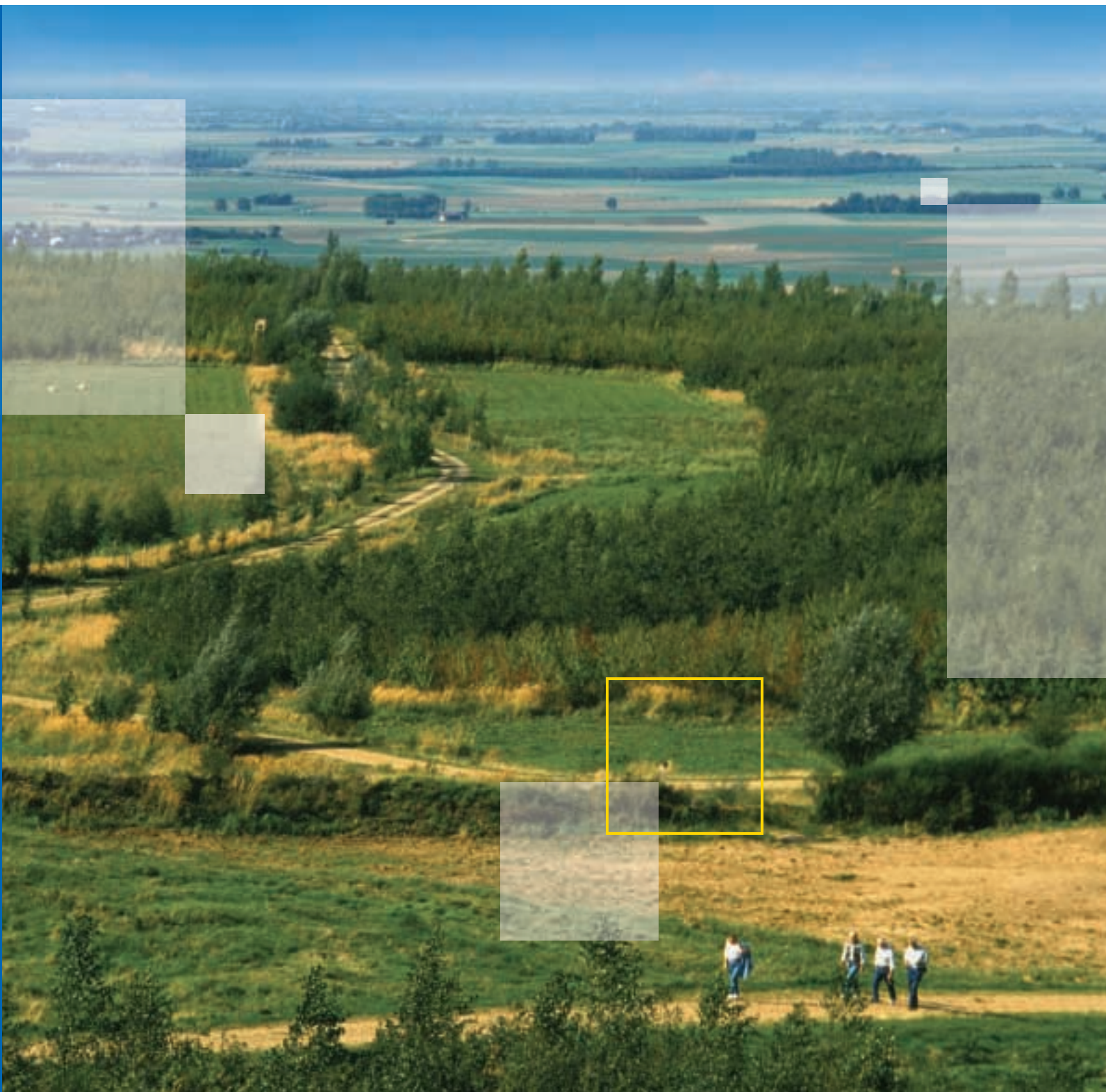


The post-mining landscape

Recultivation in the Rhineland



RWE Power – All the power

RWE Power is Germany’s biggest power producer and a leading player in the extraction of energy raw materials. Our core business consists of the low-cost, environmentally sound, safe and reliable generation of electricity and heat as well as fossil fuel extraction.

In our business, we rely on a diversified primary energy mix of lignite and hard coal, nuclear power, gas and renewable sources to produce electricity in the base, intermediate and peak load ranges.

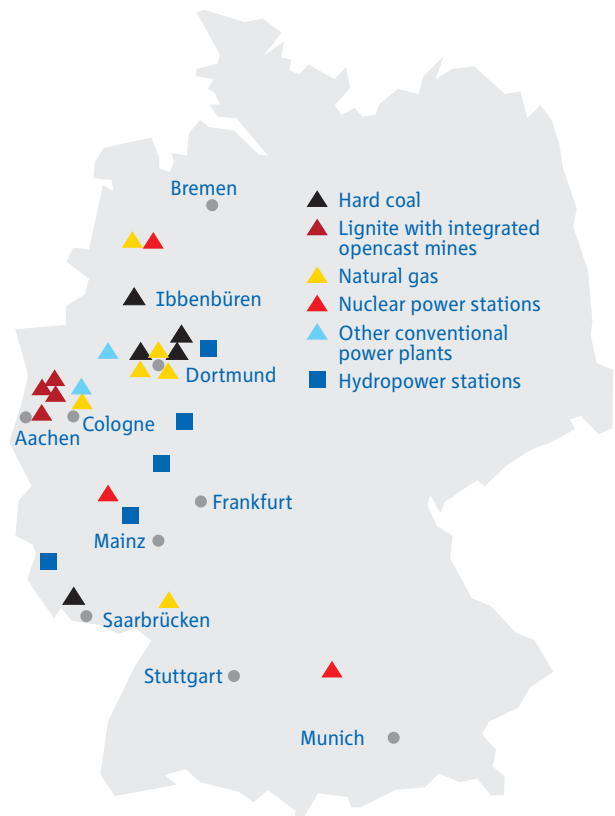
RWE Power operates in a market characterized by fierce competition. Our aim is to remain a leading national power producer and to expand our international position, making a crucial contribution toward shaping future energy supplies.

A strategy with this focus, underpinned by efficient cost management, is the basis of our success. All the same, we never lose sight of one important aspect of our corporate philosophy: environmental protection. At RWE Power, a responsible use of nature and its resources is more than mere lip service.

Our healthy financial base, plus the competent and committed support of some 18,000 employees working under the umbrella of RWE Power, enable us to systematically exploit the opportunities offered by a liberalized energy market.

In this respect, our business activities are embedded in a corporate culture that is marked by team spirit and by internal and external transparency.

The bundling of all generating activities at RWE Power has made us no. 1 in Germany, with a 30 per cent share in electricity generation, and no. 3 in Europe, with a 9 per cent share. That is what we are working for – with all our power.





KRUPP
761



Opencast mining and cultivated landscapes

Lignite can only be extracted by opencast mining, so that interference in densely-populated cultivated landscapes is correspondingly deep.

The opencast lignite mines are located in a what has always been a heavily used cultivated landscape. It is the catchment area of the cities of Cologne, Aachen, Mönchengladbach and Düsseldorf and, hence, a region with a relatively dense population. Traffic development and urbanization have significantly moulded every aspect of the structure of this space that used to be a rural area. What is more, the soil is among the best found in Germany, so that the land is mostly used for farming purposes.

It is this cultivated landscape that the opencast mines invade: wherever overburden is removed and lignite mined, landscape is a thing of the

past – for the time being. It is the loose layers of soil in the Rhineland that make impossible the underground mining that is pursued, say, in the mines of the near-by Ruhr region. Rhenish lignite must be extracted by opencast methods.

However, this interference is merely temporary, and the basic features of a post-mining landscape are defined already during the approval procedure for an opencast mine. This is when concrete planning for the new landscape commences. As soon as the first sections of a lignite seam have been stripped, restoration of farmland, forests and other surfaces starts: recultivation.



Taking stock

Worldwide, Rhenish recultivation is deemed exemplary not just among experts – and it is steadily further developed.

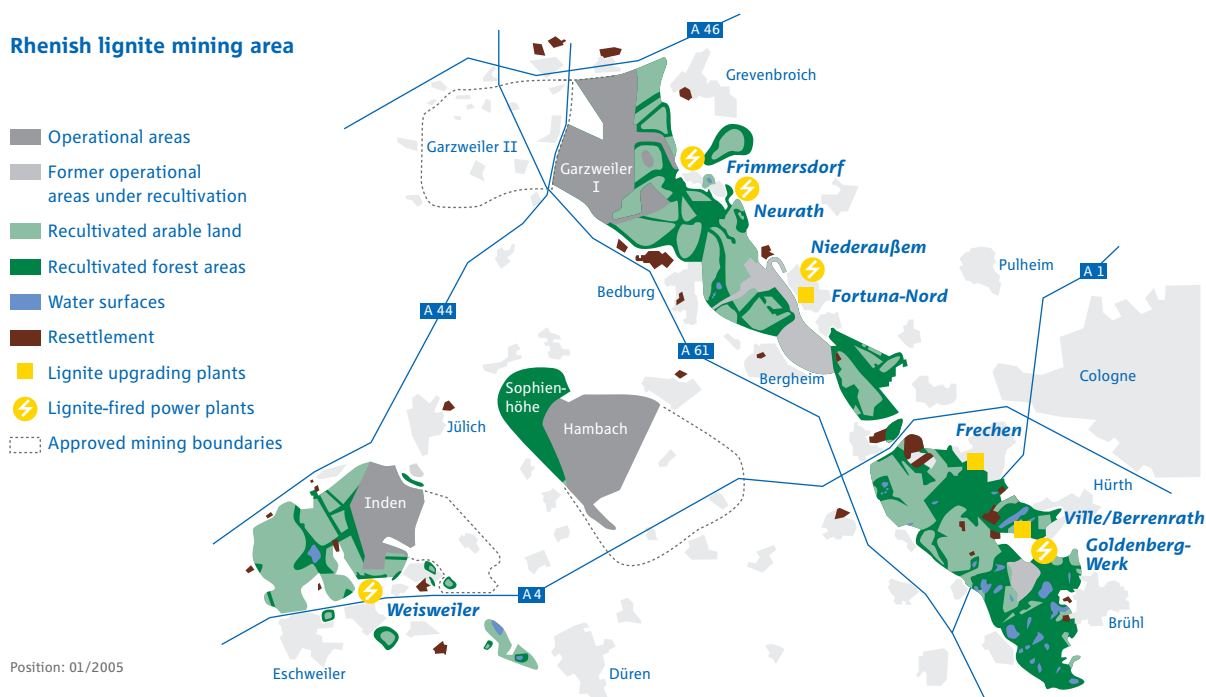
A lease covering the Roddergrube mine near Brühl dating from 1766 demonstrates that, even then, former mining areas had to be replanted. Since then, the recultivation of opencast mining surfaces has been inseparably linked with lignite extraction. The methods used in recultivation schemes have evolved steadily up a long learning curve. Down the decades, they have been adjusted to meet changing objectives and include new scientific findings. Today, the results obtained are deemed exemplary worldwide, not just among experts.

The learning is ongoing. Scientific studies by university institutes accompany the recultivation schemes to benefit the work on the new landscape. At Jüchen, RWE Power has set up a research unit for recultivation. It serves scientists as a port of call, offering a library and laboratory for their studies (www.forschungsstellerekultivierung.de).

International specialists have attended two recultivation congresses so far at the invitation of RWE Power to exchange news and views.

High-quality recultivation is important because the lignite industry depends on good neighbourly relations with the people in the region. But it is also indispensable because the new landscape must offer a substitute and an offset, not only temporarily, but on a sustainable long-term basis – as living and economic space for many generations to come.

Rhenish opencast mines have used about 290 square kilometres of land so far. Of this, some 200 square kilometres have been rehabilitated, including a good 103 square kilometres of arable land, 77 square kilometres of forests, and 20 square kilometres of water and other surfaces.



Recultivation starts before opencast mining operations

Early on, public-law approval procedures create the framework for the later design of the landscape.

How RWE Power has to design the land after an opencast mine has gone is always decided by public-law procedures. With the first regional planning approval for an opencast mine, a decision is already made on the look and feel of the new landscape. This includes initial stipulations on the breakdown of the surfaces into agricultural, forestry, settlement or other uses.

In the course of further operational planning procedures, these stipulations are concretised, section by section and in near real-time, until the time of execution. In these procedures, farmers, foresters, environmentalists, traffic planners, business sponsors and many others express their interests. Here, conflicts are pre-programmed. All representatives of public concerns usually stand up for their justified interests and have their own ideas on later

use options: new arable land is needed for farmers and their families and, hence, for their livelihoods; municipalities wish to have new industrial estates to provide an economic impetus, i.e. jobs and tax income. New forests, open fields and lakes are welcome recreation areas.

The experts from public authorities, associations, scholarship and mining sector are agreed on the basics: recultivation cannot be an attempt to copy nature. Humans can only provide start-up aid, creating the best possible preconditions for a landscape that can be used on a sustainable basis. And the compromises to be reached are no stop-gap solutions: it is not the separation of uses, but their networking that will reconcile the concerns of economy and ecology in the long term.



Operating bases

The loess soil so abundant in the Rhineland is one of the success factors for recultivation. It is treated with corresponding care.

The soil needed for recultivation purposes is provided by the opencast mine itself: stackers start by dumping clay, sand and gravel in the depleted extraction site and then top this with a drainage layer of permeable material. Embankments and hollows in the terrain are designed as close to nature as possible, meaning: as unevenly as provided by nature herself.

Where planning calls for reforestation, we spread a mixture of loess loam and gravel as topmost soil layer, so-called forest gravel. While this material is so loose that tree roots can penetrate the soil deep enough, it is also so loamy that it can store sufficient water for the drier seasons of the year. Land recultivated using forest gravel is no longer levelled today. This is to avoid compaction and, hence, stagnant moisture and erosion, and to exploit the micro-climatic advantages of rough surfaces and small hollows.

Where new farmland is envisaged, the stackers spread pure loess and loess loam. The same is true of surfaces that are to be reforested in plains. After a certain settling time, this layer must be at least two metres thick. In a next step, the loess is levelled, but in a soil-sparing fashion. Water surfaces and alternately humid locations, too, are included in the recultivation effort. The final voids of older opencast mines are lakes today and, due to the lack of material expected after lignite-mining has ceased, planning also calls for large bodies of water to be provided in the final voids of today's opencast mines.



Agricultural recultivation

After a seven-year preparation phase, the new agricultural land and fields pass into the hands of farmers.

Loess on its own does not make for fully arable soil. That takes humus, a valuable store of nutrients and micro-organisms that plants need to grow. Also, the soil's functions have to be reinstated first. For this purpose, the new fields are initially farmed by RWE Power itself. In the first few years, agriculturalists working for the Company grow pioneering plants like alfalfa that deeply root the soil and enrich it with nitrogen. The aim here is not good harvests, but biological activation of the soil. Later, grain and other field crops are grown, plants that can be cultivated and harvested in a soil-sparing manner. RWE Power experts deploy tractors and farming equipment with wide tyres and use special ploughing methods in order not to compact the sensitive young soil too much. Soil protection now plays a growing role in rehabilitation efforts.



In agricultural recultivation, ecological issues, too, matter. Local recreation and conservation have gained in importance. Field shoulders, hedges, groves and other special areas are designed to loosen up and enrich the new landscape. Weeds left to their own devices can sprout on partial areas, offering small animals on open fields food and shelter. In this way, nature returns to the new living space even during recultivation.

After a preparatory effort lasting at least seven years, the new agricultural land is passed on to the farmers who originally made their land available elsewhere for mining purposes. Often, they farm the land out of new hamlets located on the recultivated open fields.

Despite favourable conditions, the farmers have to add higher amounts of fertilizer to build up more humus, especially in the first few years of cultivation. For that, they receive a financial offset during intermediate cultivation.

To back the long-term security of the affected farmers, RWE Power assumes liability for the sold recultivated surfaces for a period of 10 years, i.e. going beyond the statutory minimum term, for defects like troughs, moist and compacted areas, or rocks. For another eight years, RWE Power is responsible for removing any troughs that occur at a later date. If we add the seven-year intermediate cultivation period, the Company warrants the good quality of the soil for a total of 25 years.



Forest recultivation

Less is more: RWE Power implements the principle of close-to-nature forest management. An opencast mine leaves more forest behind than was there before.

For many purposes, timber is a good construction material and, on top of that, a renewable raw material. So, in every respect, this is a product with interesting commercial prospects for which the foresters at RWE Power must create optimal starting conditions during reforestation already. But they work with more than the economic aspects in mind. In fact, their aim is to lay the foundations for forest communities that suit their location and are thus ecologically stable. Because less is often more when it comes to planning and caring for such new woods, the foresters follow the principle of close-to-nature forest management – as do their public colleagues.

Today's planting programme in forest recultivation comprises numerous tree and shrub species. Deciduous trees have priority over coniferous woods, because it is they that have dominated the natural vegetation in the Lower Rhine Basin since time immemorial. But there is no complete lack of conifers. In places, they liven up the landscape, and offer shelter in winter to the deer that soon immigrate here.

Every year, RWE's foresters and woodsmen plant several hundred thousand copses on the dump sites: mainly common oaks and red beech, but also small-leaf linden and wild fruit trees. They obtain the young plants from nurseries. At the same time, they harvest tree seeds from the old tree population in the area due to be mined in order to retain the genetic potential of the old native woods. In the young stock, enough gaps are left for naturally immigrating tree types like the birch.

For the opencast mines Garzweiler, Hambach and Inden, an extra 1,900 hectares and more of woodland have been defined in all. This means that, by the middle of the century, the opencast mines operating today will leave behind 19 square kilometres more woodland than was there before.

Even now, the record of the region's forest management is a balanced one: a good 7,300 hectares of wood had to make way for the opencast mines, and more than 7,300 hectares have been re-planted.



Ecology

Though man-made, several recultivated areas are nature reserves. Flora and fauna threatened by extinction have made them their home.

The creation of water surfaces is a must in recultivation. Over 700 hectares of lakes, ponds and wetlands have emerged by now in all sections of the mining area. They not only enhance the recreational value of the new landscape for people, but also offer a home to the animal kingdom. At many sites, the bird world boasts more biodiversity than in the period before mining operations intervened.

Protection of endangered species is the object of the programme: with expertise and much love of detail, RWE's specialists devote themselves to the nitty-gritty of ecology alongside their tasks in forestry: hanging up nesting boxes for cave breeders and bats, installing perches for birds of prey in the fledgling forest population, introducing toad and frog spawn from the pre-mining areas into the new biotopes. Even entire ant colonies are resettled to the recultivated landscape.

Still, the crucial work is done by nature herself. From the word go, flora and fauna develop a living community and evolve slowly, but steadily and naturally. In the course of time, locational factors will change, and the composition of the species will adapt accordingly. In many young and, hence, thin recultivated areas, for example, ornithologists observe the wheatear, a ground breeder that is on the list of endangered species. This species is then ousted as the forest grows. By contrast, the likewise endangered lesser spotted woodpecker and grey-headed woodpecker live in older forest stocks. A similar succession can be observed in the plant world. Both evolutions share one feature: they are natural processes. What matters is that recultivation provides the basis for a healthy, ecologically sustainable and stable process in such a succession. That it is capable of doing so is demonstrated by the many older recultivated areas in the mining region.

There, only those in the know will spot that these areas were created by man. Several sections measuring over 300 hectares in all are already nature reserves – although they were once man-made. Many endangered animal and plant species have settled on the recultivated land: among others, 13 native orchid species. Not least, the acclaim of people in the region proves how much they appreciate the new landscape: many recultivated areas are destinations for outings.



Examples

At many spots in the Rhenish mining area, recultivated land extends an invitation to seek recreation and experience nature. RWE Power provides hiking maps.

The age of a recultivated landscape and, hence, of the trees growing there, is not what matters either for humans or for flora and fauna. Early on, strollers and cyclists, ramblers and sportspeople use the recultivated land for leisure purposes. They visit even the youngest areas of the 200-metre-high Sophienhöhe hill on the edge of the Hambach opencast mine. A network of hiking trails nearly 100 kilometres in length extends an invitation to ramble in a peaceful setting; a hiking map is available from RWE Power by phoning +49/221/480-22010. From viewpoints like Jülicher Kopf and Steinstrasser Wall, it is possible, on a clear day, to see all the way to Cologne, the Rureifel hills and the German-Dutch border.

Near Eschweiler, right in the middle of the agriculturally recultivated former opencast mine Zukunft-West, lies Blausteinsee lake measuring some 100 hectares. Although it is not yet finally filled with well water, it has been used for all kinds of water sports for years now.



A few kilometres distant is the Inden opencast mine: in the summer of 2005, it will cut through today's bed of the Inde river along a 5-kilometre front. The river will then be diverted to a new 12-kilometre-long bed located in the recultivated land of the opencast mine. There, it can freely meander amidst a wide, largely wooded low-lying area before returning to its old, regulated bed near Kirchberg.





The medieval small town of Alt-Kaster, a district in Bedburg with many listed buildings, used to be surrounded on three sides by an opencast mine. Today, it is located in the middle of an extensive recultivated area which is marked by the Mühlenerft river and Kasterer See lake. A lake is also the highlight in the new, open landscape of the former Frechen opencast mine.

The recultivated land of the former Fortuna-Garsdorf opencast mine is situated along the "Energy Route", which was set up by Rhein-Erft county and RWE Power. The landscaped lake Peringsmaar and the Wiedenfelder Höhe heights are two stops on this stretch for cycling or motoring tourists, starting at RWE Power's information centre Schloss Paffendorf. Touring maps are available there: phone +49/221/480-22010.

Further to the south is the forest/lake district which, all the way into the 1970s, had still been one of the focuses of Rhenish lignite mining. This lake district forms part of the Kottenforst-Ville nature reserve and offers ample space for water sports, rambling and cycle tours – a local recreation area par excellence right on the doorstep of the major cities Cologne and Bonn. Hiking maps are obtainable from the book trade and from RWE Power.





Outlook

Even if much progress has demonstrably been made and success scored down the decades, recultivation remains, in every respect, a learning process.

The experts at RWE Power are open in all directions: findings, whether from our own work, from research carried out at universities or from experience exchanged at the specialized congresses staged by RWE Power, find their way into the daily work of the two technical departments in charge, and help to further develop our recultivation efforts. Nothing is so good that it cannot be improved.

Research in recultivation pursues three objectives: one aim is to document the evolution of new landscapes and show where help and support are called for. The second is to check ecological efficacy. For example, one study has found that today's customary practice of dumping without levelling in forestry areas encourages later biodiversity and promotes the growth of important

tree types. The third object of research is to supply ideas for improving recultivation work, e.g., the settlement and propagation of native shrubs and trees: today, RWE Power grows plants from the seeds of old forests for the new land, thus maintaining genetic variety, one element in biodiversity.

Recultivation remains a learning process for all those involved. The greater the in-depth input from knowledgeable participants, the better the results will be. The goal remains ambitious: to reintegrate the landscape consumed by mining operations into the surrounding cultivated space in a way that ensures versatility of use and high ecological quality, while leaving open all options for generations to come.







RWE Power AG

Essen · Cologne

T +49 (0)201/12-01

T +49 (0)221/480-0

E info.rwepower@rwe.com

I www.rwe.com