

Transmission line planning with SYNOPTRA

Responsible for the high voltage energy grid you are looking for methods to reduce the visual impact of a new transmission line to a strict minimum. Your primary objective is to obtain approval for the construction of the proposed right-of-way by demonstrating that it has a comparably low environmental impact.

To solve this task successfully, the software SYNOPTRA was developed. The algorithms integrated into this software are based on the knowledge of experts in the field of intelligent Transmission Line Planning at Saarland University. IngeniusSoftware consequently enhanced this software and integrated practical experience.

Advantages of SYNOPTRA

Planning reliability for your line project

- SYNOPTRA is based on a mathematical method to calculate visibility thus giving you a firm basis during the approval process.
- During on-site visits you are able to present the visual impact of the new transmission line from anywhere.
- These advantages have convinced even the BUND (the largest German nature protection organisation) who now strongly recommends the use of SYNOPTRA!

Optimal planning based on real life conditions

- Minimizing visibility (calculated using a recognized mathematical and analytical method) taking into account the terrain topology.
- Optimization of "approval ability" by bypassing inhabited areas and those deserving protection.
- Optimization of costs – for example by reducing the number of span poles.

Extensive information and display possibilities of variants of the planned transmission line

- Direct assessment of the costs of the variants.
- Automatic creation of profile maps with all required parameters (pole height, sag, intersections with forest areas, crossing roads, etc.).
- Analytical proof of low visibility - giving you priceless arguments for the approval process.

Visualization of transmission lines with SYNOPTRA::Image

- Create any number of photo-realistic images - without additional data collection.
- Create movies along arbitrary trajectories and angles (allows the visualization of driving in a car and looking at the planned transmission line or even fly over the line in a helicopter!).
- Compared to the conventional method (projection of pylons in photos of the site) this method is much more flexible and powerful at considerably lower cost.

Components of SYNOPTRA

SYNOPTRA consists of the following components, which - depending on the task - can be used individually or together:

1. SYNOPTRA::Planner

Generating optimal transmission lines, taking into account the optimization goals: "visibility", "approval ability" and "costs".

2. SYNOPTRA::Analyse

Calculating visibilities based on a recognized mathematical method. Allows the detection of low visibility due to the comparison of variants - and even the comparison to the visibility of wind turbines.

3. SYNOPTRA::Image

Visualization of the planned transmission line using freely definable observers and viewing directions: in the form of still images or movies. Flexible adjustment of light and visibility conditions (eg insertion of fog, twilight, etc.)

SYNOPTRA::Planner

Challenge "planning"

A key aspect of a successful transmission line planning is to achieve the widest possible acceptance among the affected population. Therefore, a right-of-way should be planned with minimal visual impact to the natural landscape - and inhabited and natural heritage areas should consistently avoided.

However there are endless possible rights-of-way between two points. There are no conventional ways to adequately consider the optimization goals "visibility", "approval ability" and "costs".

Solution with SYNOPTRA::Planner

SYNOPTRA::Planner uses intelligent algorithms to create an optimal transmission line in terms of the defined objectives. Of course the real site topology is taken into account as well as all technical constraints of transmission lines. Just by clicking on a button the software creates a complete list of pylons.

The integrated algorithms simulate natural evolution. During virtual "generations" better and better transmission lines emerge. The functionality is demonstrated by the following figures.

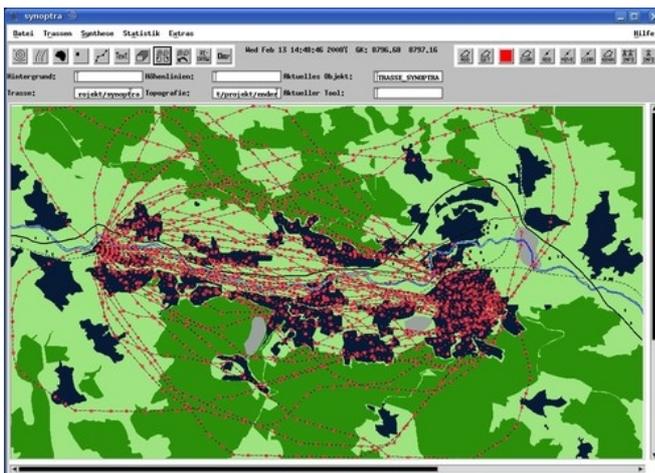


Figure 1: Generation 1 of transmission lines

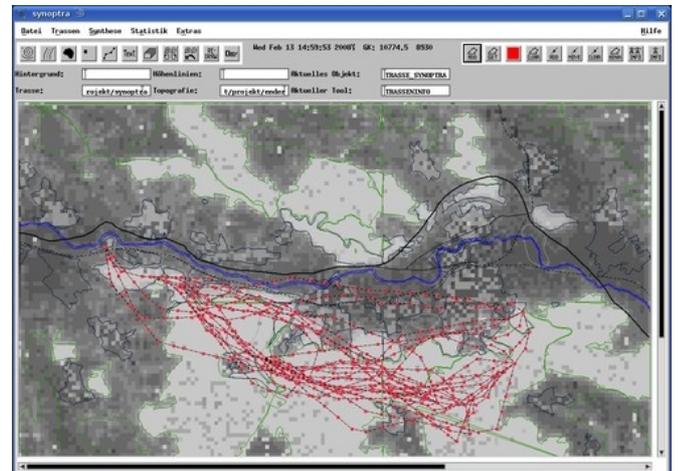


Figure 2: Generation 100 of transmission lines (Visibility optimization)

The transmission lines of the first generation (Fig. 1) are randomly generated - but already represent possible solutions to the defined problem. Over the generations, new transmission lines are created which meet the defined goal better and better. Therefore, for example, the transmission lines of generation 100 of a visibility optimization are concentrated in a corridor of low visibility - which is recognizable by the bright areas in Figure 2.

Benefits at a glance

- Considering the terrain topology
- Compliant to all technical regulations
- Optimization of the transmission line according to visibility, approval ability, and costs
- Creation of variants with provable minimal impact on nature
- Creation of possible compromise variants
- Creation of any number of variants
- Creation of complete lists of pylons

SYNOPTRA::Analyse

Assessment of visibility

How can the visibility or the optical impact of a transmission line to the landscape be quantified? You should be prepared for this kind of question.

Using SYNOPTRA::Analysis, you can calculate the visibility using recognized mathematical methods. This allows you to compare variants of the transmission line according to visibility and compare its optical impact to the one of a large wind turbine!

Recommended by BUND

Using SYNOPTRA you are on the safe side during the approval process. Its methods are commonly accepted so that even BUND Mecklenburg-Vorpommern (the largest German nature protection organisation) strongly recommends the use of SYNOPTRA (in a statement in July 2007). Literally they write: *"Such methods that work with specific landscape models quantify the optical performance of planned and existing transmission lines on the basis of serious mathematical and physical methods and thus provide an adequate basis for evaluation"*.

Visualization of results

The analysis results are visualized in SYNOPTRA in a clear manner, and thus serve as the main determinant of a reasonable argument as part of the approval process.

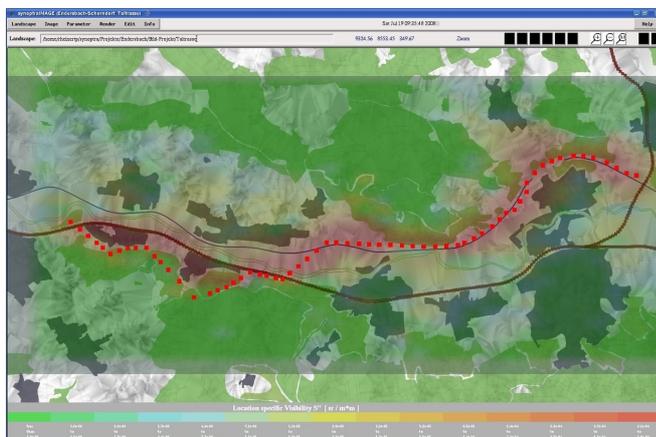


Figure 3: Visibility of "Valley Path" (sr 41570)

An illustrative example is shown in Figures 3 and 4 that compare two different possible rights-of-way according to their visibility. It could be demonstrated that the "Valley Path" had a significantly lower visibility than the "Forest Path" (sr 41,570 to sr 2,674). The figures show areas of high visibility in red color and those of low visibility in green color. Furthermore, pole locations (dark red squares), forest (green) and inhabited areas (black) can be seen on the map.

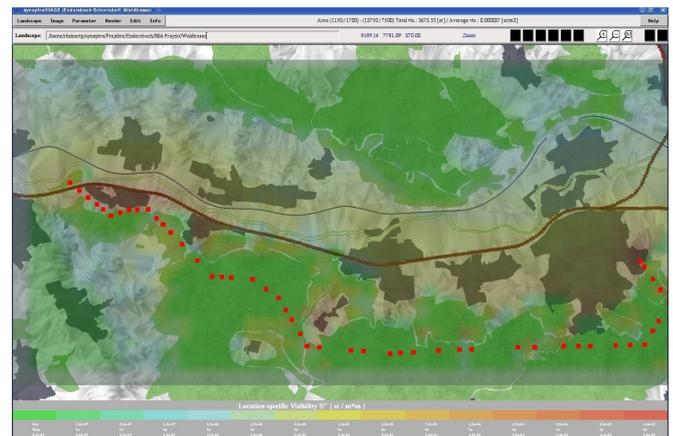


Figure 4: Visibility of "Forest Path" (sr 2,674)

Benefits at a glance

- Calculation of the evaluation parameters for
 - the entire landscape
 - single observer locations
 - certain areas or routes
- Considering the terrain topology
- Review of pylon shape, size and color
- Visualization of results
- Recommended by BUND (see details on <http://www.synoptra.de/bund.html>)

<http://www.synoptra.de/en.html>

SYNOPTRA::Image

Visualization with maximum flexibility

Is it sufficient to visualize the new transmission line by only a few points with the help of picture manipulation? For a successful approval process this could be sufficient - but how will you persuade citizens that want to have an impression of the optical impact of a planned pylon in their neighborhood?

With the help of SYNOPTRA::Image you create instant photo-realistic images of the planned line in the landscape. SYNOPTRA is based on a three-dimensional terrain model that takes into account any number of landscape details and the planned transmission line. Once the landscape data are recorded, the images can be calculated instantly. You can choose any observer location and viewing direction freely. You do this by placing an arrow on the screen using a topographic map.

Recommended by BUND

BUND Mecklenburg-Vorpommern recommends the use of the visualization component of SYNOPTRA! Literally they write *"In addition, the appropriate software component of SYNOPTRA allows the realistic visualization and animation of the scene by means of computer-generated images, where the viewer can be freely positioned on the ground and moving. ...This method corresponds to a modern, democratic planning understanding."*

Practical example



Figure 5: Positioning within the map

You navigate observer position and viewing direction within the map (see Figure 5). You can also define parameters such as angle, visibility (fog), light conditions, etc. Then SYNOPTRA calculates the resulting image in fractions of seconds - such as Figure 6.



Figure 6: View of planned transmission line

Additionally, trajectories for observer positions and viewing directions can be entered that are automatically processed to animations (movies).

Benefits at a glance

- Display photo-realistic images of planned transmission lines in landscape
- Creation of animations (movies)
- Free choice of observer location and direction of view giving you complete flexibility
- Simple interactive observer input
- Online demonstrations
- Recommended by BUND (see details on <http://www.synoptra.de/bund.html>)