiate in the future concrete projects on citizens participation and citizens engagement since this is seen as intertwined. There is on the one hand, the question how Dutch or German municipalities or regional authorities can better open up their consultation and participation projects to cross-border stakeholders and citizens. On the other hand, the question of energy communities could be of major help to avoid negative impacts on the cohesion of cross-border territories. In this respect, a fruitful research objective could be to better understand the possibilities to stimulate cross-border energy communities where citizens are financially participating in renewable energy projects. What is seen as a major instrument for the national acceptance of wind parks and ground mounted solar fields, could be also a very important element of a cross-border renewable energy strategy. The assumption is that cross-border energy communities, where citizens are together benefiting from the production of renewable energies could be a major driver of citizens engagement and acceptance of cross-border infrastructure.

More demand for cross-border projects in South Limburg

For the Province of Limburg, one of the major findings is that in South Limburg there is an urgent need for cross-border innovative solutions. Whereas in the north of the Province, several projects in the field of renewable energies are on track with the objectives laid down in the respective regional energy strategy (RES), the situation in South Limburg is very different: due to several circumstances (for instance restrictions for wind energy related to the Einstein Telescope) it seems to be very unlikely to achieve major results without profiting from the potentials of cross-border projects.

Positive development: from the Regiodeal project to Interreg Cross_Heat

In this respect, it is very inspiring that the Municipalities of Kerkrade and Landgraf (supported by the ESC project) initiated the Interreg project Cross_Heat. The aim is to investigate the potentials for a connection of district heating networks across the border and benefit from heat sources on both sides. As a learning point of the ESC project, it is in practical terms very positive to limit the project to district heating and not combining it with questions of electricity grids. As shown in the research, the restrictions in the field of electricity connections are much more persistent. Nevertheless, also cross-border heat exchange is a big challenge. At the moment due to national legal obligations in Kerkrade/Landgraf the municipalities are in the planning process of their respective heat programme (warmteprogramma). The objective of this programme is to describe options for renewable heat for the different quarters of the city and finally take decisions. For instance, whether or not to build a district heating network and what type of heat sources to use. Also on the German side, there are national legal obligations to develop a heat plan (Wärmeplanung) in order to describe potentials on the level of quarters. The results of the ESC project can help the municipalities to better coordinate their planning since ESC researchers are part of the new Interreg project. It will be a major challenge to synchronise the planning processes on both sites of the border and work on cross-border options (heat sources, network options) that can play a role in the final individual decision making processes of the municipalities on both sides of the border.

Future: new innovative legal arrangements for electricity

The presented project ideas on electricity connections across the border in the first place illustrated the problem that a direct grid connection at the distribution level across the border is today not feasible. Meaning that the solutions discussed would require a sort of island solution on the Dutch side, where a connection to the German grid would be only possible without a simultaneous connection to the Dutch grid. As discussed in the case of Rolduc this could be a stand-along solution. Nevertheless, it does not really open up possibility to tackle the persistent problem of net congestion especially on the Dutch side with cross-border solutions. Given the legal background today, more sophisticated solutions as the use of battery storage systems on the Dutch side loaded with renewable electricity from Germany still face major obstacles.