

# Mining Area Lusatia *(Lausitz)*

Dr. Stefan von Senger

## The Lusatian mining area

### A bit of geology and history

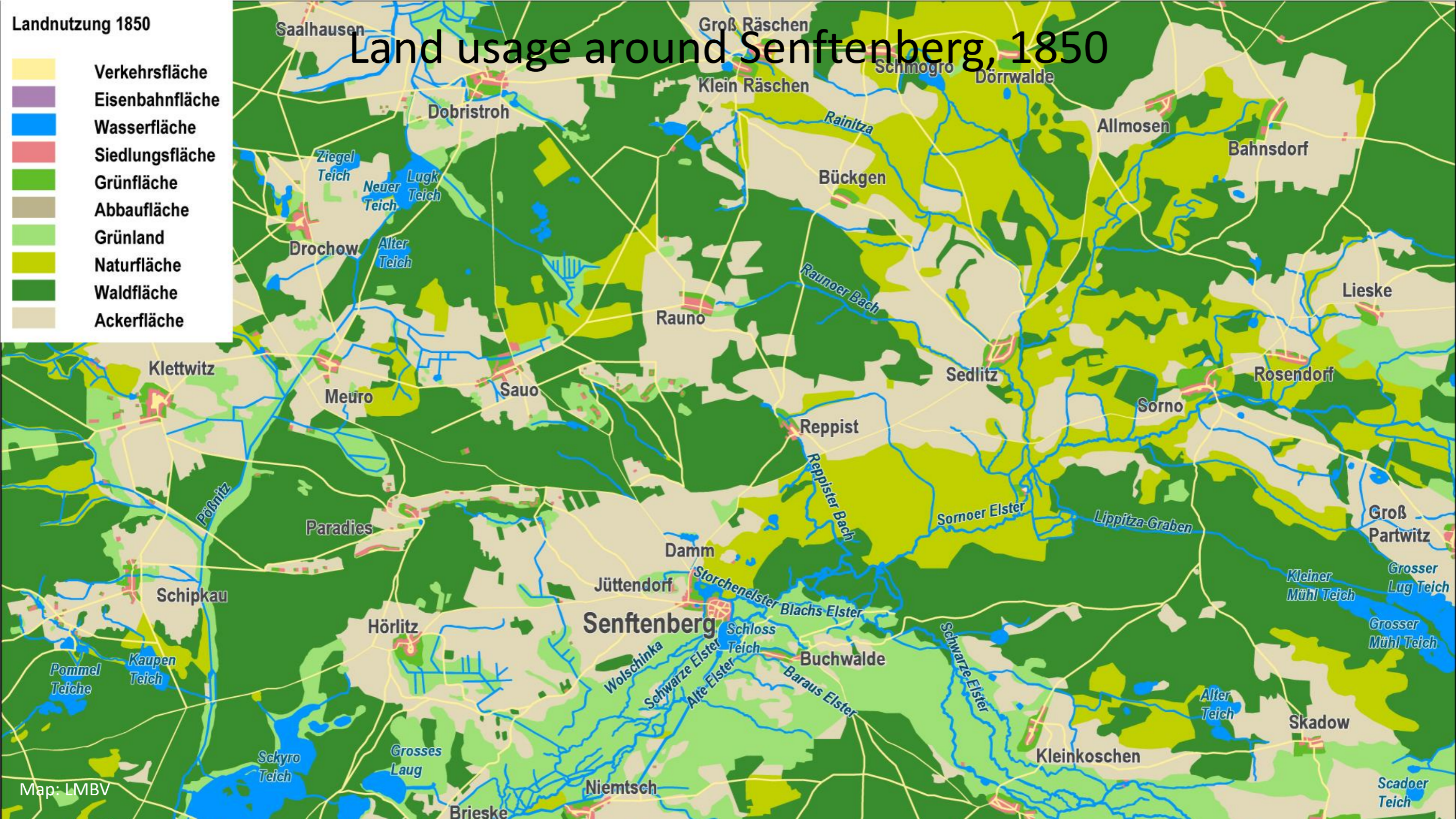
- Lusatia is an ancient landscape located almost exactly in the middle of Europe. It stretches across two East German states: Brandenburg and Saxony.
- Lignite has been mined here industrially for about 170 years. In the first decades, it was mainly extracted by deep mining, and only from about 1900 onwards mainly by open-cast mining.
- The coal seams in Lusatia, which themselves are between 8 and 20 metres thick, but in some cases up to 100 metres, lie between about 30 and 100 metres below the surface. The groundwater table in Lusatia is relatively high, often a few metres below the topsoil. So water management is a major issue.
- In 1990, at the time of German reunification, the GDR had expanded lignite to such an extent that the countryside was devastated, the air was barely breathable and tens of thousands of people in their villages had had to make way for the excavators.
- At that time, more than 350 million tonnes of lignite were mined per year in the GDR, 140,000 people worked in the lignite industry.

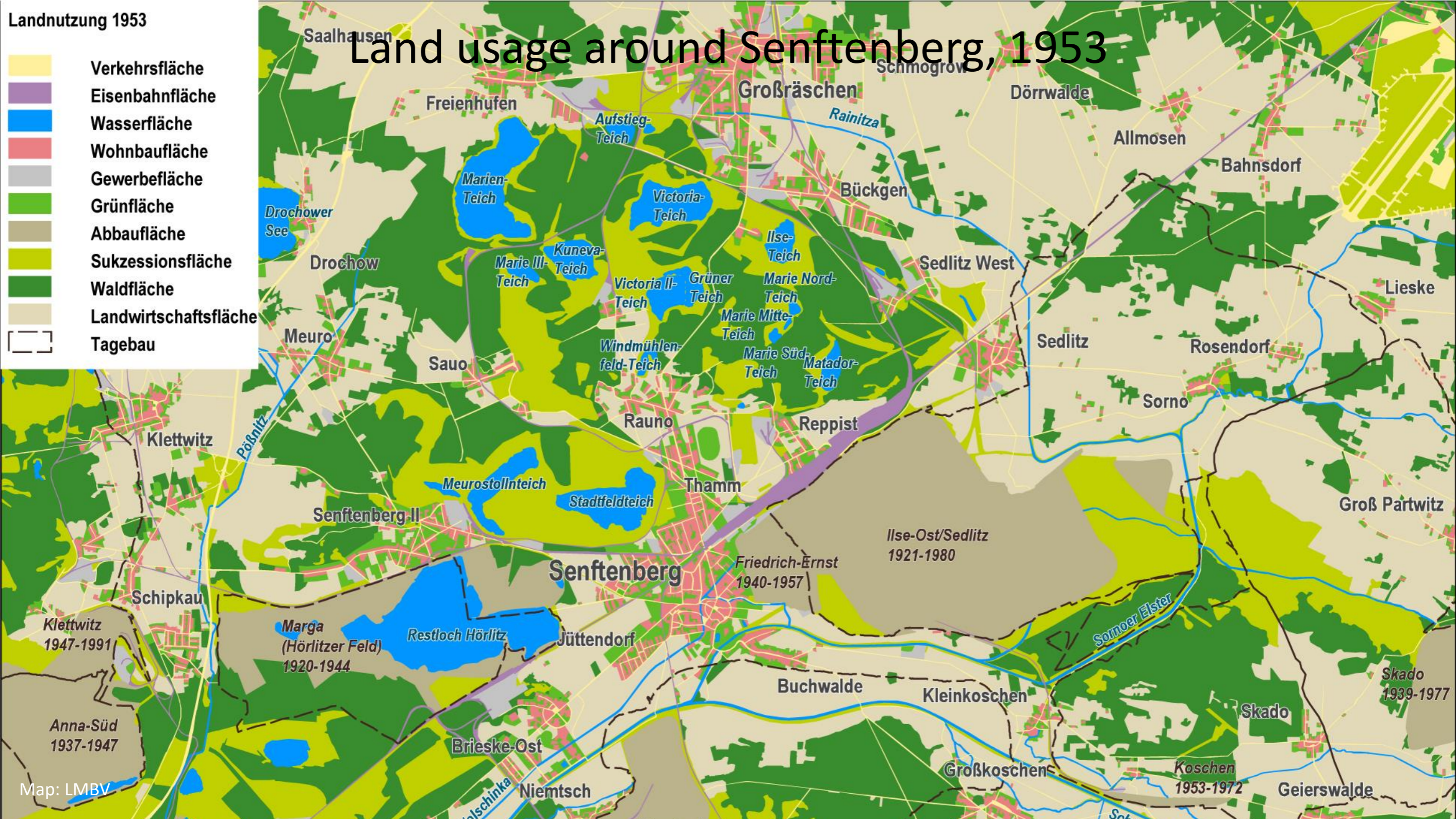
# The Lusatian mining area

## Change over time

- The following 5 slides always show the same area around the city of Senftenberg, and make the change visible. Pay attention to the brown areas - these are the opencast mines - and the blue areas - these are the bodies of water:

# Land usage around Senftenberg, 1850



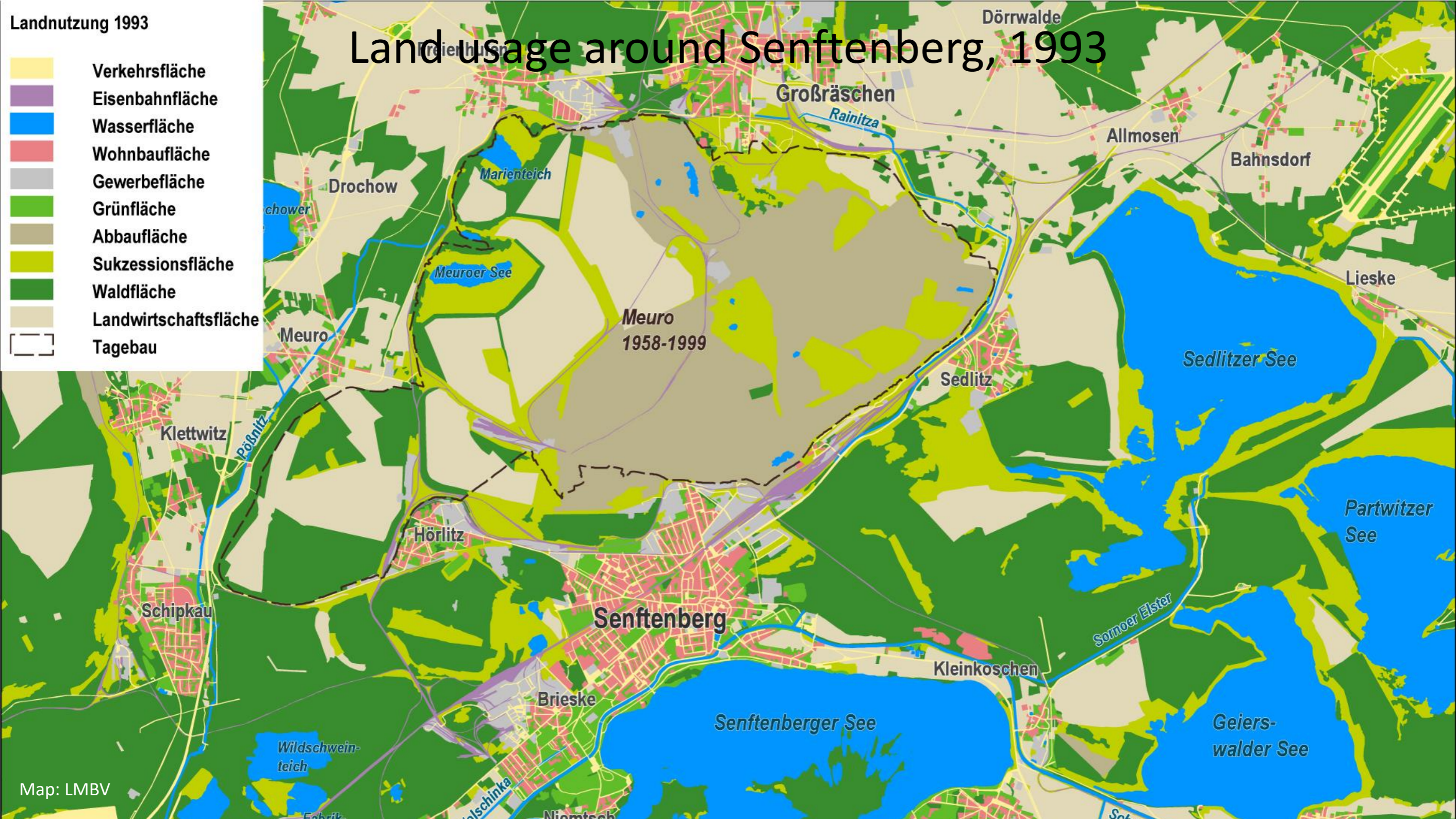


# Land usage around Senftenberg, 1953

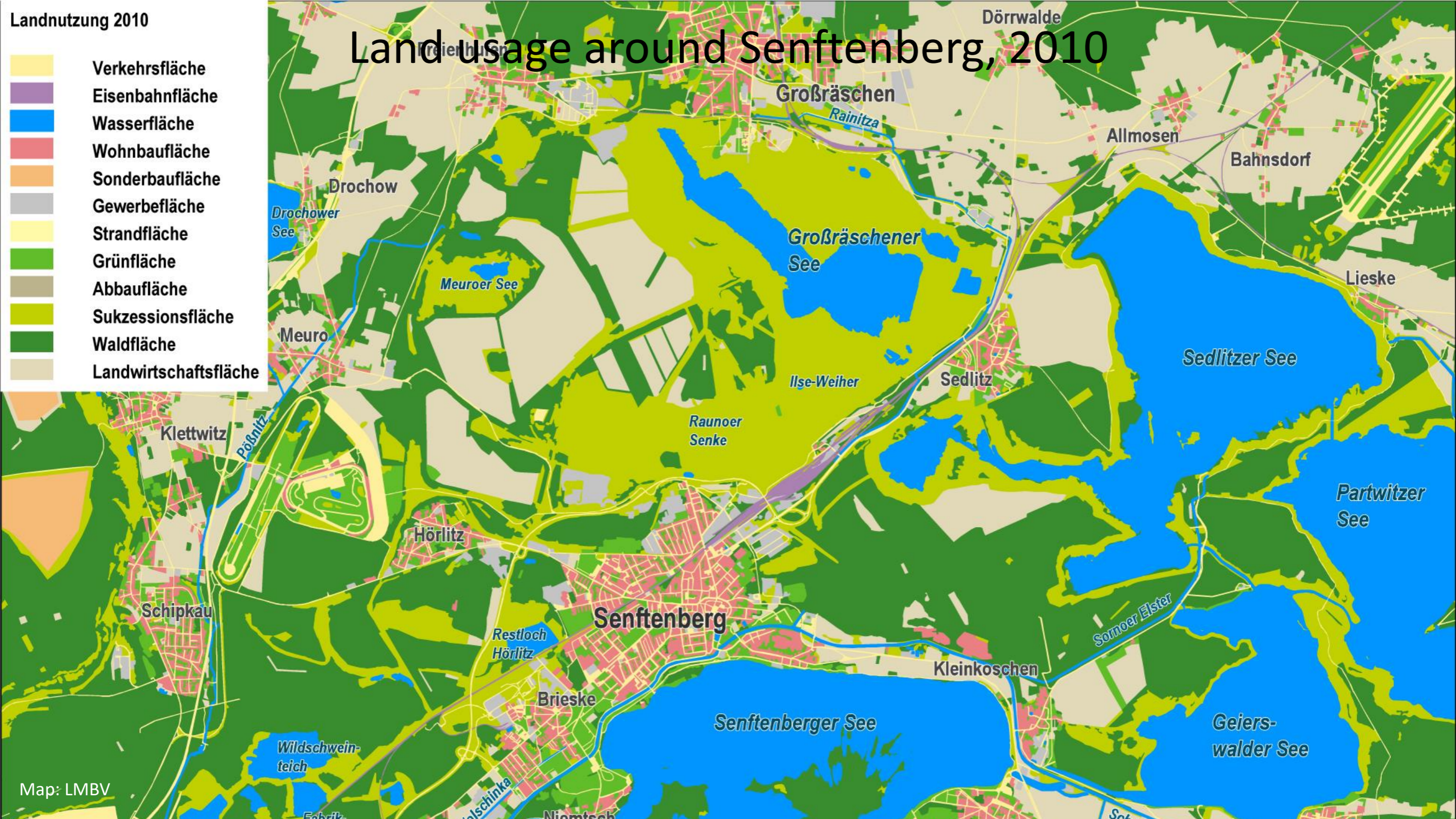
Landnutzung 1953

- Verkehrsfläche
- Eisenbahnfläche
- Wasserfläche
- Wohnbaufläche
- Gewerbefläche
- Grünfläche
- Abbaufläche
- Sukzessionsfläche
- Waldfläche
- Landwirtschaftsfläche
- Tagebau

# Land usage around Senftenberg, 1993



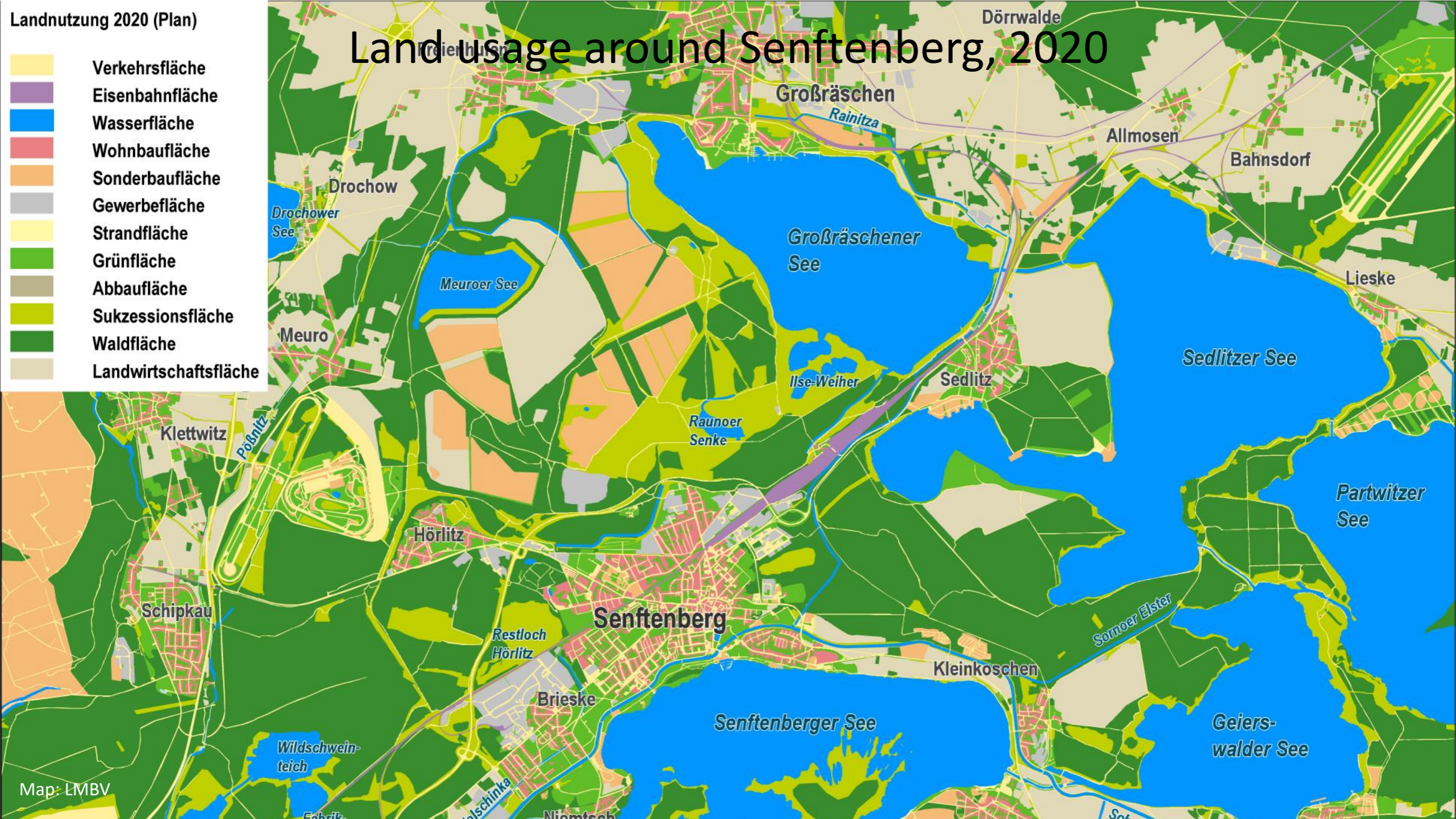
# Land usage around Senftenberg, 2010



Landnutzung 2020 (Plan)

- Verkehrsfläche
- Eisenbahnfläche
- Wasserfläche
- Wohnbaufläche
- Sonderbaufläche
- Gewerbefläche
- Strandfläche
- Grünfläche
- Abbaufäche
- Sukzessionsfläche
- Waldfläche
- Landwirtschaftsfläche

# Land usage around Senftenberg, 2020



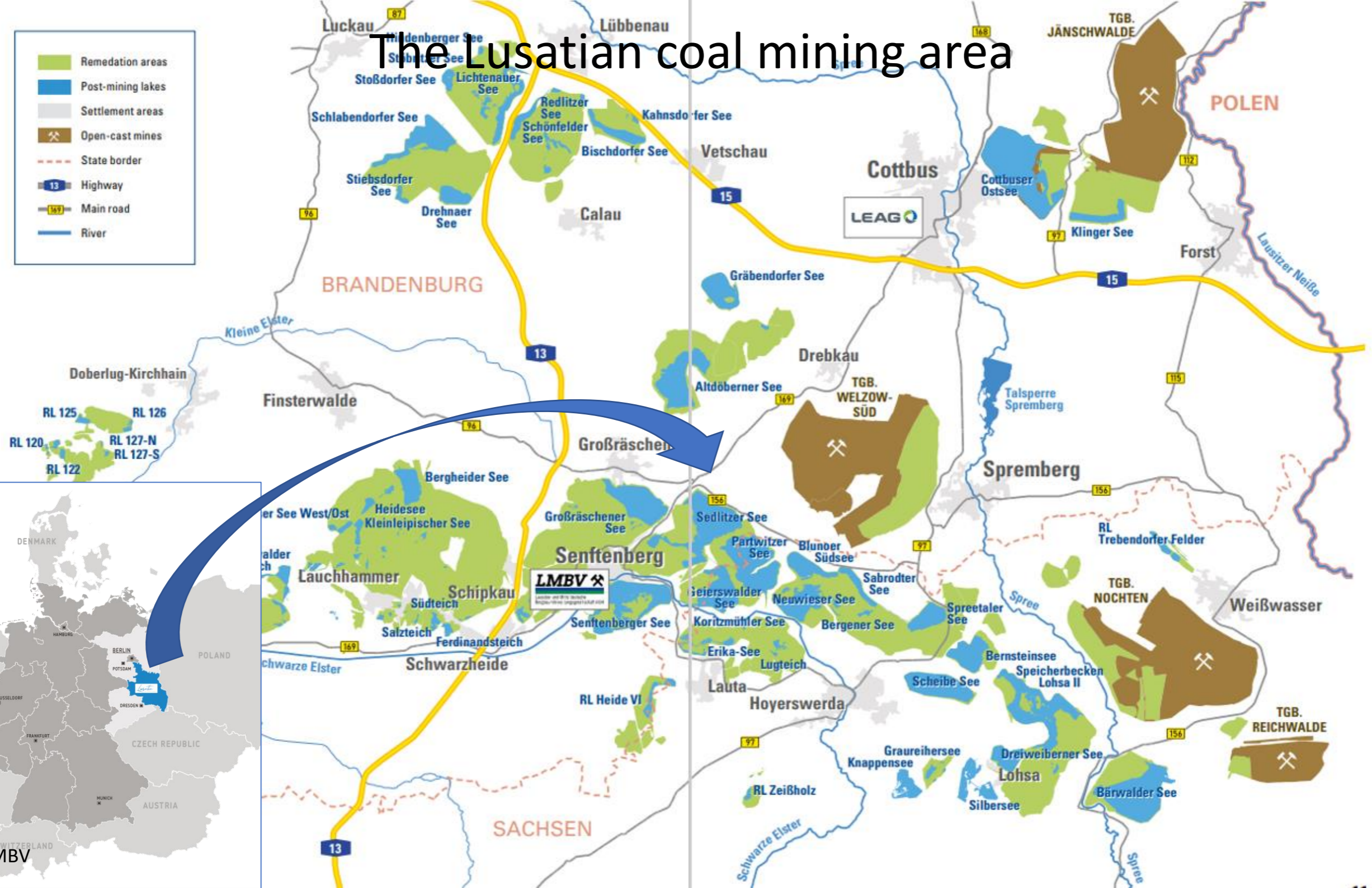
# The Lusatian mining area

## The situation today

- Overall, the situation in Lusatia today is as follows:
- There are now only 4 active mines left - marked here in brown. About 40 million tonnes of coal are still produced each year, which is used to feed 4 power plants. A total of about 8,000 miners work directly in the lignite industry and another 15,000 in lignite-related service companies.
- For climate protection reasons, Germany has decided to stop mining and burning coal altogether by 2038 at the latest. The new federal government even wants to bring this date forward to 2030.

# The Lusatian coal mining area

- Remediation areas
- Post-mining lakes
- Settlement areas
- Open-cast mines
- State border
- Highway
- Main road
- River



## Main actors

### The LEAG

- Since the privatisation of the East German lignite industry in the 1990s, there have been two main players in Lusatia.
- First of all: the Lausitzer Energie & Bergbau Aktiengesellschaft - LEAG for short.
- The company, now owned by the Czech EPH Group, is the operator of the 4 still active opencast mines, the 4 power plants and the remaining refining operations in Lusatia.



- Czech owner (EPH)
- 8,000 employees
- 2,2 billion AUD/a contract volume and wages for the region
- 3,300 partner companies servicing LEAG
- extraction of 61 million tons of lignite coal per year
- 55 billion kWh electricity generated per year
- 3,5 billion kWh heat generated per year

### The LMBV

- Second: the Lausitzer- und Mitteldeutsche Bergbau-Verwaltungsgesellschaft mbH - LMBV for short.
- The LMBV is owned and financed by the German Federal Government and four of the five East German Länder. It has about 700 employees and the exclusive task of organising the recultivation and utilisation of those parts of the East German mining legacies that have not been sold into the private ownership of LEAG. In the last 26-27 years, the LMBV has invested about 15.5 billion Australian dollars in this task.



- owned by German Federal Government
- financed by Federal Government (3/4) and four State Governments (1/4)
- 700 employees
- ca. 400 million AUD/a contract volume to private companies
- 300 partner companies contracting with LMBV
- ca. 15.5 billion AUD spent for rehabilitation measures since 1995

## Sustainable mining practices

- Let's first take a look inside an opencast mine - here with a group of visitors from Mongolia
- A view from above
- And a view of one of the bucket chain excavators removing the overburden
- Finally, a schematic representation of an opencast mine in Lusatia

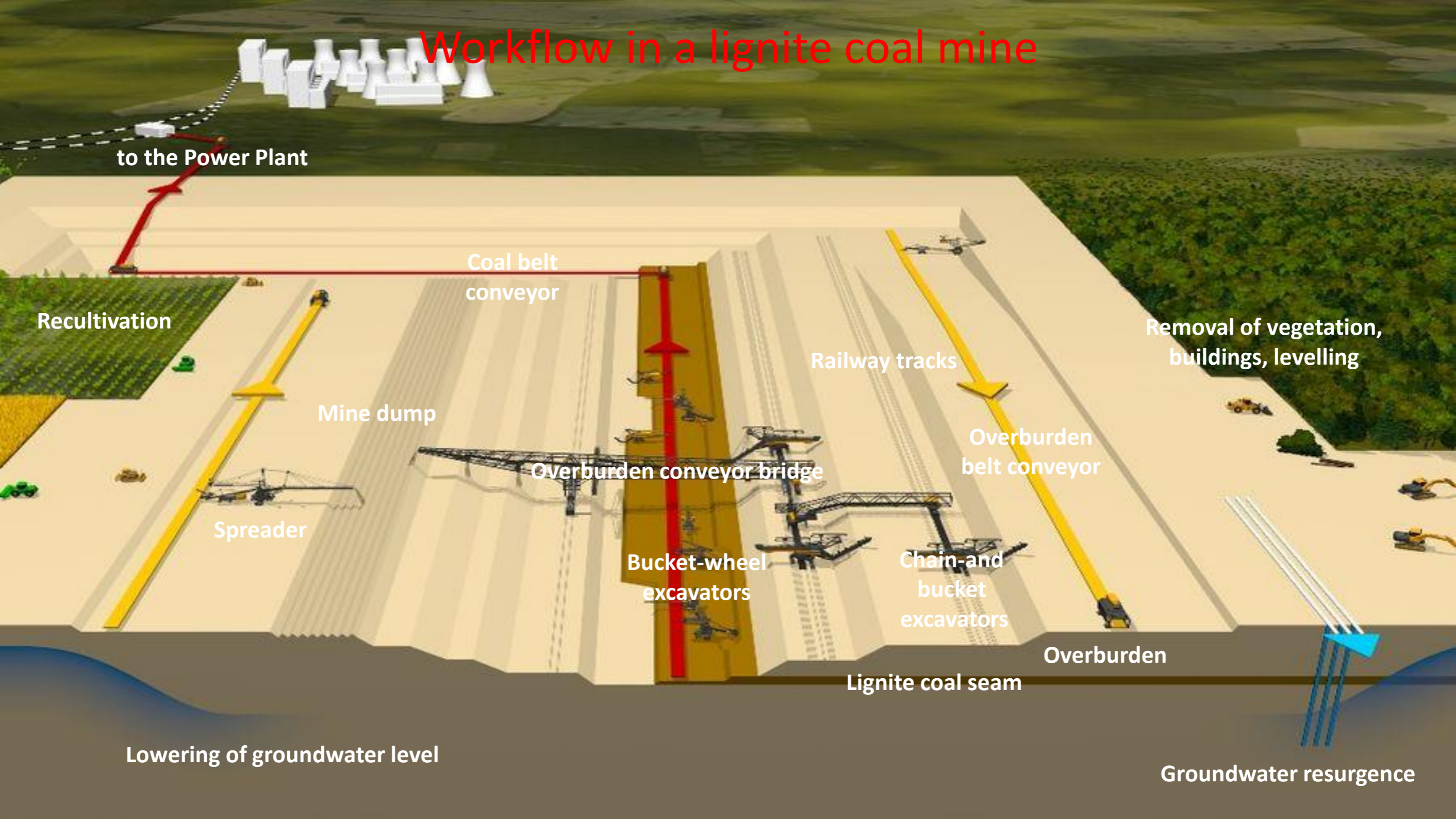
# View into an open pit near Cottbus (Brandenburg)



# Bucket chain excavator feeding the overburden conveyor bridge F60

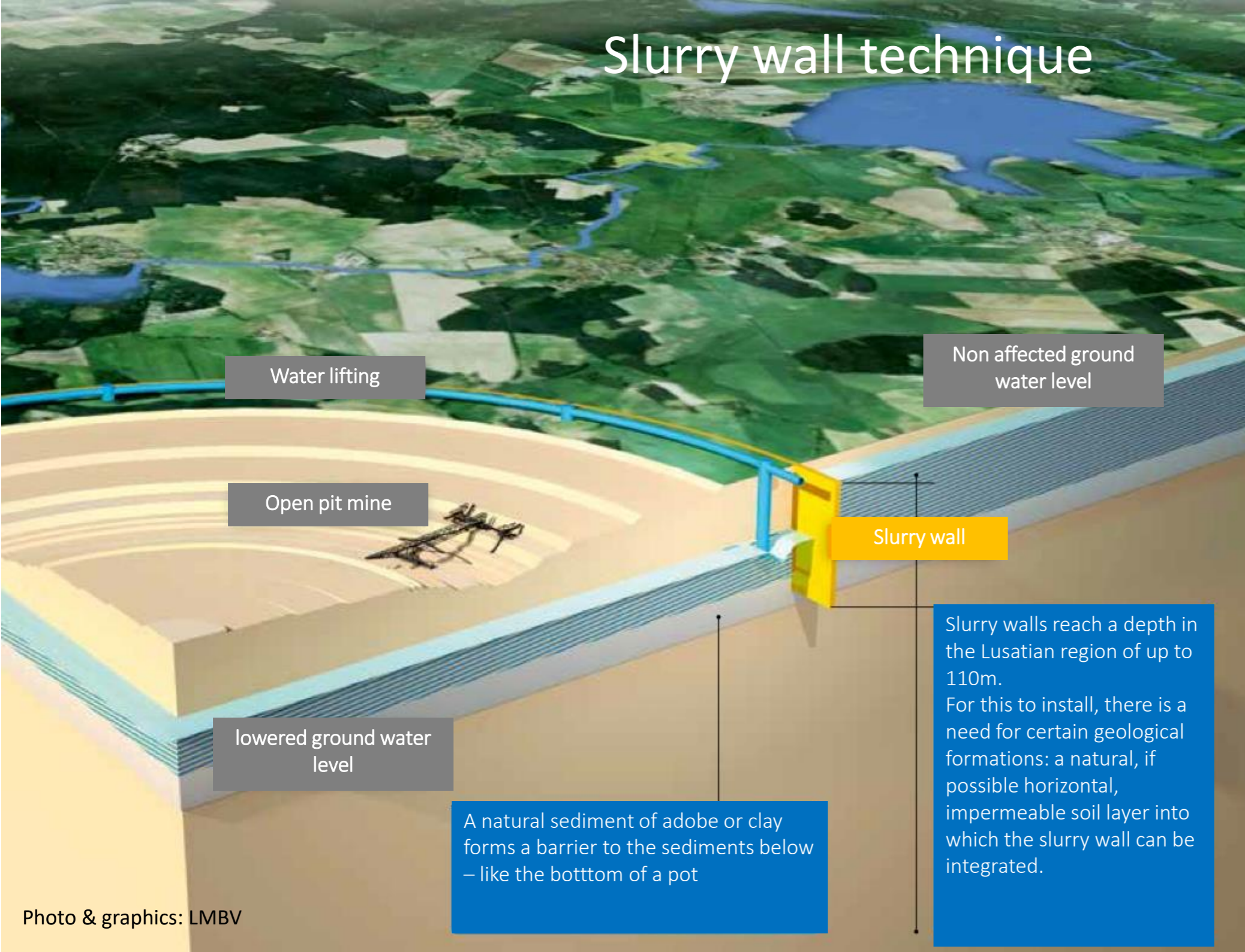


# Workflow in a lignite coal mine



- According to German mining law, no deposit may be opened up before a final operating plan has been submitted and approved by the mining authority of the respective federal state. Therefore, 30-40 years before a mine is closed, one knows what will happen to it when it is closed, who will finance the rehabilitation and who will ensure safety over the following decades.
- In this respect, LEAG already ensures during the development and mining of the lignite pits that the overburden can be reused for subsequent backfilling of the pits or landscaping with as little effort as possible.
- In addition, the water management is designed in such a way that the backfilling of selected pits can later be done as efficiently as possible.
- One way to stop the groundwater flooding the open pits is a system in which extensive slurry walls are driven into the ground around future opencast mines and filled with a layer of clay, in some cases more than 100 metres deep.

# Slurry wall technique



Slurry walls reach a depth in the Lusatian region of up to 110m. For this to install, there is a need for certain geological formations: a natural, if possible horizontal, impermeable soil layer into which the slurry wall can be integrated.

- In Lusatia, the geological and topographical conditions make it possible to organise continuous opencast mining: There is hardly any "media break" once the rock has been touched by machine: from mining to incineration. The machines have been running almost non-stop for 40 years in some cases, going back and forth, and only need to be moved every few years.
- This entire process - i.e. the removal of the surface layers by the large bucket chain excavators,
- ...the dumping of overburden via conveyor bridges - here in the picture, by the way, the F60, the largest moving machine ever built by man
- ...the digging of the coal seam by the bucket wheel excavators
- ...and the transport via conveyor belts to the power plants.
- ...this entire process is highly automated and remotely controlled. Downtimes are less than 1%.

# Bucket chain excavator in Lusatian coal mine



F60 overburden conveyor bridge



# Bucket wheel excavator in Lusatia



# Coal conveyor belt



- The control and regulation technology is so refined that the speed and quantity control of the mining machines can be based on what prices are to be expected at the energy exchange, what wind speeds and what solar radiation are to be expected in the next 2 hours.
- New construction and modernisation of all the power plants in Lusatia over the last 20 years have succeeded in increasing the efficiency of the turbines to over 40%. In addition, flue gas desulphurisation plants have been installed which filter out almost all harmful emissions except CO<sub>2</sub>.

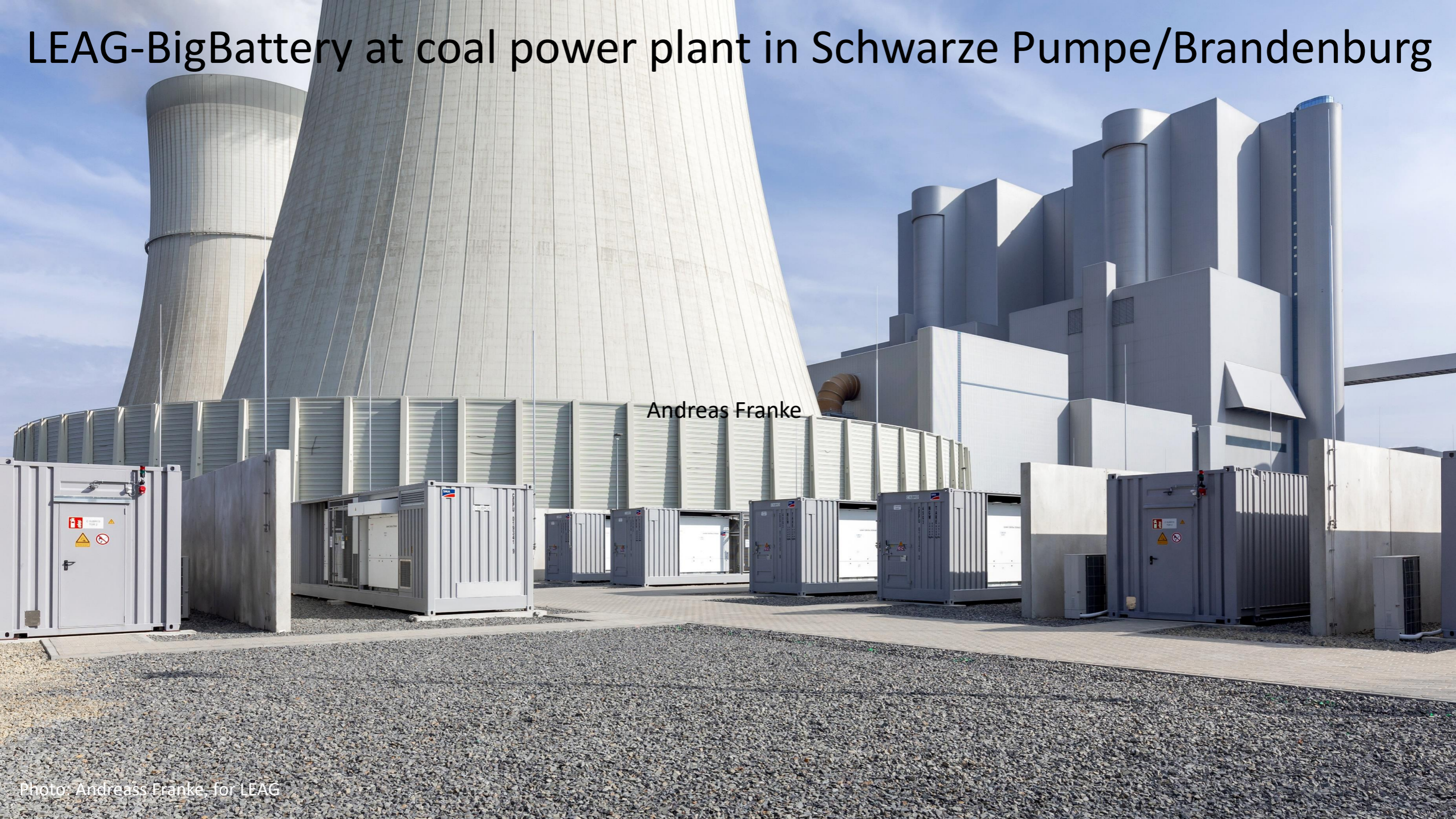
# Lignite coal power plant in Boxberg/Saxony (LEAG)



## LEAG's BigBattery

- Recently, LEAG has embarked on a new experiment to make its power plant fleet run even more efficiently. This is necessary because there is more and more volatile renewable electricity in the grids.
- Since 2020, LEAG has been running Europe's largest battery storage facility - the BigBattery. It was built right next to one of the lignite-fired power plants and is fed by its energy production. 13 of the containers contain lithium-ion batteries. In addition, there are 13 converter containers, a block transformer and medium and low-voltage switchgear. With its primary control power, the BigBattery can provide up to 50 MW to compensate for short-term fluctuations in the power supply within 30 seconds. It thus contributes to a stable electricity grid.

# LEAG-BigBattery at coal power plant in Schwarze Pumpe/Brandenburg



Andreas Franke

## Wind and solar power by LEAG

- Moreover, LEAG is now diversifying its own power generation: Wind and solar parks are not only built on recultivated dumps, but - in the case of solar parks - also on the newly created lakes.
- It is interesting to see how LEAG wants to make its plans palatable to the citizens of the surrounding communities.
- This is a photomontage in which LEAG wants to show what you can see of the floating solar park when you stand on the shore of the lake. You can see almost nothing. Just a thin white area a little to the left of the centre of the picture. The wind farm in the back on the right, that already exists.

# Floating solar park in Lusatia (planned)



## Post mining

### Some methods for rehabilitation

- As far as post-mining is concerned, I already mentioned that everything that was opened up by the GDR before 1990 is being recultivated by the state-owned LMBV, while LEAG is obliged to recultivate its post-1990 legacy.
- In recent decades, both LEAG and LMBV have developed numerous new methods and techniques to recreate entire landscapes.
- The Lusatian mining area has developed a high degree of competence in compacting the embankments by, for example, vibrating iron rods which are stencilled into the loose soils.
- Some companies in Lusatia specialize in recreating species rich biospheres with local plant seeds. To improve humus- and nutrient-poor covering materials they can be mixed with green-waste compost, pre-treated digestate, uncontaminated sewage sludge or other organic material.
- „Alley-Cropping“ is a method by way of planting various types of fast growing trees and bushes in stripes next to agriculturally used land. The trees and certain types of grain harmonize with each other very well.

# Filling mined out pits with surface water



# Compacting embankments by vibrating rods



# Soil amelioration



# Rehabilitation

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## An effort for the long haul

- It takes 20-30 years for a landscape torn apart by mining to become accessible and usable again through rehabilitation and recultivation work. But then man has played a little "God Almighty": A new, thoroughly beautiful and lively landscape has emerged where people feel at home.

Rehabilitated mines offer new opportunities and a new identity



## **New technologies and processes**

...just some examples from Lusatia

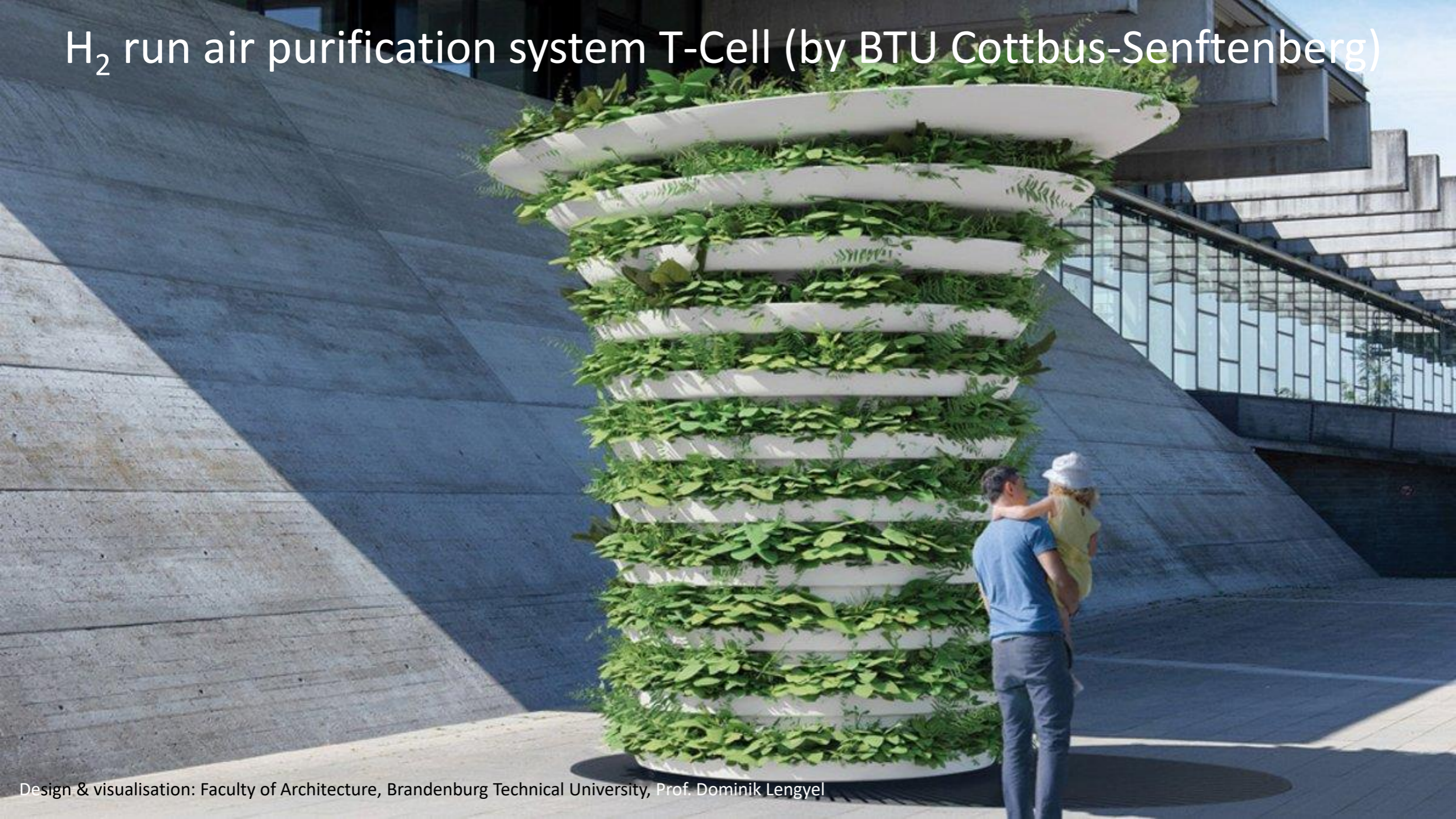
**If you want to know more about these and other ideas, then you must come to us in Berlin and Brandenburg in May 2022!**

**Thank you very much!**

# Measurement of radon in deep mining (by SARAD)



# H<sub>2</sub> run air purification system T-Cell (by BTU Cottbus-Senftenberg)



# Remining of tailings in Chile (by GLU Freiberg GmbH )



# *Susatia sustained*

## *a dramatic feature film*

### *starring*

- *The Miner* [www.leag.de](http://www.leag.de)
  - *The Recultivator* [www.fib-ev.de](http://www.fib-ev.de), [www.ecosoil-umwelt.de](http://www.ecosoil-umwelt.de), [www.nagolare.de](http://www.nagolare.de)
  - *The Machinist* [www.takraf-tenova.com](http://www.takraf-tenova.com), [www.fam.de](http://www.fam.de), [www.germanbelt.de](http://www.germanbelt.de)
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  - *The Data Scientist* <http://new.abb.com/mining>, [www.isimko.de](http://www.isimko.de)
  - *The Operator* [www.gmbmbh.de](http://www.gmbmbh.de)
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  - *The Vibrator* [www.gmbmbh.de](http://www.gmbmbh.de)
  - *The Pilot* [www.eta-ag.com](http://www.eta-ag.com)
  - *The Hydraulic* [www.lobbe.de](http://www.lobbe.de), [www.sweco-gmbh.de](http://www.sweco-gmbh.de),
  - *The Scientist* [www.b-tu.de](http://www.b-tu.de), [www.glu-freiberg.de](http://www.glu-freiberg.de)
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- ...and many others*

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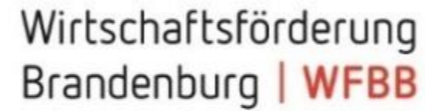
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