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Power to the People
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Energy and Commons

It's My Business: Becoming an Energy Community

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The village of Holzweiler is located east of the city of Erkelenz in the state North Rhine-Westphalia. Laying in the original Garzweiler II mining area, a surface mine used for mining lignite, the village was to be relocated. But in 2016, the NRW state government decided to reduce the size of the mining area and Holzweiler could remain. The population of Holzweiler became active in forming associations to protect their village, to fight against their relocation and to encourage community life.
Because of the active community and their chance to rebuild their village and rethink their way of living Holzweiler is an interesting case study to engage within the topic of energy independence.

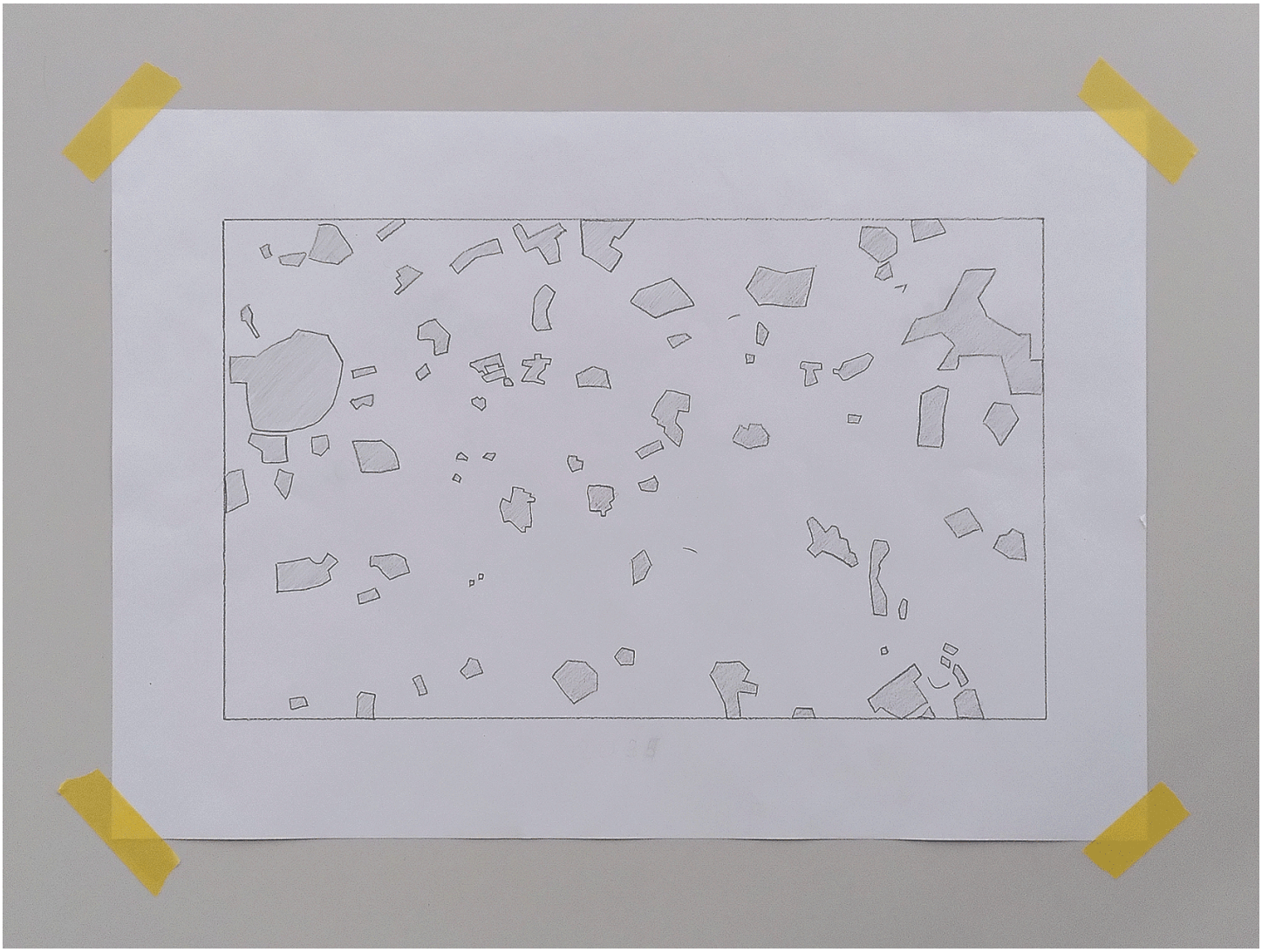
In the centralized system common today the grid is privately-owned, controlled by a few and consumed by the most. This makes communities dependent on the grid and their surroundings. In Holzweiler the energy infrastructure and the dependencies coming with it are not yet a topic the inhabitants engage with. This calls the relationship between energy infrastructure and people into question.

In the context of analysing the grid, its history and posing questions about energy autarky and ownership, a fictional story gives a better understanding of what is needed to encourage people to think about other possible systems.

HOLZWEILER, NRW

Elevation: 93 m.a.s.l.
Surface: 11.79 km2
Population: 1,386 inh. (31.12.2020)
Population density: 118 inh./km2

Holzweiler, the Village That Resisted



The village of Holzweiler has around 1,400 inhabitants and a total of 19 associations. The website of the village states: “Holzweiler is a good place to live. Here, progress is promoted, traditions are upheld and young and old are appreciated. We are open to ideas, opinions and people. We are a community. Holzweiler lives!”

Impressions of Holzweiler collected during the seminar week in the HS22

https://vimeo.com/782316447

PETRA SCHMITZ
(local farmer)

"One huge advantage of Holzweiler is that the younger generation is keen to stay in the village."

"Being independent from the grid would be the biggest wish we would have, of course."

JORGE LALE-LOPEZ
(core team of WiH)

"The events that take place here are celebrated in a very sociable way. That binds people together."

"Everyone who moves to Holzweiler feels at home very quickly because there is a strong village community here."

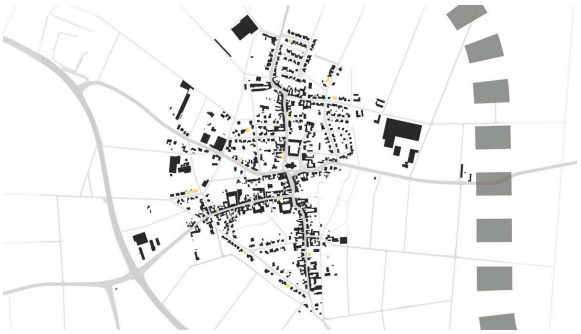
TONI VON WIRTH
(owner of gasstation)

"They dredged up 250 customers from mine."

"Some people no longer invested in their houses because they thought they will be torn down. They are of course now pinched in the ass."

Active inhabitants of Holzweiler

Map showing Holzweiler and planed border of the Garzweiler mine

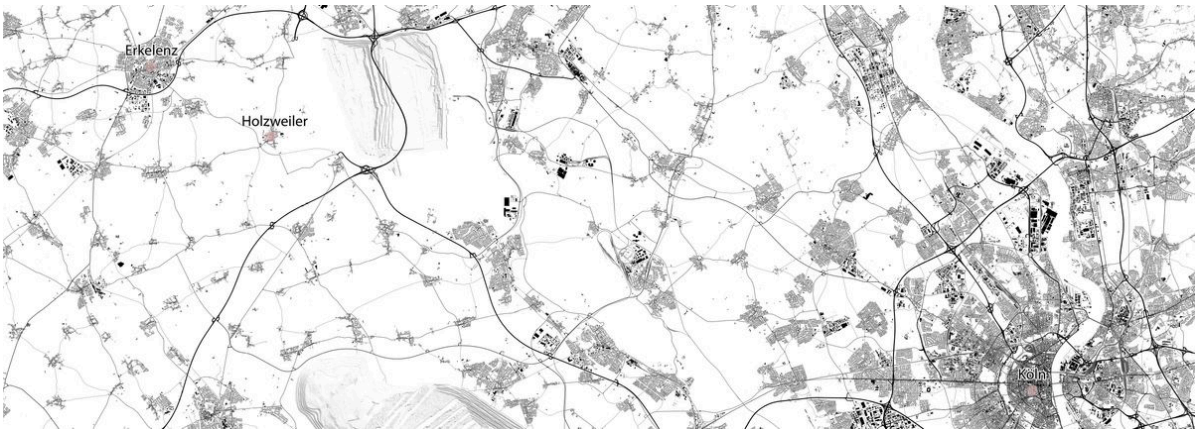


Map showing the Associations in Holzweiler

Map showing the public institutions in Holzweiler

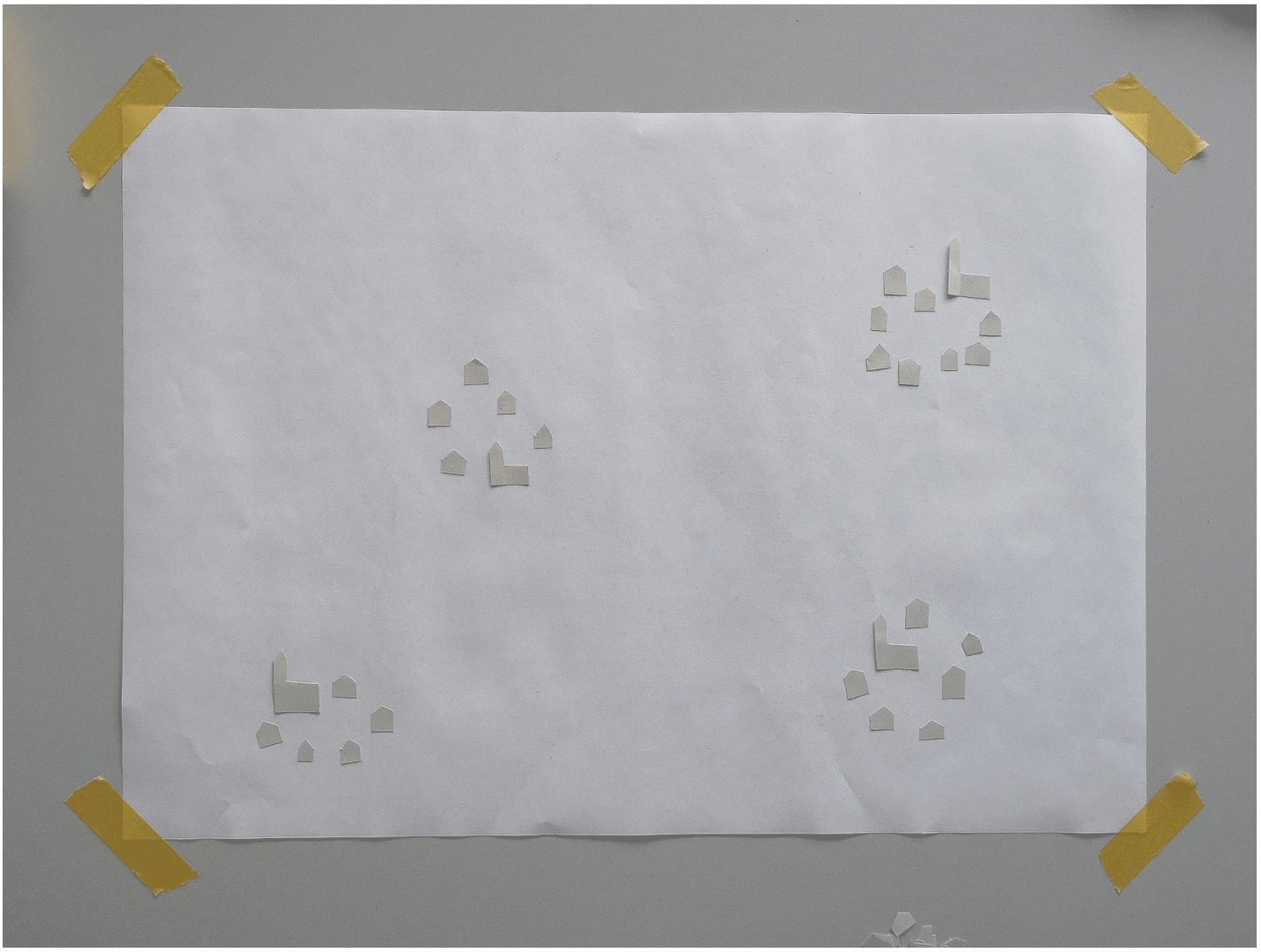
Map showing the restaurant of Holzweiler

The inhabitants of Holzweiler are really proud of their village and see themselves as an independent community that needs to be protected. They engage with different concerns that threaten their independence and quality of life.
Nevertheless, the inhabitants are strongly dependent on their surroundings. Holzweiler has no grocery store, just a gas station and one restaurant, that is open from Thursday to Sunday only in the evening. There is also just a kindergarten and no school.
With their electricity infrastructure they are connected to the local grid that is owned by Amprion, one of the four network operators in Germany. So it may be that the electricity they use got produced by companies like RWE and production methods like coal-fired power plants, methods that almost caused them to lose their home. Even though they saw how much destruction can come from fossil energy production the topic of renewable energy and being independent from the grid is not a big topic in the village.
One could conclude that as long as the inhabitants have unlimited access to electricity and the pricing is reasonable, the majority of the people do not think about where their electricity is coming from or how it was produced. Other concerns, like create places for interaction or fighting for a connection to a neighbouring village that is supposed to be dug away, are just more visible and therefore generate attention. The actions that need to take place and the infrastructure that is needed, to enable a simple act like making a coffee, stay mostly hidden.

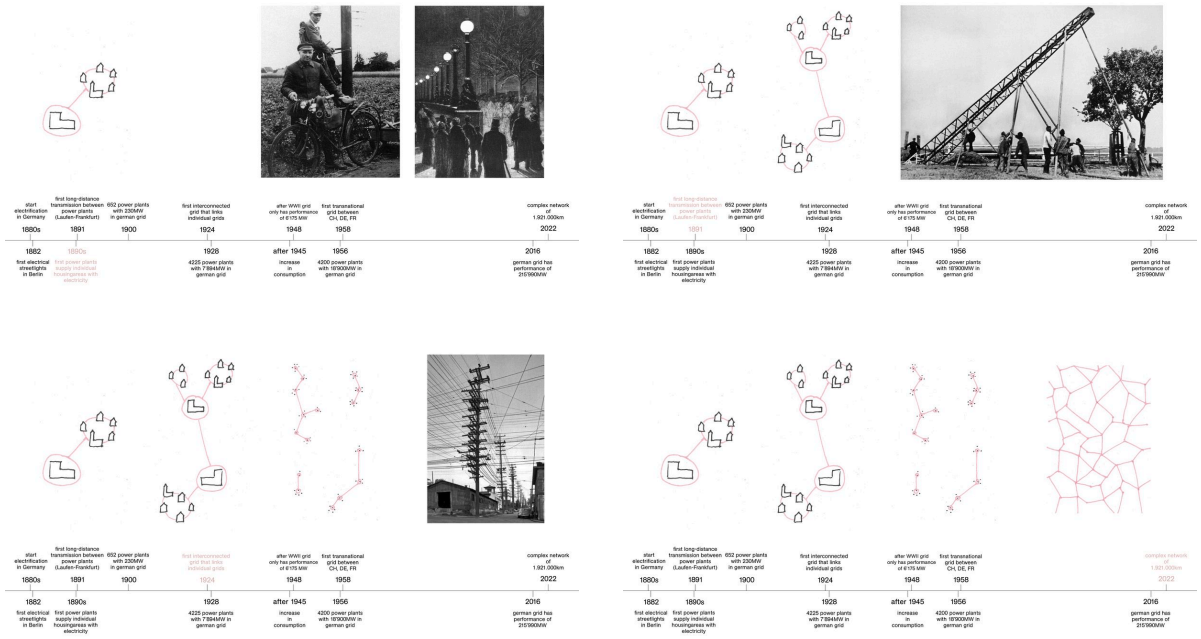


Map showing the surroundings of Holzweiler

From Light Bulb to Transnational Power Grid: A Brief History from 1880 - 2022

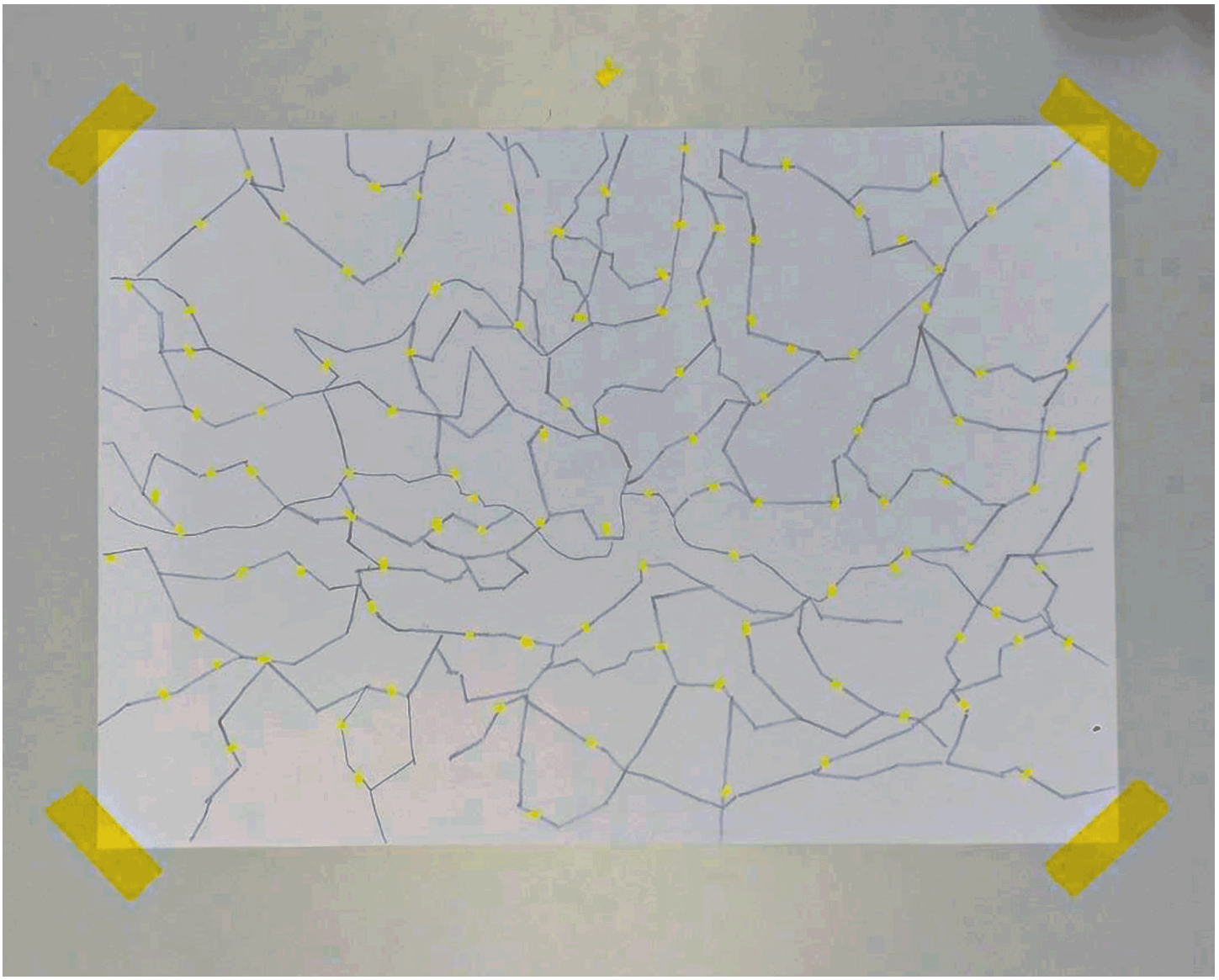


The electrification in Germany started in the 1880s. First, power plants were only connected to nearby buildings. With time they were joined together, also over long distances. The grid kept growing and formed the huge complex system one is familiar with today.



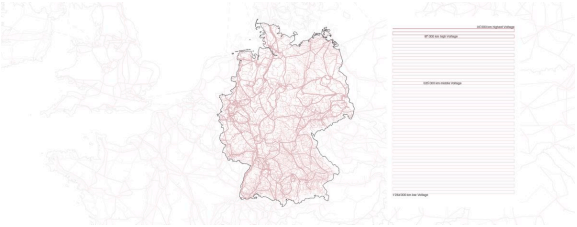
In Germany, electrification started in the 1880s. The electricity was mainly used for street lights and lighting in factories. At first, power plants only connected to nearby buildings, because the direct current could not be transported over long distances without huge losses.
With time, in order to have a better electricity availability, power plants joined together and through the alternating current it became possible to transport the electricity over further distances.
The individual grids kept growing and in the 1920s they started to interconnect. First just within each country but later also over the boarders. The first transnational grid was built between Germany, Switzerland and France in 1958.
Since people started to consume a lot more electricity after the second world war, the grid had to grow further until today.

Growth Beyond Imagination: The German Grid Today



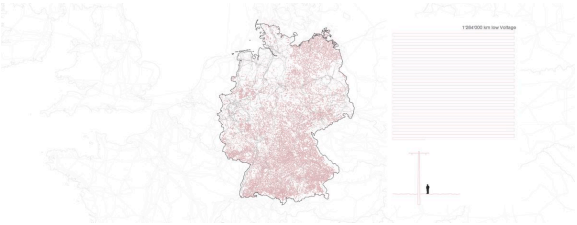
The grid in Germany has a total length of 1,9 million kilometers which equals 48 times the earth circumference. It supplies the whole population with electricity and makes the modern way of living possible. Because the energy infrastructure is hidden in the urban fabric the visibility, and the awareness of people for it, is limited.

All voltage lines in Germany

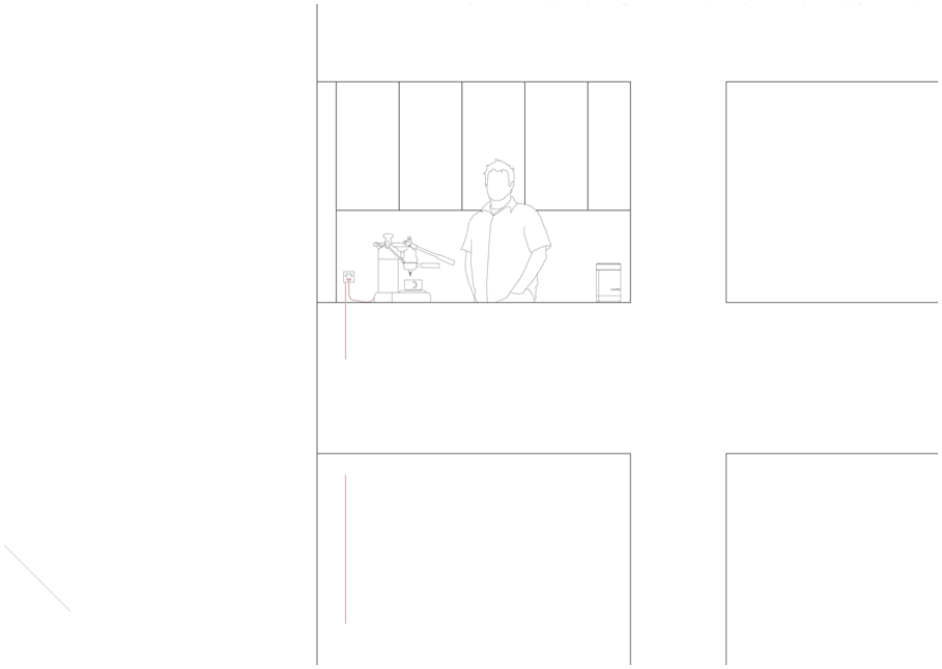


Total length of all voltage lines in Germany

High voltage lines in Germany



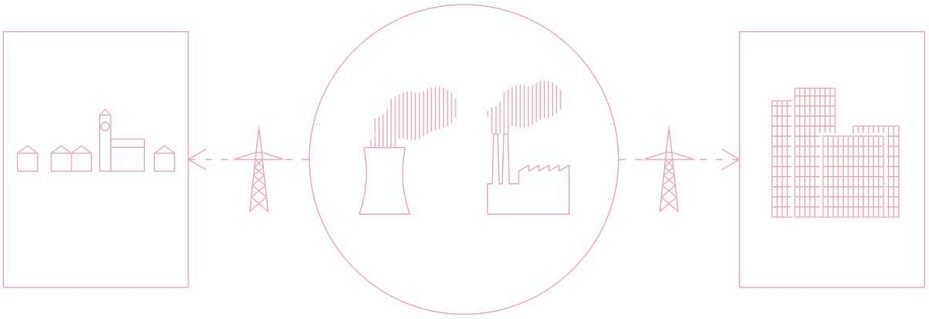
Low voltage lines in Germany



A possible way electricity needs to flow to power a coffee machine

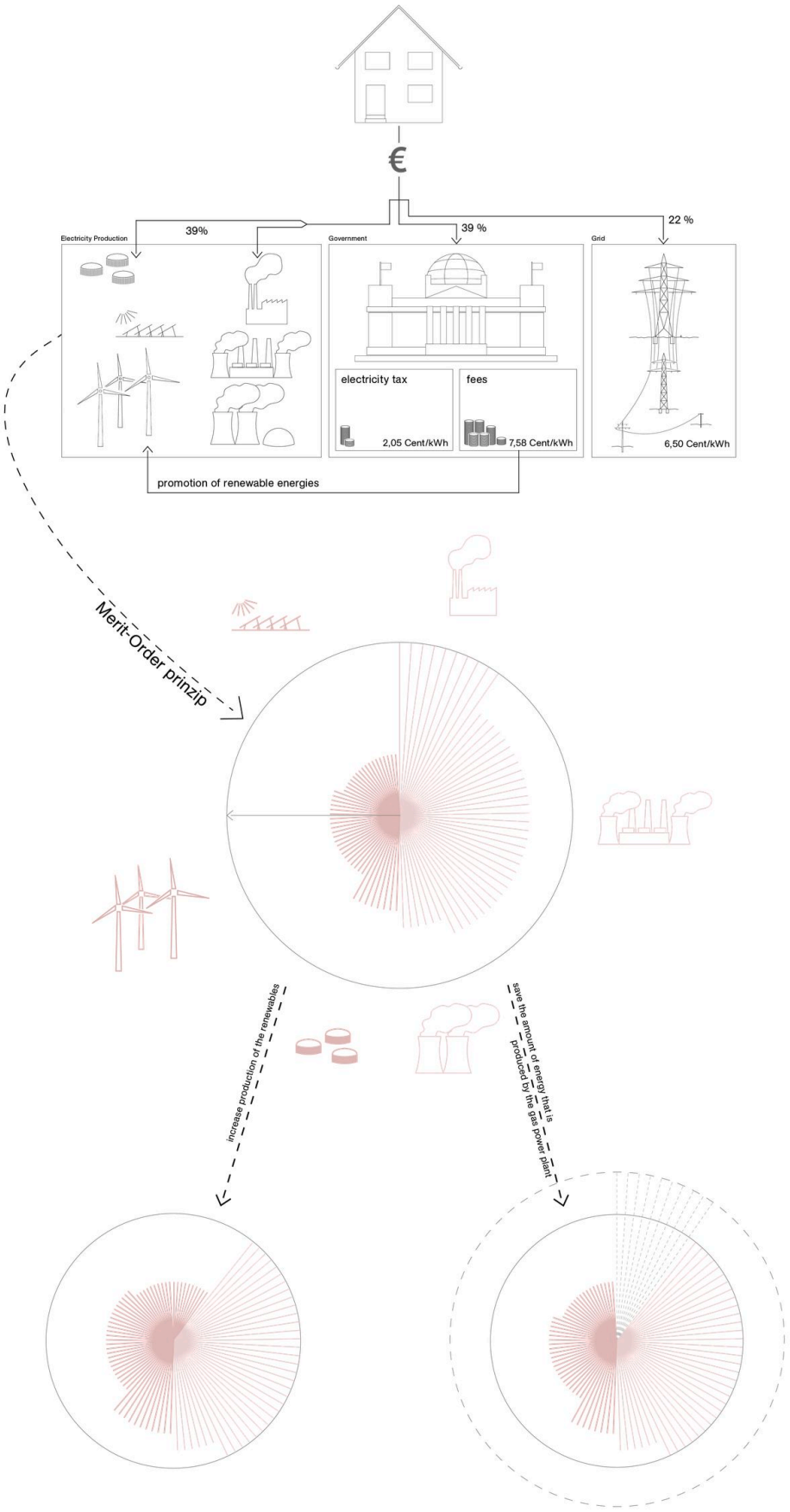
The grid in Germany is a huge and complex system. It supplies the whole population with electricity and makes the modern way of living possible.
To achieve the wanted grid stability, sometimes electricity is transported over long distances. For that it has to flow through different voltage lines and substations. The high to middle voltage lines are mostly what one thinks of, when hearing the term “the grid”, because they are the most visible. But they only make up 37% of the whole network. The biggest part with 1,2 million kilometer are the low voltage lines, which mostly run underground.

Common today is a power plant centric system. The electricity production is located close to the resources. Since these are not spread equally across the landscape the consumer is supplied with electricity by the gird but can not control where and how it got produced. Even if a consumer produces its own electricity and is connected to the grid, it cannot use it directly.



Current System (Power Plant Centric)

The electricity bill is made up of the production of electricity, of the taxes and fees from the government and of the transportation of electricity. The production and the gird make up less than 60 % of the bill. The other 40 % is the government. All of the costs are bound to the amount of electricity one uses during a certain time. The price is measured in cent/kWh. The less electricity a household uses the less they have to pay.
The prices for the taxes, fees and the grid are controlled by the state. The price for the production of the electricity follows the Merit order principle. Therefore the most expensive form of electricity production defines the prize for all others. Even when there is just a small amount of electricity produced by gas power plants, the price is fixed by this form of the production. To lower the price either one increases the production of renewables or one saves the amount of electricity produced by the gas power plants. Both options are not easy to achieve. The first one needs time to build the new infrastructure and the second requires a decrease of consumption.

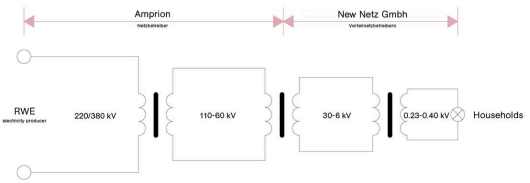


The Price System of the Electricity Bill

The network is owned by four network operator companies. They are responsible for the long distance distribution. Besides there are 875 local operator companies responsible for the distribution to the households.
The big four divide Germany in different parts and control their area. They are responsible for the maintenance and also for the development of the expansion. The system is entirely liberalized and privately owned. Today three out of the four network operators are owned by companies from other countries. TenneT is owned by a Dutch company, for 50Hertz the largest shareholder is a Belgian company and in the case of Amprion the largest shareholder is an international holding company. So the control of the German Grid is neither in the hands of German companies nor the German state.

The Big Four: Declaration of the Ownership of the Grid in Germany

Infrastructure of Holzweiler



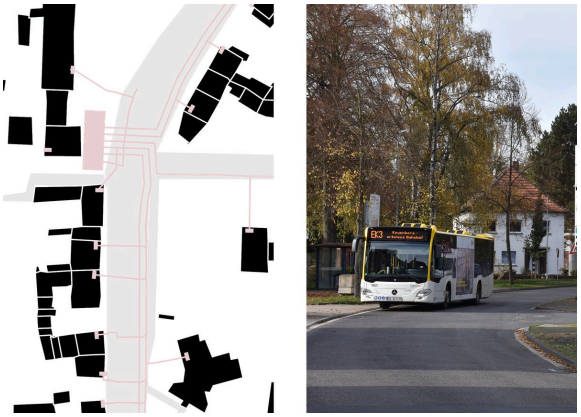
Ownership of the grid of Holzweiler

In the case of the site Holzweiler the electricity grid is owned by Amprion and by New Netz GmbH. New Netz is a company owned by different communities and Amprion was once a subsidiary of RWE. Today RWE still owns 25% of the company. Therefor the inhabitants of Holzweiler have no control over the grid they use.

In the streets of the village the electrical infrastructure is mostly hidden. The power lines run in the ground and only the transformer stations are visible. Even these are not always easily spotted. In most cases, they are well embedded into their surroundings and can be mistaken for a garage or a shed.

Kofferer Strasse

Holzweilermarkt (Main Street)



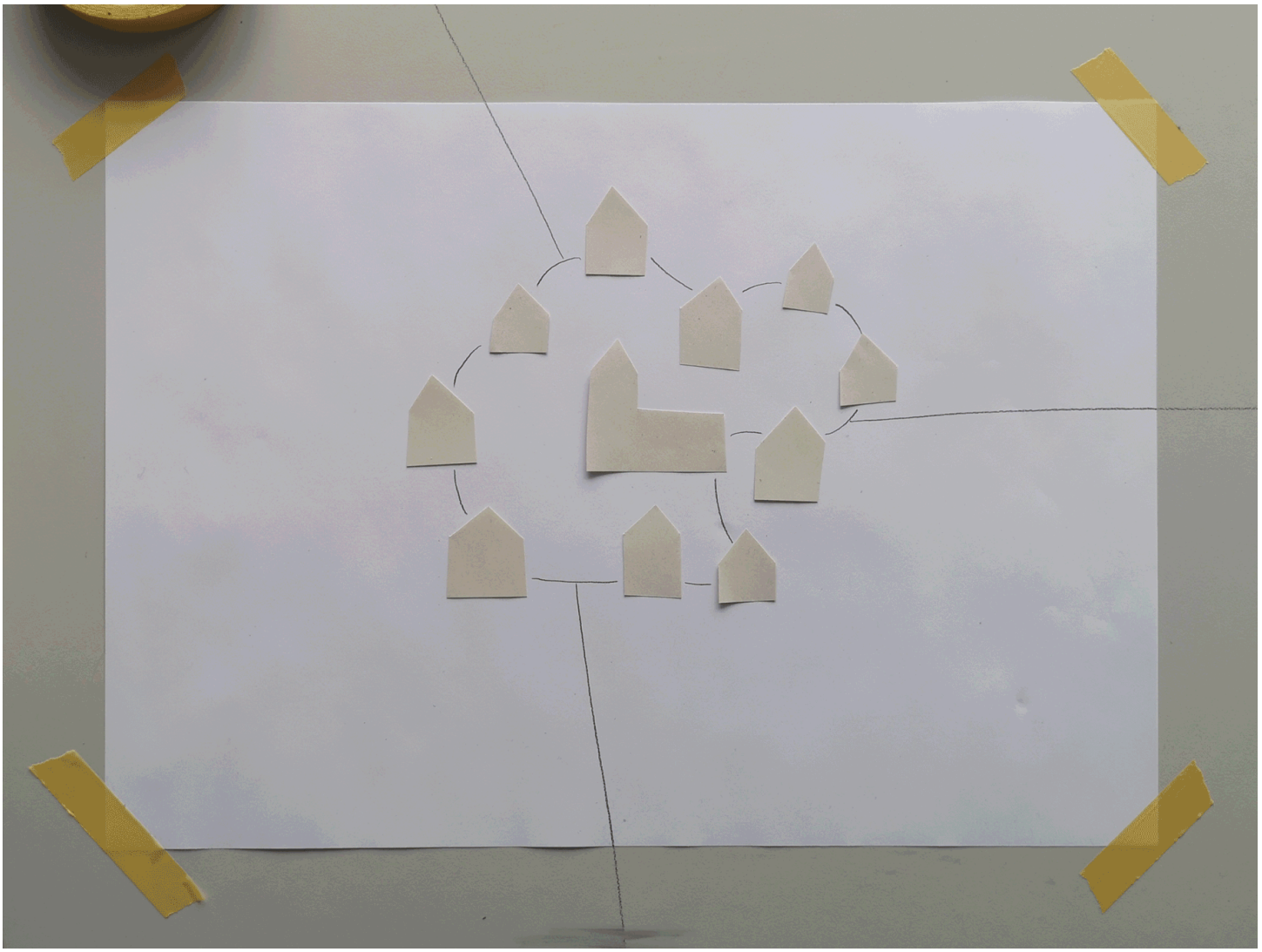
Landstrasse (Main Street)


DRIESCHER


HIGHSPEED
FÜR IHR
ZUHAUSE

The energy transition towards a fossil-free future removes the current invisibility of the electrical infrastructure and increases its relationship with the people. As renewable energy systems requires more space for power generation than classic large-scale power plants, dense cities will rely on suburban areas in the future. The new role of rural settlements increases their relevance, creates identity and strengthens community life. Therefore, it would be worthwhile for a village like Holzweiler to look into this topic and take natters into their own hands.

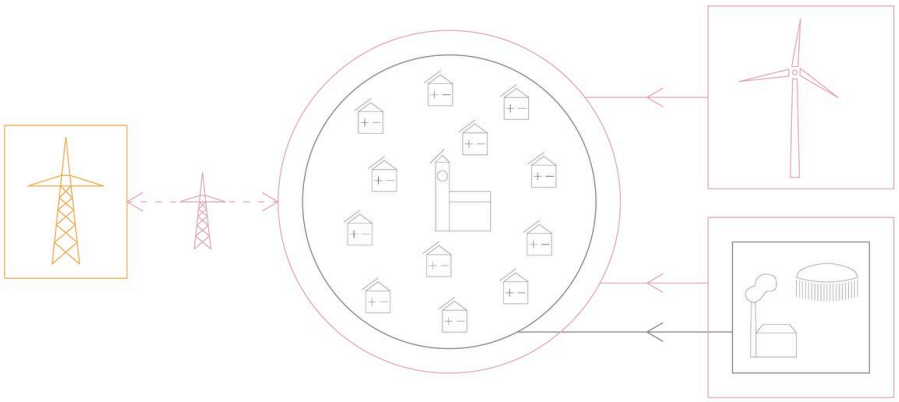
Against the Current: Two Pioneering Energy Communities



Deviations from the centric system are rare but exist. Two villages, which use a decentral system, are the villages Schönau and Feldheim. They are both located in Germany and are independent from the common grid.

Decentralised Grid (Customer Grid)

The energy transition towards a fossil-free future opens up the unique opportunity for more autonomy and decentralized electricity production that is fully owned by the people. In a customer-centric system, roles are redistributed. Larger power plants are only used to bridge the supply gap, while customers are responsible for the electricity production. This brings electricity closer to customers and results in higher appreciation. Electricity is no longer a commodity but a common good.



The customer-centric system in Schönau

The village of Schönau is located in Bavaria, has around 2400 inhabitants and is self-sufficient since 1996.
On the 26. April 1986, 2000 km east of Schönau in the Ukraine, several bombs destroyed the Chernobyl nuclear power plant. This event had severe consequences for the whole world. Not only in Germany, but all over Europe, playgrounds were closed and children had to stay inside because of the radioactively contaminated air. Numerous parents in Schönau decided to become active and founded the group called “Parents for a nuclear-free future”. The goal was the immediate nuclear phase-out. However, the local electricity supplier Kraftübertragungswerke Rheinfelden (KWR) had a different opinion and continued to invest in nuclear and fossil energy. Therefore, the group took a referendum against the renewal of the contract with the electricity supplier and won the vote in 1991. They realized that the nuclear phase-out can only succeed if the municipality owns the electricity grid themselves. With donations from all over Germany, four million marks were collected and the Schönau municipal council transferred the concession to EWS Schönau and its Netzkauf GmbH in 1995.
After KWR contested the decision, took the referendum and lost, they then demanded almost 9 million marks for the power grid, although the estimated value was at 4 million. To get the missing money, EWS Schönau launched a nationwide campaign with the slogan “I am a disruption”, supported by a professional agency for free. One million people could be found, who were willing to pay 5 marks for a T-shirt with their slogan, and in 1997 the entire electricity grid was officially transferred to EWS Schönau. Since then, Schönau has produced and sold nuclear- and fossil-free energy.

Source: image [https://www.spiegel.de/wissenschaft/technik/tschernobyl-der-super-gau-im-protokoll-a-1089220.html]

Source: image [https://www.diepresse.com/4972193/die-ersten-tage-nach-der-tschernobyl-katastrophe#]

Source: image [https://www.google.ch/url?sa=i&url=https%3A%2F%2Fwww.des-volkes-stimme.de%2Funter-strom-die-eltern-fuer-atomfreie-zukunft-werden-aktiv%2F&psig=AOvVaw26HyGwFyHTYnaJ8NKjJcqv&ust=1671519518938000&source=images&cd=vfe&ved=0CA0QjRxqFwoTCNjnts2NhfwCFQAAAAAdAAAAABAD]

Source: image [https://www.ews-schoenau.de/ews/geschichte/]

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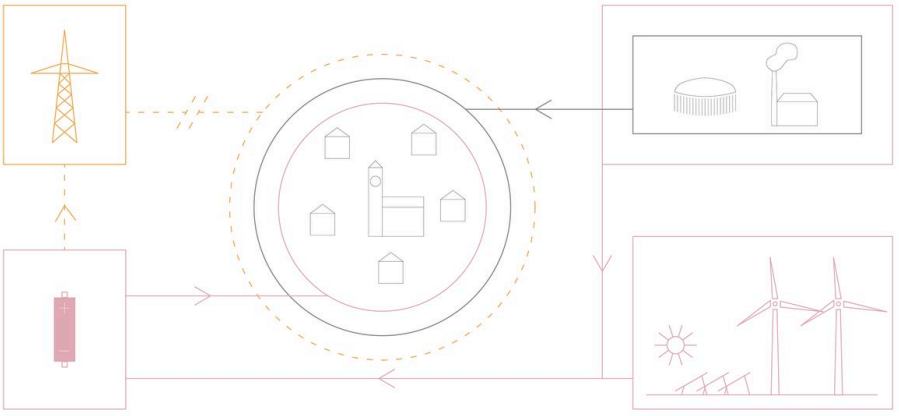


The customer-centric system in Feldheim

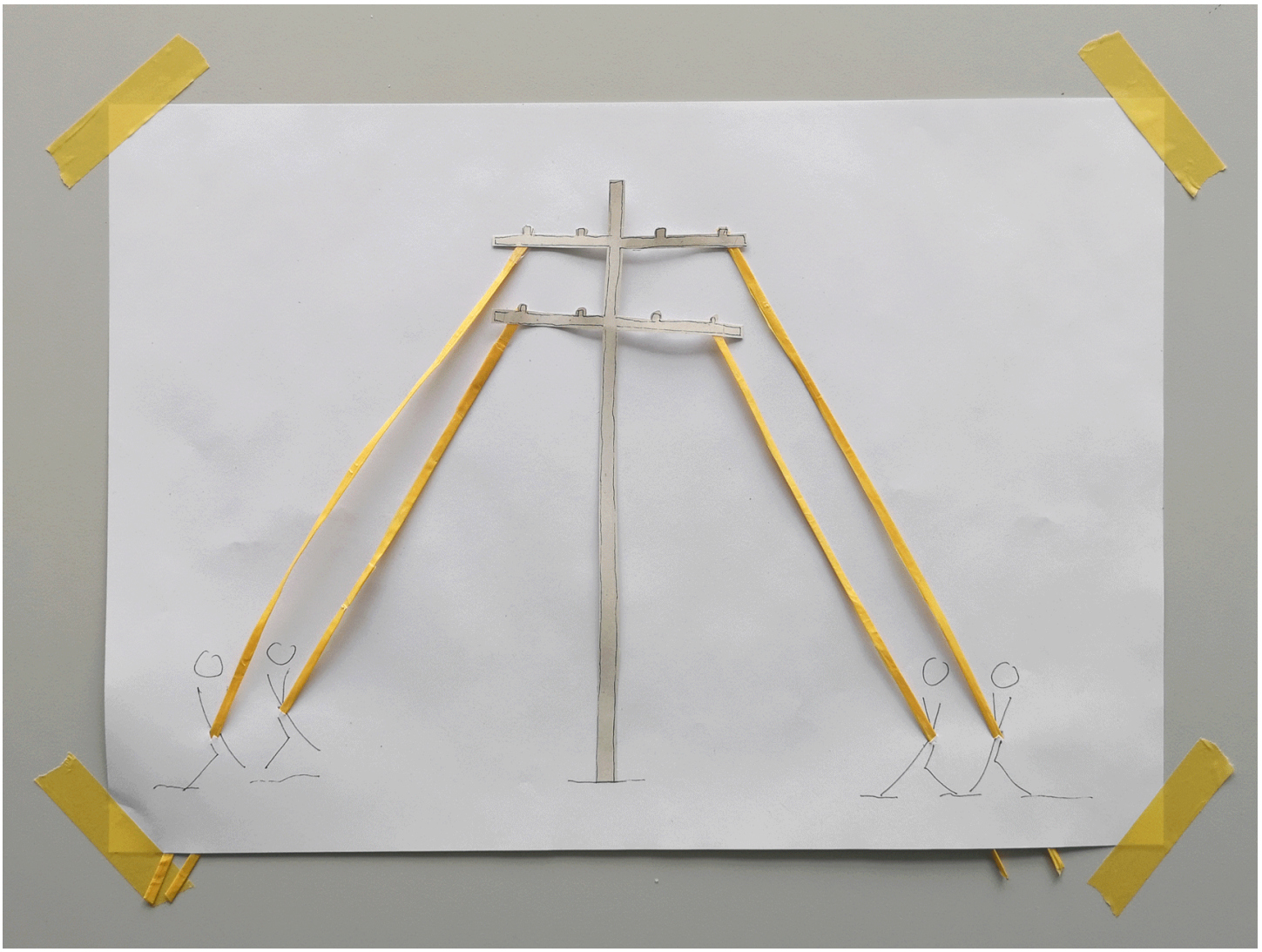
Feldheim is located between Berlin and Leipzig and has around 150 inhabitants. The village, which belongs to the federal state of Brandenburg, is fully self-sufficient and has been independent for 12 years.
In the early 1990s the mechanical engineer and resident Raschemann had the idea of erecting some wind turbines to use the local wind for electricity production. In 2008 a biogas plant was added, which produced heat from maize, grain and liquid manure.
In order to be able to supply the residents with the energy produced in the village, they also had to build their own electricity grid, as the local electricity supplier was not willing to sell the existing grid to the community. With the exception of 2 households, all inhabitants contributed 3000 euros to the construction. The rest of the 1.7 million project was financed with subsidies.

Feldheim produces a surplus of electricity. The village needs just 1% of the electricity it generates itself. The 55 wind turbines alone supply the grid with electricity for 50,000 households.

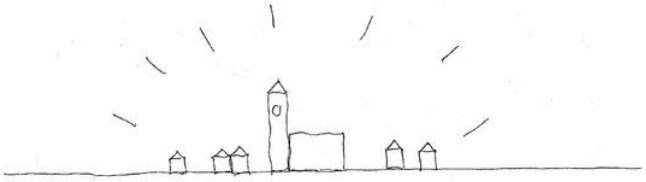
Wind turbines characterizes the village.
Source: image [https://www.google.ch/url?sa=i&url=https%3A%2F%2Fwww.deutschlandfunkkultur.de%2Ffeldheim-in-brandenburg-ein-dorf-schafft-die-klimawende-100.html&psig=AOvVaw1DLk9XbHqxy91o9xmw7LNj&ust=1671519830769000&source=images&cd=vfe&ved=0CA0QjRxqFwoTCJC3huKOhfwCFQAAAAAdAAAAABAX]

Battery station in front of wind turbines
Source: image [https://www.google.com/url?sa=i&url=https%3A%2F%2Fmil.brandenburg.de%2Fmil%2Fde%2Fpresse%2Fdetail%2F~06-07-2022-klimareise-treuenbrietzen-energieautarkes-dorf-feldheim&psig=AOvVaw07GXuzVp8WaJDMeRafM49Q&ust=1671519628564000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCLD7__6NhfwCFQAAAAAdAAAAABAE]

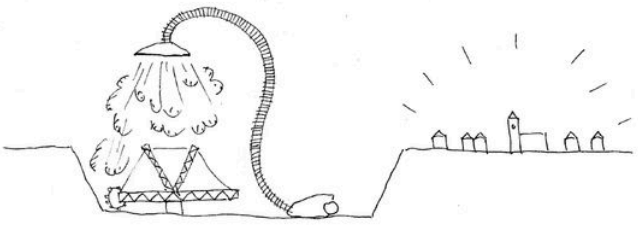
Reclaiming Power: A Fiction of Energy Independence



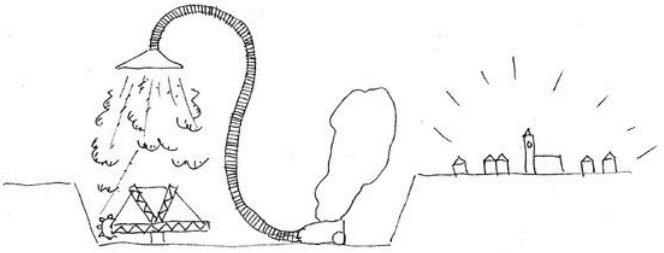
Through all the information that was collected, it gets clear that the system needs to change. What is necessary to initiate this change is told through a fictional story set in Holzweiler.



Once there was a beautiful village ...

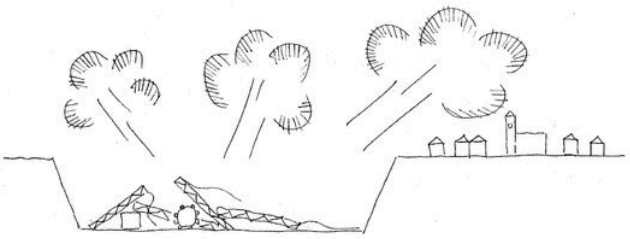


... located next to a big hole. Day and night, an excavator dug away the ground to get to the valuable material, that was used for electricity production. He was accompanied by a big vacuum cleaner that protected the surrounding from the stirred up dust.

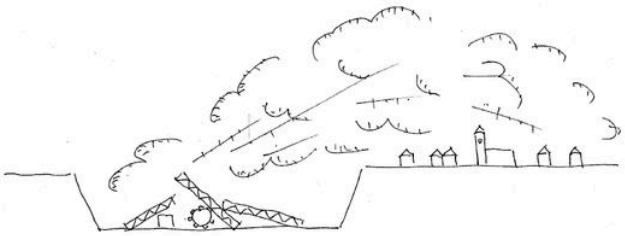


For many years they dug and vacuumed. The village right next to it, still clean and beautiful.

But one day: "Boom"

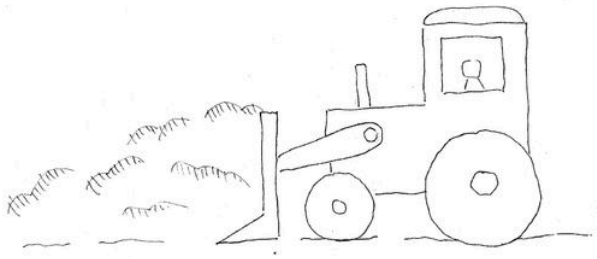


The dust bag of the vacuum cleaner got to full and bursted. The excavator broke and the dust, that was collected for all these time, started to spread in the air.



... over to the beautiful village.

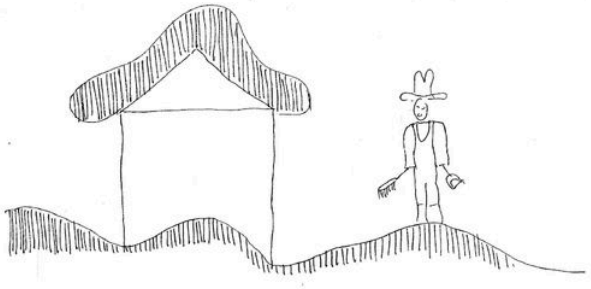
Everything got covered by the dust. There was not one inch the dust stayed out of.



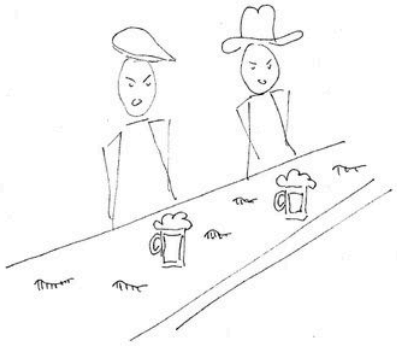
Immediately the inhabitants organized themselves and started to clean their village. Luckely the farmer Franz had a tractor with a big shovel.

After quite some time and a lot of hard work for all residents, two figures appeared in the village.
„We are sent from RWE and the state of Germany and want to apologise for the inconvenient situation", they said and handed over a present.

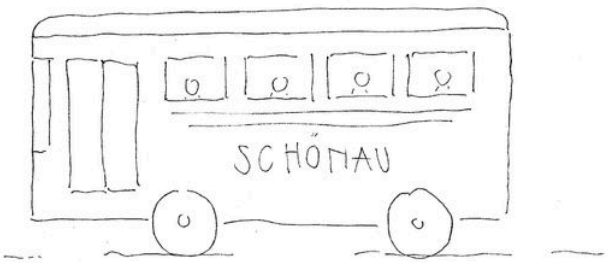
It contained a little shovel and brush for each inhabitant.



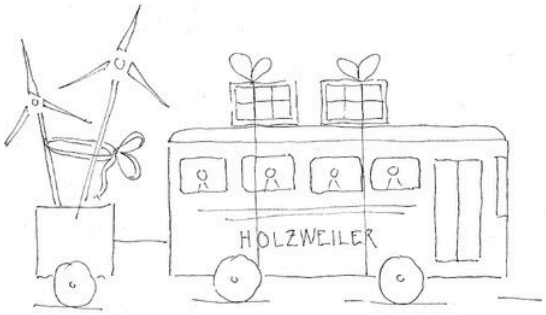
Clueless, farmer Franz and all the others were left standing in front of the big piles of dust. Each with the little shovel and brush in their hands.



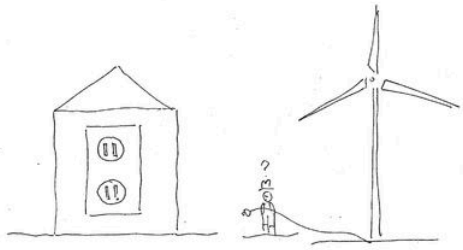
In the evening, farmer Franz met up with his friend in the local pub. "I am quite upset", he said. "Is that really everything they could do? Let us clean their mess? Something needs to change!" His friend agreed: "I heard of a village that is totaly independant from all power companies and the state. They produce their own electricity. We also need to take matters into our own hands.



After finding more people that were upset. They planned a trip to visit this self-sufficient village...

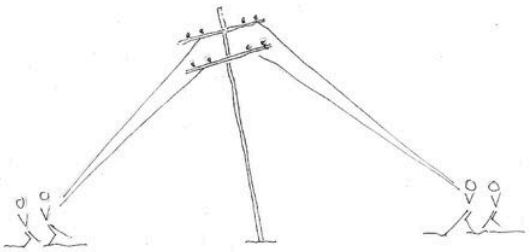


... and came back with new knowledge, equipment and lots of motivation.

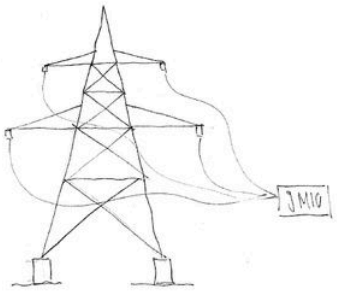


Farmer Franz immediately put up his own wind turbine after getting home, but quickly realised that it is not as easy as he thought. The wind turbine would not plug directly into his house. It only connected to the grid.

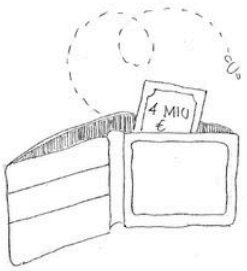
The other residents had the same problem. They were furious about how the system worked and organised a demonstration in the village.



A showdown between the grid operator and the village began.

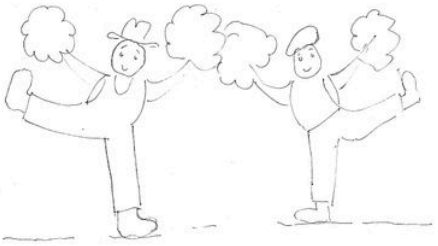


After the village fighted hard and long, the grid operator got tired and proposed to sell the grid which surrounds the village for 3 million.

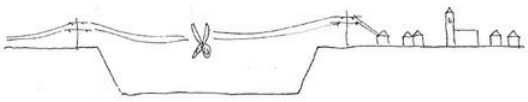


But the village only had four millions to spare, so they had to come up with a different solution.

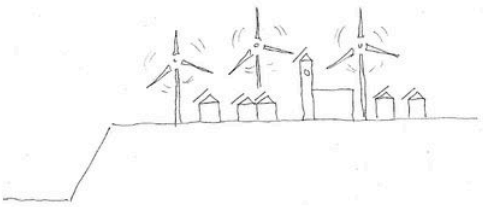
All the villagers together made t-shirts, keychains and scarves and sold them at a merchandise stall.



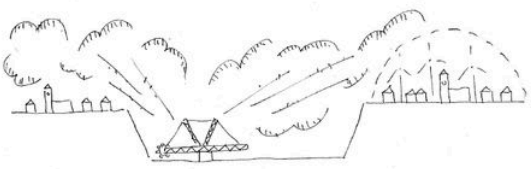
Thanks to their spirit, engagement and work, the village managed to raise the amount of money they needed.



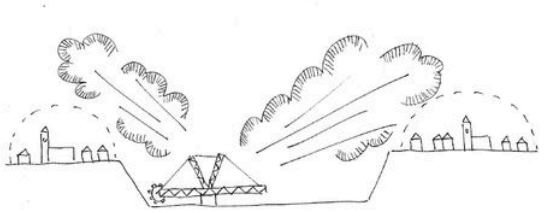
The connections to the outer grid were cut...



... And their own wind turbines rotated and the solar panels sparkled.

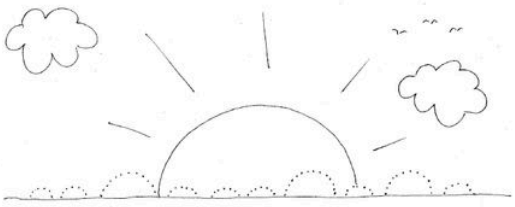


The village was protected but the hole was still right next to it with RWE digging up the ground. The neighbouring village was still affected



With the advice of farmer Franz and the other inhabitants the neighbouring village managed to get independant too. The electricity produced by RWE became more and more useless.

People started to take matters into their own hands, wanted to decide for themselves. The company and its big hole vanished.



THE BEGINNING

... And if the wind turbines turn and the solar panels sparkle, farmer Franz and all the others lived independantly every after.

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SOURCES

- “Anteilseigner” amprion.net. Accessed 15 December 2022. https://www.amprion.net/Amprion/Finanzen/Anteilseigner/
- Bernward Janzing. “REBELLISCHE ENERGIE FÜR ALLE!” Accessed 19 December 2022 https://www.ews-schoenau.de/energiewende-magazin/zur-ews/geschichte-06-rebellische-energie-fuer-alle/
- “Über TenneT” tennet.eu. Accessed 15 December 2022. https://www.tennet.eu/de/ueber-tennet
- Christian, Sperling. “Game of Zones I: Entwicklung der Stromnetze” energiegeschichte.de. Accessed 15 November 2022. https://www.dhm.de/blog/2016/08/25/die-elektrifizierung-deutschlands/
- “Die Elektrifizierung” energiegeschichte.de. Accessed 15 November 2022. https://www.energiegeschichte.de/de/meg-energiegeschichte/energiethemen/leitungsbau.html
- “Die Elektrifizierung” energiegeschichte.de. Accessed 15 November 2022. https://www.tuev-nord.de/explore/de/erinnert/eine-kurze-geschichte-der-energie/
- “Die Elektrifizierung” www.next-kraftwerke.de. Accessed 15 November 2022. https://www.next-kraftwerke.de/energie-blog/entwicklung-stromnetz
- “Eine kurze Geschichte der Energie” tuev-nord.de. Accessed 17 November 2022. http://www.geni.org/globalenergy/library/national_energy_grid/germany/index.shtml
- “Holzweiler” holzweiler.com. Accessed 5 November 2022. https://holzweiler.com
- Leonie, Sanke. “Warum Strom immer teurer wird” sueddeutsche.de. Accessed 16 December 2022. https://www.sueddeutsche.de/wirtschaft/strom-strompreis-energiekosten-1\.5600730
- “Netzentgelte Strom: Hintergrund, Stand & Entwicklung” strom-report.de. Accessed 15 December 2022. https://strom-report.de/netzentgelte/
- “Neue Energien Forum Feldheim” nef-feldheim.info. Accessed 19 November 2022. https://nef-feldheim.info/energieautarkes-dorf/
- “Stromerzeugung im 1. Halbjahr 2022: 17,2 % mehr Kohlestrom als im Vorjahreszeitraum”. Accessed 19 December 2022 https://www.destatis.de/DE/Presse/Pressemitteilungen/2022/09/PD22_374_43312\.html;jsessionid=5493265E5A10BD43B658CDF20F245A27\.live742
- “Stromrechnung einfach erklärt” germanledtech.de. Accessed 15 December 2022. https://www.germanledtech.de/de/news/stromrechnung-einfach-erklart/
- Valentin J. Herberger. “Unter Strom – Die „Eltern für atomfreie Zukunft” werden aktiv". Accessed 19 December 2022 https://www.des-volkes-stimme.de/unter-strom-die-eltern-fuer-atomfreie-zukunft-werden-aktiv/

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