DIGITAL UNDERGROUND DATA – A RESOURCE FOR PLANNING UTILITIES IN URBAN AREAS AT ENERGIE 360°

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AGENDA

1. About us
2. Main questions regarding the digital planning of utilities
3. Use of laser scanning and radar for improving BIM models
4. How a digital twin could improve utility planning
5. How much space in there underground?

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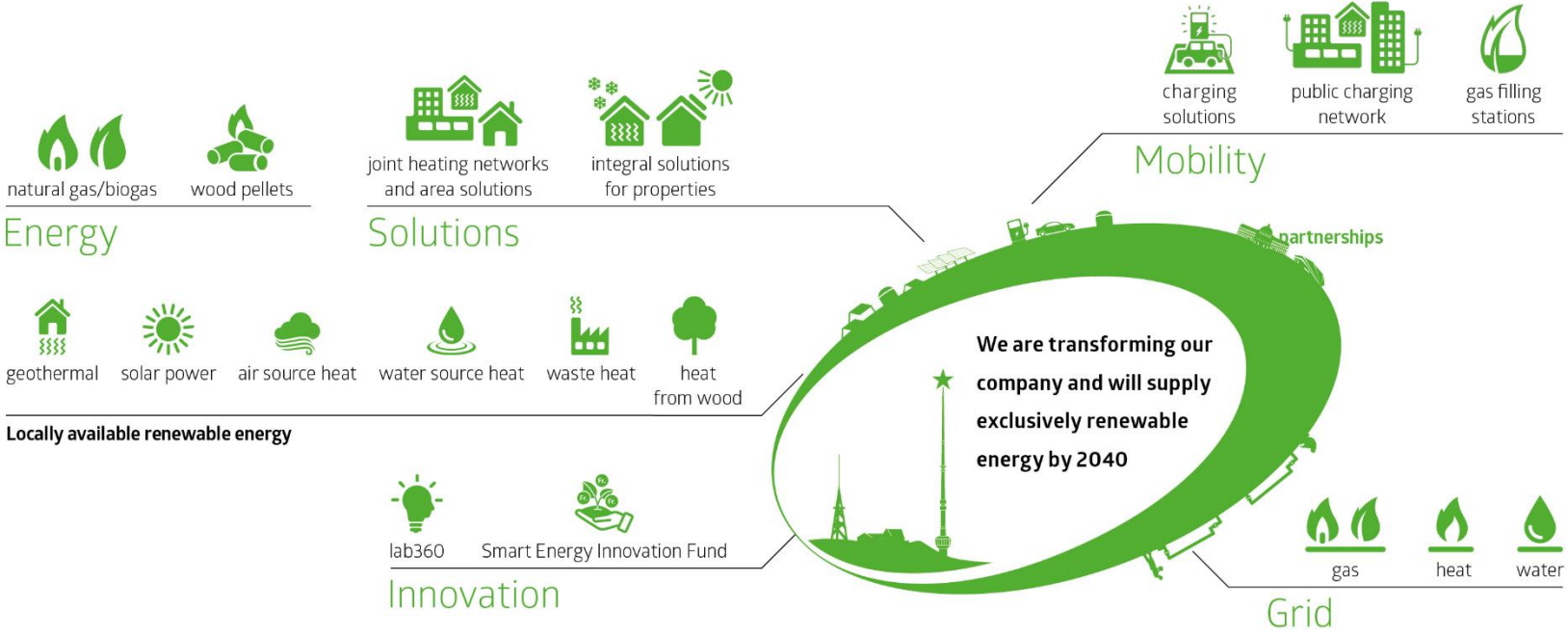
ABOUT US

ENERGIE 360°

Sustainable energy solutions for the world of tomorrow



STEP BY STEP TO A RENEWABLE ENERGY FUTURE

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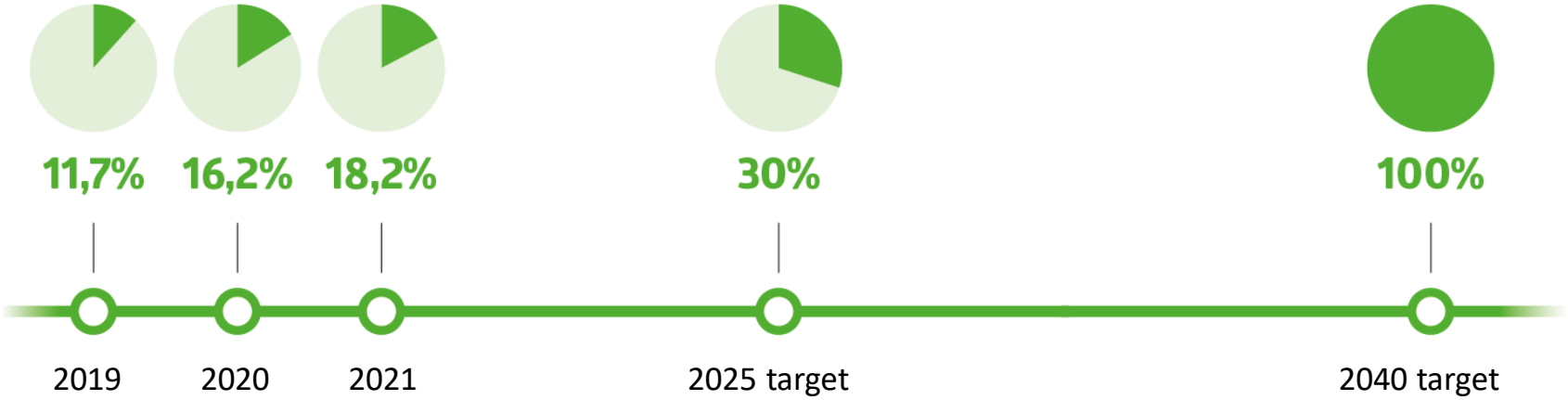

FOCUS BUSINESS SEGMENTS

We are making **energy** more and more renewable.

We are developing our **grid** into the backbone of the energy future.

We are making ecological **mobility** easily and widely available.

We are transforming individual customer needs into tailor-made **solutions**.

“GRID” BUSINESS SEGMENT

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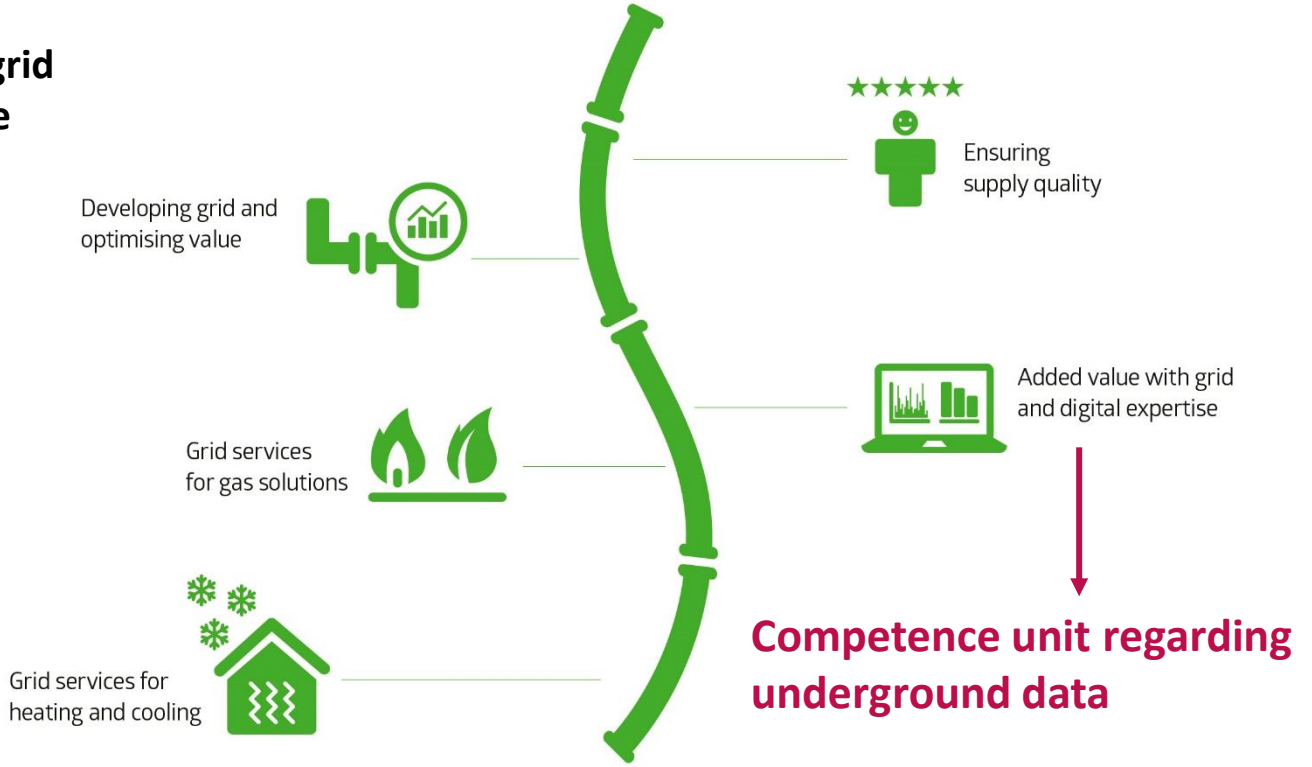

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WE AIM AT MAKING PLANNING FASTER, EASIER, AND SAFER

MAIN QUESTIONS

1
- How accurate are novel technologies regarding the determination of:
  - unknown objects in the underground?
  - the position accuracy of existing pipes?
- Are 3D point clouds from drones as reliable for utility planning as those from terrestrial recordings?

2
- To what extent can laser scanning be used to identify the components of a pressure reducing station, and thus, to create a digital twin?

3
- How can we develop an approach that predicts the optimal location for constructing new pipes while considering limited space in the underground?

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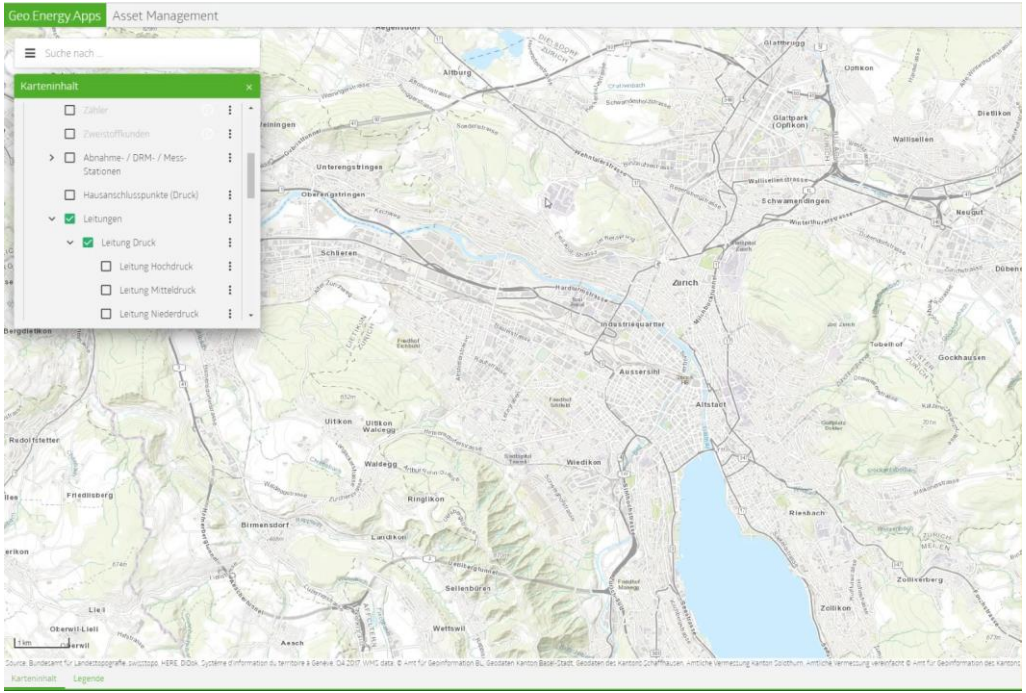
USE OF LASER SCANNING AND RADAR FOR BUILDING BIM MODELS

MÜHLACKERSTRASSE IN ZURICH AFFOLTERN



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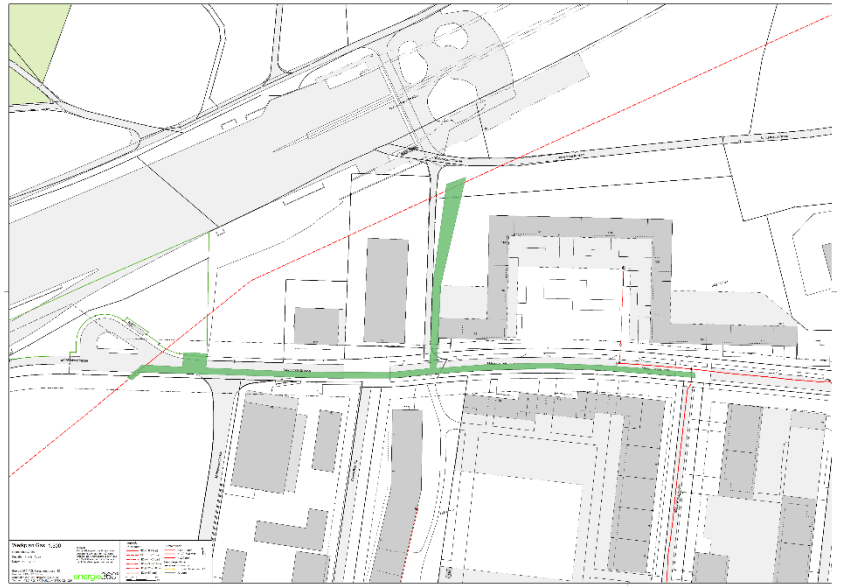

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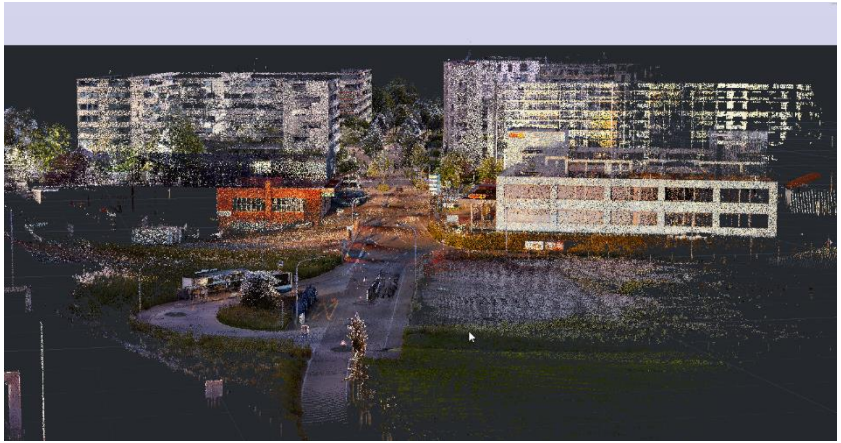

ABOUT THE PROJECT

- Owner: Energie 360° AG
- BIM pilot project in the construction of gas pipes
- New construction of 500 m HP und LP gas pipes and of a pressure reducing station (PRS)
- SIA phases: 32–53 (2020–2022)
- Software: Revit, Navisworks, Recap Pro, ACC

WHAT IS A PRESSURE REDUCING STATION?

CAN RADAR HELP UNVEIL THE UNSEEN?

Question

May a ground-penetrating radar help identify:

- unknown objects in the underground and
- the position accuracy of existing pipes?

CAN RADAR HELP UNVEIL THE UNSEEN?

Results

- Expensive usage with limited findings.
- It was not possible to improve an inaccurate map due to the resulting radar visualization.
- Even though objects including their width and location could be identified, it was not possible to determine their depth or whether another object is located below it.
- Recognizing underground obstacles was difficult.

POINT CLOUDS FROM DRONES VS. FROM TERRESTRIAL RECORDINGS

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Question

To what extent do

- the data workflow and
- the reliability of 3D point clouds

differ if they have been recorded either by a drone or by a terrestrial station?

Remark

Recordings from both data sources have been compared by eye.

POINT CLOUDS FROM DRONES VS. FROM TERRESTRIAL RECORDINGS

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Results

- 3D point data must be processed in any case.
- 3D point clouds from terrestrial recordings were more accurate since curbs could be identified more precisely.
- Data from terrestrial stations was recorded quicker than by using drones.
- Drones could not record objects located below the canopy.
- It is recommended to use a total station in areas with a high plant cover as the laser points have been scattered on their surfaces.

HOW BIM IS USED AT ENERGIE 360°

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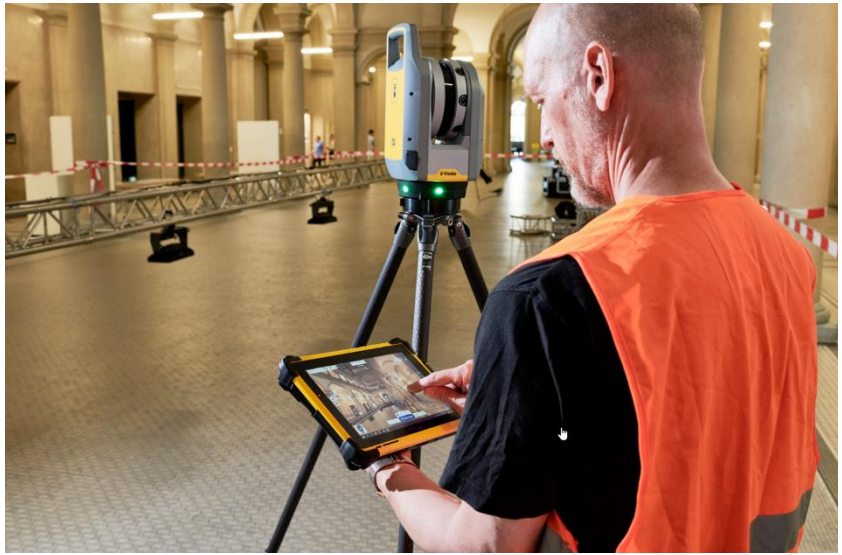
HOW A DIGITAL TWIN COULD IMPROVE UTILITY PLANNING

RECORDING 3D DATA BY LASER SCANNING

Question

To what extent can laser scanning be used to create a digital twin by identifying the components of a pressure reducing station automatically?



BASIC PRINCIPLE OF CREATING A BIM MODEL OUT OF LASER SCANS

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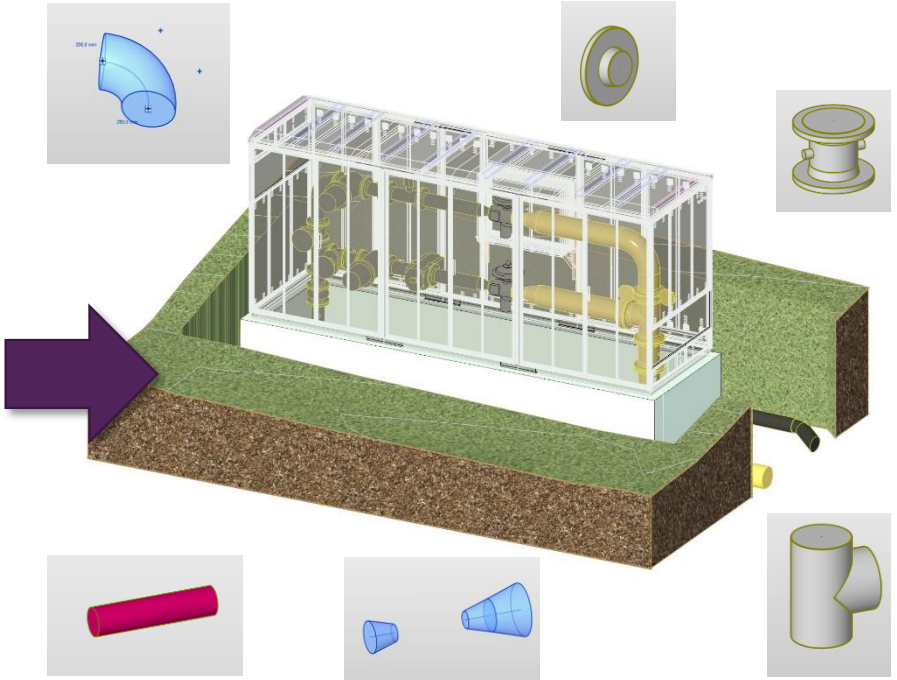

NOW THE TEST ON THE EXAMPLE…

TO WHAT EXTEND CAN 3D LASER SCANNING HELP BUILD A DIGITAL TWIN?

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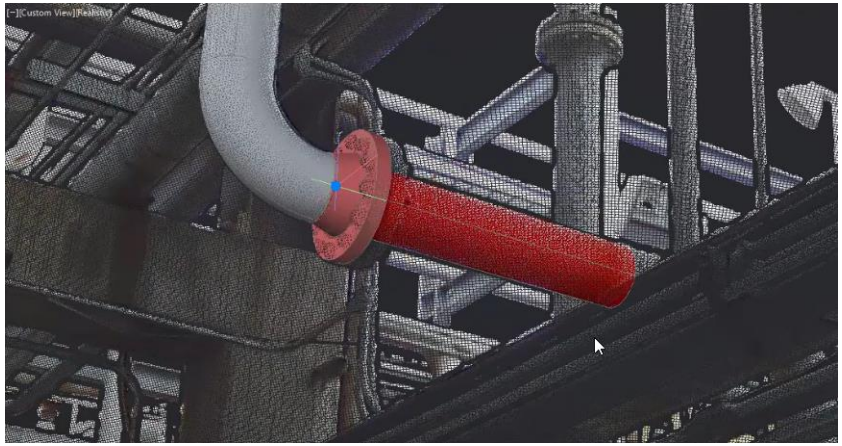
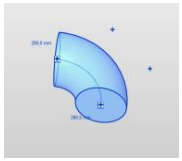
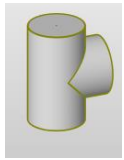
Results

- In contrast to conventional measuring methods, the use of laser scanning saves a lot of time.
- The recorded data is very accurate.
- The used software can automatically distinguish different components from each other.
- May Machine Learning be used in the future to automatically recognize specific components that are listed in a catalog?







HOW MUCH SPACE IN THERE UNDERGROUND?

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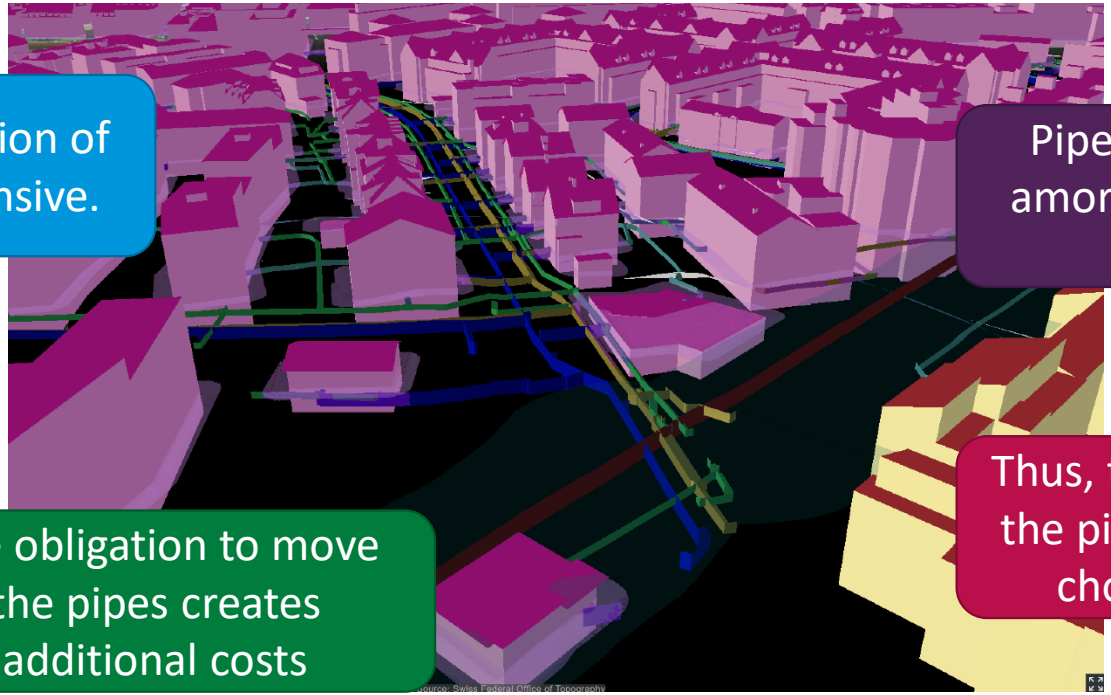
The construction of pipes is expensive.

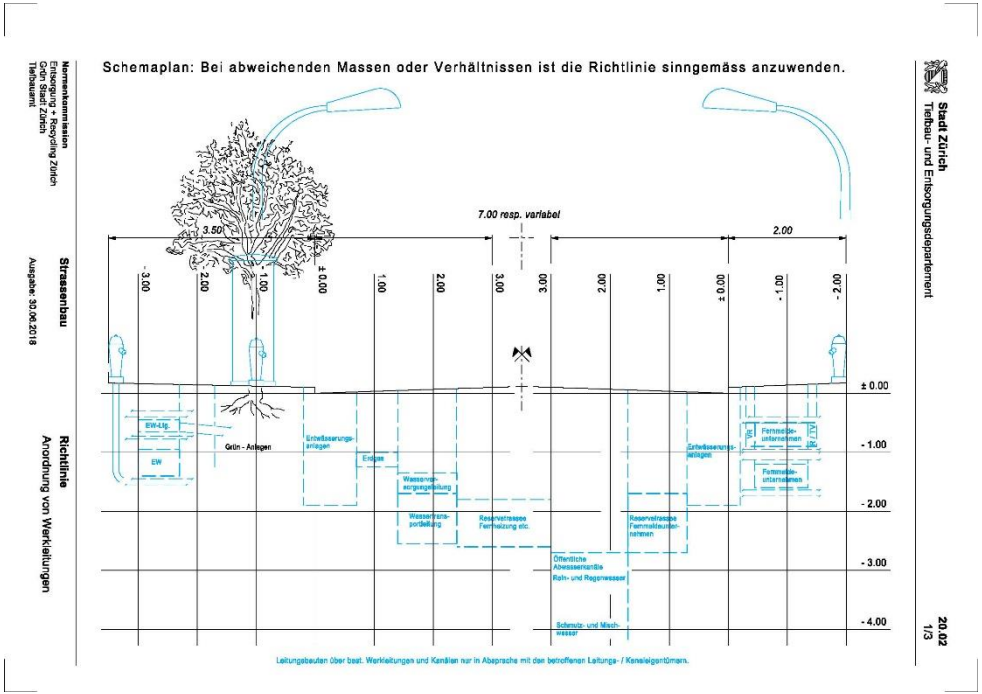


Pipes are usually amortized after 50 years.

The obligation to move the pipes creates additional costs

Thus, the location of the pipes should be chosen wisely

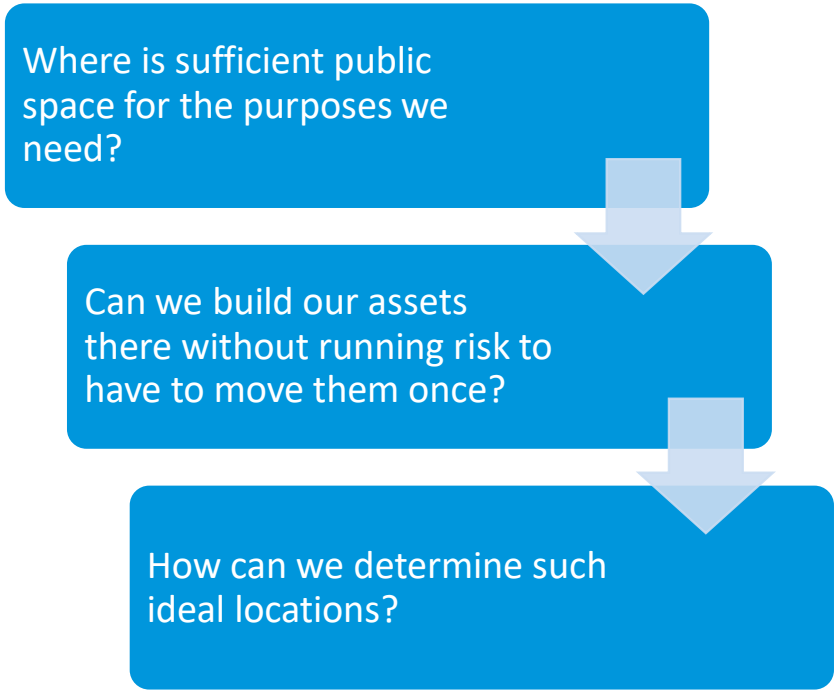
UTILITIES SHOULD BE LAID IN A SPECIFIC PLACE



HOW WE MAY GET TO AN APPROACH FOR IDENTIFYING OPTIMAL ROUTES

Current task

Finally, we are working on an approach that predicts the optimal location for laying new pipes underground while considering the space limitation.



ANALYSIS OF UNDERGROUND UTILITIES BY A 3D DECISION SUPPORT SYSTEM

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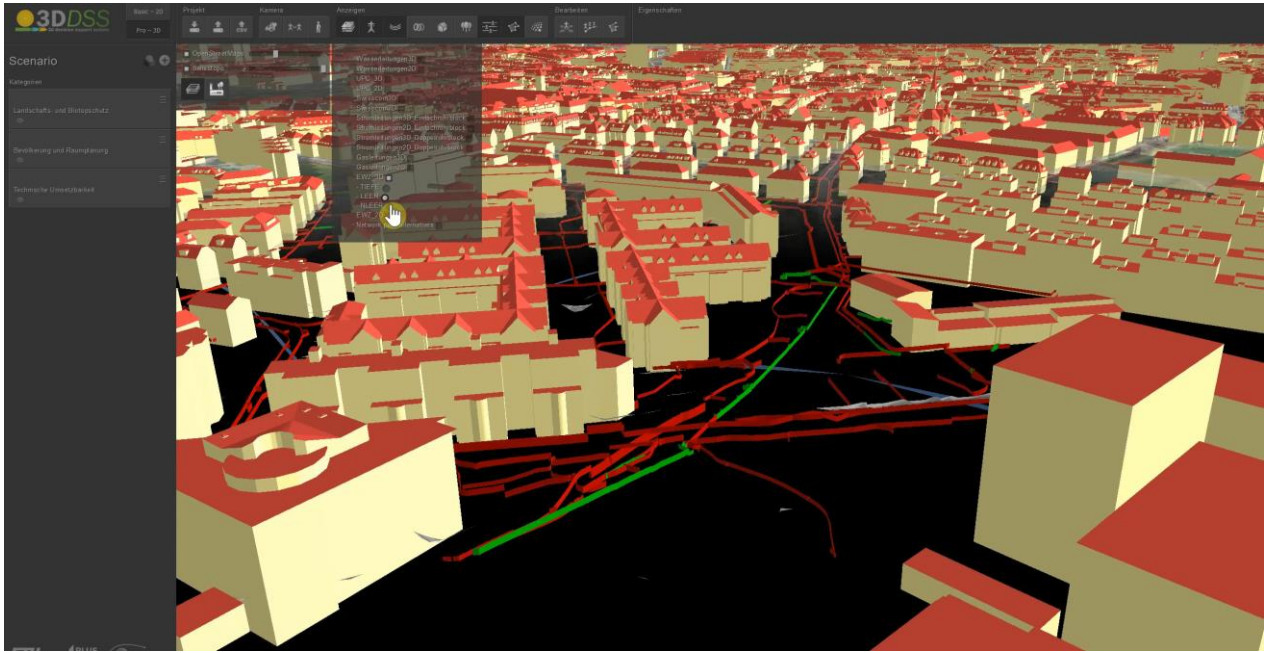

THANK YOU

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