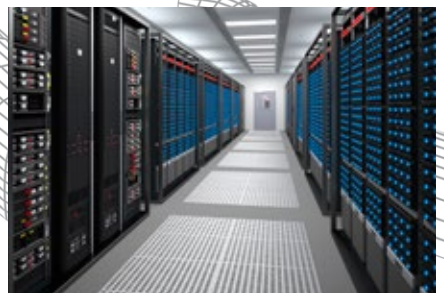
DERBERG
DATASTORAGE
GMBH

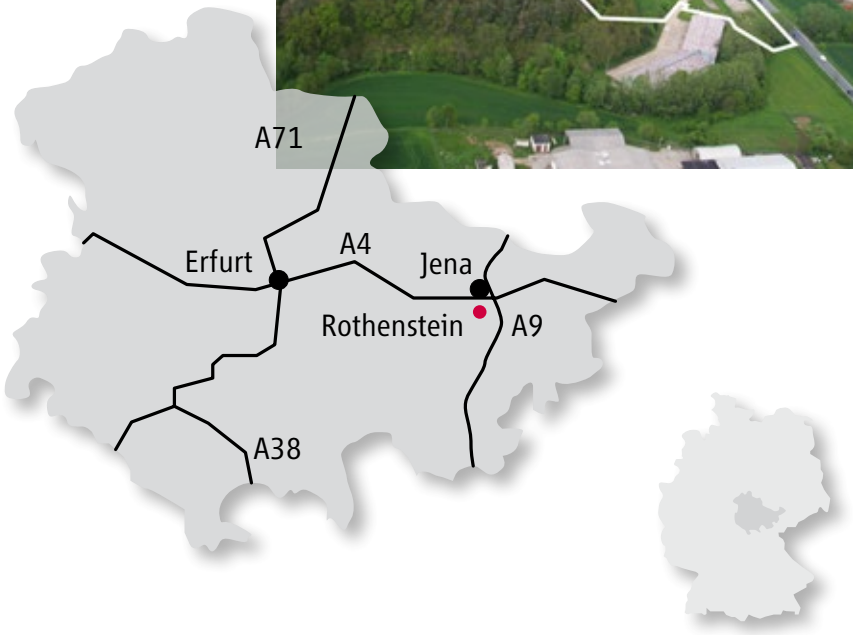
Rothenstein data center



The former D42 high-security depot in Rothenstein (Germany) is the ideal property for realising a state-of-the-art data center thanks to its specific attributes and site-related factors. The site offers:
Optimum passive security, **efficiency**, **availability** and **environmental safety**.

Location

Rothenstein in Thuringia



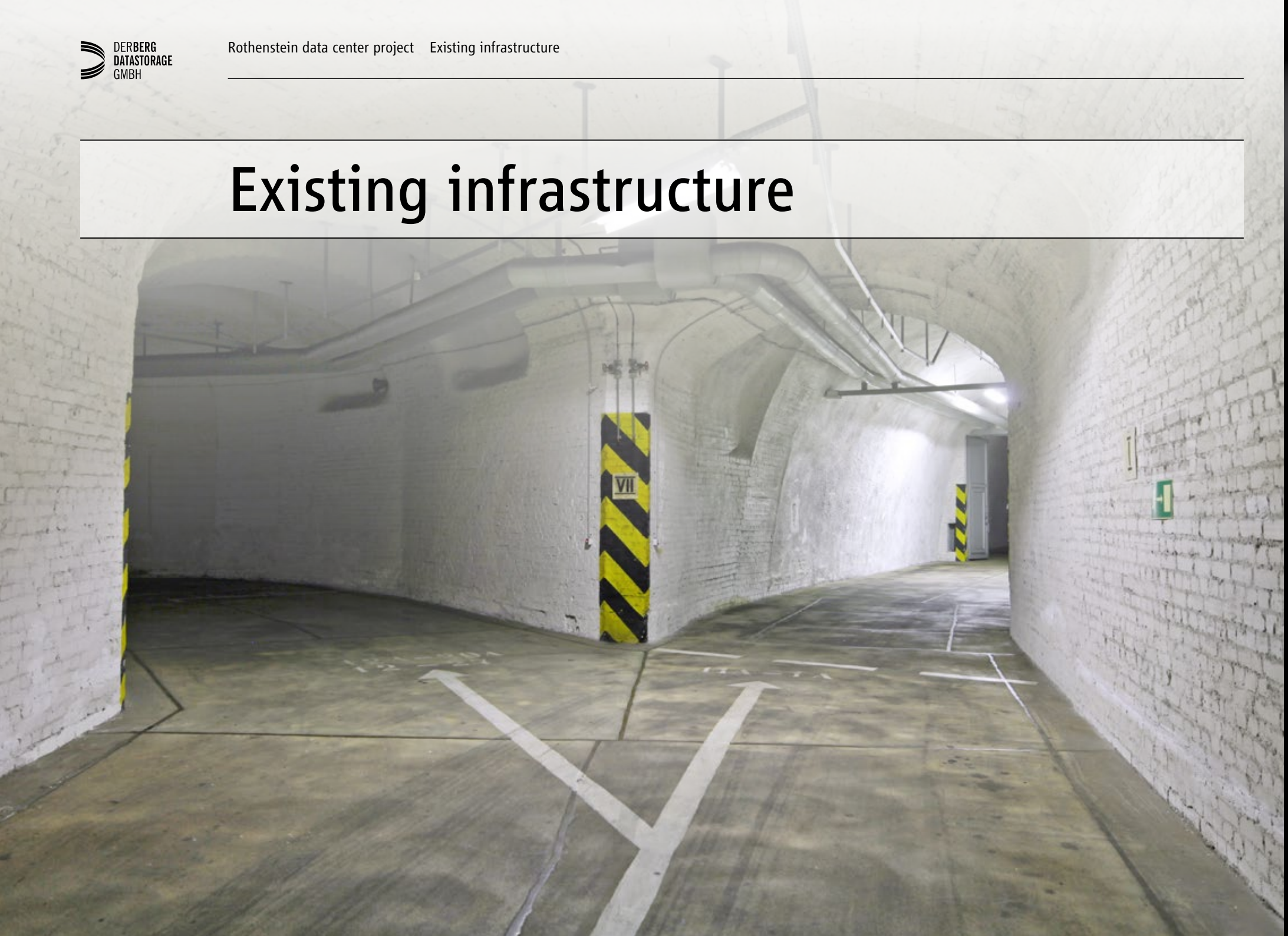
Excellent transportation infrastructure

— Situated 3 km south of Jena city limits

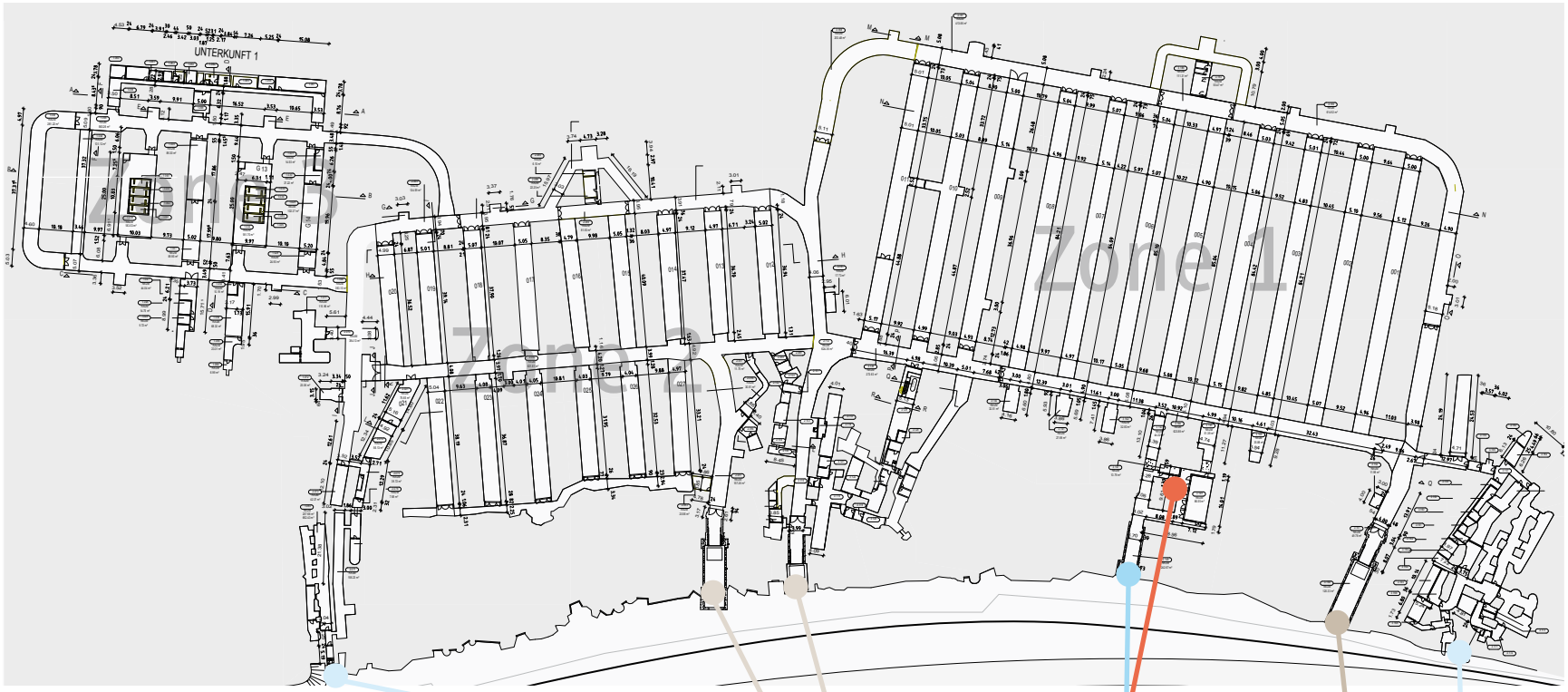
— Situated 3.5 km from the A4 motorway via the B88

— Rail connection to DB AG network, Berlin-Nuremberg route

Existing infrastructure



Overview of layout



Zone 1

- 11 storage tunnels at approx. 420 m²
- Efficient tunnel cross-sections
- Horizontal, level access
- Simple logistics within the facility
- Water drainage not required

Facts

— The site spans **283,000 m²** of completely enclosed space

— The site is worth **115 million** euros according to official reports

— An underground high-security depot spanning **17,571 m²**, with up to 100 m of mountain above it

— An area of **10,000 m²** can be used as pure server space

— Accessible on ground level by vehicles loaded with heavy equipment; up to **5.5 m** ceiling height

— A **triple access gate system** is in place (weather cladding, 20-t hydraulic-powered gate with 12-way lock, air-tight steel gate)

— **Rail link** to the DB AG network, Berlin–Nuremberg route

— **Constant year-round temperature** is possible, with low upkeep costs

— Site features a **ventilation** and **air-conditioning system**

— Site has a **deep-well plant** with potential supply capacity of 750 m³/day

— It is possible to use a **water cooling system** in the data center by means of the facility's own deep-well

— It is possible to connect to the **high-speed data network** (fibre optic cable)

— Planning permission has been granted for **commercial use** incl. **fire protection concept**

— **Administrative areas** are also available at the facility

— **Biomass heating station** is available at the facility

Security

— **ABC protection** of the tunnels

— **Protected from air-borne disasters** thanks to its underground location

— **Protected from earthquakes and flooding** thanks to its geographic location

— It is possible to monitor, manage and monitor using CCTV by persons situated in an external building; minimum persons present in the data center, **protected from sabotage**

Usage concept

Multi-tier approach: Scalable availability classes

Modular tunnel structure

Tiers 2 to 4 are appropriate for developing the data center in Rothenstein. From an economic viewpoint, it is also advisable to consider adopting a mixed usage and even expand in different stages in different areas where required.

It is possible to provide the availability classes by:

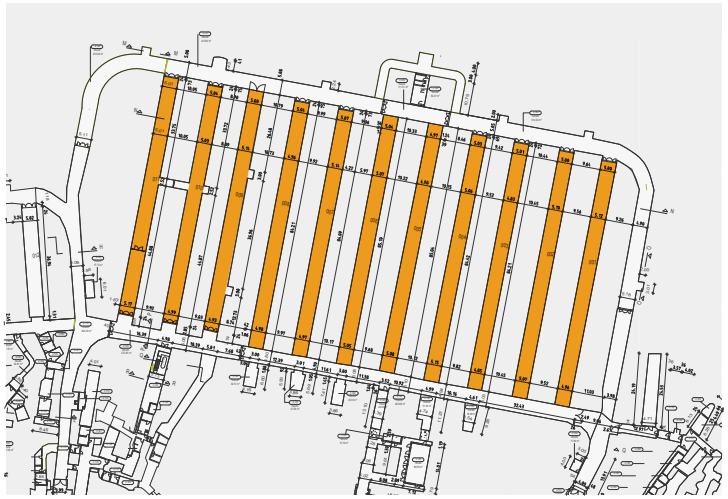
— Having different aisles with different availabilities (i.e. one aisle with tier 2, another aisle with tier 3 or 4)

— Distributing applications across multiple aisles in order to increase availability

Assigning individual applications to the respective availability classes represents huge potential, operational savings — adopting a **cost-effective** approach!

Potential site layout

A total of 11 tunnels at around 85 m in length and around 5 m in width are available for developing the data center. A raised floor is fitted throughout the entire tunnel section (height approx. 25 cm). This raised floor conceals the required electric cables and LAN (Local Area Network) cables.

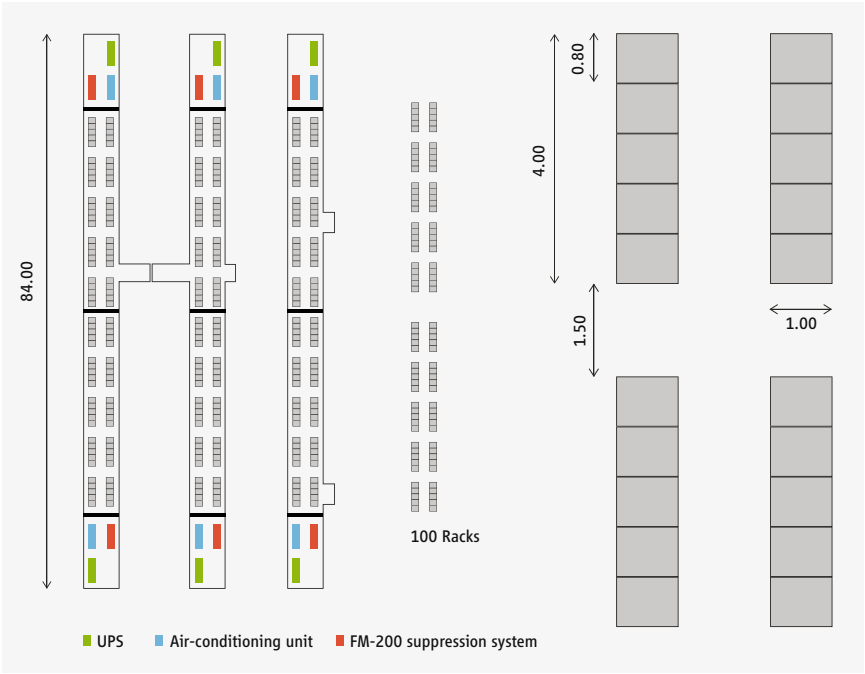


Layout of the 11 tunnels, zone 1

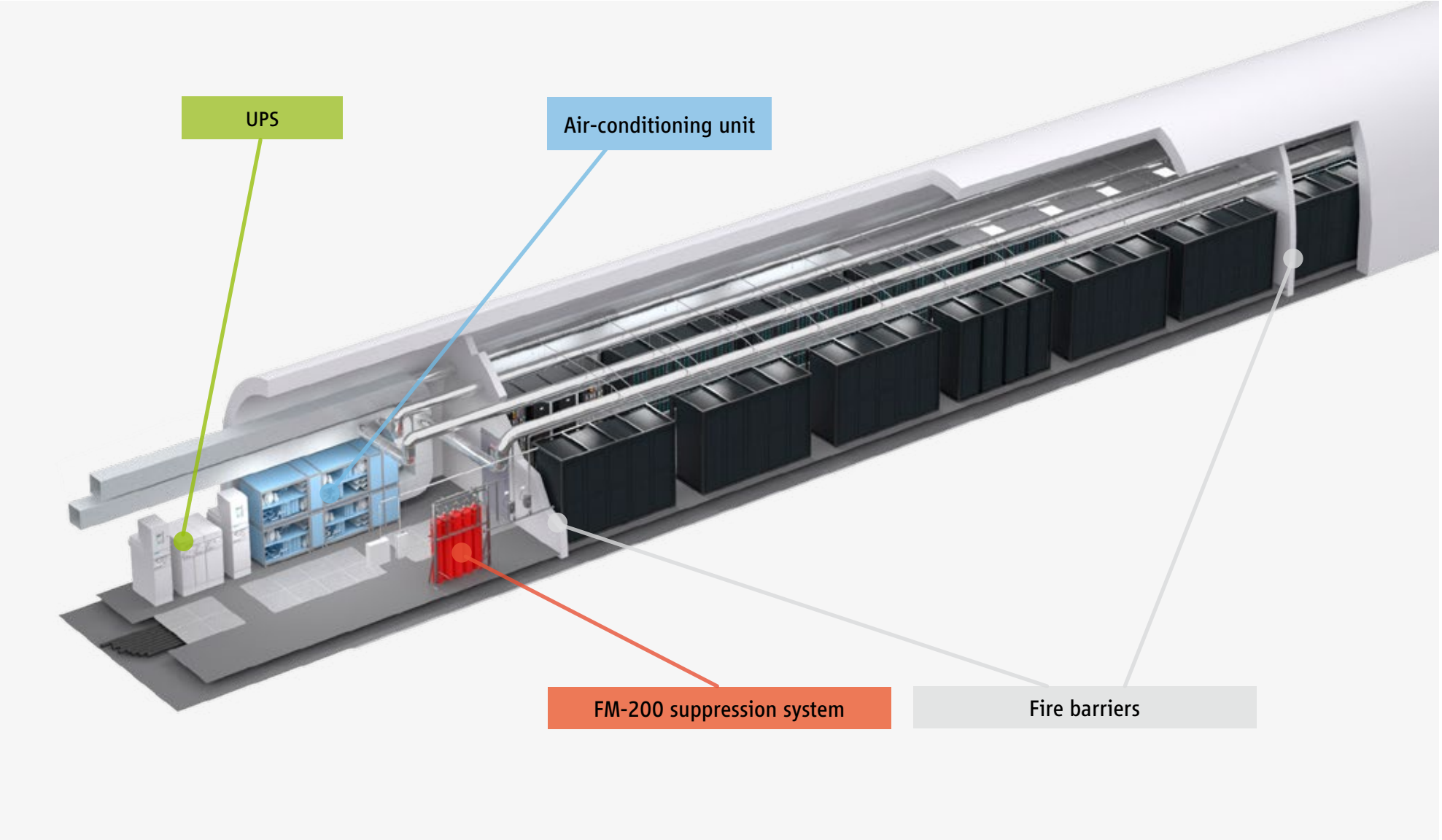
The tunnel is divided into three sections:

1. Supply section 1: approx. 15 x5 m, uninterruptible power supply (UPS) unit, air-conditioning unit and fire-extinguishing system
2. Data rack section: approx. 55 x 5 m
3. Supply section 2: approx. 15 x 5 m for the redundant systems (UPS unit, air-conditioning unit and fire-extinguishing system)

The data racks at approx. 100 mm in depth, 800 mm in width and 2,200 mm height (42 rack unit) are positioned in two rows with their front doors 1.5 m from each other. For safety reasons (escape route in the event of a fire), there is a passageway 1.5 m in width every ten data racks in every row. Working on this basis, a maximum of approx. 100 data racks can be installed in each tunnel. Depending on how the rack is equipped (server or storage), the resulting power draw is between 5 kW and 15 kW per data rack. In order to estimate the energy draw per tunnel, a median value of 10 kW per rack is used as the basis; this provides an energy requirement of 1 MW for each tunnel. The same amount of energy might be required for redundancy. This means that an overall energy requirement of approx. 2 MW is needed in each tunnel.



Sample rack position



Energy requirements

Electrical energy of 2 MW is required per tunnel, i.e. per 100 data racks. When completed with all 11 tunnels, approx. 2 x 22 MW will be required.

A 2 MW UPS (uninterruptible power supply) is installed in each of the supply sections 1 and 3. Depending on the corresponding installation level, this UPS is connected to a redundant power supply provided by the public energy provider and/or to a gas-fired power plant (gas turbines) if necessary. The data racks are supplied using electrotechnical means by both supply sections, enabling the devices with redundant power packs installed in the data racks to be supplied with fail-safe power. Both UPS units in the supply sections are each loaded by up to 50% in normal operation (load sharing). If there is a power failure in one of the supply sections or the UPS needs to undergo maintenance, the other supply section can provide the energy required on its own.

Power supply

Depending on the energy required, the power can be increased in stages.

Power

A redundant power supply of **10 to 20 MW** can be provided in either the **Jena-Göschwitz substation** or the **Kahla substation**.

Natural gas

An hourly nominal heat input of 10 to 20 MW can be presented via the existing high-pressure network in **pressure rating PN16**.

Gas tanks

To be used as redundant backup in the event of natural gas pipeline failing.

Thüringer Energienetze

Biomass heating station

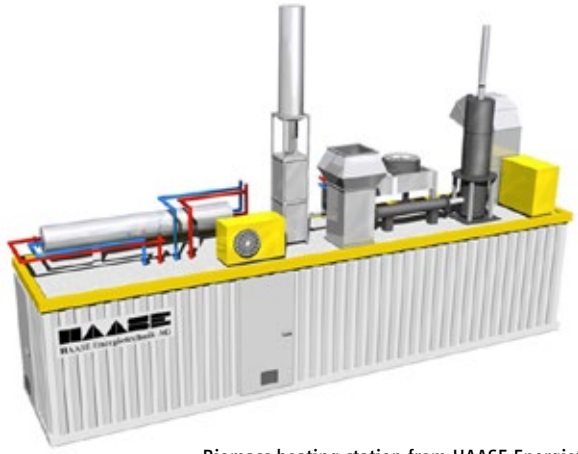
The benefits

— Proven container design

— Quick to commission

— Optimum operating results

— Complete plant packages



Biomass heating station from HAASE Energietechnik AG

Fully equipped

— Up to 1,560 kWel as a power station (incl. gas compressor, flare system, analysis and control system)

— Up to 366 kWel as a biomass power station (incl. complete process technology for biomass heating station and biogas plant)

Possible container position

IT infrastructure

During the initial development phase, the data center will be connected to two redundant fibre optic cables.

The corresponding fibre optic connections are provided by various providers.

A total of 10 Gbits is planned to be delivered per fibre optic cable during the initial development phase. However, the bandwidth can be added to as required. A core switch is fitted in each of the first two tunnels (Redundancy: Distribution switches, which ensure that the tunnels are connected to the core switches, are fitted in all tunnels. Two access switches are installed in each data rack; these switches have a redundant connection to the distribution switches).

The data center can be monitored and managed in an external building (security feature, minimum persons present in the data center).

All LAN connections have a redundant design with fibre optic cables across different routes.

Data circuit connection

Data rates of **100 Gbit/s** per wave length.

Primary route

The primary route would run from a northerly direction from **Jena** via Maua to the data center. In Jena, the telecommunications provider Thüringer Netkom has a **PoP** with network connections to **multiple carriers**, including **Colt**.
The route from Colt runs along the A4/A9 motorway to Berlin or alternatively Nuremberg, therefore providing an **optimum link** to corresponding backbone nodes.

Secondary route

The secondary route would run in a southerly direction from **Erfurt** via Kahla. Thüringer Netkom has a **PoP** with corresponding network connections to carriers, including **Colt, euNetworks, Verizon**, on this route too.
From the Erfurt PoP, the main route runs to **Frankfurt/ Main**; at this point, it would be possible to connect to the **DE-CIX** or other backbone nodes.

Thüringer Netkom

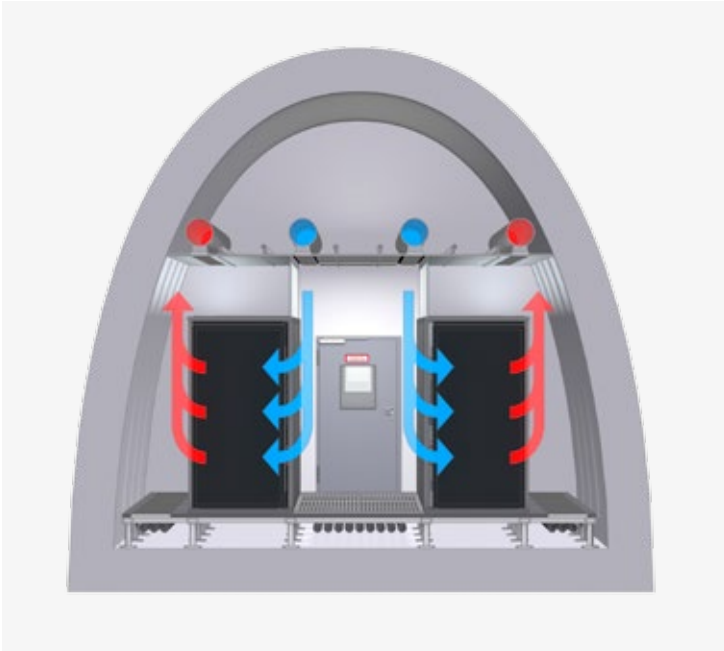
Air conditioning

The tunnel is air-conditioned using a ceiling installation in false (suspended) ceiling.

Approx. 1 MW is required to air condition a single tunnel.

This output is generally achieved by cooling towers. For the development of a tier 3 and 4 data center, two redundant cooling towers would be required each with a capacity of 11 MW.

A deep-well inside the mountain represents an alternative to using cooling towers. The water from the deep-well can be used to cool the towers, but it cannot achieve the required cooling power overall.



Fire protection in the tunnels (FM-200)

FM-200 is a colourless gas at room temperature (Heptafluoropropane). FM-200 does not contain any chlorine or bromine, meaning it does not harm the ozone layer.

The FM-200 works based on its property of removing as much heat from the flame during the suppression process to enable the temperature to fall below the value required to maintain combustion. At the same time, the release of small quantities of free radicals causes additional suppression of chemical processes, which lead to flames forming. The fire-suppression effect of FM-200 is NOT based on reducing oxygen. FM-200 is not corrosive, nor does it conduct electricity. FM-200 is residue-free. It does not reduce visibility during a suppression action. Therefore, FM-200 is ideally suited for protecting valuable items, computers/DP and telecommunication systems, server rooms, industrial and chemical plants, laboratories, archives, museums and art galleries: It combines security and environmental safety.

Extensive medical testing has demonstrated that FM-200 does not pose a health risk to humans. FM-200 is used worldwide in a range of equipment including pharmaceutical metered-dose inhalation devices (such as for administering asthma medication). The FM-200 intrinsic safety is recognised by various institutes, including the National Fire Protection Association (NFPA), the German Hygiene Institute in Gelsenkirchen, VdS Schadenverhütung GmbH (organisation for fire protection), the Federal Register of the US Environmental Protection Agency and UK Halon Alternatives Group (HAG).

Summary

- The site offers sufficient space for a large-scale data center
- The property offers optimum security
- The infrastructure requirements are already in place (data connection, power, cooling system)
- Costs are saved by using state-of-the-art energy-saving IT technology
- Costs are saved by using state-of-the-art energy recovery and air-conditioning technology
- The intelligent and just-in-time modular design of both the server and its associated security structure (tiers 2-4) enable the Rothenstein system to expand with its requirements almost limitlessly.
- The data storage concept can be combined with the "Securities depot D42" concept (see separate concept presentation)