



Cultural Heritage Agency
Ministry of Education, Culture and Science

01 *The Netherlands -
Meaningful Land*

Manual Energy, Heritage & Environment



How to make room for sustainable energy production?

Our landscapes are always evolving. Our collective actions are constantly adding new layers to our history. How can we utilize the spatial qualities of our cultural landscape in the production of sustainable energy? The following four aspects may serve as guidelines.

Spatial and temporal continuity.

Landscapes are constantly evolving but at a highly variable rate. Some have developed slowly and display a high degree of **continuity in settlement and exploitation**. Others came about in leaps and bounds as a result of **human action**. The latter can accommodate transitions to new forms of energy more easily than the former.

*Industrial landscape, Liesboslaan, Breda ('fast' landscape).
A landscape periodically dissected and radically overhauled.
An ideal location for solar and wind energy.*



Functional continuity.

In every cultural landscape a few functions dominate, like **agriculture** or **nature**. In the past, **energy** was yet another dominant function (e.g. timber production, peat cutting). This past may be included in discussions on new energy landscapes. Explore ways in which the new function may proceed naturally from the old and match the landscape and its inhabitants.

*River landscape, Galgendaalsedijk ('slow' landscape).
A landscape that for centuries changed but slowly.
Its ancient settlement history followed the river's unpredictable moods.
The energy transition could match the scale and speed of this 'slow' natural system
(e.g. water-based energy, biomass, algae cultivation).*



*Agricultural landscape, Betuwe, Zetten. This river landscape with its fertile soils is marked by its rich past of harvests and orchards.
Future developments in the energy transition could centre on the concept of the harvest, for example by cultivating and harvesting high-energy crops.*

Continuity of form.

Their subsoil-derived functions have given cultural landscapes their specific form. In each case, **landscape structures - field patterns, infrastructure or settlement patterns** - are essential components of an area's spatial identity. Such spatial identities can serve as starting points for the development of new functions.



The field patterns and settlement history of the characteristic peat meadow landscape around Hardinxveld-Giessendam are unique. Straight drainage ditches testify to the landscape's systematic reclamation. The proportions of fields, ditches and settlements are harmonious and much appreciated, in part also due to their human scale. This human scale may be a source of inspiration when designing new solar, wind and biomass plants.

Sustainable development.

Sustainability is related to landscape **robustness**. Landscapes are resilient, but only up to a point. Sustainability also relates to the question how to safeguard landscape **quality**: does an intended new function contribute to or instead detract from the preservation of valuable (agricultural) cultural landscapes?

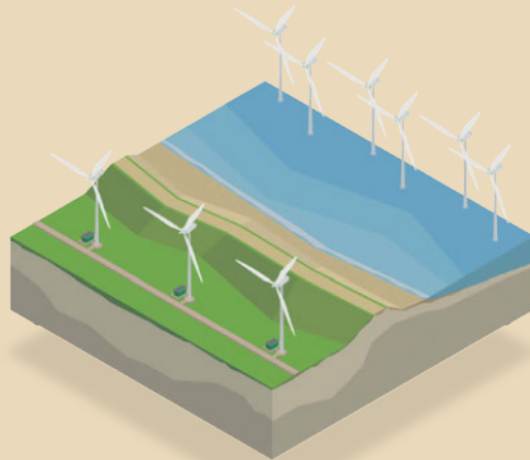


An example of a landscape which in the last century acquired a new function: a section of IJsselmeer ('Lake IJssel', the former Zuiderzee) has been converted into agricultural land. When the present Noordoostpolder was reclaimed the former island of Schokland was deliberately spared, its outline emphasized by forest plantations along its perimeter. On the photo the fields visible to the right of the green 'island' are kept moist in order to preserve valuable archaeological sites in situ. The new land has provided an opportunity for the old landscape to remain visible and meaningful indefinitely. The present agricultural production landscape is sufficiently robust to allow its continued conversion into an energy production landscape whilst preserving its cultural aspects.

How to embed sustainable forms of energy in the landscape?

Three development strategies for integrating sustainable energy production in the landscape exist: preservation, embedding, and/or transformation. Embedding sustainable forms of energy in a cultural landscape is always case-specific. Each location demands its own unique solution. However, all three development strategies have in common that sustainable energy production tends to be reversible, allowing its eventual removal from the landscape.

Wind



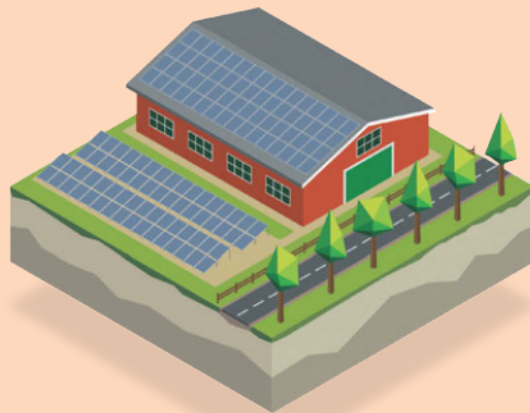
Preservation

Wind turbines are large and conspicuous. They cannot be invisibly embedded in an existing landscape. On the other hand, wind turbines do not affect the overall landscape structure since the landscape has to remain open to take optimum advantage of the prevailing winds. Existing landscape structures around turbines can therefore be preserved.



Open polder landscape, Zeewolde, surrounded by wind turbines

Sun



At present, solar panels are usually camouflaged. In a level landscape a solar plant can be rendered 'invisible' by vegetation, e.g. hedges. Examples of this approach are the solar plants Ouddorp and Ameland.



Solar plant, Ameland, embedded in the landscape, next to Ballum Airport (Kees van de Veen)

Biomass



Biomass energy provides an opportunity to assign a new function to coppice, lines of trees, wooded banks and hedgerows, or even to replant former hedgerows, hawthorn hedges and thickets, thus restoring not only these features' historical function but also the area's original layout. Biomass production is a potentially sustainable and energy-saving form of landscape management, particularly for smaller or larger country estates.



Twickel Castle is partly heated by wood chips from the estate itself (Wouter Borre/Tubantia).

Embedding

Wind turbines affect an area's experience value. In the case of landscapes with a high cultural-historical value it is advisable at the planning stage to first visually explore the various scenarios by means of photomontage or video in order to ascertain whether an alternative arrangement might mitigate the turbines' visual impact.



Photo-processed images demonstrated that wind turbines near Alblasterdam would seriously detract from the famous view of the windmills at the World Heritage site of Kinderdijk (Impressie-Land-ID)

Transformation

Wind energy production adds another layer to the landscape. Under certain conditions this may produce a striking visual landscape or underline an existing impression.



A line of wind turbines along the dike between Lelystad and Ketelbrug marks out the border between land and water.

Strips or fields of solar panels may be placed so as to pick out certain elements in a landscape in order to visualize historical elements or lines. Solar energy production need not be limited to dry areas. Groningen now features the first floating solar plant.



Floating solar plant, Groningen (EnableMi)

Conversely, by giving solar plants a striking shape, solar energy may become a component of local identity.



An example of this approach is Zoneiland (Sun Island) near the Noorderplassen-West housing development, Almere. Water heated up by the island's solar panels is pumped into the municipal district heating system.

The cultivation and extraction of biomass may accentuate certain landscape elements and make original linear structures visible again. This option is currently being explored in the Cultural Heritage Agency of the Netherlands' project Energieliniën.



Yellow rapeseed field in full flower, Gelderland (Nationale Beeldbank)

The planned layout of the Waterlinie Museum, established at Fort Vechten (Bunnik), encompassed an 80m wide and 450m long strip of grass clipped short to mark out the otherwise overgrown fortress. This approach can also be applied at other locations on the Holland Waterline. Fields of fire, for example, may also be planted with strips of bio-energy crops, which can be removed just as quickly as the wooden houses in the past.



Fort Vechten, Bunnik, with the Waterlinie Museum (Luuc Jonker, Waterliniemuseum)

Heritage perspective

There are three options for the utilization of heritage in the context of energy transition.

Inspiration

- Enhancement of spatial qualities.
- Heritage as a (co-)vehicle for development.
- The heritage sector as developing partner.
- The past as an economic asset or a source of innovative solutions.

The challenge of energy transition may breathe new life into existing cultural-historical landscapes or add new layers of meaning to them. Cultural-historical landscapes may inspire innovative spatial solutions.

Public support

- Creating public support may lessen opposition.
- Telling the local or regional story and looking for suitable starting points.
- The heritage sector as communication partner.
- Heritage enjoys wide popular support.

Public support and collaboration are increasingly becoming essential to the success of spatial plans. When communicating and participating with those directly involved (residents, businesses, local organisations), heritage may be deployed as a trump card. Presenting local or regional narratives and exploring ways in which the new forms of energy production may tap into them can be helpful.

Preconditions

- Attention to heritage-related preconditions at an early stage.
- Access to correct (digital) information.
- The heritage sector as information partner.
- Prevention of delays at a later stage.

An early assessment of what is needed or mandatory from a heritage perspective is advisable. Are there conflicts of interest? Will a specific landscape intervention provoke public protest? What has been agreed upon at a national, provincial and/or municipal level? Taking these preconditions into account at an early stage prevents delays later on.

Expertise and advice provided by the Cultural Heritage Agency of the Netherlands

The Netherlands are constantly changing. How can the landscape's character best be preserved?

The Cultural Heritage Agency of the Netherlands works towards spatial development on a cultural-historical basis and provides expertise and advice to that effect. Municipalities and provinces wishing to involve heritage in the challenges of sustainable energy may contact the agency.

The Netherlands - Land of Energy

The Dutch landscape is complex and in a permanent state of flux, with new layers being constantly added. The series *Nederland, land van betekenis* (The Netherlands - Meaningful Land) provides a step-by-step overview of the development of the Dutch landscape through the ages. The starting point for each publication is a spatial challenge, for instance sustainable energy. The series explores opportunities to draw lessons from the past and to apply them intelligently to the search for new spatial solutions. *'The Netherlands - Land of Energy'* will enable you to view the challenges posed by sustainable energy in their proper context and to engage in discussions on the added value of cultural history in your own professional situation.



The manual 'Energie, erfgoed en ruimte' (Energy, Heritage and Environment) presents various ways in which municipalities and regions may involve the cultural landscape in wind, solar and biomass-based energy projects. The manual is also available online (www.erfgoedenuimte/energie) and is regularly updated with new information and case studies (www.kiezenvoorkarakter.nl).

Info desk

For questions, call +31-33-421 7 456, or send an email to info@cultureelerfgoed.nl.

The Cultural Heritage Agency of the Netherlands gives the past a future by offering expertise and advice.

Acknowledgements

Photos by Siebe Swart in the collection of the Cultural Heritage Agency of the Netherlands.

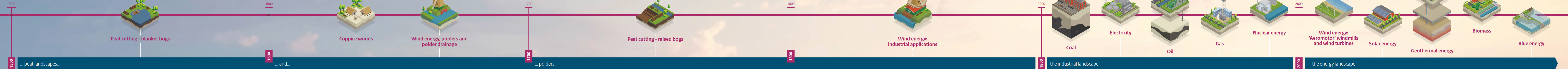
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Colophon

Cultural Heritage Agency of the Netherlands
Smallepad 5 | 3811 MG Amersfoort,
the Netherlands | Postal address: PO Box 1600
3800 BP Amersfoort, the Netherlands
Telephone +31-31-4217 421
www.cultureelerfgoed.nl

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The Netherlands - Land of Energy



Summary

The Netherlands is facing a major challenge with regard to its energy supply. Fossil fuels such as coal, oil and gas will ultimately run out. Moreover, they are responsible for an increase in atmospheric greenhouse gases, which has a negative impact on our climate. The Energieakkoord (the Dutch National Energy Agreement) therefore states that CO₂ emissions should be reduced by 80 to 95% by 2050 and that more sustainable forms of energy should constitute up to 14% of the total production in 2020.

The transition to alternative forms of energy will have a major impact on our environment. That was also the case in the past. Peat cutting left behind large artificial lakes as well as new settlements along the larger and smaller canals. Following the invention of the wind mill, thousands of new structures soon dotted the open landscape. The tremendous speed at which the landscape is changing is a relatively recent development. It took us four hundred years to reclaim the peat marshes and turn them into polders. The transformation from an agrarian society to an industrial nation dependent on coal, petroleum and natural gas took less than a century. This acceleration increases the challenge to complete the switch to a climate neutral lifestyle based solely on sustainable energy within the next 35 years. Some new energy sources, such as geothermal energy or hydrogower, will more or less blend in with the landscape and raise little protest. New wind farms and solar plants, however, will profoundly alter our environment for several decades to come. In those cases, integration should proceed with great care.

It may also be helpful to inform local residents of the temporal nature of certain modifications. In the course of technological progress, existing energy sources are constantly replaced by other technologies with a greater capacity. Moreover, past examples show that local residents find it easier to cope with change if they share in the benefits. In areas affected by economic recession, sustainable energy sources may create more jobs and businesses or mitigate the consequences of earlier landscape modifications. Finally, we should remember that energy production has also generated a wide range of landscapes and features which today are highly appreciated or even designated as World Heritage sites, such as the Kinderdijk windmills. The transition to other forms of energy will add a new and exciting chapter to the rich biography of the Netherlands.

then

The production of turf by extracting peat from blanket bogs began around 1500AD. The towns in the west of the Netherlands were growing fast and required much fuel. New techniques to extract and process the wet peat were developed and applied systematically. As a result, vast areas in the west of the Netherlands and Midden-Friesland changed into marsh lakes. This form of turf production peaked in the 17th and 18th centuries.

now

Scattered remnants of the original peat landscapes can still be found. Nevertheless, the turf industry has obliterated most of these unique areas. What remains is increasingly affected by oxidation caused by today's artificially reduced water tables.

then

For centuries, farmers planted coppice woods near villages and farms. They needed the wood for fuel and to make tools. Willow, alder and other fast growing trees were often planted in the lowest parts of meadows. Every ten years the trees were trimmed down almost to the roots, after which the stumps were allowed to sprout until the next round of pollarding.

now

Although some oak coppices can still be found near villages, they have lost their original function. However, clippings are occasionally used as a biomass fuel for cleaner electricity production. Landscape maintenance also benefits from this.

then

In the 16th century new technologies for the first time made it possible to drain the lakes in the west of the Netherlands. The first drainage projects centred on some small lakes near Alkmaar but in the 17th century larger polders were created, such as the Beemster (1612), the Purmer (1622), the Schermer (1659) and the Wijde Wormer (1656). Earlier, thousands of windmills had been deployed to artificially drain existing land, sometimes by means of a staggered system of successive mills.

now

The most famous example is the series of windmills near Kinderdijk (1738). Like the polder Beemster, Unesco has also added this unique location to its list of World Heritage sites. After ca. 1900, pumping stations powered by steam, electricity and diesel began to replace most windmills. Some, however, are still operational.

then

In the 16th and 17th century the demand for fuel in the western Dutch towns soared and the exploitation of the raised peat bogs in the provinces of Groningen and Drenthe began. This was the start of the so-called Veenkoloniën, a region defined by a characteristic grid of canals, to transport the turves, and by hundreds of bridges. It set in motion the region's industrial development.

now

In the course of the large-scale land consolidation programme of the 1980s, segments of this unique system of waterways were lost. Locally, however, canals and drawbridges still dominate the landscape and a few towns and villages that are typical for the period have been declared designated conservation areas, such as Amnervenscheekanaal/ Eexterveenscheekanaal and Veenhuizen.

then

In the 17th and 18th century, windmills dotted the Dutch landscape in growing numbers: oil mills, saw mills, grist mills. By applying wind energy on a massive scale the formerly rural Zaanstreek became one of the Netherlands' first truly industrial zones. With the Amsterdam shipyards of the Dutch United East India Company just around the corner, dozens of timber mills arose along the river Zaan, to remain part of the landscape until the arrival of steam power.

now

Of the original number of Zaanstreek windmills only a few remain. These are cherished icons of the Netherlands' oldest industrial landscape, as are the warehouses and factory buildings along the river Zaan.

then

In 1899, the Dutch government explored options for the exploitation of coal in the province of Zuid-Limburg. As industrialization proceeded, fuel demands soared. Four state-owned (Staatsmijnen) and nine privately owned collieries opened in the area. Their headframes, storage and sorting sheds, spoil tips and railway yards transformed the landscape into an industrial zone. Elsewhere in the Netherlands, extensive plantations of pine (Pinus sylvestris) totally altered the appearance of the land: these plantations supplied the supports for the mine shafts.

now

Around 1970, all collieries were closed and the demolition of their built structures began. Renewed interest in the Dutch mining past only arose in the mid-1990s, when some of the former mining settlements became designated conservation areas.

then & now

The early 20th century saw the great advance of electricity. The first overhead power line became operational in 1929. More lines followed in quick succession and electricity pylons grew taller. Their conspicuous presence in the landscape evokes mixed feelings among local residents.

then & now

The exploitation of oil fields is less visible on the surface. Pump jacks appeared near the Orenthe village of Schoonebeek after 1948, but these devices are relatively small. Some years ago they were replaced by larger pumps using new techniques to bring the oil to the surface. Some of the older devices are now appreciated as industrial heritage.

then & now

Since 1959, the Slochteren gas fields have been exploited largely from below the surface. However, after several decades the effects of their exploitation are becoming increasingly clear. The Groningen soil is replaced by larger pumps using new techniques to bring the oil to the surface. Some of the older devices are now appreciated as industrial heritage.

then & now

In 1959, the Netherlands embarked on its own nuclear energy programme with a power station near Dodewaard, followed by a second one near Borssele which produced up to eight times more electricity than the Dodewaard station. While no CO₂ is released in the production of nuclear energy, radioactive waste constitutes a serious problem. The Dodewaard power station was shut down in 1997 in the wake of the Chernobyl disaster and persistent environmental protests. The Borssele installation, too, is ultimately due to be powered down. However, both installations will remain standing until at least 2045.

then

The early 20th century saw the arrival of the first great windmills of the quintessentially American 'Aeromotor' type in the Netherlands. These mills kept the polders dry. In the 1980s, other wind turbines were installed for electricity production. The first specimen, in Petten, was 25m high.

now

Today, some of the existing 'Aeromotor' type windmills in the province of Friesland are scheduled monuments. New wind mills are under construction on government-appointed wind farms, producing up to 100 megawatt or more. One of the nation's highest wind turbines - 198m - will soon be towering over its Noordostpolder surroundings.

then

Solar panels and solar farms on large-scale solar energy production can be found in the Heerhugowaard housing development (Vinea) 'Stad van de Zon' - Sun City.

now

Solar panels and solar farms in rural areas are necessary in order to be able in the future to use more sustainable energy. The solar farm at Ouddorp-aan-Zee demonstrates that it is possible over its Noordostpolder surroundings.

then

The earth's own heat can be utilized as a sustainable source of energy. At a depth of ca. 3km, water is heated to a point where it can be used to generate electricity. A geothermal energy plant in The Hague, built in 2008, supplies central heating to three thousand houses. At several other locations, the residual heat produced by electricity plants serves as an energy source while individual buildings may in addition use geothermal heat pumps. In winter, groundwater pumped from a depth of ca. 100m provides an additional source of heat before being injected back into the soil. In summer, groundwater may be used as a cooling agent.

now

Solar panels and solar farms in rural areas are necessary in order to be able in the future to use more sustainable energy. The solar farm at Ouddorp-aan-Zee demonstrates that it is possible over its Noordostpolder surroundings.

now

Biomass is a potential source of renewable electricity. It may include both vegetable and animal substances, such as wood (-clippings), algae or manure. Nature and landscape organisations and major land owners are the main suppliers of biomass fuel to Dutch electricity plants. A reasonable yield, however, requires the planting, harvesting and burning of vast quantities of biomass, which is why, at present, most biomass is imported from abroad. Research into the potential for greater efficiency and large-scale production of algae-based gas is ongoing.

now

Osmosis and tidal energy Blue energy is a collective term for energy generated by the interaction of salt and fresh water (osmosis) or by the difference between low and high tide (tidal energy). Techniques to produce these sustainable forms of energy are currently being tested near the Afsluitdijk, that can of the Dutch war against the waters and perhaps a future symbol of sustainable energy.